# HF Install instruction

**(1) HF program and control system includes following hardware and software.**

1. One control card.
2. One software dog.
3. One floppy disk (or CD).
4. One operation instruction manual.

(2) HF usable condition.

1.586 computer at least.
2.With ISA socket or PCI socket.
3.With hard disk and floppy drive.
4.Usable under Windows98 or pure DOS (6.22, 7.0)

**(3) Install steps.**

1. Install control software.
   i. If install with CD, it will be installed under directory C:\HF automatically.
   ii. If install with floppy disk, please set up a HF subdirectory (file) in hardware first, and executing "FHGD-C.EXE" from floppy disk under the new file to decompress the software to subdirectory.

2. Shut down the computer, and pull out power cord. Insert control card into the ISA or PCI socket. Then, insert software dog into LPT.

3. Shut down the machine and power supply. Then, connect the control card and control circuitry according to connection feet instruction.

4. Startup the computer. If use PCI control card and under Windows98 operate system, there will be a clue to enter the control card driver.

If use PCI control card and under pure DOS system, the driver is not needed.

If use ISA control card, driver is not needed. But please make sure that the jump-lines No. accord with what you set in main menu(parameter setting).

5. Install software dog driver.

Executing file “install.exe” under the HF subdirectory till “install ok” comes out.

**Notice:**

1. The install and using system should be the same.
2. If use under Windows, please set up a shortcut menu, and go to “program” under “attribute” to close “close when exit”.
3. When executing file “install.exe”, if the installation is not successful, please check the software dog and LPT.
4. The software dog cannot to use with other software dogs.
5. If install this control system at the first time, you can put jump-lines to “test” without connecting control card and machine, in order to try the “cut” function under “process”. If “cut” function” working well, shut down the computer, put jump-lines to “normal” or “work”, and connect the control card with machine.

**(4) Execution**

If under DOS, please enter HF subdirectory and executing: FHGD.BAT, if under Windows98, please set up shortcut menu and executing: FHGD1.BAT(or FHGD.BAT).

**(5) Instruction about control card and connection feet**

1. **ISA**

**HF25（Hole）**

| | |
|---|---|
| 1 | XA |
| 2 | XB |
| 3 | XC |
| 4 | XD |
| 5 | XE |
| 6 | YA |
| 7 | YB |
| 8 | YC |
| 9 | YD |
| 10 | YE |

11 12V-
12 PJD2
13 12V+
14 UA
15 UB
16 UC
17 VA
18 VB
19 VC
20 TK1 ( TK0, TK1,TK2 are stopping controls.TK0,TK1 are normally open contacts.TK0,TK2 are normally close contacts.)
21 TK0
22 PJD1 (PJD0,PJD1P,JD2 high frequency control.PJD0,PJD1 are normally open contacts. PJD0,PJD2 are normally close contacts.)
23 PJD0
24 PM- (PM+,PM- are sampling voltages.)
25 PM+

**HF 9（Needle）**

1 12V-
2 ZA
3 ZB
4 ZC
5 12V+
6
7 TK0
8 TK1
9 TK2

**2、PCI**

**HF25（Hole）**

1 XA
2 XB
3 XC
4 XD
5 XE
6 YA
7 YB
8 YC

9 YD
10 YE
11 12V-
12 PJD2
13 12V+
14 UA
15 UB
16 UC
17 VA
18 VB
19 VC
20 TK0
21 TK1 ( TK0,TK1,TK2 are stopping controls。TK0,TK1 are normally open contacts.TK0,TK2 are normally close contacts.)
22 PJD1 ( PJD0,PJD1,PJD2 high frequency control.PJD0,PJD1 are normally open contacts. PJD0,PJD2 are normally close contacts.)
23 PJD0
24 PM- (PM+，PM- are sampling voltages.)
25 PM+

**HF 15（Needle）**

1 TK0
2 TK1*
3 TK2*
4 TK0* (TK0*, TK1*，TK2* are alarm control.TK0*,TK1* are normally TK0*,TK2* are normally close contacts.)
5 ZB
6 ZA
7 ZC
8 12V-
9 TK2
10 TK1
11 12V+
12
13
14 PM-* ( PM+*，PM-* are external sampling voltages.)
15 PM+*

**Note: 12V can not be connected with PM; 12V is supplied by external**

**equipment.**

## Complement explanation for HF system verion7.0

HF(V7.0) can run in two mode conventional and expanded. We can select mode in main menu [system parameter]. As long as not working in processing state, we can switch mode conveniently.

1． Usually, working under ‘expanded mode’, some instability coming from computer can be avoid.

2．To work under ‘expanded mode’, you must set the computer’s ramdrive disk (as long as you don’t cancel it, setting one time is ok). You can use ‘set/cancel ramdrive disk’ in ‘system parameter’under main menu to set ramdrive disk. HF automatically set the ramdrive disk to 30M. So you must calculate the computer’s memory: under DOS, it is greater than 32M; under Windows98/ME,it is greater than 64M.

3．Though the default setting is ‘conventional mode’ when first install this software. But we suggest you set the computer’s ramdrive disk, and change the mode to ‘expanded mode ’.

**Note: V7.0 software must use with V7.0 softdog. Otherwise you can’t enter the system.**

Chapter 1 Program

After the computer system is initiated, input “a” under DOS prompting symbol and press “ENTER”, i.e., c>a↙. A picture of “Digital Control Electric Sparking Linear Cutting Machine System” appears. Press “ENTER” and enter the processing window. In this window, click function icon of “Program”, and then enter main menus of HDG linear cutting program window shown as follows (Figure 1.1.1).

Program window is committed to introduce all menus functions、corresponding operations, drawing and compiling of graphs, etc.

# 1.1 Description of Main Menu and Software

## 1.1.1 Main Menu of Program Window

Main menu of program Window is shown as follow. It is composed of 6 functional sub-menus. They are “Process”, “Program”, “4-Axes”, “Parameter”, “Other” and “Vector”.


Figure 1.1.1

In which:

**Process**: Switch to processing window directly from program window

**Program**: the function sub-menu of drawing graph.

**Vector:** Vector bit map

**4-Axes**: the functional sub-menu, which will perform integrated processing on graph with different upper and bottom surfaces.

**Parameter**: the functional sub-menu to perform system parameter setup. In general, the parameter is forbidden to change.

**Other**: the functional Sub-menu to perform regular processing on files.

### 1.1.2 Description of programming software

#### 1.1.2.1 Software Structure

Linear cutting program software adopts tree type interactive software structure. The specific form is shown as following:

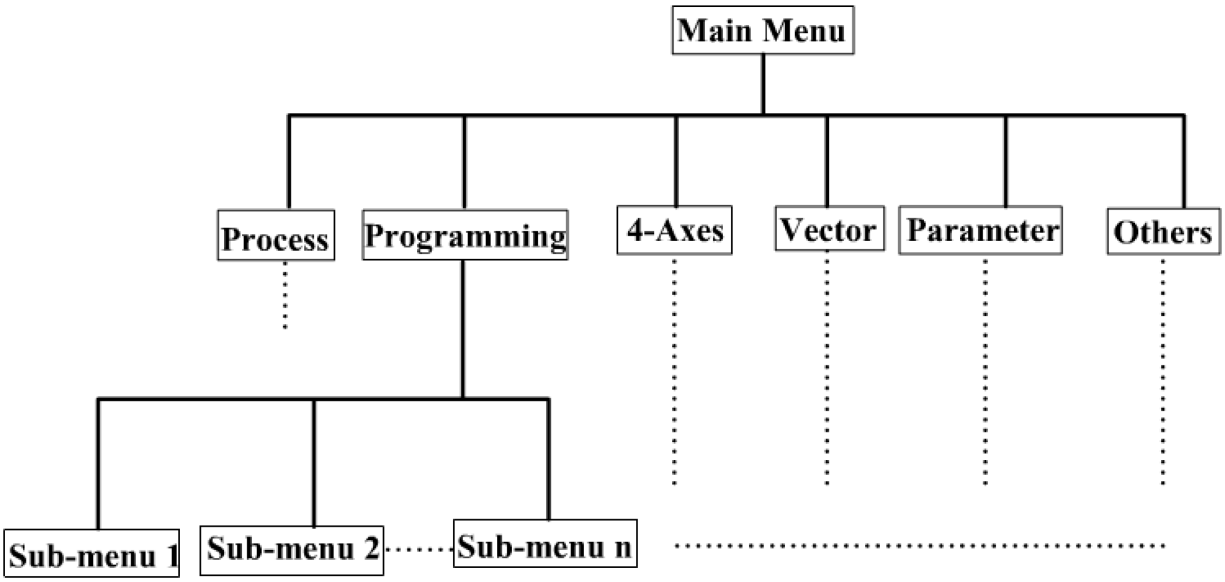



Figure 1.1.2

For example, as for “Program” function, when drawing graphs, from beginning of “Program”, user can go to submenus step by step. After drawing is finished, user can exit sub-menu step by step. Operations of other menus are similar to this.

#### 1.1.2.2 Drawing Method

There are two ways of drawing graphs when system software is programming:

(1) Drawing graph with auxiliary line;

(2) Drawing graph with traces.

In which:

Auxiliary point, auxiliary straight line, auxiliary circle——called “auxiliary line” by a joint name;

Trace, trace circle (include circle) ——called “Trace” by a joint name.

#### 1.1.2.3 Trace Generation Method

After drawing is finished, traces required by processing have to be generated. There are two ways to generate processing traces:

(1) If the graph is shown with "auxiliary line", the steps to generate traces are given as follows:
After "take auxiliary point", "Take auxiliary line", or "take auxiliary arc" is finished→ pick the point of intersection→ change the auxiliary line between two points into traces with "Pick trace".

(2) If the graph is drawn with "trace", the traces can be taken out with "draw line", "draw arc", "regular curve", etc.

**Direction: After the graph becomes traces, it is necessary to add "lead-in line" and "lead-out line"(i.e., feed-in line and feed-out line).**

**Note: After "lead-in line" and "lead-out line" are added, if the graph is required to modify, "order for traces" has to be performed on the graph, otherwise, the generated processing list is probably wrong.**

**1.1.2.4 Common Basic Technical Terms and Agreements of Software**

(1) **Auxiliary line:** Geometric element, used to calculate and generate traces. It includes point, line and arc. In the software, point is expressed as "red", line is expressed as white and arc is expressed as highly bright white.

**(2) Traces:** Curve segment with starting point and terminal point. Line segment in traces is expressed as light blue and arc segment is expressed as green.

(3) **Cutting line direction:** The direction from starting point to terminal point of cutting.

**(4) Lead-in and lead-out line:** A special cutting line (called feed-in line and feed-out line in general), expressed as yellow. They appear in pairs.

**(5) Agreement:**

1) In "Program", if confirm a point or line with mouse at first, the user can also input parameters of next point or line with mouse or keyboard; But if input parameters of a point or line with keyboard at first, it is impossible to confirm next point or next line with mouse.

2) In order to assign a point, a line, an arc or a known value accurately in following drawing operations, the system software allows to make marks on points, lines, arcs and values:
$P_n$ (n=0,1,2,……) means point, the system defaults $P_0$ as origin point of

coordinate;

$L_n$ (n=0,1,2,……) means line, the system defaults $L_1$ and $L_2$ as X axis and Y axis of coordinate respectively;

$C_n$(n=0,1,2,……) means arc;

$V_n$(n=0,1,2,……) means value, the system defaults PI as $\pi$ ($\pi$ =3. 1415926……)。

## 1.2 Introduction of "Program"

### 1.2.1 "Program" window

Under the main menu, click "program" to enter following window.

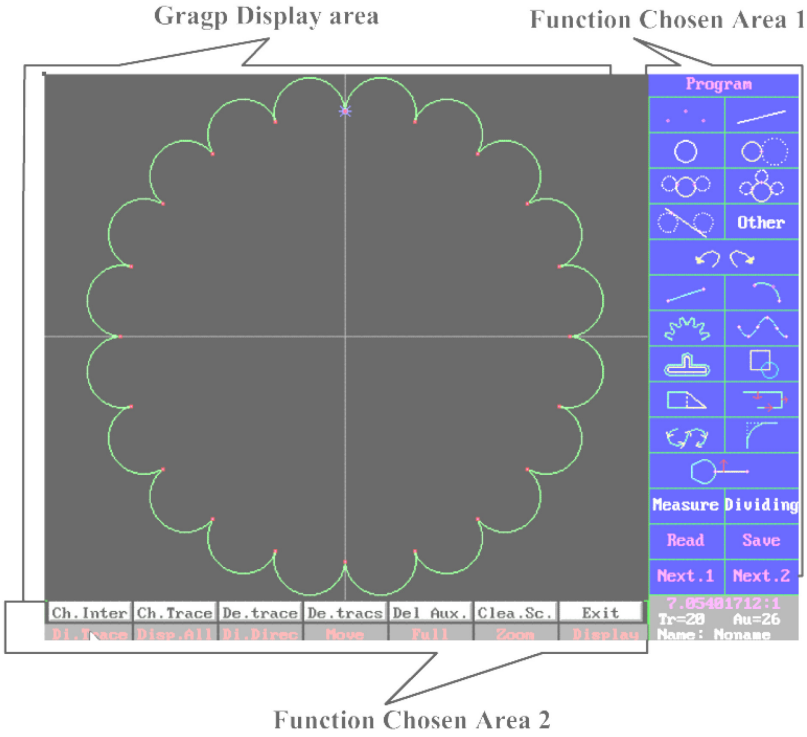



Figure 1.2.1

The "Program" window has 3 areas: graph display area, function chosen area 1, function chosen area 2, in which:

Graph display area: the area to display drawing graph. During the whole "Program" procedure, this area always exits;

Function chosen area 1: the area used in drawing graph. During the "Program" procedure, it varies with menu. When graph is being drawn, this

function chosen area has detail operation;

Function chosen area 2: the menu area used when graph is changed. During "Program" procedure, it also varies with menu. When graph is being drawn, there is dialogue prompting and hot-key prompting directions in this area.

For example:

After choose sub-function of "center, R" in "Take auxiliary arc" function, following window (Figure 1.2.1) appears:

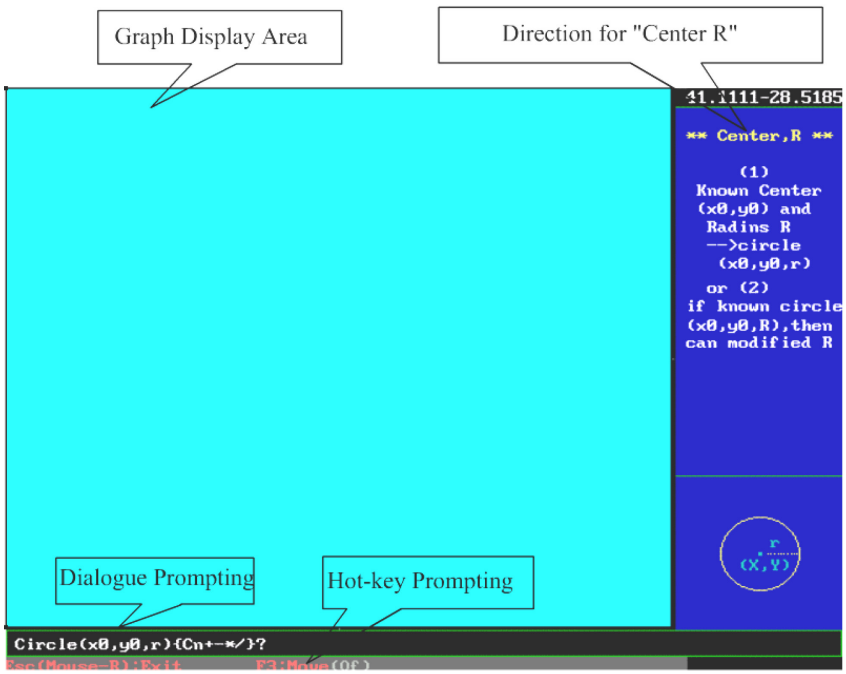



Figure 1.2.2

"Graph display area" in this window will not change

"Function chosen area 1" becomes "Direction for 'Center, R' function".

"Function chosen area 2" becomes "Dialogue prompting" and "Hot-key Prompting", in which, "Dialogue prompting" prompts to input "center point and radius". Press "ENTER" after input values according to requirements, an arc appears in "graph display area" and "Hot-key prompting" prompts that there are available hot-keys in this function.

**Note：The above two windows often appear in "Program" procedure. The second "center, R" window has different display contents according to different sub-menus.**

### 1.2.2 Function Introduction of "Program"

"Program" functional modules are included in "Function chosen area 1" and "Function chosen area 2"

### 1.2.2.1 Introduction of Function Chosen Area 1

The system divides "Function Chosen Area 1" functional block into 4 sub-areas. Shown as follows:

- Auxiliary line drawing function area
- Traces drawing function area
- Preparation working area before processing list is generated
- Additional area

#### 1.2.2.1.1 Auxiliary line drawing functional area

After graph is drawn out with auxiliary line, it is necessary to change auxiliary line between two points into traces with "Take points of intersection" and "Take traces". Main functions of this functional area are: "Take Aux point", "Take Aux line", "Take Aux arc", "1 tang circle", "2 tang circle", "3 tang circle", "common tangent line" and "other".(Figure 1.2.3)

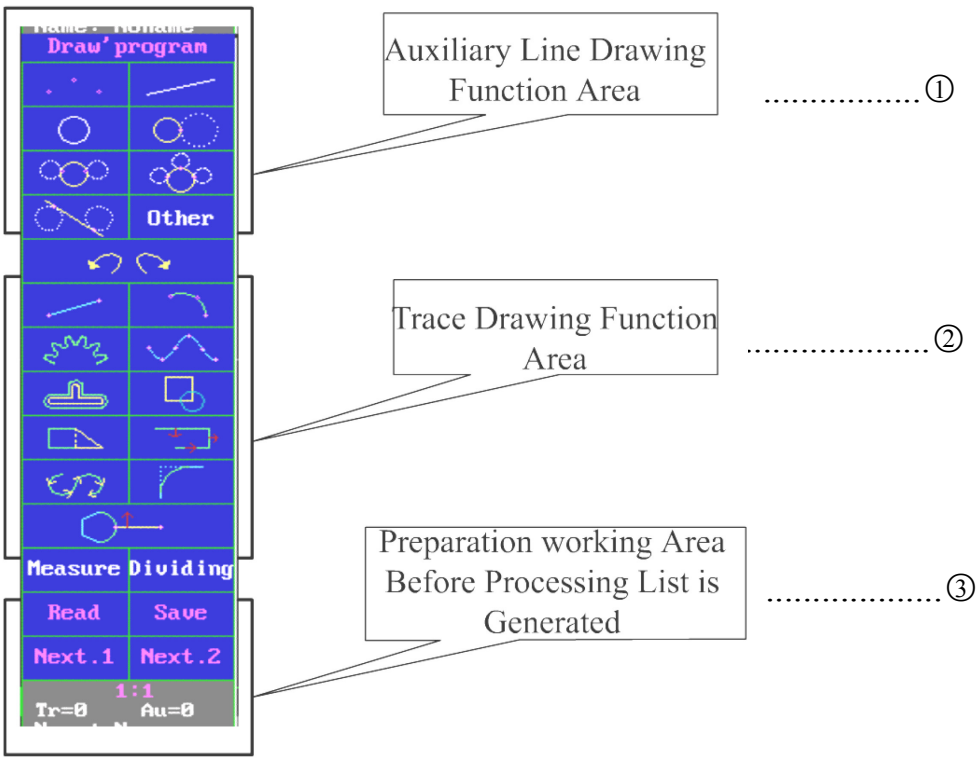



Figure 1.2.3

①This area mainly incorporates functional modules used when drawing graph with auxiliary line.

② This area mainly incorporates functional modules used when drawing graph with traces directly, including edition & modification of traces and definition of lead-in line & lead-out line, etc.

③ This area mainly incorporates preparations, which are made before processing list is generated, such as “save”, “read” and “generated processing list”.

In which:

When click functional items of “take aux point” and “take aux line”, following sub-menus (Figure 1.2.4) pop up. When continue click functional items (such as “points”) on sub-menu, enter specific graph drawing area and succinct operation directions will be seen. Function item operations of other sub-menus are similar to this.

