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## Safety notice

Please carefully read the manual before using the product. Here list some safety operation items, but they can't replace some safety operation rules from the country and the company.

## Safety operation

Users must follow safety operation rules made by the country and the company.

## Mechanical dangerousness

Operation and repair of automation equipment are a little dangerous and are careful. Please be far away from the working equipment. Please control the equipment by correctly using the panel's buttons. Don't wear so loose clothes when using and repairing the equipment.

## High-voltage dangerousness

Be careful of electric shock during operation. Please install the equipment according to its manual. Don't touch cables or wires after power on. Only professional maintenance personal can open the controller. When the equipment has problems, power should be off and then repair.

## Power isolation

Please check whether power is right (AC220V±15%).
You must need an AC stabilized-voltage power if power is beyond the above range.
In some places there is no normal power, such as zero line and ground line are together or no zero line, an isolation transformer must be used from 2-phase/3-phase AC380V to 2-phase AC220V.
A lightning rod is also a must.

## Working environment

The controller's working temperature is 0-40℃. If out of its working temperature, the controller probably

works worse. If the temperature is below 0℃, the screen will not display normally.
Relative humidity is 0-85%.
Special protection is a must when working in high-temperature, high-humidity, and corrosive-gas environment.
Don’t ask dusts, metal chips and others to go into the controller.

## Controller connection

The controller’s input/output uses DC24V power (3A or over 3A) and the power can’t be used for other electrical equipment. When the power is not connected and emergent stop and limit position are both valid, the controller will in the state of emergent stop and limit position.
The connection line between the controller and the driver should be shielding wire.
Don’t plug in and plug out when power on.
Controller’s input/output line should connect well.

## Good ground-connection

All parts of the cutting machine and the controller should connect ground.
**The most effective method of reducing plasma interference is to use shielding wire and good ground-connection.**
Controller’s ground wire diameter should be over 4 $mm^2$ , and try to keep a shorter distance to the ground.
DC24V ground (-) must break with ground.

## Controller protection

Don’t ask dusts, metal chips and other materials to go into the controller so that it can’t normally work.
The controller’s LCD screen should be protected.
Others
The controller can use U disk and its format is FAT or FAT32
The controller has a manual.
If the controller damages because of abnormal operation, we are not responsible for maintenance.

Controller operation and maintenance
Only professional operators can use the controller.

## Controller operation

Please use fingers to press buttons.
Please don’t change functions and parameters at random if you are not familiar with them.
Please feel free to let us know problems during operation.

## Controller maintenance

When the controller can’t work normally, you need to check relative hardware or wire connection after power off.
Don’t open the controller to repair without professional personnel.
Please feel free to let us know when the controller has problems.

## Declaration

Controller guarantee instruction

Guarantee period: within 12 month after leaving our company.
Guarantee terms: during guarantee period any problems under normal operations.
During guarantee period, we charge for out of guarantee terms.
We charge for all problems out of guarantee period.

## Following situations are beyond guarantee:

Any damage under abnormal operation or accident damage;
Damaged by plug in and out of the controller when power on;
Natural disasters;
Repair, disassemble, retrofit, etc. at random without our allowance.

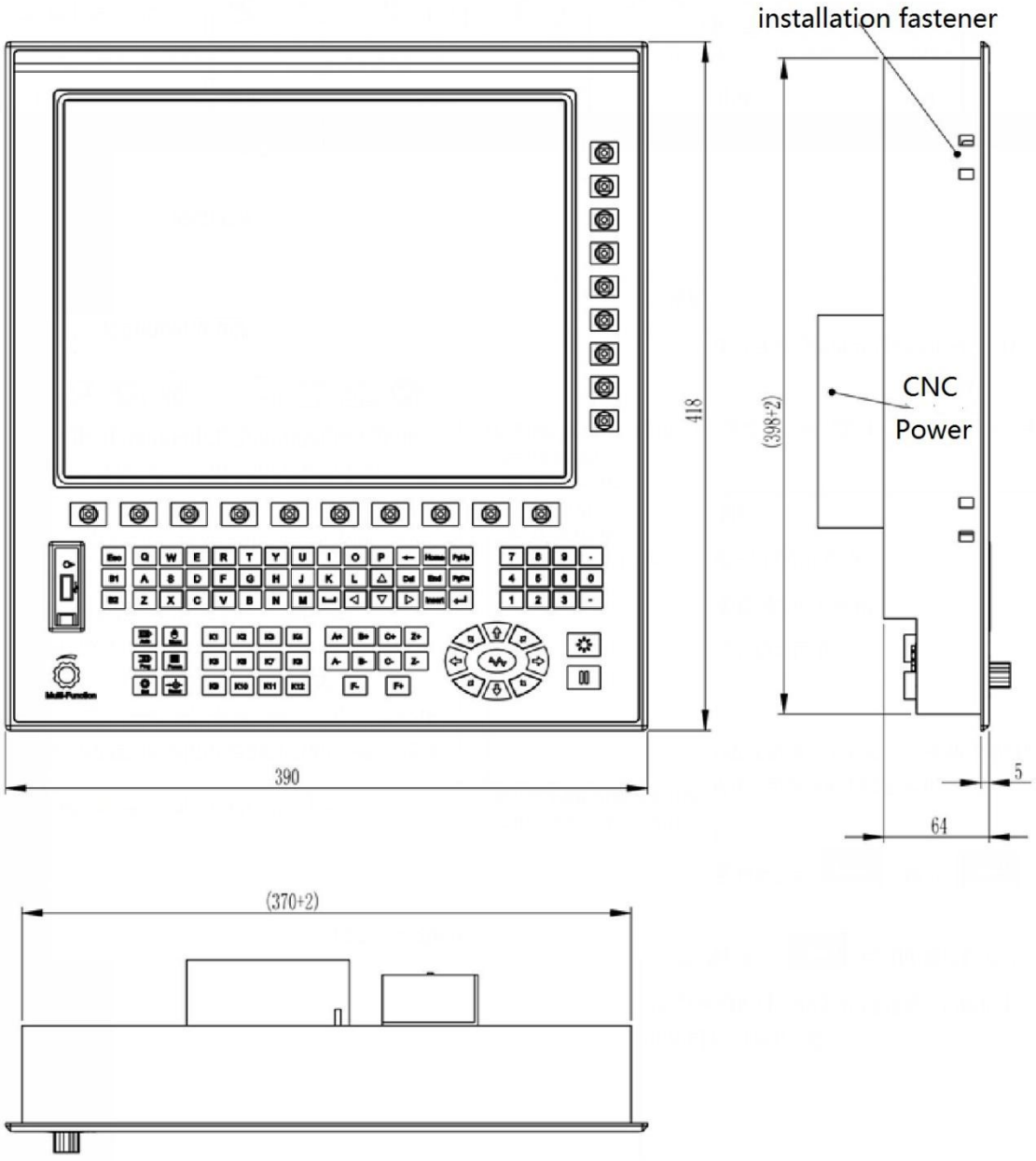
## Chapter 1 controller general introduction

Basic parameters
Processor: industrial ARM chip

Display: 15” true color LCD
Input/output: 32 optoelectronic isolation input, 24 optoelectronic isolation output
Axis number: 4 axes, 6 axes is available after upgrade
AD/DA: 2/2
Encoder input: CC-Z4: 3
PWM output: 4
Communication: RS232 X 2, USB X 1, 485 X 1
Pulse equivalence: electronic gear numerator, denominator set range: 1 ~ 65535
Store space: 4G
Working temperature: 0℃ ~ +40℃
Store temperature: -40℃ ~ +60℃

## 1-1 installation dimension

CC-Z4




Installation hole distance: height 400, width: 372

## 1-2 display

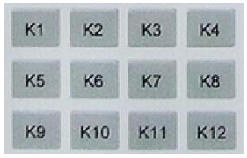
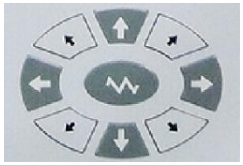
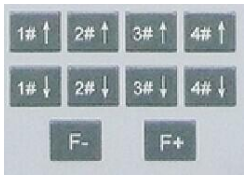
15” true color LCD, resolution 1024*768.

## CNC front panel

CC-Z4


## 1-3 keys

| | |
|---|---|
|  | Function keys<br>The specific function is up to the interface display. |
|  | Cursor movement keys |
|  | Edit keys<br>Fast operation:<br>1, when revise values, press ␣, press ↵ again, can clear back numbers<br>2, ↵ to confirm and line feed<br>3, when preview figure, [X] zoom out, [Y] zoom in, [G] restore, move figure by edit direction keys |

| | |
|---|---|
| | 4, [Del] delete, [Ins] insert, [Home] line head, [End] line end, [PgUp] pageup, [PgDn] pagedown |
|  | Manually open or closed external switches |
|  | Direction keys<br>Manually move torch<br>  change manual multiplying power, 10% or 80% |
|  | Speed adjustment, torch up/down keys<br>Up/down keys separately control 4 torches<br>[F+]: speed up, [F-]: speed down |
|  | Start/Pause keys<br>When preheat delay,  prolong delay,  skip delay |

Press the same key, multi-choice display in cycle

| | |
|---|---|
| Section | Display “pierce point” and “line number” in cycle, automatically tip input range |
| Breaking point | Display three breaking points in cycle, start with the latest breaking point |
| Mirror | “X mirror”, “Y mirror” and “XY mirror” display in cycle |
| Return | “parts reference point” and “laser location point” (if set the parameter) |

## 1-4 USB port

 U disk is FAT or FAT32 format without several partitions, and small storage is better.

It’s better to save parts program in U disk to CNC to cut and cover the port when cut in order to avoid dust.

“A” key is CNC upgrade button, turn on CNC after press it.

## 1-5 back panel

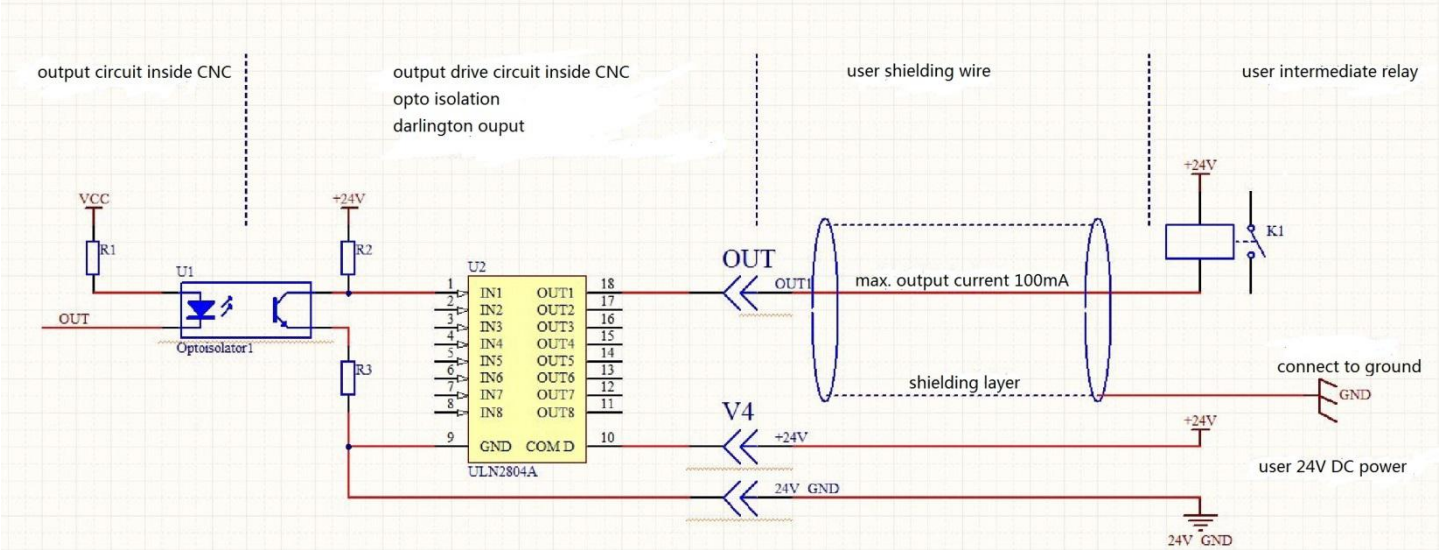
CC-Z4

Input signal port X 4;  Output signal port X 3;  Communication signal port RS232 X 2
Motor signal port X 3; Power supply port X 2;

**Note: 220V AC power for CNC connects the AC input port of the switch power supply.**

## 1-6 signal port

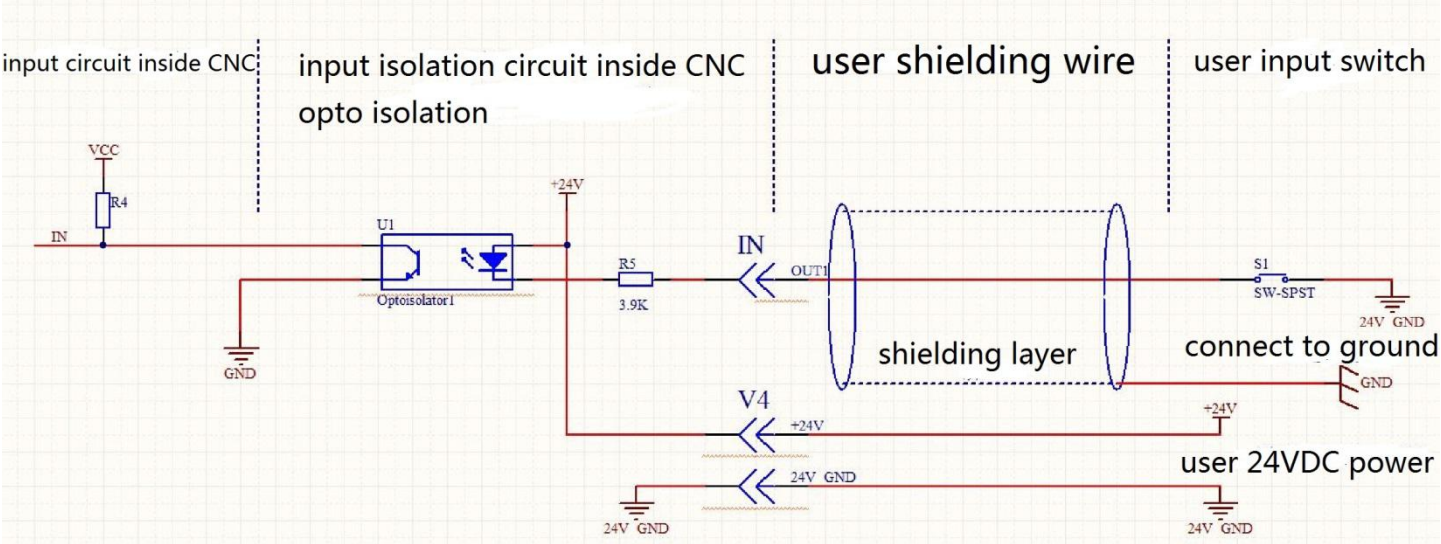
Output principle diagram




Note:

1. no shielding wire or bad ground connection of shielding layer may week ability of output anti-interference.
2. max. load of CNC single output is 100mA, and CNC will burn if exceed the range.
3. input/output power from user's 24VDC should be bigger than 50W, or may bring unstable input/output.

Input principle diagram




Note:

1. no shielding wire or bad ground connection of shielding layer may seriously reduce input anti-interference ability.
2. suggest to use normally-closed contact connecting to 24V ground to improve anti-interference ability.
3. whatever normally-open or normally-closed, must set normal state in parameter.
4. set unused input port to be invalid in paramter to improve anti-inteference ability. Input/output power of 24VDC is bigger than 50W, or unstable.

**Note: offer 24V DC power to CNC because itself needs at least 50W power.**

**Input signal port definition**

Diagnose interface can check input port and change input port position and set input signal logic.

| IN terminal | Signal definition | Instruction |
|---|---|---|
| 1 | Start | Connect external start switch |
| 2 | Pause | Connect external pause switch |
| 3 | Close | Connect external close switch |
| 4 | Alarm | Connect external alarm input signal |

| | | |
|---|---|---|
| 5 | Torch Collision | Torch collision check |
| 6 | E-stop | Connect external e-stop switch |
| 7 | Arc strike success feedback | Connect plasma arc strike success signal |
| 8 | | |
| 9 | X + limit | Connect X + limit switch |
| 10 | X – limit | Connect X - limit switch |
| 11 | X 0 point | Connect X 0 point switch |
| 12 | Y + limit | Connect Y + limit switch |
| 13 | Y - limit | Connect X - limit switch |
| 14 | Y 0 point | Connect Y 0 point switch |
| 15 | | |
| 16 | | |
| 17 | Z + limit | Connect Z + limit switch |
| 18 | Z - limit | Connect Z - limit switch |
| 19 | Z 0 point | Connect Z 0 point switch |
| 20 | Torch 1 in-position | Connect torch 1 in-position signal |
| 21 | Torch 2 in-position | Connect torch 2 in-position signal |
| 22 | Torch 3 in-position | Connect torch 3 in-position signal |
| 23 | Torch 4 in-position | Connect torch 4 in-position signal |

**Output signal port definition**

Diagnose interface can check output port and change input port position and set input signal logic.

| OUT terminal | Signal definition | Instruction |
|---|---|---|
| 1 | M10 | Gas/preheat |
| 2 | M12 | Cut oxygen/arc strike |
| 3 | M14 | Torch 1 up |
| 4 | M16 | Torch 2 down |
| 5 | M18 | Low preheat |
| 6 | M20 | ignition |
| 7 | M22 | High preheat |
| 8 | M24 | preheat |
| 9 | M36 | Torch 2 up |
| 10 | M40 | Torch 2 down |
| 11 | M32 | Low oxygen |
| 12 | M34 | Powder |
| 13 | | Stir |
| 14 | M38 | Height control |
| 16 | M42 | Drill up |
| 17 | M44 | Drill down |
| 18 | M46 | Drill on |
| 19 | | Torch 3 up |
| 20 | | Torch 3 down |
| 21 | | Torch 4 up |
| 22 | | Torch 4 down |
| 23 | | Arc strike |
| 24 | | |
| 25 | | Torch 1 enable |
| 26 | | Torch 2 enable |

| | | |
|---|---|---|
| 27 | | Torch 3 enable |
| 28 | | Torch 4 enable |

**Communication signal port**

CN1, CN2 (RJ45) port definition

| Internet access | Signal definition | Instruction |
|---|---|---|
| 1 | +24V | 24V + |
| 2 | TXD | Serial port signal |
| 3 | RXD | Serial port signal |
| 4 | 51in | Sub-panel communication |
| 5 | +5V | 5V + |
| 6 | Jerk | External E-stop |
| 7 | 24VG | 5V/24V ground |
| 8 | 24VG | 5V/24V ground |

For remote control and expansion control panel connection

**AD/DA port**

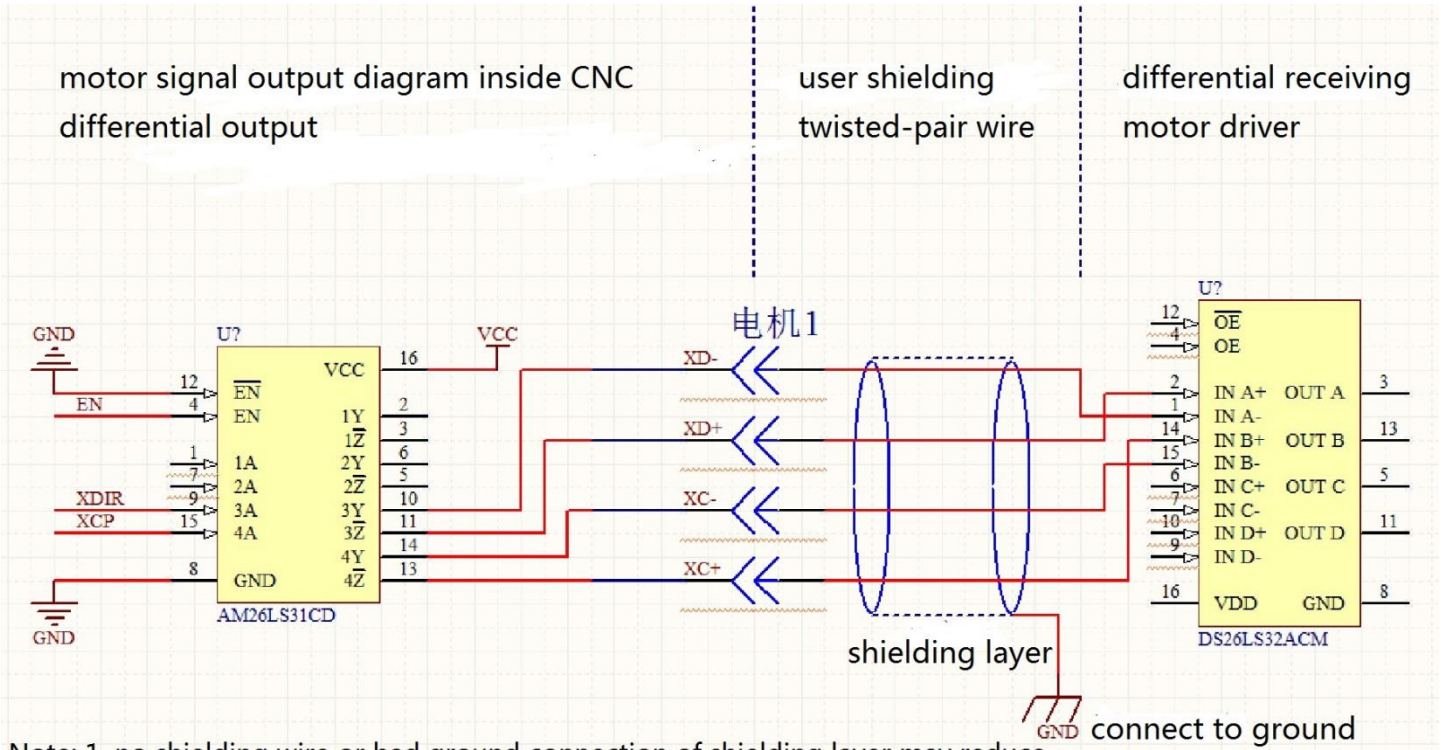
J1 port connection

| Port | Signal definition | Instruction |
|---|---|---|
| 1 | ADIN1 | Analog input 1 |
| 2 | AGND | Analog input 1 ground |
| 3 | ADIN2 | Analog input 2 |
| 4 | AGND | Analog input 2 ground |
| 5 | DAOUT1 | Analog output 1 |
| 6 | AGND | Analog output 1 ground |
| 7 | DAOUT2 | Analog output 2 |
| 8 | AGND | Analog output 2 ground |

Default DC0-5V analog quantity, can customize DC0-10V

**Motor signal port**

Differential signal driver connection principle diagram

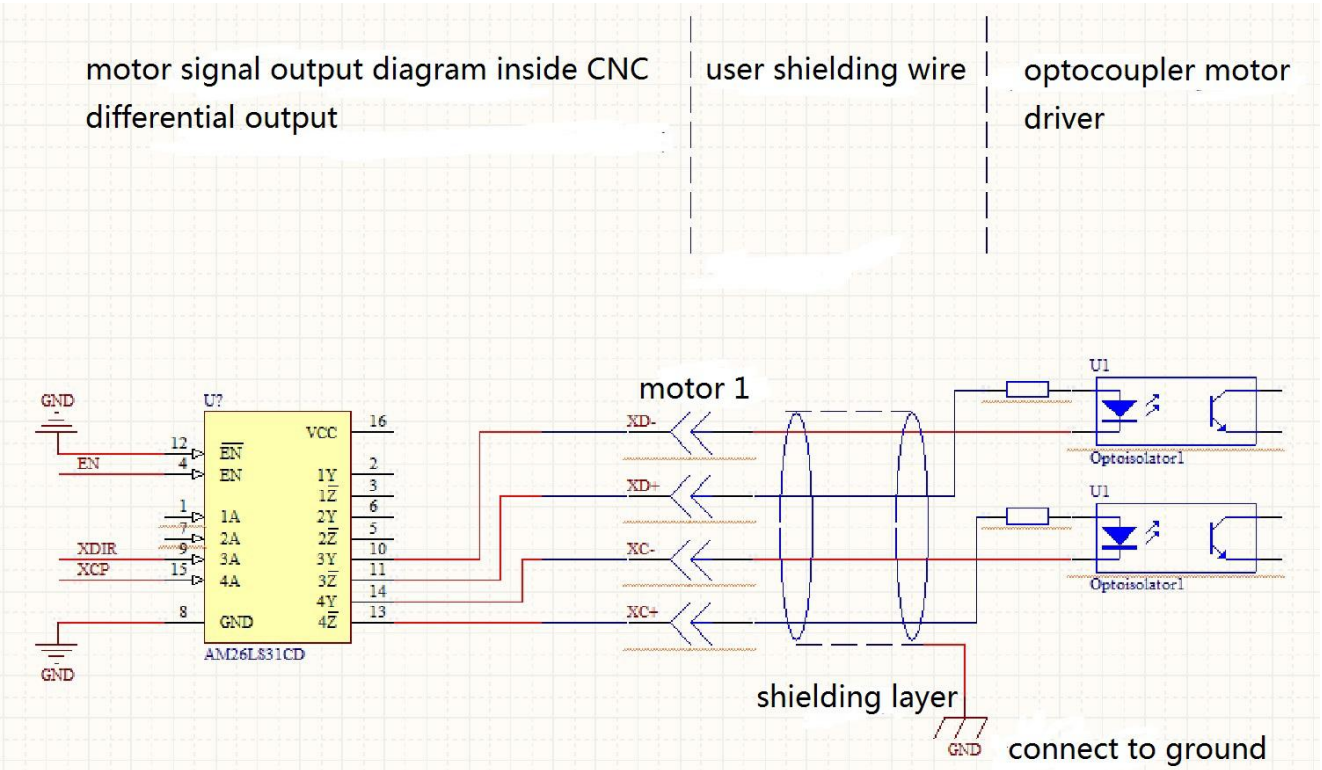



Note: 1. no shielding wire or bad ground connection of shielding layer may reduce output anti-interference ability, please use shielding twisted-pair wire.

2. CNC motor signal is 5V, max. load of single output is 20mA, it will burn if exceed the range.

3. almost all servo and stepper drivers have differential receiving port and there is current-limiting diagram.

Optical coupler driver connection principle diagram




Note: 1. no shielding wire or bad ground connection of shielding layer may reduce output anti-interference ability.

2. CNC motor signal is 5V, max. load of single output is 20mA, it will burn if exceed range.

3. optocoupler driver usually has current-limiting diagram.

**Motor signal port definition**

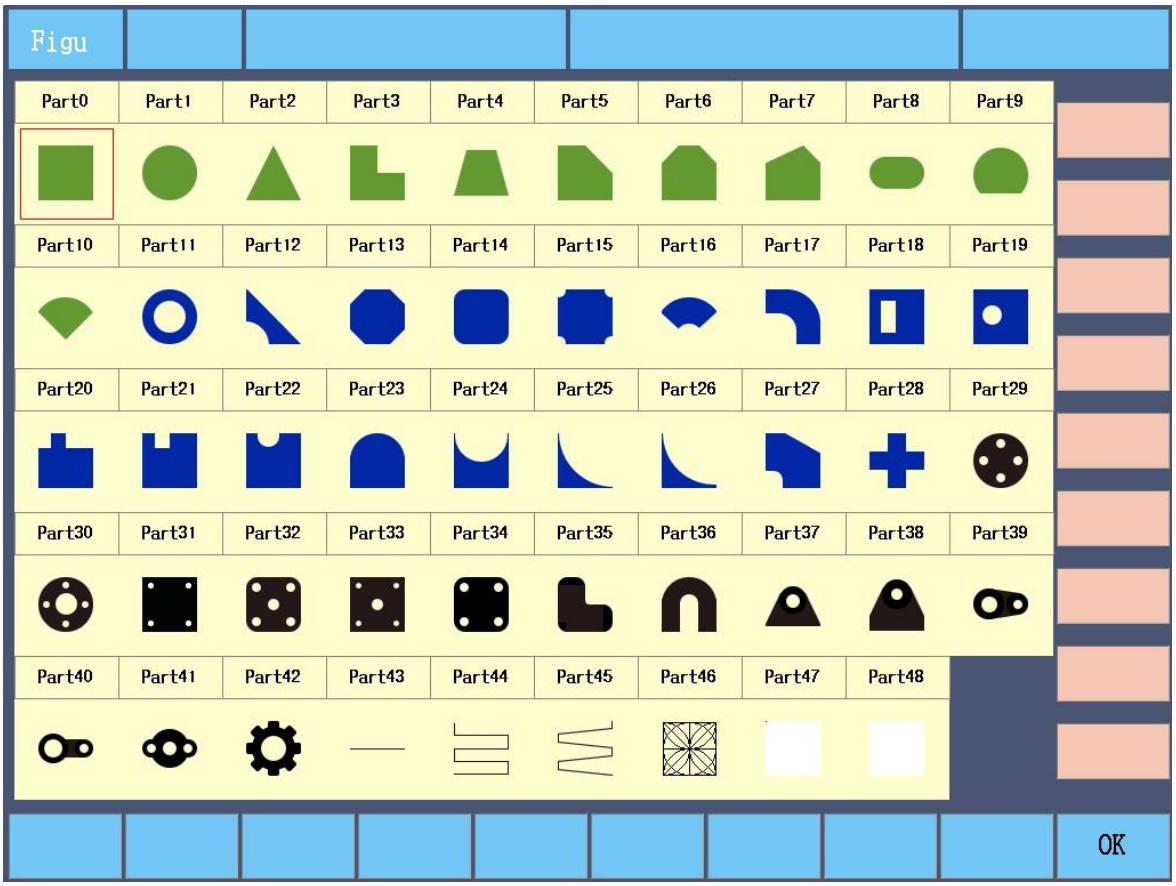
| Signal definition | Instruction |
|---|---|
| XD+ | X axis direction |
| XD- | X axis direction |
| XC+ | X axis pulse |
| XC- | X axis pulse |
| YD+ | Y axis direction |
| YD- | Y axis direction |
| YC+ | Y axis pulse |
| YC- | Y axis pulse |

| | |
|---|---|
| ZD+ | Dual X axis direction |
| ZD- | Dual X axis direction |
| ZC+ | Dual X axis pulse |
| ZC- | Dual X axis pulse |
| 4D+ | Dual Y axis direction |
| 4D- | Dual Y axis direction |
| 4C+ | Dual Y axis pulse |
| 4C- | Dual Y axis pulse |

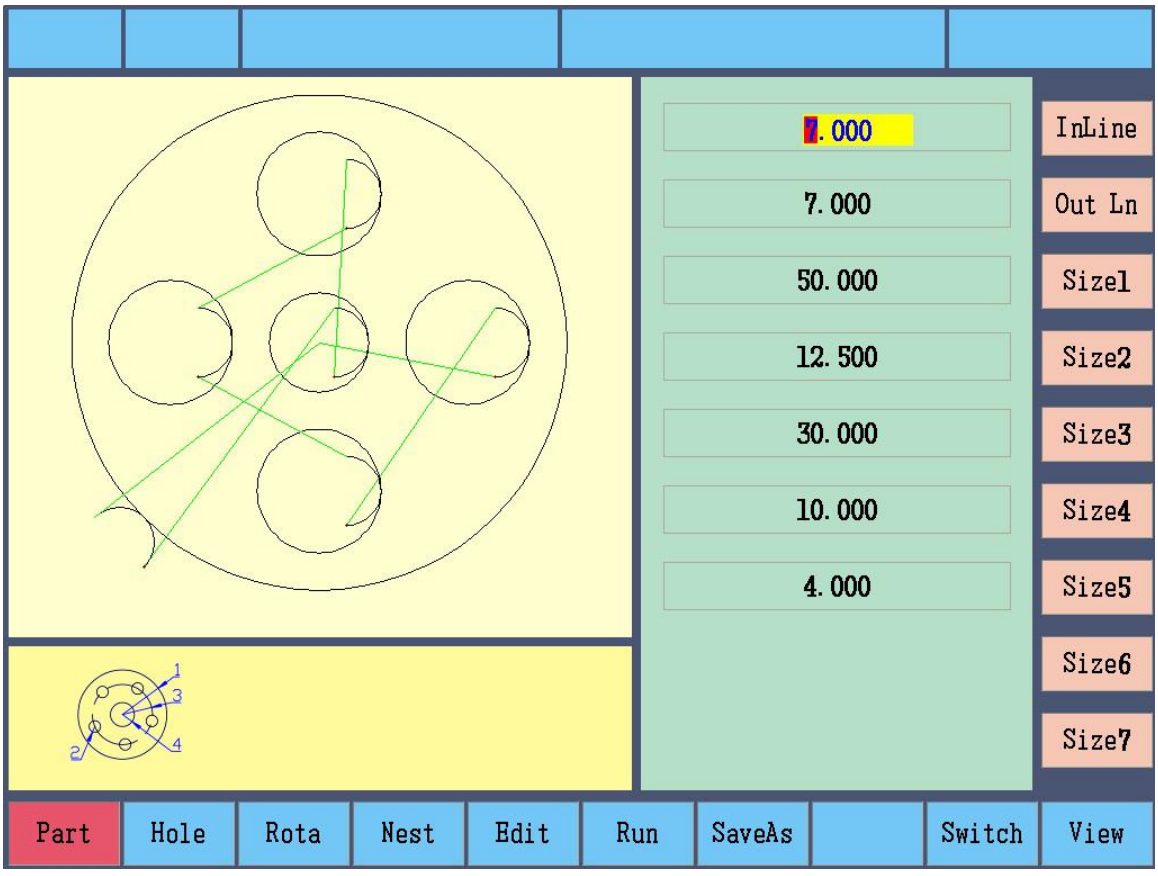
# Chapter 2 load parts

## 2-1 load from figure

Turn on CNC, press Figure

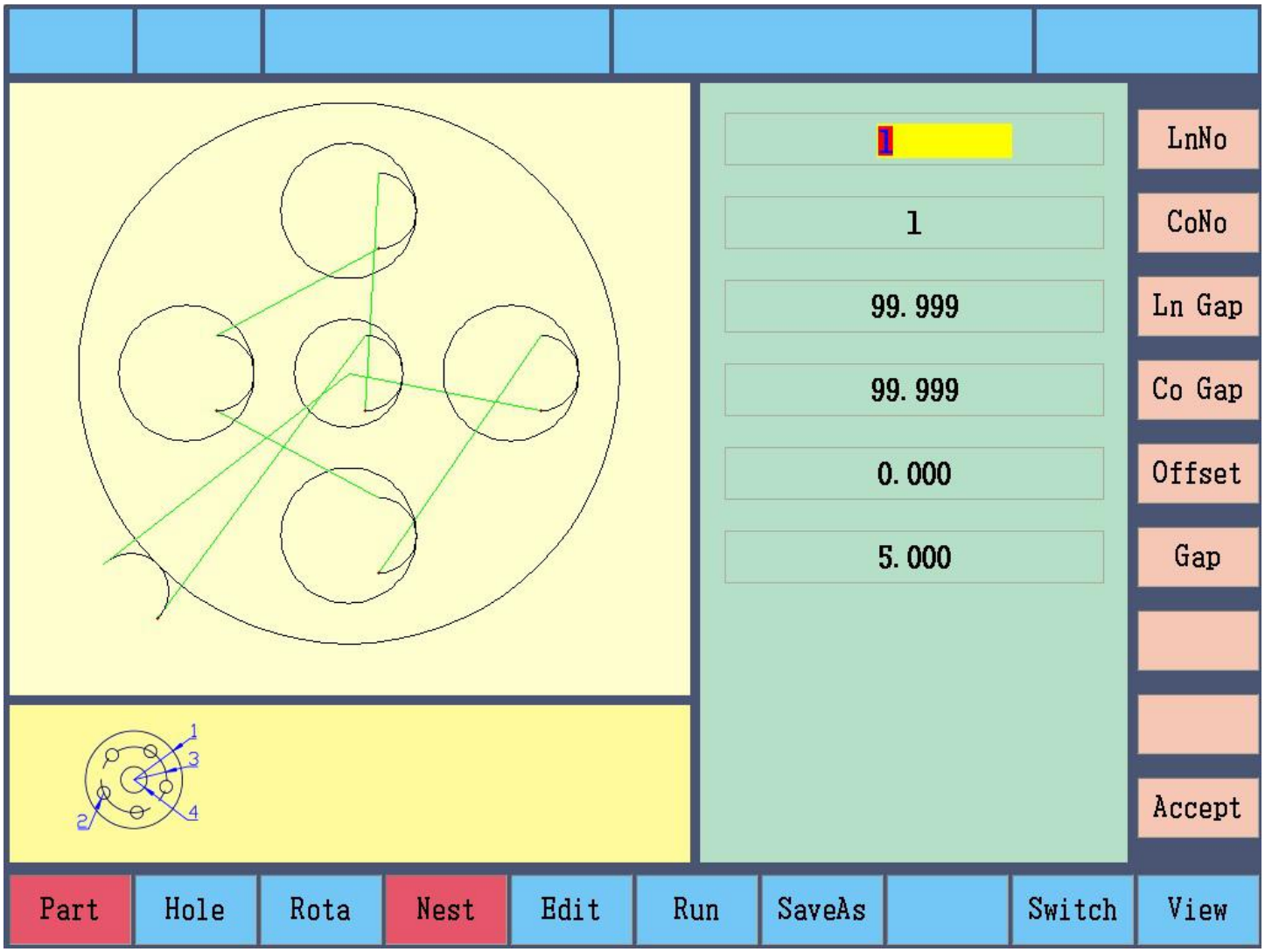



There are 47 common parts, choose by direction keys and then to confirm.



