FRIENDS★LASER
By Your Side

User Manual for Laser Marking Machine

Suzhou Friends Laser Technology Co., Ltd.

Integrity Innovation Cooperation Sharing

Version: A1

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Catalogue

Please read this manual carefully before using the equipment.

Security information

A. Safety signs

	May cause serious personal injury or even endanger life

	may cause general personal injury or damage to products or equipment.

B. Laser Safety Level

According to the European Standard EN 60825-1, Clause 9, the device's internal laser belongs to 4 types of lasers. the product emits laser radiation at wavelengths around 1064 nm or 1080 nm, causing damage to the eyes and skin directly or indirectly exposed to such light intensity. Although the radiation is invisible, the beam can cause irreparable damage to the retina or cornea. Suitable and certified laser protective glasses must be worn during laser operation.

	In the operation of the product to ensure the entire wearing of laser safety protection glasses. Laser safety protection glasses have laser wavelength protection selectivity, so please choose the laser safety protection glasses according to the laser output band of the product. **When the laser cleaner is energized, it is forbidden to direct the laser output head towards someone's the person, and the laser output head is forbidden to illuminate the mirror surface of the strong reflective material.**

C. Security identification

1.1 Laser identification

1.2 Do not fold the fiber

D. Electrical safety

①grounding the product through the PE line in the power cord, and ensure the grounding is firm and reliable.

	Grounding disconnection will cause the product shell to be charged, which may cause personal injury to the operator.

②Ensure AC voltage supply is normal.

	Wrong wiring or supply voltage will cause unrecoverable damage to the laser.

1 Power on/off sequence

1.1 Power on operation steps

Step 1: Confirm that the emergency stop switch is in the pop-up state. If it is in the closed state, release the emergency stop switch in the direction indicated by the arrow on the button.

Attention: The emergency stop switch is a forced power-off button used in the event of a temporary malfunction of the equipment. During the normal operation of daily equipment, the emergency stop switch should not be pressed, otherwise it may cause the equipment to suddenly shut down abnormally, affecting the normal service life of equipment components and the loss of related unsaved files.

Step 2: Turn on the main power circuit breaker;

Step 3: Rotate the control key switch clockwise, the power indicator light will turn on, and the main control box will be powered on;

Step 4: Turn on the monitor and Start the industrial computer;

Step 5: Double click the EzCad2 shortcut icon on the desktop as shown in Figure 1-1 to open the EzCad2 marking software.

Figure 1-1

1.2. Shutdown operation steps

Step 1: Exit the marking software.

Step 2: Turn off the industrial computer and monitor.

Part 3: Rotate the control key switch counterclockwise, and the power indicator light will be off.

Step 4: Turn off the main power switch.

2 Mouse usage tips

2.1 Push the scroll wheel forward to shrink the interface;

2.2. Pull the scroll wheel backwards to enlarge the interface;

2.3. Hold down the scroll wheel, move the mouse, and the interface will follow the mouse movement;

2.4. When selecting an object, hold down the left mouse button in the upper left corner of the target object, and then drag the mouse to the lower right corner of the target object to select the object (i.e. select the object in the forward direction). The target object needs to be completely enclosed before it can be selected;

2.5. When selecting an object, hold down the left mouse button in the lower right corner of the target object, and then drag the mouse to the upper left corner of the target object to select the object (i.e. select the object in the opposite direction). This method only requires touching the object to select it.

3 Edit text content and parameters

3.1. Draw text

Step 1: Select the "Text" command from the drawing menu or click on the  icon;

Step 2: Under the command to draw text, move the mouse to the workspace and click the left button to create a text object, as shown in Figure 3-1;

Figure 3-1 Text Object

Step 3: Select the text object. You can edit the text content that needs to be marked in the text editing box in the left text attribute/property bar. The text editing box is shown in Figure 3-2. After editing the text content, click "Apply", and the text object will be displayed as the modified text content.

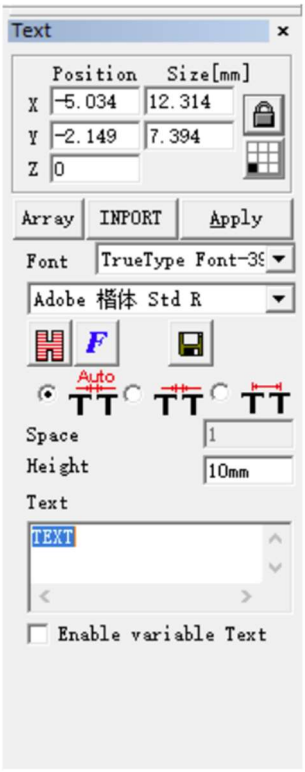
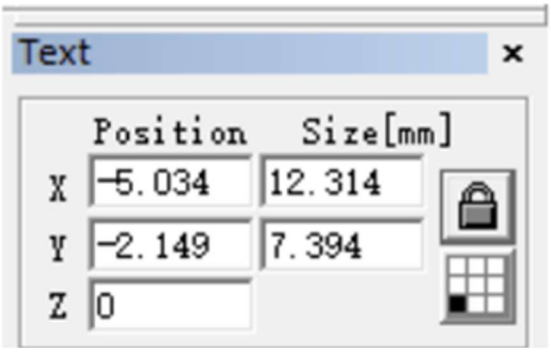


Figure 3-2 Text Attribute/property

3.2. Modify text properties

After selecting the text object, the text properties shown in Figure 3-2 will be displayed in the properties toolbar.

