

# Laser System Character Circulation Protocol

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# 1 Protocol Specification

The configuration interface is  .

① If the content does not contain Chinese, please use [Ascii], the configuration interface is

;

② If the content contains Chinese, please use [Unicode], the configuration interface is

;

Unicode Chinese example:

All characters are sent in Unicode double bytes.

English characters: The first byte value is 0x00, and the second byte value is the corresponding Ascii value (for example, the character A corresponds to the Ascii value of 0x41).

Chinese characters: Find Chinese Unicode values. For example, the Unicode value of Chinese "中" is 0x4E2D, the first byte is 0x4E, and the second byte is 0x2D.

Unicode Chinese example:

External hexadecimal sending:

**00 3C 00 45 6D 4B 8B D5 65 87 5B 57 00 3E 00 3C 00 4C 00 44 00 65 00 6D 00 6F 00  
3E 00 3C 00 44 65 87 67 2C 00 2C 8B F7 6C 42 4E 2D 65 87 00 3E 00 3C 00 58 00 3E**

Laser machine hexadecimal return:

**00 3C 00 45 6D 4B 8B D5 65 87 5B 57 00 3E 00 3C 00 4C 00 44 00 65 00 6D 00 6F 00  
3E 00 3C 00 44 65 87 67 2C 00 2C 8B F7 6C 42 4E 2D 65 87 00 3E 00 3C 00 58 00 3E  
00 3C 00 58 00 45 00 3E**

**Command explanation:**

The character content received by the laser machine is: <E test text><LDemo><D text, request Chinese><X>

The character content returned by the laser machine is: <E test text><LDemo><D text, request Chinese><X><XE>

Function explanation: The laser machine enters the working mode, the test returns to <E test text>, opens and loads the Demo.lmf3 file, and changes the content of the tag name text to request Chinese, triggers the engraving, and the engraving is completed.

**Note:** If the content contains the English right arrow > symbol, please add the English slash \ symbol in front. For example, the <Dtest,ABC\>> command will modify the content of the tag named test to ABC>.

## 2 Command Category

### 2.1 Test

#### 2.1.1 Test function

<E{test text}> is the test command, the command will be returned after the test is successful.

example:

Send: <Etest>

Return: <Etest>

Accepting the correct content means that the wiring and configuration are correct, and other instructions can be used further.

### 2.2 Document operations

#### 2.2.1 Load documents

<L{file name}> is to load the laser template file (The default is the file in the root directory), and the command will be returned after successful loading.

example:

Send: <Lfile1>

Return: <Lfile1>

Execution result: call the system to pre-save the file, named: file1.lmf3.

If you call a folder in a subdirectory, the command format is: <L{directory name}/{file name}>.

#### 2.2.2 Create document

<LNEW,{file name}> is to create a laser template file, and the command will be returned after successful creation.

example:

Send: <LNEW,CommTest>

Return: <LNEW,CommTest>

Execution result: Create a new file, the file name is CommTest.lmf3.

#### 2.2.3 Save document

<LSAVE> is to save the currently edited template file, and return to the command after

successful saving.

example:

Send: <LSAVE>

Return: <LSAVE>

Execution result: save the currently edited file.

## 2.2.4 Get a list of documents

<L> is the command to read the first 20 document names.

example:

Send: <L>

Return: <L,001.lmf3,002.lmf3>

## 2.3 Mark operation

### 2.3.1 Create a mark

<DNEW,{mark type},{name}> is the instruction to create the mark, and the instruction is returned after successful creation.

Mark types:

Mark types	Description
TEXT	TEXT
BARCODE	Bar code
VECTOR	Vector illustration
IMAGE	bitmap
LINE	straight line

**Note: Do not set the mark's name to NEW.**

example:

Send: <DNEW,TEXT,tx>

Return: <DNEW,TEXT,tx>

Execution result: Create a text mark, the mark name is tx.

### 2.3.2 Delete mark

<DDEL,{name}> is the instruction to delete the mark, and the instruction is returned after successful deletion.

example:

Send: <DDEL,tx>

Return: <DDEL,tx>

Execution result: delete the tag named tx.

### 2.3.3 Clear all marks

<DCLEAR> is the instruction to clear all the mark of the current document, and the instruction is returned after successful clearing.

example:

Send: <DCLEAR>

Return: <DCLEAR>

Execution result: Clear all mark in the current document.