Press direction keys to choose parameters of parts, input values by number keys, then preview.
Part: set the figure as parts.
Hole: set the parts as hole type, some parts can't change inner/outer outline (can't change lead-in/out line direction).
Rota (rotate): input angle, positive number is anticlockwise, negative number is clockwise.
Nest: align parts.
Edit: load the parts program in the edit area.
Run: load the parts and enter auto cutting interface.
SaveAs: save current parts program.

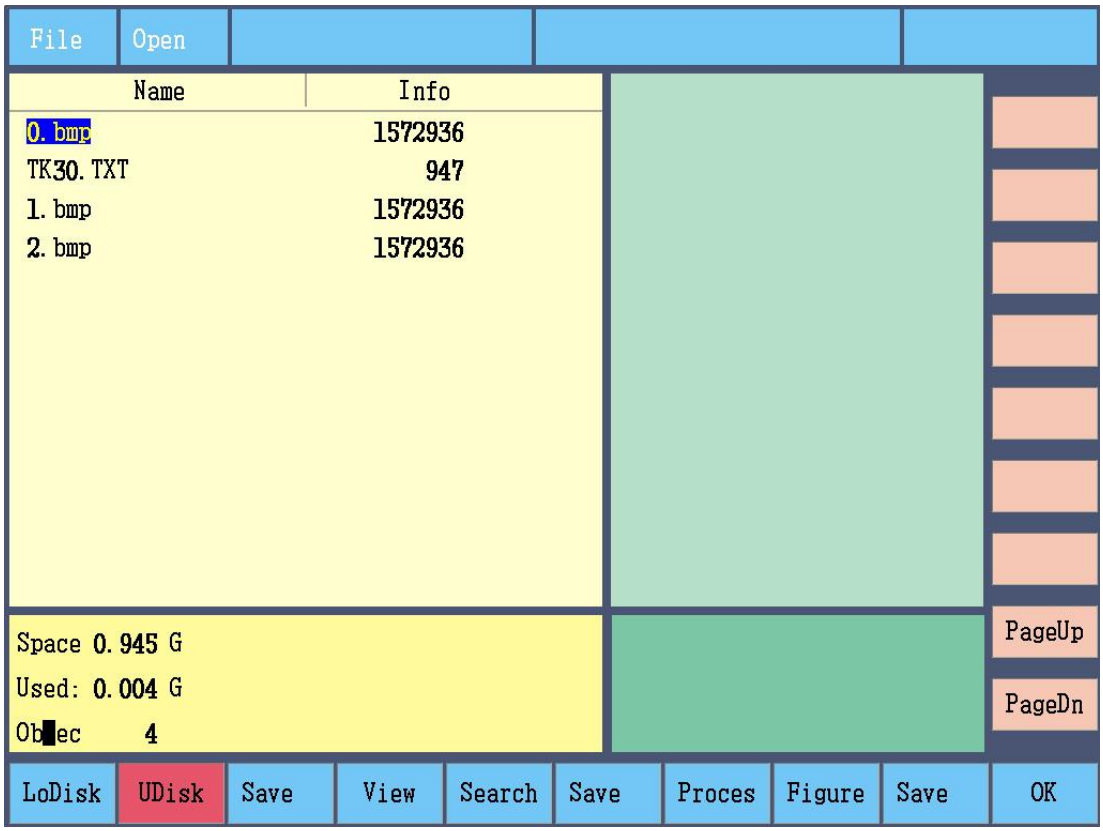
F4 Nest: after set parts size, align the parts




LnNo, line number
CoNo, column number
Ln Gap, line gap
Co Gap, column gap
Offset, line offset
Gap (safe distance), between two parts to avoid wrong cutting

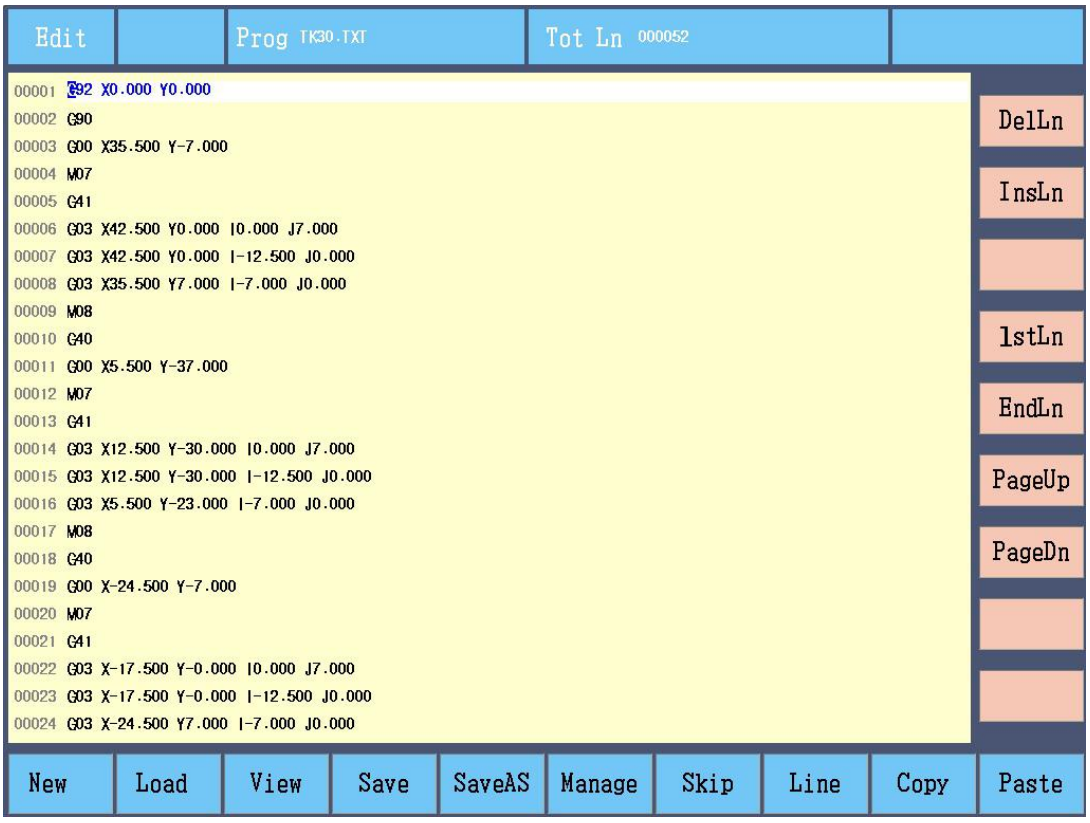
## 2-2 load from Disk

Two methods:
1. press shortcut key "Prog" in Auto interface.




LoDisk (local disk): files in CNC disk.
U Disk: files in U disk.
View (preview): preview the current file.
Search: input file name and search it.
OK: load the file.
Note: CNC only supports 1-level folder, don't set folder in the folder.

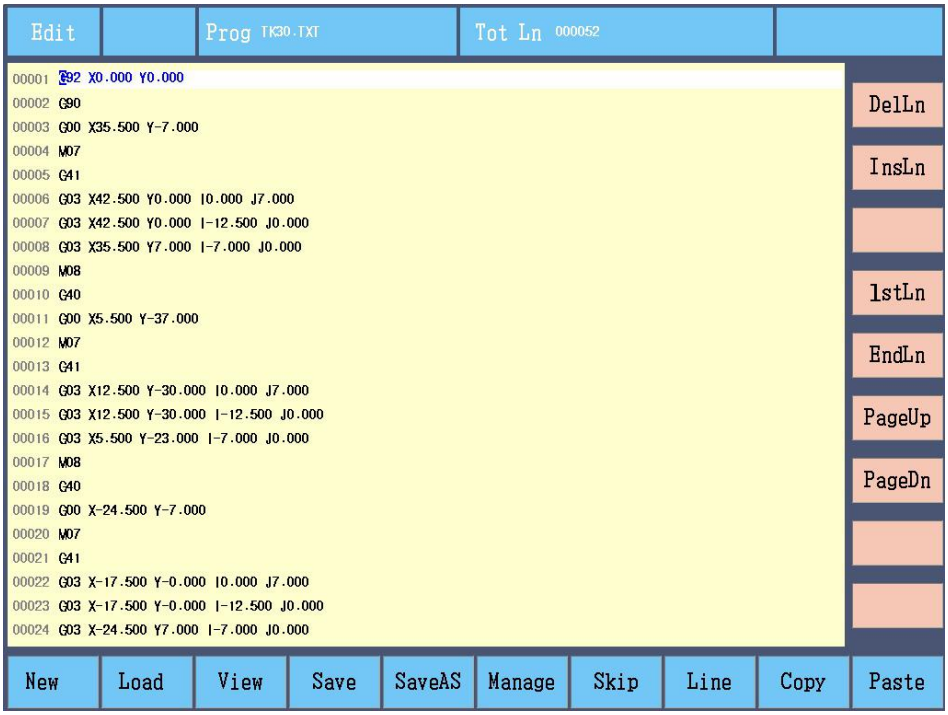
2. Press Load in Edit interface




The difference of two methods is that if cut the part program from the Edit interface, it needs to go to Auto interface.

## 2-3 load from Edit

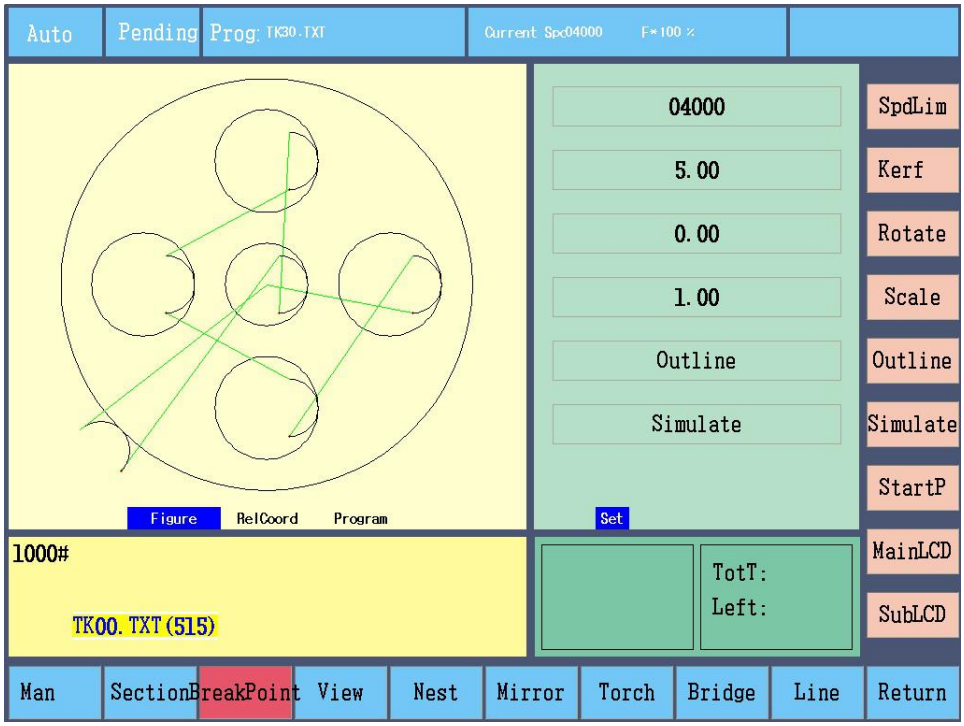
In the Edit interface edit G code program and save and go to auto cutting interface.




New: clear parts program area, then manually input G code, edit cutting program
View (preview): preview program cutting path.
Save: input file name and save to the local disk.
SaveAs: choose save path and then save

## 2-4 restore part cutting

Cutting break, pause or power off
If there is a more urgent part to cut, then you can press Pause to stop the current cutting. Then continue the previous cutting by “break point”.
If power off when cut, the controller can automatically record the current position and save break point, when power on, continue the previous cutting by “break point”.



BreakP (break point): display the file name of the latest breakpoint, (serial number).
Controller can record 3 latest break points of 2 files, press F3 again to display last break point till the first break point. The controller automatically loads the file and preview figure and display the break point position.

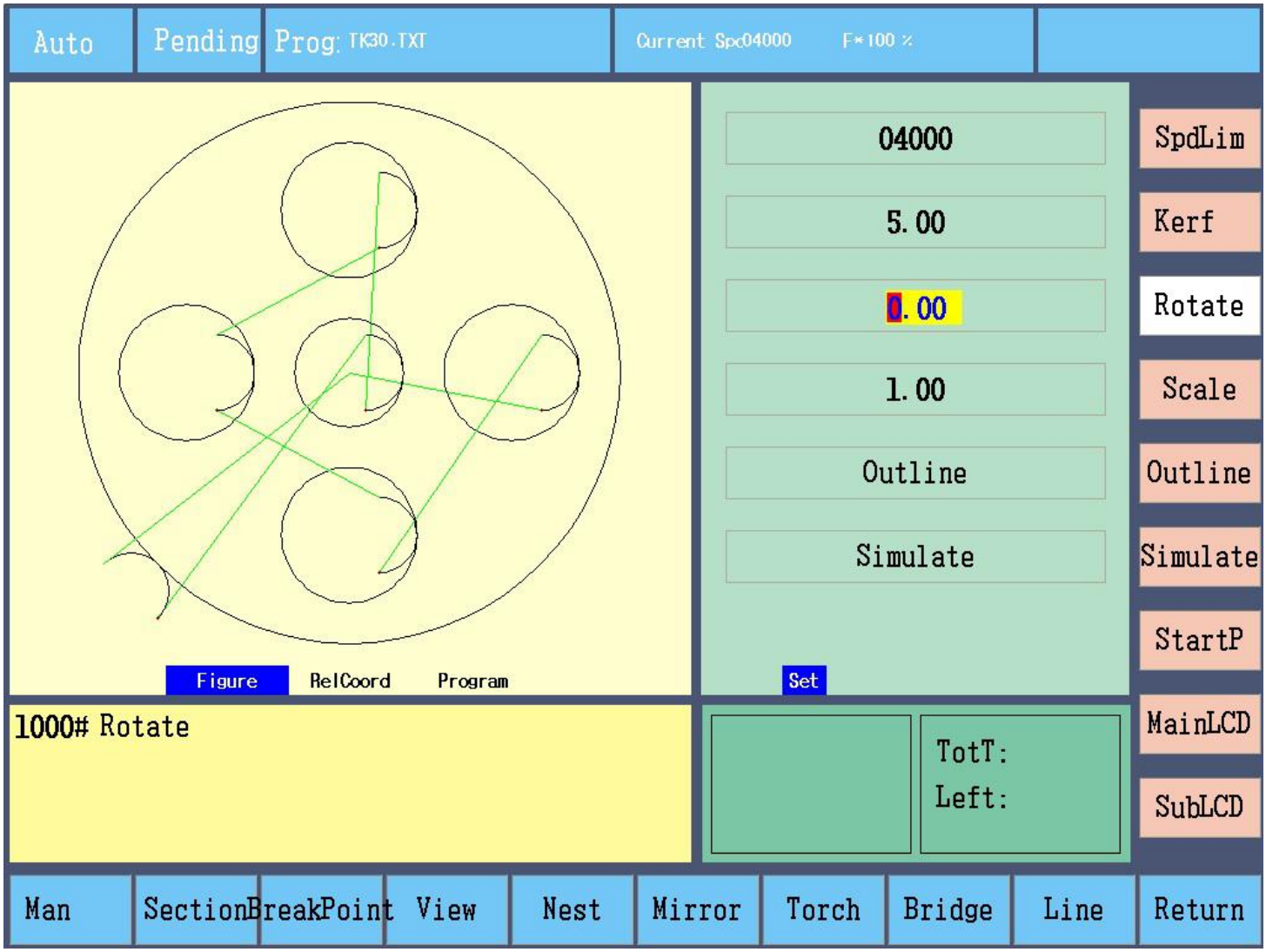
Record rule:
a. Record two latest break points in the same file, when over two points, then the first point is covered.
b. cut a new file and have 2 break points, then the last point of last file is recorded.

Note:
1. If the program is not saved, then can't restore cutting by "break point".
2. Restore cutting by "break point" is useful when no machine coordination clearance and troch movement and other operations, or torch position may be wrong.

## Chapter 3 array parts

After loading the parts, it can be rotated, mirrored, zoomed or arrayed.
Note: the parts loaded by "break point" can't be rotated, mirrored, scaled and arrayed.

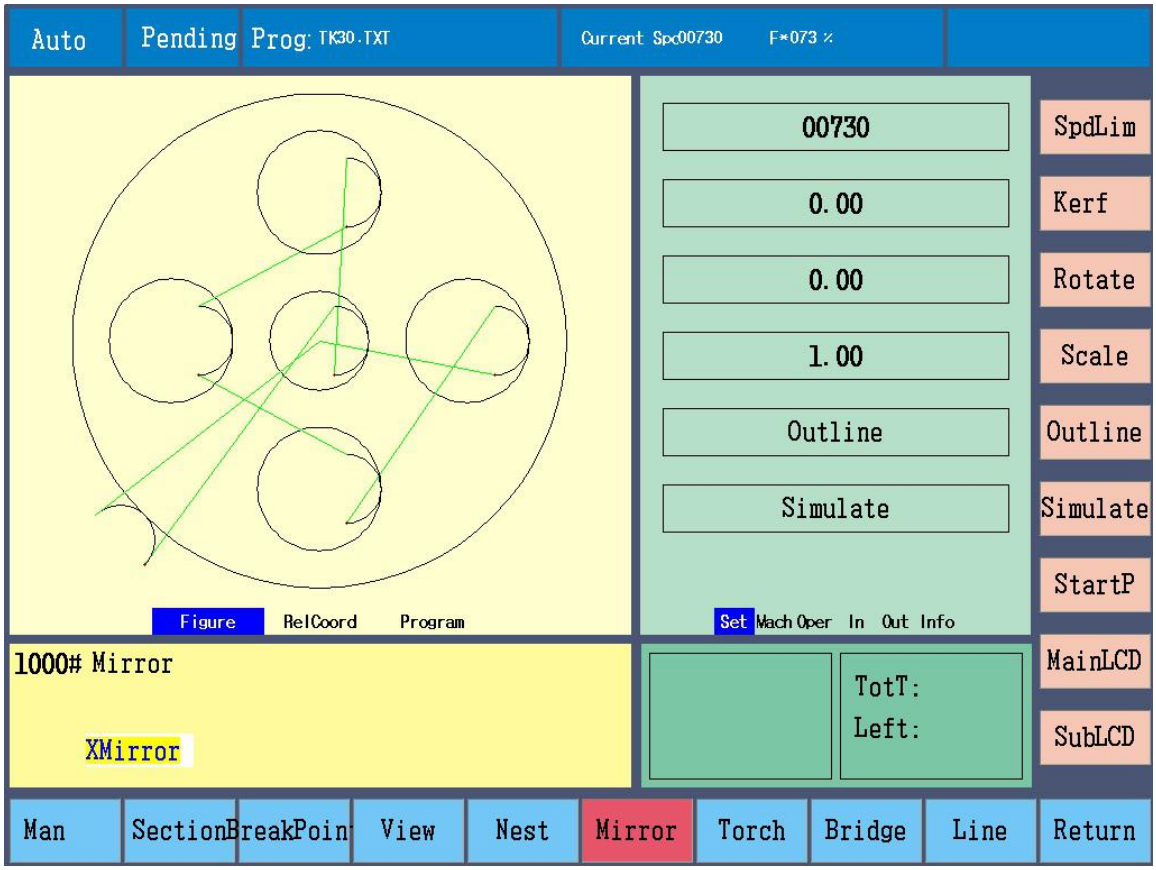
3-1 rotate
In Auto interface, press Rotate




After input angle, press Enter, the parts is rotated, positive value is anticlockwise, negative value is clockwise. Press the key again to cancel.

3-2 mirror

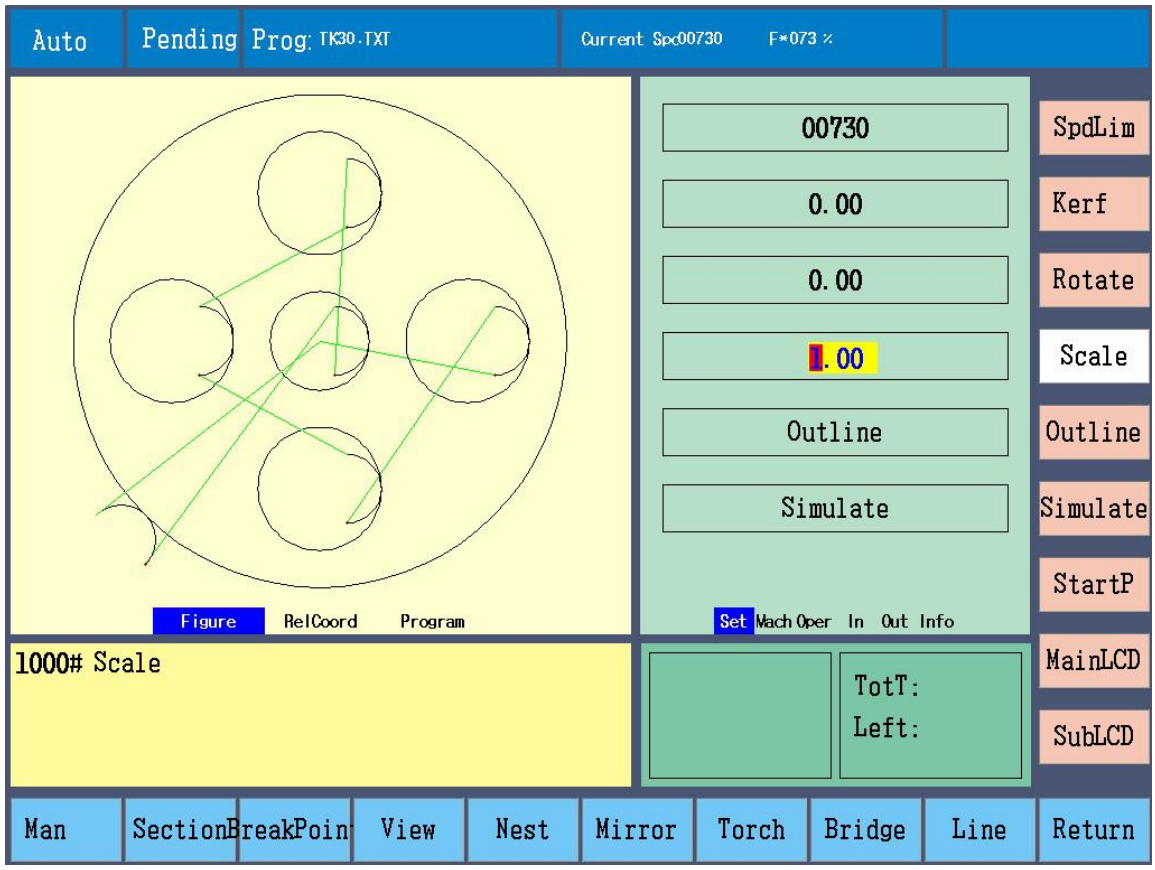
Press Mirror




X mirror, Y mirror and XY mirror display in cycle, press Enter to confirm. Press again to cancel.

3-3 scale

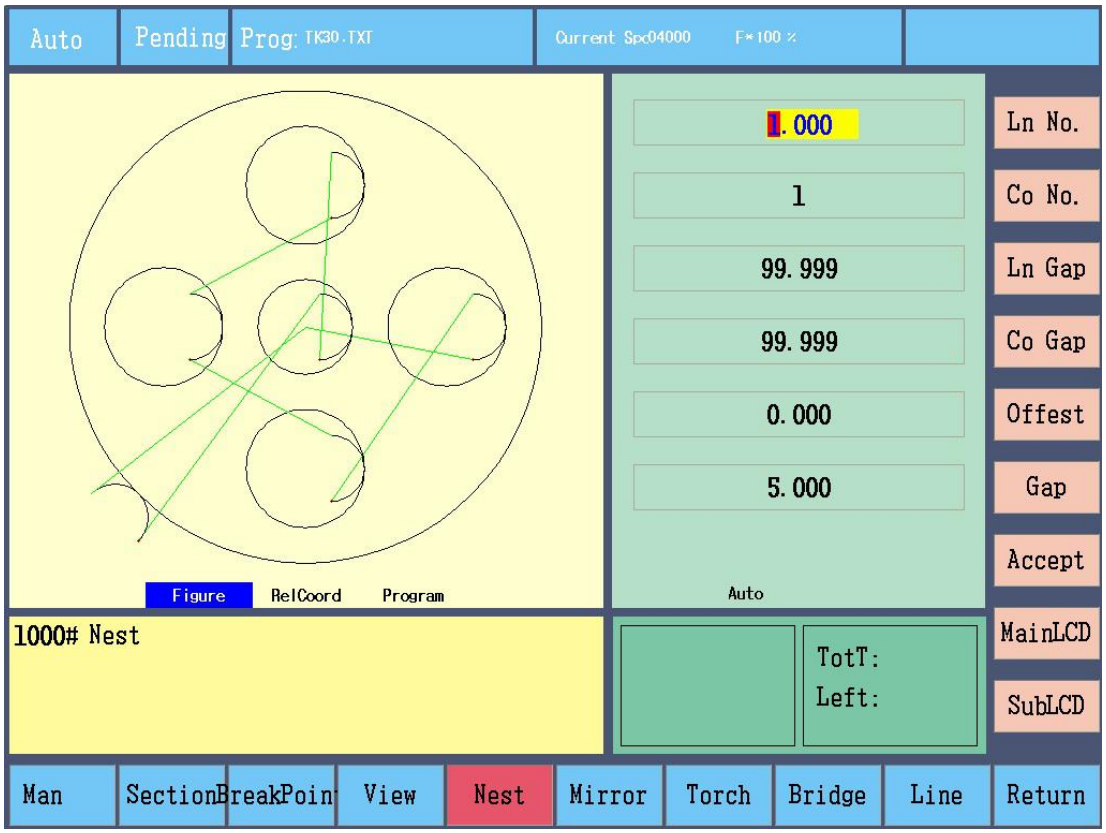
Press Scale




After input scale value, press Enter to confirml.

3-4 nest

Press Nest

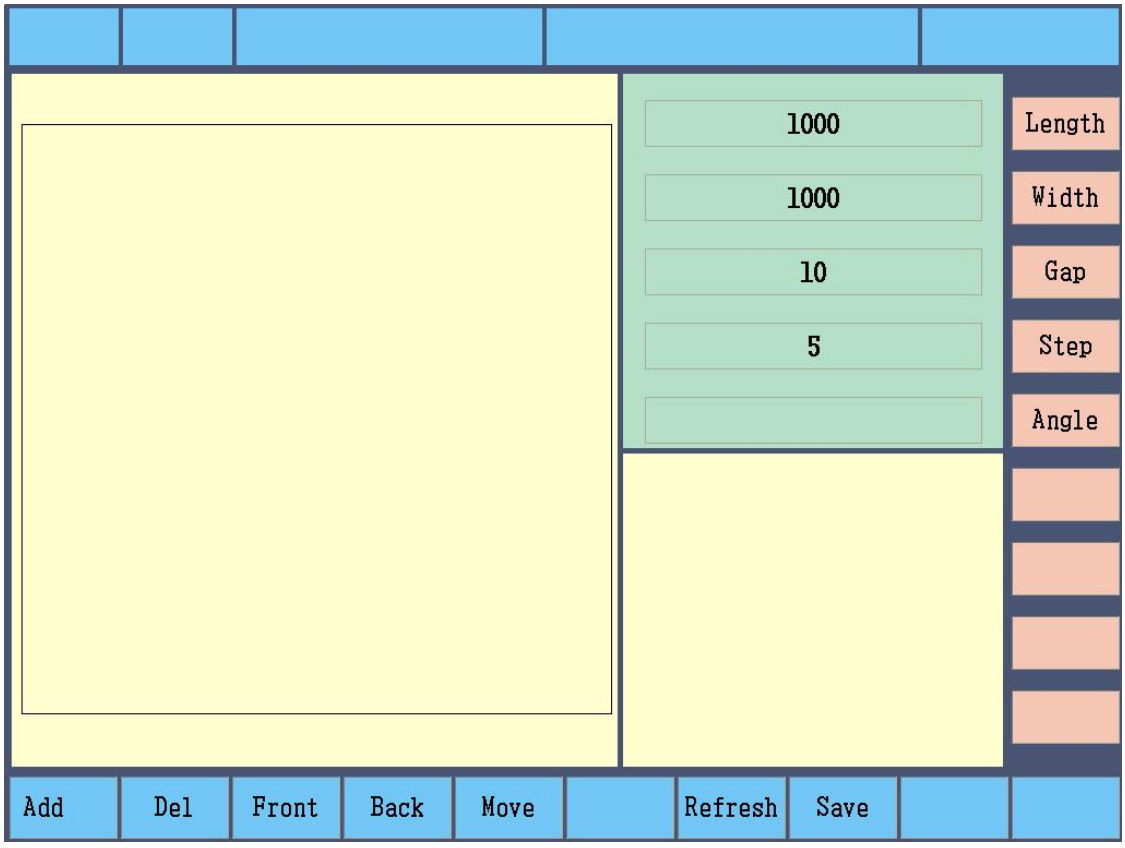



Ln No. (line number), Co No. (column number), Ln Gap (line gap), Co Gap (column gap), Offset (line offset), press Accept to submit and refresh.

Note: after set line offset, controller automatically limits the width, actual quantity is fewer than input quantity.

## 3-5 Nest

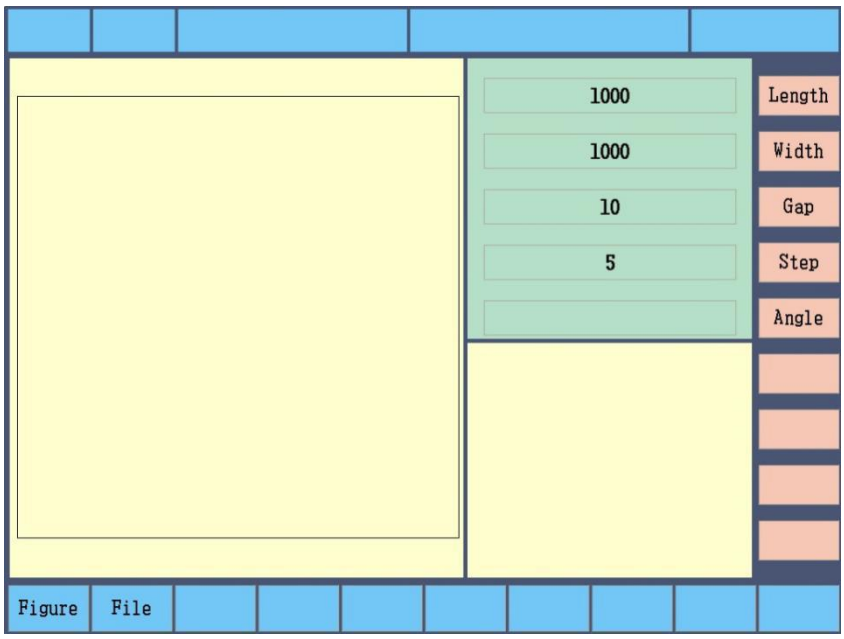
Press F7 to Nest



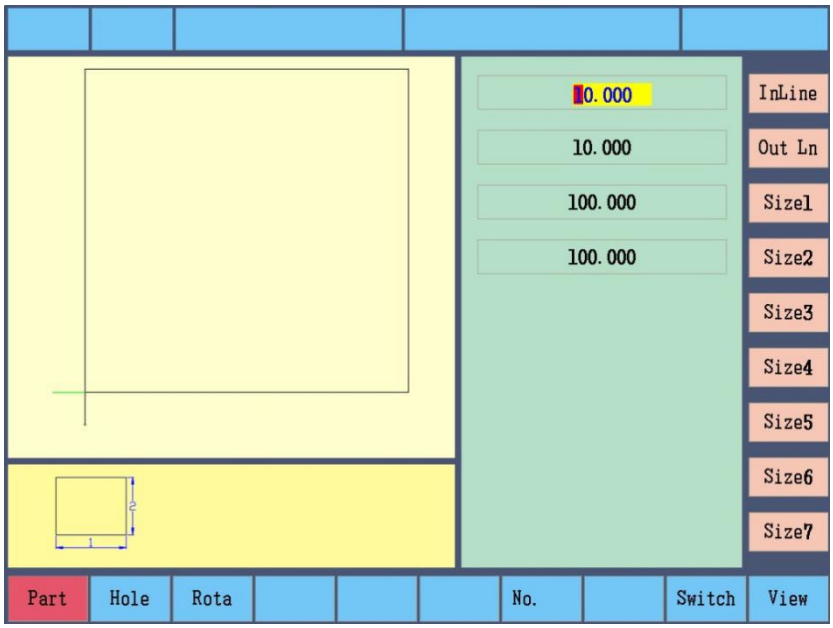
Add: add parts.
Del (delete): delete parts.
Front: change cutting sequence, a place in advance.
Back: change cutting sequence, a place back.
Move: move the part by direction keys.
Refresh: display cutting sequence.
Save: save parts program.

