

NcEditor V12 Plasma Cutting CNC System

Users' Manual

4th Edition

Weihong Electronic Technology Co., Ltd.

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Preface

About This manual

This manual is intended for operators. If you use Weihong CNC system for the first time, it is suggested to read through this manual. If not, however, you can search for the desired information via the contents.

With 8 chapters, this manual can be divided into 4 parts, as follows:

- 1) Software part. See chapter 1, 2, 3 and 4. Chapter 1 summarizes all the advantageous features of NcEditor. Chapter 2 and 3 introduce the interface while chapter 4 is the menu introduction.
- 2) Machine debugging part, including chapter 5. It introduces the CNC system installation and ports wiring.
- 3) Advantageous function part, referring to chapter 6. This part focuses on the advantageous functions, including screw error compensation, leapfrog etc.
- 4) Appendix part, including chapter 7 and 8. The former lists all the system parameters, shortcut keys while the latter is the software license agreement.

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Revision History

You can refer to the following table for the revision records of each edition.

Date	Edition	Revision
2016.02	R4	Contact information updated.
2015.11	R3	<ol style="list-style-type: none"> 1. Updating chapter 4, including nest, parameter backup; 2. Replacing all the old screenshots; 3. Updating chapter 7.2 the terminal board wiring; 4. Updating the parameter list; 5. Other revisions.

Precautions

Precautions can be divided into caution and warning according to the degree of possible loss or injury in case of negligence or omission of precautions stipulated in this manual.



: general info, mainly for informing, such as supplementary instructions and conditions to enable a function. In case of negligence or omission of this kind of precautions, you may not activate a function. Note that in some circumstances, negligence or omission of this kind of precautions could cause physical injury or machine damage.



: warning info requiring special attention. In case of negligence or omission of this kind of precautions, you may suffer physical injury, or even death, machine damage or other losses.

WARNING

1) Precautions Related to Storage and Transportation

- The products should be transported properly in terms of the weight;
- An excess of specified quantity of stacking products is prohibited;
- Climbing, standing or placing heavy loads on the products is prohibited;
- Dragging or carrying the products via cables or devices connected to them is prohibited;

2) Precautions Related to Installation

- Only when this equipment installed in the qualified electricity cabinet can it be used. The construction of the cabinet must reach IP54 grade of protection;
- Paste sealing strips on the joint of the cabinet to seal all the cracks;
- Cable entry should be sealed while easy-to-open on the spot;
- A fan or heat exchanger should be adopted for the heat dissipation and air convection of the cabinet;
- If a fan is adopted, air strainer is a must in air inlet or air outlet;
- Dust or cutting fluids may have access to the CNC device via the tiny cracks and tuyere. Therefore it is necessary to pay attention to the surroundings and air flow direction of the air vent to make sure that the outflow gas is towards pollution source;

 **WARNING**

- 100 mm space should be preserved between the back of the CNC device and the cabinet wall for plugging cable connected with the device and the ventilation & heat dissipation in the cabinet;
- Space between this device and other equipment should also be preserved according to the requirements;
- The product should be installed firmly and without vibration. During installing, casting, knocking, striking, or loading on the product is forbidden;
- To reduce electromagnetic interference, power-supply components used should be above AC or DC 50V and the space between cable and CNC device should be preserved above 100mm;
- It will be better if CNC device is installed at a position facilitating debugging and maintenance.

3) Precautions Related to Wiring

- Only qualified people are allowed to participate in the wiring and checking;
- The CNC device should be grounded reliably and grounding resistance should be less than 4 ohm. Neutral line is absolutely not allowed to replace earth wire. Otherwise, it may result in malfunction of the device due to the interference;
- Wiring should be firm and steady, or mis-operation may occur;
- Voltage values and positive & negative polarity of any connection plug should be in accordance with specifications set forth in the manual, or it may result in breakdowns such as short circuit and permanent damage to the device;
- To guard against electric shock or CNC device damage, fingers should keep dry before plugging or touching switch;
- The connecting wire should not be damaged and squeezed, or the leakage or short circuit may occur;
- It is prohibited to plug or open the chassis of CNC device when power on.

4) Precautions Related to Running & Debugging

- Parameters setting should be checked before running, since wrong setting may lead to accidental movements;
- Modification to parameters should be within the allowable range, or such breakdowns as unsteady running and machine damage will occur.

5) Precautions in Use

- Before power-on, please make sure that the switch is on blackout to avoid occasional start-up;

 **WARNING**

- Please check the electromagnetic compatibility during electrical design in order to avoid or reduce electromagnetic interference to the CNC device. A low pass filter should be employed to reduce electromagnetic interference if there are other electrical devices nearby;
- It is not allowed to frequently power on and power off. It is recommended to power up the machine again at least one (1) minute later after power failure or blackout.

 **CAUTION****1) Precautions Related to Product and Manual**

- Matters related to restrictions and functions available stipulated in the manuals issued by the machine manufacturer are prior to those in this manual;
- This manual assumes all the optional functions are available, which you must confirm through manuals issued by the machine manufacturer;
- Please refer to manuals issued by the machine manufacturer for the instructions of machine tools;
- Functions, and software interfaces vary with the system and the version of software. Before using the system, you must confirm the specifications.

2) Precautions When Opening the Package

- Please make sure that the products are what you have ordered;
- Check if the products are damaged in transit;
- Check if the components and accessories are damaged or missing in terms of the detailed list;
- Please contact us promptly if product discrepancy, accessory missing or transit damage occurs.

