

Instruction Manual

Fiber Laser Marking Machine

Please read the instructions before installing and using the product

Chapter I - Equipment operation safety protection

According to the classification of laser products in Chinese national standard GB7247.1-2001 (IEC60825-1:1993) this product belongs to class IV laser products, which can produce dangerous diffuse reflection, which may cause personal injury or fire. Special care should be taken during use! Before installing, operating and maintaining the equipment, be sure to carefully read and understand the contents of this chapter. The operators must pass the system training before operating the equipment!

1. It is forbidden to look directly at any form of laser beam with naked eyes (including direct, specular and diffuse laser beams). The laser beam will directly enter the eyes, which may cause injury to the eyes and, in serious cases, may lead to blindness!
2. It is forbidden to directly contact the direct laser beam or the laser beam through specular reflection and diffuse reflection! During operation, do not extend your hands or other parts of your body into the processing area, otherwise you may cause skin burns!
3. When entering the laser processing control area, be sure to wear laser protective glasses! The corresponding protective glasses are selected according to different laser wavelength and irradiation amount.
4. It is forbidden to mark the mirror material with high reflectivity to prevent the mirror reflection of the output laser beam from damaging the equipment or operators!
5. During operation, do not place the path of the laser beam at the same height as the operator's eyes, but use a high temperature resistant light absorber
Stop the laser leakage for the baffle!
6. Laser processing of flammable and explosive materials and stacking of flammable and explosive materials and sundries around the equipment are prohibited! Flammable and explosive materials will cause fire or explosion when they encounter laser!
7. Do not cover the equipment with blankets, cloth and other textiles when the equipment is working, so as to avoid local overheating of the equipment and fire!
8. Repeated processing at the same position of materials is prohibited. Processing at the same position for a long time may cause fire!
9. Users are not allowed to disassemble or restructure the equipment by themselves! Safety accidents and equipment failures caused by non professional personnel dismantling, repairing and transforming the equipment do not belong to the scope of warranty!
10. Please do not use this equipment when there is vibration, impact or strong electromagnetic interference source! Vibration and electromagnetic interference will affect the machining accuracy and may damage the equipment!
11. Please ensure that there is enough space around the equipment and the equipment is used in a well ventilated environment! If the working space of the equipment is poorly ventilated and the exhaust air continuously circulates at the inlet, the internal temperature rise of the equipment may cause equipment damage

Chapter II - Equipment Overview

2.1 Introduction to optical fiber laser marking machine

Laser marking machine uses laser beam to print permanent marks on the surface of various substances.

The main effects of laser marking machine are:

- 2.1.1. The surface layer of the target material is evaporated by laser light energy to expose the deep layer of the material;
- 2.1.2. Through the chemical and physical changes of surface materials caused by laser light, the required patterns and words are "engraved";
- 2.1.3. Part of the material can be burned by laser light, so as to show the patterns and characters to be etched.

The optical fiber laser marking machine is mainly composed of optical fiber laser, galvanometer, software control board, cabinet, horizontal table for placing workpieces, etc.

2.2 Application scope of optical fiber laser marking machine

Laser marking machine is mainly used in the following industries: electronic components, integrated circuit (IC), electrical appliances, mobile phone communication, hardware products, tool accessories, precision instruments, glasses, clocks, jewelry, auto parts, plastic keys, building materials, PVC pipes, medical instruments, etc.

Applicable materials include: ordinary metals and alloys (all metals such as iron, copper, aluminum, magnesium and zinc), rare metals and alloys (gold, silver and titanium), metal oxides (all kinds of metal oxides), special surface treatment (phosphating, aluminum anodizing and electroplating surface), ABS materials (electrical appliance shell and daily necessities), ink (transparent keys and printed products), Epoxy resin (packaging and insulating layer of electronic components).

2.3 Working principle of optical fiber laser marking machine

After the laser beam with the output wavelength of $1060 \pm 10\text{nm}$ is internally expanded, it is emitted onto the mirrors of the x-axis and y-axis galvanometer scanners. The galvanometer scanners swing rapidly under the control of the computer to scan the laser beam in the two-dimensional directions of plane X and y. Through the lens, the laser beam is focused on the surface of the processed object to form a fine and high-energy density spot. Each high-energy laser spot is ablated and carved on the surface of the object in an instant. Through the continuous process controlled by computer, the pre arranged characters, graphics and other marking contents are permanently etched on the object surface.