### 2.3.4 Edit mark

①<D{name},{text}> is the command to modify the text, and the command will be returned after successful modification.

- If it is text/combined text/barcode, the content of the marked text is modified;
- If it is a picture/vector diagram, the name of the marked file is modified;

example:

Send: <Dtext1,1234>

Return: <Dtext1,1234>

Execution result: modify the content of the mark which name text1 to 1234.

example:

Send: <Dimg,apple.png>

Return: <Dimg,apple.png>

Execution result: Modify the name of the image file named img as apple.png.

②<D{name},{property type},{value}> is the instruction to modify the tag attribute, and the instruction is returned after successful modification.

Property types :

Property types	Description
PENNO	Marked pen number, the range is 0-20
WIDTH	The width of the mark, in mm
HEIGHT	The height of the mark, in mm

X	The X coordinate of the mark (default upper left corner), the unit is mm
Y	Y coordinate of the mark (default upper left corner), the unit is mm
POSR	coordinate datum of the mark 0=upper left corner 1=top center 2=Upper right corner 3=left end center 4=center 5=right end center 6=lower left corner 7=Bottom center 8=Small right corner
FILL_SPACE	The spacing of the lines when the mark has FILL enabled.
FILL_ANGLE	The angle of the lines when the mark has FILL enabled.
LINE_X1	The X coordinate of the starting point of the line segment.
LINE_Y1	The Y coordinate of the starting point of the line segment.
LINE_X2	The X coordinate of the end point of the line segment.
LINE_Y2	The Y coordinate of the end point of the line segment.
TEXT_SPACE	distance between characters
TEXT_CHAR_WIDTH	Width of characters
TEXT_CHAR_HEIGHT	Height of characters
TEXT_ENFONT	Filling distance of the mark, the unit is mm
TEXT_CNFONT	The filling angle of the mark, in degrees
BARCODE_TYPE	Type of barcode mark Code128 = 0 QRCode = 1 Code39 = 2 Code93 = 3 Code11 = 4 CodaBar = 5

	C25Matrix = 6 C25Inter = 7 ExtendCode39 = 8 EAN128 = 9 EAN8 = 10 EAN13 = 11 UPCA = 12 UPCE = 13 ISBN = 14 PDF417 = 15 DataMatrix = 16 DataMatrixGS1 = 17 Code128A = 18 Code128B = 19 Code128C = 20
BARCODE_SHOWTEXT	Whether the barcode mark displays text Hidden = 0 Display = 1
ENTITY_CLOSE_MARK	Whether to turn off marking Turn off marking = 1 Enable marking = 0

**Example:**

**Send:**

<Dtext1,WIDTH,20.0><Dtext1,HEIGHT,7.0><Dtext1,POSR,0><Dtext1,X,-10.0><Dtext1,Y,3.5>

**Return:**

<Dtext1,WIDTH,20.0><Dtext1,HEIGHT,7.0><Dtext1,POSR,0><Dtext1,X,-10.0><Dtext1,Y,3.5>

Return result: Modify the mark named text1, set the width to 20.0mm, the height to 7.0mm, the coordinate reference datum to the upper left corner, the X coordinate to -10.0mm, and the Y coordinate to 3.5mm.

## 2.3.5 Get mark's content

① <?{Name}> is the instruction to read text, and the read content will be returned after success.

- If it is text/combined text/barcode, what is read is the marked text content;
- If it is a picture/vector diagram, it reads the marked file name;

Example:

Send: <?text1>

Return: <?text1,1234>

Execution result: read and return the content of the tag name text1.

Example:

Send: <?img>

Return: <?img,apple.png>

Execution result: read and return the current picture with the mark's name img as apple.png.

②<?{name},{property type}> is the instruction to read the mark's attribute.

<?{name},{property type},{number}> are instructions for reading and returning results.

For the attribute type, please refer to **[2.3.3 Modifying the marked content]**.

Example:

Send: <?text1,WIDTH><?text1,HEIGHT><?text1,X><?text1,Y>

Return: <?text1,WIDTH,20.0><?text1,HEIGHT,7.5><?text1,X,-10.0><?text1,Y,3.5>

Return result: Read the mark named text1, the width is 20.0mm, the height is 7.5mm, the X coordinate is -10.0mm, and the Y coordinate is 3.5mm.