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1. Features of NcEditor

1.1. Graph Editing Features

- Designed for planar cutting, editing planar pictures and outputting data of planar machining objects;
- Supporting the basic element creation of machining objects, including points, lines, polylines, rectangles, circles, ellipses, arcs, etc;
- Supporting view change function, including translation, zooming in, zooming out and fit to window;
- Supporting feature point catch function, such as catch of endpoint and midpoint of a straight line, catch of center and quadrant point of a circle;
- Supporting mouse dragging edit of nodes to adjust the size of an object;
- Supporting displaying and modification of object attribute;
- Supporting inserting and editing a file of other format into currently loaded file.

1.2. Graph Manipulation Features

- Supporting object change function, including translation, rotation, mirror image, zoom, combination and break-up of objects;
- Supporting view grid and ruler displaying function;
- Supporting grid catch function;
- Supporting multi-object alignment, including “align right”, “align left”, “align top”, “align bottom”, “align vertical midline”, “align horizontal midline”, “align center point”, “distribute horizontally”, and “distribute vertically”;
- Supporting object selection;
- Supporting mouse dragging an object;
- Supporting saving part of objects in currently loaded file as another processing file;
- Supporting undo and redo functions, which can undo or redo 64 previous operations sequentially;
- Supporting basic editing functions: copy, cut and paste;
- Supporting preview of an processing file and combination of objects;
- Supporting auto combination and deleting points when importing a file.

1.3. Technology Setting Features

- Supporting auto and manual bridge contact addition function;
- Supporting kerf compensation function;
- Supporting manually and auto setting lead-in/out line;
- Supporting closed detection, self-cross detection, intersection detection and overlap detection to check whether a path is good;
- Supporting intelligent direction setting of objects;
- Supporting display options of various auxiliary drawing lines.

1.4. Processing Features

- Supporting direct processing and mating with NcStudio;
- Supporting intersectional cutting and tilted cutting of round tube;
- Supporting processing condition setting for a single object, distinguished by color, and parameters setting;
- Supporting auto sorting according to start point & end point and manual sorting, which can optimize cutting jobs that require thoroughness;
- Supporting display of machining object type and display & modification of object name;
- Supporting analog machining function;
- Supporting editing of ports and delay in a layer;
- Supporting load and transformation of ENG files, G code files, DXF files and PLT files;
- Supporting origin mark, which can be reset and adjusted, and after file loaded, the origin can be set as the start point of machining;

1.5. Info Display Features

- Chinese-English switchover;
- Supporting view window showed in proportion;
- On-line running report and alarm info are showed in real time;
- Displaying machining speed, track G00 time, cutting time, machining file name and machining progress bar.

2. Software Interface

The main interface of NcEditor encompasses “Title Bar”, “Menu Bar”, “Toolbar”, “Drawing Toolbar”, “Status Bar”, “Object Editor Space”, “Machine Control Bar” and “Ruler Bar”, as shown in Fig. 2-1.

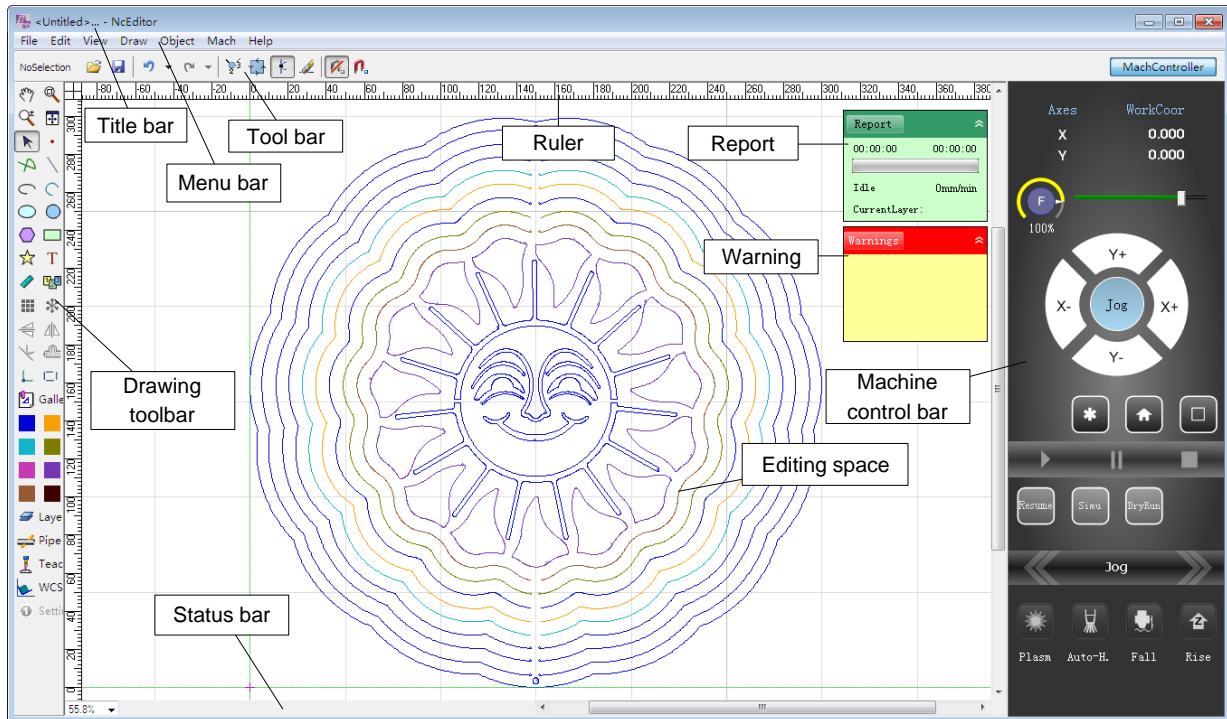


Fig. 2-1 Main interface

2.1. Drawing Toolbar

In Drawing toolbar, there are drawing tools (dot, straight line, circle, polyline, rectangle, etc.), graph manipulation bar (array, mirror, add bridge, lead-in/out line, kerf compensation, etc.) and layer manager, some of which have their counterparts under [Object] menu.