2.4 Features are as follows:

- 2.4.1. The fiber laser marking machine adopts fiber laser, with a service life of 100000 hours and superior performance, ranking top in the world.

High beam quality, basic mode (TEM00) output, focusing spot diameter less than 20um. The divergence angle

is 1 / 4 of that of semiconductor pumped laser. Single line is thinner, especially suitable for fine and precision marking.

2.4.2. Small size, low power consumption, and the power consumption of the whole machine is less than 500W;

The built-in air-cooled cooling mode abandons the bulky water-cooling unit, covers a smaller area and is easier to install, which truly achieves energy saving and portability.

2.4.3. High electro-optic conversion efficiency, simple and easy to use, no optical adjustment or maintenance, compact structure, high system integration and few faults.

2.4.4. Without any maintenance, it has long service life and is suitable for working in harsh environment.

2.4.5. The processing speed is fast, 2-3 times that of the traditional marking machine. The optical scanning galvanometer has high laser repetition frequency, high speed and no distortion.

2.4.6. Fiber lasers are equipped with optical isolators to effectively shield the reflected light. They can operate on high reflective materials with bright surfaces such as gold, silver, copper, aluminum and silicon. They do not need to deviate from the center of the field mirror, which greatly expands the application field.

2.4.7. The marking software is powerful and compatible with CorelDRAW, AutoCAD and other software files; Support PLT, PCX, DXF, BMP, etc., and can directly use SHX and TTF font libraries; It supports automatic coding, printing serial number, batch number, date, bar code, QR code, automatic number skipping, etc., and USB interface output control.

Chapter III - Equipment structure



(please refer to the real object)

3.1 Galvanometer

The system composed of X Y galvanometer and driver is used for high-precision scanning and precise positioning of laser. The galvanometer adopts high stability and precision position detection sensing technology and dynamic magnetic and dynamic coil deflection working mode design. The driver adopts a new topology circuit design, and outputs a servo signal under computer control to control the galvanometer deflection, so as to accurately carve the graphics.

3.2 Laser power supply

The function of laser power supply is to provide power to the laser. The special 24V switching power supply is used as the laser power supply.

3.3 Optical system

The optical system consists of laser, scanning galvanometer, focusing field mirror, optical fiber, etc.

3.3.1. Laser: laser is an important part of the equipment; Its output wavelength is $1064 \pm 5\text{nm}$. The laser has low heating and easy cooling. Air cooling can meet the requirements of the machine.

3.3.2. Scanning galvanometer: the function of optical scanning galvanometer is to deflect the laser beam irradiated on it, and control the movement of laser beam by controlling the movement of optical scanning galvanometer. The galvanometer adopts high stability and precision position detection sensing technology and dynamic magnetic and dynamic coil deflection working mode design. The driver adopts a new topology circuit design, and outputs a servo signal under computer control to control the galvanometer deflection, so as to accurately carve the graphics. The power supply of the driver is provided by the main control box.

3.3.3. Focusing field mirror: used to focus the laser beam on the workpiece surface, and can obtain good focusing effect in the working area on the two-dimensional plane perpendicular to the optical axis. The rear focusing mode is adopted, which installs the focusing lens behind the galvanometer scanner. Its focus lens is specially designed F- θ No matter how the beam moves, the focus position of the flat field lens is always maintained on a plane, which ensures that the spot size and energy density in the marking area are consistent, and improves the quality of the marking. In addition, this method makes it easy to replace the focus lens. The focus lens can be replaced at any time according to the size of the marking range and specific requirements.