## 2.3.6 Mark rotation

<D{name},{action type},{value}> is the instruction to modify the mark, and the instruction is returned after successful modification.

Action types :

| Action types | Description  |
|--------------|--|
| ROTATE       | The mark is rotated based on the center, positive value is clockwise rotation, negative value is counterclockwise rotation |

Example:

Send: <Dtext1,ROTATE,90.0>

Return: <Dtext1,ROTATE,90.0>

Return result: Rotate the mark named text1 by 90 degrees clockwise.

## 2.3.7 Get a list of marks

<D,{mark type}> is to get the list of marks, and successfully return all the object names of the specified mark type in the document.

<D>Returns the names of all marked objects.

For the mark type options, please refer to [2.3.1 Create Mark].

example:

Send: <D>

Return: <D,text1,img1,barcode1>

Return result: There are a total of 3 marks in the document, the names are text1, img1 and barcode1.

Send: <D,IMAGE>

Return: <D,IMAGE,img1,img2,img3>

Return result: There are a total of 3 bitmap objects in the document, the names are img1, img2 and img3.

## 2.4 Marking pen number operation

### 2.4.1 Modify pen number parameters

<D{property},{value}> is the command to modify the first pen number print parameter, and the command will be returned after successful modification.

Fixed function names:

| Function name  | Description                                      |
|----------------|--|
| SPEED          | Print speed of pen number, unit is mm/s          |
| POWER          | The power of the pen number, the unit is%        |
| FREQ           | The frequency of the pen number, the unit is kHz |
| MARKLOOP       | The print times of pen number                    |
| OPEN_DELAY     | Ligth-on delay of pen number, the unit is us     |
| CLOSE_DELAY    | Light-off delay of pen number, unit is us        |
| END_DELAY      | The end delay of the pen number, the unit is us  |
| CORNER_DELAY   | Corner delay of pen number, unit is us           |
| JUMP_SPEED     | Jump delay of pen number, unit is mm/s           |
| JUMP_MIN_DELAY | The minimum jump delay of pen number,            |

|                |   |
|----------------|---|
|                | the unit is us  |
| JUMP_MAX_DELAY | Maximum jump delay of pen number, unit is us  |
| JUMP_MAX_LEN   | The maximum jump length of the pen number, the unit is mm                                     |
| DOT_MODE       | Dot mode of pen number<br>Time = 0<br>Pulse = 1<br>Diamond = 2                                |
| DOT_DELAY      | Pen number marking time (only valid when the marking mode is time or diamond), the unit is us |
| DOT_PULSE      | Number of dotting pulses of pen number (only valid when dotting mode is pulse)                |
| DOT_SIZE       | The dot size of the pen number (only valid when the dot pattern is diamond), the unit is mm   |
| PULSE_WIDTH    | The pulse width of the pen number, the unit is us   |

**Note: Do not set the tag name as a fixed function name.**

example:

Send: <DSPEED,2000><DPOWER,80><DFREQ,20>

Return: <DSPEED,2000><DPOWER,80><DFREQ,20>

Execution result: Modify the marking speed of the first pen number to 2000mm/s, power to 80%, and frequency to 20kHz.

<D{function name},{pen number},{value}> is the command to modify the print parameter of the specified pen number, and the command will be returned after successful modification. The pen number range is 0-20.

Example 1:

Send: <DSPEED,0,2000><DPOWER,1,80><DFREQ,2,20>

Return: <DSPEED,0,2000><DPOWER,1,80><DFREQ,2,20>

Execution result: modify the marking speed of pen number 0 to 2000mm/s, modify the power of pen number 1 to 80%, and modify the frequency of pen number 2 to 20kHz.

## 2.4.2 Read pen number parameters

<?{function name}> is the instruction to read the marking parameter of the first pen

number.

<?{function name},{number}> is the command to return the marking parameter result of the first pen number.

For the fixed function name, please refer to [2.4.1 Modify Pen Number Parameters].

Example:

Send: <?SPEED><?POWER><?FREQ>

Return: <?SPEED,2000><?POWER,80><?FREQ,20>

Execution result: The marking speed of the first pen number returned is 2000mm/s, the power is 80%, and the frequency is 20kHz.

<?{function name},{pen number}> is the instruction to read the marking parameter of the specified pen number. The pen number range is 0-20.