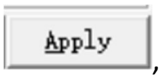
① Refers to the position coordinates and size dimensions of the text within the workspace;



② There is a locker icon,  , in the text properties. When modifying dimensions, scaling proportionally;

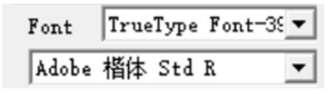
③ After clicking on the icon,  , it becomes the icon,  , indicating unequal scaling when modifying the size;

④ The reference point  whose position coordinates are within the work area;

⑤ To modify any parameter in the attribute bar, you need to click,  , "Apply" to modify it to the target object;

⑥ Fill parameters for text objects by clicking  ;

⑦  , Refers to the font parameters of the text object;

⑧ 

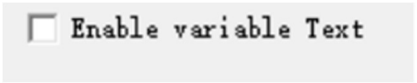
, The font type of the text object;

⑨ 

, The average height of the font;

⑩ 

, Text editing box

⑪ After clicking/selecting 

, the variable text can be enabled, and the system will display the variable text properties as shown in Figure 3-3. Variable text refers to the dynamic change of text content during the processing according to user-defined rules. For detailed introduction, please refer to page 53 of the software user manual.

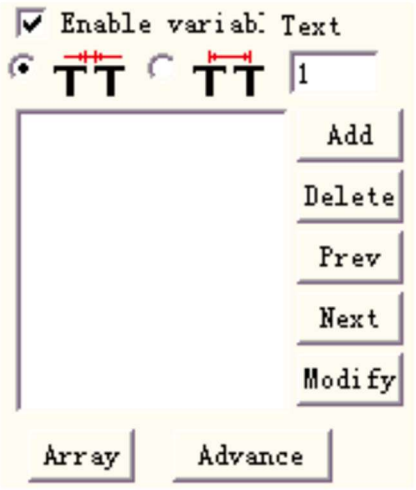


Figure 3-3 Variable Text Attributes

3.3. Modify the font type of the text

EzCad2 supports five font types: TrueType font, single line font, dot matrix font, barcode font, and SHX font, as shown in Figure 3-4.

Figure 3-4 Font Types

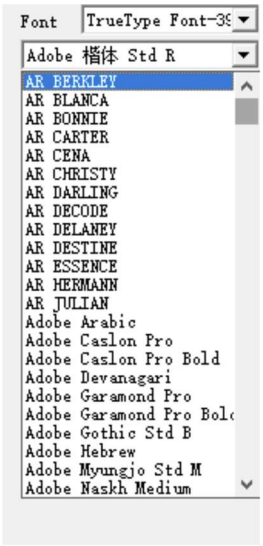


Figure 3-5 TrueType Font List

Note: The number after the font type refers to the number of fonts in the system. If there are no specified fonts in the font list, you can download the font library online and install it in the "My Computer/C Drive/Windows/Fonts" font library.

After selecting the font type, the font list will correspondingly list all fonts of the current type, as shown in the TrueType font list in Figure 3-5. You can select the required font from the font list, and click 'Apply' to change the text content to the font type we have chosen.

3.4 Modify font parameters

Select the edited text, click on the text properties  , and the system will pop up a font parameter dialog box as shown in Figure 3-6.

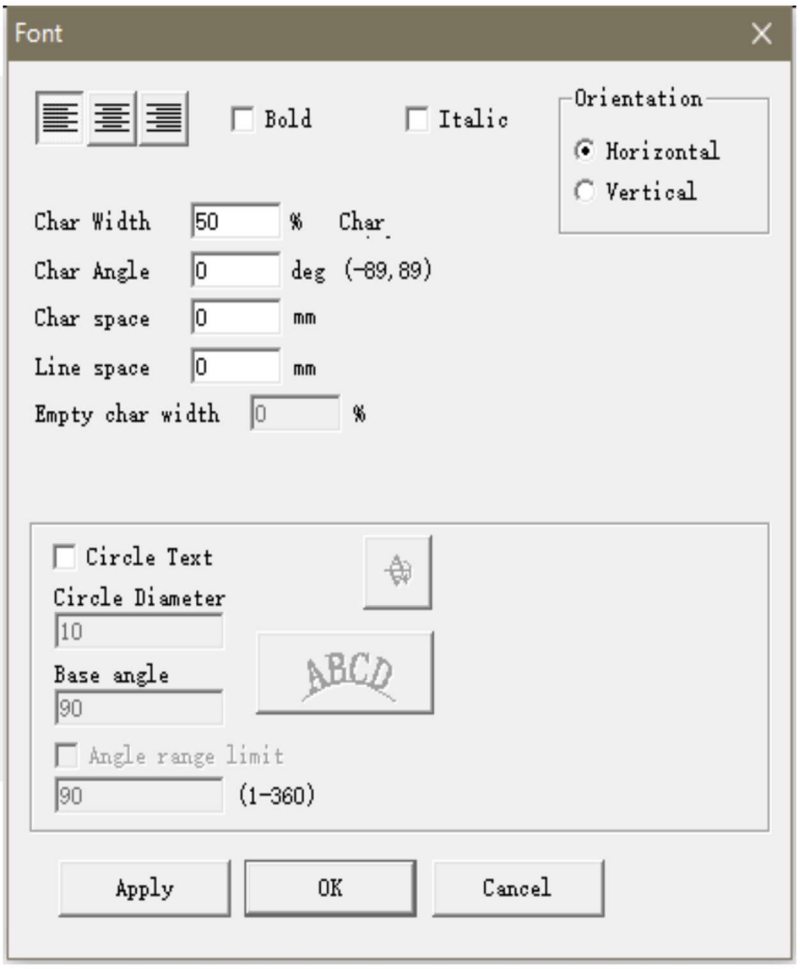


Figure 3-6 Text Parameters

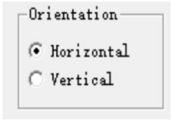
①  , The current text is arranged in a left aligned manner;

②  , Align the current text in a centered manner;

③  , Right aligned refers to the arrangement of the current text;

④ The characters drawn are in bold font after selecting  ;

⑤ The drawn text is italicized after selecting  ;

⑥ The direction of font arrangement is horizontal or vertical by selecting  ;

⑦ All characters have the same width;

⑧  The average width of a characters;

⑨  The inclination angle of the characters;

⑩ 

The spacing between characters.