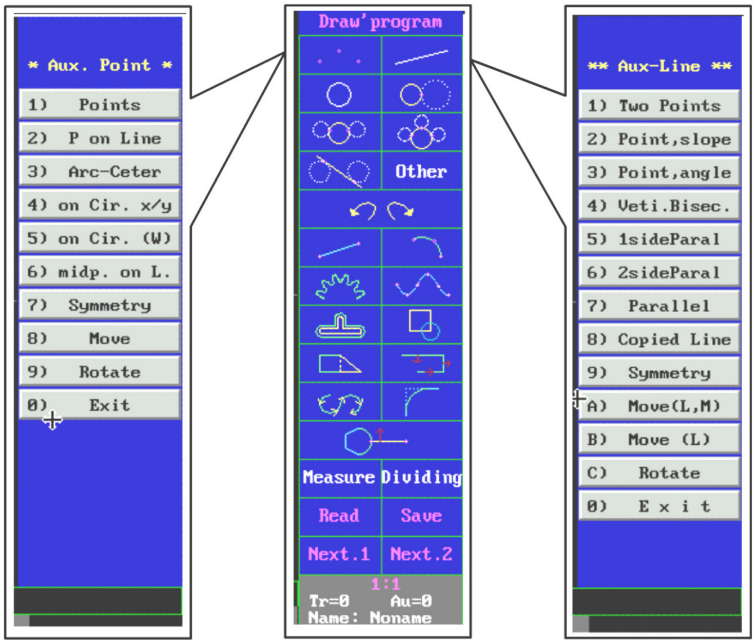


Figure 1.2.4

When click function items of “Take aux arc” and “1 tang arc”, following sub-menus (figure 1.2.5) pop up. When continue to click functional item of sub-menu (such as “take aux arc”), enter specific graph drawing area and succinct operation direction will be seen. Functional item operations of other sub-menu are similar to this.

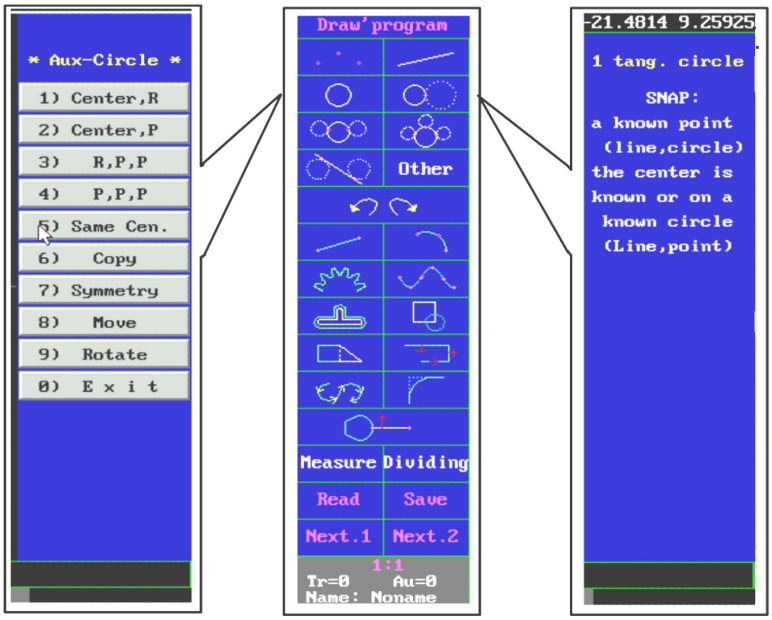



Figure 1.2.5

When click “2 tang arc” and “3 tang arc”, following sub-menus (Figure 1.2.6) pop up. When continue to click functional item of sub-menu (such as “2 tang arc”), enter specific graph drawing area and succinct operation direction will be seen. Function item operations of other sub-menus are similar to this.

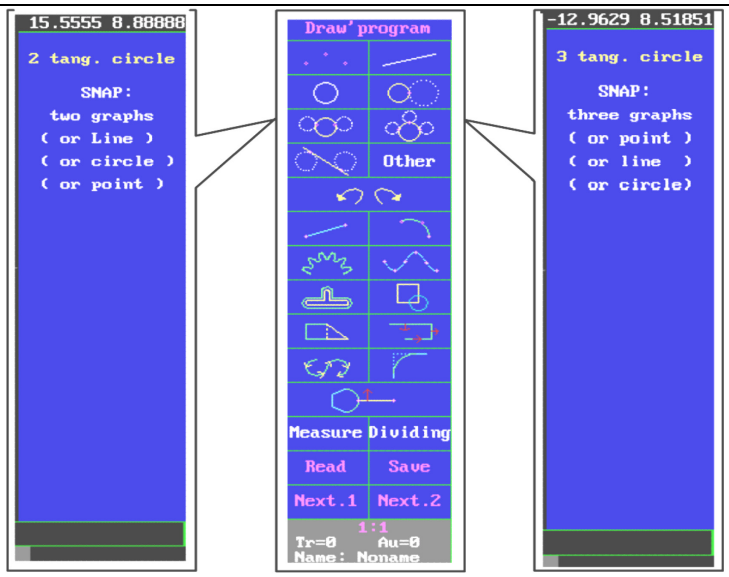



Figure 1.2.6

When click "common tangent line" and "other" functional items, following sub-menus (figure 1.2.7) pop up. When continue click to functional items of sub-menu (such as "common tangent line"), enter specific graph drawing area and succinct operations directions will be seen. Function item operations of other sub-menus are similar to this.

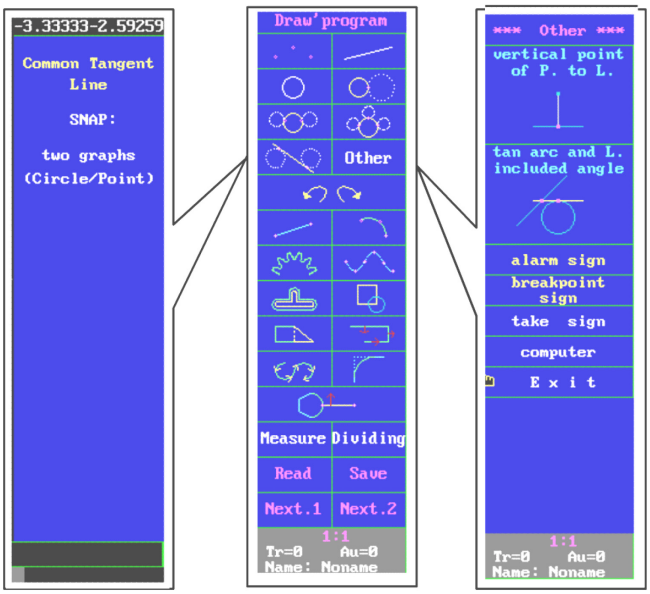



Figure 1.2.7

For example, if draw following graph (Figure 1.2.8) with auxiliary line drawing way:

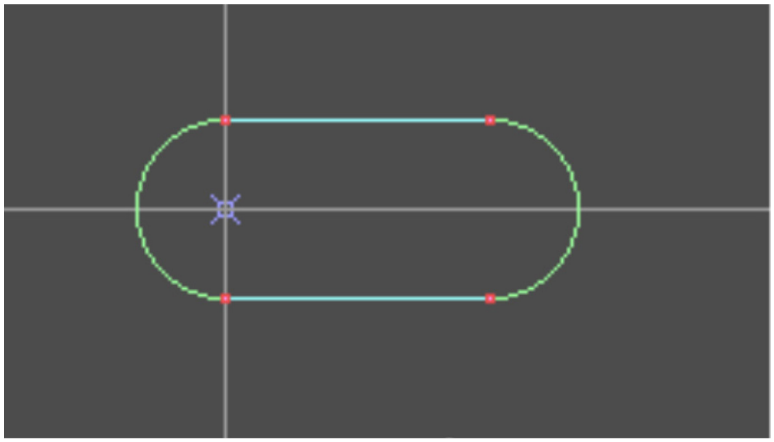


Figure 1.2.8

The drawing steps are shown as follows:

1) Take auxiliary arc
   (1) Click “Program” in program window and the system goes to its sub-menu;
   (2) Choose “center, R” in “take aux arc” of auxiliary line drawing area, the system prompts “circle ($X_0$ , $Y_0$, R) {$C_n$ +-*/}?”;
   (3) Input (0,0,10), the system prompts “circle ($X_0$ , $Y_0$, R) {$C_n$ +-*/}?”;
   (4) Input (30,0,10), the system prompts “circle ($X_0$ , $Y_0$, R) {$C_n$ +-*/}?”
   (5) Press “ESC” key to terminate and return to “Program” window;
2) Take auxiliary line
   (6) Drawing line with auxiliary line: choose “2 side parallel” in Aux line” menu, and system prompts “known line (X3, Y3, X4, Y4) {Ln+-*/}?”
   (7) Choose X axis with left key of mouse, the system prompts “Translation distance L={Vn + -*/}?
   (8)Input 10, the system prompts “known line (X3, Y3, X4, Y4){Ln+-*/}?
   (9) Press “ESC” key to terminate and return to “Program” window;
3) Change intercrossing point
   (10) Click “Change inter” on screen bottom in program window, the system prompts “change inter crossing (tangent) point?”
   (11) Change all intercrossing points of the curve in accordance with the requirements of the curve.
   (12) Press “ESC” key to terminate and return to “program” window;

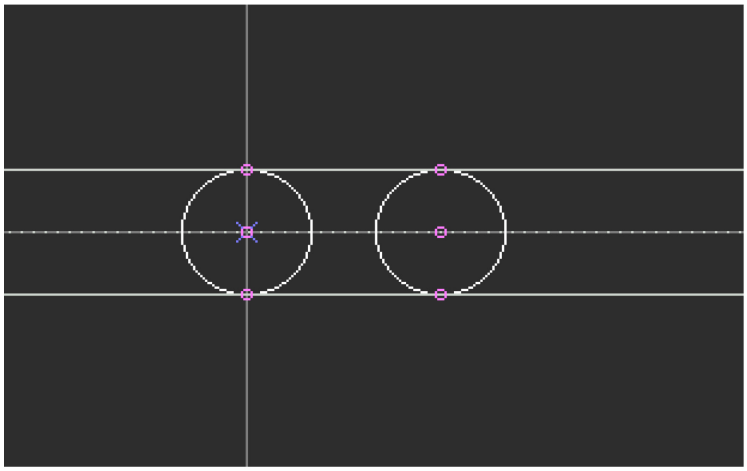


Figure 1.2.9

4) Change trace

(13) After all intercrossing points have been changed (As figure 1.2.9), click "change trace" on screen bottom in "Program" window, then the system prompts "Take a point between two terminals of auxiliary line?"

(14) Change all traces of the curve in accordance with the requirements of the curve, and get the new curve as shown in the picture below.

(15) Press "ESC" key to terminate and return to "program" window; Click "display trace" on screen bottom and get the required curve.

**1.2.2.1.2 Trace drawing functional area**

The graph is drawn with traces directly, "change inter" and "change trace" functions are not required to be used to change the auxiliary line between two points into trace. Main functions of this function area include: "draw trace line", "draw trace arc", "regular curve", "list points curve", "change continues", "change block", "modify trace", "change trace", "order for trace", "fillet/chamfer" and "in/out-line". In which:

Click "draw trace line", and "draw trace arc" functions and appear sub-menu as shown in picture below. Click the functions item in sub-menu (for example "new startpoint") and enter detailed graph drawing area with simple operation description. Operations of other functions item in sub-menu are similar to this.

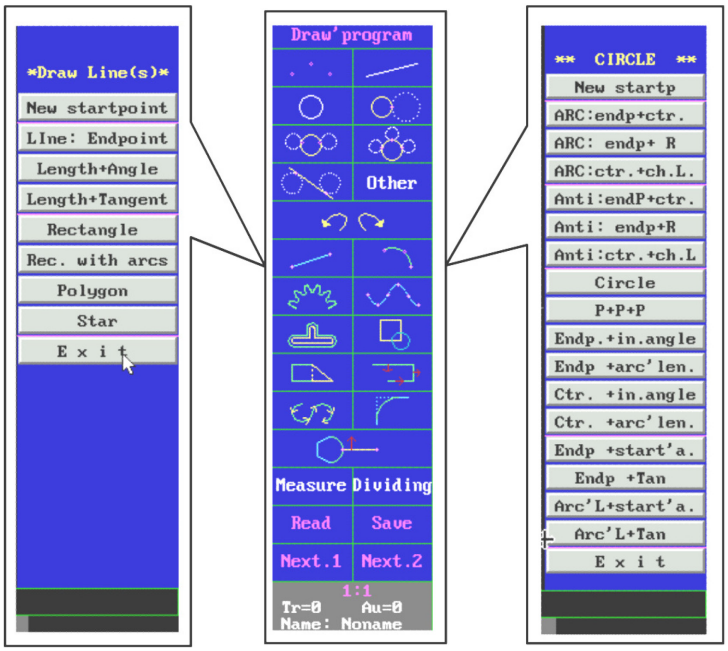



Figure 1.2.10

Click “Regular curve” and “list points curve” functions item and appear following sub-menu (Figure 1.2.11). Click functions item of the sub-menu (for example “Input discrete point”) and enter detailed graph drawing area with simple operation description. Operations of other functions item in sub-menu are similar to this.

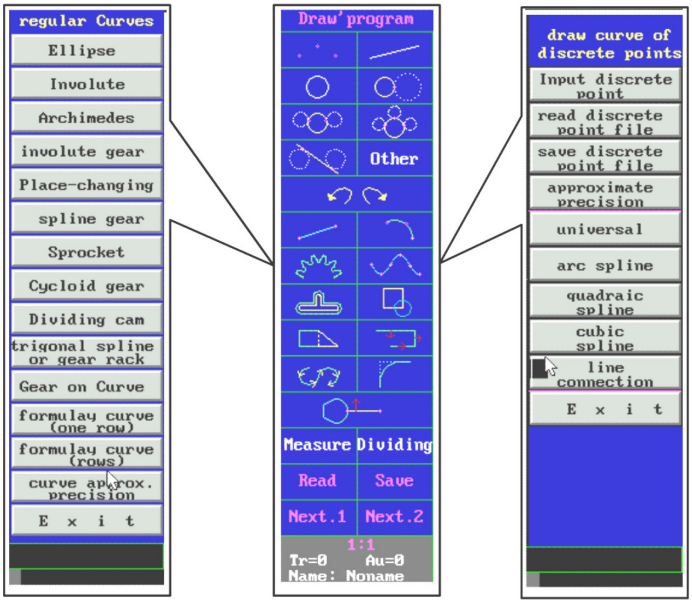



Figure 1.2.11

Click “change continues” and “change block” functions itemd and appear following sub-menu (Figure1.2.12). Click sub-functions item of the sub-menu (for example “specified continuous graphs”) and enter detailed graph drawing area with simple operation description. Operations of other functions item in sub-menu are similar to this.

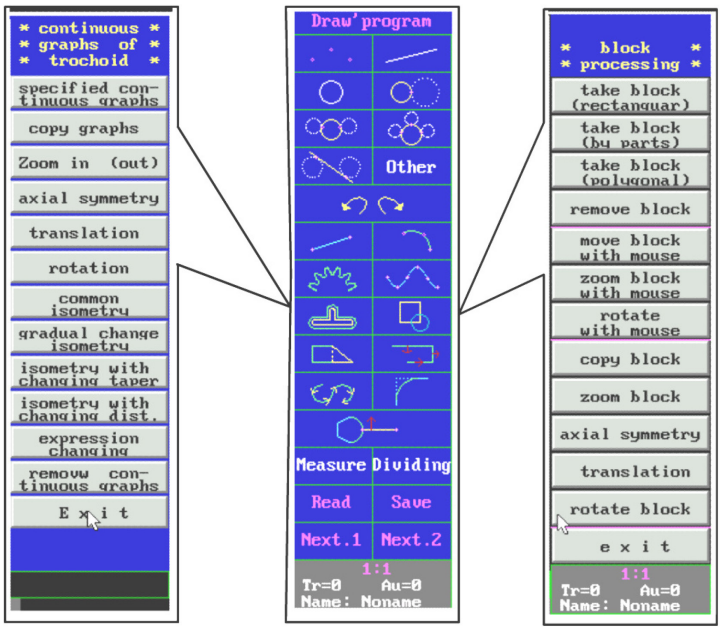



Figure 1.2.12

Click “Modify trace” and “change trace” functions items and appear following sub-menu (Figure 1.2.13). Click functions item of sub-menu (for example “two point into line”) and enter detailed graph drawing area with simple operation description. Operations of other function items in sub-menu are similar to this.

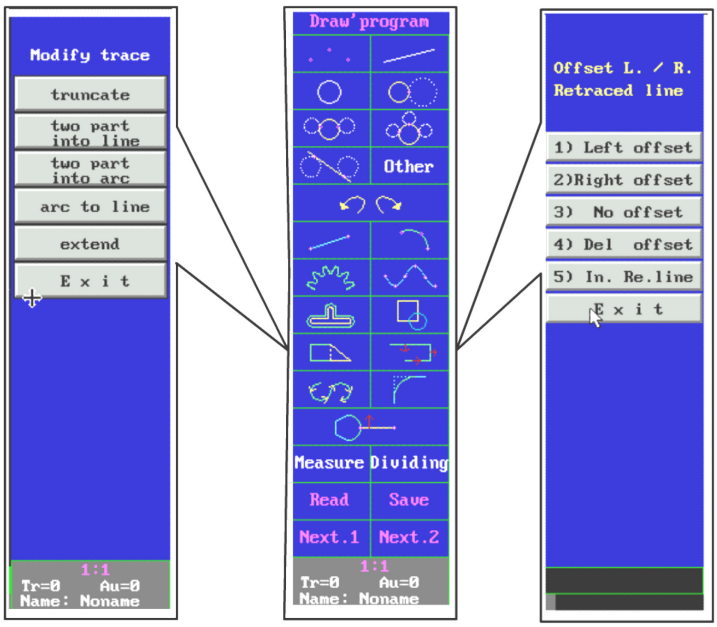



Figure 1.2.13

Click “Modify trace” and “change trace” functions and appear following sub-menu (Figure 1.2.14). Click functions of sub-menu (for example “two part into line”) and enter detailed graph drawing area with simple operation description. Operations of other functions in sub-menu are similar to this.

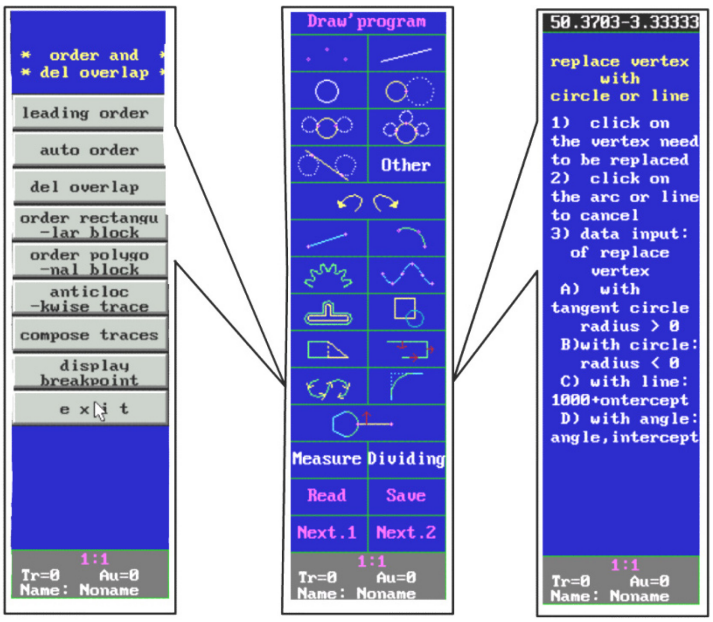



Figure 1.2.14

Click “in/out-line” function item and appear following sub-menu (Figure 1.2.15). Click functions items of sub-menu (for example “point method” and enter detailed graph drawing area with simple operation description. Operations of other function items in sub-menu are similar to this.