Chapter IV - Equipment software introduction and output process

4.1 Software introduction

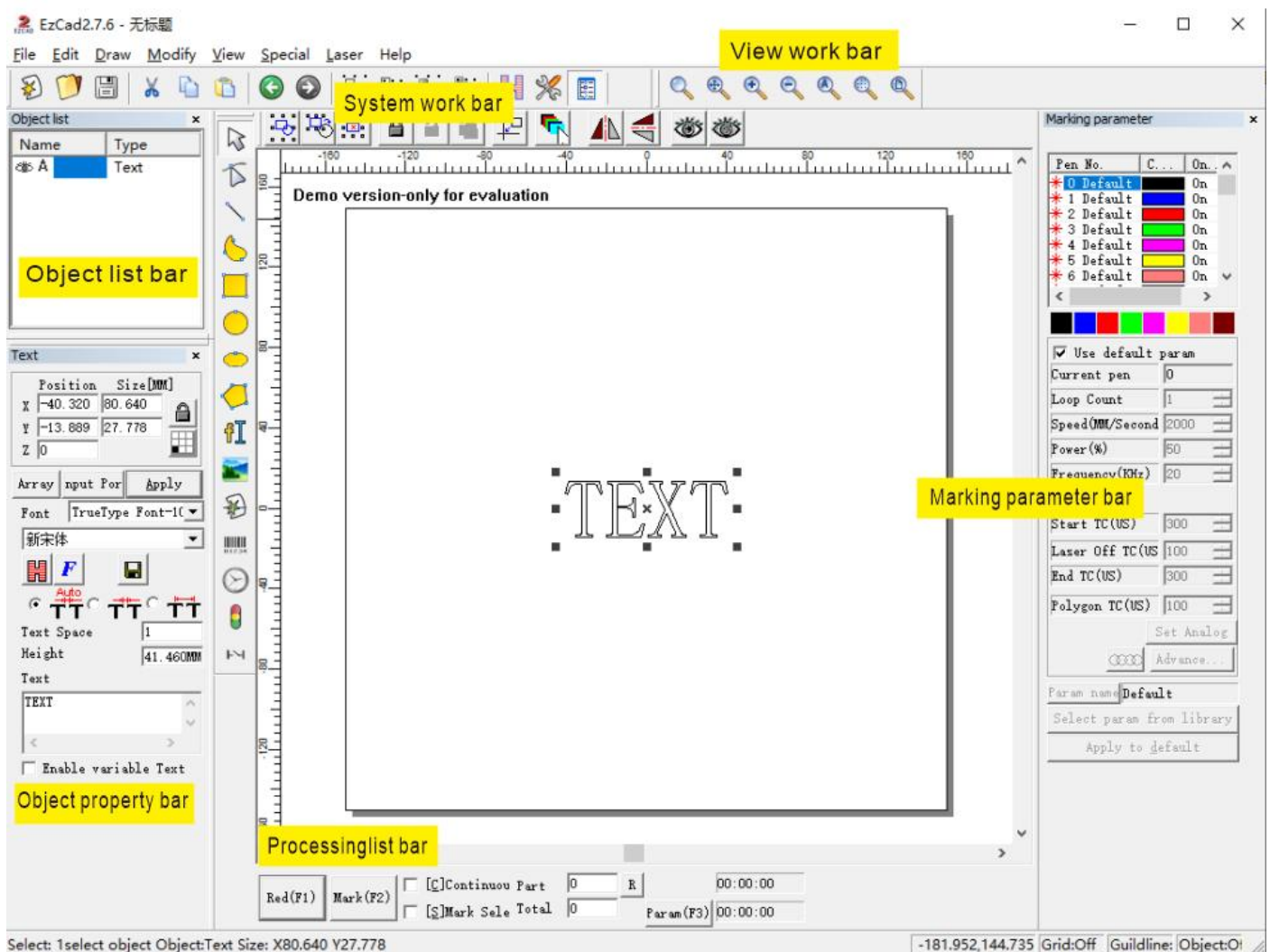
The software has the following main functions:

- ⌘ freely design the graphics and patterns to be processed
- ⌘ support TrueType font, single line font (JSF), SHX font, dot matrix font (DMF), one-dimensional bar code and two-dimensional bar code.
- ⌘ flexible variable text processing, real-time change of text during processing, and direct dynamic reading and writing of text files and Excel files.
- ⌘ text data can be read directly through serial port.
- ⌘ text data can be read directly through the network port.
- ⌘ it also has the function of automatic text segmentation, which can adapt to complex processing conditions.