Length: plate length
Width: Plate width
Gap: distance of parts
Step: movement distance
Angle: rotation angle
X: zoom in, Y: zoom out, G: restore
Note: suggest to set plate size and distance of parts before add the parts.

Add parts
Press Add

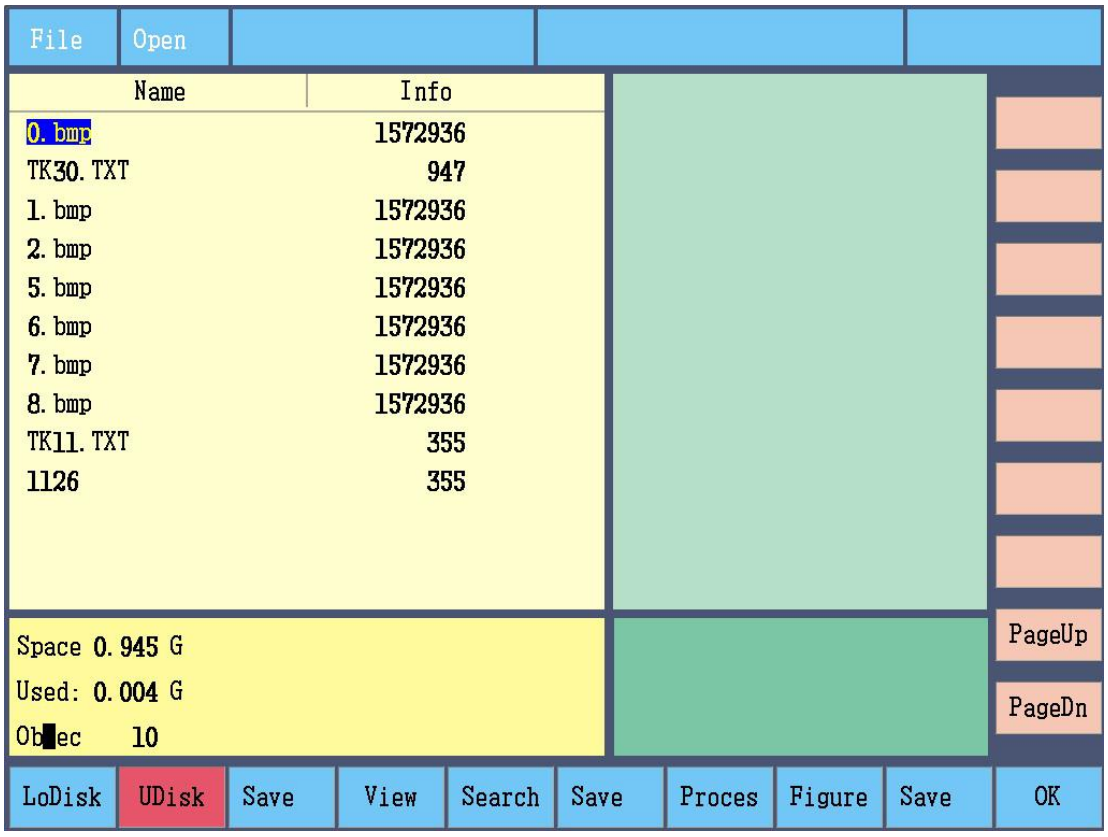



Add parts from Figure



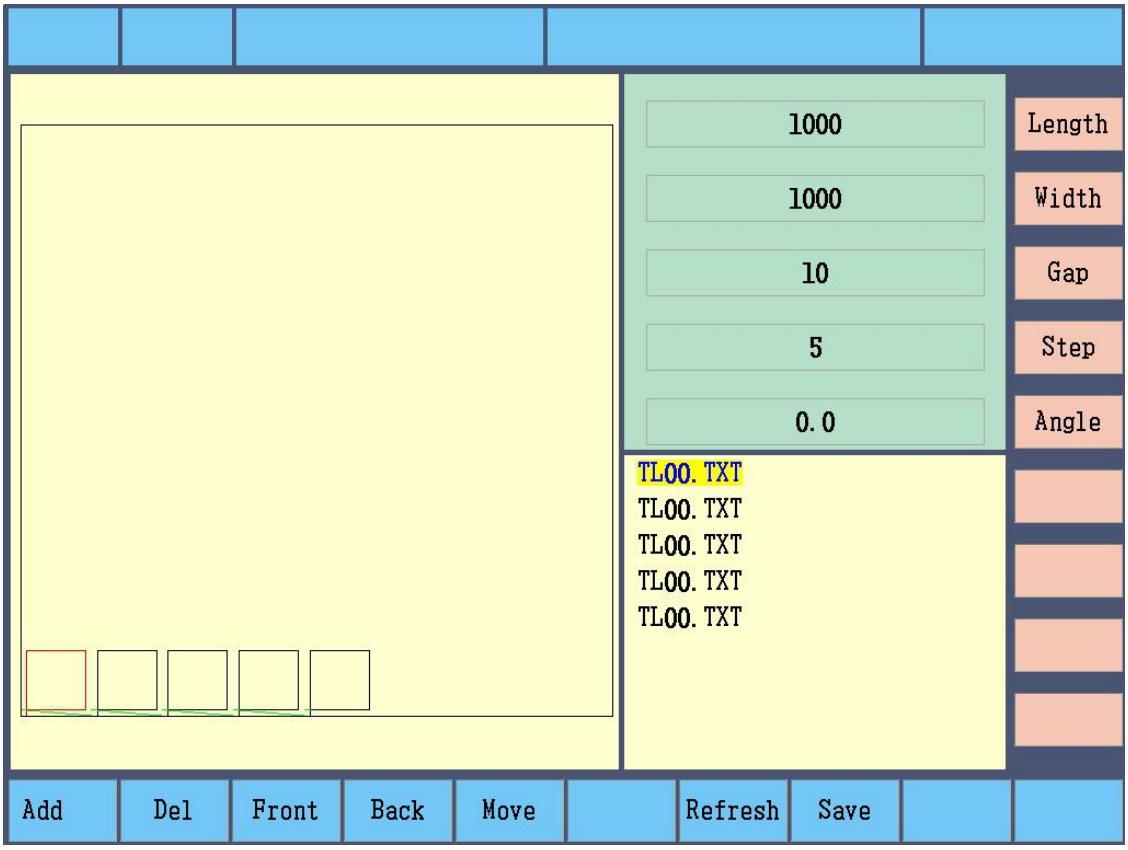
Choose the parts and set parameters, press View (preview) to display parts, press confirm key, input the number of parts, press Enter.
Note: after revise the number of part, must preview.

Press F2 File, dd parts from disk.



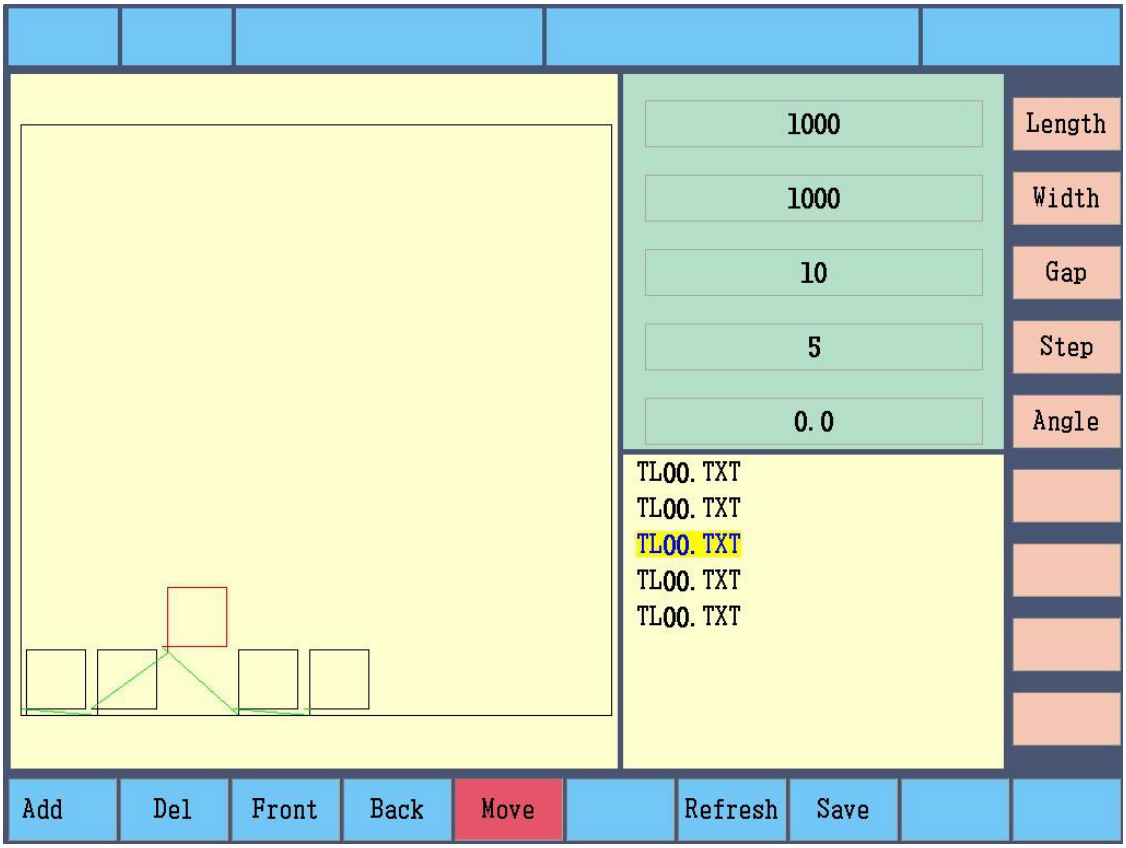

Choose parts and press OK to confirm and input the number of parts, press Enter.

Delete parts
After adding parts, choose them by direction keys, press Del to delete.

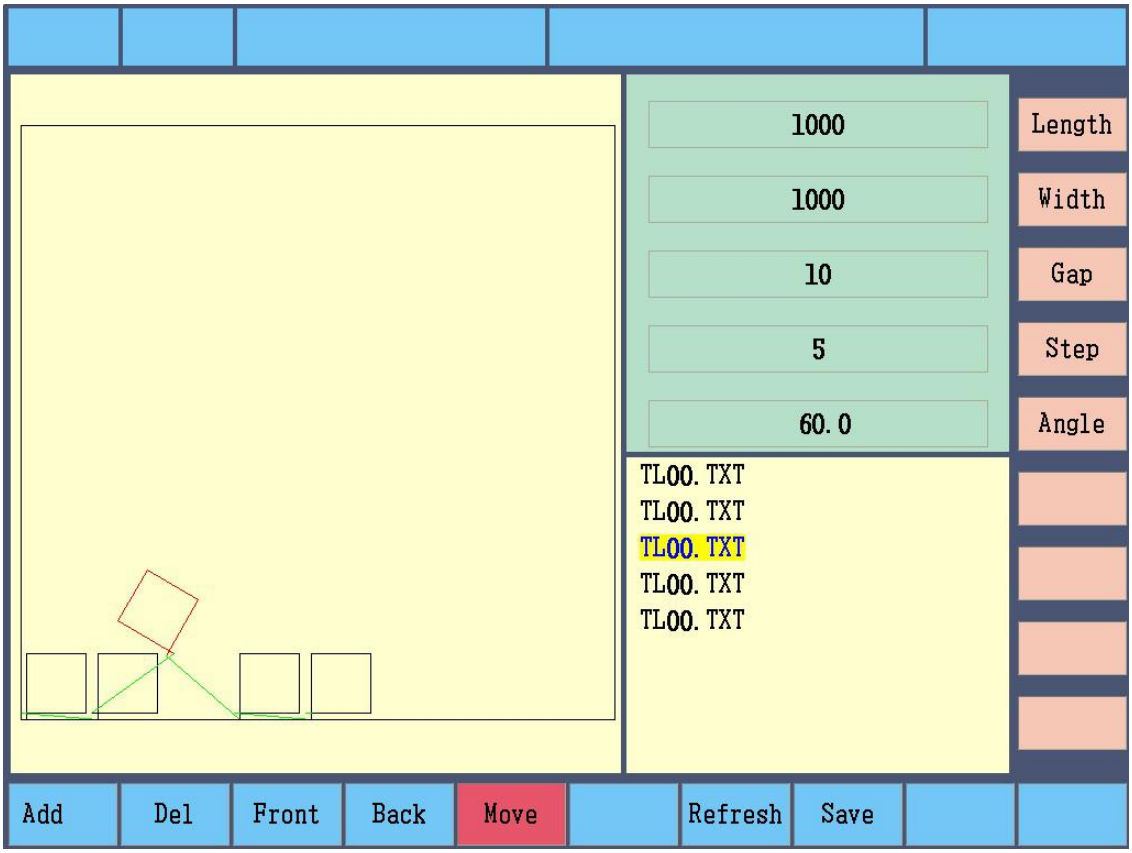


Change parts sequence
After adding parts, change cutting sequence by “Front” and “Back”, press F7 to refresh.

Move parts
After adding parts, choose them by direction keys, press Move key or Step key distance.

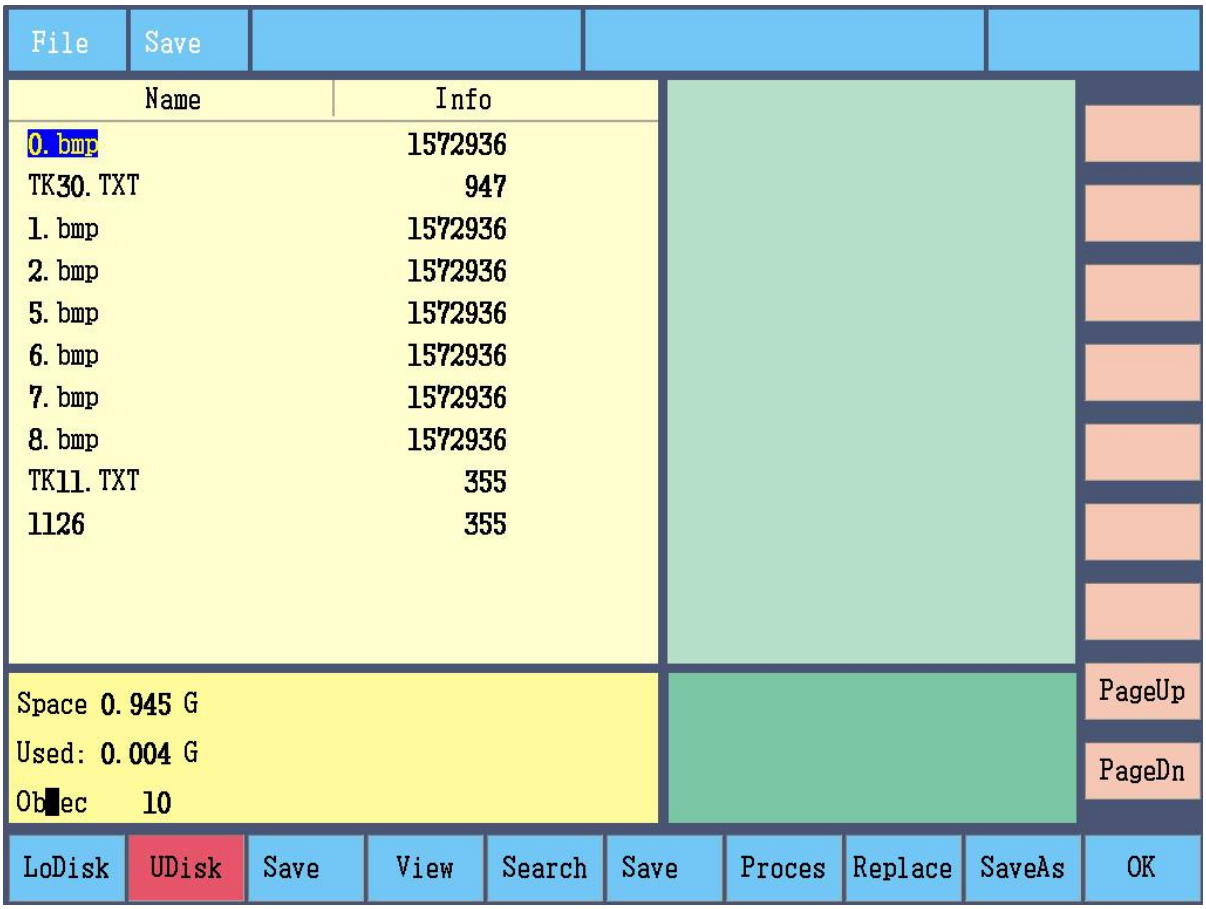



Rotate parts
After choosing parts, press Angle key to input rotation angle



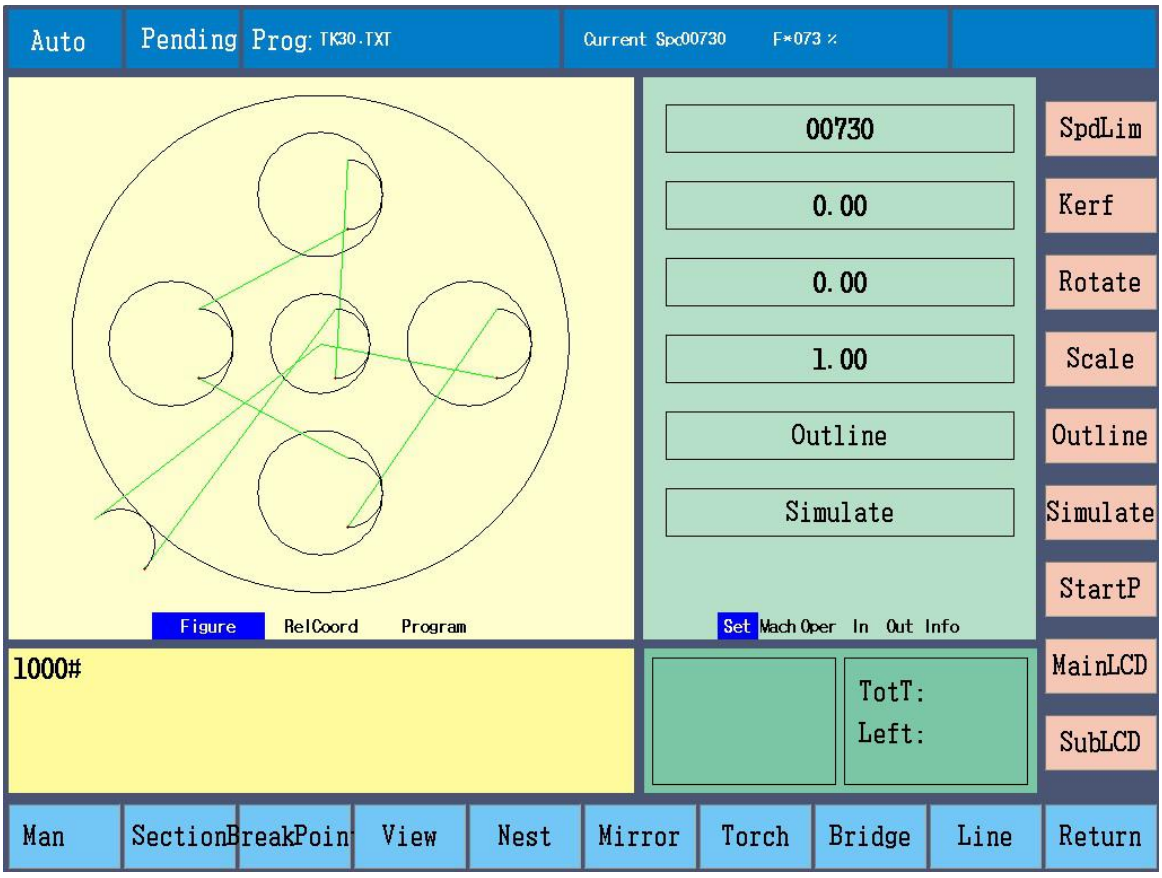
Save nesting parts program

Press Save key

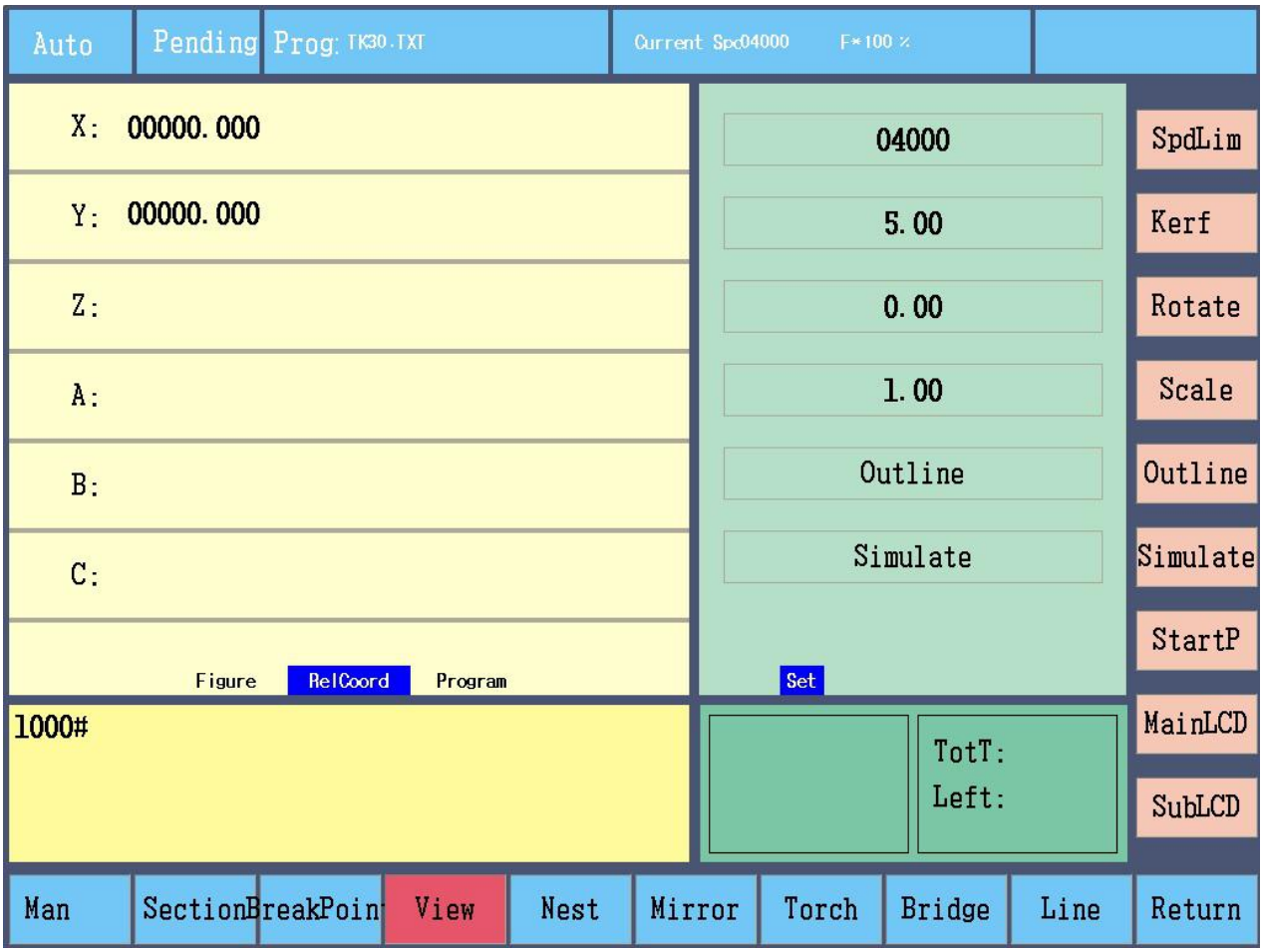



## Chapter 4 cut parts

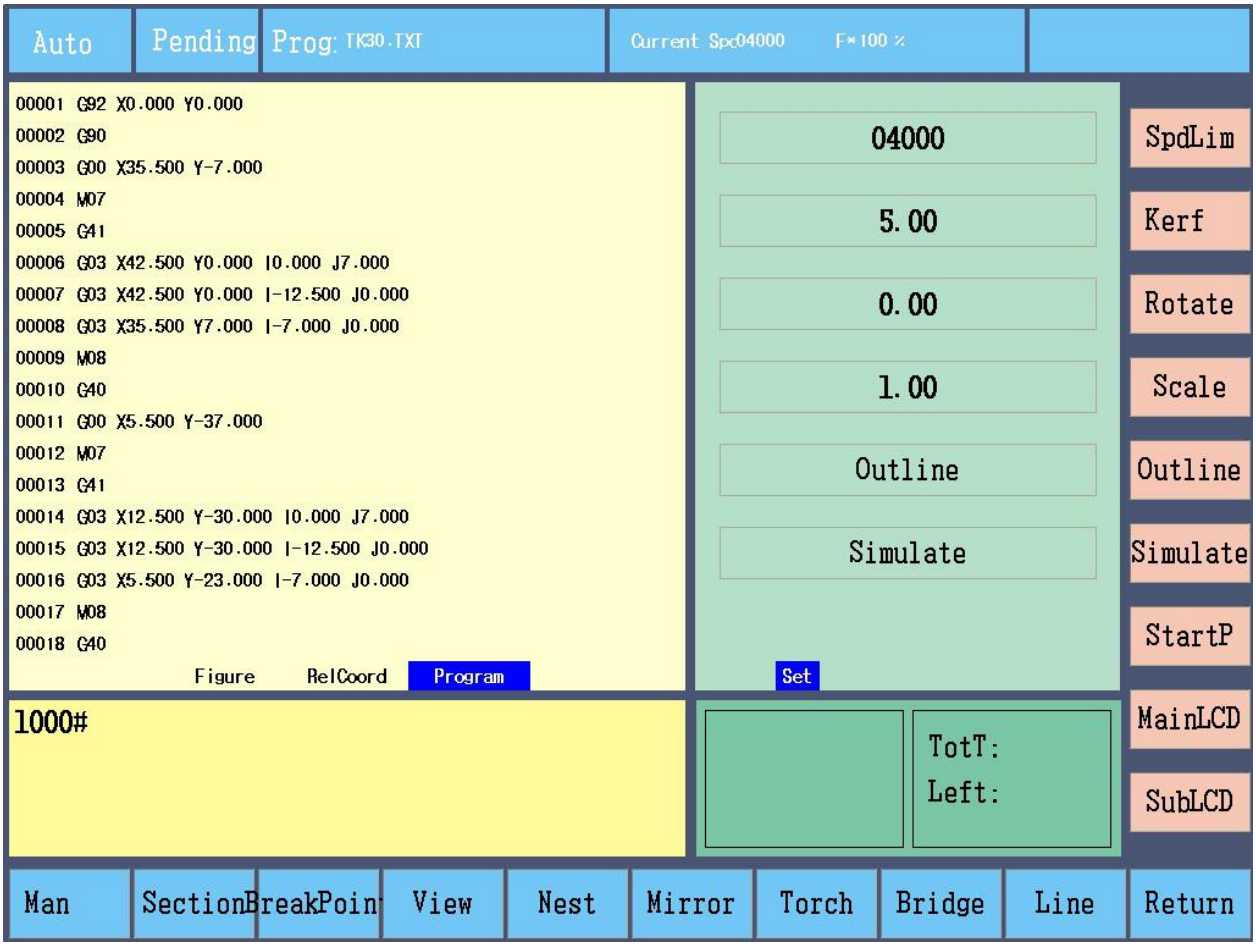
### 4-1 Auto interface



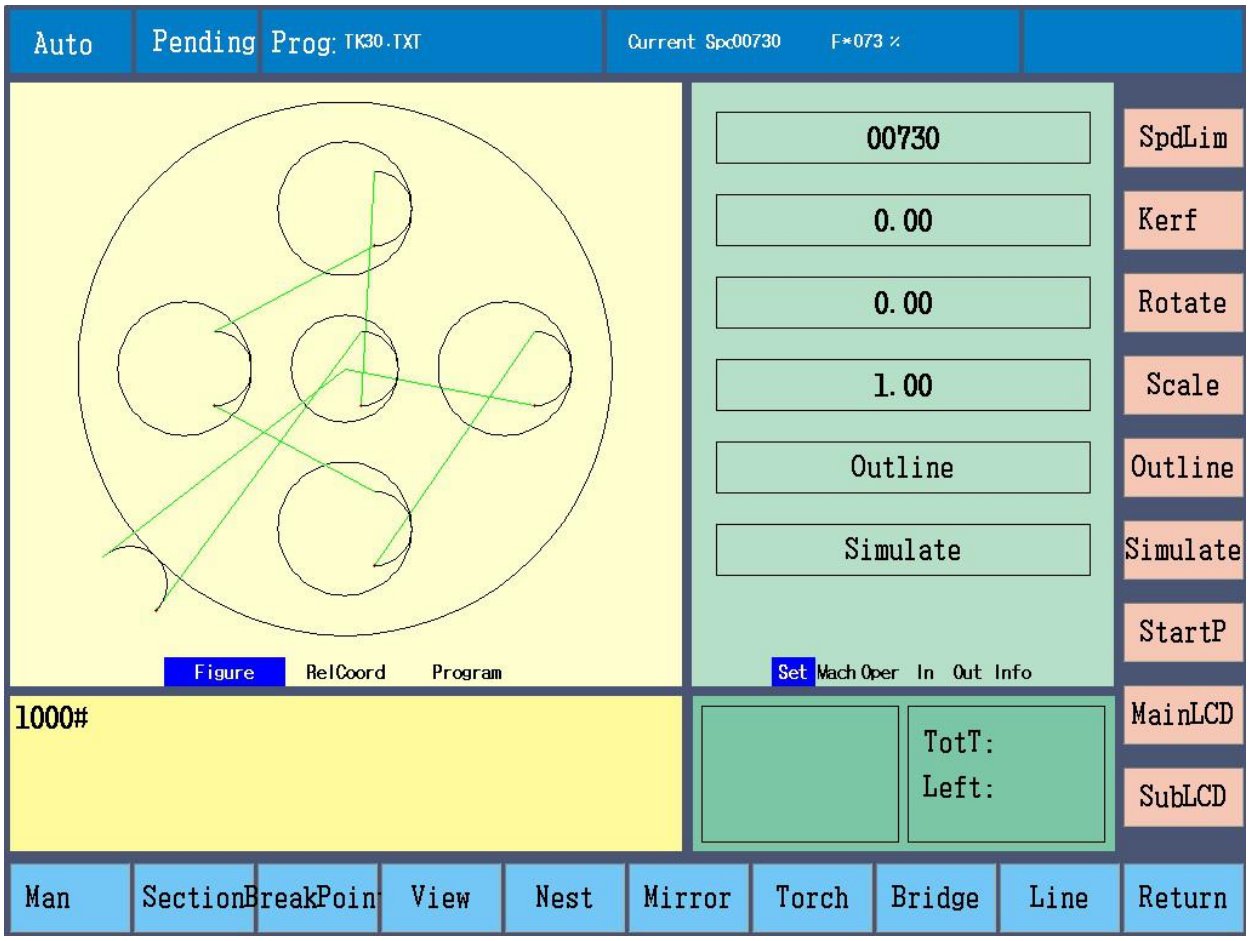
Press MainLCD key to display in cycle following interfaces as below,
Relative coordinate:



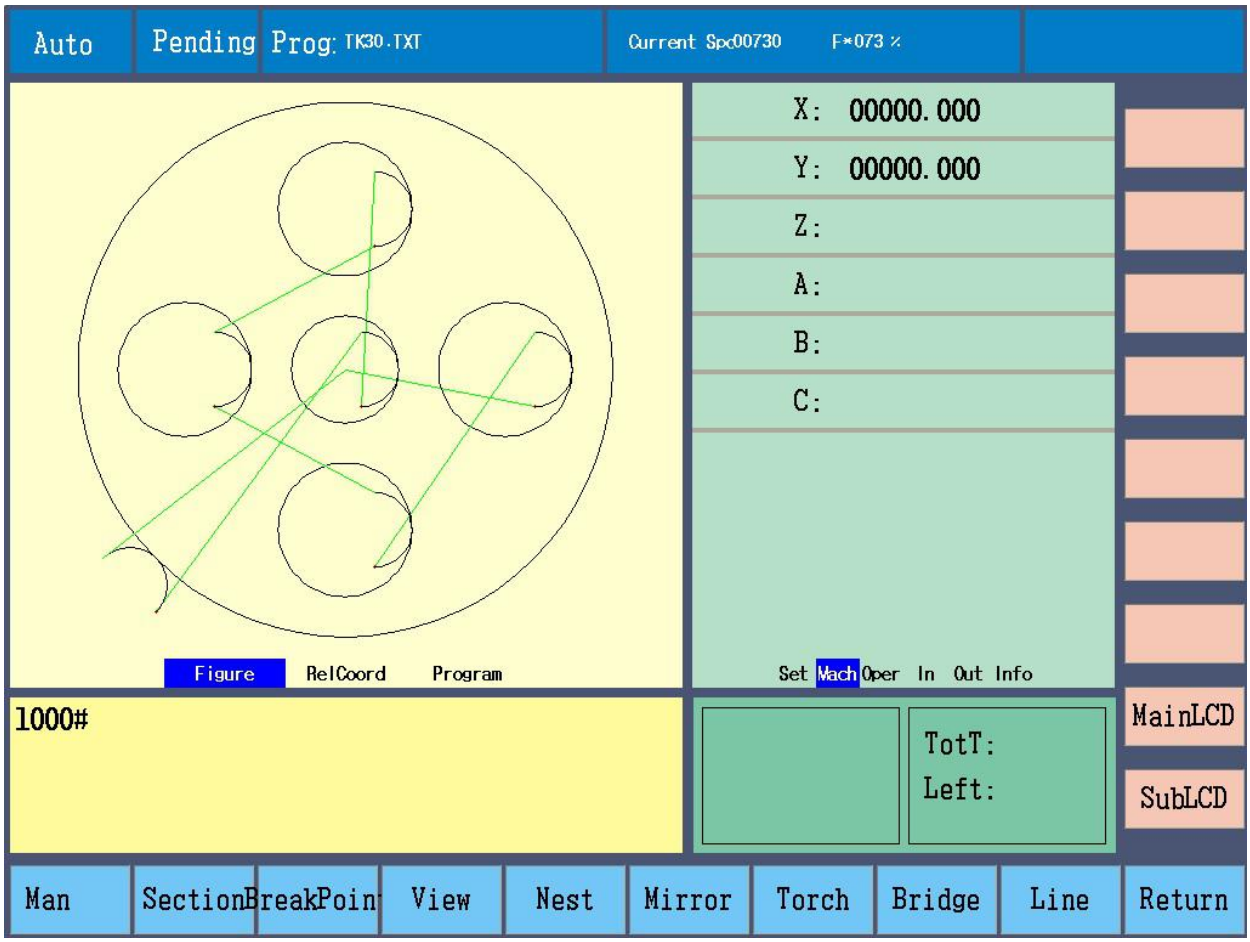

Program codes:



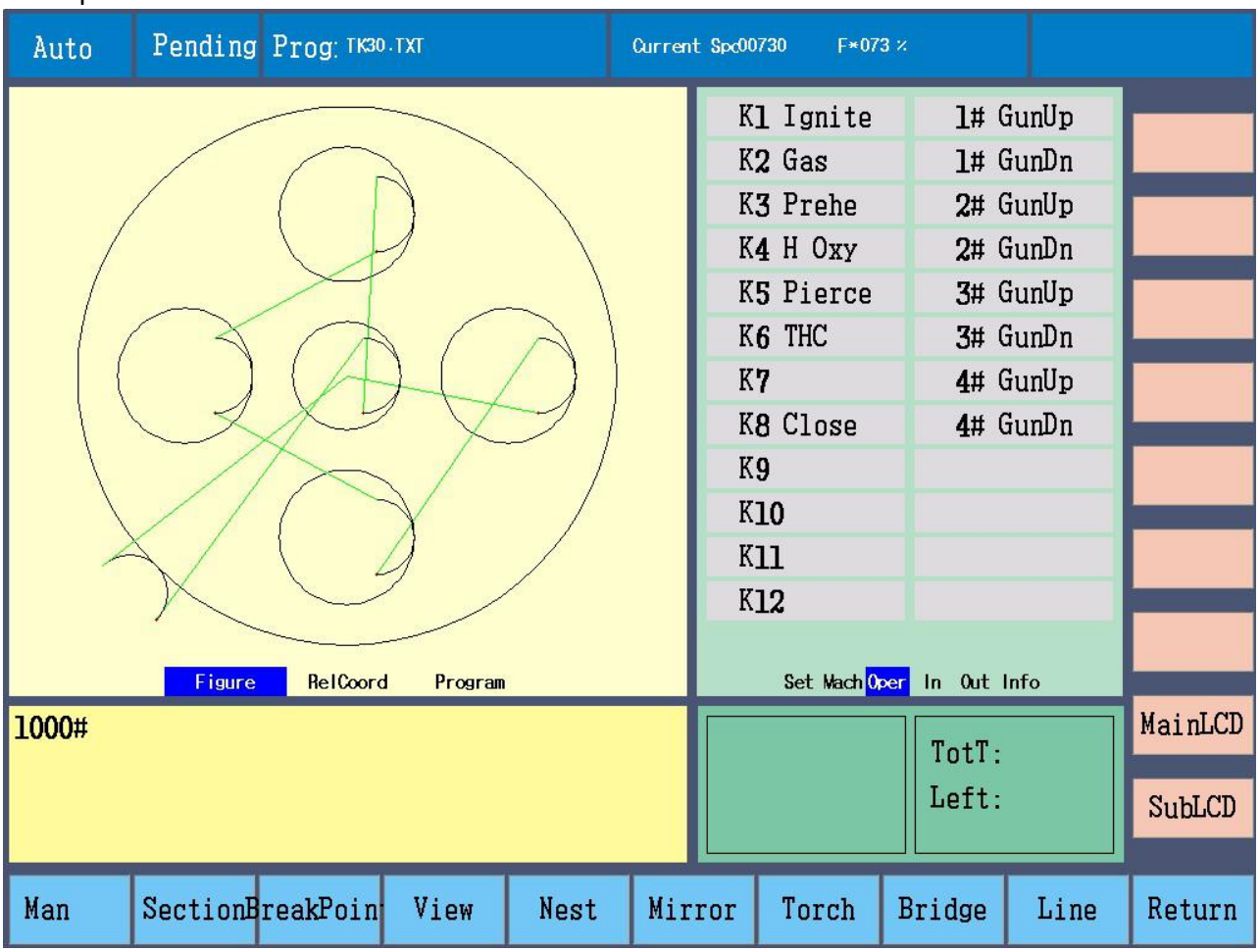
Press SubLCD key to display in cycle following interfaces as below,
Current auto cutting settings:



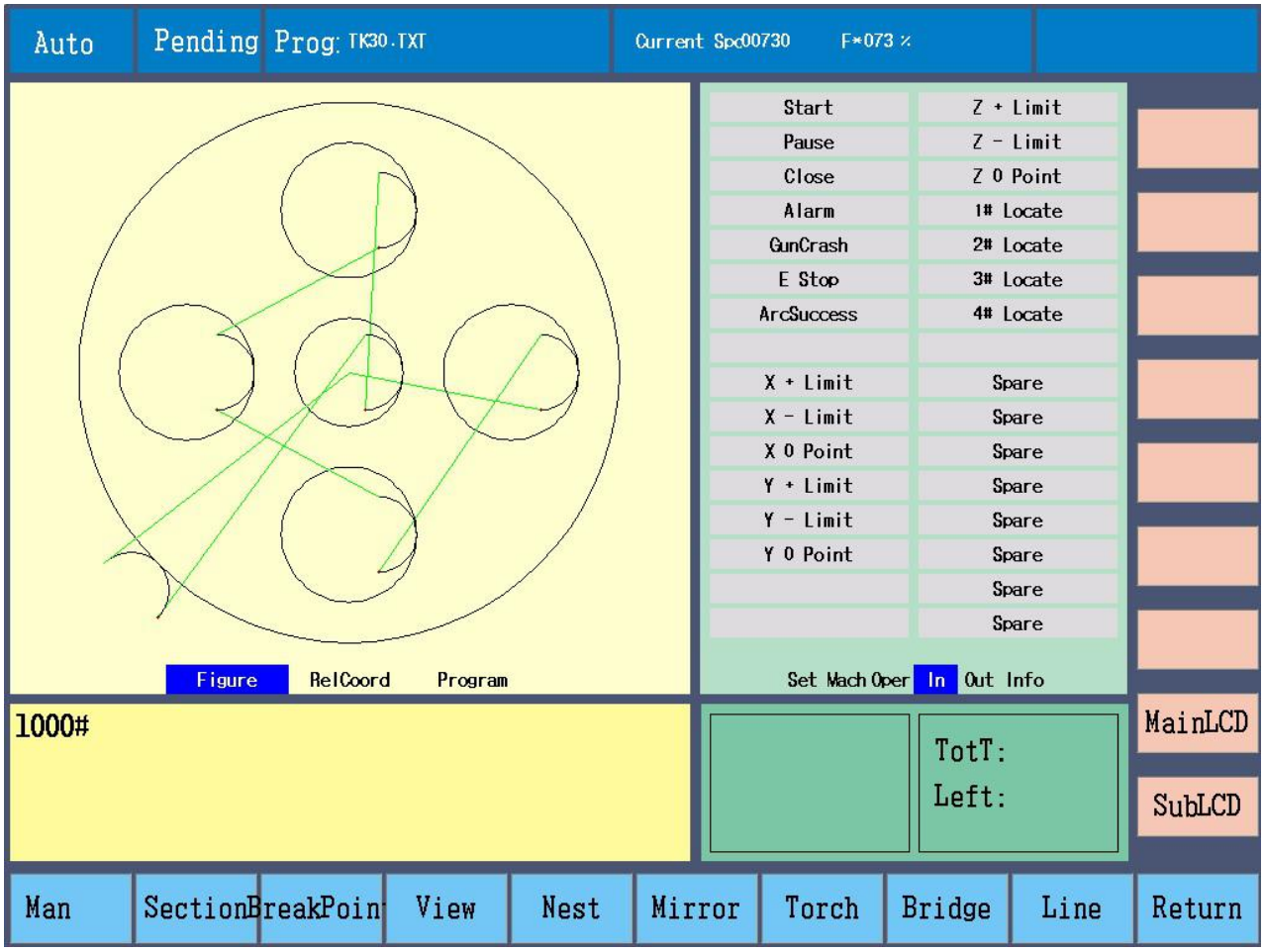

Machine coordinate:



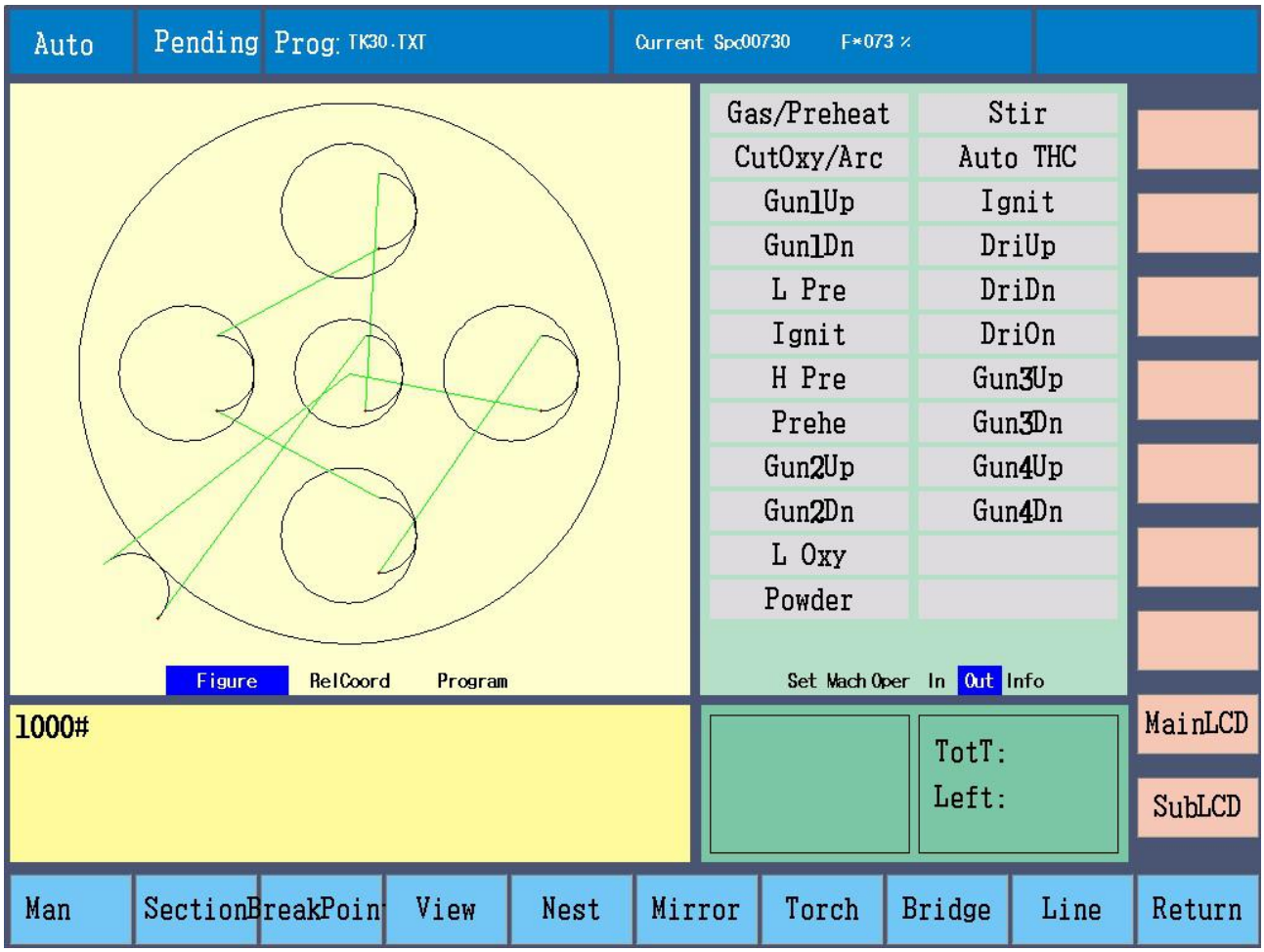
Operation tips and states




Input states:




Output states:




Current parts program information:

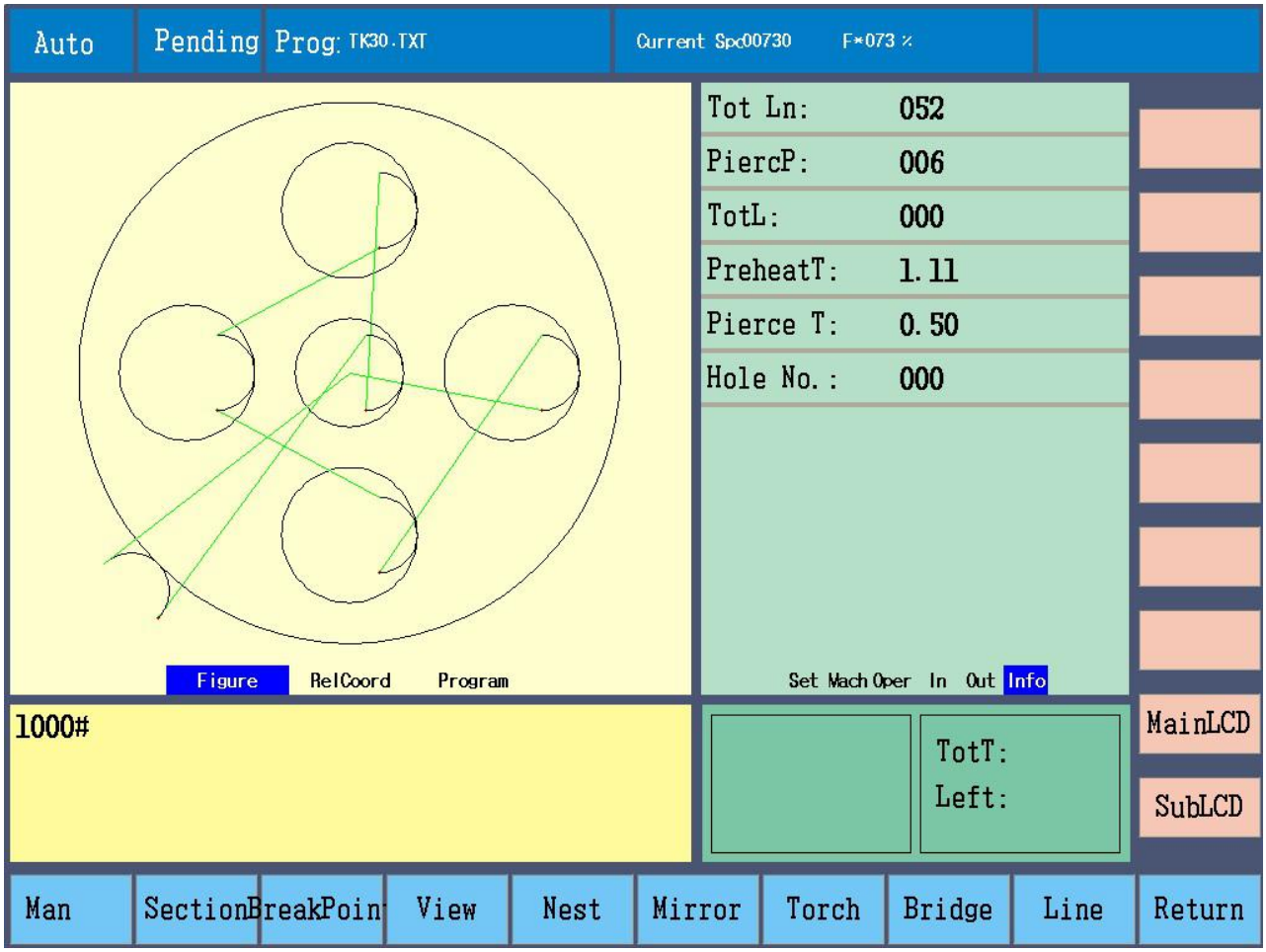
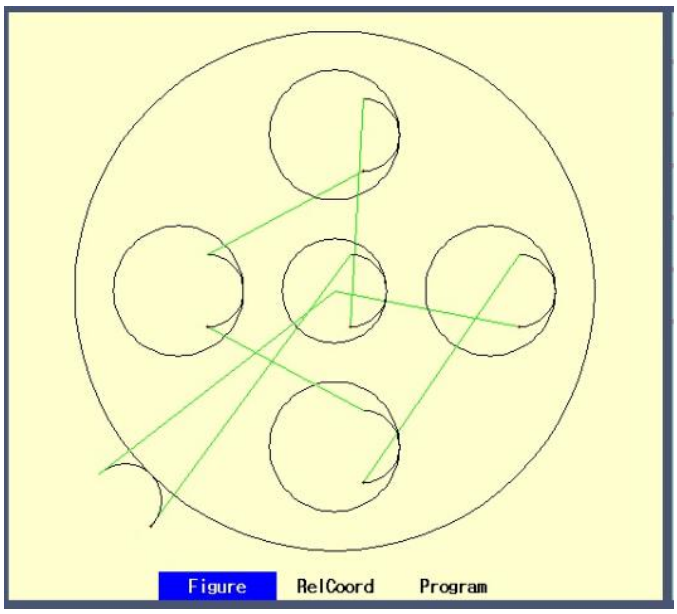


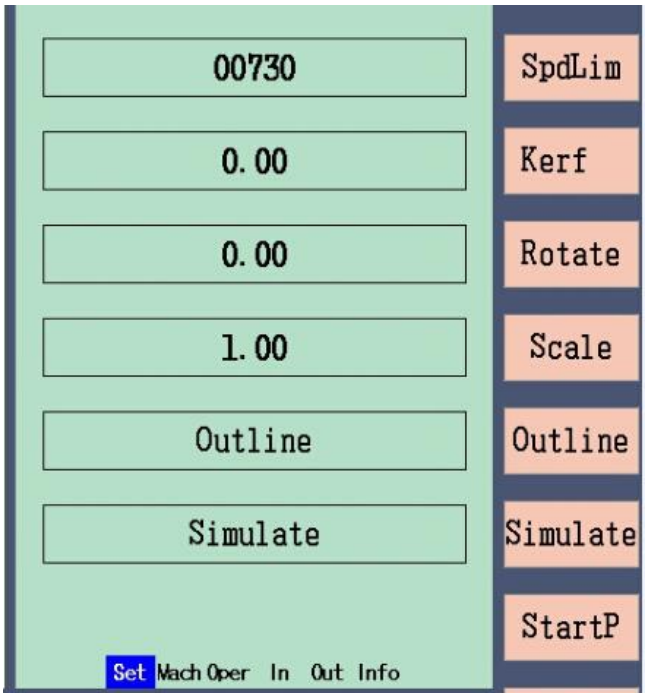

Figure display in the main LCD




X: zoom in the figure
Y: zoom out the figure
G: restore the figure
Move and preview the figure by direction keys.

Figure display setting
In Parameter and Figure interfaces, figure can be set.

Sub LCD setting display



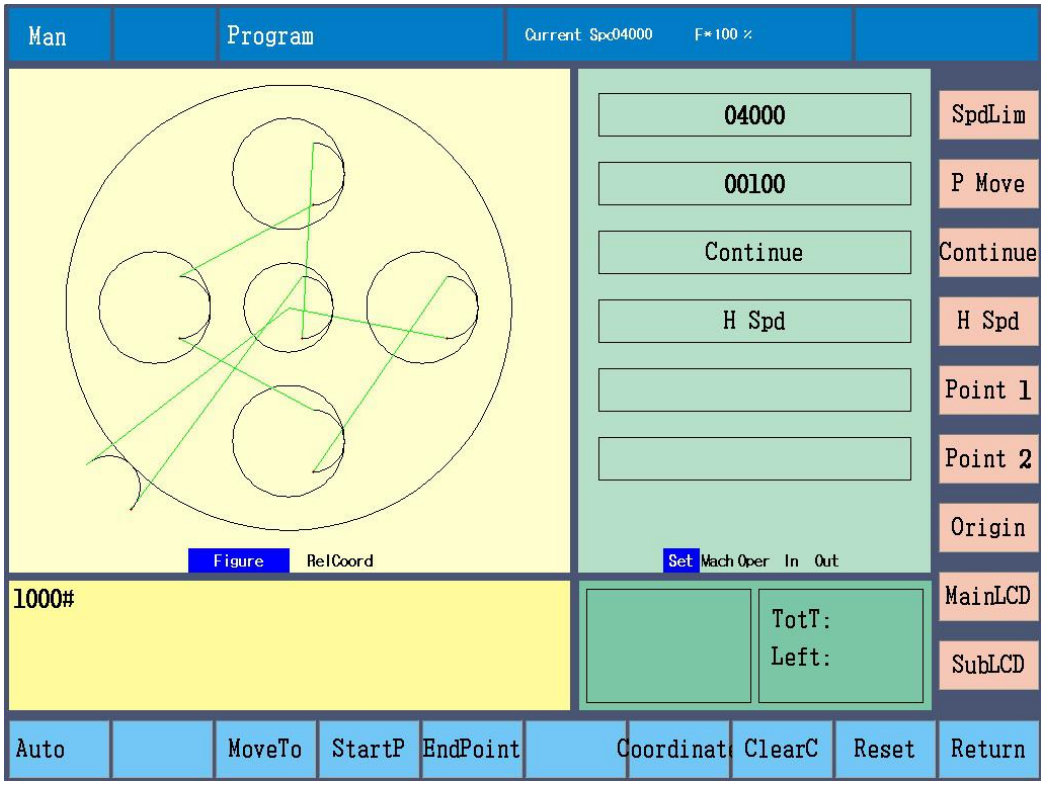

SpdLim (speed limitation): set auto cutting speed limitation
Kerf: set kerf compensation value
Rotate: rotate the parts
Scale: zoom in/out the parts
Outline: outline mode, press Start, torch will move along the outline to check whether the plate is big enough.
Simulate: simulation run mode, press Start, torch will move along the cutting path till program ends without output.
StartP (start point): change start point, choose torch start point (initial position), change 5 different positions.
Operation display area


Man: go to manual interface
Section: section operation
BreakPoint: break point operation
View: preview parts
Nest: array parts
Mirror: mirror parts
Torch: choose 4 torches
Bridge: bridge mode
Line: draw line mode
Return: back to parts reference point, when laser location, press again, tip to laser location point.

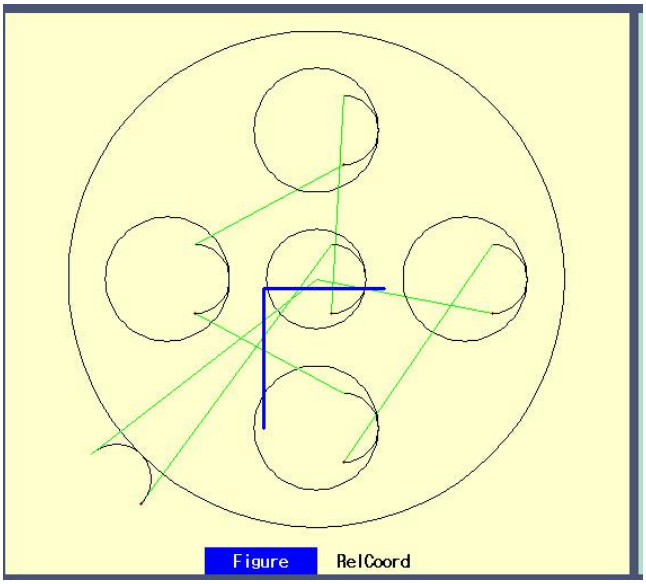
State display area


Setting tip & state tip

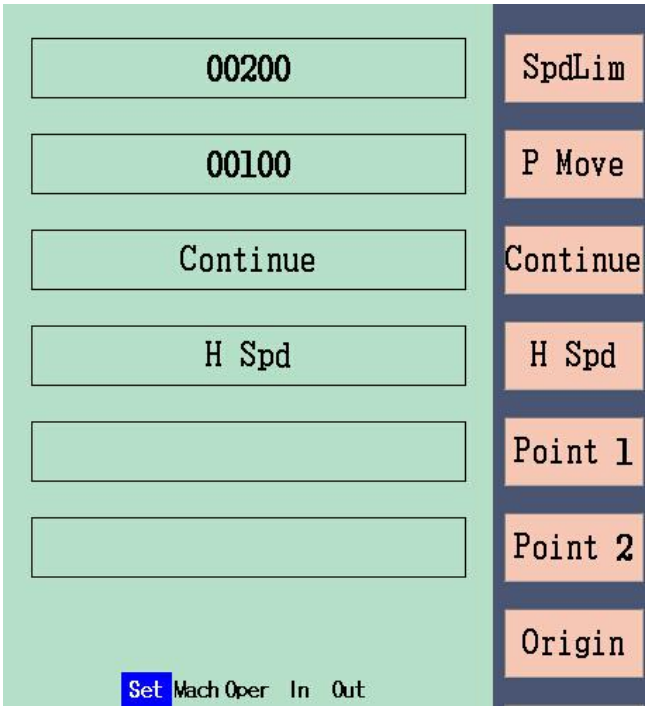

## 4-2 manual interface




Manual path display




Manual settings




SpdLim (speed limitation): speed limitation of manual movement and idle run.
P Move (point movement): set point movement increment.
Continue: continuously move
H Spd (high speed): fast change moving speed, 10% or 80% of manual speed limitation.
Point 1/2: set the current point as the fixed point, machine coordinate.
Origin: machine origin.

**Note:**

1. If don't choose "Continue", then press the direction keys to move, release keys to stop.
2. During continuously movement, press keys of the same or reverse directions to pause, press other direction keys to slantly move, press direction keys again, stop to move in one direction.

Operation display area


Auto: go to auto interface

MoveTo: input X/Y axis point movement increment, move to the target point.
StartP (start point): set the current point as the deflection start point.
EndPoint: set the current point as the deflection end point.
Coordinate: set reference coordinate.
ClearC (clear coordinate)
Reset: machine reset
Return: back to parts reference point, if has laser location, press again, tip back to laser location point.

## 4-3 preparation before cut

1. Cutting situation is safe, gas and plasma power source are ready, intermediate relay and solenoid valve DC24V power on.
2. Cutting machine precision is set (CNC parameters), motor and drivers are ready.

After load the part program, check cutting mode, speed and kerf, then press Start button.

**Cutting mode**
Plasma & flame. Main menu ---> Para (parameter) ---> Switch

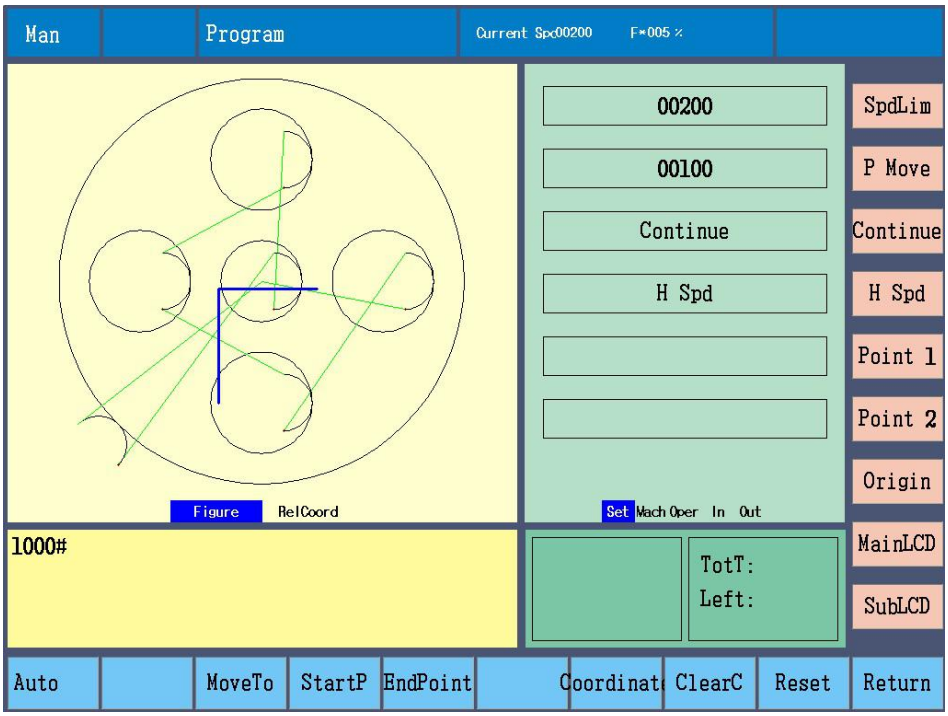
**Speed limitation**
1. Set cutting speed limitation, the maximum values is not bigger than “Cut Speed Limit” value in Speed parameter.
2. Multi-functional knob, turn it to adjust speed rate.
3. F+/F- to adjust.

**Note**: during cutting, idle run, go forward and backward, speed adjustment is to change the current speed rate, the adjusted speed rate will be recorded till adjust next time.

**Kerf**
In auto interface, under pending state, press Kerf to revise, set value is a half of the actual kerf width, unit:mm.

## 4-4 other operations before cut

Move torch, in manual interface

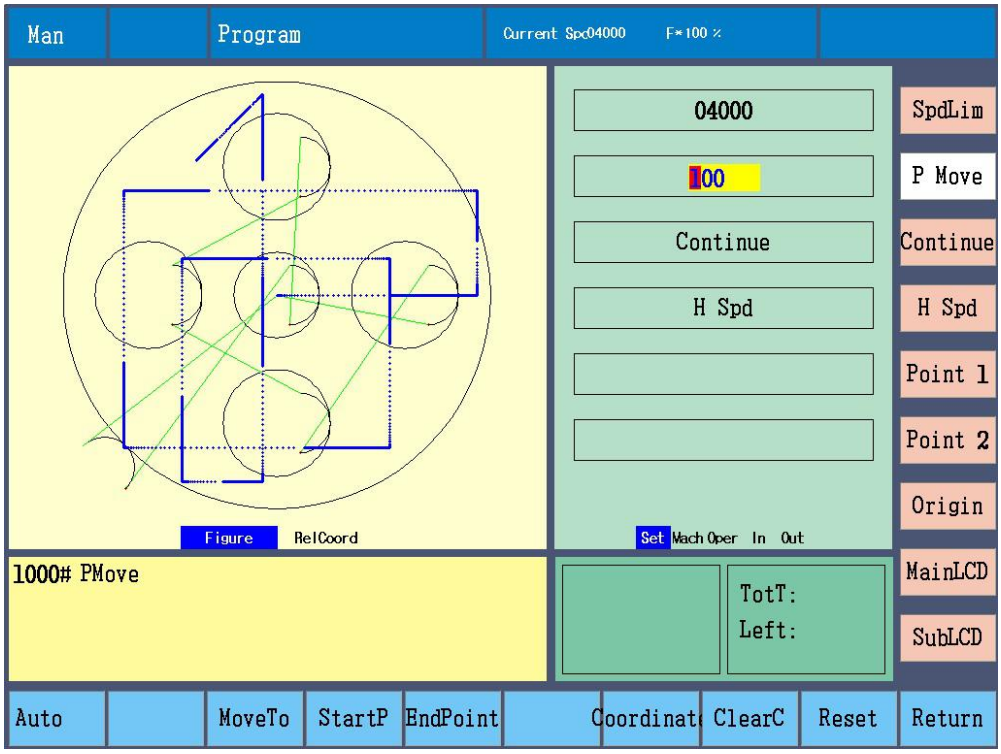



1. Manually move the torch to any position

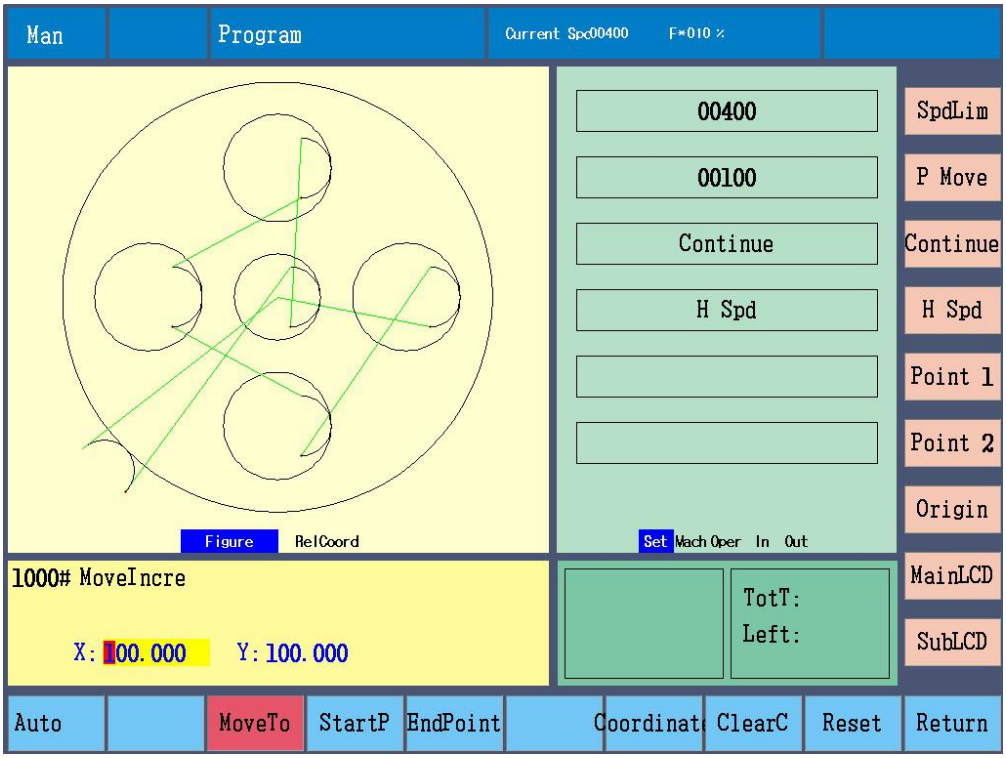
The initial setting is that press direction keys to move the torch, release keys and the torch stops.
Choose “Continue”: press direction keys to move the torch, it stops till press Pause, or the same or reverse direction keys.
In continue mode, press the direction key of another axis, and torch obliquely moves, press direction keys again to cancel another axis movement.

2. Manually adjust torch to specified position

Press “P Move”, input “point movement increment” value, after Enter, press direction keys to move torch at specified distance.