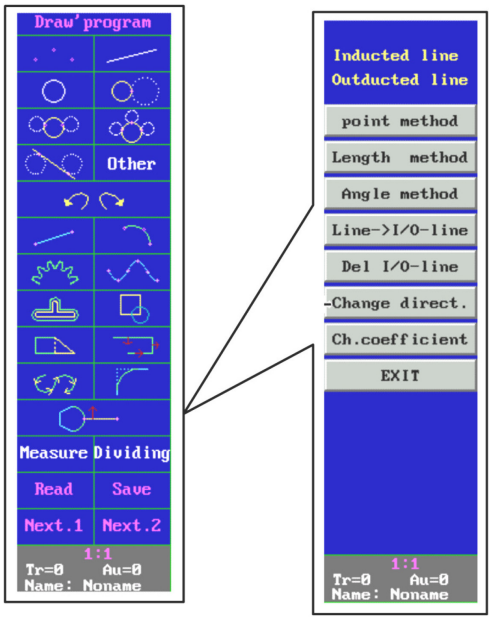



Figure 1.2.15

For example, draw the following graph (Figure 1.2.16) with drawing line method:

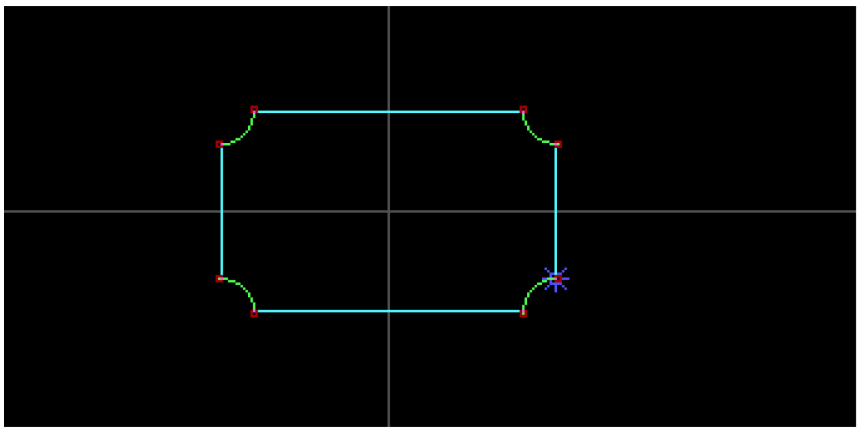


Figure 1.2.16

Drawing steps are as follows:

1) Click “program” function in program window, the system enters the sub-menu of “program”
2) Draw the graph with traces directly, click “Rec. with arcs” sub-

function of “Draw trace line”, then the system prompts “center (X0, Y0){Pn+-*/}?”

3) Input (0,0) and press “enter”, the system prompts “X length={Vn+-*/}?”
4) Input “50” and press “enter”, the system prompts “X width={Vn+-*/}?”
5) Input “30” and press “enter”, the system prompts “arcs radius {Vn+-*/}?”
6) Input “5” and press “enter”, the system prompts “center (X0, Y0){Pn+-*/}?”
7) Press “ESC” key to terminate and a graph required for drawing appears on the screen.

After the graph has been drawn, the system returns to the “program” window.

### 1.2.1.3 Preparation operation area before generation of processing menu.

This area is for the preparation operation of drawn graph before processing menu. Its main functions include “read”, “save”, “next 1” and “next 2”

Click “read” and “save” function items and following sub-menu (Figure 1.2.17) appears on the screen. Click the function item in sub-menu (for example “1> call traces”) and enter detailed graph operation area. Operations of other functions in sub-menu are similar with the introduction above.

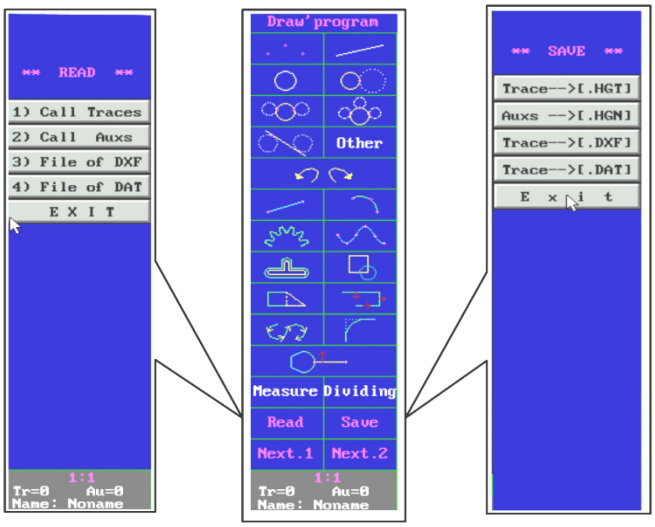



Figure 1.2.17

Click “next 1” and “next 2” functions and appear following sub-menu (Figure 1.2.18). When offset has been input, press “Enter” key to continue. Operations of other functions in sub-menu are similar with the introduction above.

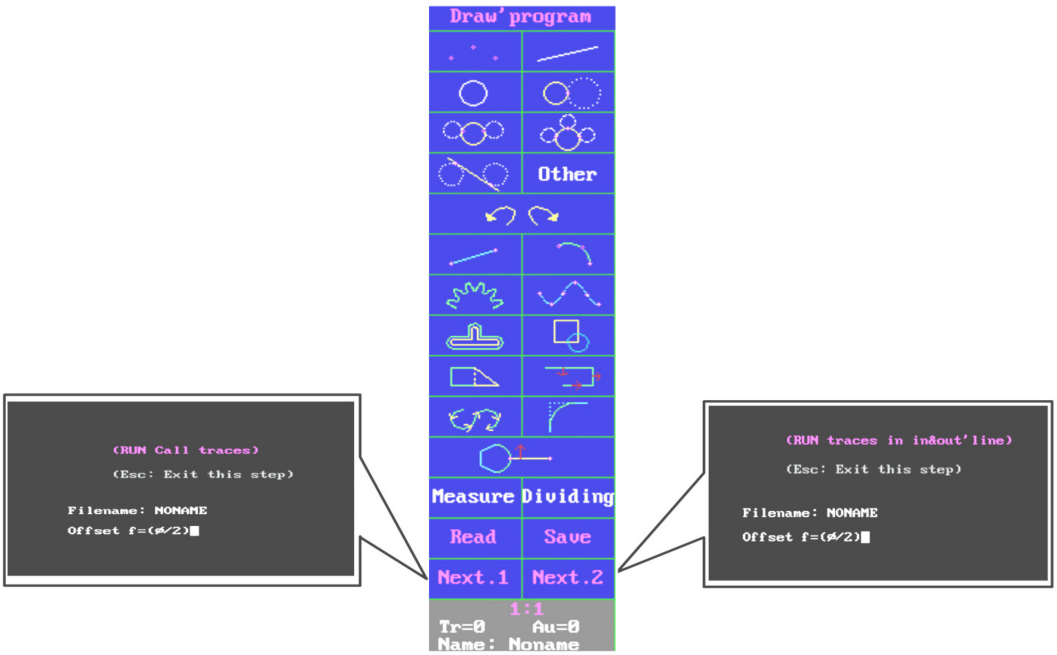



Figure 1.2.18

### 1.2.1.4 Additional Area

The area used for additional procession of drawn graph. The main function items include “backward”, “measure” and “dividing”. Click “backward”, “measure” and “dividing” function items and enter following sub-menus (Figure 1.2.19). Click function items of the sub-menu (for example “measure length”) and enter detailed graph measure area with simple operation description. Operations of other function item in sub-menu are similar to this.

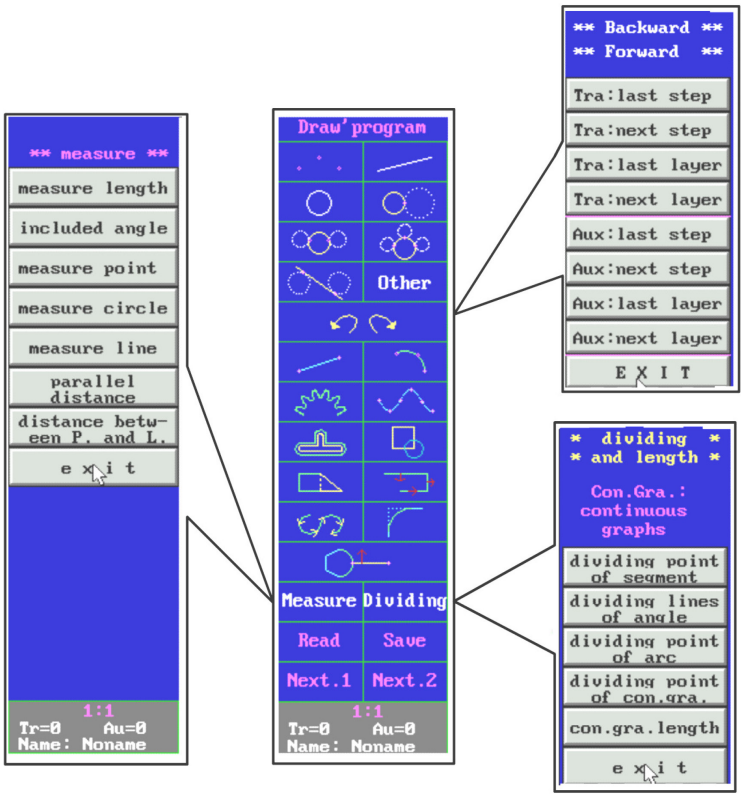



Figure 1.2.19

### 1.2.2 Introduction of function optional area 2

"Function optional area 2" is a optional dialog box with special function on bottom of "Program" window, as shown in the picture (Figure 1.2.20) below:


Figure 1.2.20

**Ch. Inter**: Choose the intercrossing point of two traces in graph display area

**Ch. Trace**: Choose the segment between two points on the curve as a trace

**Note: Both of these two points have to be displayed together in the graph area in "Ch. Trace"**

**De. Trace:** delete a trace line

**De. Traces**: delete several tail-around traces

**De. Aux**: delete the point line and circle that is drawn with auxiliary lines.

**Clear**. Sc: clear the graph in the graph display area

**Exit:** return to the main menu of "program" window.

**Di. Trace**: display the trace line only and hide the auxiliary line in the graph display area.

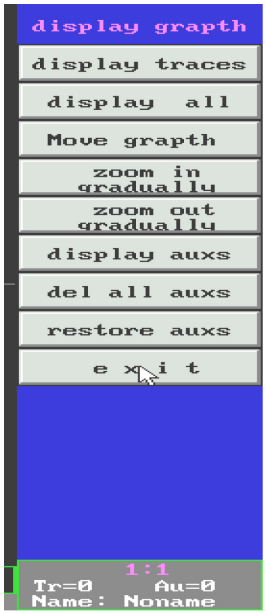
**Disp. All**: display all geometrical elements (including auxiliary lines and traces)

**Di. Direc**: display the trace's direction

**Move**: move the graph within the graph display area.

**Full**: display the graph in full display area.

**Zoom**: zoom parts of the graph in or out.



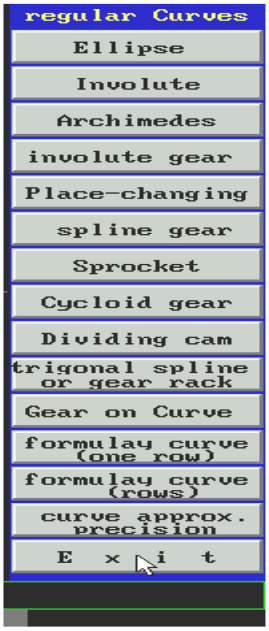

**Display**: The functions of "display" are composed of several sub-functions. Some sub-functions are same as above functions, as shown in right picture (Figure 1.2.21). "Display traces", "display all" and "move graph" have same functions as above "Di. Trace", "disp. all" and "move". Sub-function of "del all auxs." is different from function of "del aux." and can recover the deleted auxiliary lines to the graph display area with recovery function.

### 1.2.3 Introduction of "program" sub-functions

This item is used to further introduce main sub-functions of "program". Figur1.2.21

#### 1.2.3.1RegularCurves

Curves could be seen everywhere of products' components. Curve's processing is a regular work in the processing of linear cutting. This software provides powerful functions for curves' programming. Click "regular curves" function in "program" window and appear 14 sub-functions options in the figure 1.2.22.




#### 1.2.3.1.1 Choose curve approx precision

Click "curve approx. precision" and enter this function. The system prompts "point precision" in the dialog box, which ensure required point number for curves' drawing. Less of the precision value, higher of the precision and more points for curves' drawing while more segments for curves' drawing. The system's default precision is 0.002

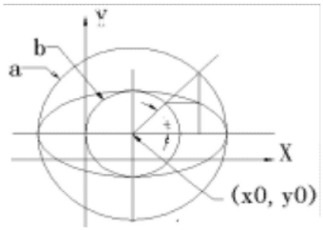
**Note: The default precision should not be changed normally**.

If you reset a precision value, the precision value will recall the default precision value (0.002) after the system returns to "program" window.

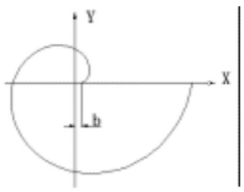
#### 1.2.3.1.2 Regular geometric curves

Figure 1.2.22

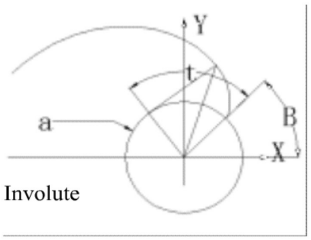
"Regular geometric curves" means curves that are regularly used in production. The system simplified the definition method of following regular geometric curves. The user inputs corresponding data and the curve could be drawn, as shown in the figure (figure 1.2.23) below, including ellipse, involutes and



Eliipse



Archimedes



Involute

Archimedes

Figure 1.2.23

### 1.2.3.1.3 Regular components' curves

The system also provide many curves used for mechanical components' design, other than these regular geometric curves introduced above, including "involute gear", "place changing", "spline gear", "sprocket", "cycloid gear", "dividing cam", "trigonal spline or gear rack" and "gear on curve"

Drawing method of these curves is very simple. The user is only required to input the corresponding standard parameter in the curves form, and then the curve's programming operation is finished. For example, click "place-changing" and appear following menu (Figure 1.2.24):

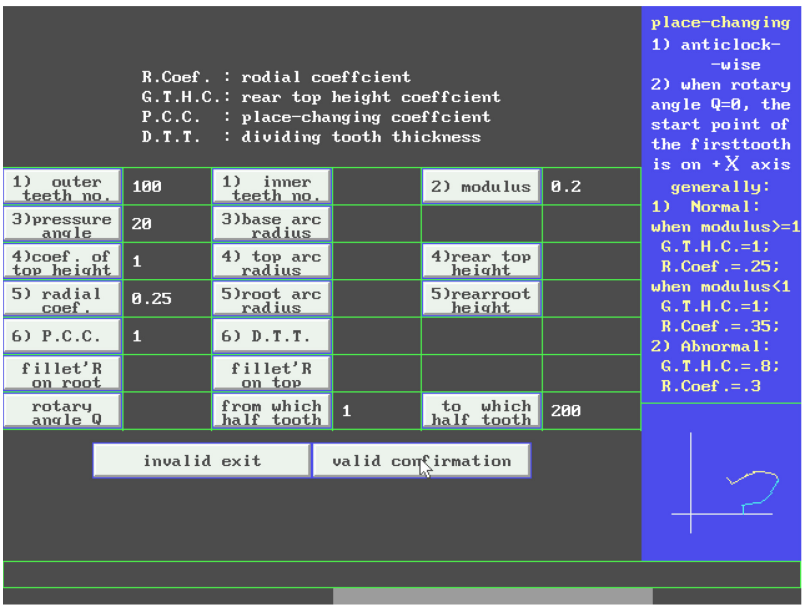


Figure 1.2.24

Click a data item with mouse (for example “out teeth no.”) and input a value (“100”), then press “ENTER” key. After all data item are input, click “valid confirmation” and appear following graph.

**Note: The user must press “ENTER” key after a single value has been input**.

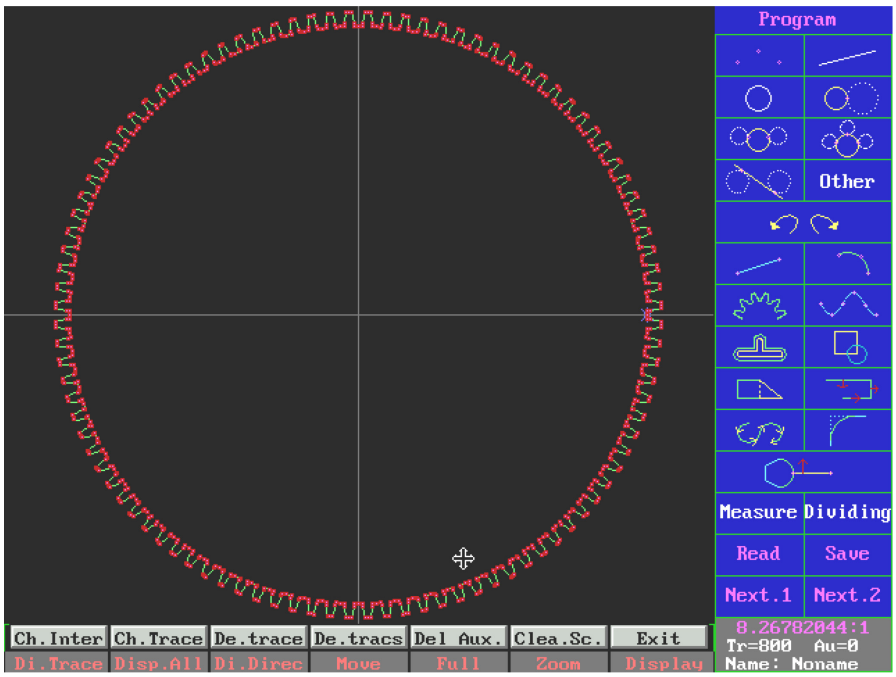



Figure 1.2.25

### 1.2.3.1.4 Formula Curve

The system provides two formulas to define the curve’s functions, including “formula curve (one raw)” and “formula curve (rows)”.

For “formula curve (one raw)”, a variable (for example “t”) is the parameter of curve’s formula, i.e. x and y are t’s function in the formula.

For “formula curve (rows)”, x and y are (variable) t’s indirect function in the formula, i.e. there is one or many other variables among x, y and t.

**Note: Following operational symbols could be used in the formulary expression.**

| Sign | Name | Note |
|---|---|---|
| + | **Plus** | **Addition operation** |
| - | **Minus** | **Subtraction operation** |
| * | **Multiplied by** | **Multiplication operation** |
| / | **Divide by** | **Division operation** |
| ^ | **Power** | **The power of a number. For example: 2^5 is the fifth power of 2** |
| ( | **Left bracket** | **These two signs are always used in pair to determine the priority of the question.** |
| ) | **Right bracket** | |
| **Sin ()** | **Sine function** | **The number in the bracket is the angle in radian. The brackets are in pair.** |
| **Cos ()** | **Cosine function** | **The number in the bracket is the angle in radian. The brackets are in pair.** |
| **Tan ()** | **Tangent function** | **The number in the bracket is the angle in radian. The brackets are in pair.** |

| | | |
|---|---|---|
| **Asc ()** | **Arc sine function** | **The number in the brackets is sine of the angle; the measurement is the radian of the angle. The brackets are in pair.** |
| **Acs ()** | **Arc cosine function** | **The number in the brackets is cosine of the angle; the measurement is the radian of the angle. The brackets are in pair.** |
| **Atn ()** | **Arc tangent function** | **The number in the brackets is tangent of the angle; the measurement is the radian of the angle. The brackets are in pair.** |
| **ABS ()** | **Absolute value function** | **The absolute value of a number. The measurement is positive whatever the sign of number in brackets** |
| **EXP ()** | **X power of e** | |
| **SQR ()** | Square | **The square value of a number, for example: 234 is SQR (234)** |
| **LOG ()** | **Logarithm function** | **The nature logarithm of a number.** |
| **PI/Vn** | **Pi or sign** | **Constant: Π or the sign of a number** |

### 1.2.3.1.4.1 Formula Curve (one row)

Press "Formula curve (one row)" and enter the function. "X (t), y (t): [Fn]?" is displayed in the dialog box, then input formula expression after the cursor. For example, to define a star curve, which parameter expression is:

$$\begin{cases} x = a * \cos^3 t \\ y = a * \sin^3 t \end{cases} \quad (a = 20)$$

Input the right part of the parameter equation on the prompting line and use a comma (,) between every two equations, i.e., inputting:

20*(cos (t*v2))^3,20*(sin (t*v2))^3

After pressing "enter", the prompting content changes to be:

Variable range is from t1={Vn+-*/}?

Input an initial value (for example "0") and press "enter", then the prompting content changes to be:

Variable range to t2={Vn+-*/}?

Input a final value (for example "360") and press "enter", then a star curve defined by the parameter expression will be displayed in the graph area.