- ⌘ powerful node editing function and graphic editing function, which can carry out curve welding, clipping and intersection operation
- ⌘ up to 256 pens (layers) are supported, and different processing parameters can be set for different objects
- ⌘ compatible with common image formats (BMP, JPG, GIF, TGA, PNG, TIF, etc.)
- ⌘ compatible with commonly used vector graphics (AI, DXF, DST, PLT, etc.)
- ⌘ common image processing functions (gray conversion, black-and-white image conversion, dot processing, etc.) can process 256 gray images
- ⌘ powerful filling function, supporting ring filling
 - ⌘ a variety of control objects, users can freely control the interaction between the system and external devices
 - ⌘ open multi language support function, which can easily support languages all over the world

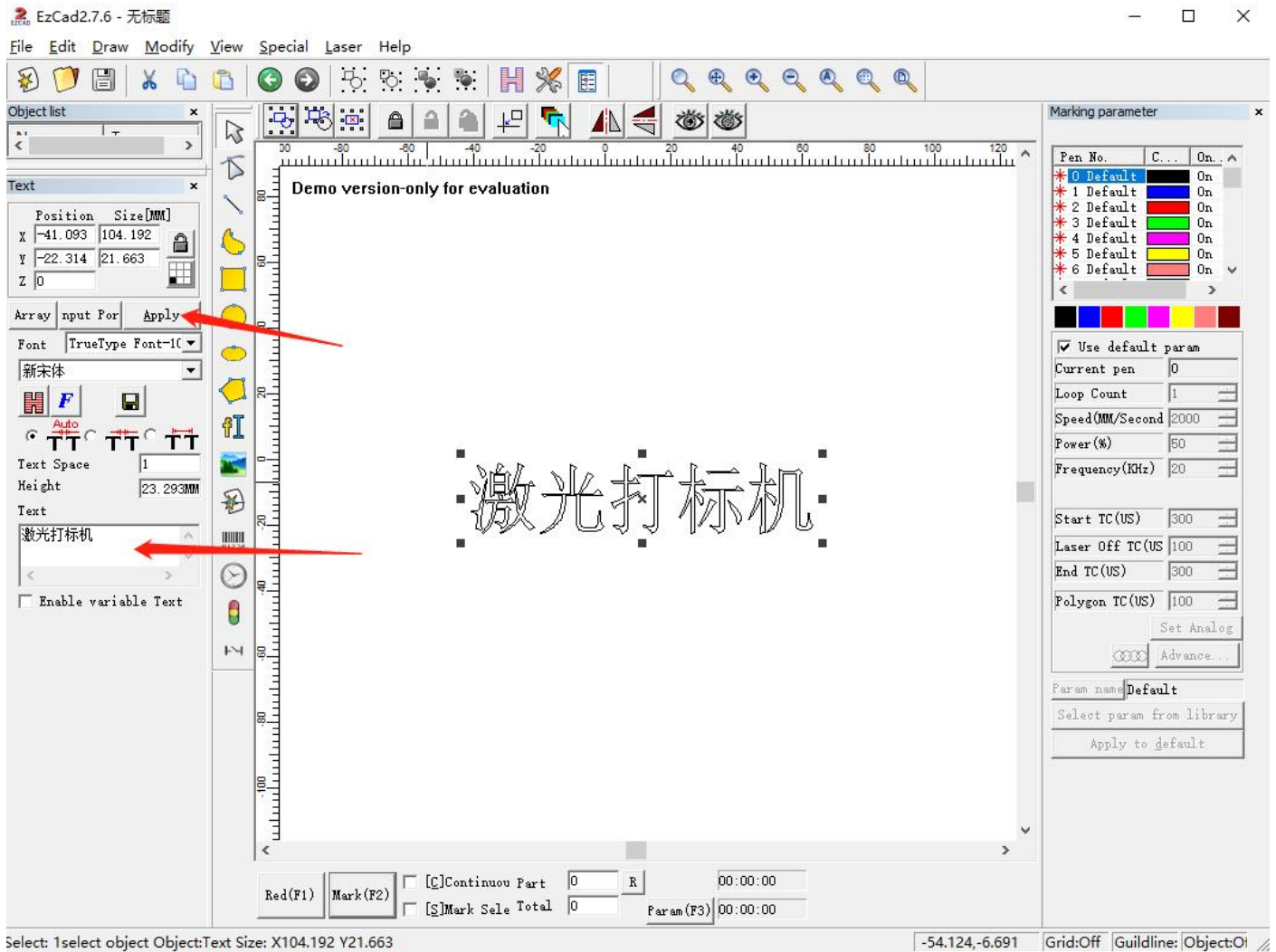
For detailed software instructions, please refer to the electronic manual in the USB flash disk.