Example 1:

Send: <?SPEED,0><?POWER,1><?FREQ,2>

Return: <?SPEED,0,2000><?POWER,1,80><?FREQ,2,20>

Execution result: the marking speed of return pen number 0 is 2000mm/s, the power of pen number 1 is 80%, and the frequency of pen number 2 is 20kHz.

## 2.5 Marking mode operation

### 2.5.1 Modify marking mode parameters

<D{property types},{value}> is the command to modify the marking mode, and the command will be returned after successful modification.

Fixed property types:

| Property types        | Description  |
|-----------------------|--|
| MARK_MODE             | Document marking mode<br>Static: 0<br>Flight: 1<br>Pipeline: 2 |
| MARK_START_DIST_DELAY | Start delay length of flight/pipeline mode (mm)                |

example:

Send: <DMARK\_MODE,1><DMARK\_START\_DIST\_DELAY,100>

Return: <DMARK\_MODE,1><DMARK\_START\_DIST\_DELAY,100>

Execution result: Modify the current document marking to the flight mode, and modify the start delay length of the flight mode to 100mm.

## 2.6 Marking completed operation

### 2.6.1 Read completion parameters

<?{Fixed name}> is a command to read parameters.

<?{Fixed name},{numerical value}> is the instruction to read and return the result.

Fixed function name:

| Property types | Description                        |
|----------------|------------------------------------|
| MARKTIME       | Document marking time (in seconds) |
| MARKCOUNT      | Number of documents marked         |
| PLANCOUNT      | Number of document plans           |

**Note: Do not set the tag name as a fixed function name.**

example:

Send: <?MARKCOUNT><?PLANCOUNT><?MARKTIME>

Return: <?MARKCOUNT,100><?PLANCOUNT,1000><?MARKTIME,2.50>

Execution result: Return the current document has marked number of 100, planned number of 1000, and current marking time of 2.50s.

### 2.6.2 Revise the plan and the number of completions

<D{property type},{numerical value}> is an instruction to modify the plan and complete the number, and return the instruction after successful modification.

Fixed property type:

| Property types | Description                              |
|----------------|--|
| MARKCOUNT      | Number of documents marked               |
| PLANCOUNT      | Number of documents planned to be marked |

example:

Send: <DPLANCOUNT,1000><DMARKCOUNT,0>

Return: <DPLANCOUNT,1000><DMARKCOUNT,0>

Execution result: modify the planned number of markings in the current document to 1000, and the number of markings to 0.

**Note: The planned number must be greater than or equal to the marked number.**

## **2.7 Infrared Preview and Print**

### **2.7.1 Print**

<X> is to trigger the engraving instruction.

example:

Send: <X>

Return: <X><XE>

Execution result: return to command <X> after starting to engrave, return to <XE> after engraving is completed.

### **2.7.2 Start Infrared Preview**

<XP> is to trigger the preview command.

example:

Send: <XP>

Return: <XP>

Execution result: Start the red light preview, and return to the command <XP> after the preview is started.

### **2.7.3 Start Infrared Preview specify size position**

<XP,{width},{height},{center X position}, {center Y position}>, trigger the preview to the specified position size red light, the parameter unit is mm.

example:

Send: <XP,30.00,10.00,0.0,0.0>

Return: <XP>

Execution result: Start the red light preview, the preview content is a rectangle, the width is 30.00mm, the height is 10.00mm, the center X position of the rectangle is 0.00mm, and the center Y position is 0.00mm.

### **2.7.4 Move the galvanometer and control the red light point**

<XP,{Coordinate X},{Coordinate Y},{Whether to display red light point Y/N}>, used to control the current position of the galvanometer, optional display of red light point (Y=display, N=not display).

example:

Send: <XP,30.00,10.00,Y>

Return: <XP>

Execution result: Move the current galvanometer position to X=30.00mm, Y=10.00mm position, and display the red light spot.

## 2.7.5 Stop print

<P> is the instruction to stop engraving.

example:

Send: <P>

Return: <P>

Execution result: Return to command <P> after stopping engraving.

## 2.7.6 Rotating mark print

<T{name},ROTATE,{reference point reference},{value}> is a rotation marking command, this command only takes effect when marking, and it will be automatically cleared after marking stop/document close/marking error is 0.