### 1.2.3.1.4.2 Formula Curve (rows)

Supposed that a curve is defined by a group of equations as follows:

$$\begin{cases} H_0 = \cos(t + \frac{\pi}{4}) \\ H_1 = 1 + 0.8 * H_0 \\ H_2 = \frac{40}{H_1} \\ X_t = H_2 \cos(t) \\ Y_t = H_2 \sin(t) \end{cases} \quad 0<t<2\Pi$$

"Formula Curve (rows)" function has to be used to draw above curve. Press "Formula Curve (rows)" and enter the function, following prompting content will be displayed in the dialog box:

Variable rang: from t1={Vn+_-*/}?

Input an initial value "0" and press enter, prompting content changes to be:

To: t2={Vn+_-*/}?

Input a final value 2*PI and press enter. There will be: "filename of formula curve (rows)"

Input the file name of the multi-line formula curve that you have edited before and press "Enter". The operation of this function is finished. Then a curve will be displayed in graph display box as shown in the following graph (Figure 1.2.26).

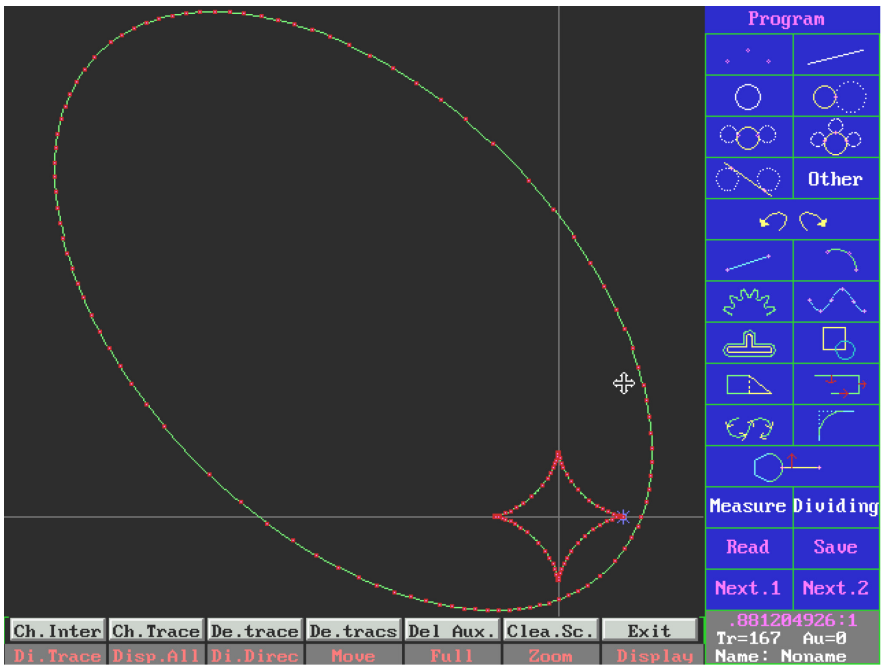



Figure 1.2.26

Note: File content of the multi-line formula curve should be input firstly in the mode of text editing.

1.2.3.2 List' points Curve


**"List' point curve" is used to draw the require curve with coordinates of discrete points. Press "list' point curve" and enter this function, as shown in figure 1.2.27. Among these sub-functions, the first four sub-functions are used to make preparations for following five sub-functions.**

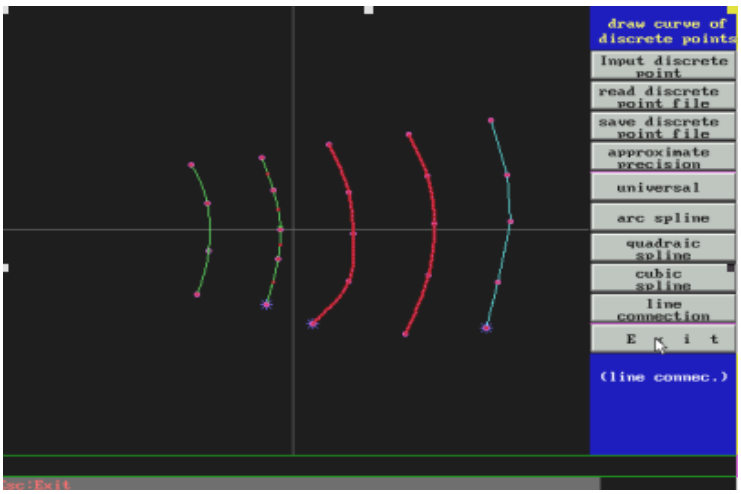
**Input list points firstly. If the file of list points has been stored, the coordinates of list points could be directly from the file. After all list points have been input, the coordinates of these points could be stored in the disk by storing the file of list points.**

Note: The approximation accuracy should be conformed before using the following five sub-functions.

Warning: The approximation accuracy should be the system's default value and not be changed generally.

**The sub-function of "list curve" could be easily operated following the prompting words in dialog box. The graph should below is drawn with same list points in different five drawing modes. Curves are respectively in**

**accordance with sub-functions “universal” “arc spline” “quadraic spline” “cubic spline” and “line connection” from left to right.**



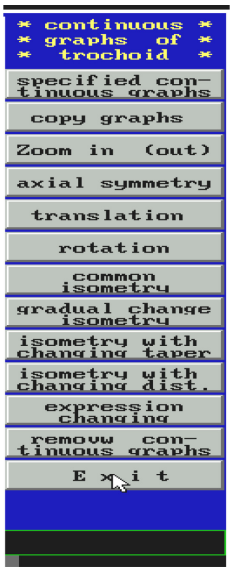




**Figure1.2.28**

**Figure1.2.29**

1.2.3.3 Change continues

**“Change continues” function is used to edit the pass way of continues graph. The pass way of continues graph means a series of pass way, which connected with terminals.**

**Press “change continues” and enter this function. A menu of sub-functions is displayed as shown in figure 1.2.29. These sub-functions will be introduced respectively.**

1.2.3.3.1 Specified continuous graph

The continuous curves have to be named before editing, or the system will be display error prompting words. Press “specified continuous graph” and press enter this function. Following information will be displayed in the dialog box:

Initial point of continuous curve (Ax, Ay) ={Pn +-*/}?

Take the initial point of curve by mouse or input coordinates of the point directly by keyboard and press enter. The prompting information changes to be:

Terminal point of continuous curve (Bx, By)={+-*/}?

Take the terminal point of curve by mouse or input coordinates of the point directly by keyboard and press enter. The prompting information changes to be:

Take a segment on the passway of the continuous curve.

Take a random segment by mouse. All operations of this sub-function are finished till this step. Then following sub-functions could be operated step by step.

**1.2.3.3.2 Copy graphs**

"Copy graphs" function is used to copy the continuous curve. Press "copy graphs" and enter this function. Following information will be displayed in the dialog box:

Initial point for copying (Ax, Ay)={Pn+-*/}?

Input coordinates of the initial point for copying and press enter.

Then the curve will be copied from the initial point and original curve also exists.

**1.2.3.3.3 Zoom in (out)**

"Zoom in (out)" function is used to perform the operation of contracting and magnifying. Press "zoom in (out)" and enter this function. Following information will be displayed in the dialog box:

Zoom in (out) scale (L=1 keeping, L>1 magnifying, 0<L<1 contracting={Vn+-*/}

Input a number and press enter. The graph will be magnified or contracted and the original graph exists.

**Note: Zoom in (out) operation of continuous curve is performed based on origin of coordinates system.**

**1.2.3.3.4 Axial Symmetry**

"Axial symmetry" is used to copy the graph based on an axis of symmetry. Press "Axial symmetry" and enter this function. Following information will be displayed in the dialog box:

Axis of symmetry on the graph (X1, Y1, X2, Y2){Ln+-*/}

Take a line as the axis of symmetry by mouse or input the coordinates of two points on the line directly and press enter. Then the symmetric graph will be displayed on the screen and the original graph also exits.

**1.2.3.3.5 Translation**

"Translation" function is used to translate the continuous curve, which means the continuous curve could be copied isometric ally by many times. Press "translation" and enter this function. Following information will displayed in the dialog box:

Number of translation times [1]=?

Input the number of translation times (for example: 2), the prompting information will change to be:

Translation metric (if 0,0; continuous translation) (Dx, Dy)={Pn+-*/}?

Input a translation metric and press enter. Then, two continuous curves after translation are displayed on the screen and the original graph also exists.

**Note: Coordinates' increment of the corresponding points on two continuous curves is used as the translation metric. So coordinates of the points should be input. If input (0,0), the terminal point of the first continuous curve is the initial point of the second continuous curve, and the terminal point of the second curve also is the initial point of the third curve, which are called "continuous translation"**

**1.2.3.3.6 Rotation**

"Rotation" function is used to rotate the continuous graph. Press "Rotation" and enter this function. Following information will be displayed in the dialog box:

Number of rotation times [1]=?

Input the number of rotation times and press enter, the prompting information will change to be:

Rotation center (x0, y0){Pn+-*/}?

Take a rotation center by mouse or input coordinates of the rotation center by keyboard, then press enter. The curve after rotated is displayed in graph area and the original curve also exists.

**Note: If input "0" for the rotation angle, the rotation is continuous and following graph is displayed on the screen: the initial point of the second continuous curve is on the connecting line between the terminal point of the first curve and the rotation center**.

**1.2.3.3.7Common Isometry**

Common isometry of the graph means that the distance between the

initial point and the terminal point of continuous graph along the curve's direction, i.e. the distance between two corresponding points of two curves' is always same. Press "common isometry" and enter this function. Following information will be displayed in the dialog box:

Isometric value of the curve (along the curve's direction, left is positive (+) and right is negative (-)) d=?{Vn+-*/}

Input the isometric value of the curve and press enter. The isometric graph is displayed in graph area and the original graph also exists.

**1.2.3.3.8 Gradual Change Isometry**

"Gradual change isometry" is different from "common isometry" and means that the distance between corresponding points of two curves is different and general varying. Press "gradual change isometry" and enter this function. Following information will be displayed in the dialog box:

Isometric value from the initial point of the curve (along curve's direction, left is positive and right is negative) d=? {Vn+-*/}

Input the isometric value from the initial point and press enter, the prompting information changes to be:

Isometric value from the terminal point of the curve (along curve's direction, left is positive and right is negative) d=? {Vn+-*/}

Input the isometric value from the initial point and press enter, a new continuous curve will be displayed in the graph area.

**Note: If the signs of above values are positive and negative respectively, the curve after variation will cross the original curve.**

**1.2.3.3.9Isometry with changing taper & distance**

The isometry value of some segments on the continuous curve could be different from the other isometrc value. This function deals with taper isometric, i.e. the isometric value could be expressed either in taper mode or in distance mode.

**1.2.3.3.10 Expressing changing**

"Expressing changing," means there is an expression relation between the new graph and the original graph. For example, if you want to process a turning tool, you should produce a fixture firstly. The fixture could make the bottom of the turning tool tilted against the platen in X and Y direction. By calculation, coordinates of points on the turning tool change by following

expression:

If coordinates of cross point on the turning tool's contour lines changing are (x, y) and the coordinates after changing are (X, Y), to the relation between (x, y) and (X, Y) is as follows:

$X=x*\cos(n)-y*\sin^2(n)$

$Y=y*\cos(n)$

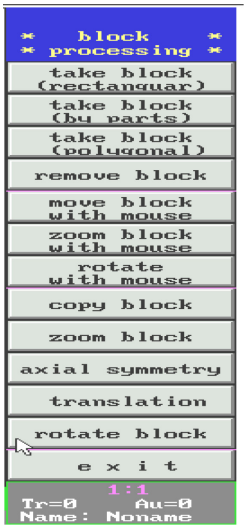
The function of "expression changing," is used to get the contour lines after changing. Press "Expression changing" and enter this function. Following information will be displayed in the dialog box:

X (expression)

Input y* cos (n*v2) and press enter. The contour after changing will be displayed on the screen.

**1.2.3.3.11 Remove Continuous Graph**

"Remove Continuous Graph" is used to delete the original continuous graph. Without any prompting information, click "remove continuous graph" once more and the original continuous graph is deleted.




**1.2.3.4 Chang Block**

"Change Block" function is different from "change continuous" function. "Change block" is used to press a continuous graph, i.e. the processing graph has to be trail-around and there is only one routing for the graph. "Change block" is another method for graph processing when the graph cannot meet the requirements of "change continuous". Press "change block" and enter this function, as shown in right picture.

**1.2.3.4.1 Take Block**

As "change continuous" function, user has to select the block before graph processing. The system provides three methods to select the block (i.e. first three items of "change block" sub-functions): rectangular selecting box, direct catching and polygon selecting box.

**1.2.3.4.1.1 Take Block (rectangular)**

The function is used to select the block of graph with a rectangular box. Click "Take Block (rectangular)" and enter this function. Following prompting message will be displayed in the dialog box;

Give block range by mouse

Define initial point of the graph by mouse firstly. A blue rectangular box changes following mouse's moving, then define the terminal point of the graph. The graph in the blue rectangular box will changes to be in blue color. Now, a block is selected.

**Note: If a certain terminal point of a line is not in the blue rectangular box, the line will not be selected as the block (i.e. the block has not been selected).**

**1.2.3.4.1.2 Take Block (by parts)**

The function is used to catch a trace line. Several selected lines group to be a graph block. Click 'take block (by parts)" and enter this function. Following information will be displayed in the dialog box:

Catch a trace line ($F_1$ for exit)?

Select trace line directly by mouse and selected lines will change to in blue color. Then press "$F_1$" after the selecting is finished and the graph block is defined.

**1.2.3.4.1.3 Take Block (polygonal)**

The function is used to select the block of graph with a polygon box. Click "Take Block (polygon)" and enter this function. Following prompting message will be displayed in the dialog box:

Take terminal points of polygon:

Define the initial point of the graph by mouse firstly and move mouse to select the screen point. Then, there will be a blue line between the first and the second point on the screen. The second point will be connected with the third point also by a blue line after the third point is selected. Click the right key of the mouse after all points are selected, then the polygon is closed. Following message will be displayed in the dialog box:

Take a point within the polygon:

Click the left key on mouse within the closed polygon and define an area. The segment of curve within the area is the graph block.

**1.2.3.4.2 Block Processing With Mouse**

The system provides three sub-functions operated by mouse for block processing, including "Move block with mouse", "Zoom block with mouse" and "rotate block with mouse".

**1.2.3.4.2.1Move Block With Mouse**

Click “move block with mouse” and enter this function. Then a defined block is moving with mouse in the graph box. When the block is moved to a suitable position, click the left key of mouse and form a new block, while the original defined block also exists.

**1.2.3.4.2.2Zoom Block With Mouse.**

Click “zoom block with mouse” and enter this function. Following prompting information will be displayed in the dialog box:

Give zooming reference point (x, y) {Pn +-/*}?

Move mouse to a suitable position and click the left key of mouse once (i.e. give coordinates of zooming reference point), then the operation of this sub-function is finished.

**Note: The relation between the reference point and zooming connect the reference point and every point within the block to group a team of radiation lines. Every point is moving on the radiation line respectively and keep the geometric relation of graph. That’s zooming operation.**

**1.2.3.4.2.3 Rotate Block With Mouse**

Click “rotate block with mouse” and enter this function. Following prompting information will displayed in the dialog box:

Give rotating center (x, y) {Pn+-*/}?

Move mouse to a suitable position and click the left key of mouse (i.e. give coordinates of the rotating center). The operation of this sub-function is finished.

**Note: The relation between the rotating center and rotation is: let the rotating center as the center of a circle and the distance between every point within the block and the center as the radius, then a series of concentric circles are formed. Every point within the block is moving on its respective circle and keeping the geometric relation of graph. That’s rotating operation.**

**1.2.3.4.3 General Operation of block**

In “block editing” functions, the system provides five general operations: copying, zooming, axial symmetry, translation and rotation.

**1.2.3.4.3.1 Copy Block**

Click “copy block” and enter this function. Following prompting information will be displayed in the dialog box:

Give the reference point within block (x, y){Pn+-*/}?

Take a reference point with mouse, or input coordinates of the reference point with keyboard and press enter. Then, information displayed in the dialog box will change to be:

Give the insertion point of the block (x, y) {Pn+-*/}?

Take an insertion point on the expected position, or input coordinates of the insertion point with keyboard and press enter. Then a copied graph will be displayed in the graph box.

**Note: Copied graph is displayed based on the reference point.**

**1.2.3.4.3.2Zoom block**

Click "zoom block" and enter this function. Following prompting information will displayed in the dialog box:

Give zooming factor on X direction {Vn+-*/}?

If zooming factor>1, the block will be amplified; if 0<factor<1, the block will be contracted on x direction. Input a suitable number and press "enter". The information will change to be:

Give zooming factor on Y direction {Vn+-*/}?

Input a suitable number and press "enter". The information will change to be:

Give reference point (x, y) {Pn+-*/}?

Take a reference point with mouse or input coordinates of the reference point with keyboard, then press enter. The information displayed in the display box will change to be:

Give insertion point (x, y) {Pn+-*/}?

Take an insertion point on suitable position with mouse, or input coordinates of the insertion point with keyboard. Then press enter, the graph after zooming will be displayed in the graph box.

**1.2.3.4.3.3 Axial Symmetry, Translation & Rotate block**

The function and operation method of these three sub-functions are as same as that of "Axial symmetry", "Translation" and "Rotation" in "change continuous". Please refer to the introduction of "change continuous"

**1.2.3.5 Change Trace**

The Function of "change trace" is different from that of "change continuous and "change block". "Change block" is processing a series of traces or a team of traces, but "change trace" is processing only one piece of

trace. Click “change trace” and enter this function as shown in the right picture.

**1.2.3.5.2Direction Processing of trace offset**

During the compilation of processing graph, it is required to add molybdenum wire’s offset value and direction to the processing trace. If one or several traces will not add wire’s offset value or add only one side offset of the trace, “left offset”, “right offset” and “no offset” functions could be used to perform these operation.

**1.2.3.5.2.1 left offset**

“Left offset” function is to add the wire’s offset to left side of the trace. Click “left offset” and enter this sub-function. Following information will be displayed in the dialog box:

Pick left offset trace:

Move mouse to the trace, which the offset will be added to the left side, then click once. A leftward red arrow appears in the middle of the trace, which means that the offset will be added to the left side of the trace.

**1.2.3.5.2.2 right offset**

Click “right offset” and enter this sub-function. Following information will be displayed in the dialog box:

Pick right offset trace:

Move mouse to the trace, which the offset will be added to the right side, then click once. A rightward red arrow appears in the middle of the trace, which means that the offset will be added to the right side of the trace.

**1.2.3.5.2.3 No Offset**

“No offset” means that processing trace will not add the molybdenum wire’s offset. Click “no offset” and enter this function. Following prompting information will be displayed in the dialog box:

Pick no offset trace

Move mouse to the trace, which will not add the offset, and click once. A red arrow on trace direction in the middle of the trace, which means that the trace will not add offset and only cut on trace direction.

**1.2.3.5.2.4 Delete offset**

If the user wants to delete the operations of “left offset”, “right offset” and “no offset” which function has been clicked, “delete offset” could be

used.

**1.2.3.6 Modify trace**

"Modify trace" function is used to process the trace and is different from "graph edit", "block edit" and "offset L./R.". Function of "graph edit", "block edit" and "offset L./R." are used to perform regular procession, but "modify trace" function is used to process the traces that are not required too exactly for the accuracy of components' size and could be modified flexibly. Click "modify trace" and enter this function, as shown in the right picture.

**1.2.3.6 Truncate**

The function is used to truncate the trace into two or several pieces, and new traces have same property as the original trace. Click "truncate" and enter this function. Following information will be displayed in the dialog box:

Pick the truncate point between two terminals of the trace?

Take a point on the trace with mouse, then the operation is finished. Above cnotent will be displayed in the dialog box again. One point could truncate the trace into two segments (i.e. two new traces), and so on.

**1.2.3.6.2Two part into line**

The function is used to integrate two parts traces into a straight line. The new trace is a straight line from the initial point of the first trace to the terminal point of the second trace. Click "two part into line" and enter this function. Following information will be displayed in the dialog box:

Click at the cross point of two traces

Click once at the cross point of two traces, then these two traces will be integrated into a new trace.