4.2 Interface description

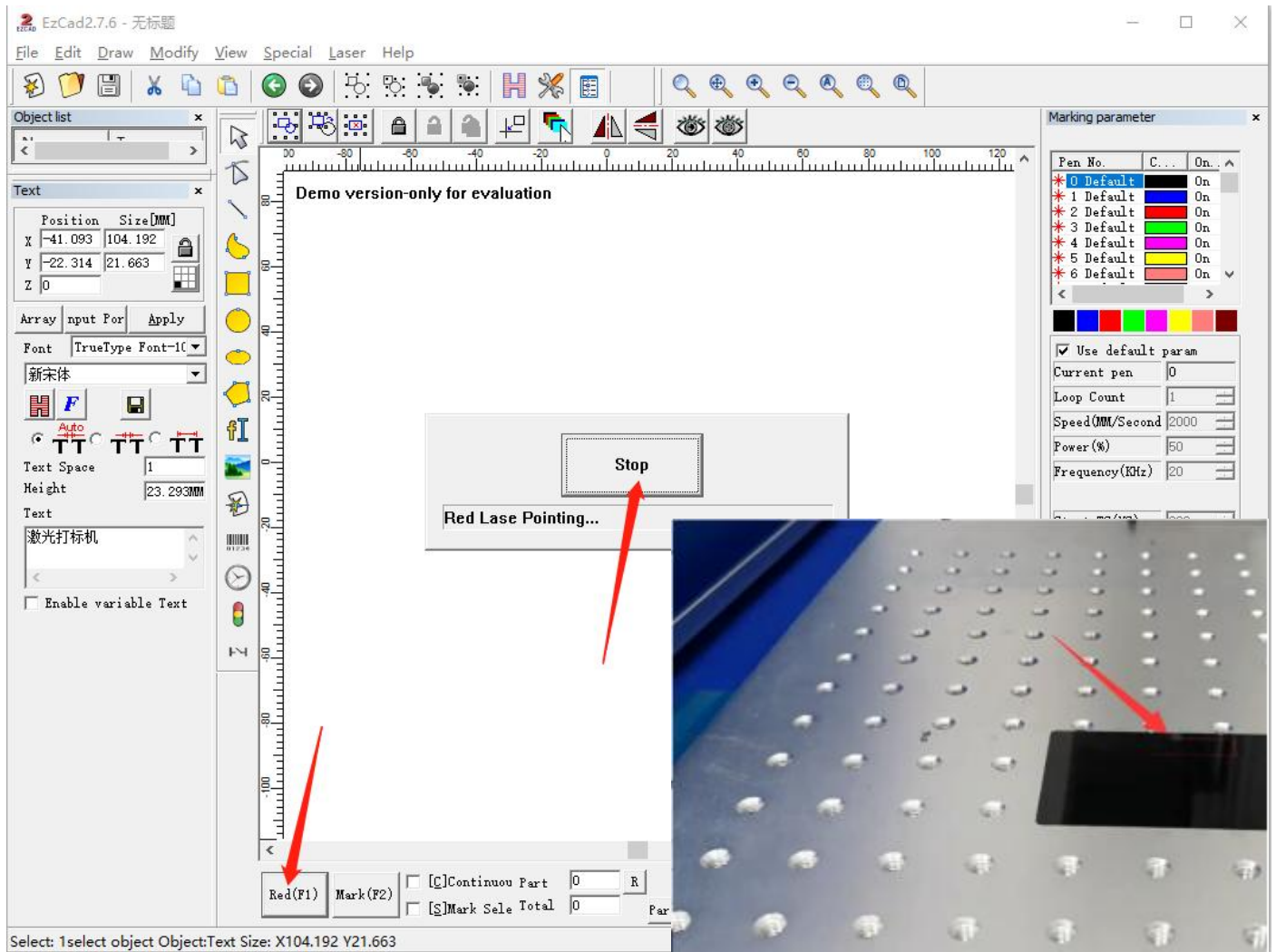


4.3 Text engraving

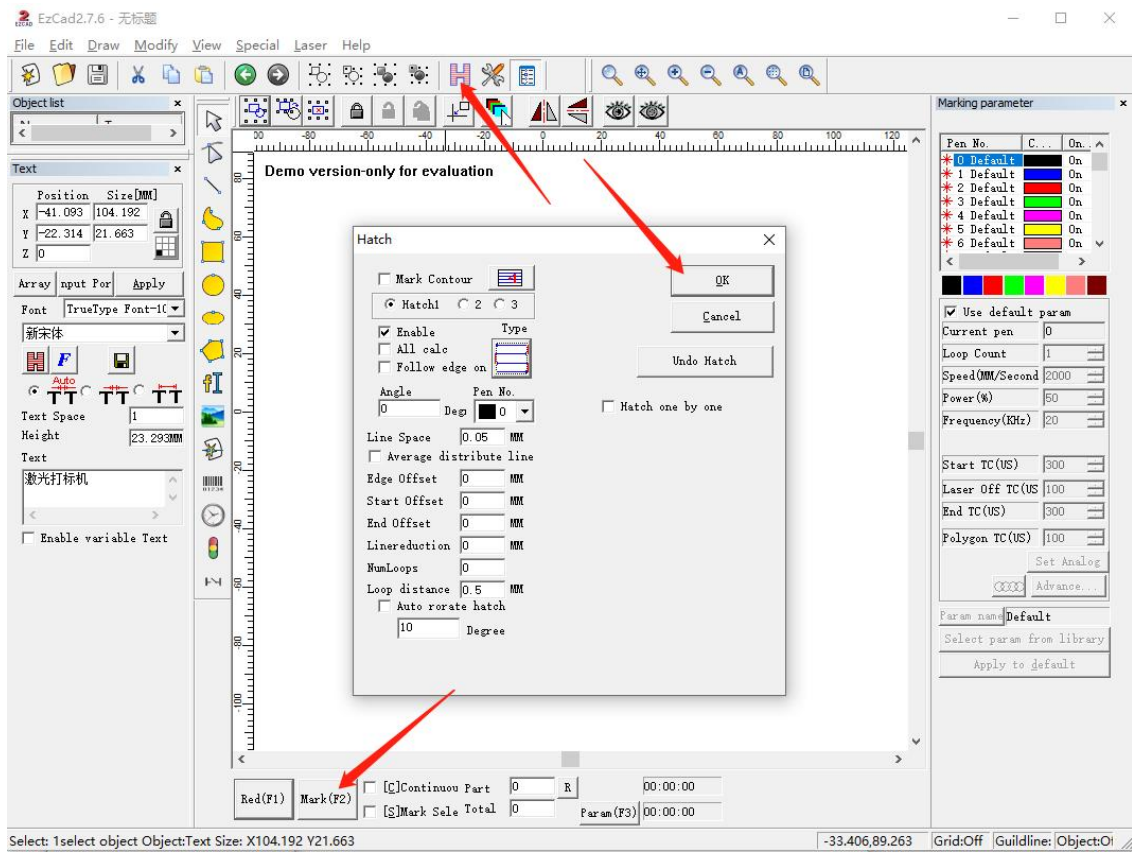
- 4.3.1 Click  the draw text tool and click the blank space of the page, and the text will appear on the left
- Output the content you want to carve, and click apply.