Reference point reference value description:

0=upper left corner

1=top center

2=Upper right corner

3=left end center

4=center

5=right end center

6=bottom left corner

7=Bottom center

8=bottom right corner

example:

Send: <Ttext1,ROTATE,4,90.0><X>

Return: <Ttext1,ROTATE,4,90.0><X><XE>

Execution result: Rotate the mark named text1 by 90 degrees from the center position and mark.

## 2.7.7 Offset and rotate document marking

<T> is the command to offset and rotate the document (based on the coordinate center), which is generally used for visual positioning and marking. This command only takes

effect when marking, and it is automatically cleared to 0 after marking stop/document close/marketing errors occur.

example:

Send: <T,6,1.0,2.0,3.0,4.0,5.0,6.0><X>

Return: <T,6,1.0,2.0,3.0,4.0,5.0,6.0><X><XE>

Execution result: marking twice, the first marking has a horizontal offset of 1.0mm, a vertical offset of 2.0mm, the document rotated by 3.0 degrees, the second marking has a horizontal offset of 4.0mm and a vertical offset of 5.0mm , Rotate the document by 6.0 degrees.

Command explanation:

T resolves to offset and rotation instructions

6 means the number of coordinate values, every 3 coordinate values corresponds to the document offset and rotation once, here a total of two

1.0 means that the horizontal offset is 1.0mm in the first time

2.0 means that the vertical offset is 2.0mm in the first time

3.0 means to rotate 3.0 degrees in the first time

4.0 means that the horizontal offset is 4.0mm in the second time

5.0 means vertical offset of 5.0mm in the second time

6.0 means to rotate 6.0 degrees in the second time

<X> is parsed as the start of marking, here it means that the document is marked twice, the first offset and rotated document is marked, and then the second offset and rotated document is marked, and so on. Return to XE after marking.

## 2.7.8 Offset and rotating galvanometer marking

<T, MIRROR, Offset X, Offset Y, Angle> are instructions for offset and rotation of the galvanometer. After receiving this instruction, the offset and angle parameters are applied to the laser calibration. After the marking is completed, it will automatically restore to the original calibration.

example:

Send: <T,MIRROR,-1,-2,0><X>

Receive: <T,MIRROR,-1,-2,0><X><XE>

Execution result: horizontal offset -1mm, vertical offset -2mm, rotate 0 degrees to correct the laser and mark. After the marking is completed, the system automatically restores the original correction.

## 2.7.9 Group label direct marking

<S{0},X> S0 means to select all labels with a sequence number of 0, and X means to mark immediately.

example:

Send: <S0,X>

Return: <S0,X><XE>

Execution result: All the labels with the label control marking group number 0 are marked and issued once when the marking is triggered, and then returns to XE after the marking is completed.

## 2.7.10 Select the mark name to print directly

<C{Name},X> is to select and mark according to the name.

example:

Send: <CAPPLE,X>

Return: <CAPPLE,X><XE>

Execution result: Only the mark with the name APPLE is marked, and XE is returned after the marking is completed.

## 2.7.11 Marking complete output

① <XE>, <XE> is the default marking completion output instruction;

② <XE{name},{marking content}>, this command outputs the content of the marking, the software needs to be configured before it can be used.

## 2.7.12 Marking interrupt output

<XT> is the marking interrupt command.

This command will be issued in the following two situations:

① In single mode, during the marking process, click /IO to trigger to stop marking;

② In the continuous/trigger/flight mode, during the marking process, click /IO to trigger to stop marking or encounter errors such as the serial number/database/document plan number has been marked, etc.;

## 2.7.13 Query marking status

<?X> is the instruction to query the marking status;

| Return value | Status      |
|--------------|-------------|
| 0            | Not working |

|   |                      |
|---|----------------------|
| 1 | Marking              |
| 2 | In red light preview |

example:

Send: <?X>

Return: <?X,1>

Execution result: The return value is 1, which means that the marking is currently in progress.

## 2.7.14 Start to shine

<XL,{Power},{Frequency},{Duration}> is the instruction to start light emission, which is used to continuously emit light without interruption until {duration time}.

If {duration time} is less than or equal to 0, the light will keep emitting without stopping.

The power unit is %, the frequency unit is kHz, and the duration unit is ms.