**1.2.3.6.3 Two Part Into Arc**

The function is used to integrate two traces into an arc. The new trace is an arc from the initial point of the first trace to the terminal point of the second trace. Click "Two part into arc" and enter this function. Following information will be displayed in the dialog box:

Click at the cross point of two traces

Click once at the cross point of two traces, then two traces will be integrated into an arc (i.e. the new trace)

**1.2.3.6.4Arc To Line**

The function is used to change an arc trace into a straight-line trace.

Click “Arc into line” and enter this function. Following information will displayed in the dialog box:

Click on the arc

Click once on the arc segment, which will be changed to be a straight line, then the arc trace will be changed to the straight-line trace.

**1.2.3.6.5 Extend**

The function is used to extend the trace and could be operated with one or two traces. Click “extend” and enter this function. Following prompting information will be displayed in the dialog box:

Pick the cross point of two traces or click the trace directly

Take the cross point of two traces if user wants to extend these two traces; or click one trace if user wants to extend only one trace. Then the information will change to be:

Extend the trace to a suitable position and click the mouse

(Press “ESC” key and keep original shape)

Move mouse and the trace changes its shape following mouse moving. Click the left key on mouse if the trace is extended to a suitable position.

**Note: If user picks the cross-point of two traces at the first step, these two traces will change to be straight line following mouse’s moving whatever these two traces are straight lines or arcs. If user picks only one trace at the first step, then this trace will change to be an arc trace following mouse’s moving whatever the trace is straight or arc.**

**1.2.3.7 Measure**

The function of measure is used to measure graph’s size and to know whether the graph can meet the requirements before the graph will be post-processed and after the graph has been drawn. Click “measure” and enter this function, as shown in right picture. There are several sub-functions, including “measure circle”, “measure length”, “measure included angle”, “measure point”, “measure circle”, “measure line”, “measure parallel distance” and “measure distance between point and line”. Descriptions of above sub-functions are very clear and user can perform the operations following these descriptions. Result of each measure will be displayed in the function description box at right part of the screen.

**1.2.3.8Dividing length and Con.Gra**

The function of “dividing” has five sub-functions, as shown in the right picture. These sub-functions include “dividing point of segment”, “dividing lines of angle”, “dividing point of arc”, “dividing point of con.gra” and

"con.gra. Length" Description of above sub-functions is very clear and user can perform the operations following these descriptions

**1.2.3.9 Read**

The function of "read" is in correspondence with the function of "save" and has four sub-functions, as shown in the right picture. "Call traces", "Call Auxs", "File of DXF" and "File of DAT" are sub-functions to read files.

Click one sub-function and enter it. Following information will be displayed in the dialog box:

Select "call traces"——filename[.HGT]

Select "call Auxs"——filename[.HGN]

Select "File of DXT"——filename [.DXF]

Select "File of DAT"——filename[.DAT]

In which:

[.HGT],[.HGN],[.DXF],[.DAT] respectively present the extended names of pathway file, auxiliary file, AUTOCAD file.

Press "Enter" key after inputting the name of graphic file, then the

corresponding graph will be displayed on the graphic display area in the drawing-programming interface.

**Note:**

**(1) If you want to inquire corresponding name of calling file, you can push the "Enter" key according to the left prompting box of the screen, then a grey window will be shown on the screen center and the file names of existing files will be listed on the window.**

**(2) If you want to inquire corresponding graph, you can press "F1" key, then all existing graphs in current catalog will be shown in the graphic display space of the screen.**

**1.2.3.10Other**

Press "other"; enter this function, shown as right figure.

**1.2.3.10.1Marking**

Press "marking", enter operation of definition Pn, Ln, Cn. Display in dialogue prompting box shown as right figure:

(Marking) select point/line/circle select one point or one line or circle with mouse.

When selecting one point, notation of "This point will be stored in P1. Will be displayed in the bottom of function description box of right screen. If you select another point, display "the point" will be stored in p2, and so on.

When selecting a direct line, "The line will be stored in L3" will be displayed in the bottom of function description box of right screen. If selecting another line, display "the line will be stored in L4" and so on.
Note: The marking number of direct line is recorded from L3, L1 and L2 are respectively expressed in X-axis and Y-axis by the system.

When selecting a circle, "the circle will be stored in C1" will be displayed in the bottom of function description box of right screen. If you select another circle, display "the circle will be stored in C2", and so on.

The marking of value V is defined with calculator function.

**Note: In the function description box of right screen, the content shown in the upper is the type and number marked by current system, for example:**

**Marking (register value)**

**V value number register=4; P value number register=5;**

**L value number register=6; C value number register=2;**

**Respectively express that Vn values register in the current system are from V1 to V4; P values from P1 to P5; L values from L1 to L6; C values from C1 to C2.**

With the definition of Pn, Ln, Cn and V value, if you meet the following prompting when making point, line and circle:

When {Pn+-*/},{Ln+-*/},{Cn+-*/},{Vn+-*/} displayed directly input Pn (n is the number of register value, n=1,2,…n) to confirm some point; Input Ln (n is the number of register value, n=1,2,…n) to confirm some direct line; Input Cn (n is the number of register value, n=1,2,…n) to confirm some circle; input Vn (n is the number of register value, n=1,2,…n) to confirm some value.

**1.2.3.10.2Calculator**

Press “calculator”, enter operation for calculating and displaying register value, display in dialogue prompting box is shown in right figure:

In which:

Look at (single) V value: look at value of Vn(n=1,2,…n) already marked;

Look at (point) P value: look at value of Pn(n=1,2,…n) already marked;

Look at (circle) C value: look at marked coordinate and radius of Cn(n=1,2,…n);

Look at (line) L value: look at marked origin coordinate and terminal coordinate of Ln(n=1,2,…n);

Calculation of expression: make algebraic operation for an expression.

For example: expression operation: 10*sin45+20*cos60-12*4 etc.

Calculation of iterative method: calculate root with iterative method of an equation.

For example: calculate the root of equation

F(y)=4*3+2*2+0.2*y+6 with iterative method, etc.

**1.2.3.10.3Auxiliary definition function of point, line and circle**

Defined function in relation with point is as follow: “pedal from point to line”.

Defined function in relation with the straight line is as follows: “tang arc and l included angle.”

You can operate according to the prompting, because the description of

the above-mentioned subsystems is very clear.

**1.2.3.10.4 Warning symbol and breakpoint symbol**

Move the mouse to warning point or breakpoint, and then press the mouse, if you need to warn and set breakpoint. Press again, the function of warning and breakpoint is cancelled.

**Note: This function is not often used during the process of the general graphic drawing.**

**1.2.3.11 Backspace**

When error operation occurs, you can return (cancel operation) with this function. This function is same as “Undo”, “Redo” or “Cancel”, “recovery” of the common software. Press “Backspace” key; enter this function, shown as right figure.

In which:

The first 4 items are used for operation of pathway; the others are used for operation of auxiliary line.

In which:

Forward space back’s function is same as “Redo” and “Recovery”

Note: The different between “a step” and “a layer” is as follows:

When you draw pathway and auxiliary line and use the function on the bottom of the screen to make operation of pathway and auxiliary line, these operations are called as “a step”. When you use the function on the right screen to make operation of pathway and auxiliary line, this operation is called as “a layer”. A layer is composed of multi-steps.

**1.3.1 Calling font library option**

**There are 2 kinds of font library in this system for calling: CAD font library and international standard numeric character library.**

**1.3.2Calling CAD Library**

Press the serial number (4), and then enter the sub-function of calling CAD library, shown as the figure.

In which:

The first 2 options correspond with the appropriate font library. If new font is not in the library, you can input the new font file with 2 functions of “self-selection font library” and “self-selection character library” for calling new font.

### 1.3.3Calling HGD library

Press the serial number (5), and then enter the sub-function of calling CAD library, shown as the right figure.

There are 6 options in this function list, these libraries are made according to GB standard.

Calling of HGD library is not same as calling of CAD library. In CAD library, you can all character string composed of several characters one time, while you can call only one character one time in HGD library, in which there are b fonts composed of 10 numbers and 26 alphabets.

Select any option, corresponding font of this operation will be shown in the graph display space, then you can directly select any character with mouse.

## 1.4 4-Axes

Graph drawing of top surface and bottom surface will be performed as following: Graph of top surface will be drawn and saved, the graph of bottom surface will be drawn and saved, then the two surface graph files will be combined with function of 4-axes. Finally, ISO-processing program (processing list) will be generated.

Press “4-axes” in the program window, following menu will be shown (figure 1.4.1):

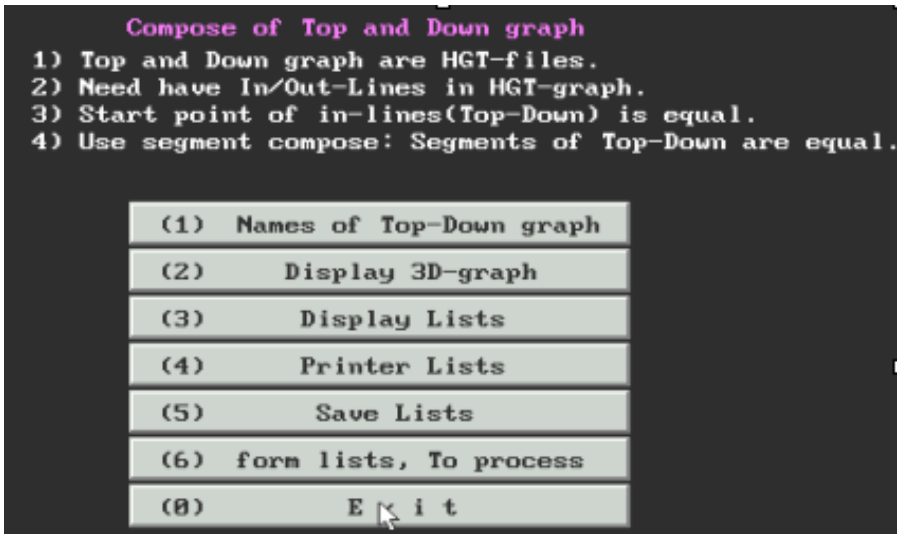



Figure1.4.1

In which:

Graph names will be given: graph files with trace of up and down surface which will be combined, workpiece thickness and integrating mode will be given.

If graph file with trace of top surface is lxw1.hgt, graph file with trace of bottom surface is lxw2.hgt, thickness workpiece is 40, then

Press this function; following prompting will be the shown in the lower part of the window (figure 1.4.2).

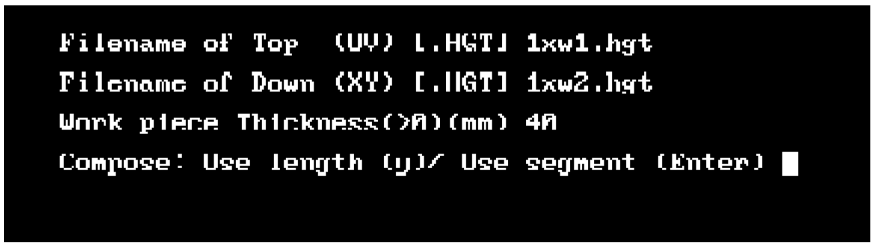



Figure1.4.2

At last, combined mode (combined by length or by section) will be chosen, then press “Return ”, surface integration will be performed.

Display stereograph: After combining of top and bottom surfaces, stereograph effect will be checked by this function.

Display processing list: After combining of top and bottom surfaces, 3B processing program combined will be checked with this function.

Print processing list: If printer is connected, processing list will be printed.

Store processing list: Processing list could be stored in a form of file in the diskette.

Generate processing file, and operate: After combining of top surface and bottom surface, and 3B-processing program have been generated with this function and operation window will pop up.

**Direction:**

**1） Trace graph of top and bottom surfaces should be drawn in the window of program mode and be stored in the diskette.**

**2） Trace graph of top and bottom surfaces should have in/out-line.**

**3） As combined according to segment, segment numbers of top and**

**bottom surfaces should be equal.**

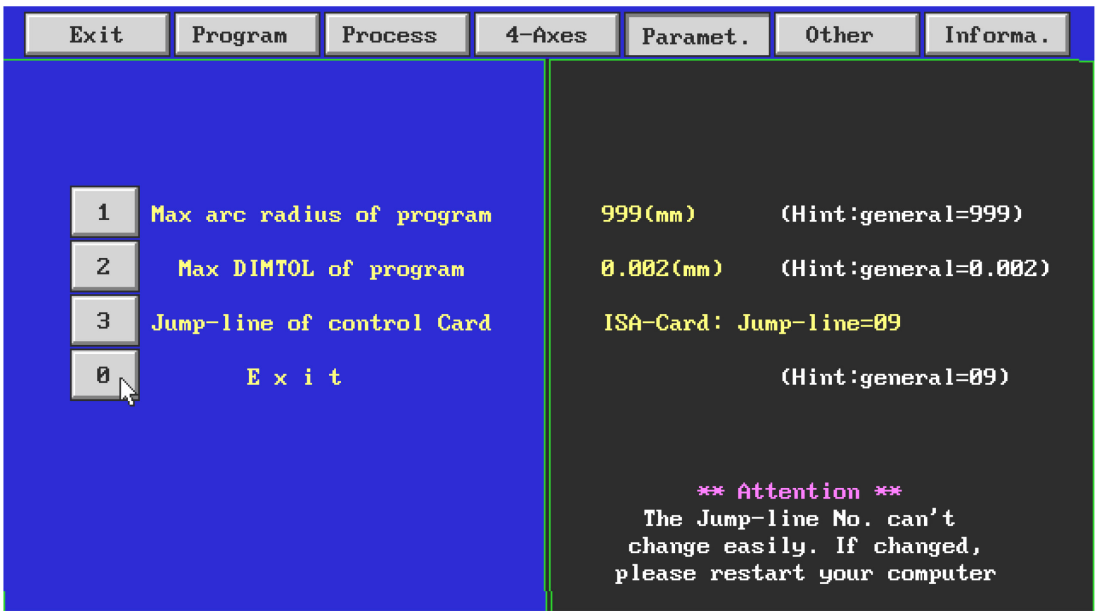
**4） As combined according to segment, system will divide segment automatically.**

**5） 4-Axes processing shouldn’t be used in leapfrog mode.**

26 1.5 Setting Parameter

Setting parameter is mainly to set up parameters in the system, and usually, parameters of system wouldn’t be randomly modified.

Click “setting parameter” in the window of program, following window will be shown as figure 1.5.




. Figure1.5.1

In which:

The biggest radius of circular arc is 999mm:

The biggest tolerance is 0.002mm.

## 1.6 Others

The function “Others” is mainly a function sub-menu with which the files would be conventionally processed (like DOS).

Click “Others” in the window of program, the following window will be shown as figure 1.6.1

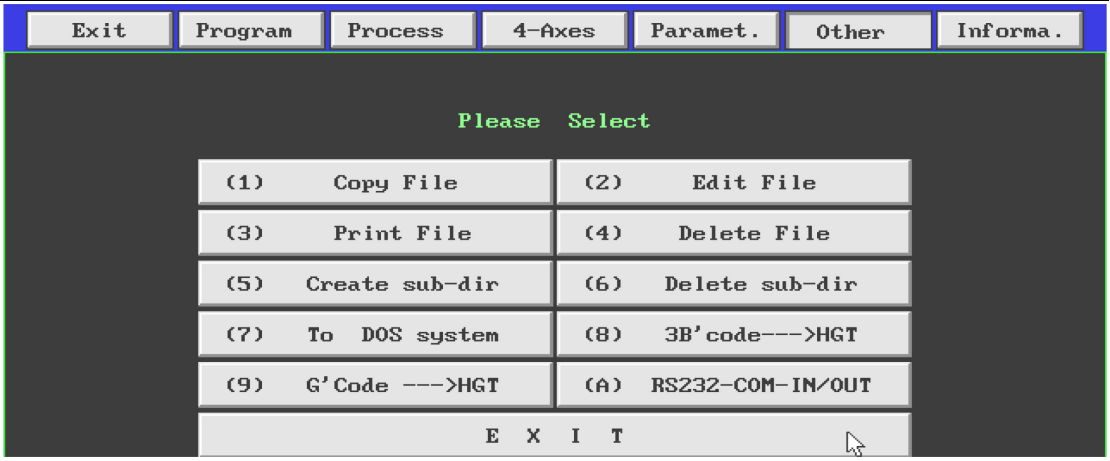



Figure1.6.1

In which:

Option ⑴,⑵…⑺ are all the contents which files will be operated in DOS.

Option ⑻—Transforming ISO processing list : In this option, ISO files in other format will be transformed into ISO files, which the system could identify.

Option ⑼—System information. Operation notice of this system and relative contents of program operation are introduced in detail.

## 1.7 Programming Example

In mode of all drawing program, there's two methods of graph drawing:

〈1〉 Drawing graph by subsidiary line;

〈2〉 Drawing graph directly by path.

In this section, programming procedure of specific graph will be introduced, such as graph drawing, editing and ISO code generating, etc. Users will grasp operation.

27 Example 1 Programming of simple graph

Procedures such as drawing of rectangle, editing and ISO processing list generating will be introduced.

**1. Drawing of rectangle**

⑴Press "program" function in the window of program, system will get in its sub-menu ;

⑵ Graph drawing will be performed directly by path, "Line: Endpoint" option of "Draw Line" modes will be chosen, indirection "Endpoint (bx, by)

{ Pn+-*/ } ?" appears;

⑶ Input (50,0) , press "return" key , the system indicates to "Endpoint (bx ,by) { Pn+-*/ } ?";

⑷ Input (50,25) , Press "Return " key , the system indicates to "Endpoint (bx ,by) { Pn+-*/ } ?";

⑸ Input (0,25) , Press "Return " key , the system indicates to "Endpoint (bx ,by) { pn+-*/ } ?";

⑹Input (0,0) , Press "Return " key , the system indicates to "Final point (bx ,by) { pn+-*/ } ?";

⑺ Press "ESC" to end the commands . A 50*25 rectangle appears on screen. Drawing is finished and window of program appears as follow.

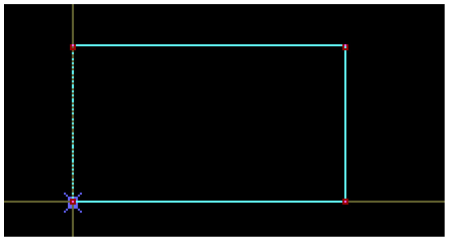


Figure1.4.2

2. Editing

⑻ Press "In/Out-line" option, system will enter the sub-menu .

⑼ Select "Point method", the system will indicates to "Start'P of In-line (Ax , Ay) ? ;"

⑽ Input (25,10) , press "Return" , the system indicates to "End'p of In-line (Bx , By) ? ;"

⑾ Input (0,10) , press "Return", the system indicates to "radius of arc (Auto-fillet)? (NO: Enter)", If not, press "Enter", and the system indicates to "direction: Yes(Mouse-R)/No(Mouse-left)" ;

⑿ Press right key of mouse to define direction of compensation, and return window of program ";

3. Generating ISO-processing list.

⑬ Press “Execute 1” option ,the system indicates to “input offset: ”;

⑭ Input 0.1 and than press “Enter” ,the system give menu of “next” processing , as following ;

⑮ Press “next” option , “Generating cone Format(y)/No cone Format (Return)” , press “Return” the following back menu will appear .

⑯ Press “⑴Display lists” ,ISO-processing list code which the system finally generate appears as following (Figure 4.7.2).

⑰ And “⑶save lists” …“⑺Others” options can also be used to operate .

28 Example 2 Programming of common graph

The following shown graph will be drawn. (figure 1.7.3)

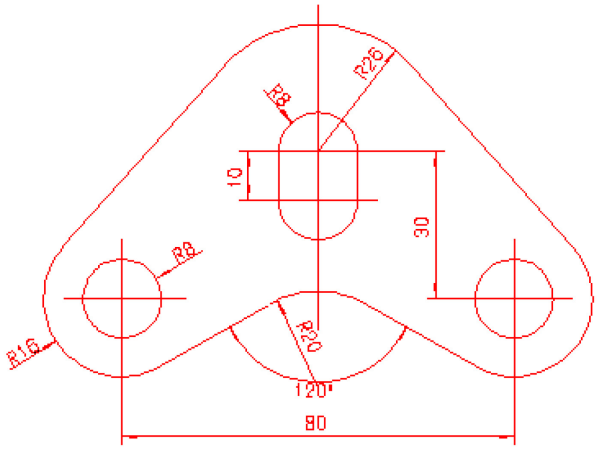



Figure 1.7.3

**1. Drawing Circle**

(1) Press “program” option in window of program, the system will enter sub-menu.