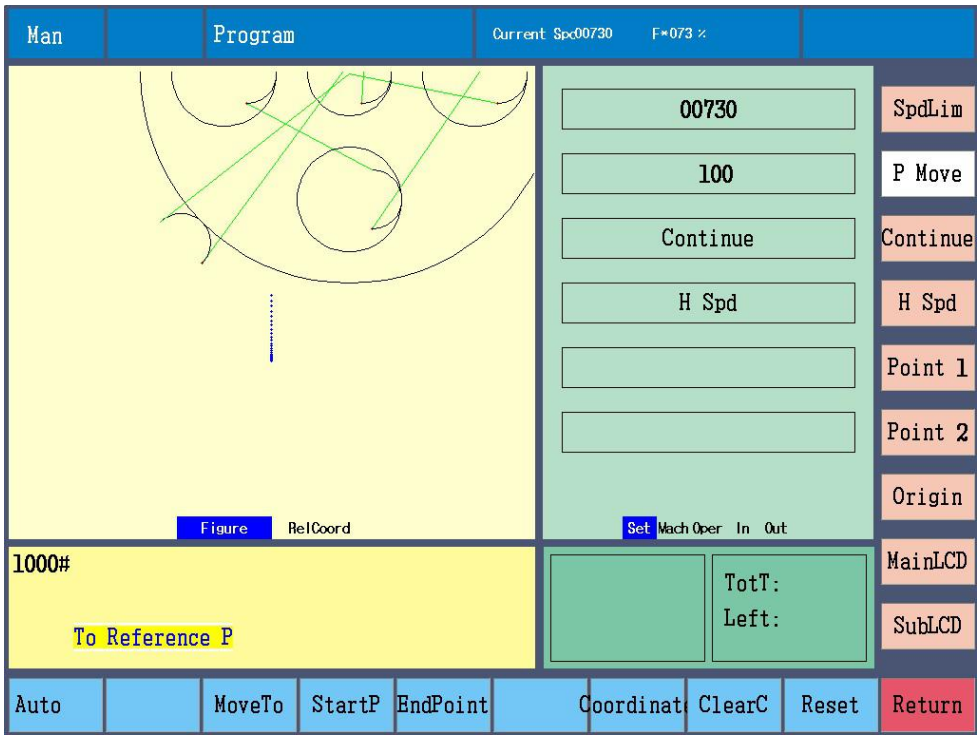



MoveTo, single or dual axis to move, input “point movement increment” value of X axis and Y axis, after Enter, press Start key, the torch moves in two axes at the same time.




**Return**

Move the torch to the parts reference point, default is G92 X0 Y0.




Press Return to tip “To Reference Point”

XY axis to reference point/X axis to reference point/Y axis to reference point

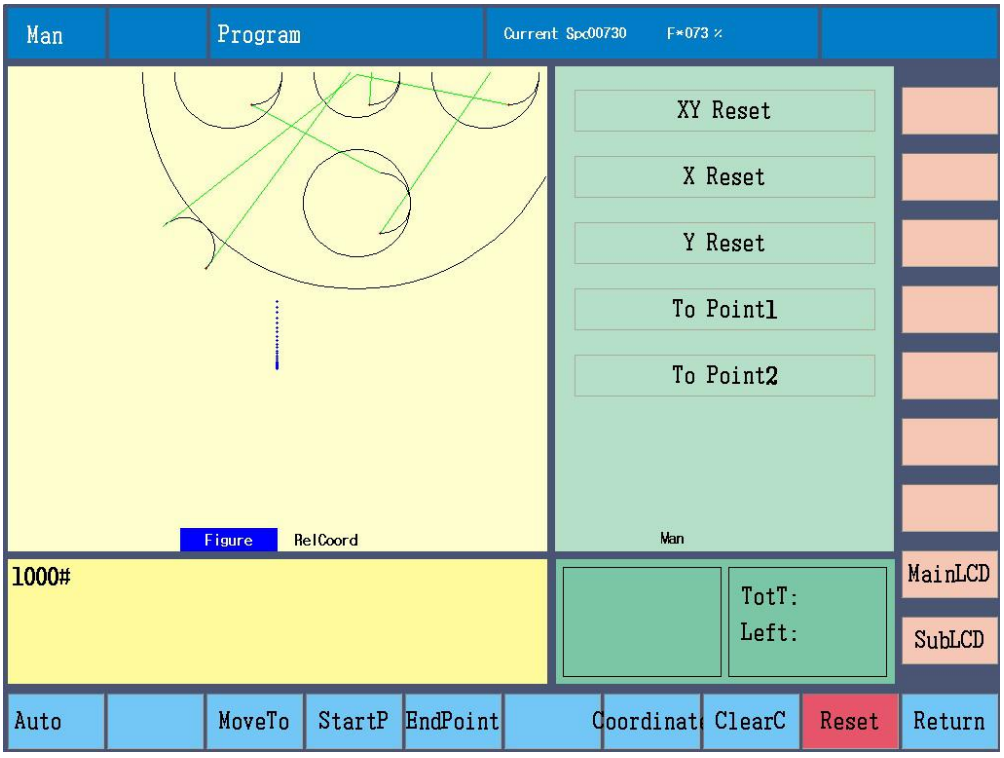
The movement speed is idle-run speed.

**Reset**

“Zero Point Switch” is 1 in “Machine” and Reset Direction in “System” is not 0, press Reset, the axis fast moves along reset direction, and stops when meet mechanical 0 point signal, current coordinate is parameter origin coordinate, machine coordinate clears.

“Zero Point Switch” is 0 in “Machine” and Reset Direction in “System” is not 0, press Reset, the axis fast moves along reset direction to the machine 0 point, the current coordinate is parameter origin coordinate.

“Zero Point Switch” is 0 in “Machine” and Reset Direction in “System” is 0, press Reset, the axis doesn’t move, machine coordinate clears, current coordinate is parameter origin coordinate.




**Note:**

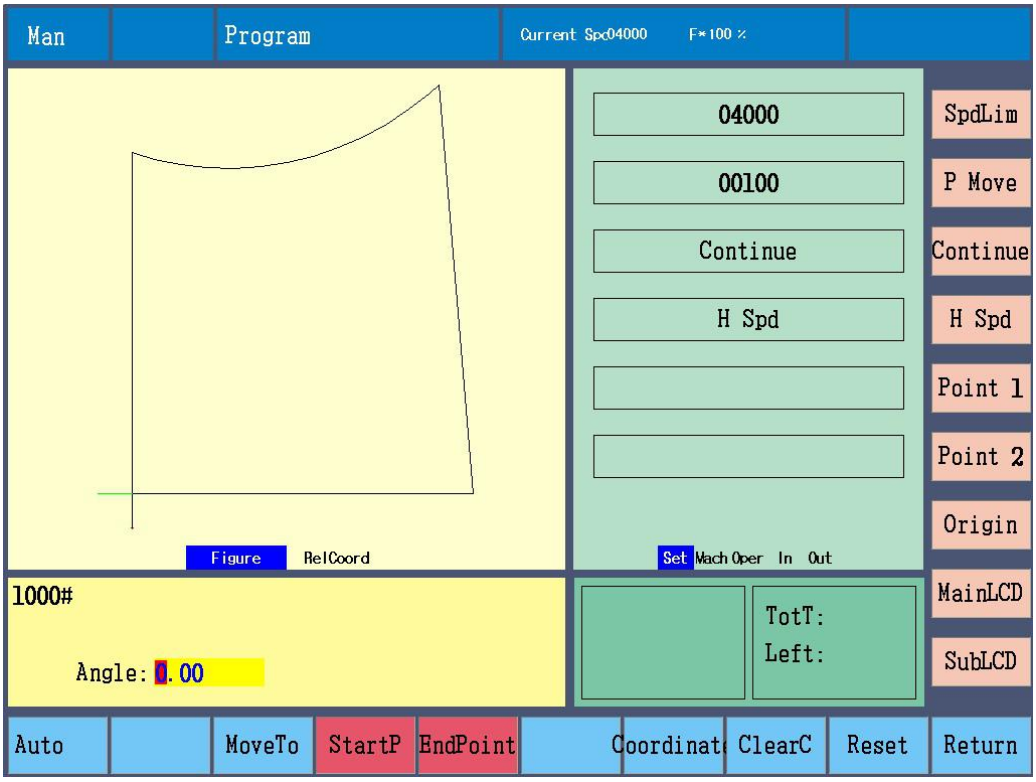
1. When Zero Point Switch is 0, and continue off-line to move torch, the machine coordinate will accumulate,

clear by reset.

2. Two axis reset at the same time, one axis meets 0 point switch, two axis stop, after one axis reset, another axis continue.

**Align parts (plate calibration)**

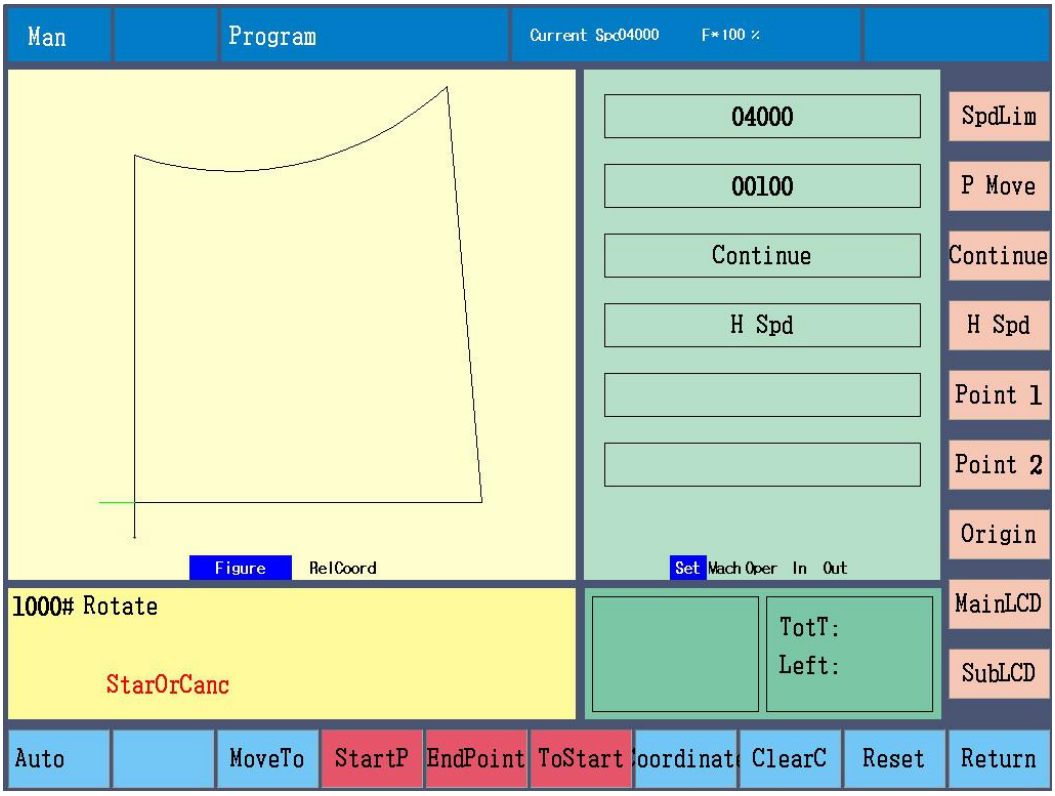
If plate doesn't align with machine axis, then manually align parts, in manual interface,




Press direction keys to move torch, align one side of plate, press start point.

Press direction keys to move torch, align another point of the same side of plate, press end point.

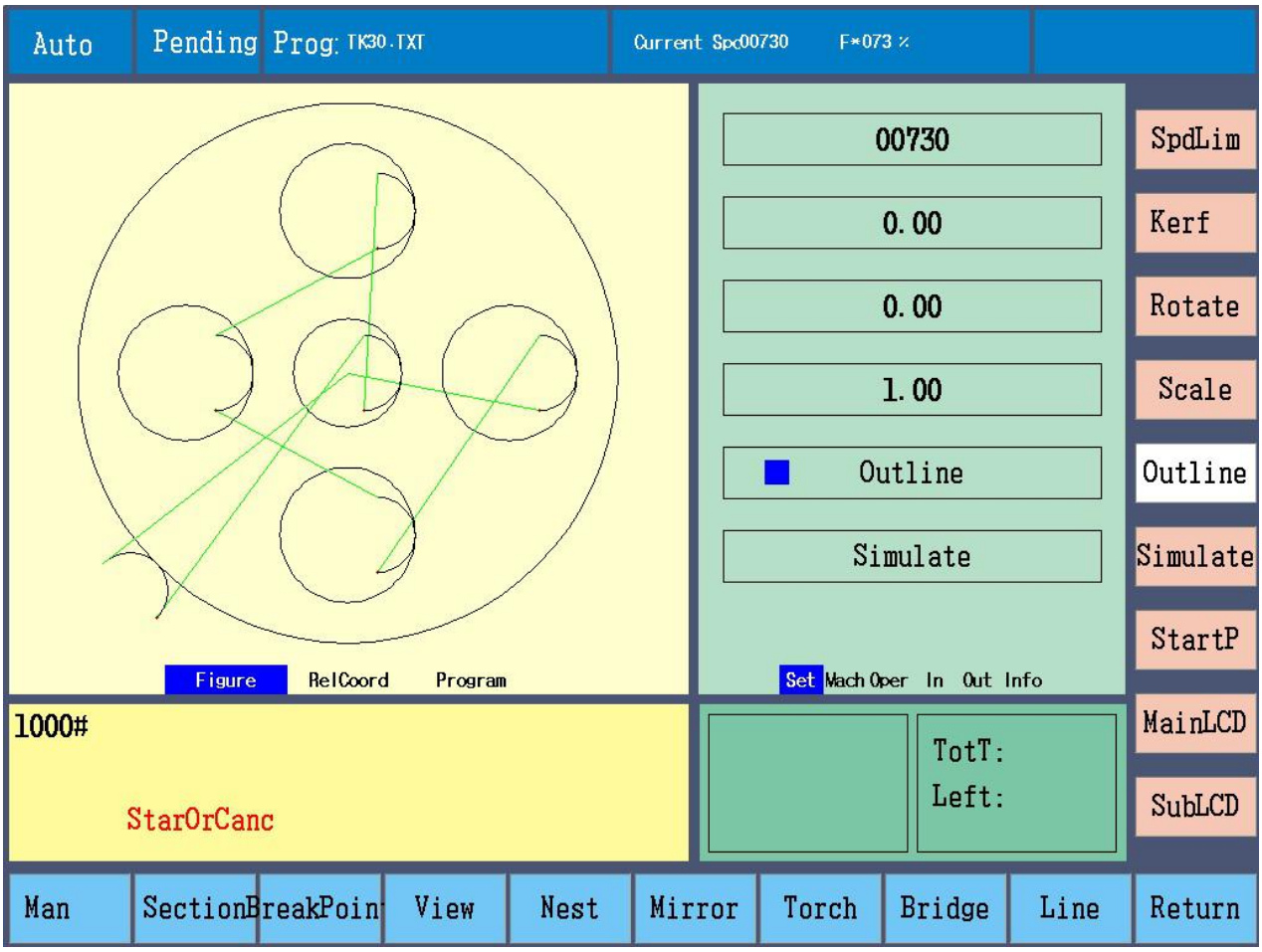
Controller tips rotation angle, after confirm, back to Auto, preview, display the figure after rotation.



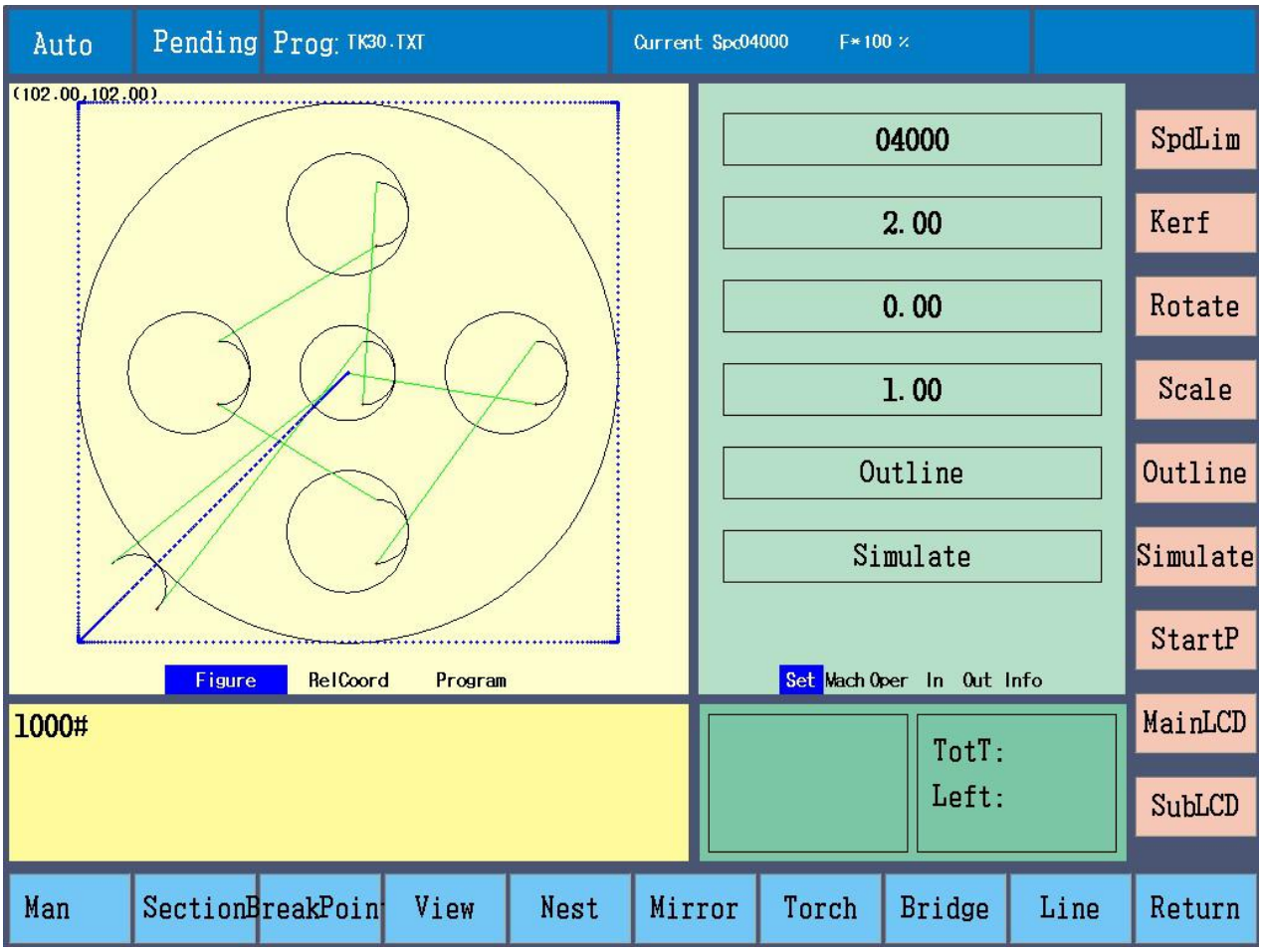

Note: after set end point, can press StartP(point), back to the start point.

**Outline**

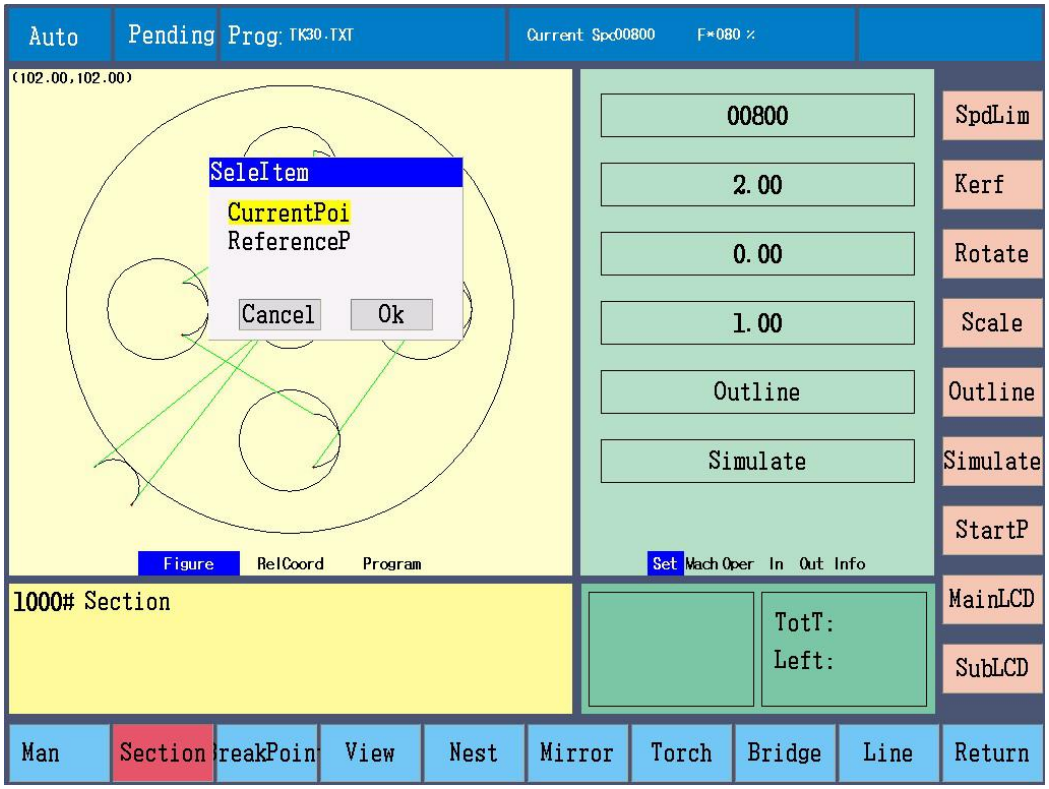
If want to check whether the plate is big enough for parts, can choose Outline before cutting.




Outline, choose it, press start key, torch moves along outer outline to check whether torch is beyond plate.



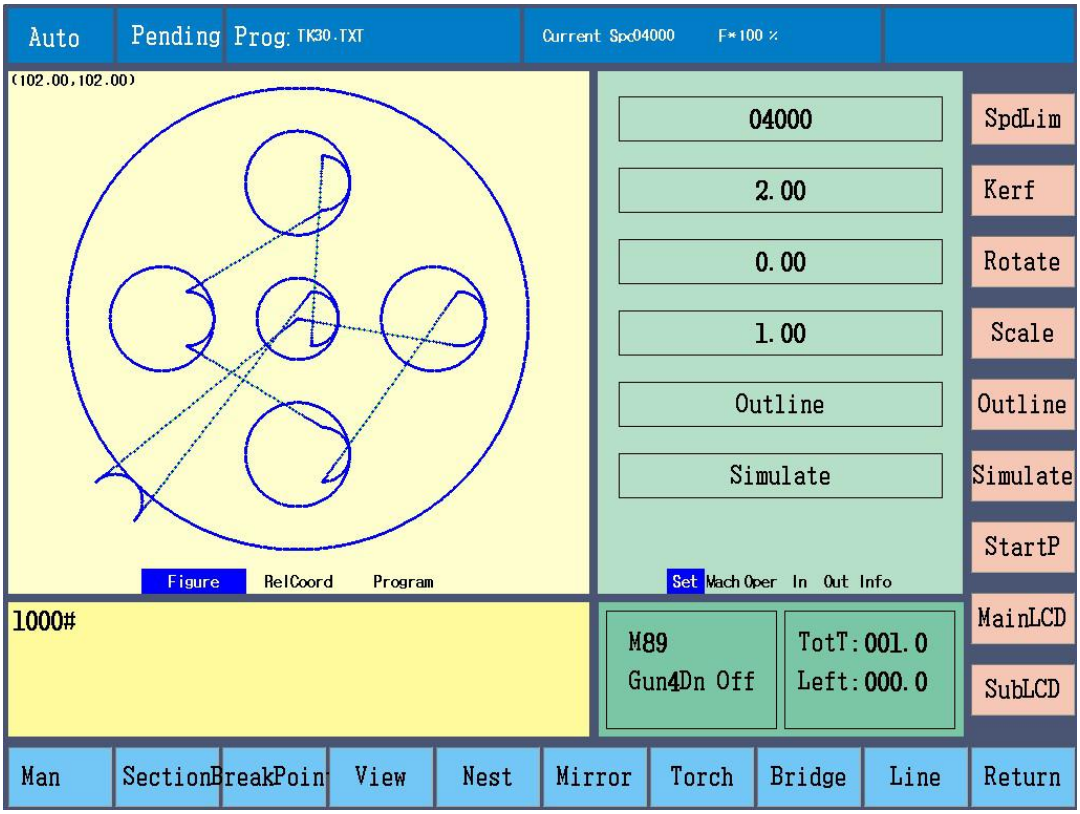

If the current point relative coordinate is not the parts reference point, after pressing Start key to tip “CurrentPoi (current point)” or “ReferenceP (reference point)”




"CurrentPoi", the current point is the parts reference point, relative coordinate is reference coordinate, start to over to the bottom left corner of the outline, run along the parts edge at clockwise.
"ReferenceP", don't change current relative coordinate, move to the parts reference point from the current point, then move to the bottom left corner of the outline, run along the parts edge at clockwise.

**Simulation run**

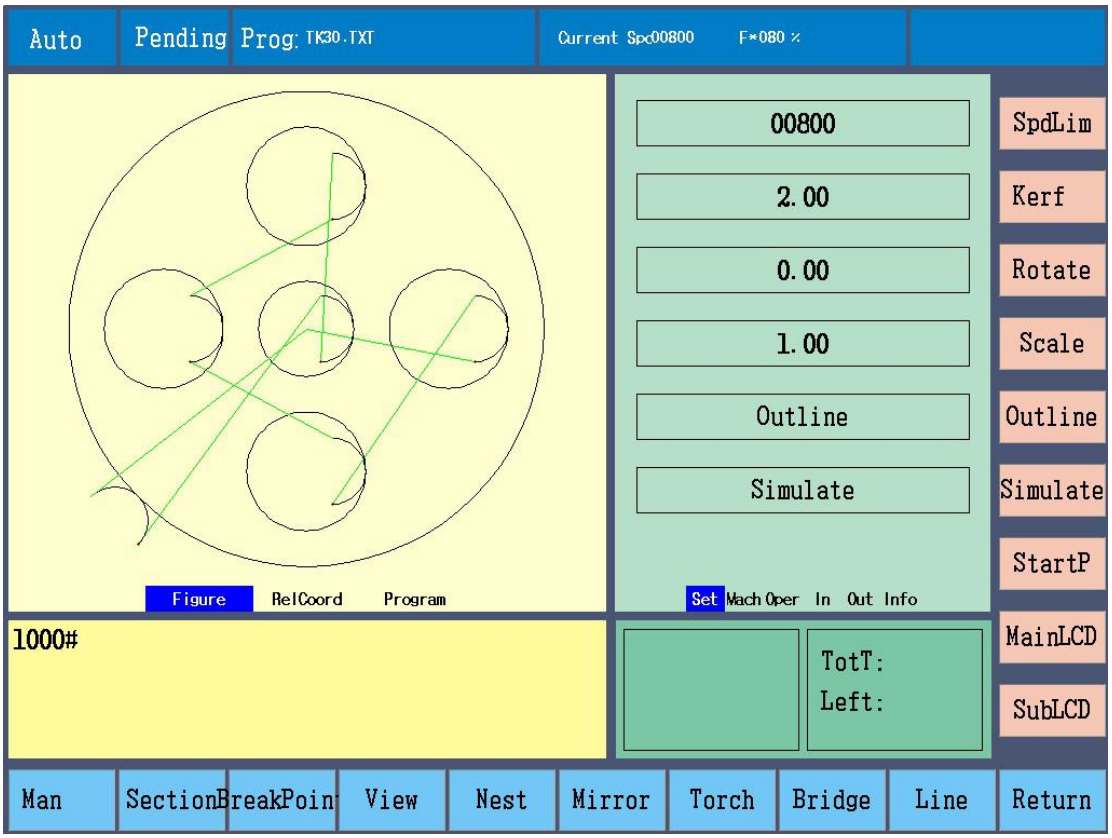
Before cutting, choose Simulate to check cutting path is right or not.
Simulate, choose it and press start button, torch moves along program path at cutting speed.
During the operation, output is invalid. E-stop, pause, limit and other input are valid.




**Change start point**

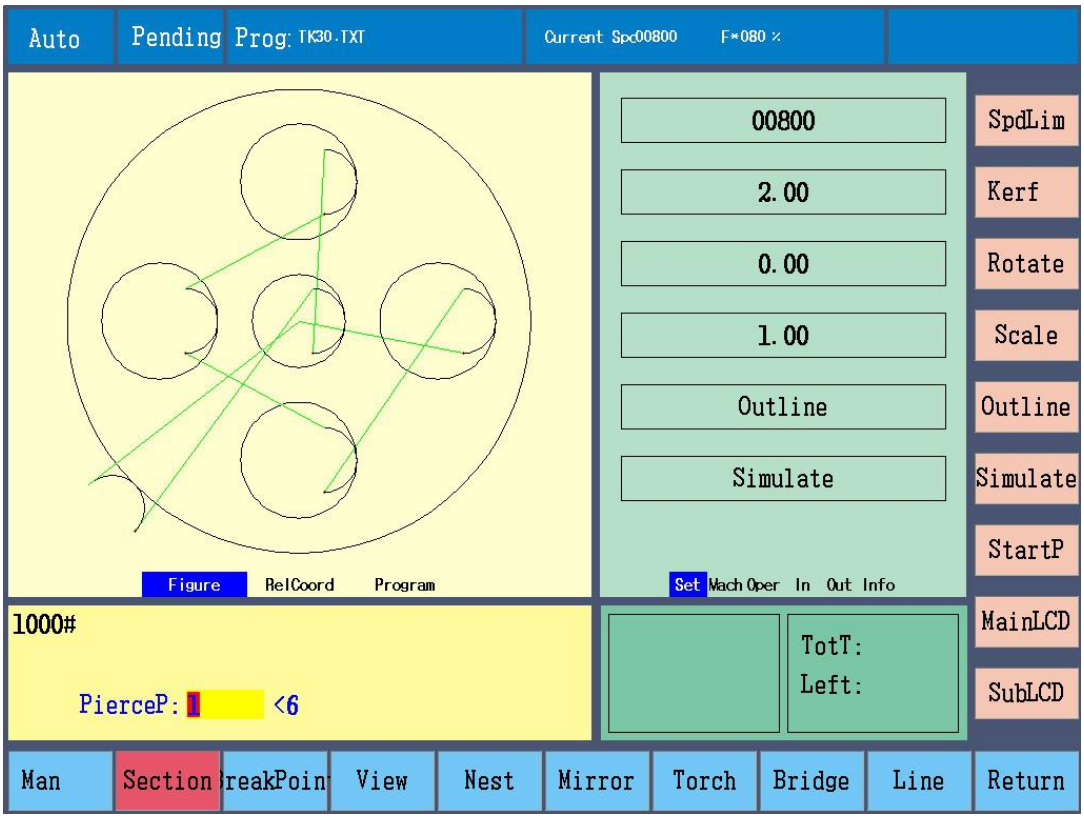
For some irregular parts or plate, in order to get cutting start point, can change that point.

StartP (start point), current start point displays at left bottom corner in preview area. Press it several times to change that point. Press start key, torch moves to the first pierce point from selected start point and then cut.
Moving sequence: left bottom --- left top --- right top --- right bottom --- center

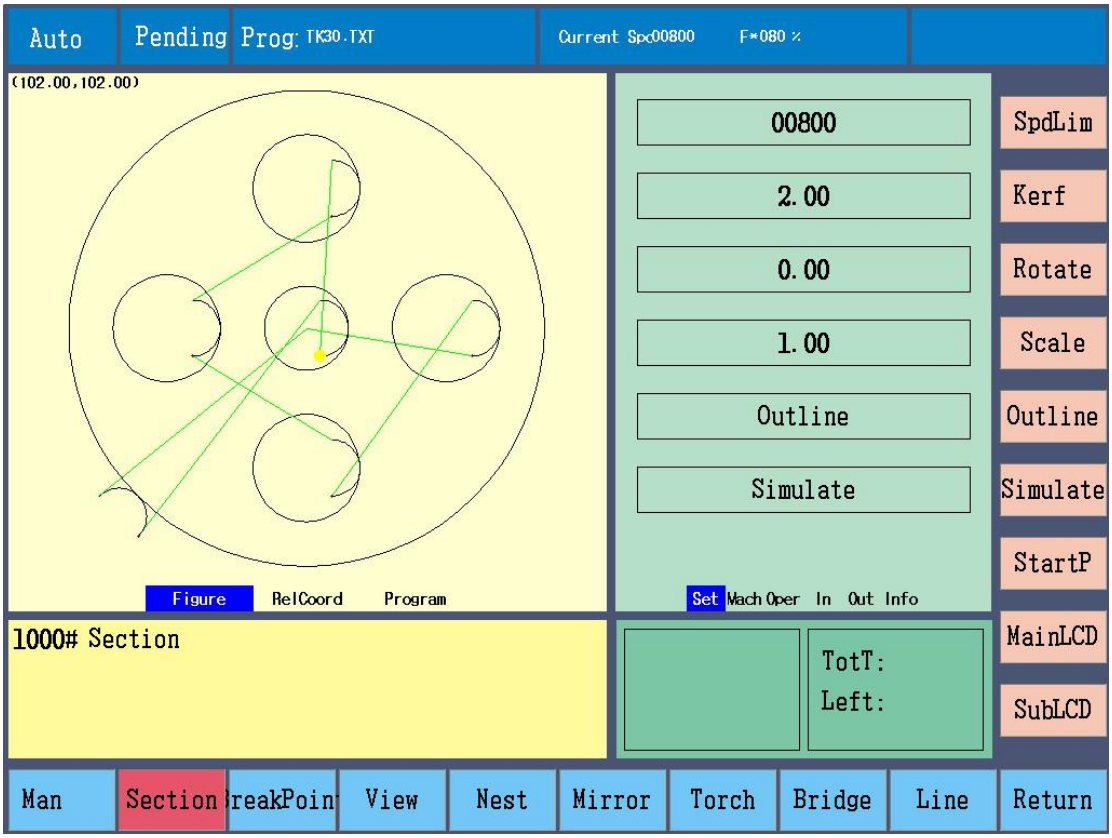



## Section

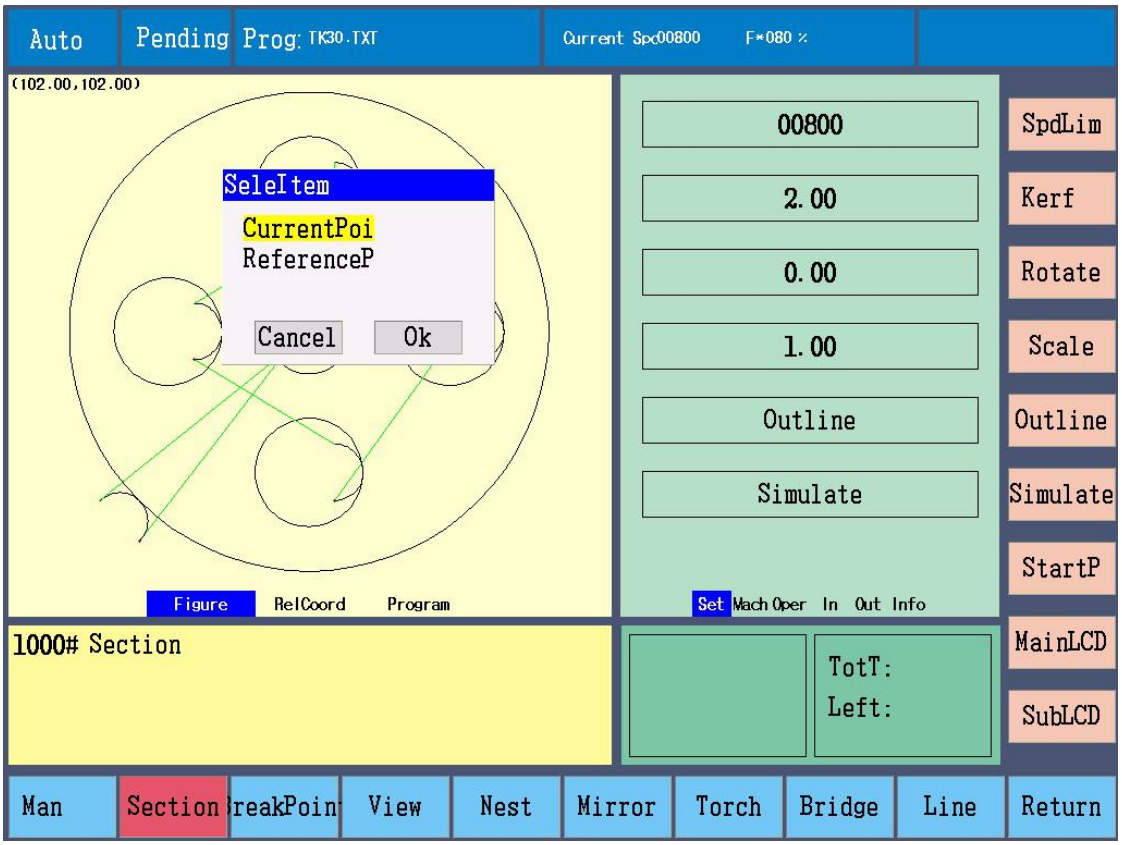
Before cutting, choose a certain position of the parts to cut by Section function.
Press Section to input PierceP (point) number, press again to input line number.
After input pierce point number, and confirm to preview selected pierce point position.