After modifying the font parameters, click "OK" or "Apply" to apply them to the edited text.

3.5 Draw arc text

3.5.1 Click on "Circle" in the drawing menu, or click on the icon  , move the mouse to the workspace, left click and drag the mouse, then release the left mouse button and right-click to draw a circle in the workspace. The diameter of the required circle can be modified in the left object property bar, as shown in Figure 3-7.

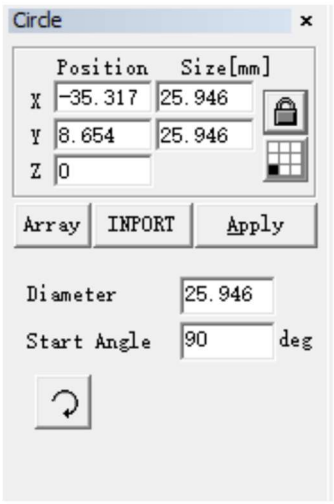


Figure 3-7 Object Attribute Bar

3.5.2 Click on "Text" in the drawing menu, or click on the icon  and left click on the arc of the drawn circle. The text will be arranged as shown in Figure 3-8.

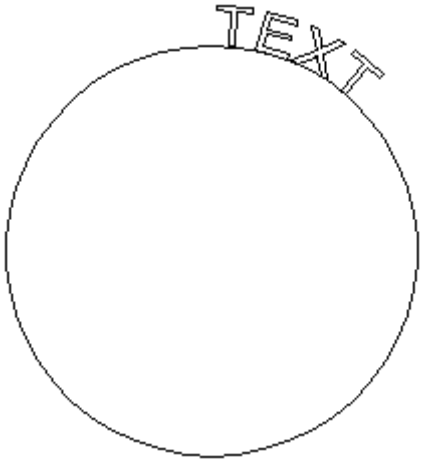


Figure 3-8 Text Arrangement

3.5.3 Select the text object and click  in the left object property bar. The system will pop up a dialog box as shown in Figure 3-9.

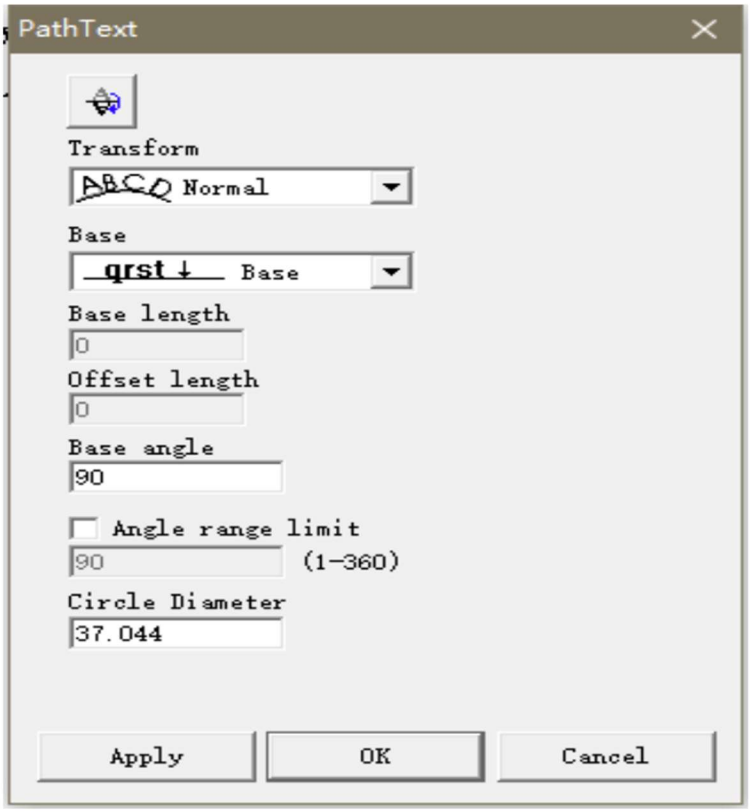


Figure 3-9 Curve Text Parameter Dialogue Box

For detailed instructions on curve text parameters, please refer to pages 43-46 of the EZcad software user manual.

4、 Edit vector graphics file

1. Confirm the format of the drawing file

The commonly used vector file format for marking software is DXF/AI:

DXF: If the drawing file is created using Auto CAD, select the "Auto CAD2000/LT2000DXF" format when saving the file, and then import the saved drawing file into the marking software for use;

AI: If the image file is in another format, it can be converted to AI format and exported using CorelDRAW software, and then the exported AI image file can be imported into the marking software for use.