2.2. Editing Space

Object Editor Space corresponds to the range of worktable stroke. During machining, machining objects must be within the range of worktable stroke, or machining fails.

2.3. Report

In Report, elapsed machining time and total machining time are displayed; current system state is displayed: running or idle; current machining speed and layer can also be learned in real time.

Clicking on “Report” will eject a dialog displaying statistical information of machining. On the Running column, information of currently being processed file is displayed, ranging from file name, start time, cutting length to G00 time. The information of completed files is displayed below the Running column. To charge for a machining file, after machining finishes, select the file and click the “Charging” button to calculate the machining fees in terms of the holes cut and total cut length. See Fig. 2-2. After entering unit price of holes and cut length, click “Calculate” to automatically count the total fees.

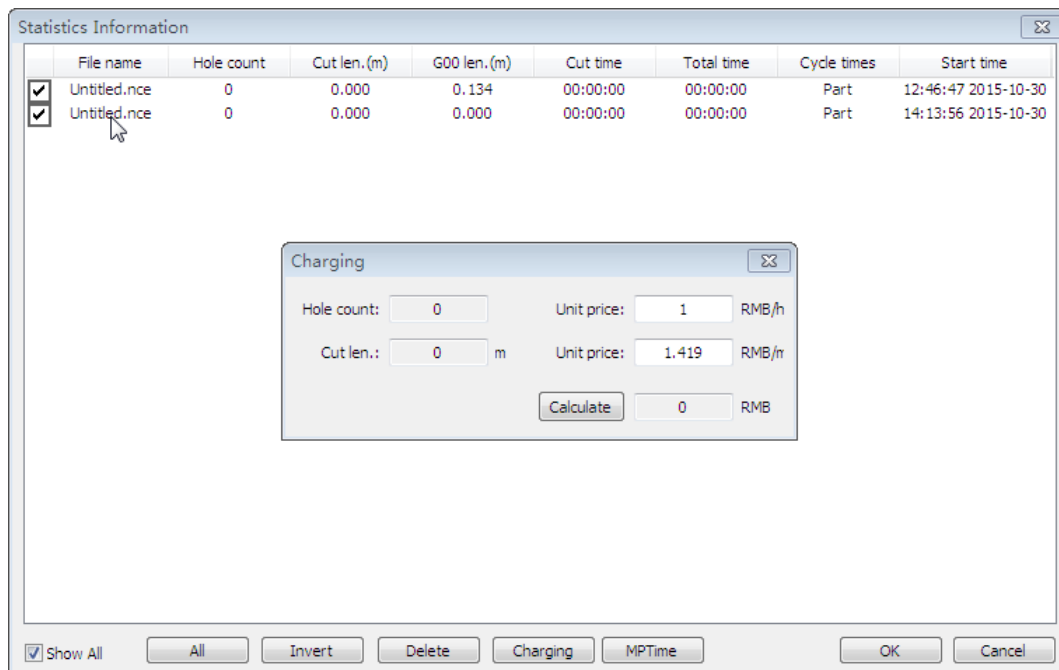


Fig. 2-2 Statistical information of machining

2.4. Warnings

In Warnings, error message and warnings are displayed.

Error message mainly relates with errors that prevent the software from running, such as E-stop alarm, limit alarm, file error, software error, etc.

Warning information mainly prompts information that the user needs to be aware of; for example, if a port is operated without being configured, corresponding warning will be shown in Warnings.

2.5. Status Bar

Status bar is at the bottom of NcEditor, as shown below:



Generally, it displays the info of current object, such as steps and meanings to draw an object, whether current operation is successful or not.

3. Machine Control Bar

The interface of machine control bar is as shown in Fig. 3-1. When the cursor is on a button, the software will prompt the button function accordingly.



Fig. 3-1 Machine control bar

3.1. Coordinate Display Area



As it displays current workpiece coordinates or machine coordinates of each axis.

Double clicking “WorkCoor” (“MachCoor”) will shift to display current machine coordinates (workpiece coordinates), so will clicking on pull-down arrow on the right side of “WorkCoor” (“MachCoor”).

3.2. Manual Settings Area

The operation interface of manual settings is as shown below:

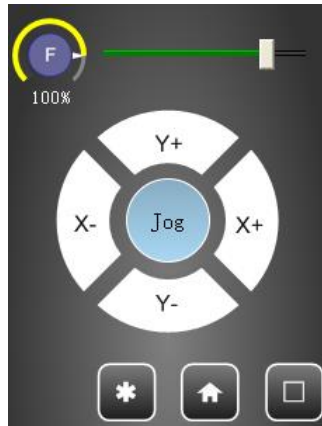


Fig. 3-2 Manual settings interface

◆ **[Feedrate Override]**



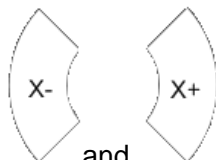
As , feed rate is controlled by adjusting current feedrate override.