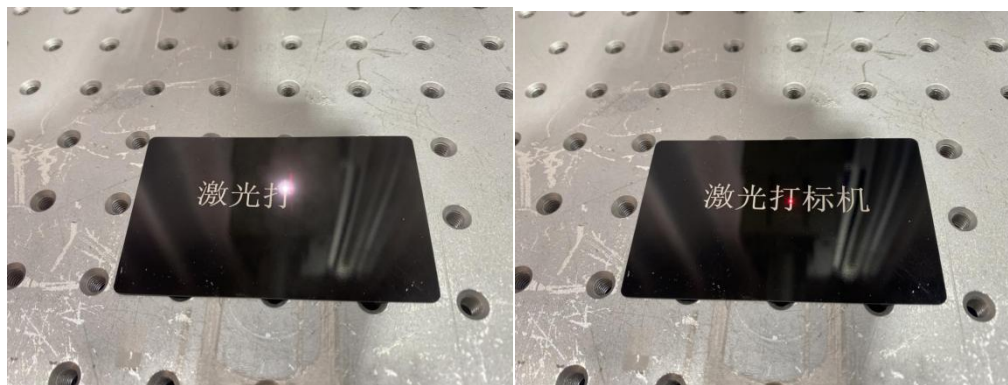
4.3.2 Click the red light, and a red preview box will appear on the workbench. Place the product you want to carve on the workbench, align the preview box with the carving area, and click the stop button.