Display the target point after Section.




Option dialog displays after start.




CurrentPoi (current point location): after confirm, torch makes the current position as pierce point, after presssing start key, start to cut.
RefrenceP (reference point location): after confirm, torch locates as reference coordinate and moves to the pierce point in idle-run speed, press start key, and then cut.

Choose as program line number: press Section twice, input line number, after confirm, and preview the start position of selected line.
**Manual output**: Before cutting, according to cutting mode, manually open some output.

Flame mode
1, press K1 for ignition cycle (M52), press K8 to close.
2, press K2 to open gas output (M10), press K2 again or K8 to close (M11).
3, press K3 to open preheat oxygen output (M24), press K3 again or K8 to close (M25).
4, press K4 to open cutting oxygen output (M12), press K4 again or K8 to close (M13).
5, press K5 for pierce cycle (M07), press K8 to close.
6, press K6 to open torch height control auto output (M38), press K6 again or K8 to close (M39).
6, press SU for torch up, release button to stop.
7, press SD for torch down, release button to stop.

Plasma mode
1, press K4 to open plasma arc strike output (M12), press K4 again or K8 to close (M13).
2, press K5 for pierce cycle (M07), press K8 to close.
3, press K6 to open torch height control auto output (M38), press K6 again or K8 to close (M39).
4, press SU for torch up, release button to stop.
5, press SD for torch down, release button to stop.
**Note:** when cut and torch moves, torch up/down are valid.

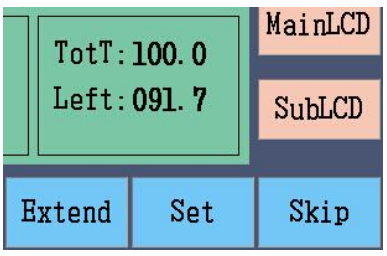
## 4-5 auto cutting

After cutting preparation, in auto mode, press start key to cut according to current cutting mode and parameter settings.

After start, controller will work as below,
1, deal with parts cutting program, draw parts preview figure.
2, output and delay time and other movements.
3, control torch up/dwon.
4, port input signal.
5, speed adjustment.
6, refresh figure and state.

**Dynamic figure display**: During cutting, controller dynamically displays current torch position, can zoom preview figure.
X zoom in
Y zoom out
G restore
Note: after zoom in preview figure, controller can automatically move the figure and follow the torch position, if moves too fast, maybe refresh figures frequently.

**Delay timer**: During cutting, delay has timer, can operate “extend”, “set” and “skip”.




Extend time, add 100s.
Set current time as operation time of the same movement. Time setting in parameter also changes.
Skip left time, can’t change time setting of same operation and parameter.
**Note:**

1, in flame mode, load new file, the initial preheat time is 100s.
2, when delay, start key is like skip function, pause key is like extend function.
3, flame: ignition and pierce time; plasma: arc strike and pierce time. Set before cutting.

## Pause during auto cutting

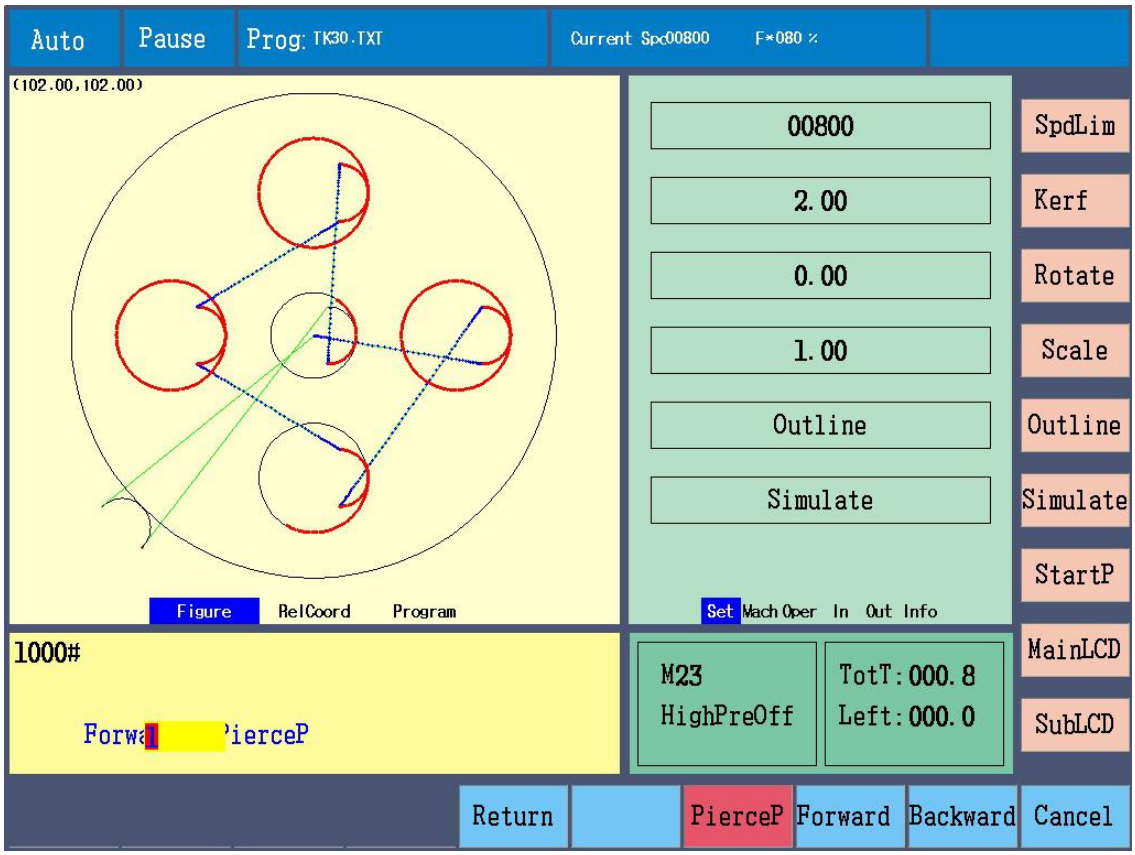
After cutting, not delay, can press Pause to stop cutting, close output, slow speed and stop torch movement, after pause, controller records current position as break point.

When pause, can operate output control at left side, torch up/down and speed adjustment, and can operate items at right side, also can move torch at 10% of manual speed, press F to change between 10% and 80%.

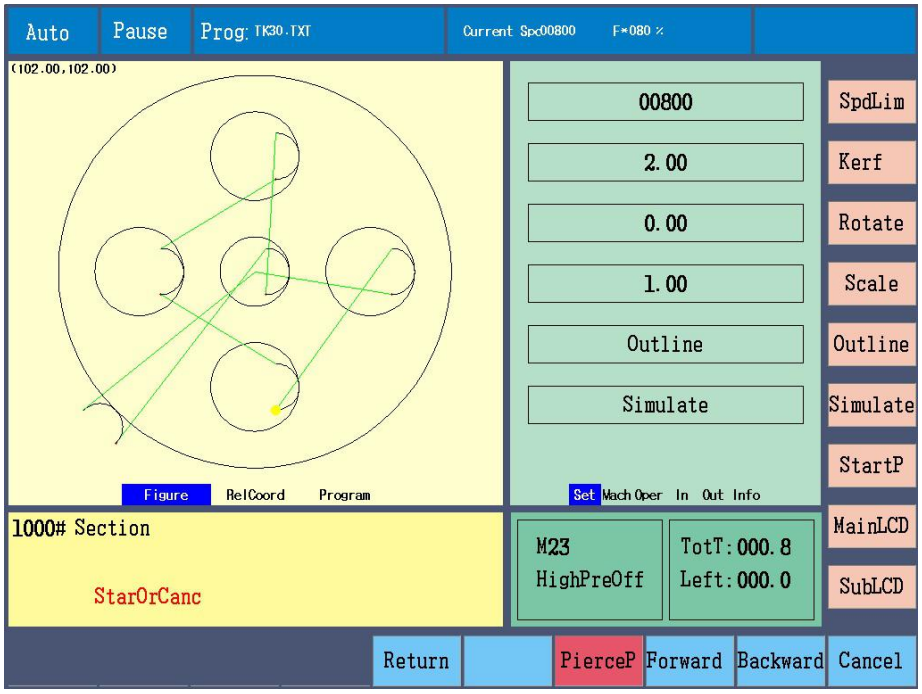
**Start**: After pause, press start button, controller pierce at current position, then continue to cut.
Flame cutting, if close preheat, controller finishes pierce; if preheat goes on, then skip preheat, then pierce, so discover preheat state, after enough preheat, then start.

**Forward and backward**: After pause, can move forward and backward along program path, press F6 and F7, initial speed is back speed in parameter settings, only move torch, don't change output state.
Move forward and backward to a position, can press start button to continue cutting.
When don't cut through the plate, can use forward and backward.
After forward start, no pause to stop movement, then automatically start preheat, pierce, cutting at the next pierce point.
After backward start, no pause to stop movement, then automatically pause at the next pierce point, can continue backward or forward.

**Pierce point**: After pause, choose pierce point and cut.
Press PierceP(point) to display pierce point number of "forward" and "backward".



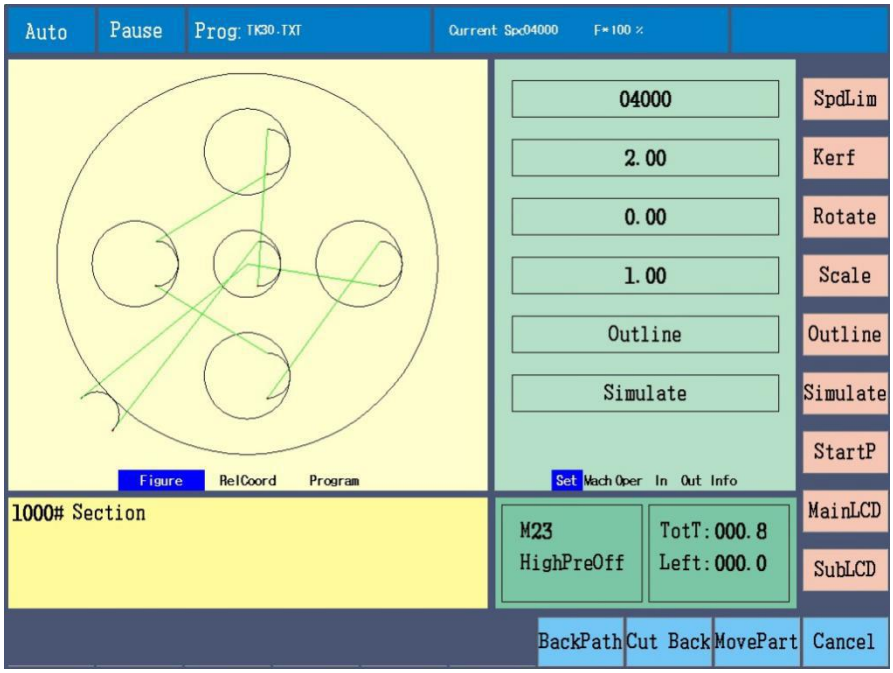

Press Enter to confirm, controller displays selected pierce point position.




Press start button, torch moves to selected pierce point position from current position. But still in the state of Pause, following operations are available.

**Return**: torch returns to the start point at idle run speed.
Press L3 after pause, torch moves back to start point in idle-run speed.
**Simulate:** choose Simulate, press Start key, then simulatively run the left parts program
**Cancel**: exit pause state, back to auto pending state, can continue to cut by “break point”.

**Start after path deviate**
After pause, use direction buttons to move torch, to make torch to deviate path, there are 3 methods to continue cutting.




**BackPath**: keep current output state, torch moves to pause position from current position by shortest path.
**Cut Back**: pierce at current position, then cut to pause position by shortest path, choose the operation, please carefully choose path to avoid wrong cutting.
**Move Part**: pierce at current position then cut the left parts.
When plate and parts have enough space, or near plate edge, choose “Cut Back” , better smoothness of break point.

**Note:** pierce in flame mode, controller finishes different tasks according current output state.
1, gas, preheat oxygen, cutting oxygen all close, execute complete M07, then cut left parts program.
2, gas and preheat oxygen open, cutting oxygen close, execute “pierce torch up” (delay) --- “open cutting oxygen” (delay) --- “pierce torch down” (delay), then cut left parts program, just like manually finish preheat.
3, not above two situations, then firstly close output, and execute complete M07, cut left parts program.

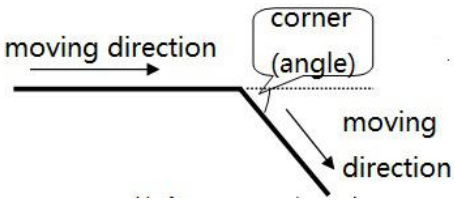
**Input port**: Controller has 13 input signals, when cut in auto or manual mode, check input port state and deal with accordingly.
Input port
1, correctly connect external input switches.
2, correctly set port logic state in diagnose interface.
3, connect external 24VDC power and start.
**Note:** port logic state setting is available in “diagnose”.

When have e-stop or alarm signal input, controller immediately stop torch movement, close all output, save the current position as break point, display e-stop or alarm in tip place, before e-stop and alarm input state change, can’t move torch and open output.
When limit signal input, controller will operate the same as e-stop or alarm signal input, but can manually move torch in reverse direction to leave limit.
**Note:** when e-stop, alarm and limit input, torch urgently stops movement, maybe there is overshoot, so the actual stay position may be a little different from break point position, when restart or break point restore, maybe need to manually calibrate.

## Chapter 6 Setup

Press Para (parameters) at main menu, Speed

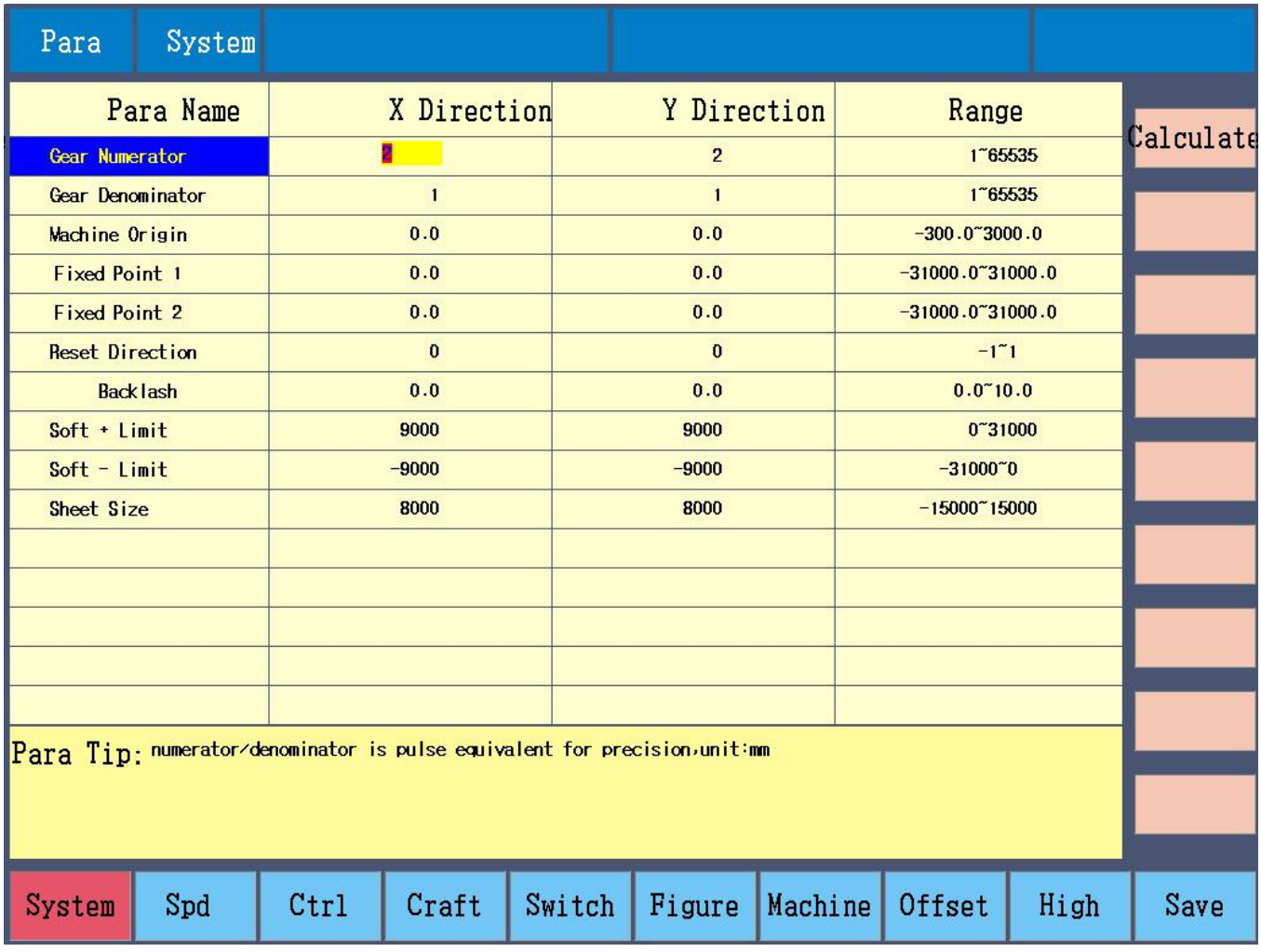
| | | |
|---|---|---|
| 1 | Start Speed | Start and stop speed |
| 2 | Lifting Rate | When reduce or increase speed, change is fast or slow, the bigger, the slower |
| 3 | Speed Limit | Max. speed when manually or idle-run (G00) |
| 4 | Cut Speed Limit | Max. speed when auto cutting |
| 5 | Back/Forward Speed | After pause, forward or backward speed |
| 6 | Reset Speed | Reset speed |
| 7 | Speed Angle | Auto mode, direction change of two sections is over the angle, slow speed in advance |
| 8 | Corner Speed Limit | Auto mode, max. speed of cutting the corner between two sections |
| 9 | Climb Speed Ratio | After pierce, torch movement speed during climb time |




Note: when change direction during torch movement, controller will lower speed in advance to avoid torch shake.

In fact, torch shake is caused by different factors, such as inertia, machine rigidity and so on, users can set the corner speed to improve steadiness.

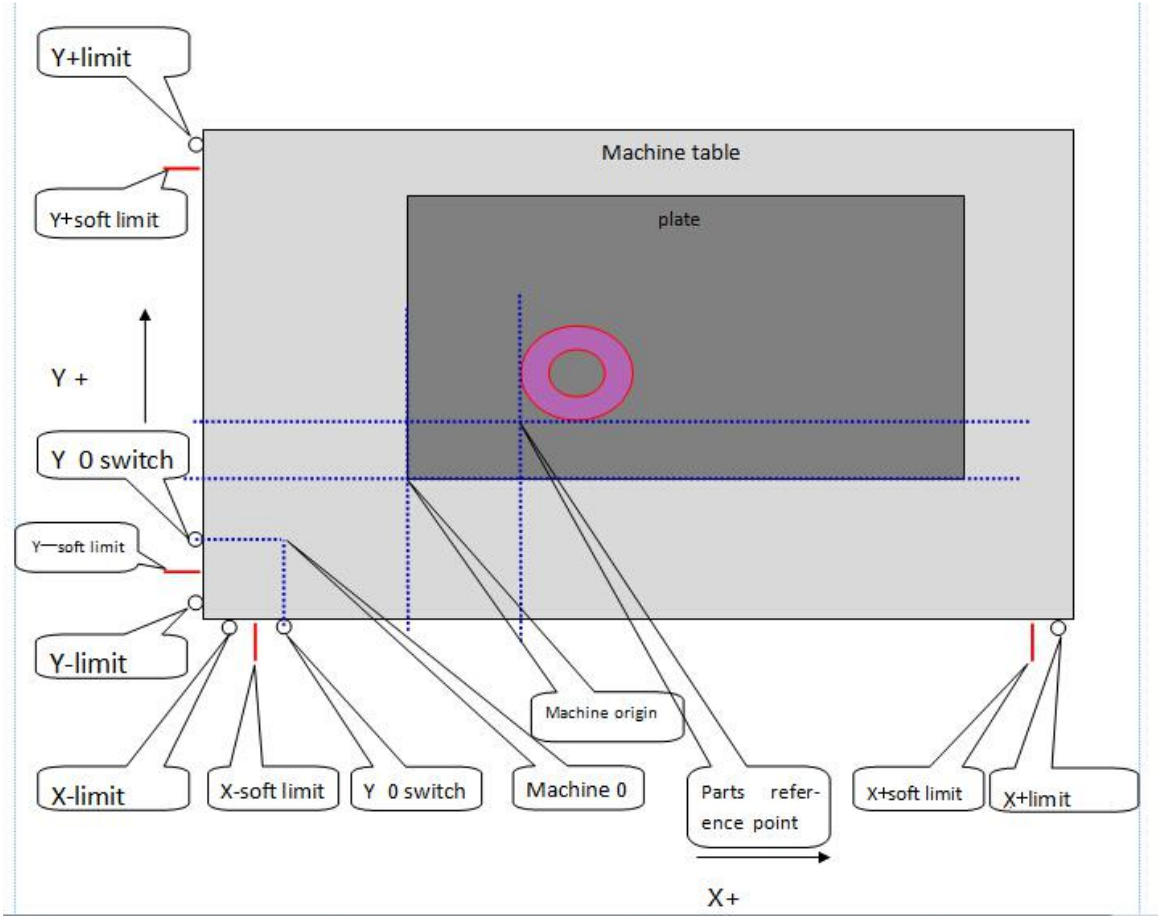
## System



| | | |
|---|---|---|
| 1 | Gear Numerator | Numberator/denominator is pulse equivalent, for machine accuracy, unit: μm |
| 2 | Gear Denominator | Numberator/denominator is pulse equivalent, for machine accuracy, unit: μm |
| 3 | Machine Origin | Machine origin coordinate, a certain position coordinate for machine 0 point |
| 4 | Fixed Point 1 | Fixed position 1 for machine 0 point |
| 5 | Fixed Point 2 | Fixed position 2 for machine 0 point |
| 6 | Reset Direction | -1 negative direction, 0 don't move, 1 positive direction |
| 7 | Backlash | Mechanical gap when compensation direction change |
| 8 | Soft + Limit | Positive direction max. value of machine coordinate |
| 9 | Soft - Limit | Negative direction max. value of machine coordinate |
| 10 | Sheet Size | |

**Gear Numerator and Denominator**: Numerator/denominator is pulse equivalent; controller sends a pulse, the torch movement distance,
Example: numerator is "2", denominator is "1", and pulse equivalent is 0.002mm.
Formula: numerator/denominator=lead screw pitch X 1000/(360*subdivision number/step angle* drive ratio)
Adjustment method:
1) set a ratio, such as 8/1, manually move a standard distance, such as 2000, measure actual moving distance, use formula, 8*actual distance/1*2000, if the actual distance is 2651, then the simplified fraction is 2651/250.
2) set a ratio, such as 8/1, manually move a standard distance, such as 2000, measure actual moving distance, press F key, input the value, press Enter, there is result, press F8 to confirm.
**Note**: automatic calculation is better.
**Machine Origin**: Set a coordinate point as machine reference point, or in manual interface to move the torch to a certain position, confirm the origin position by F6 Test Origin.
Test origin: machine has mechanical zero point, and when reset direction is right, move the torch to the selected position, set current coordinate, then press F7 Test Origin, execute "XY axis reset at the same time", then display XY axis current coordinate, press Enter to confirm, current coordinate is machine origin coordinate.
**Backlash**: eliminate mechanical backlash, usually check mechanical structure, it's better not to use backlash, or easy to damage the machine.
**Soft Limit**: set a machine coordinate range, when torch moves beyond the range, reduce speed and stop, only move torch in reverse direction to limit torch movement range to avoid torch collision, if don't use soft limit, can set soft limit invalid in Machine parameter.
**Note:** when automatically run, then stop after soft limit, automatically record break point.
**Reset Direction**: when set reset, torch movement direction is 1, torch positive movement direction is -1, torch negative movement direction is 0, torch doesn't move, when machine coordinate become X0, Y0, current position is equal to machine zero point position.

## Coordinate setting reference diagram




**Note:** machine origin can set to any point of value range.

## Control

Para | Ctrl

| Para Name | Value | Unit | Range |
|---|---|---|---|
| Metric/British | 0 | 0~1 | 0~1 |
| Coordinate | 0 | -1~1 | -1~1 |
| G41/G42 Check | 0 | 0~1 | 0~1 |
| TorchUp after Pause | 0 | 0~1 | 0~1 |
| Edge Pierce | 0 | 0~1 | 0~1 |
| Corner Arc | 0 | 0~1 | 0~1 |
| Smooth Precision | 0.1 | mm | 0.0~100.0 |
| Bridge Cut Length | 0.0 | mm | 0.0~100.0 |
| Bright Length | 0.0 | mm | 0.0~100.0 |
| Stir Time | 0.0 | s | 0.0~20.0 |
| Drill On Time | 0.0 | s | 0.0~20.0 |
| Drill Up Down Time | 0.0 | s | 0.0~20.0 |
| | | | |
| | | | |
| | | | |

Calculate

Para Tip: 0: metric system mm, 1 British system inch

System | Spd | Ctrl | Craft | Switch | Figure | Machine | Offset | High | Save

| | | |
|---|---|---|
| 1 | Metric/British System | Length unit, 0: metric system (mm), 1: metric system (in) |
| 2 | Remote Control | Use external switch, connect input port to control torch |
| 3 | Coordinate | Same as machine direction |
| 4 | G41/42 Check | Whether check interference caused by kerf compensation |
| 5 | Torch Up after Pause | Whether torch automatically move up after pause (height is up to torch up time) |
| 6 | Edge Pierce | Valid: move to pierce point, automatically pause, manually move to proper position, after start, cut to pierce point and continue, better for thick plate. |
| 7 | Corner Arc | Arc transition at corner, transition radius is kerf width |
| 8 | Smooth Precision | For programs with small sections, to improve stability |
| 9 | Bridge Cut Length | Set bridge, cutting length |
| 10 | Bridge Length | Set bridge, bridge length |
| 11 | Stir Time | Powder draw line, lasting time |
| 12 | Drill On Time | Lasting time of turning on drill |

**Torch Up after Pause**: Choose 1, press “torch up delay” after pause, torch moves up after the time, after start again, press “torch down delay”, torch moves down after the time, choose 0, after pause, torch keeps the current cutting height.

**Edge Pierce**: Valid: torch moves the pierce point, options column appear, choose “edge pierce”, “continue locally”, “no pierce”.

Edge Pierce, this moment can manually move torch, away from original path, choose plate edge pierce, then cut back to the previous point in shortest path, continue the left cutting, equal to cutting return after pause, can reduce preheat time for thick plate and improve cutting efficiency.

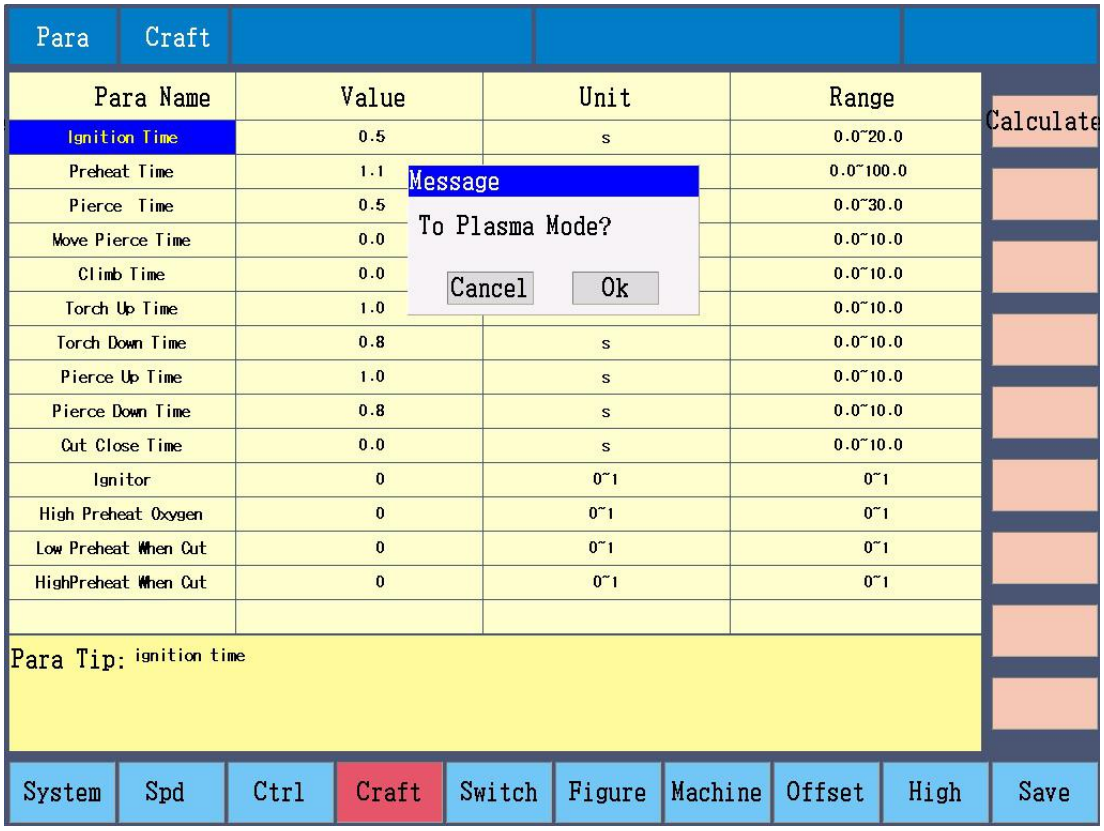
Local Pierce, pierce at local point and continue left cutting.

No Pierce, idle run the path till next pierce point, new tip appears.

**Note:** when several pierce points, there is tip for every pierce point.

**Smooth Precision**: When use parts drawings not made by CAD, such as art word, with lots of small sections, use smoothness precision to improve cutting efficiency.