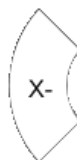
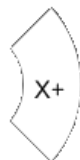
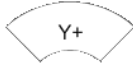
The formula is:

$$\text{Current feed rate} = \text{Current feedrate override} \times \text{Rated feed value}$$

The least unit of feedrate override scale is 1%. Current feedrate override is displayed beneath “F”. Three ways can be used to revise the feedrate override: click on the sliding axle; drag the slide block; click the slide block to choose it, then press [PageUp], [PageDown] key; when [PageUp] or [PageDown] key is pressed once, the feedrate override decreases (or increases) by 20%. The range of feedrate override is 0% ~ 120%.


◆ **[Manual Operation]**



As  and , they are manual buttons of X axis, corresponding to negative and positive motion direction of X axis, with shortcut keys as 4 and 6 on the keyboard; as  and




, they are manual buttons of Y axis, corresponding to positive and negative motion direction of Y axis, with shortcut keys as 8 and 2 on the keyboard.

Jog mode and incremental step mode can be switched by .

Under Jog mode, an axis manual button plus number key 0 can be used to switch between jog speed and rapid jog speed. For example, current rapid jog speed is 1800mm/min, and jog speed 1200mm/min. Pressing down number key 6, current speed will be 1200mm/min; at the same time, pressing down number key 0, current speed will be 1800mm/min; releasing number key 0, current speed will be changed to 1200mm/min.


Under incremental step mode, step length can be customized, and the corresponding axis will move the custom step length with each press of X or Y axis manual button. The lower limit of customized step is 0.01mm; when the set value is smaller than 0.01mm, the system will take 0.01mm instead automatically.

◆ [Set WorkOrg (F5)]


As , clicking this button will set current coordinates as workpiece origin.

Generally the start point of workpiece machining, workpiece origin is set for the sake of workpiece dimension programming. It is fixed relative to a certain point on workpiece, while floating relative to machine origin (home).

◆ [BackWorkOrg (F6)]

As , clicking this button will make spindle back to workpiece origin automatically from current position.

◆ [Frame Check (F7)]

As , after load of a machine file, clicking this button will make the system move around along the circumscribed rectangle of machining file to decide the machining range. This operation is optional.


3.3. Machining Operation Area

The machining operation interface is as shown in Fig. 3-3:



Fig. 3-3 The interface to run a program


◆ [Start (F9)]

As , if there is no loaded processing file, the button is disabled; if a processing file is loaded, the button is enabled. After the button is clicked, the system will start machining automatically from the first line of the loaded processing file.


The button has two functions:

- If a certain processing procedure has been loaded, homing has been finished, and the system is in "Idle" state, by pressing the button, the machine tool will carry out the procedure automatically from the first line. Once machining starts, the system enters into "Running" state.
- If the system is under "Auto|Pausing" state, by clicking the button, the system will resume machining from the suspended position automatically and enter into "Running" state.


◆ [Pause (F10)]

As , after this "Pause" button is clicked, the machine tool will suspend machining and lift its gun, and then enter into pausing state. So as to continue machining, press [Start] button or select the relative menu item.

◆ [Stop (F11)]

As , this button is valid during machining. Clicking this button will make the machine tool stop working and enter into idle state. This is the normal way to stop machining during machining process.

◆ [Resume]

As , after this button is clicked, the system will resume machining from the last stop position automatically.

In case of E-stop, power failure, or clicking "Stop" button during machining, the user can press this button to make the machine tool rapidly resume machining from breakpoint if the accuracy of workpiece coordinate is ensured. If the accuracy of workpiece coordinate can not be ensured, the user needs to home all axes before clicking this button to resume machining.




The software saves the machining info every 5s. If power failure occurs before the software saves the machining info, after re-powered, the software will return to the last saved position after this function is used, i.e. the machine tool will retract a little distance before continuing machining.

If this function is used not after power failure in machining, machining will be continued from the exact breakpoint.

◆ [Simu]




As , if a program is loaded and the system is in “Idle” state, clicking this button will make the system start rapid simulation from the first line of program automatically.

Under simulation mode, the system will not drive the machine tool to do the relative machinery and electric actions, but only show the machining path at a rapid speed in the [Object Editor Space].


◆ [DryRun]



As , in dry run mode, except for not cutting the workpiece, the machine tool will start working as in actual machining under the running of a machining program.

◆ [Go Forward & Backward (F4, F3)]



As , this button is used for forward motion or reverse motion during machining. If the user wants to go back to a previous machining position, selecting “Go Backward”, i.e. the left arrow, will make the system reverse along the original path.

The user can set the distance of forward motion or reverse motion according to his own needs. After setting, clicking “Go Forward” or “Go Backward” will move the corresponding distance.

After the cursor is moved onto this button, a little double-arrow will appear. Clicking on this double-arrow can change to “Jog” or “Specify Distance”. If “Jog” is switched to, clicking on “Go Forward” (“Go Backward”) and holding down the mouse will make the plasma head keep forwarding (reversing) till the mouse is loosed. If “Specify Distance” is switched to, forward (reverse) distance can be user-defined by clicking on the original distance and entering a new distance. After the distance is changed, each time clicking on “Go Forward” or “Go Backward” will make the plasma head forward (reverse) the set distance.