Example 1:

Send: <XL,100,20000,-1>

Return: <XL,100,20000,-1>

Execution result: Use 100% power, 20kHz frequency, and continue to turn on the light until it stops after receiving the [Stop Light] command.

Example 2:

Send: <XL,100,20000,1000>

Return: <XL,100,20000,1000>

Execution result: use 100% power and 20kHz frequency, continue to turn on the light, stop emitting light after 1000 milliseconds.

Note: Even if the light is stopped after 1000 milliseconds, it still needs to use the [Stop Light] command to exit.

## 2.7.15 Stop the light

<PL> is the stop light emitting command, which can only be used in conjunction with the [start light emitting] command.

## 2.8 IO config

### 2.8.1 Input Port

<?I> is the command to query the voltage status of input ports IN1-IN5. There are two status. 1 for high level, and 0 for low level.

Example:

Send:<?I>

Return:<?I,0,1,1,1,1,1,1,1,1,1,1,1,1,1>

Execution Result: The voltage status of input port IN1 is low level, and the IN2-15 is high level.

### 2.8.2 Output Port

<O,port,level,duration> is the command to control output port. It can control out1-out15.

| Parameter | Description   |
|-----------|---|
| port      | 1-15, represent output port out1-out15  |
| level     | 0 for low level, 1 for high level   |
| duration  | 1-999999999, unit is millisecond, the duration of the voltage state of the output port. |

Example 1:

Send:<O,1,0,100>

Return:<O,1,0,100>

Execution result: Output port out1 outputs a low level for 100 millisecond.

Note: If the output port be used by other functions, there will return FAIL, see in [2.9 Error message](#)

<?O> is the command to query the output port voltage status, 0 for low level, 1 for high level.

Example 2:

Send:<?O>

Return:<?O,0,1,1,1,1,1,1,1,1,1,1,1,1,1>

Execution Result: The output port voltage is that out1 is in low level and out2-15 is in high level.

## 2.9 Error message

### 2.9.1 Error output

Format: <FAIL{n}... ..>, the output command with error code n, this command is the active output of the board. in:

- ①Code 1, <FAIL1>, means that the marking has repeated codes;
- ②Code 2, <FAIL2>, means that an invalid command was received;
- ③Code 3, <FAIL3>, means that the output port is used by other function, failed to control output port.
- ④Code 4, <FAIL4>, means communication failed when software try to config hardware.

### 2.9.2 Error input

Format: <FAIL, {content text prompt}, {output port number}, {output signal type}, {Duration}>. This command is sent to the board card, and the board card receives the rear interface and IO output prompt.

Content text prompt: In Ascii transmission mode, only English prompts are supported; if in Unicode transmission mode, English and Chinese prompts are supported.

Output port number: range 0-9, if 0, there is no output. If 1-9, the OUT1-OUT9 port corresponds;

Output signal type: 0= low level, 1= high level.

Duration: Unit is in seconds. -1= The interface is maintained and the output port is output until the interface is closed.

Note If you are currently marking, the current marking is stopped before this command.

example 1:

Sent: <FAIL, Error, 1,1, -1>

Returns: <FAIL, Error, 1,1, -1>

Execution result: interface prompt [error] and output high level at OUT1. When the interface is closed, OUT1 returns to low level.

example 2:

Sent: <FAIL, Error, 0,1,5>

Returns: <FAIL, Error, 0,1,5>

Execution result: interface prompt [error], no output port, after 5 seconds, the interface automatically closed.

## **2.10 Other information**

### **2.10.1 The External IO triggers the output instruction**

Note: Only the included IO input port configuration versions are supported.

Function: When the external IO is triggered, the communication sends this command.

Format: <COMMIO>

## **2.11 The only ID for the board**

Form <?BOARD\_ID>, read the board card unique ID instruction.

example:

transmit by radio:<?BOARD\_ID>

return:<?BOARD\_ID,9496561E62ED1085>

### 3 Example

Example:

External Serial port sent: <Etest> <Lfile2> <Dtext1,1234> <Dtext2,9876> <X>

Laser return machine: <Etest> <Lfile2> <Dtext1,1234> <Dtext2,9876> <X> <XE>

Function explanation: laser enters working mode, test returns <Etest>, load the file file2.lmf3, modify the tagname text1 content to 1234, modify the tagname text2 content to 9876, trigger the carving, and the carving is complete.