(2) The following graph are drawn by the method of drawing by subsidiary line : Select “Circle, R” of “Take aux’arc”, prompt “circle (x0,y0,r) ｛Cn+-*/｝? ”;

(3) Input(0,30,8),system prompts “circle (x0,y0,r) ｛Cn+-*/｝?”;

(4) Input(0,20,8),system prompts “circle (x0,y0,r) ｛Cn+-*/｝?”;

(5) Input(0,30,25),a circle is drawing as c1, system prompts “circle (x0,y0,r) ｛Cn+-*/｝?”;

(6) Input(-40,0,16), a circle is drawing as c2, system prompts “circle (x0,y0,r) ｛Cn+-*/｝?”;

(7) Press “ESC” to end, return the window of program.

(8) Circle is drawing directly by path: Select “Circle” option of “Take Aux’arc” function , the system prompts “Center (x0,y0,r) ｛Cn+-*/｝?”;

(9) Input(-40,0,8), system prompts “circle (x0,y0,r) ｛Cn+-*/｝?”;

(10) Input(40,0,8), the system prompts “circle (x0,y0,r) ｛Cn+-*/｝?”;

(11) Press “ESC” to end, return the window of program.

**2. Drawing Line**

(12) Straight line is drawn by the method of subsidiary line: Select “Two side parallel” option of “Take Aux’line” ,the system prompts “Line (x3,y3,x4,y4) ｛Ln+-*/｝?”;

(13) Select Y axis with left key of mouse ,the system prompts “Move distance L=｛Vn+-*/｝?”;

(14) Input 8 ,the system prompts “Line (x3,y3,x4,y4) ｛Ln+-*/｝?”;

(15) Press “ESC” to end , select “Point Angle” option of “Take Aux’line”, the system prompts “Line (x3,y3,x4,y4) ｛Ln+-*/｝?”;

(16) Select X axis with left key of mouse , the system prompts “passing point (x1,y1) ｛Pn+-*/｝?”;

(17) Input (-40,0), the system prompts “Angle (Degree) W=c”;

(18) Input 30 , a straight line contained angle 30 with X axis is done , and the line is known as L1 , then system prompts “Known Line (x3,y3,x4,y4) ｛Ln+-*/｝?”;

(19) Press “ESC” to end , Select “One side parallel” option of “Drawing Line”, the system prompts “Known Line (x3,y3,x4,y4) ｛Ln+-*/｝?”;

(20) Select Line L1 with left key of mouse, the system prompts “Take one side of parallel”;

(21) Click below under Line L1 with left key of mouse, prompt “Move distance L=｛Vn+-*/｝?”;

(22) Input 16, a line to L1 with distance 16 was down , and this line is

known as L2 , prompt “Known Line (x3,y3,x4,y4) { Ln+-*/ } ?”;

(23) Press “ESC” to end, and return to the window of program.

**3. Drawing Common Tangent**

(24) Common tangent is drawn by subsidiary line: click “Common Tange’ line ”, prompts “SNAP the first point/circle?”;

(25) Click Circle C1 with leftkey of mouse, prompt “Take the second point/Circle (common tangent)?”;

(26) Click Circle C2 with leftkey of mouse, a common tangent that twinkles in blue will be drown;

(27) Click common tangent chosen with leftkey of mouse (Assuming common tangent is L3), than click and insure with rightkey of mouse.

**4. Drawing Symmetrical Pattern**

(28) Symmetrical pattern is drawn by subsidiary line: Click “symmetry” of “Take Aux’arc”’ prompt “Circle (x0,y0,r) { Cn+-*/ } ?”;

(29) Click Circle C2 with left key of mouse, prompt “symmetrical axis (x1,y1,x2,y2) { Ln+-*/ } ?”;

(30) Click Y axis with left key of mouse, symmetrical pattern which reflects C2 about Y axis is drown, prompt “Circle (x0,y0,r) { Cn+-*/ } ?”;

(31) Press “ESC” to end, return to the window of program.

(32) Click “symmetry” option of “Take Aux’line”, prompt “Line (x3,y3,x4,y4)
{ Ln+-*/ } ?”;

(33) Select Line L2 with left key of mouse, prompt “Symmetrical axis (x1,y1,x2,y2) { Ln+-*/ } ?”;

(34) Click Y axis with left key of mouse, the line which reflects L2 about Y axis (This symmetrical line is named as L4), and prompts “Line (x3,y3,x4,y3) { Ln+-*/ } ?”;

(35) Click Line L3 with left key of mouse, prompt “Symmetrical axis (x1,y1,x2,y2) { Ln+-*/ } ?”;

(36) Click Y axis with left key of mouse, the line which reflects L3 about Y axis is drawn, prompt “Line (x3,y3,x4,y4) { Ln+-*/ } ?”;

(37) Press “ESC” to end, and return to the window of program.

5. Drawing 2 tange’ Circle

(38) Tangent Circle is drawn by subsidiary line: Click “2 tange’ Circle” option, prompt “SNAP the circle (or point or line)?”;

(39) Click Line L2 with left key of mouse, prompt “SNAP the second circle (or point or line/)?”

(40) Click Line L4 with left key of mouse, prompt “Radius r (>0)=? ｛ Vn+-*/ ｝?”;

(41) Input 20, Circle, which is tangential to Line L2 and Line L4 is drawn, and it twinkles in blue.

(42) Click tangent circle needed with left key of mouse, and insure with right key of mouse.

**6. Del Aux**

(43) In the window of program, click “Delete Subsidiary Line” option on lower of screen prompt “Position of delete (Subsidiary Line) Point/line/circle?”;

(44) Click line L1 with leftkey of mouse, line L1 is deleted.

(45) Press “ESC” to end, return to the window of program.

**7. Taking point of intersection**

（46）In the window of program, click “Ch.Inter” option on lower of screen, prompt “Position of talking point of intersection (tangent)?”;

(47) According to requirements of drawing graph, take all points of intersection for curves.

(48) Press “ESC” to end, return to the window of program.

**8. Taking path**

(49) After taking all points of intersection, click “CH.trace” option on lower of screen, prompt “Taking one point between two ends of subsidiary line?”;

(50) According to requirements of drawing graph, take paths of graph;

(51) Press “ESC” to end, return to the window of program;

**9. Arranging**

(52) After taking paths, click “Arrange” option on the right side of , select “Arranging automatically” to arrange path.

(53) Press right key of mouse and end, return to the window of program

Notice: After arranging, user could check by clicking “Display” option on lower of screen.

## 10. Editing and Generating processing list

(54) For leap-frog mode of graph, “Entrance path and exit path” would be independently entered. When processing list is generated and “Execute 1” is executed, leap-frog path will be added automatically by system, the detailed editing and process list generating methods are same as example 1.

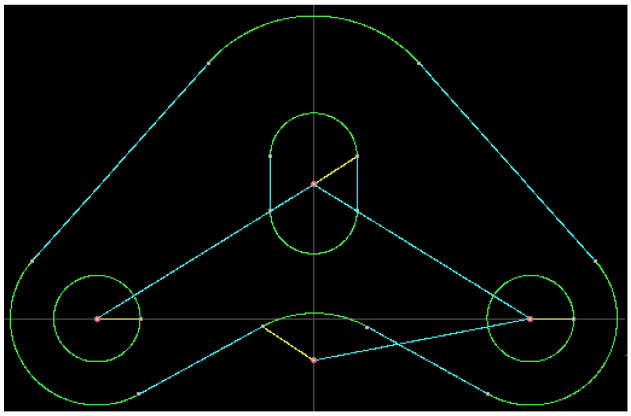


Figure1.7.4

Example 3 Drawing of Complex graph

The graph is shown as following(figure 1.7.6)

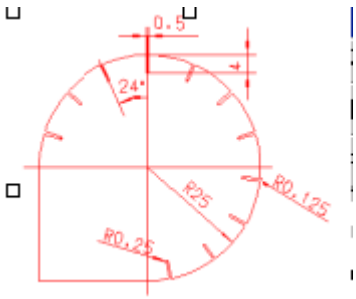



Figure1.7.6

The procedures of drawing graph is:

### 1. Drawing Circle

(1) Clicking “programming” in the window of programming, system enters sub-menu;

(2) The following graph is drawn by the method of subsidiary line: Select “Center R” of “Take Aux’arc”, prompt “Circle (xx0,y0,r) { Cn+-*/ } ?”;

(3) Input (0,0,25), a circle is drawn and named as C1, system prompts

"Circle (x0,y0,r) { Cn+-*/ } ?";

(4) Press "ESC" to end, and return to the window of program

**2. Parallel is drawn**

(5) Click "Two side parallel" of "Drawing Line", prompt "Known Line (x3,y3,x4,y4) { Ln+-*/ } ?";

(6) Click Y axis with left key of mouse, prompt "Moving Distance L= { Vn+-*/ } ?";

(7) Input 0.25, two lines are drawn, line in left of Y axis is named as L1, right of Y axis L2, prompt "Known Line (x3,y3,x4,y4) { Ln+-*/ } ?";

(8) Press "ESC" to end, click "Line with point and corner" option of "Drawing Lie", prompt "Known Line (x3,y3,x4,y4) { Ln+-*/ } ?";

(9) Select X axis with left key of mouse, prompt "Passing Point (x1,y1) { Pn+-*/ } ?";

(10) Input (0,0), system prompts "Angle (Degree) W= { Vn+-*/ } ?";

(11) Input 154, a straight line contained angle 154 with X axis is drawn, and the line is known as L3, the system prompts "Known Line (x3,y3,x4,y4) { Ln+-*/ } ?";

(12) Click Y axis with left key of mouse, prompt "Passing Point (x1,y1) { Pn+-*/ } ?";

(13) Input (0,0), prompt "Angle (Degree) W= { Vn+-*/ } ?";

(14) Input –24, a straight line contained with Y axis is drawn, and the line is known as L4, then system prompts "Line (x3,y3,x4,y4) { Ln+-*/ } ?";

(15) Press "ESC" to end, click "One side parallel" of "Drawing Line", the system prompts "Line (x3,y3,x4,y4) { Ln+-*/ } ?";

(16) Select Line L3 with left key of mouse, prompt "one side parallel ";

(17) Click above Line L3 with left key of mouse, prompt "Moving Distance L= { Vn+-*/ } ?";

(18) Input 21, a line to L1 with distance 21is drawn, and this line is named as L5, prompt "Line (x3,y3,x4,y4) { Ln+-*/ } ?";

(19) Select Line L4 with left key of mouse, prompt "one side parallel in";

(20) Click above Line L4 with left key of mouse, prompt "Move distance L= { Vn+-*/ } ?";

(21) Input 0.25, a line to L4 with distance 0.25 is drawn, and this line is named as L7, prompt "Known Line (x3,y3,x4,y3) { Ln+-*/ } ?";

(22) Click Line X axis with left key of mouse, prompt “Taking one side parallel in”;

(23) Click above Line X axis with left key of mouse, prompt “moving Distance L= { Vn+-*/ } ?”;

(24) Input 21, a line to X axis with distance 21 is drawn, and this line named as L6, prompt “Line (x3,y3,x4,y4) { Ln+-*/ } ?”;

(25) Click Line X axis with left key of mouse, prompt “one side parallel in”;

(26) Click below under Y axis with left key of mouse, prompt “Move Distance L= { Vn+-*/ } ?”;

(27) Input 25, a line to X axis with distance 25 is drawn, and this line is named as L8, prompt “Line (x3,y3,x4,y4) { Ln+-*/ } ?”;

(28) Click Line Y axis with left key of mouse, prompt “one side parallel in”;

(29) Click left side of line Y axis with left key of mouse, prompt “Move Distance L= { Vn+-*/ } ?”;

(30) Input 25, a line to Y axis with distance 25 is drawn, and this line is named as L9, prompt “Line (x3,y3,x4,y4) { Ln+-*/ } ?”;

(31) Press “ESC” to end, return to the window of program

**3. Taking point of intersection**

(32) In the window of programming, click “Ch.Inter” option on lower of screen, prompt “Take intersect point?”;

(33) Separate, take all points of intersection for Circle r1 and Line L1, r1 and L2, L1 and L6, L2 and L6, r1 and L7, L7 and L5, corresponding points of intersection: P1、P2、P3、P4、P5、P6;

(34) Press “ESC” and end, return to the window of program

**4. Taking Trace**

(35) After taking all points of intersection, in the window of programming, click “CH.Trace” option on lower of screen, prompt “(choose trace) Take any between two point of Aux”.

(36) According to groove shape, take all paths, r1,L1,L6,L2,L7.

(37) Press “ESC” and end, return to the window of program

**5. Circular arc transition**

(38) In the window of all drawing programming, click “Circularizing

/shaping", the system prompts "Clicking in the place of shape point /circular arc?";

(39) Click Point P1, prompt "Circularizing Circle R/Cutting Circle R/Shaping (100+length of cutting)/shaping (angle, length of cutting)";

(40) Input radius of transition arc: 0.125, a transition arc with 0.125 radius is drawn, and prompt "Clicking in the place of shape point /circular arc?";

(41) Following same ways, transition arc of Point P2, P3, P5 are drawn.

(42) Press "ESC" and end, return to the window of drawing program

(43) In the window of all drawing programming click "Assigned continued graph" of "Changing graph" on the right of screen, prompt "Starting point of continued graph (Ax,Ay)= { Pn+-*/ } ?";

(44) Click Start Point P3 with leftkey, prompt "Final point of continued graph (Bx,By)= { Pn+-*/ } ?", Select final point with leftkey of mouse: arc of Point P3 intersects Y axis, prompt "Taking a path of continue graph";

(45) Select a part of continue graph path where arc of Point P3 intersects Y axis.

(46) Select "Axial symmetry" option of "Changing graph", prompt "Symmetrical axis off graph (x1,y1,x2,y2) { Ln+-*/ } ?";

(47) Click Y axis with left key of mouse, graph with reflects arc path about Y-axis will be drawn.

(48) Click right key of mouse back to the window of program

**6. Eliminating Trace**

(49) In the window of programming, click "De Trace" option of lower part of screen, prompt "Take any (between two points of trace)?";

(50) According to groove shape, eliminate surplus paths, and paths between Point P1and P5 are remained.

(51) Press "ESC" to end, back to the window of program

**7. Rotating Trace**

(52) In the window of programming, click "Specified continuous graphs" option of "Changing continues", prompt "Start point (Ax, Ay)= { Pn+-*/ } ?";

(53) Click Point P1 with left key of mouse, prompt "End point (Bx, By)= { Pn+-*/ } ?", Click Point P5 with left key of mouse, prompt "Take a trace in graphs";

(54) Click any part path between P1 and P5 with left key of mouse;

(55) Click “Rotation” option of “Change continues”’ prompt “Times of Rotation [1]=?”;

(56) Input 14, prompt “Angle of rotation (if is 0, then continuous) { Vn+-*/ } ?”;

(57) Input –24, prompt “Center of rotation ((x0,y0) { Pn+-*/)?”;

(58) Input (0,0), rotating of graph is performed;

(59) With right key of mouse, back to the window of programming;

**8. Taking points of intersection again**

(60) In the programming window, click “Ch.Inter” option in the bottom of screen, prompt “Take intersect’ point?”;

(61) Separately, take all points of intersection for Line L8 and Y-axis, L9 and X-axis, L8 and L9. Corresponding points of intersection are: P7, P8, P9.

(62) Press “ESC” and return to the window of program

**9. Change block**

(63) In programming window, click “Taking Block (rectanquar)” option of “Change block” on the right of screen, prompt “input block area”;

(64) Click paths of continued graph on the lower left of circle with leftkey of mouse.

(65) Click “Remove Block” option of “Change block” to eliminate selected block.

(66) Back to the window of programming with right key of mouse.

(67) In the window of programming, click “Ch.trace” option on the bottom of screen, prompt “Take any (between two points of Aux)?”;

(68) Taking path between Point P8 and P9, P7 and P9, and all paths are taken according to drawn graph;

(69) Press “ESC” and end, back to the window of programming;

**10. Order for Trace**

(70) After taking paths, in the window of programming, click “Order for Trace” option on the right of screen. Firstly, click “Del overlap” option to eliminate repeat lines. And click “Auto Order” option to arrange path automatically.

Notice: Generally, after drawing graph paths with modes of auxiliary lines,

repeat paths will be eliminated, and then others are arranged. Finally, users can look up in “Di.Direct (Display traces’ direction)” option in bottom screen on the window of program

**11.Editing and Generating ISO processing list**

(71) The operation method of editing and generating processing list is same as Example 1, Excepts when ISO process list is generated, “Next 2” is used to perform.

29 Example 4 Drawing of top graph and down graph for 4-axes

Drawing of top graph and down graph will be performed as following (figrure 4.7.7): top graph will be drown and stored, the down graph will be drown and stored, then two graphs files will be composed with function of 4-axes. Finally,ISO process program (process list) will be generated.

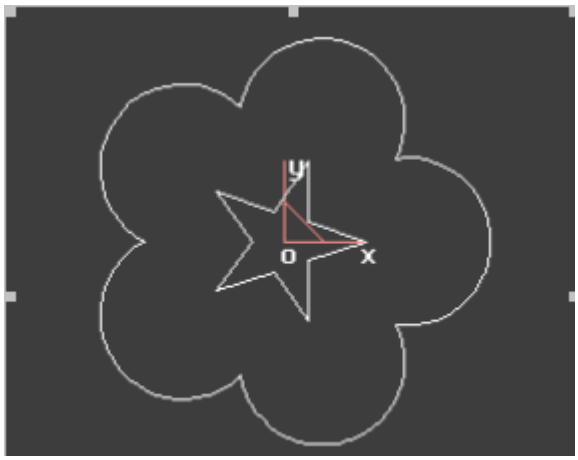



Figure1.7.7

Top graph and down graph are shown as right drawing, and top graph is winter flower, down graph is star.

The drawing procedure of graph is:

**1. Drawing top graph**

**1.1 Drawing circle**

(1) Click “programming” option of program window, sub-menu will be shown:

(2) Following graph will be drawn with auxiliary line: Click “Center R” of “Take Aux’arc”, prompt “Circle (x0,y0,r) { Cn+-*/)?”;

(3) Input (30,0,20) a circle is drawn, and is named as C1, system prompts “Circle (x0,y0,r) { Cn+-*/)?”;

(4) Press “ESC” to end, but not back to window of all drawing program.

1.2 Rotating

(5) Click “Rotate” of “Take Aux’arc”, prompt “Circle (x01,y01,r1) { Cn+-*/)?”;

(6) Click Circle C1 with left key of mouse, prompt “Rotate Center (x0,y0, { Pn+-*/)?”;

(7) Input (0,0), prompt “Rotate Angle: W (°)= { Vn+-*/)?”;

(8) Input 72, prompt “Time [1]= { Vn+-*/)?”;

(9) Input 4, prompt “Circle (x01,y01,r1) { Cn+-*/)?”;

(10) Press “ESC” to end, back to the window of all drawing program.

1.3 Taking point of intersection

(11) In the window of programming, click “CH.inter” on the bottom of screen, prompt “Take the intersect’ point?”;

(12) According to requirements of drawing graph, all points of intersection for corresponding traces will be taken.

(13) Press “ESC” to end, back to the window of all drawing program.

**1.4 Taking traces**

(14) After taking all points of intersection, in the window of all drawing program, click “CH.trace” option on the bottom of screen, prompt “[Choose trace] Take any between two points of Aux”.

(15) According to requirements of drawing graph, take all needed graph traces

(16) Press “ESC” to end, back to the window of program

**1.5 Adding In/Out-Line**

(17) Click “In/Out-Line” option, sub-menu is displayed.

(18) Click “Point method” option, prompt “Start’P of In-Lines (Ax, Ay)?;

(19) Input (0,0), Press “Enter”, prompt “End’p of In-Line (Bx, By)?”;

(20) Input (50,0), press “Enter”, the system indicates to “radius of arc (Auto-fillet)? (No: Enter)”, If not, Press “Enter”, and the system indicates to “Direction: Yes (Mouse-R)/No (Mouse-L)”.

(21) Click right key of mouse to define direction of compensation, and back to window of all drawing program.

**1.6 Save graph**

(22) Click “Trace-->[][.HGT]” of “Save”, prompt “Enter filename of trace []][.HGT]?”;

(23) Input name of file, such as LXW1, press “Return”;

(24) Press “ESC” to end, back to the window of program

## 2. Drawing Down-graph

### 2.1 Drawing Star

(1) In the window of programming, click “Clear Scr” at the bottom of screen and clear display region.