4.3.3. Click the fill button and click OK to fill the text into a solid figure



4.3.4. Click marking and the equipment starts working



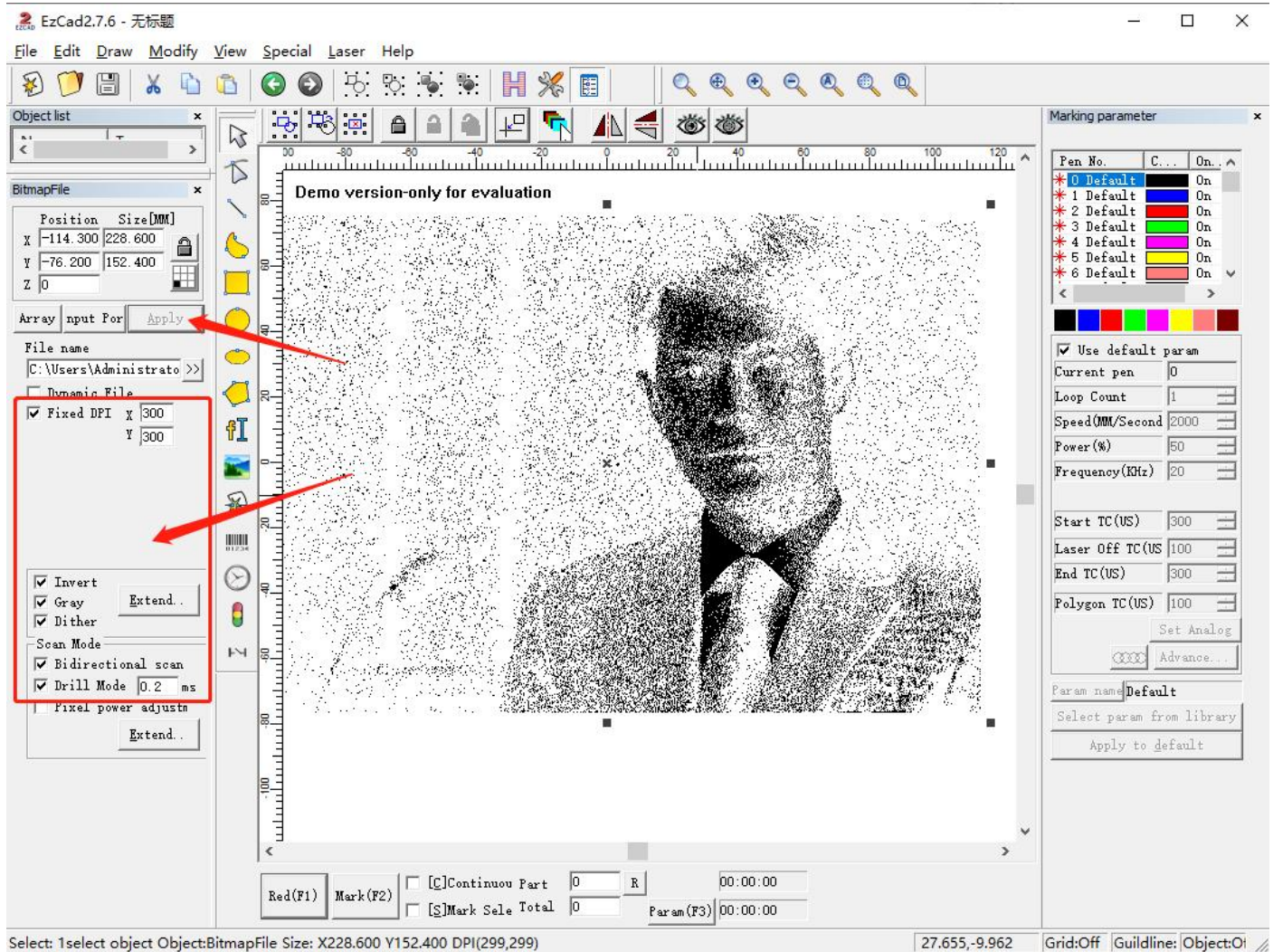
(Marking)

(Finished Marking)