2. Use CorelDRAW software to convert image file formats

Step 1: Double click the desktop CorelDRAW software shortcut icon, as shown in Figure 4-1, to open the CorelDRAW software;

Figure 4-1 CorelDRAW software

Step 2: Click on "File - Import", and a dialog box as shown in Figure 4-2 will pop up. Select the file that needs to be converted, click "Import", and then click "OK" in sequence until the file import software interface appears;

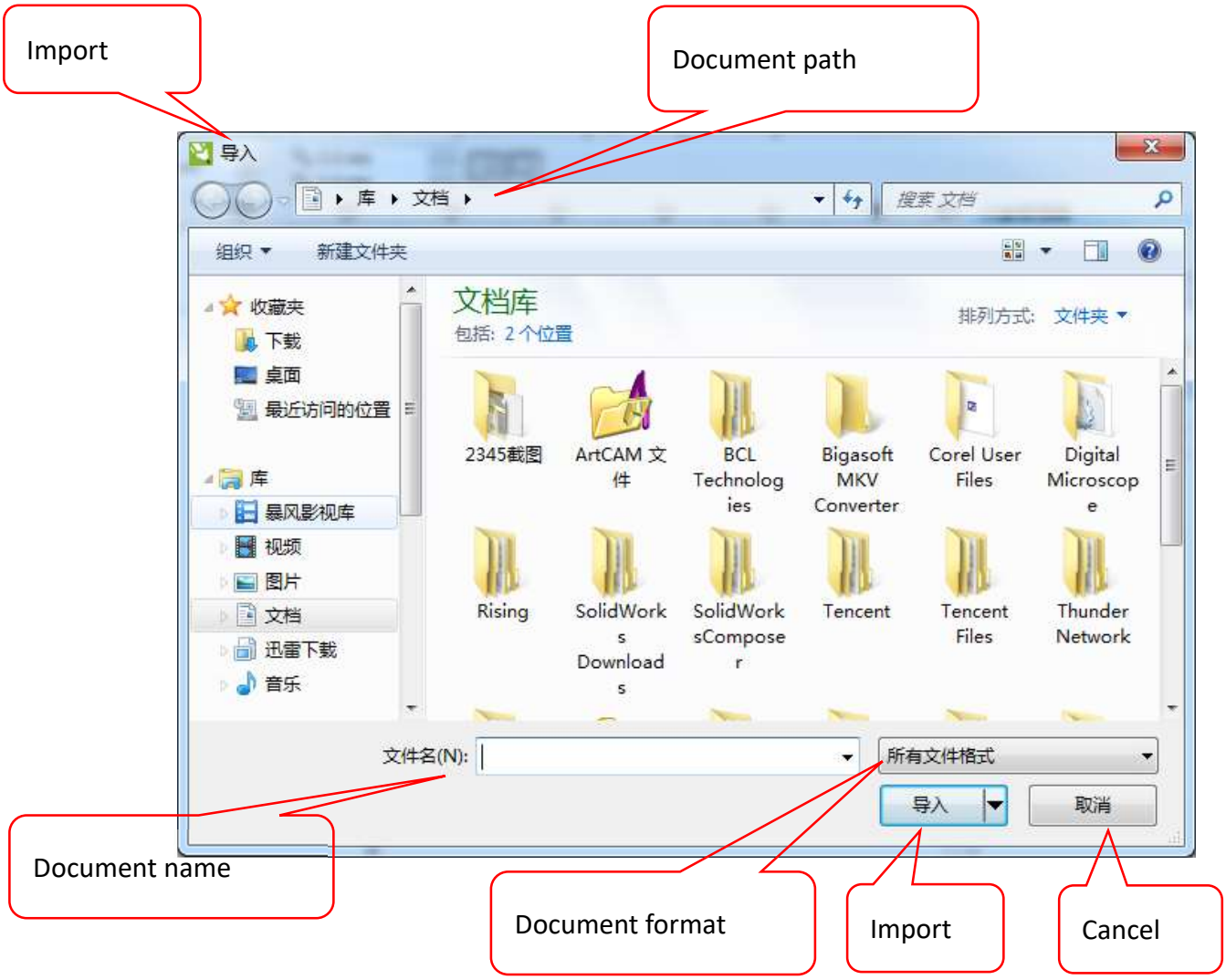
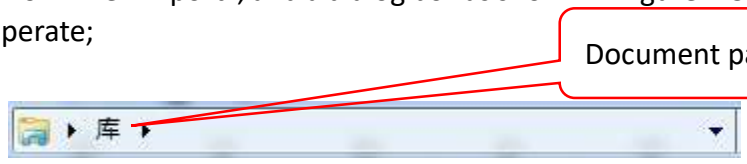
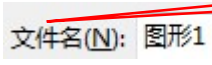


Figure 4-2 Import File Dialogue Box

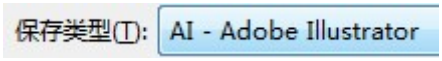
Step 3: Click on "File - Export", and a dialog box as shown in Figure 4-3 will pop up. Please follow the instructions below to operate;



① Select the save path here;



② Change the file name here;



③ Select the save type as' AI Abode Illustrator 'here.