3.4. Process Control Area


The operation interface of process control is as shown in Fig. 3-4.



Fig. 3-4 Operation interface of process control


◆ [Plasm]



After the  button is clicked, the system will send an arc striking signal which will be opened automatically when machining starts. After striking, normal machining can be started.


◆ [Auto-H.]



After  is clicked, the system will open auto height gauge and adjust the distance between cutter head and the part.


◆ [Fall]



After  is clicked, the system will send a signal of falling and the cutter will descend automatically. Clicking it again stops it from falling.

◆ [Rise]



After  is clicked, the system will send a signal of rising and the cutter will lift up automatically. Clicking it again stops it from rising.

4. Menu Functions

NcEditor includes such menus as file menu, edit menu, view menu, draw menu, object menu, mach menu and help menu, which will be introduced separately as follows.

4.1. File Menu

File menu comprises various operation commands related to machining files, such as [New], [Open], [Import File], etc, as follows:

◆ **[New (Ctrl + N)]**

Used for creating a new NcEditor file (.nce).

◆ **[Open (Ctrl + O)]**

The menu item is used for opening a NCE file generated by our system and loading it into the program interpolation buffer zone of the system. Then the parsing engine will parse buffered data into instructions, and transfer these instructions to CNC card.

◆ **[Import File (Ctrl + I)]**

This menu item is used to open files of all other formats supported by the system, like .G, .NC, .DXF, .ENG, .PLT. This function will overwrite all previously loaded files and perform auto combination and deleting points for the currently loaded file. After this menu item is selected, an [Open] dialog will pop up, as shown in Fig. 4-1. Select a machining file, and then check [Preview] to preview the file in this dialog. Pressing "Open" will load the file automatically; the file name will appear on the title bar, which is clear at a glance.

If files of unsupported format are opened, warning box "File error" will pop up.

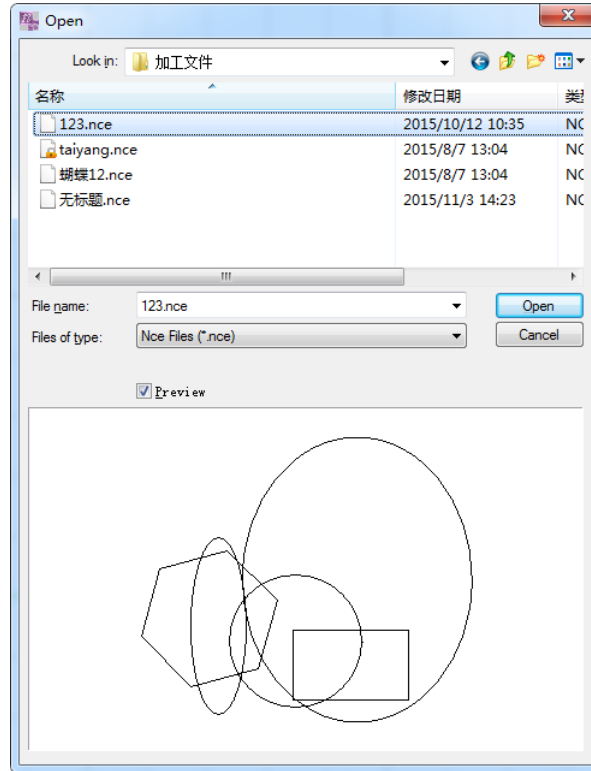


Fig. 4-1 Open dialog

◆ [Insert File]

The function of this menu item is to add machining objects of a supported format file to the loaded file, instead of overwriting the loaded file.

◆ [Nest]

This function is used to nest parts. Clicking it will eject the dialog box shown as below:

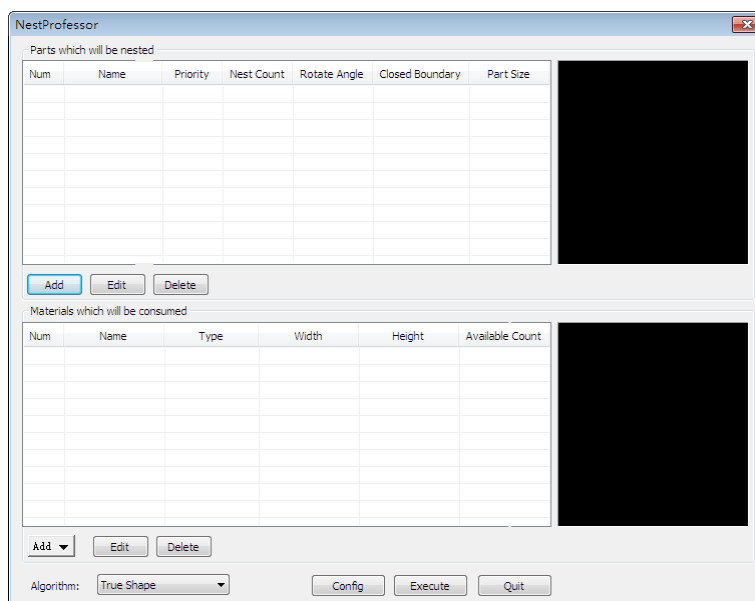


Fig. 4-2 Nest dialog box

Users can click [Add] in the [Parts which will be nested] section to select the parts to be nested. The system supports nce.format, dxf.format and dwg.format. After the parts are loaded, the parts nesting illustration will be displayed on the right side. And users can press [Edit] to edit priority, rotate angle and nest count.