## Craft (Two cutting types: plasma and flame.)

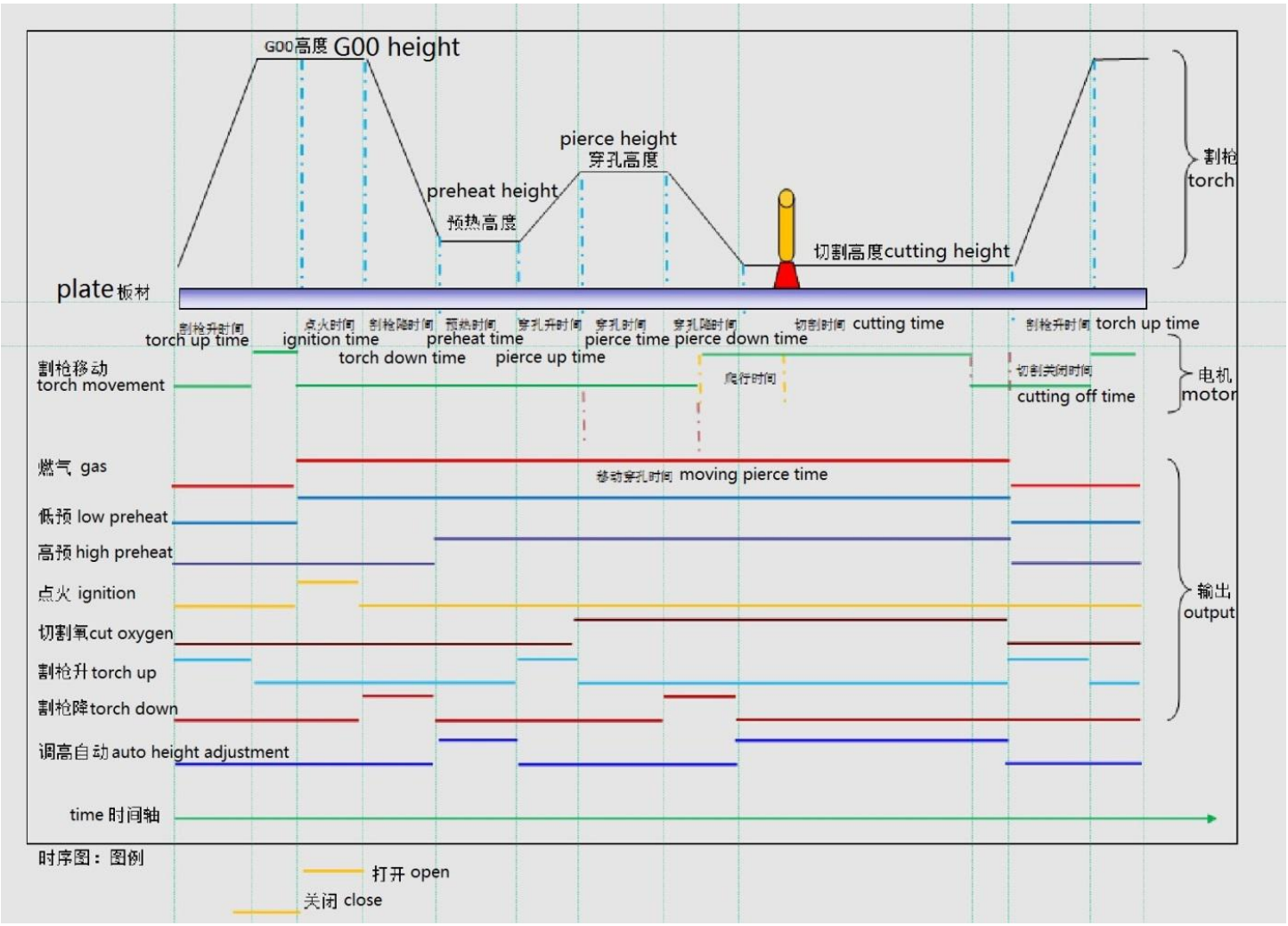



| | | |
|---|---|---|
| 1 | Ignition Time | Ignition time |
| 2 | Preheat Time | Preheat time, default is 100s for new program |
| 3 | Pierce Time | Pierce time at pierce height |
| 4 | Move Pierce Time | Keep output when pierce and XY axis start to move |
| 5 | Climb Time | Moving time of XY axis starting to move at climbing speed |
| 6 | Torch Up Time | Torch up time after cutting |
| 7 | Torch Down Time | Torch down time after ignition |
| 8 | Pierce Up Time | Torch up time to pierce height after preheat |
| 9 | Pierce Down Time | Torch down time to cutting height after pierce |
| 10 | Cut Close Time | Input positive value, after torch stops, cutting output close after a period of time for eliminate cutting lag angle, then torch move up; input negative value, close cutting output before torch stops. |
| 11 | Ignitor | Set whether use ignitor, when don't use, keep preheat between two cuttings, when use, ignite again for every pierce |
| 12 | High Preheat Oxygen | Set whether use high-pressure preheat oxygen to assist preheat |
| 13 | Low Preheat | Whether keep low preheat oxygen on after preheat and start to cut |
| 14 | High Preheat | Whether keep high preheat oxygen on after preheat and start to cut |

**Ignition Time**: time of torch ignition
**Preheat Time**: before pierce turn on low preheat and high preheat oxygen
Note: when use auto ignitor

1, when ignite, firstly turn on gas output, then turn on low preheat output, then turn on ignitor output, after ignition time, turn off ignitor output, keep gas and low preheat output.
2, when pierce (output off), according to setting of “high preheat” to judge whether turn on high preheat. If choose high preheat, firstly turn on gas output, then turn on low preheat output, then turn on ignitor output, after ignition, turn off ignitor output, keep gas and low preheat output, turn on high preheat, preheat starts, after preheat delay, pierce starts; if don’t use high preheat, firstly turn on gas output, then turn on low preheat output, then turn on ignitor output, after ignition, turn off ignitor output, keep gas and low preheat output, preheat starts, after preheat, pierce starts.
Don’t use auto ignitor
1, when ignite, ignition time set 0, firstly press K1 to open gas and low preheat output, manually ignite gas
2, when pierce, controller doesn’t open ignitor output, ignition time skip, directly preheat starts
**Pierce Time**: after preheat, torch moves up to pierce position, open cutting oxygen (high oxygen) output, the time of pierce starts
**Move Pierce Time**: after start pierce, before torch moving down to cutting height, X and Y start moving time, the time is to avoid steel slag
**Climb Time**: after pierce, torch moving time at climbing speed, climbing speed is set in speed parameters, percentage of cutting speed
**Torch Up Time**: after cut, torch move up time
**Torch Down Time**: after ignition, torch move down time
Note: 1, torch up time and torch down time decide torch idle-run and preheat height, usually up time is longer than down time
2, before start cutting every time, firstly move torch to align plate start point, and adjust torch to proper cutting height, then start, controller firstly executes torch up, then idle-run to pierce position and ignite, after ignition, move down to cutting height (torch down time), after cutting, execute torch up, idle-run to start position, don’t execute torch down, so before next start, firstly need to adjust torch to proper cutting height.
Pierce up time: after preheat, torch move up time
Pierce down time: after pierce, torch down time
Note: 1, pierce up time and pierce down time decide torch cutting height, usually up time is longer than down time.
2, move up before pierce to avoid steel slag
**Cut Close Time**: after cutting, keep cutting output time, to avoid lag angle, after the time, torch starts to move up
**Ignitor**: when set 0, before move to the next pierce point, keep gas and low preheat output (with fire), set 1, close gas and low preheat output after cutting current part, ignite again at the next pierce point
**High Preheat Oxygen**: when set 0, don’t use high preheat, when set 1, use high preheat to assist preheat
**Low Preheat**: 0 to close low preheat during cutting, 1 to keep low preheat during cutting
**High Preheat**: 0 to close high preheat during cutting, 1 to keep high preheat during cutting
Note: can’t set 0 at the same time of keep low preheat and keep high preheat

## Flame cutting procedure


G00高度 G00 height
pierce height
穿孔高度
preheat height
预热高度
切割高度cutting height
割枪
torch
plate板材
torch up time
ignition time
preheat time
pierce time
pierce down time
cutting time
torch up time
torch down time
pierce up time
割枪移动
torch movement
爬行时间
切割关闭时间
cutting off time
电机
motor
燃气 gas
移动穿孔时间 moving pierce time
低预 low preheat
高预 high preheat
点火 ignition
切割氧cut oxygen
割枪升 torch up
割枪降torch down
调高自动 auto height adjustment
输出
output
time 时间轴
时序图：图例
打开 open
关闭 close

Plasma


Para
Craft
Para Name
Value
Unit
Range
Calculate
Torch Up Time 1.0 s 0.0~10.0
Torch Down Time 0.8 s 0.0~10.0
Location Up Time 0.5 s 0.0~3.0
Arc Strike Time 0.3 s 0.1~10.0
Times of Retry 0 0~20
Pierce Up Time 0.0 s 0.0~10.0
Pierce Time 0.3 s 0.0~10.0
Pierce Down Time 0.0 s 0.0~10.0
Move Pierce Time 0.0 s 0.0~10.0
Climb Time 0.0 s 0.0~10.0
Auto THC Delay 0.0 s 0.0~10.0
Stop Time 0.0 s 0.0~10.0
Close THC SpdDn Scale 90 % 0~100
Arc Break Distance 0.0 mm 0.0~90.0
Arc Break Time 0.0 s 0.0~10.0
Para Tip: torch up time after cut finish
System
Spd
Ctrl
Craft
Switch
Figure
Machine
Offset
High
Save

| | | |
|---|---|---|
| 1 | Torch Up Time | Time of torch moving up after cutting |
| 2 | Torch Down Time | Torch lifter has no location switch (zero point switch), location feedback set 0, torch down time, torch height is arc strike height; when check location feedback, down all the time till zero point |
| 3 | Location Up Time | When location feedback valid, check location switch signal input, close torch down output, open torch up output, keep location up time and then close, torch height is location height (arc strike height) |
| 4 | Arc Strike Time | Time of opening arc strike switch, end till check arc strike success feedback signal |
| 5 | Times of Retry | After arc strike fails, times of try |
| 6 | Pierce Up Time | After finish arc strike, time of torch up to pierce height, when don't check arc strike success feedback signal, time from arc strike time ends |
| 7 | Pierce Time | Time of torch at pierce height, to pierce though plate |
| 8 | Pierce Down Time | After finish pierce, time of torch down to cutting height |
| 9 | Move Pierce Time | Keep output during pierce, XY axis start to move |
| 10 | Climb Time | After finish cutting, time of torch moving at climbing speed |
| 11 | Stop time | After finish cutting, time of torch stopping movement |
| 12 | Auto THC Delay | After torch starts to move, open height adjustment auto signal output |
| 13 | Close THC Speed Down Scale | During cutting, speed down to setting range, close THC auto signal output, reduce arc voltage THC wrong action |
| 14 | Lower Current Speed Down Scale | During cutting, speed down to setting range, reduce plasma current output |
| 15 | Current Scale Lower Limit | Reduce plasma current output lower limit |
| 16 | Arc Break Distance | Set a position before end point, close arc strike output in advance, finish left cutting by left temperature to reduce overburn, close THC auto output after arc break |
| 17 | Arc Break Time | When arc strike success feedback valid, set time, continue cutting after arc break |
| 18 | Location Feedback | Torch lifter has location switch (zero point switch), set 1 |
| 19 | Arc strike Feedback | After arc strike, whether check arc strike success feedback signal input, plasma power or arc voltage auto THC has the signal, can connect to the controller, set 1 |
| 20 | Linedraw Current Scale | Use plasma power source to draw line and current output ratio |

**Torch Up Time**: after cutting, time of torch moving up

**Torch Down Time**: torch lifter has no location switch (zero point switch), location feedback set 0, torch down time end, torch height is arc strike height

Note: when check location feedback, torch down time invalid

**Location Up Time**: when check location feedback valid, check location switch signal input, close torch down output, open torch up output, keep location feedback and close, torch height is location height (arc strike height)

Note: when don't check location feedback, location up time invalid

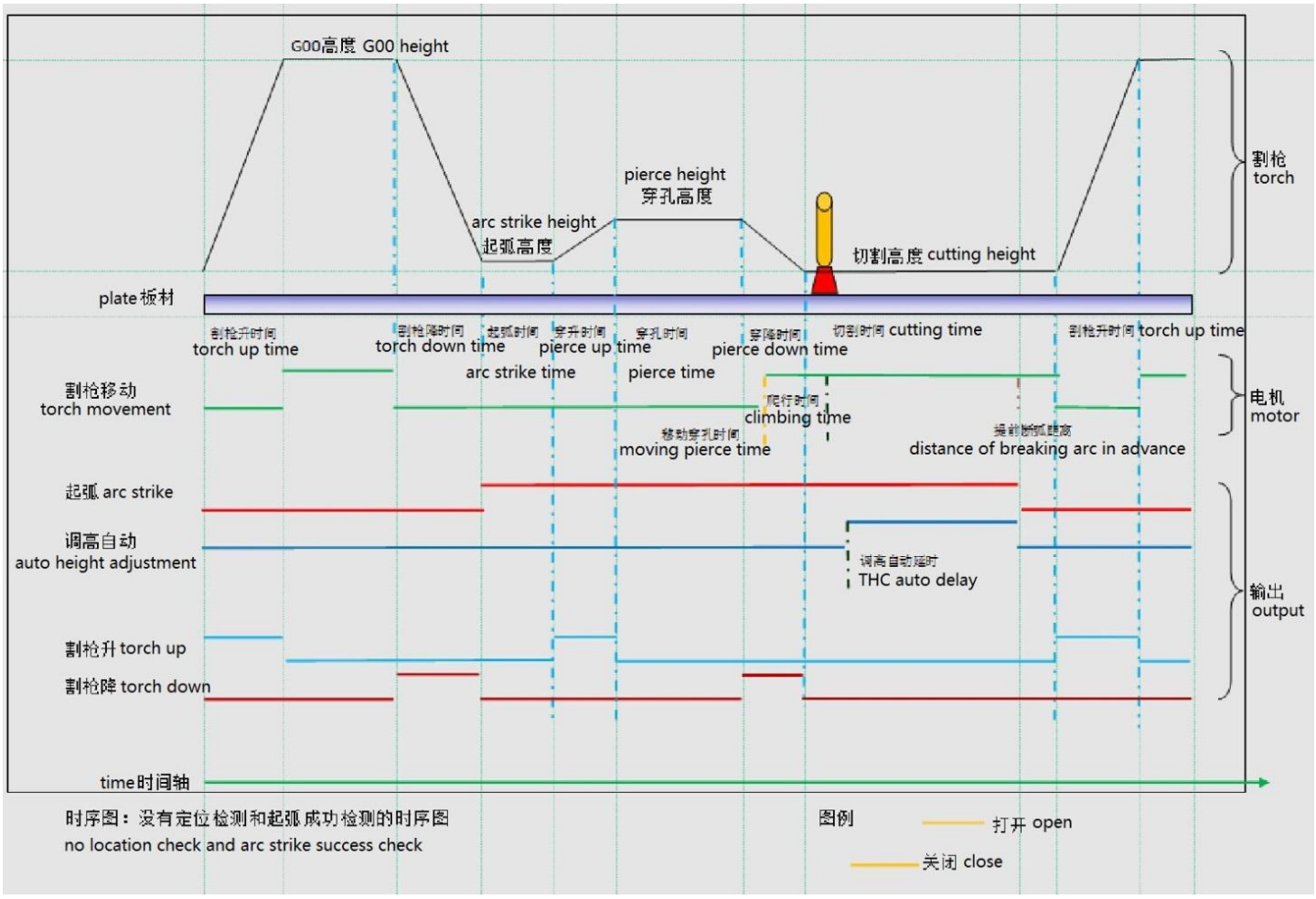
**Arc Strike Time**: time of arc transfer

**Times of Retry**: after arc strike fails, times of restart arc strike

Note: 1, if choose check arc strike success feedback valid, check arc strike success feedback signal input, end arc strike time, or firstly close arc strike output, restart arc strike, try arc strike according to times setting, if

can’t arc strike, “arc strike fails” wait for next command
2, if choose check arc strike success feedback invalid, end arc strike time and start next movement, times of retry invalid
**Pierce Up Time**: after arc strike, time of torch moving to pierce height
Note: choose check arc strike success feedback valid, controller checks arc strike success feedback signal input, timing, or start after arc strike time
**Pierce Time**: torch up to pierce position, start to pierce
**Pierce Down Time**: after pierce, torch down to cutting height
**Move Pierce Time**: after torch starts pierce, before torch down to cutting height, XY start to move, this period of time to avoid steel slag
**Climb Time**: after pierce, torch moving time at climbing speed, climbing speed is set in parameters, percentage of cutting speed
**Auto THC Delay**: after pierce, open the time
Note: set the time, help THC to avoid unsteady arc voltage time and reduce torch shake
**Close THC Speed Down Scale**: during cutting, speed change is in the range, close auto height adjustment, reduce arc voltage auto THC wrong action caused by speed change, set 99, cutting speed is 99% of set speed, don’t close THC auto output caused by speed change
**Lower Current Speed down Scale**: during cutting, speed change is in the range, plasma current automatically adjust along with speed change to improve cutting, set 99, cutting speed change is 99% of set speed, start to adjust plasma current, set 0, cutting speed stops, and adjust plasma current, don’t change current caused by speed change
**Current Scale Lower Limit**: during cutting, adjust plasma current minimum value according to speed change, when speed is lowest, plasma power output current, to pierce through plate, example set 80, when cut straight angle, cutting speed reduce to “reduce current speed down ratio”, start to reduce plasma power output current, to straight angle peak, plasma power current output reduce to 80%, after peak, increase plasma power output current along with cutting speed increase, cutting speed restore, current increase to 100%
**Arc Break Distance**: set a position before the end point, close arc strike output in advance, finish left cutting by left temperature, to avoid overburn.
Note: close THC when break arc
**Arc Break Time**: check arc strike success feedback valid, set time, so that torch continues to move after arc break
Note: don’t check arc strike success feedback, time of arc break invalid
**Location Feedback**: torch lifter has location switch (zero point switch), can set 1, choose check location feedback, or set 0
Note: set 1, torch location, keep torch down output, till check location switch signal input close
**Arc Strike Feedback**: open arc strike output, whether check arc strike success feedback signal input, plasma power or arc voltage auto THC has the signal output, can connect to controller input, set 1

## Plasma cutting procedure (no location check and arc strike success check)




Plasma cutting procedure (with location check and arc strike success check)

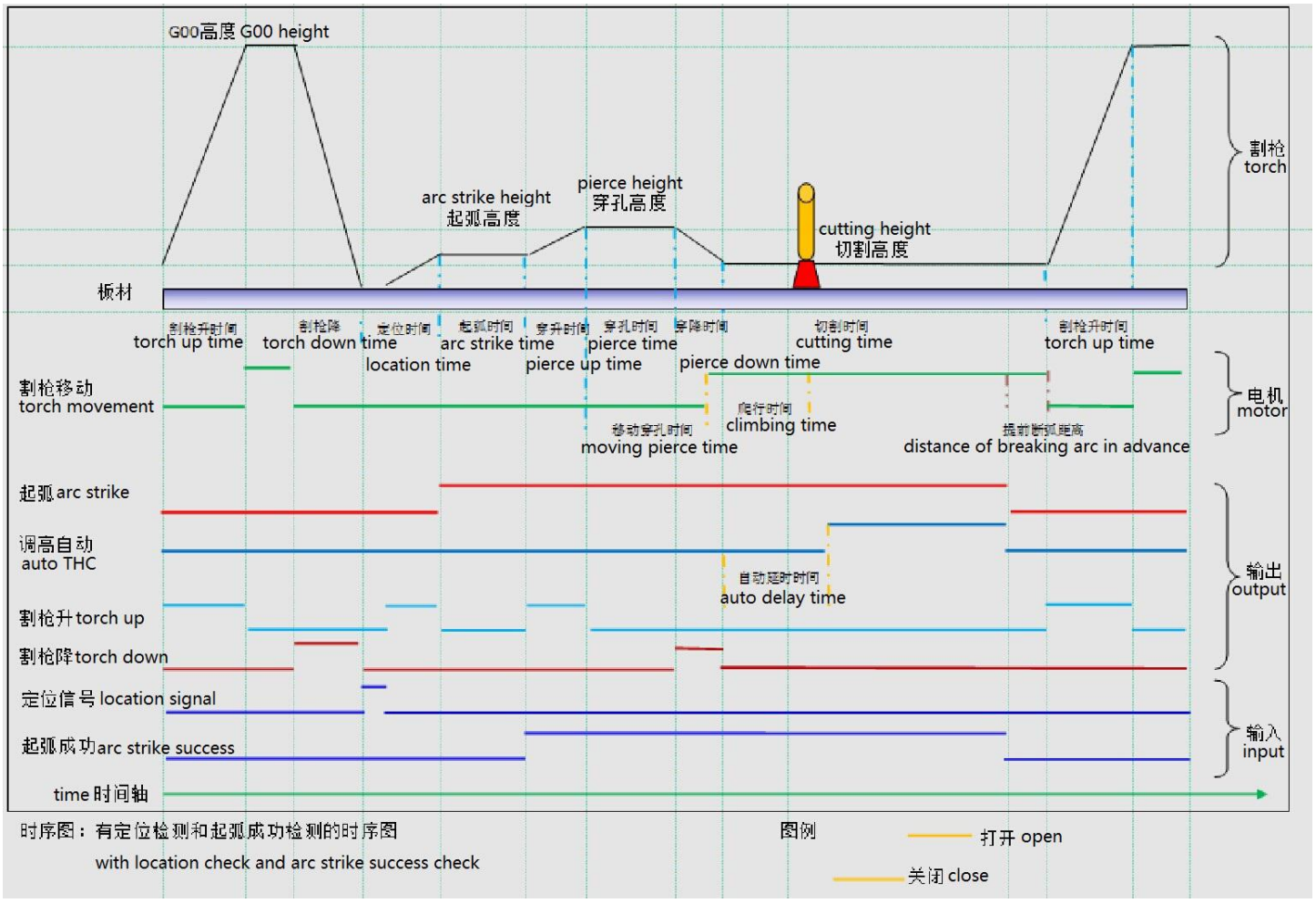
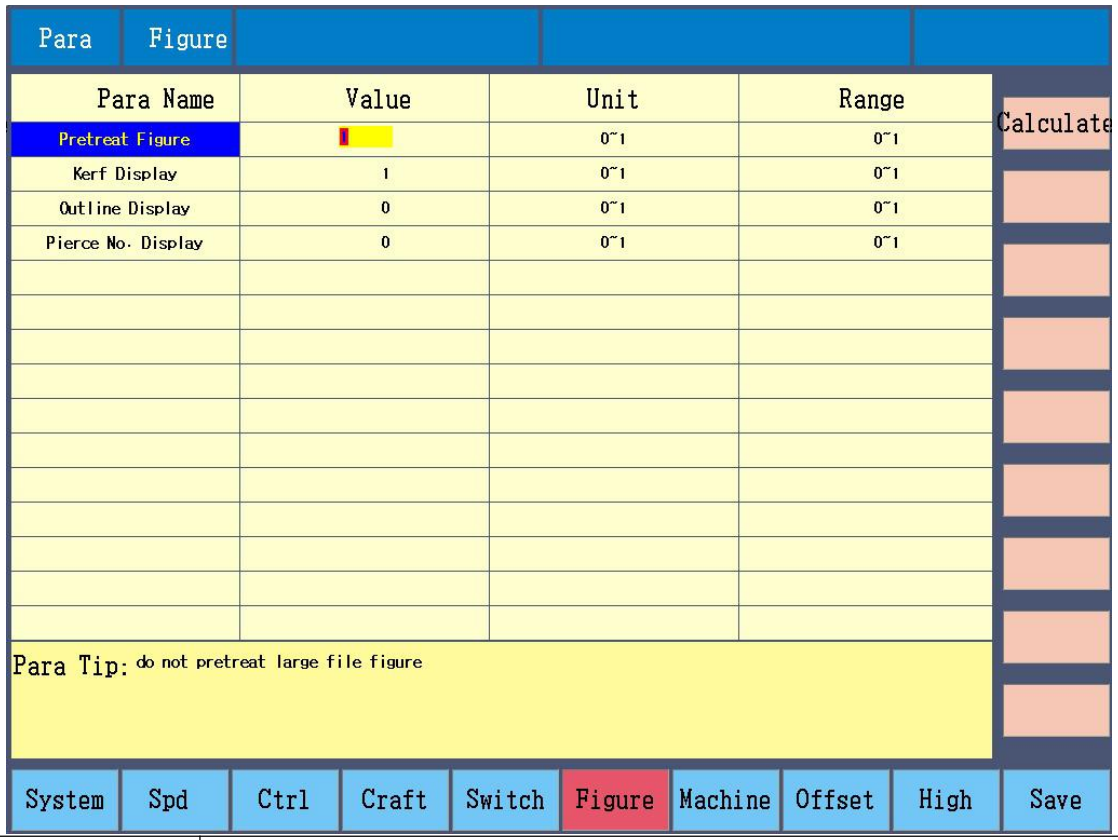


**Figure parameters**



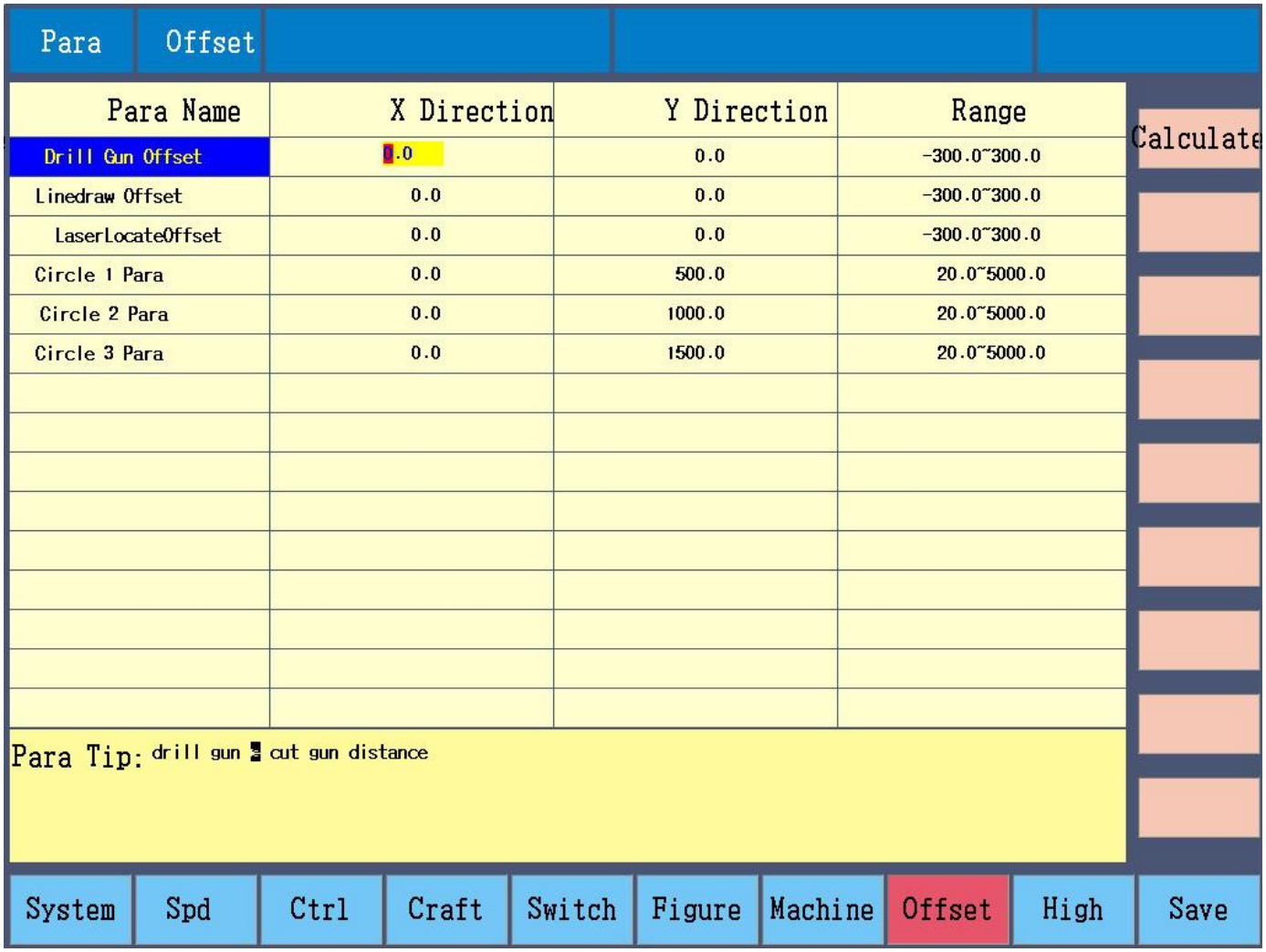

| | | |
|---|---|---|
| 1 | Pretreat Figure | You'd better not choose figure pretreatment for oversized file |
| 2 | Kerf Display | Cancel kerf line display to simplify figure display |
| 3 | Outline Display | Cancel outline display to simplify figure display |
| 4 | Pierce No. Display | Cancel pierce number display to simplify figure display |

Figure pretreatment: set whether preview figure before cut, when file is over 1M, can choose don't pretreat figure to save time

**Machine parameters**

| | | |
|---|---|---|
| 1 | External Limit Valid | 1 use, 0 don't use |
| 2 | Soft Limit Valid | 1 valid, 0 invalid |
| 3 | Torch Collision | 1 use, 0 don't use |
| 4 | Dual Side XZ/YZ | 1 YZ axis, 0 XZ axis |
| 5 | Pneumatic Lifting | 1 use, 0 don't use. When use, arc strike and pierce keep torch down output during cutting |
| 6 | Laser Location | 1 use, 0 don't use |
| 7 | Zero Point Switch | 1 use, 0 don't use. Moving method when manual reset |

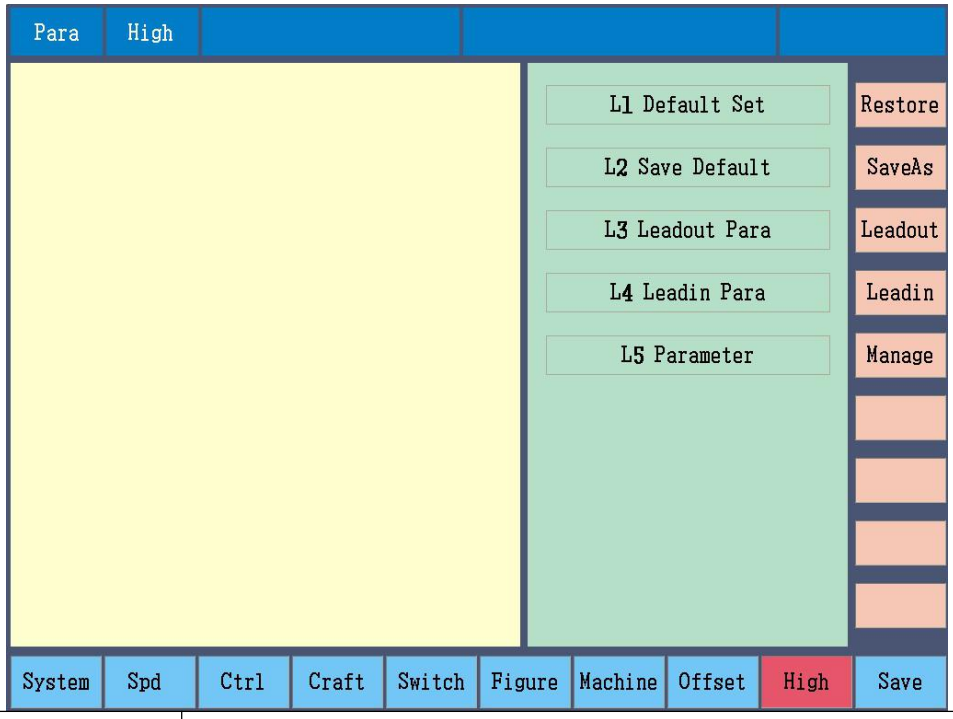
## Offset




| | | |
|---|---|---|
| 1 | Drill Torch offset | Offset distance between the drill torch and cutting torch |
| 2 | Linedraw Offset | Offset distance between the line-draw torch and cutting torch |
| 3 | Laser Location Offset | Offset distance between the laser assist location device and cutting torch |
| 4 | The First Arc | Set small circle 1 speed limitation, diameter ≤ the value hole, cutting speed is limited within the speed value |
| 5 | The Second Arc | Set small circle 2 speed limitation, diameter ≤ the value, and > small circle 1 value hole, cutting speed is limited within the speed value |
| 6 | The Third Arc | Set small circle 3 speed limitation, diameter ≤ the value, and > small circle 2 value hole, cutting speed is limited within the speed value |

**Note:** the function of small circle speed limitation is mainly used for high-speed plasma cutting to avoid not round at high speed. When cut a complicated non-circle parts but including small arc, suggest to cancel the function.

**High (advanced) parameter**

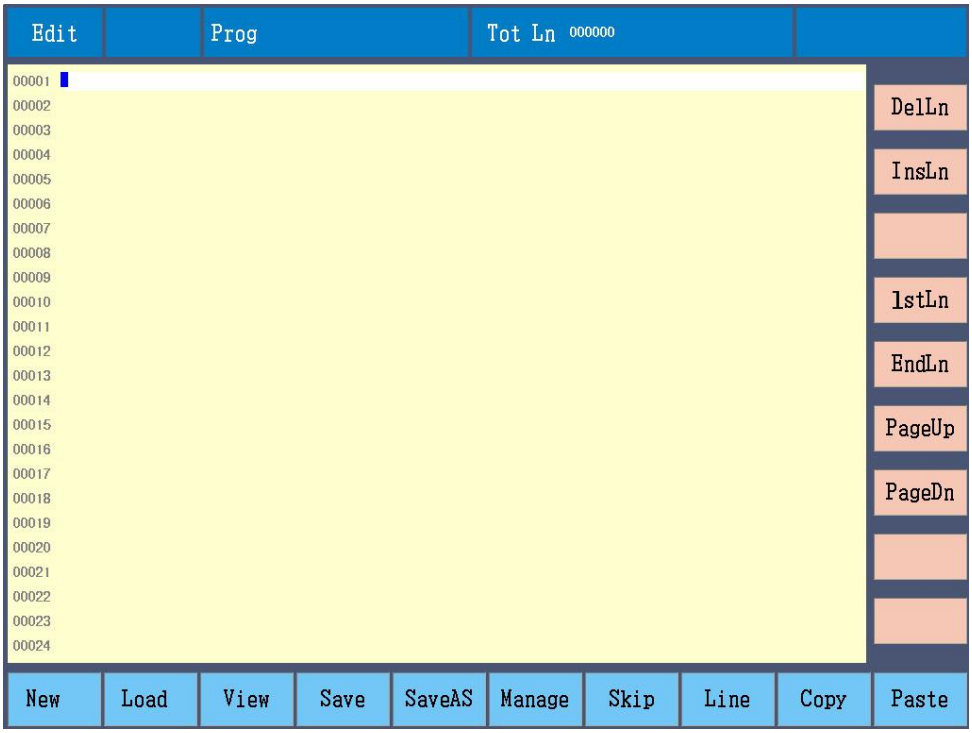



| | | |
|---|---|---|
| 1 | To Default | All parameters become default |
| 2 | Save As Default | Save all parameters as default |
| 3 | Lead out Parameter | Create parameter file in SD card, expanded name “PAG”, existed parameter file will be replaced, please backup |
| 4 | Lead in Parameter | Lead in parameter file in SD card to replace all parameters, if from U disk, firstly by manager, save all parameter file in SD card |
| 5 | Parameter | Set parameter revise permission |

**Note:** 1, restore and save default, need to input password 999, after testing machine, the machine supplier should save parameter default before sales.

2, machine users can save as default, but cover machine maker’s parameters, if cover and want to restore machine maker’s default, can use lead-in parameter file.

## Chapter 6 Edit, Main menu press Edit



## 6-1 edit function

New, clear edit area, create a new parts program
Open, open a parts program
View (preview), preview current parts program
Save, save current parts program
SaveAs: save current parts program as a new file
Manage: open file manager
Del Ln (delete line): delete current line
Line: input program line number and go to that line

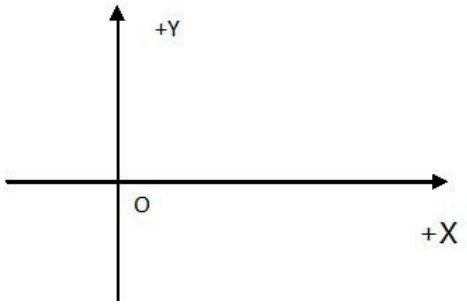
## 6-2 codes instruction

Every action of CNC machine running according to regulate program, every machine program be composed of some instruction segment, and every instruction segment be composed of some function word, each function word must start by letter, parameter follow.

Definition of function word:
N: The No. of instruction segment
G: Prepare function
M: Assistant function
T: Knife function (it's kerf width in this controller)
L: Cycle times or delay time
X: X axis absolute coordinate
Y: Y axis absolute coordinate
U: distance of X axis relative points
V: distance of Y axis relative points
I: When cutting arc, the value of the coordinate of the circle centre subtract X axis start point value
J: When cutting arc, the value of the coordinate of the circle centre subtract Y axis start point value
R: Specified arc radius
H: Chord height of the arc
A: assistant variable
F: Specified moving speed, used for G01, G02 and G03

**Attention 1**: There are some appointments:
X [U]n -- It can be X or U, n express a value, but only appear once.
Y [V]n -- It can be Y or V, n express a value, but only appear once also.
PPn -- It can be assembled random axis, at least include one axis, also can include two axes.
**Attention 2**: The instruction executes order is sequence (except transfer and call sub program instruction); In same program the M,S and T will be executed before G instruction.