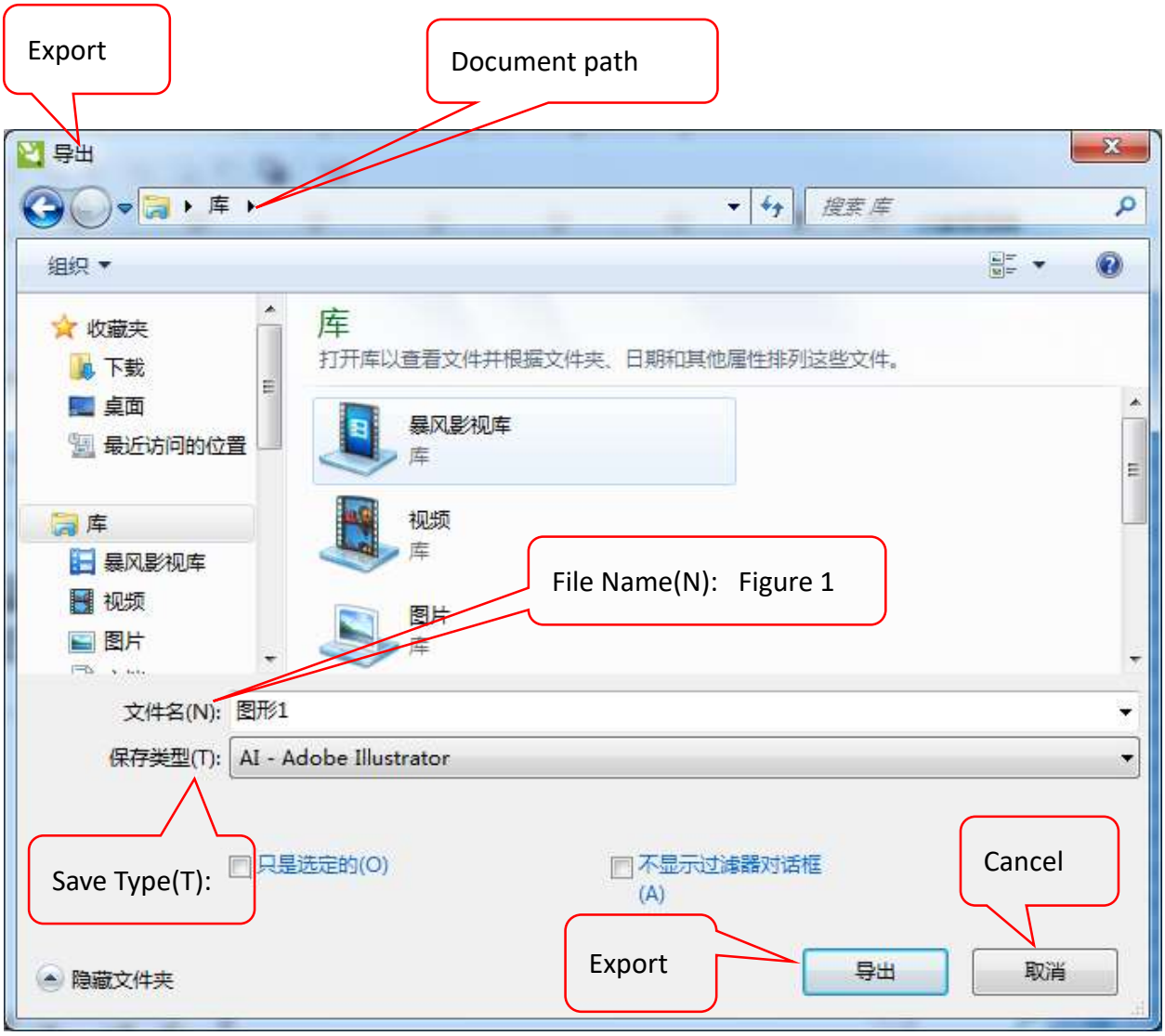


Figure 4-3 Export File Dialogue Box

Step 4: Click "Export", and a dialog box as shown in Figure 4-4 will pop up. Modify the options according to the content shown in the figure, and then click "OK" to complete the file format conversion. At this point, enter the marking software to import the converted file.