- Priority: set the priority of the parts arrangement. The smaller the number is, the higher the priority will be. In case of insufficient materials, the system will nest those parts that have higher priority first.
- Rotate angle: set the parts rotary angle.
- Nest count: set the number of the parts to be nested.

As to adding materials, the system provides two methods, including make new materials and import materials. [New] clicked, users can custom the name, width, height and number of the material. And through [Import], users can load dxf and dwg format material from local.

Nest algorithm consists of “remnant rectangle” and “true shape”. “Remnant rectangle” is mainly used in nesting regular figures such as rectangle while “true shape”, which boasts high efficiency in using material, focuses on irregular figures and applies to special parts with small number.

After [Config] is clicked, a dialog box as below will pop up. Users can set nest border, part space, start corner and nest direction here.

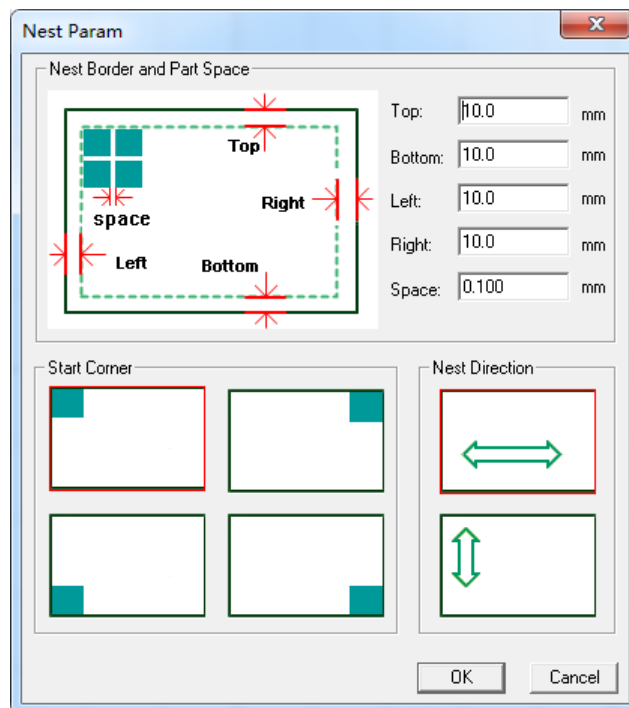


Fig. 4-3 Nest parameter dialog box

After the parameters are set, click [OK] and then click [Execute] to enable the function.



The material size should be larger than that of the parts, or the nest will fail without any nested parts.

After a click on [View sheet], a nest sketch will appear as shown in Fig. 4-5.

Clicking [Save sheet], users can save the nested parts to the local file folder in dxf or nce format;

[Remnant] clicked, a dialog box as Fig. 4-6 ejects. Remnant refers to the remaining part of the nested materials and users can click [Save As Dxf] to save it.