(2) Following graph are drawing by trace method: click “star” of “Draw Trace’ Lines”, prompt “Center (x0,y0) { Pn+-*/)?”;

(3) Input (0,0), prompt “Radius of circumscribed r1= { Vn+-*/)?”;

(4) Input 20, prompt “radius of Inscribed r2(can be 0) { Vn+-*/)?”;

(5) Input 0, prompt “Number of angle N= { Vn+-*/)?”;

(6) Input 5, a star is drawn, and system prompts “Center (x0,y0) { Pn+-*/)?”;

(7) Press “ESC” to end, but not back to the window of program

### 2.2 Rotate

(8) Click “Specified continuous graphs” of “Change continues”, prompt “Start point (Ax, Ay)= { Pn+-*/)?”;

(9) Click start point with left key of mouse, prompt “End point (Bx, By)= { Pn+-*/)?”; Click final point with left key of mouse, prompt “Take a trace in graphs”;

(10) Click a segment of trace with left key of mouse;

(11) Click “Rotation” of “ change continues”, prompt “Times of Rotation [1]=?”;

(12) Input 1, prompt “Angle of rotation (if is 0, then continous) Q= { Vn+-*/)?”;

(13) Input –18, prompt “Center of rotation (x0,y0) { Pn+-*/)?”;

(14) Input (0,0), Rotating of Graph will be finished.

(15) Click “Remove continuous graphs” option, original graph will be deleted.

(16) Press “ESC” to end, back to the window of all drawing program.

### 2.3 Adding In/Out-Lines

(17) Click “In/Out-Line”, sub-menu will be displayed.

(18) Click “Point Method”, prompt “Start’P of In-Lines (Ax, Ay)?”;

(19) Input (0,0), press “Enter”, prompt “End’P of In-Lines (Bx, By)?”;

(20) Input (20,0), press “Enter”’ the system prompts “Radius of Arc”, if not, press “Enter” and the system prompts “Direction: Yes (Mouse-R)/No (Mouse-L)”.

(21) Click right key of mouse to define direction of compensation, and back to window of Program

**2.4 Save**

(22) Click “Trace-->[][.HGT]” of “Save”, prompt “Enter filename of trace []][.HGT]?”;

(23) Input name of file, such as LXW2, press “Return”;

(24) Press “ESC” to end, back to the window of program

**3 Editing and Generating 3B Processing List**

(25) Click “Exit” at the bottom of the screen in “Program” window, the system return to the main menu

(26) Click “Names of Top-Down gragh” function of “4-Axes”, system prompts “Filename of Top (UV) [.HGT]”

(27) Input the filename of the trace of the top graph: “LXW1”, system prompts “Filename of Top (XY)[.HGT]”

(28) Input the filename of the trace of the bottom graph: “LXW2”, system prompts: “work piece thickness (>0)(mm)”

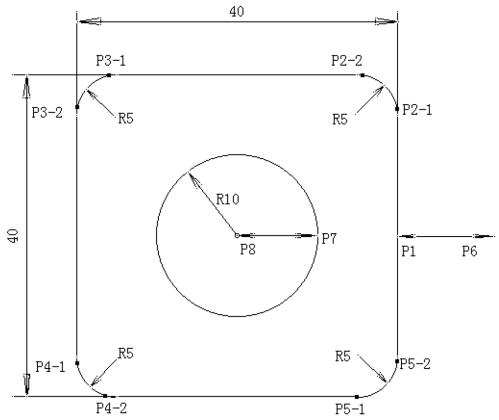
(29) Input the thickness of work piece, for example 40, system prompts: “Compose: Use Length (Y)/Use segment (Enter)”

(30) Select the first, i.e., input “y”. System will finish composing.

(31) Then you can select functions such as “(2) Display 3D-graph” “(3) Display Lists” “(5) Save Lists” and “(6) Form lists, To process”.

# Demonstration of programming

## Example one: familiarity with basic programming



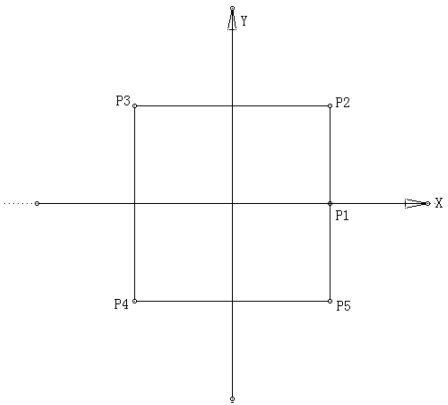

Picture 1

Note： 1． It is two close pictures

2． P1P6 and P6P1are leadin and leadout。

3． There are four circle with R5 radius at four corners

**Step 1：** work out square trochoid




Picture1-1

You can use assistant line to work out square trochoid(Or you can use 'draw line' work out square trochoid directly)

**Draw line** **two parallel line** get X axis，parallel distance 20 get Y axis，parallel distance 20

**Get point of intersection** Hit at the Intersection of four assistance line, producing four point of intersection：P2，P3，P4，P5。 And hit the intersection of P2P5 and X axis, producing P1.

**Get track** Hit the assistant line between P1-P2，P2-P3，P3-P4，P4-P5，P5-

P1, producing five trochoid to form a square.

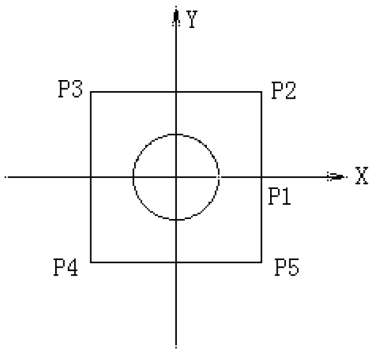
**Step 2**： work out the whole circle track

**Draw circle** **drawing circle with center and radius of the circle** input the centre of circle 0,0 radius10

**Get point of intersection** Hit the intersection of assistant circle and X axis, producing a point of intersection。

**Get track** Hit the assistant circle，produce the trochoid of the circle。

Now ,producing the figure as followed：

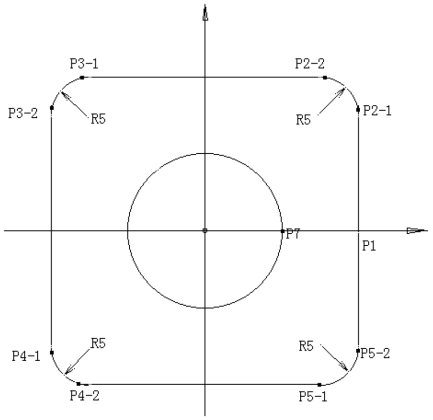



Picture 1-2

**Step 3**： Round processing the four corner of square trochoid

**Produce round corner** Hit four corner and input radius value 5。

Now ,producing the figure as followed：




Picture 1-3

**Step 4**： Draw leadin line and leadout line

**Leadin line and leadout line** **Draw downlead（End point function）**

▲The start point of square’s leadin line：Get 30,0 to form P6 点

(thread hole)。

The end point of square’s leadin line：Hit P1。

Don’t automatically trim round

According to hint(use arrowhead to ask you to select),hit the left and right key of your mouse to select the compensating direction of square

▲ The begin point of full circle leadin line, Can use：0，0 to produceP8。

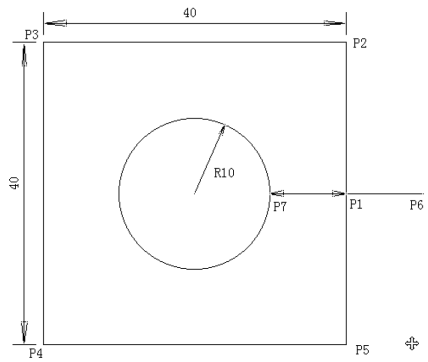
The end point of full circle leadin line,：Hit P7。

Don’t automatically trim round

According to hint，select the compensating direction of full circle。

Note：The final compensating direction and track direction can use **Show direction** to examine。Needed amend，choose **Amend compensating direction** to amend。

**Example2 ： familiarity with programming for trochoid with special character**



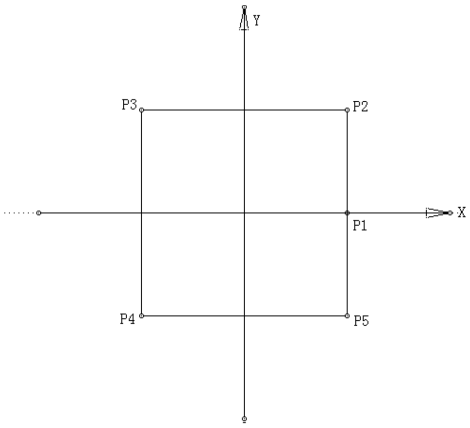

Note： 1． It is two close pictures

2． P1P6 and P6P1 is leadin and leadout。

3． P1P 7 andP 7 P1 are two track line with unswerving character

Picture 2

**Step1**：Draw square trochoid



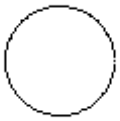

Picture 2-1

**Draw Line** **right angle oblong**

The center of oblong is 0,0； X length is 40； Y length is 40。

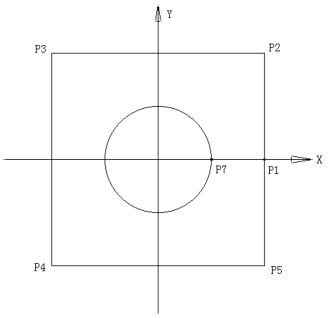
**Get the point of intersection** Hit the intersection of P2P5 and X axis， producing P1。

**Step2：Draw the full circle track**



**Draw arc** **Draw full circle**：input 0,0,10。

30 Picture 2-2



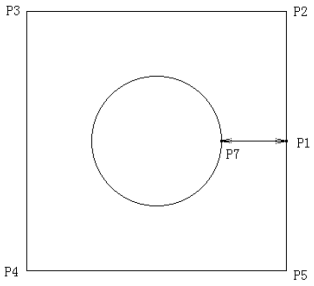

Now ,producing the figure as followed

**Step3**： Now link P1P7and P7P1, produce two trochoid with special character(unswerving compensating)

**Draw line** **Get new start point of track** Hit P1。

**Line:End point** Hit P7，（form P1P7 line）Hit P1。

Now ,producing the figure as followed：




To make P1P7 and P7P1 have the "unswerving", must:

**Change track** **prescribe impartiality** Hit two line。

Note： Now, can **show direction** ,can see the direction of trochoid is disorderly and unsystematic。

**Step4：Order trochoids according to track direction showed in picture 2**

**Order** **Steer order function**

Hit the line between P1 and P7(get the first section)

Hit P1（Get the start point of first section）

Press **[F1]**Key（finish the selection of first section）

According to hint（using arrowhead to ask you to select），Press right key of your mouse to select the direction of track

Finally, use **Show direction** to see whether the direction is right，if wrong，order again。

Note：through order，we can get：

Impartiality line—full circle—Impartiality line—square。

**Step5：**Draw leadin and leadout line

**Leadin line and leadout line** **drawing down-lead(end point method)**:

The begin point of leandin line：30,0(thread hole)。

The end point of leandin line：Hit P1。

Don't automatically trim round

According to hint（using arrowhead to ask you to select），Press right key of your mouse to select the direction of track

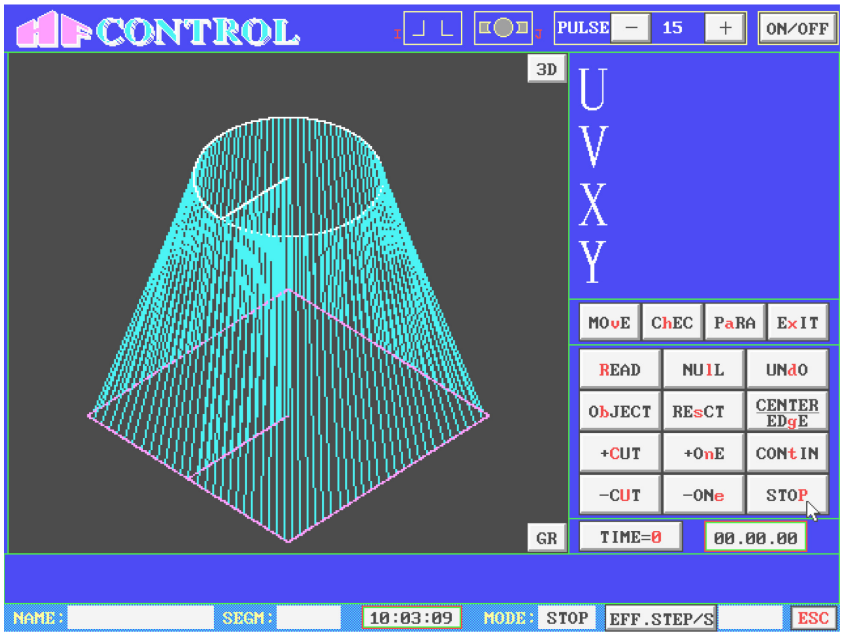
Note：Finally, use **Show direction** to see whether the direction and compensating direction are right，

If compensating direction is wrong, select **amend compensation direction** to amend.

If track direction is wrong, use **Order** to process。

# Specification of interface

To enter the machining interface, please select [machining] from main menu or select [turning machining] in full drawing programming mode.




Before machining, please prepare machining files. This system produces absolute G code. If you use no-cone mode, system produces 3B machining files.

To prepare machining file, you can use one of following methods:

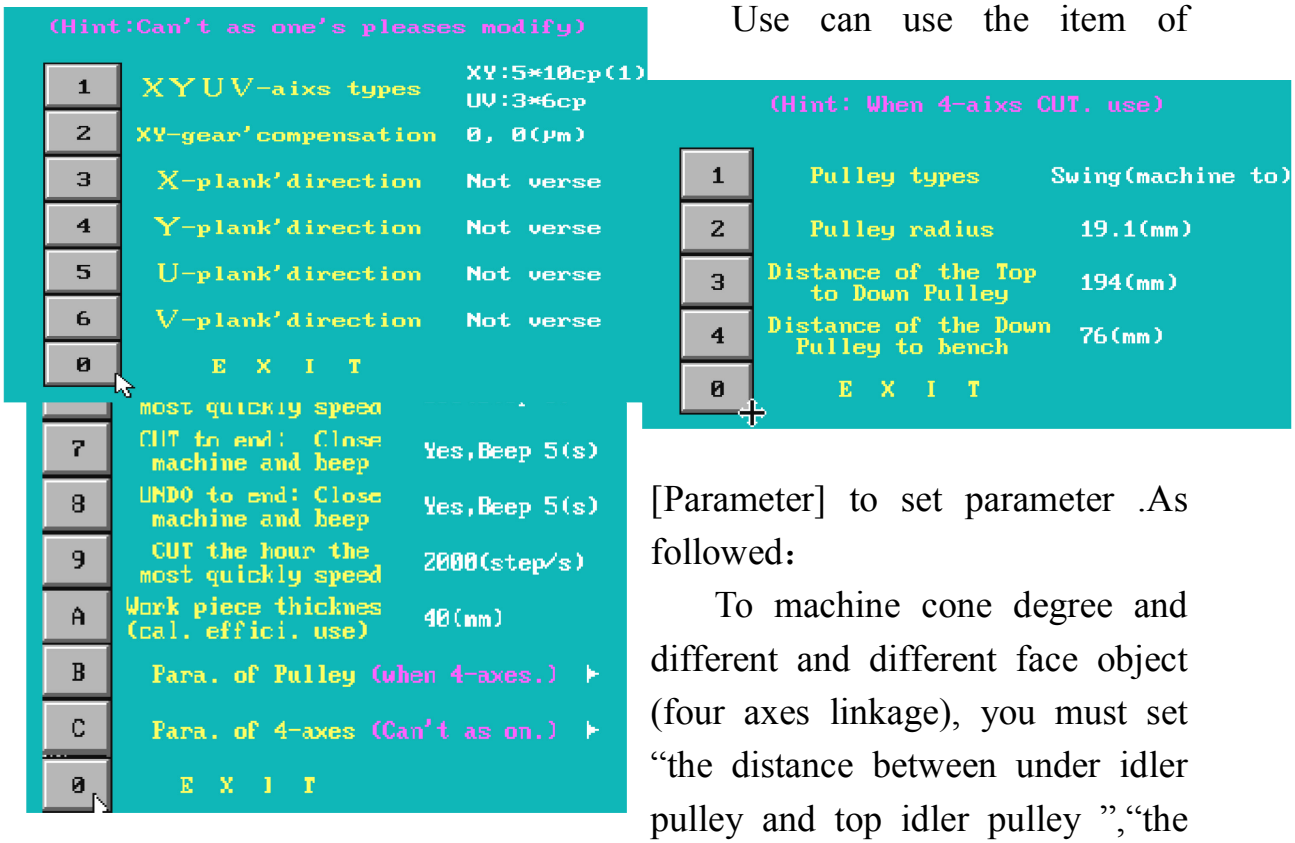
1、In [full drawing programming], please select [execution1] or [execution2] after you draw pictures. And system will enter [postposition]. Now, system will

produce no-cone G code files or cone G code file or changing cone G file. These file's suffix name is "2NC or 2 axis" , "3NC or 3 axis", "4NC or 4 axis"

2、Select [different face synthesize] from main menu，system will produce the G code file of product whose upside and downside are not in the same *face*. It's suffix file name is "4NC or 4 axis"。Of course, before [different face synthesize], you must prepare HGT picture files which is draw in full drawing programming .

Now, we have machining file. We can begin to machine. The machining menu is following:

### A、Parameter setting




Use can use the item of [Parameter] to set parameter .As followed：

To machine cone degree and different and different face object (four axes linkage), you must set "the distance between under idler pulley and top idler pulley ","the distance between under idler pulley and work desk", "radius of idler pulley" .When four axes linking, including small cone degree, system use precise calculation. It has considered that idler pulley may produce error for the X,Y,U,V axis movement trace. When machining plane, this three parameter is not used. You can set any value to them.

[short circuit testing time]： It is used to judge whether there is short circuit when machining. Usually, set it to 5—10 second.

[clean corner delay tmei]：It is set for the delay of transition between segments. It's aim is to smaller the trace error produced by electrode wire bending at the corner. It's default value is zero.

[back step]： If shorting when machining, the system will go back automatically. The step of going back is decided by this item. Manual going back also use this item.

[Speed of going back]：This item is used for both automatical and manual going back。

[empty walk speed]：When empty waling, moving axis, going to origin, finding center, finding border , the speed is decided by this item。

[Delay time for reporting when finishing incising and stopping]：The time for reporting after finishing machining. You can set it.

[The maximal speed of incision]：When machining very thick or very thin piece, because of the instability of sampling frequency, there may some unnecessary short circuit report. You can set maximal speed to solve it.

[machining thickness]：To calculate machining efficiency, you must set the thickness of machining part.

[idler pulley parameter]：This item include idler pulley type, idler pulley radius, distance between up idler pulley and under idler pulley, distance between under idler pulley and work desk. User can set them according to machine tool.

[X、Y、U、V axis type]：It must be set and set once.(Usually machine tool producer set it).

[XY axis tooth compensation]：This is an option. It is used to compensate the error when the tooth gap of machine tool's pole changes. You must measure the tooth gap; otherwise the machining precision will be weaken.

[The direction of X drags board.]、[The direction of Y drag board]、[The direction of U drag board]、[The direction of V drag board]。If a axis's direction is opposite to the desired direction, please set it(Usually machine tool producer set it)

When machining, some parameter can't be changed at will. When using [reading disk] to produce machining data, the current parameter is used. For example, when machining polyhedron, the "distance between two pulleys" is used. If you change these parameters, some mistake will be produced. When automatic machining, if you change these parameters, system will ignore these change.


**B、Moving axis**

You can manually move XY axis and UV axis. The moving distance can be automatically or manually set. As right:

To automatically set, please select "moving distance". The distance is 1.00，0.100，0.010，0.001。

To manually set， please select "automatically moving distance". The distance can be input using keyboard.

**C、Checking**

If two axis, the display is：


If four axis, the display is：


[display machining sheet]：Display G code machining sheet .If using two axis, 3B machining sheet is displayed.

[machining data ]：If using four axis, up-surface and down-surface pictures are displayed. At the same time, the parameter used by 'reading disk' and current parameter are displayed. Please make sure these parameter are consistent.

[simulation of trace]：when simulating trace, the dragging board don't move.