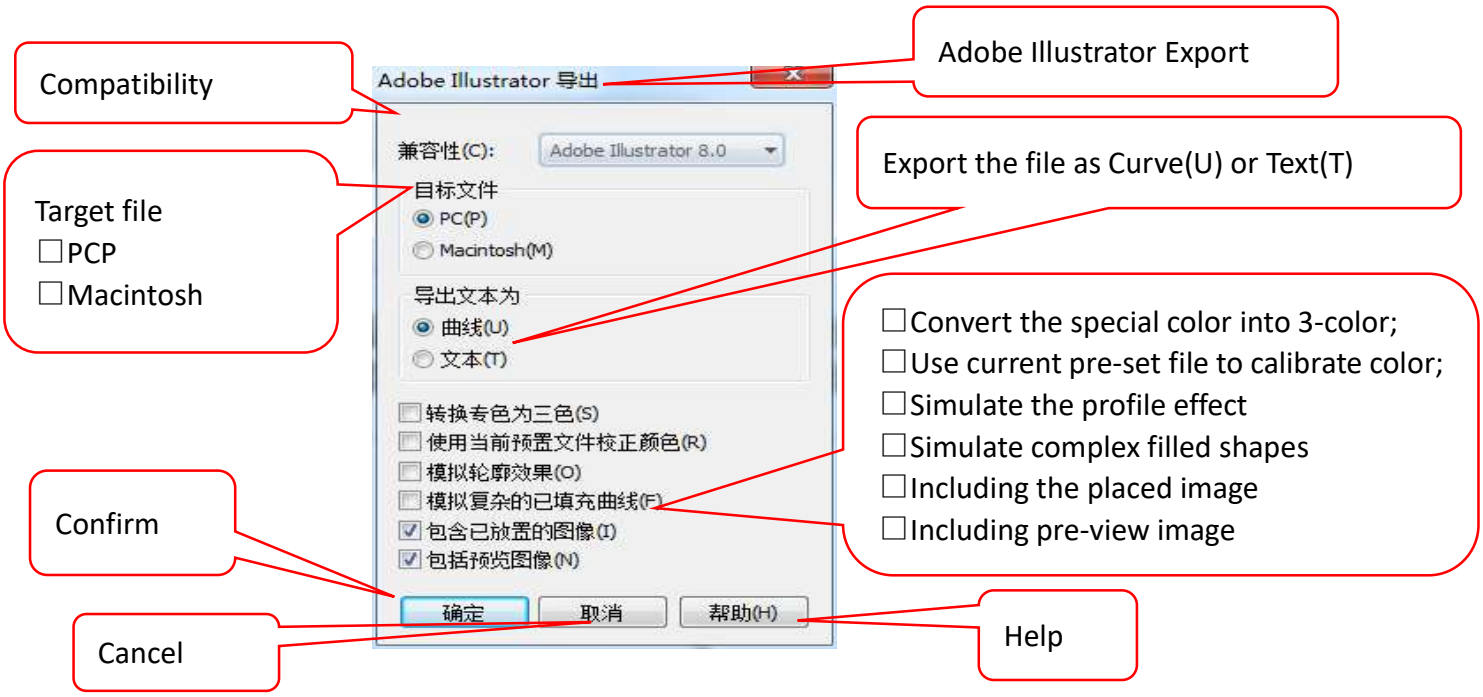


Figure 4-4 AI Export Dialogue Box

3. Edit vector files

Step 1: Select the "Vector File" command or click the icon ,  , in the drawing menu. The system will pop up a dialog box as shown in Figure 4-5. Select the vector file you want to import, click "Open", and import the vector file;

Figure 4-5 Vector File Input Dialogue Box

Note: Often times, after importing a graphic file, it cannot be seen in the workspace. We can observe the object

list and vector file attribute bar on the left, as shown in Figure 4-6. From the object list, we can see the vector file that has been imported,

but from the file's position coordinates, it can be seen that the graphic file is outside the workspace. At this point, click the icon to center the graphic file and place it at the origin. The vector file position coordinates will change to (X=0, Y=0), and we can see the graphic file in the workspace.

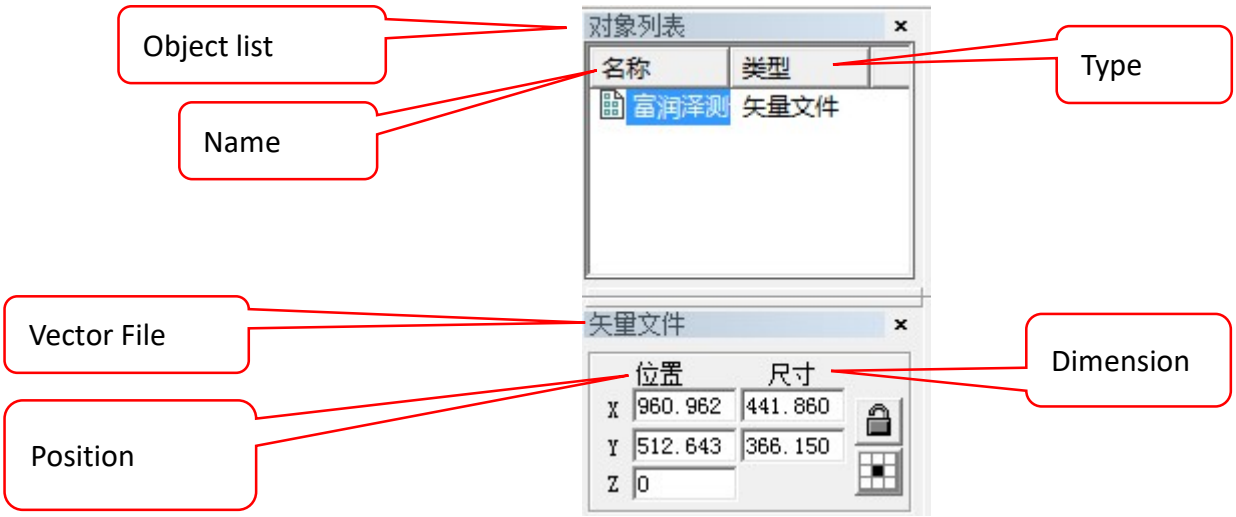


Figure 4-6 Object List and Attribute Bar

Step 2: Select the imported vector image file, click on the icon ,  , continuously to dissolve the group until the icon turns gray color,  . At this point, we can see in the object list that the vector file has become many curves;

Step 3: Select the unwanted curves (there may be many curves that are needed and unnecessary that are intertwined, and we can use the method of selecting objects in the opposite direction mentioned above to select the unwanted curves), and click the icon,  , to delete these curves;

Step 4: Select the remaining curves, click the group icon,  , and group the curves we need to mark together. (It is also possible to rent each marked object individually in a group, which makes it more convenient for each object to adjust its position separately.)

Now that the image file is edited, you can adjust the parameters according to the desired effect.

5、 Parameter setting and debugging

5.1. Set filling parameters

If the content we need to mark is an entity, we can select the object that needs to be filled and click the icon,  , to fill it (if no object is selected, this icon will be gray,  , and there will be no response when clicked). At this time, the fill parameter dialog box as shown in Figure 5-1 will pop up.

Figure 5-1 Filling parameter setting column

The definition of each item in the settings column can be found in the introduction on pages 15-20 of the software user manual. Here, I will talk about the range of **Line Distance** settings for some commonly used processes:

- The range of line distance for stainless steel whitening and aluminum whitening is 0.03mm-0.05mm;
- The range of line distance for stainless steel blackening and aluminum blackening is 0.005mm-0.02mm;
- The range of black line distance for stainless steel without tactile sensation is 0.005mm-0.01mm;
- The line distance range for marking lines on plastic materials is 0.04mm-0.08mm.

2. Find the focus

Laser is focused into a small spot through a lens, and then controlled by a galvanometer to scan the edited text or graphics on the processing surface. Therefore, before debugging, the focus should be adjusted to the processing surface.