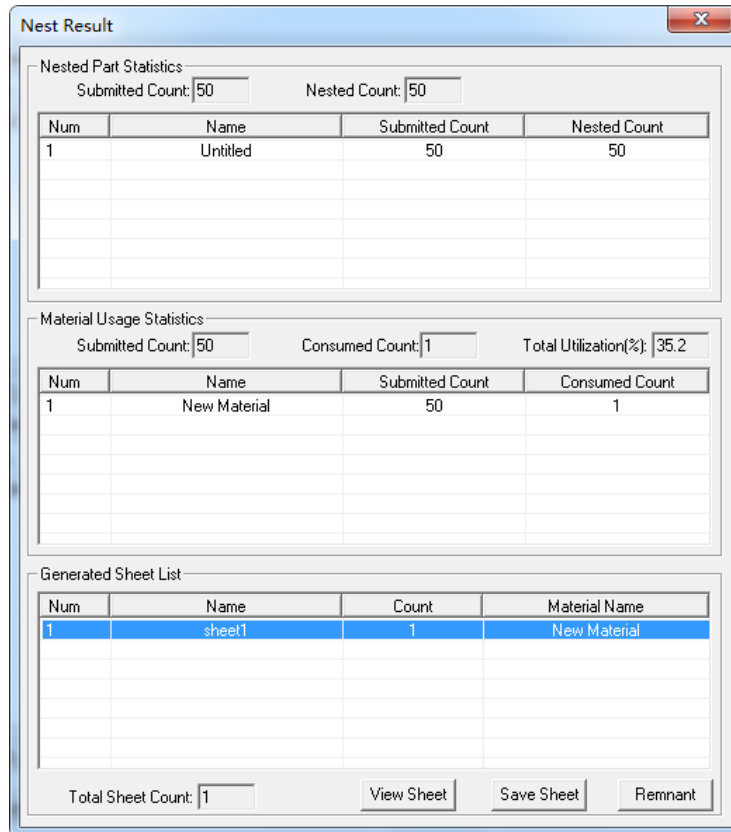


Fig. 4-4 Nesting result

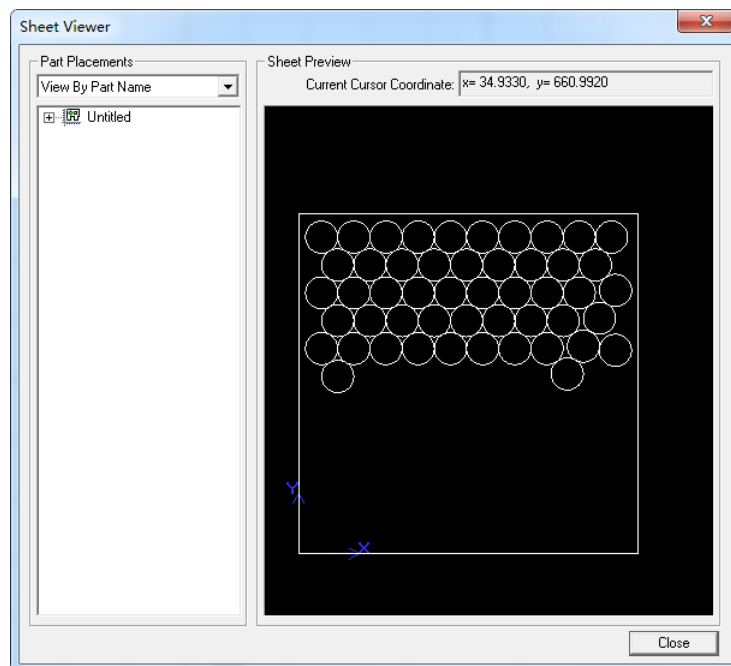


Fig. 4-5 View sheet

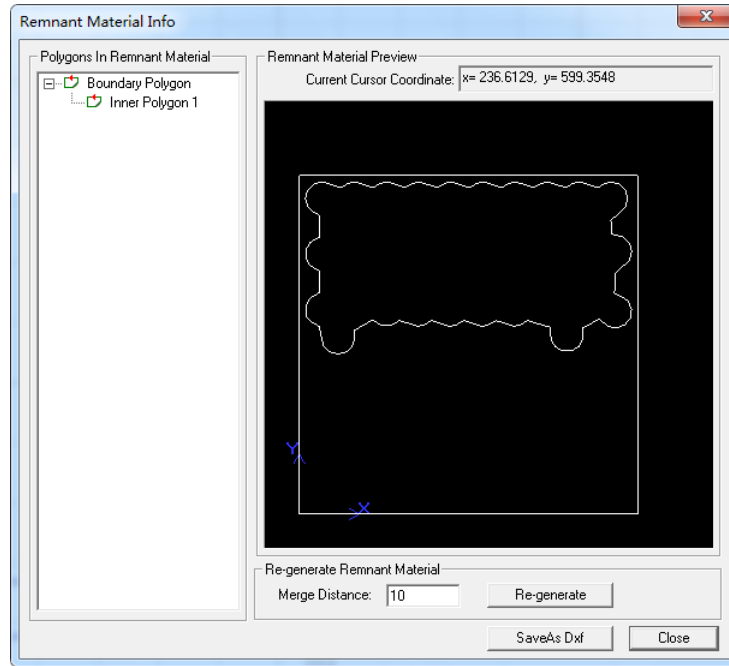


Fig. 4-6 Generate remnant

◆ **[Save (Ctrl + S)]**

Its main function is to save the file currently edited.

◆ **[Save As]**

The function is using another file name to save the file currently edited.

◆ **[Save Selected Objects As]**

Its function is to select part of objects in the currently loaded file as a separate machining file.

◆ **[Recent Nce Files]**

This function can be used to view the recently loaded .NCE files and open them.

◆ **[Make Param Backup Installer]**

This function selected, users can backup the software to the default directory(D:\Weihong\Setup) quickly. It provides great convenient to save the preset parameters.

◆ **[Make Param Backup]**

After this submenu is clicked, a dialog shown as below will pop up:

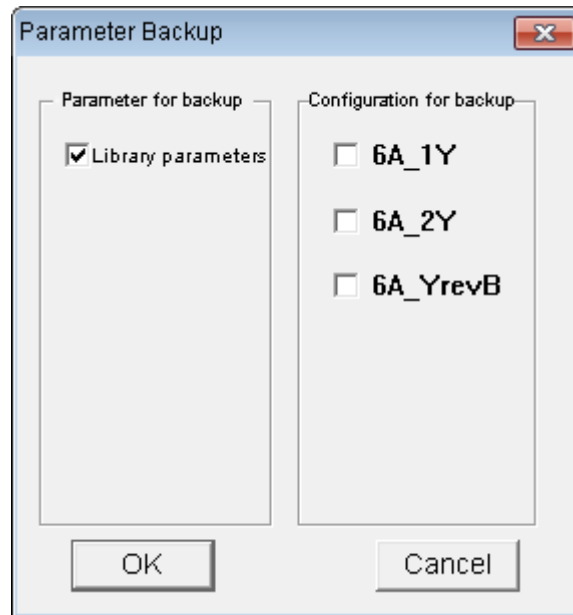


Fig. 4-7 Parameter backup dialog box



This dialog box varies with the software configuration. The above just gives an example under 63A configuration. Please stick to the software version in actual situation.

The library parameters and configuration to be backed up checked, the system will save the library parameters under the designated configuration to the target directory.

◆ [Exit]

Used to exit from the system.

4.2. Edit Menu

Edit menu includes such menu items as [Undo], [Redo], [Select All], etc, which are introduced as follows:

◆ [Undo, Redo (Ctrl + Z/ Ctrl + Y)]

In possession of strong redo and undo functions, this software can redo or undo several previous operations sequentially until the user is satisfied.

Operation method is: after execution of an operation, clicking on the undo button on the toolbar will undo this operation, so will pressing the shortcut key Ctrl + Z. Likewise, to execute the undo operation again, click the redo button on the toolbar or press the shortcut key Ctrl + Y. After a new operation, which will be put under undo list, is performed, all actions in the redo list will be cleared.