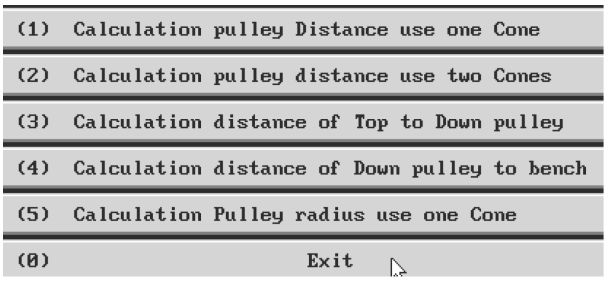
[Inspecting of coming to origin]：As usually, we define the start point of

machining as origin despite of the real picture's begin point. This definition is helpful to coming to origin inspection to close picture.

[extremum inspection]：If using four axis machining , the max. and minimum value of X,Y,U,V axis can be inspected. It's aim is to make sure that the machining bound can satisfy you workpiece.

You can see, when using four axis machining, "machining data " and "extremum inspection " is different. And UV dragging board always moves relative to XY dragging board. So the UV value is relative to XY value.

[calculating idler pulley]：System can calculate the parameter of idler pulley, as right:




The parameter of idler pulley such as the distance between up and down idler pulley, the distance between down idler pulley and working desk, radius of idler pulley can influence four axis machining and big cone degree machining . These parameter can't be measure exactly. You can using system's calculating function to calculate them.

Furthermore, according to theory analysis and experiment, we can correct the idler pulley distance by differentiation of a up small cone. The rules is as followed:

If the right is bigger than the left of the cone, you should make the distance of between the up and down idler pulley bigger. Otherwise, make the distance smaller.

If the up circle of cone is big, please make the distance between the down idler pulley and working desk smaller. Otherwise, make the distance bigger.

**D、Reading disk**

As mentioned before, to machining and incise, you must produce machining file in full drawing programming mode or in [different plane synthesize]. The file's suffix name is "2 axis /2NC","3 axis/ 3NC", "4 axis/ 4NC". Now, you can select [reading disk] to process these files. And then, you can begin to machining.

As long as you don't change these parameter in the parameter table, next

time, you needn't read disk again.

Reading the 2 axis file is quick. But, it will take longer time to read 3 axis and 4 axis file, you can see the gauge on the bottom of screen.

When the system reading disk, it can process the 3B machining sheet. The 3B machining sheet can also be produce if you use [other] in [postposition]. You can also edit it using [edit text] in [other].Of course, the system can read other 3B machining sheet producing by other software.

**E、Empty walking**

Empty walking can be divided to positive direction empty walking, reverse empty walking, positive direction single segment empty walking, reverse empty single segment walking. You can interrupt empty walking using "ESC".

**F、Moving back**

It is manually moving back as mentioned before. You can interrupt manually moving back using "ESC". The direction of manually moving back is relative to the direction of automatic incising. If the system performing positive direction incision before moving back, it will move back.

**G、Orientation**

1、Decide the jumping-off point of machining

After [reading disk] a file, system will automatic go to the jumping-off point. But, if the workpiece is machining completely, and you want to machining again, you must use [Orientation] to go to the jumping-off point. Using [Orientation], system can go to end point or a jumping-off point of a segment.

If system stop when machining, and you want to keep on machining, you needn't use [Orientation], and you can use [incision],[reverse incision], [continue] to carry on machining. [Orientation] is applicable to empty walking.

2、Decide the end point of machining

When positive direction incision, the end of machining is the reporting point or the end point of the trace.

When reverse direction incision, the end of machining is the reporting point or the begin point of the trace.

The end point of machining can be changed by the method of Orientation.

3、Make sure whether save the reporting point

The machining jumping-off point, end point, report point are displayed on screen.

**H、Going to origin**

Replace the X,Y dragging board and U,V dragging board (if four axis) to origin (0,0).You can interrupt the reposition using “ESC” key.

**I、Centering and aligning border**

HF controlling card have the circuit used for centering and aligning border. The lathe don’t need special circuit. If the clamps is insulated well, this function can be realized. There are dragging board indication when centering and aligning border. You can interrupt the centering and aligning border using “ESC”. When using this function, the distance between molybdenum wire’s beginning point and the border of workpiece must be greater than 1mm.

**J、Automatically incising**

There are six items in automatically incising. They are [incise], [single segment], [reverse incising], [single reverse], [continue],[pause]

[Incise] is positive direction incising; [single segment] is positive direction single segment incise. [Reverse incising] is reverse direction incise. [single reverse] is reverse direction single segment incise. When automatically incise, these four item can be switched.。

[Continue] mean continuing incising as last automatically incision direction.

[Pause] can stop automatically incise. When automatically incise, “ESC” can’t work.

When automatically incise, the speed is controlled by frequency conversion. The bigger frequency conversion is, the smaller speed is. The frequency conversion vary from 1 to 255. When automatically incise, the frequency conversion can be changed. Press “-” to minish the frequency conversion. Press “+” to largen it. Press the left key of mouse change the value of the frequency conversion by 1. Press the right key of mouse change

the value of the frequency conversion by 10.

When automatically incise, if the system automatically coming back because of short, you can press F5 to interrupt .

When automatically incise, you can do full drawing programming or other operation. If you select [coming back to main menu], you can select the full drawing programming or other choice.

In full drawing programming, you can enter the machining menu. If system stay in automatically machining, the trace and data are displayed on screen.

**K、Display picture**

When automatically machining, empty waling, simulating, the trace is displayed.

When automatically machining, the displayed picture can be zoomed in, zoomed out, moved. When four axis machining, you can switch between plane picture and three-dimensional picture.

**L、Others**

This system's interface is usually controlled by mouse. If you want to use hot-key, please consult [system information].

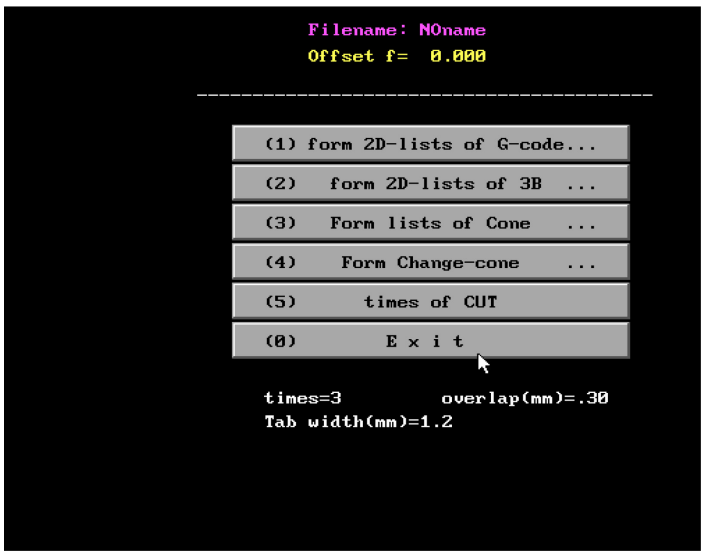
This system can correct pitch of screws.

This system can protect machining data. If power is turn off suddenly, after reboot computer, this system can recover machining data.

This system can also protect programming data.

# HF WEDM Programming and Controlling System --- Multitimescutting Explanation

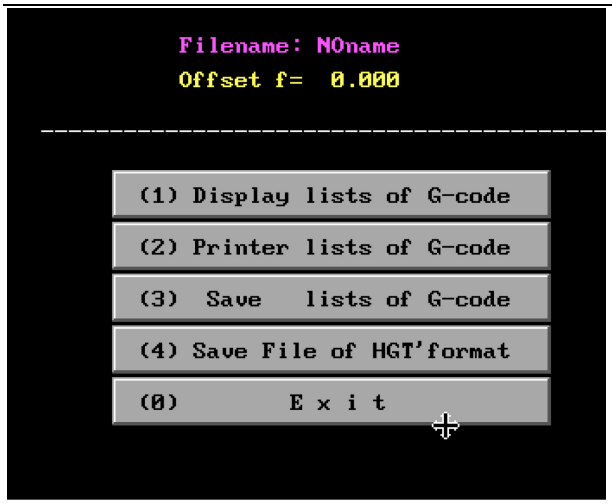
Picture 1-1 is what you will see after you choose the “next”command .




picture 1-1

**(1) form 2D-lists of G-Code:**

This Button provides some functions about G-Code.It includes :




1.Display the lists of G-Code on the screen after you save you G-Code.

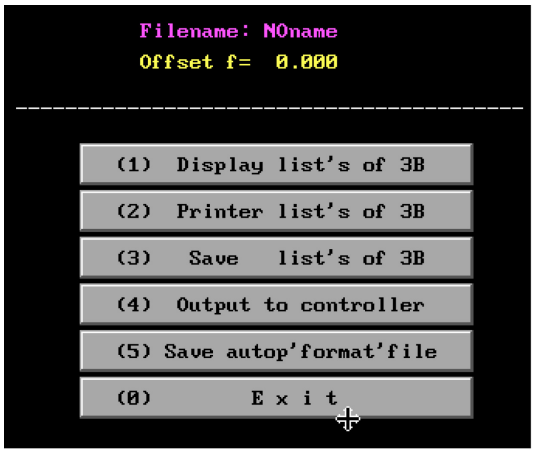
2.Print the lists of G-Code on a paper after you save your G-code.

3.Save the G-code to the hard disk

4.Save HGT'format file. It is different from "Trace→HGT" command. Because there we Take the offset into account.

**(2) form 2-D lists of 3B**

This Button provides some functions about 3B-Code.It includes :




1.Display list of 3B on the screen after you save your 3B-Code.

2.Print the list of 3B-code on a paper after you save you 3B-code.

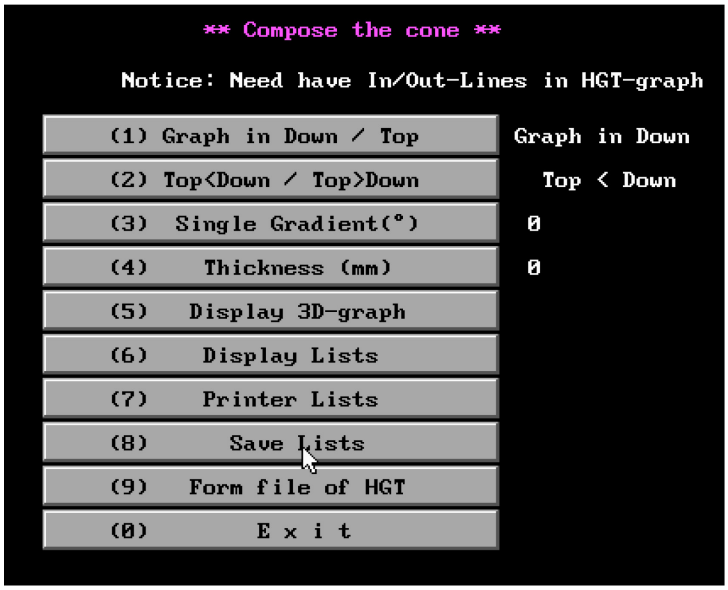
3.Save the 3B-code To the hard disk.

4.Output the 3B-Code to the specified controller that you can choose.

5.Save AUTOP'format file to the hard disk.

**(3)form list of cone**

This Button provides some functions about generial cone.It includes :




1.Graph in Down/Top .This function means that the graph paper measurement is based on the cone's top graphic measurement or the cone's down graphic measurement.

2.Choose the types of the cone,Top>down or Top<down .

3.Single gradient defines the gradient of the con,but single side gradient.

4.Thickness defines the thickness of the workpiece.

5.Display 3D Graph.This function provides the three dimensional view of your cone.

6."Display list" will print the G-code on the screen.

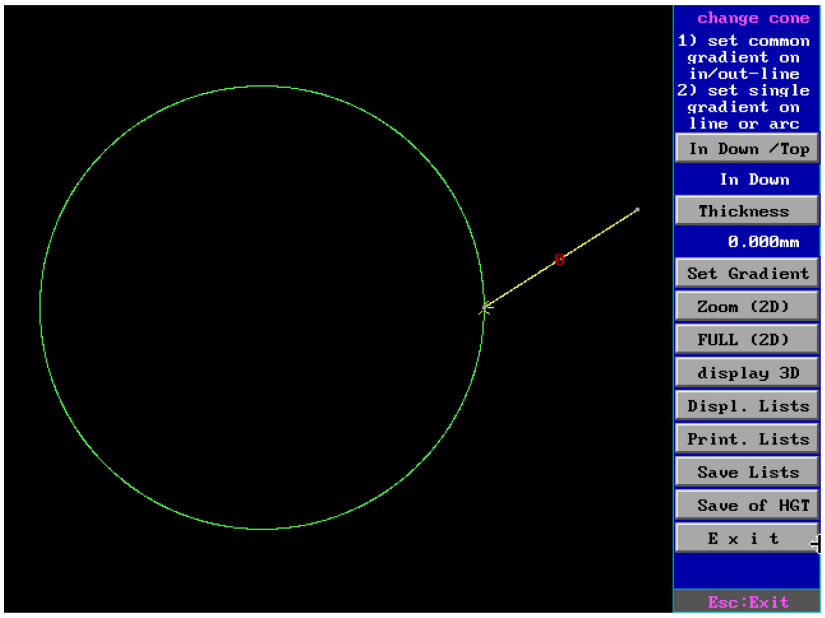
7."printer list " will print the G-code on a paper.

8."Save list" will save the G-code to the hard disk.

9."form file of HGT" will save the cone as a HGT format file.

**(4) form chang cone**

This Button provides some functions about changed gradient cone.It includes :




1.”In down /top “ is the same as “Graph in Down and top”.

2.”Thickness” is the same as previouse.

3.”Set gradient” ,there you can define your own gradient on the necessary segment .

4.”Zoom” zoom the view.

5.”full” full screen display.

6. “display 3D” ,display the 3D view.

7.”display list” ,display the G-code on the screen.

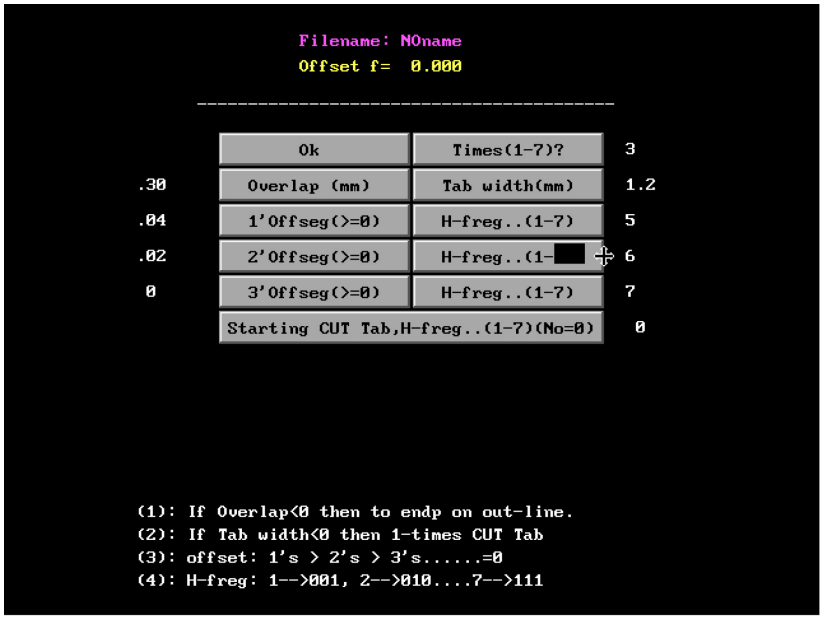
8.”print list” ,print the G-code on a paper.

9.”save list” ,save the G-Code to hard disk.

10.”save of HGT” ,save the cone as a HGT format file.

**(5) times of cut**

This Button provides some functions about Times of CUT.It includes :




The function you will get in this button is the setup of the times of cut. There are four explanations under the screen you will get. Please pay attention about them.

Nothing else is value to pay more attention except the last one.

"Starting Cut tab ,H-freg",there it provides more safer pattern to cut.For example, avoid the filament breakage.

## Solution

1. the program HF can't run

Please run the softdog Install.exe again as followed:

A) After the execution of the softdog, if the message "Install OK" appears, the softdog was installed successfully.

B)If the message "Not Install" appears, the installation is unsuccessful. Now, please make sure that the softdog and the parallel port are installed rightly.

c) If no message appear, the control card was not found. Please make sure the card is inserted rightly. You can try another ISA/PCI slot.

2. The HF programe is dead or exit automatically

If the OS is Windows98/ME, please make sure the integrality and security of OS. You can install the full Windows system.

If the OS is DOS, please make sure the integrality and security of OS. If your computer is old and the computer is not powerful, please edit the Config.sys as followed:

DEVICE=C:\DOS\HIMEM.sys

DEVICE=C:\DOS\EMM386.exe

DOS=HIGH,UMB

BUFFERS=40

FILES=30

（HF software package contain the boilerplate of Config.sys.)。

3.HF run abnormality

Please unpack FHGD-C.EXE, and select “A overlay” .And run Install.exe, reboot the computer.

Please inspect whether many HF are running. They may conflict.

4.HF controlling card not incise

1) Please inspect interrupt jumper and make sure test/work jumper accord with your work state.

2) If you use ISA card, please make sure the interrupt setting in card accord with the setting in computer(if the parameter is changed, please reboot computer.)

3) If you use ISA card, please make setting is BIOS.

Entering the PNP/PCI Configuration, change the content according to the content in controlling card

Pnp OS Installed：YES

Resources Controlled By：Manual

Rest configuration Data：Enabled

IRQ-3 assigned to: PCI/ISA Pnp

IRQ-4 assigned to: PCI/ISA Pnp

IRQ-5 assigned to: PCI/ISA Pnp

IRQ-6 assigned to: PCI/ISA Pnp

IRQ-7 assigned to: PCI/ISA Pnp

IRQ-9 assigned to: Legacy ISA (if the interrupt is set IRQ-9,the item must be set)

IRQ-10 assigned to: PCI/ISA Pnp

IRQ-11 assigned to: PCI/ISA Pnp

IRQ-12 assigned to: PCI/ISA Pnp

IRQ-14 assigned to: PCI/ISA Pnp

IRQ-15 assigned to: PCI/ISA Pnp

(If ISA controlling card's interrupt jumper is set to 9, please choose the jumper in control card. Of course, you can set the interrupt to 10-13)。

5.HFcan use which printer?

All parallel port printers are supported by HF.USB-printer are not supported.

6.How can I get the last version if I buy HF before.

Please buy a new floppy disk which contain the last HF version. You can install old software (the default directory is C:\HGD\HF). Copy new file in the flop to the directory(overlay old files),and select "A overlay installation". Run the program "Install.exe". Reboot computer.

7. Computer is contaminated with virus and HF can't run

HF software is destroyed, please install again.

8.Can't save file

Some computer is old or secondhand and it's hardware may be aging. So it don't work well. If you can't save file, please inspect whether the hard disk is damaged.

9.HF automatically exit when longtime running

Please inspect whether the computer power management is set to automatically close up the hard disk or other hardware. At the same, please inspect the screen protect is cancel. Some power management are set in BIOS.

10. Can HF software be download form HGD website?

We don't provide download of HGD series software, but we provide our longtime user with web download. User can get website by

our email. User can download software within 24 hours, after 24 hours, user must reapply.

11. Can HF automatically update from internet?

Yes. From version6.2, HF can automatically update from internet. But only special user can use this function.

12.How can HF work efficiently?

Firstly, the computer must work in good condition .The static and other factor can harm the computer. If computer is instable, the program running on it will be instable too. So you must keep the computer work stably.

Windows OS must be full and efficient, and install anti-virus software. You must update anti-virus software regularly.

Avoid other people use this computer to affect system's safety. Avoid lose data.

13. Analysis to the failure of centering

①. Arriving at border, molybdenum wire don't come back and keep going ahead Usually the molybdenum wire don't touch well with conductive block. The sampling signal line PM＋、PM－ don't link well.

②. The wire march a little and go back, but don't arrive at the border.

Workpiece and molybdenum wire short. Or the insulation between clamp and lathe bed is weakened. The load resistance of impulse power output loop is too small. (Usually the resistance must be greater than 250ohm. You can cut off the power and test it.)

Note: Between the PM＋ and PM－, there is about 0.5V DC adding between the workpiece and molybdenum wire. There must be no link between PM＋、PM－ and power supply's anode and cathode.

**HF official**

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