**6-3 Coordinate System**
This controller uses standard right angle coordinate system, as below



## 6-4 G command (Basic Prepare Command)

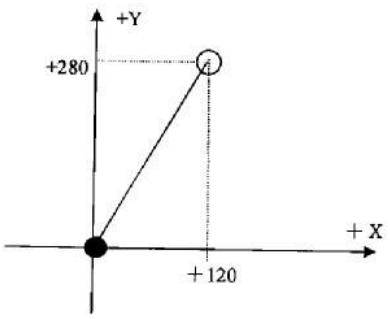
1) G92 reference point setup
When set up a program, coordinate value of fabricating starting point (reference point) must put in

front of program and set up with absolute coordinate.
Format: G92 Xn Yn
If behind G92, there is no X, Y, then make current X, Y coordinate as reference point. Generally to locate with machine origin, there is no X, Z behind G92.

2) G90/G91
Absolute coordinate G90 (default) / relative coordinate G91;
Using G90, X, Y are coordinate values, U, V are relative values for current point; using G91, X, Y and U, V all are relative values for current point.
Format: G90
Format: G91
e.g. 1: G92 X0 Y0
G91 // relative coordinate
G00 X100 Y100 // rapidly locate to (100, 100), equal to G00 U100 V100
G01 X500 Y100 // straight line to the position (600, 200), equal to G01 U500 V100
e.g. 2: G92 X0 Y0
G90 // absolute coordinate, default
G00 X100 Y100 // rapidly locate to (100, 100)
G01 X600 Y200 // straight line to (600, 200)

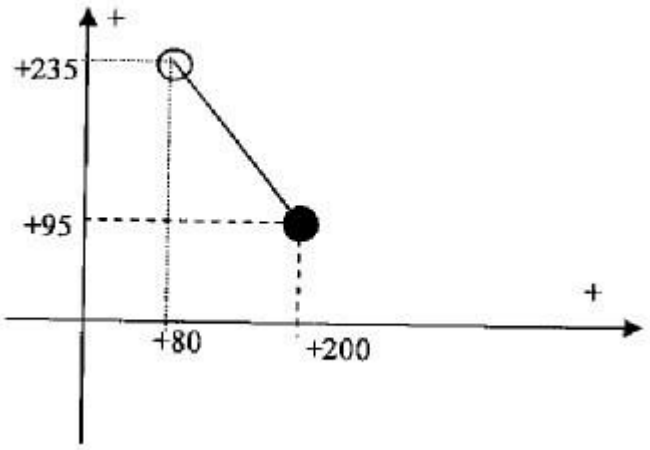
3) G20/G21 British system/ metric system instruction
G20 British system, X, Y, I, J, R, U, V, H, F, behind G20, all are British system unit
G21 Metric system (default), X, Y, I, J, R, U, V, H, F, behind G21, all is metric system unit
Format: G20
Format: G21

4) G00 point movement
This command is to go to specified position rapidly. When two axes have displacement, the controller uses max. limit speed by multiplying power, from starting point to finishing point move straightly. G00 moves, affected by speed multiplying power.
Format: G00 X [U]n Y[V]n
Or G00 PPn
e.g.: G92 X0 Y0
G00 X120 Y280
(or G000 U120 V280)



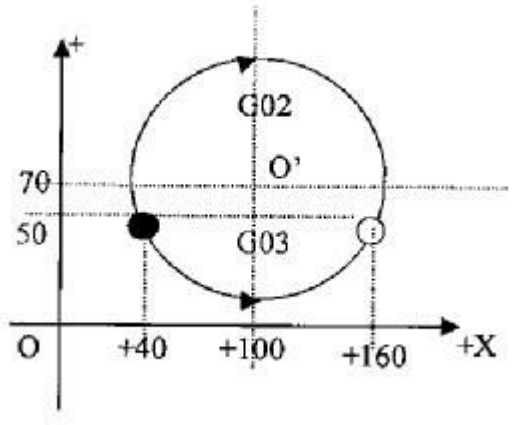
● current torch position
○ torch expectant position

5) G01 straight line cut
This command is to make cutting tool to straightly go to specified location, as cutting movement command, one axis or two axes straight-line interpolation movement. Movement speed can be specified by F.
Format: G01 X[U]n Z[W]n [Fn]
Or G01 PPn [Fn]
e.g.: G92 X0 Y00
G00 X200 Y95
G01 X80 Y235
(or G01 U-120 V145)
M02




● current torch position
○ torch expectant position

6) G02/G03 arc cut
This command is for arc interpolation, clockwise arc G02, anticlockwise arc G03,
Format: G02[03] X[U]n Y[V]n In Jn [Fn] or G02[03] X[U]n Y[V]n In Rn [Fn]
G02[03] PPn In Kn [Fn] or G02[03] PPn Rn [Fn]
e.g. (G02)
G92 X0 Y0
G00 X40 Y50
G02 X160 V0 I60 J20
G28
M02
e.g. (G03)
G92 X0 Y0
G00 X40 Y50
G03 X160 V0 I60 J20
(or G03 X160 V0 R63.25)
G28
24
M02




● current torch position
○ torch expectant position
Instruction:
I、J are X axis, the center of the circle in Y axis has a increment for starting point
R is the radius of the circle (R is positive value, when arc <=180 degree, R is radius)
If I、J are specified, don't use R; vice versa

7) G04 pause / delay command
This command is to set up delay, when program run to this command, program will be delayed as L specified time, unit is second
Format: G04 Ln
e.g.: G04 L2.4 (delay 2.4 s)
When run G04, press [start] to stop delay, to continue the program after G04, press [esc] to stop current program

8) G26, G27, G28 back to reference point
This command is to make cutting tool back to the reference point
Format: G26 X axis back to reference point
G27 Y axis back to reference point
G28 X, Y axis back to reference point at the same time
e.g.: G28 (X, Y axis back to reference point at the same time, equal to G00)

9) G22/G80 loop statement
This command is for program loop, G22 is the start of loop, and the number of loops, G80 is the end of the loop, can nest loop, not over 5 levels, G22 and closest G80 is a loop.
Format: G22 Ln_ (L is the number of loop)
Loop
G80
e.g.: N000 G92 X100 Y100
N001 G00 X60 Y80
N002 G22 L5----------start of the first-level loop
N003 G00 V50 U-25
N004 G22 L5----------start of the second-level loop
N005 G01 U5 V-10
N006 G80----------end of the first-level loop
25
N007 G80----------end of the second-level loop
N008 G28

N009 M02
10) Cutting tool radius compensation statement (G40、G41、G42)
Format: G41 (or G42) Rn
.
Program section in need of compensation
.
.
G40
Remark: G41 is along fabricating route, left compensation half of flame diameter
G42 is along fabricating route, right compensation half of flame diameter
G40 is excursion end
Because cutting tool compensation is finished automatically, before G41, G42, there should be G00 rapid location statement, so that the nozzle adjusts the position; after G40 cancels compensation, it needs a G00 statement to adjust the position back.
Finish M80 all output ports are closed

## 6-5 M assistant function

M00: program pause command, press [Start] to continue
M02: program end command, program is in the state of wait
M30: same as M02
M10/M11: gas (acetylene) valve switch, M10 (on), M11 (off)
M12/M13: cut oxygen valve switch, M12 (on), M13 (off)
M14/M15: torch up switch, M14 (on), M15 (off)
M16/M17: torch down switch, M16 (on), M17 (off)
M24/M25: preheat switch, M24 (on), M25 (off)
M20/M21: ignition switch, M20 (on), M21 (off)
M07: pierce fixed cycle (enter M07, can't return, can move torch)
M08: close cut fixed cycle

Flame cut operation as below,
M07
If gas (acetylene) valve is closed, then open gas (acetylene) ignition
Torch down (torch down delay, M71)
Turn on preheat oxygen valve, preheat delay start, if preheat time is not enough, press [Pause] key, preheat delay can automatically be longer to 100s, if preheat is ready, press [Start] key, preheat is over, and press F7 [Set] to end preheat and save parameter.
Note: it is different from SH series controller, and there are 3 options of extend, set and skip.
4, Torch up (pierce torch up delay, M72)
5, Turn on cut oxygen valve (M12), after delay pierce, torch down (pierce torch delay M73)
6, Turn on torch height controller (M38), start to run next program

Plasma cut operation as below:
M07
1, Torch down (torch delay, M71)
2, If choose pierce location (parameter setup) valid, then torch down, touch low limit switch, stop; torch up, after pierce location delay, torch stop
3, Turn on arc switch
4, check "arc voltage success" signal, if choose 0 (not check) in the parameter setup, then don't check arc voltage, after start arc is successful, delay pierce (s)

5, Turn on torch height controller (M38), start to run next program

M08 turn off cut fixed loop
Flame cut operation as below:
1, Turn off cut oxygen (M13)
2, Turn off torch height controller (M39)
3, Torch up (M70)

Plasma cut operation as below:
1, Turn off arc voltage switch (M13)
2, Turn off torch height controller (M39)
3, Torch up (M70)

M50 pierce
1, torch up (M72), plasma has no this movement
2, Turn on cut oxygen (M12), or plasma start arc, check signal of “arc voltage success”
3, torch down (M73), plasma has no this movement
4, Turn on the torch height controller (M38)

M52 ignition fixed cycle
Turn on gas (acetylene) valve (M10), turn on high voltage ignition (M20), delay ignition, turn off high voltage ignition (M21)

M70 torch up fixed cycle
It’s used for the start and the end of a program, torch up, to make torch move to another position. Turn on torch up switch (M14), delay torch up (7.3 flame parameter), turn off torch up switch (M15)

M71 torch down fixed cycle
It’s used before piercing, has adverse function of M70, the value is small, because of gravity, down is faster than up. Turn on torch down switch (M16), delay torch down (7.3 flame parameter), turn off torch switch (M17)

M72 pierce torch up cycle
It’s used after preheat, torch up, avoid flying slag blocking the nozzle when turning on cut oxygen. Turn on torch up switch (M14), delay pierce torch up (7.3 flame parameter), turn off torch up switch (M15)

M73 pierce torch down cycle
It’s used after preheat, finish M72, after turning on cut oxygen, torch is in cutting position, the adverse movement of M72, and value is small, because of gravity, down is faster than up. Turn on torch down switch (M16), delay pierce torch down (7.3 flame parameter), turn off torch down switch (M17)

M75 torch location delay
Plasma torch location, firstly torch down (M16), touch low limit (input port 8 XXW), torch down stop (M17), then torch up turn on (M14), after torch location delay (7.4 plasma parameter), torch up stop (M15)

M62 draw line function starts
After M62, torch offsets a unit of a draw line offset (parameter-system) till M63. There is no kerf compensation when drawing line.

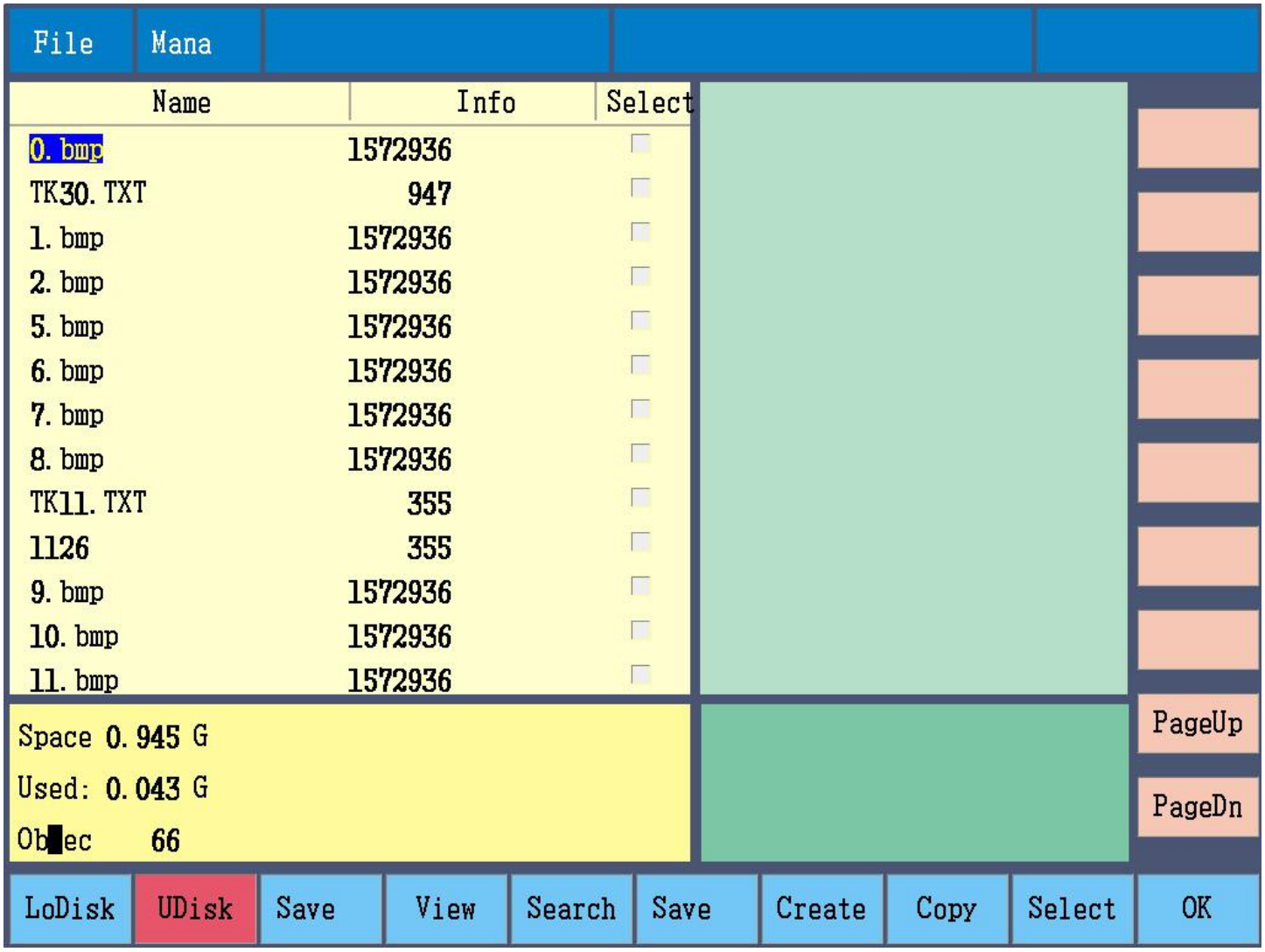
M63 draw line function ends

After running M63, draw line function is over, torch return an offset from current position

M80 close
Execute M80, all output ports are closed

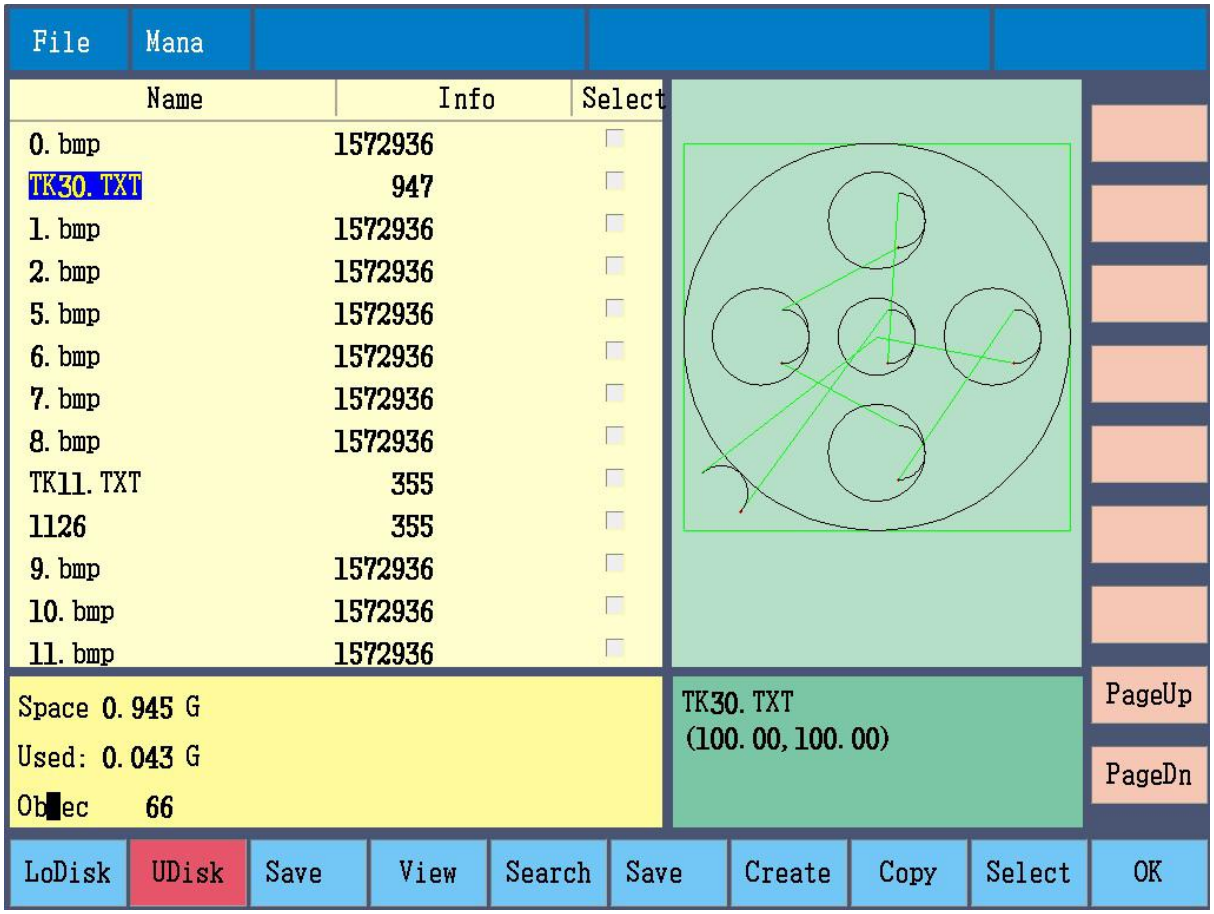
## 6-6 Manage

In edit interface, press Manage to open file manager




LoDisk (local disk), display local disk directory
U disk, display U disk directory
View (preview), display current part figure
Search, search file as file name
New, build file folder
Copy, copy file to U disk and local disk
OK, confirm input or choose
Enter key: choose current file
Del: delete current file
PgUp: pageup
PgDn: pagedown
Right key: enter file
Left key: exit file

Preview current parts figure

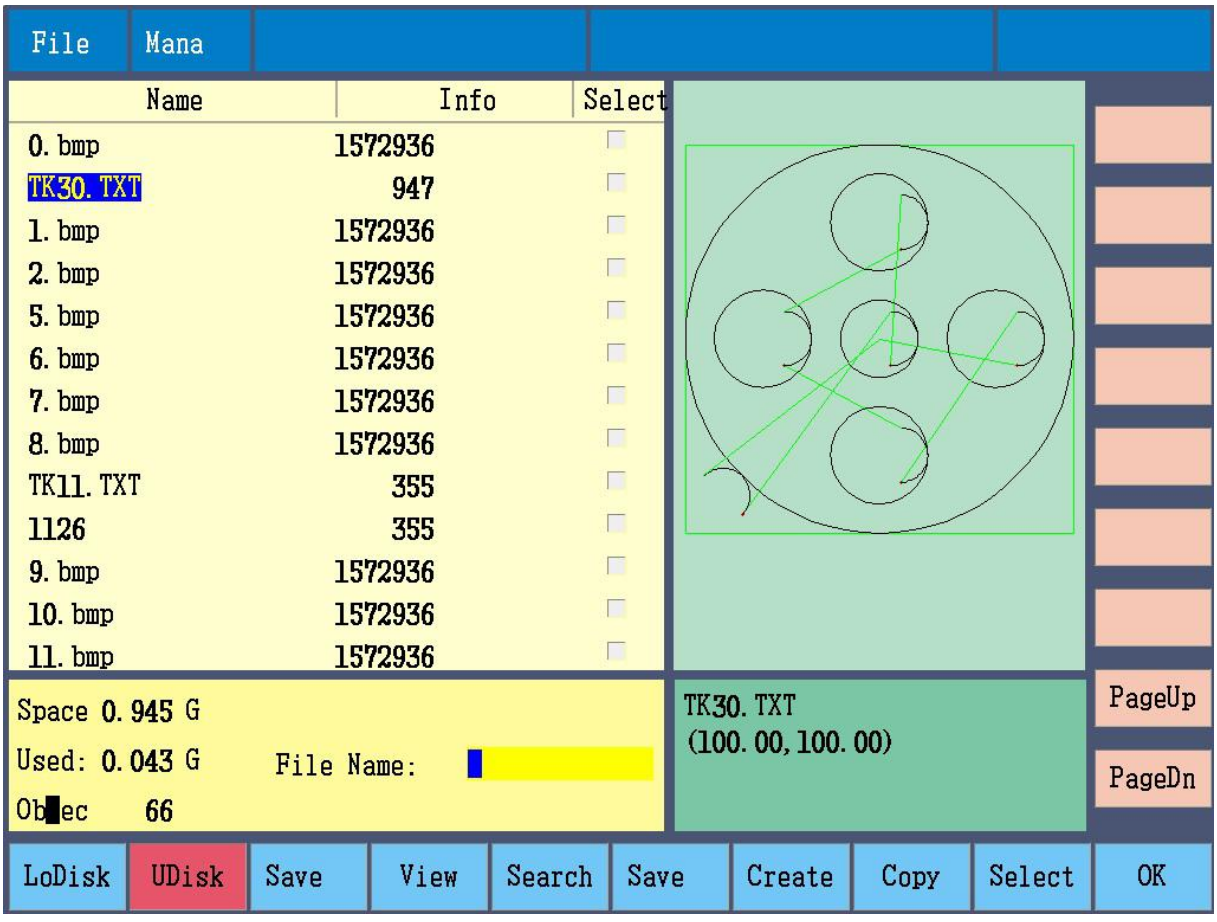



1, U disk format is FAT32

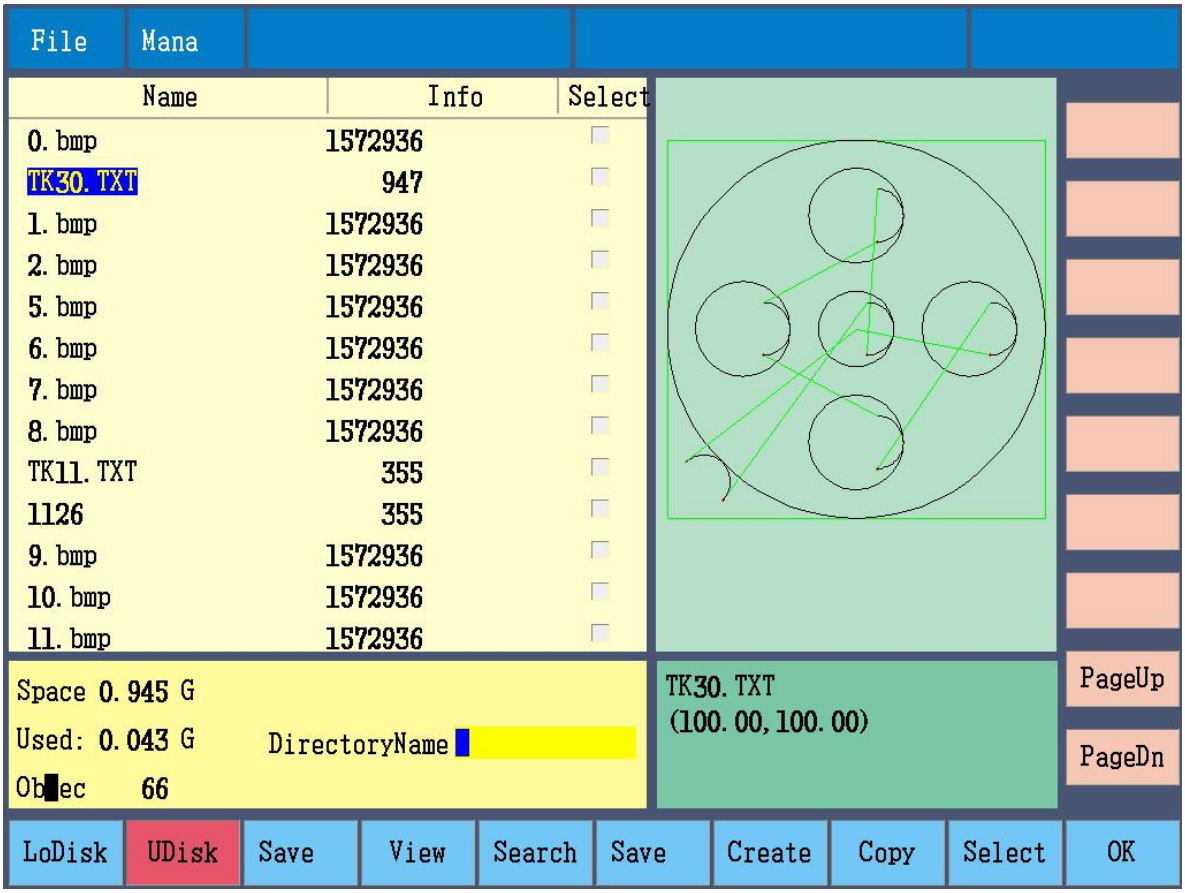
2 can copy and delete several files at the same after select

3, there is operation tip when cursor moves to file folder

Search, input file name to search



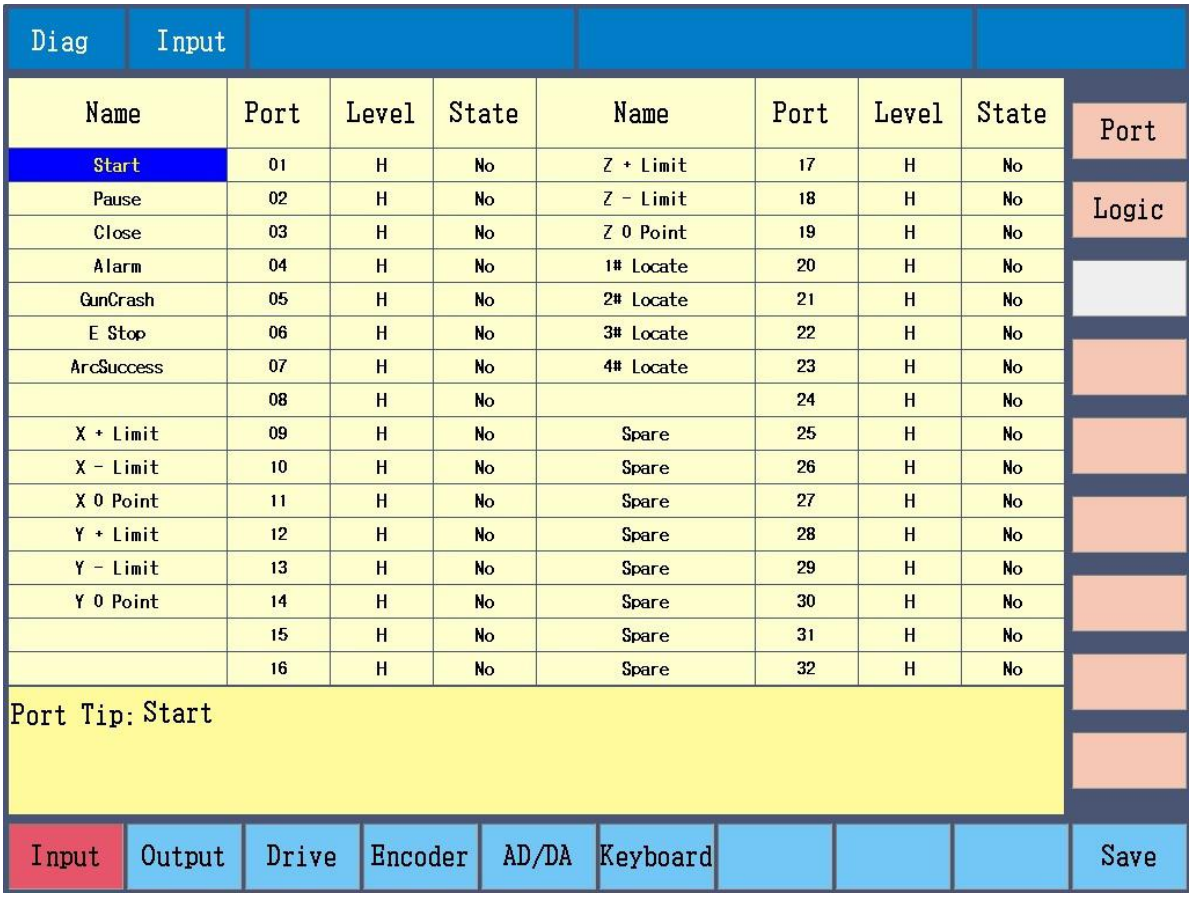
Create, input file folder name to build




## Chapter 7 Diagnose

Main menu press Diag (diagnose)

7-1 diagnose



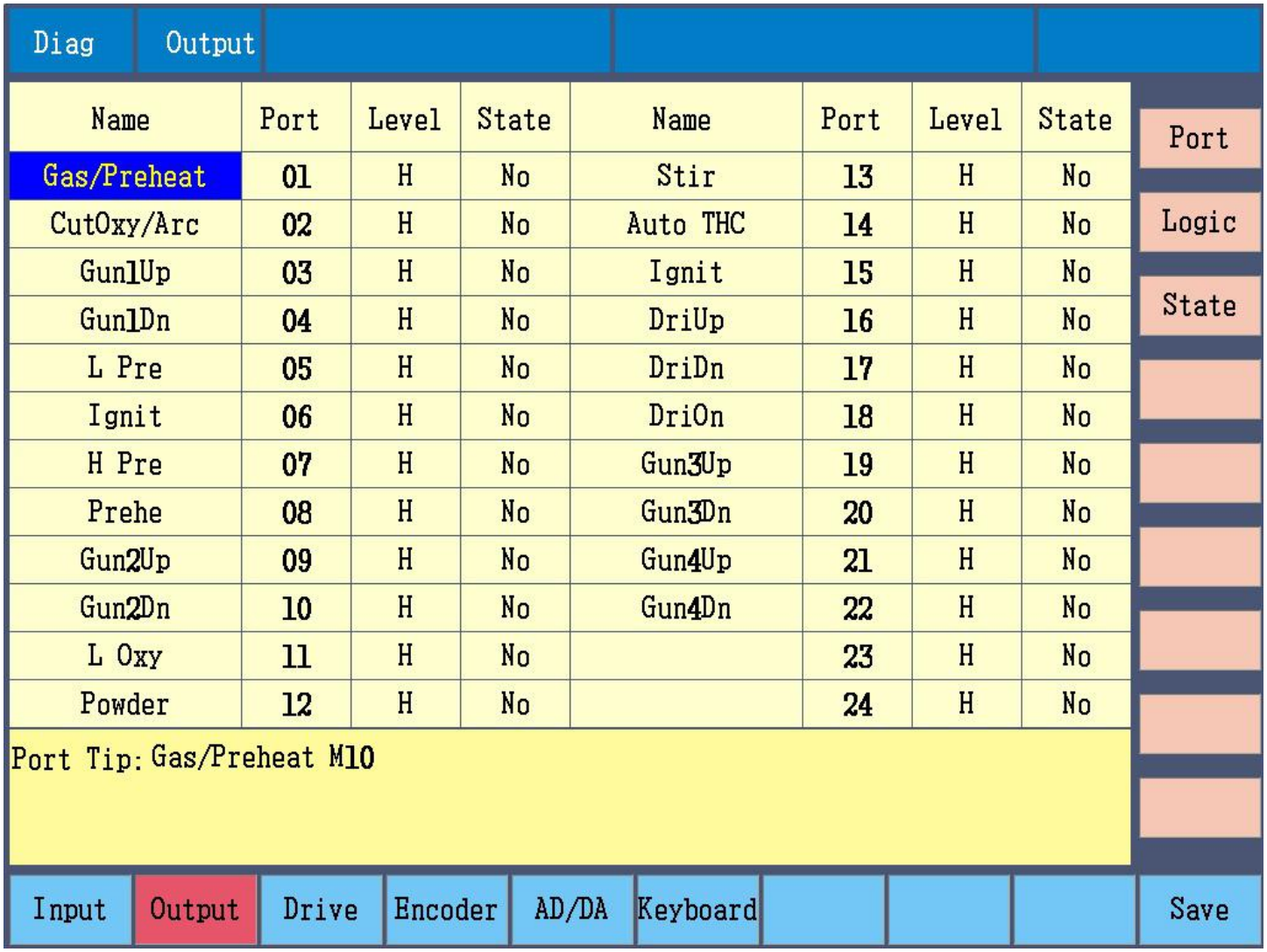
Input, display input state
Output, display output state
Port, change output port level
Logic, set current port state logic
Save, save current port state logic

## Input

Display current input port level high/low, can set current level high/low and logic, logic has “Yes”, “No” and “disable”.
“Yes”, current level has output signal.
“No”, current level has no output signal.
“Disable”, don’t send command to current port.

## Output

Display current output port level high/low, can set current level high/low and logic, logic has “Yes”, “No” and “disable”.
“Yes”, current level has output signal.
“No”, current level has no output signal.
“Disable”, don’t send command to current port.




State, change output state

## Adjust moving precision

Start ---> parameter-system (numerator:2, denominator: 1) ---> manual-point move-increment:100 ---> move-direction buttons-measure actual moving distance ---> parameter-system-calculation-input actual distance-press Enter, numerator & denominator change-save parameters ---> manual-point move verification ---> right or not ---> yes ---> end.

## Controller upgrade

Start ---> connect U disk (FAT32 format, with upgrade file) ---> main menu GG9 ---> confirm upgrade ---> F2 Update ---> automatic upgrade, restart the controller ---> end.

Start ---> connect U disk (FAT32 format, with upgrade file) ---> press upgrade button and restart the controller ---> F2 Update ---> automatic upgrade, restart the controller ---> end.

## Special setting after turn on the controller

| Operation | Setting | Instruction |
|---|---|---|
| GG1 | Check controller ID | Display controller ID |
| GG2 | Revise time | Display or revise controller time |
| GG3 | Format | Delete all programs in local disk |
| | ParaInitial<br>(parameters initialization) | All parameters become controller factory default, if become machine supplier parameter settings, press “Parameter” – “High” – L1 back to default setting |
| | SetInitial<br>(settings initialization) | All settings become controller factory default, such as “speed limitation”, “kerf” and other settings in auto and manual mode. |
| | Chinese/English | Chinese/English |
| | New Code | Set power-on password |
| GG5 | User No.:<br>Code: | Input machine supplier ID and verification code, we offer that ID for encryption. |
| GG6 | Upgrade Word? | Upgrade word stock and power-on background picture |
| GG7 | Version Info | Check controller software version |
| GG8 | Is Change Logo Name | Connect U disk with company name |
| GG9 | Upgrade? | Upgrade controller software |
| G90 | Log in | There is a 6-digit number |