First, draw a random pattern in the work area. Then, in the processing control bar shown in Figure 5-2, click on "Red Light" (or press F1 on the keyboard). The position indicated by the red light is the marking position. Place the metal sheet on the surface of the workpiece at the red light position, then check for continuous processing. Click "Marking" (or press F2 on the keyboard), adjust the lifting platform to the brightest and loudest height of the marking, and then click "Stop" (or press ESC on the keyboard) to stop marking. At this point, the focus is on the surface of the workpiece. (After adjusting the focus, cancel to prevent continuous light output during subsequent debugging)

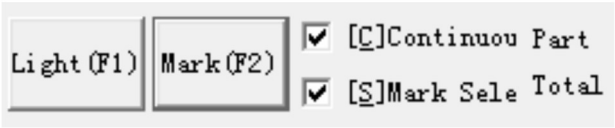
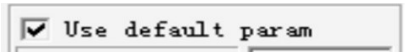


Figure 5-2 Processing Control Bar

5.3. Parameter settings in the marking parameter column

The marked parameter column is shown in Figure 5-3. We need to debug the speed, power, and frequency. The delay parameters are already set at the factory and do not need to be debugged during use.

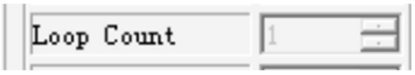
5.3.1  Referring to the pen number, different colors represent different strokes, and different pen numbers can set different parameters. Generally, when we have the same marking effect, we can use one pen number;

5.3.2Before setting the parameters, it is usually checked to "use default parameters", 

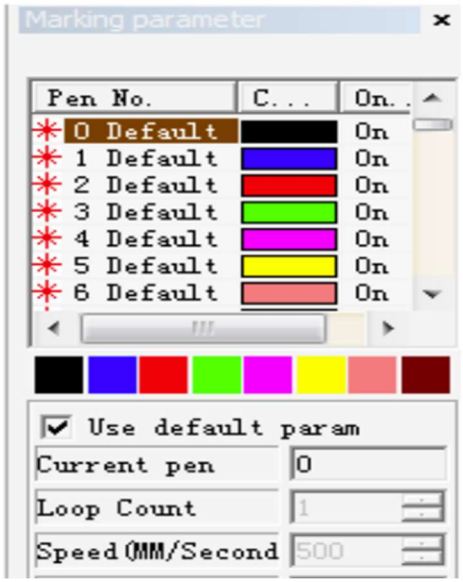
. If you need to debug the parameters yourself, you need to uncheck the check to set the following parameters;

5.3.3 

Refers to the current pen number, black represents "0", and the corresponding relationship can be seen in the "pen number color" corresponding list above;

5.3.4 

Refers to the number of times it needs to be processed, usually 1, requiring multiple unmarked times and can be debugged;



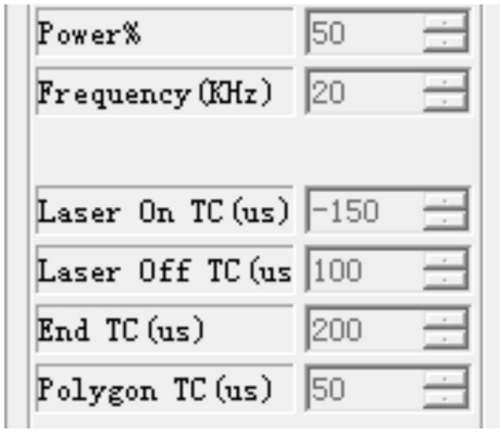


Figure 5-3 Marking Properties Table

5.3.5 

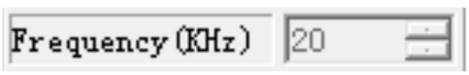
Refers to the speed of laser movement, with an adjustable range of 1mm/s-7000mm/s;

- The speed range for blackening stainless steel and aluminum materials, and blackening stainless steel without tactile sensation, is 100mm/s-300mm/s;
- The speed range for whitening stainless steel and aluminum materials, as well as plastic materials, is 1000mm/s-2000mm/s;

5.3.6 

Refers to the magnitude of laser energy, with an adjustable range of 0-100%;

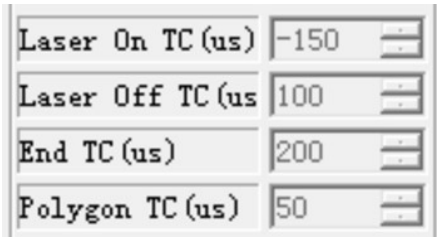
- The power setting range for blackening stainless steel and aluminum is 80% -100%, and the higher the power, the darker the marking effect;
- The power setting range for stainless steel without tactile black is 30% -50%;
- The power setting range for stainless steel and aluminum whitening is 50% -80%;
- The power setting range for plastic materials is 1% -80%. Plastic materials are more complex, so the power application range is also wider. Generally, light colored plastics use more power, while dark colored plastics use less power.

5.3.7 

The speed at which the laser emits laser light, with an adjustable range of 1-400KHz;

- The frequency range for blackening stainless steel and aluminum is 30-40KHz;
- The frequency setting range for stainless steel without tactile black is 80-120KHz;

- The power setting range for stainless steel and aluminum whitening is 40-60KHz;
- The frequency setting range for plastic materials is 10-30KHz.

5.3.8 

The delay parameters are usually adjusted at the factory and may not be adjusted during use.
In summary, the main parameters to be debugged during the debugging process are speed, power, frequency, and fill line spacing. Speed and line spacing are the two parameters that mainly affect efficiency. At the beginning of debugging, we can set these two parameters according to the material, desired effect, and efficiency requirements, and then debug the power and frequency to achieve the desired effect.