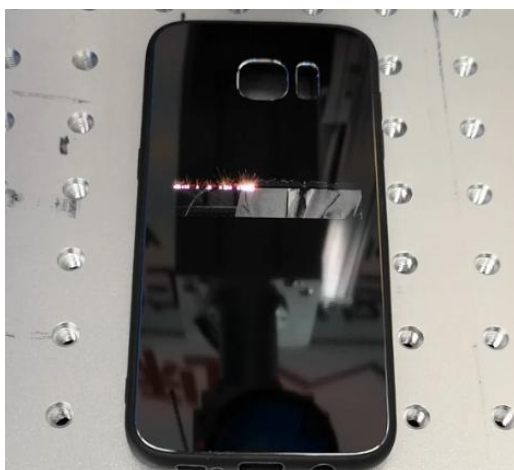
4.4.1. Click the draw bitmap tool, find the photo you want to carve, and click open



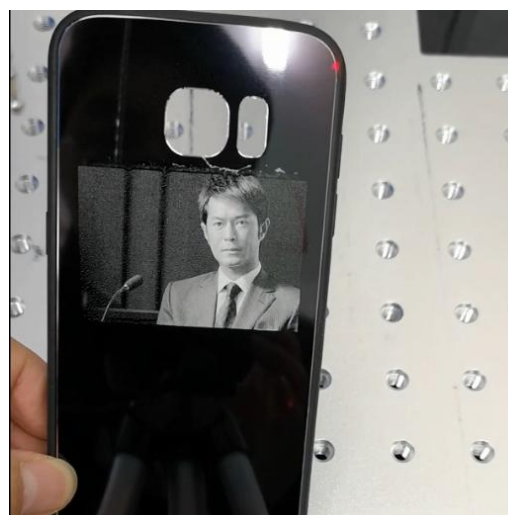
4.4.2. Set the size and other parameters



4.4.3. Click the red light to align the position, click stop, and click marking



(Mrking)



(Finished marking)

Chapter V - Maintenance and troubleshooting

Optical fiber laser marking machine is mainly composed of electronic devices, precision instruments and optical devices, which has high requirements for use environment and daily maintenance.

5.1 Precautions during maintenance of the machine

5.1.1. when the machine is not working, cut off the power supply of the marking machine and computer.

5.1.2. when the machine is not working, cover the field lens to prevent dust from polluting the optical lens.

5.1.3. The circuit of the machine is in high voltage state during operation. Non professional personnel shall not repair it when starting it to avoid electric shock.

5.1.4. in case of any fault of the machine, the power supply shall be cut off immediately.

5.1.5. when the equipment is used for a long time, the dust in the air will be adsorbed on the lower surface of the focusing lens. If it is light, the power of the laser will be reduced and the marking effect will be affected. If it is heavy, the optical lens will overheat and burst. When the marking effect is poor, carefully check whether the surface of the focusing lens is polluted.

If the focus lens surface is contaminated, remove the focus lens and clean its lower surface.

When removing the focus lens, be careful not to damage or fall. At the same time, do not touch the focus lens with your hands or other objects. The cleaning method is to use long fiber cotton swab or lens paper to invade absolute ethanol, gently scrub the lower surface of the focusing lens, and replace the cotton swab or lens paper every time.

5.1.6. during the operation of the marking machine, do not move the marking machine to avoid damaging the machine.

5.1.7. do not stack or put other items on the marking machine, so as not to affect the heat dissipation effect of the machine.

5.2 Common faults and troubleshooting

Due to use or other reasons, the fiber laser marking machine may fail.

In order that you can judge and eliminate some simple faults in time, we list the prone fault phenomena and solutions for reference only.

Number	Fault phenomenon	Cause of failure	resolvent
1	No power indicator light	No mains power	
		The power line is not connected properly	Connect the power line
		The power indicator is broken	replace the indicator
2	No Laser indication light	The laser indicator is broken	Replace the indicator
3	Laser indication light normal, No Laser beam	The field mirror lens cover is not removed	Remove the field mirror lens cover

		The power percentage setting is too small	Increase power percentage
4	No Laser indication light, No Laser beam	The signal cable is not connected properly	Reconnect the signal line
5	No Laser indication light, Laser beam normal	The laser indicator is damaged	Replace the laser indicator
		Laser indicator desoldering	Welding laser indicator
6	Unevenly marking lines	The workpiece is not in the focal plane	Make the beaten surface in the focal plane
7	Some marking words or photos, some are clear and some are not clear	The marking surface is not parallel to the field mirror	Level the marking surface of the workpiece