6、 Fixing fixtures and adjusting marking positions

6.1. Fixed fixtures

Step 1: Before fixing the fixture, select all the marked content, click on the icon,  , to center it, so that the marked content is in the middle of the work area, then click on the "red light" to display the area where the marked content is located. Place the product on the fixture, place the fixture in a suitable position, and insert the screw lock a few cycles, but do not lock it;
Step 2: Gently swing the fixture to ensure that its horizontal or vertical direction is parallel to the horizontal or vertical direction of the red light (this can ensure that the pattern is aligned with the product without any deviation angle during marking), and then fix the fixture. During the fixing process, pay attention to whether the fixture deviates relative to the red light until it is locked.

6.2. Adjust the marking position

There are three main methods to adjust the marking position:
Method 1: Drag with the mouse
After selecting the object to be adjusted, move the mouse to the middle of the object. When the cross arrow appears, click the left mouse button and drag the mouse to adjust the object to any position. During this process, use red light to adjust and roughly adjust the target object to the target position.
Method 2: Use the up/down/left/right arrow keys on the keyboard to adjust
After selecting the adjusting object, press "Up, Down, Left, Right" on the keyboard to move the object in these four directions. The jumping distance of one click can be set in the system parameters;

Select "System Parameters" from the file menu or click on the icon,  , "System Parameters". A dialog box as shown in Figure 6-1 will pop up. Then select "Move and Rotate", and the "Nudge Distance/Fine Adjustment Distance" on the right is the distance that the keyboard object moves each time it is pressed. We can set the size of the " Nudge Distance/Fine Adjustment Distance" as needed, and click "OK" to exit.

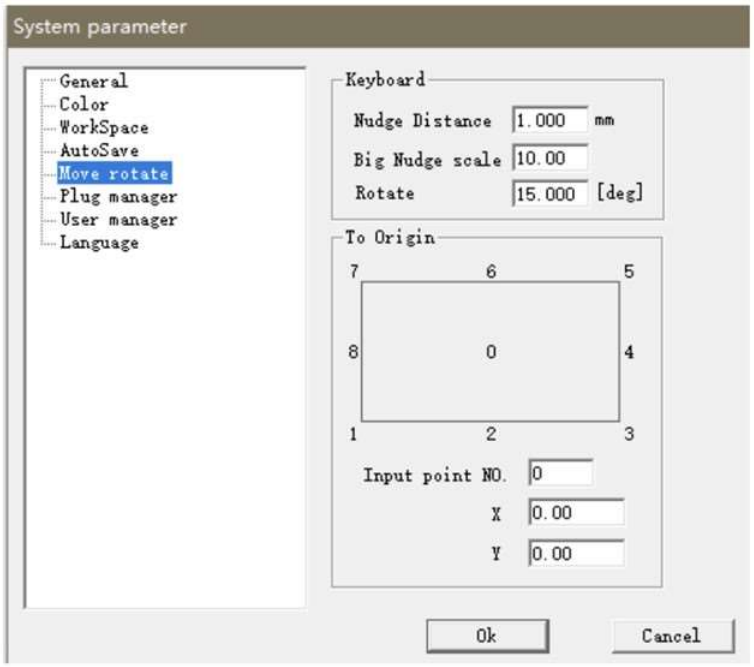


Figure 6-1 System Parameters

Method 3: Use "Modify Transform" to make precise adjustments

After selecting the target object, select "Transform" in the modification menu. A dialog box as shown in Figure 6-2 will pop up. Then, follow the settings shown in Figure 6-3 to make the XY position 0. At this time, we can enter the exact size we need to adjust in the XY position (right X is a positive value, left X is a negative value, up Y is a positive value, down Y is a negative value). After setting it up, click "Apply", and the target object will move to the position you adjusted.

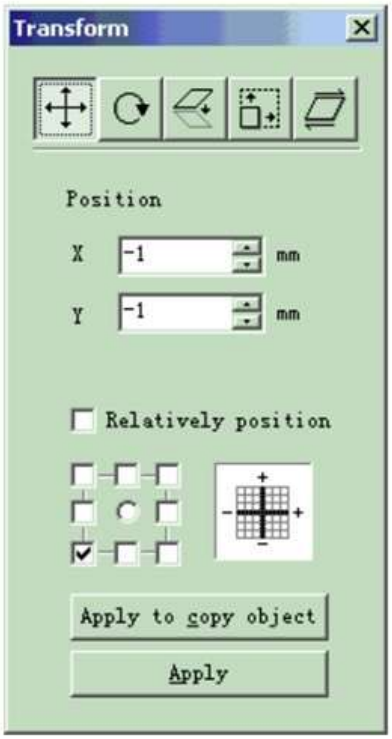


Figure 6-2 Transformation Parameters

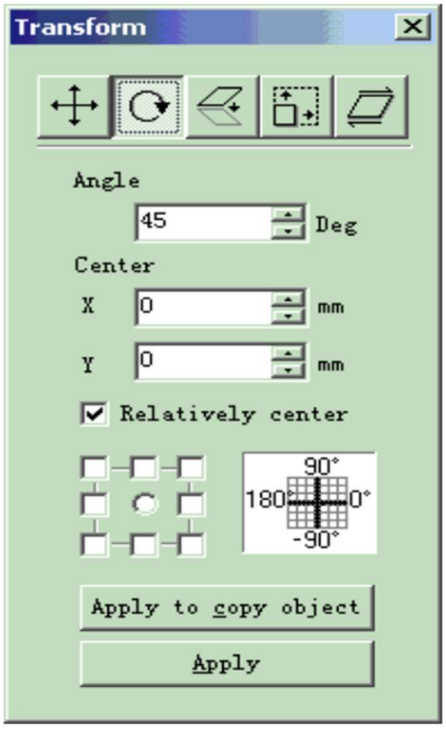


Figure 6-3 Transformation Parameters after Setting