◆ [Select All (Ctrl + A)]

This menu item is used to select all the objects in “Object Editor Space”, which avoids the trouble to continuously select objects.

There are two ways for selection in this NcEditor software: click and region.

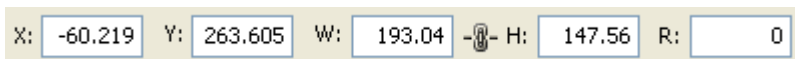
Click: clicking on an object will select it. To continue to select other objects, press Ctrl at the same time.

Region: if there is a circumscribed rectangle outside an object, it indicates that the object is selected.



Region can be divided into left region and right region, as follows:


- 1) Left region: select an object from the left side towards the right side. Under this mode, an object to be selected must be totally in the region rectangle, or it won't be selected.
- 2) Right region: select an object from the right side towards the left side. Under this mode, an object to be selected just needs to contact with the region rectangle.

When several objects are selected simultaneously, size and coordinates of the general circumscribed rectangle will be displayed on the toolbar, as following:



X\Y: coordinates of left-bottom vertex of the general circumscribed rectangle.

W\H: width and height of the general circumscribed rectangle. Clicking the icon  can determine whether width and height are changed in proportion. When the icon is shown as , width and height are in proportion, i.e. changing the value of one of them will change the value of the other accordingly.

When shown as , width and height can be changed separately in spite of original proportion.

If there is a need to remove the selection state of one or several objects after selection of multiple objects, simultaneously press Shift and click on an object (objects) to be deselected.

To select objects of a certain type when all objects are selected, double click the desired type under Multiple Objects. See Fig. 4-8.

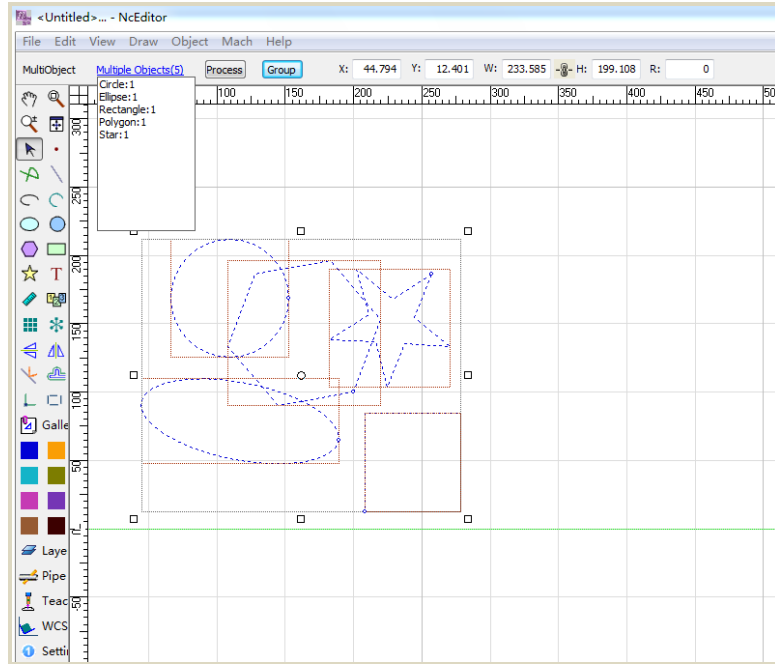


Fig. 4-8 All object selected

For instance, to only select the two rectangles among all the selected objects in the above picture, double click on “Rectangle: 2”.

To delete selected objects of a certain type, directly click on the corresponding “X”. For example, to delete the two rectangles in Fig. 4-8, directly click on the “X” after “Rectangle: 2”.

◆ [Select Invert (Ctrl + Shift + A)]

This item deselects the objects previously selected while selecting previously unselected objects. The contrast between before “Select Invert” and after “Select Invert” is as shown in Fig. 4-9 and Fig. 4-10.

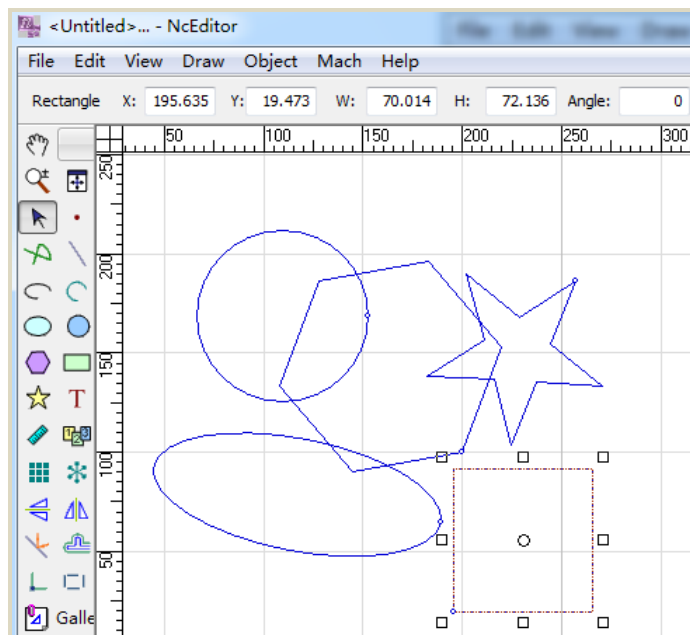


Fig. 4-9 Before “Select Invert”

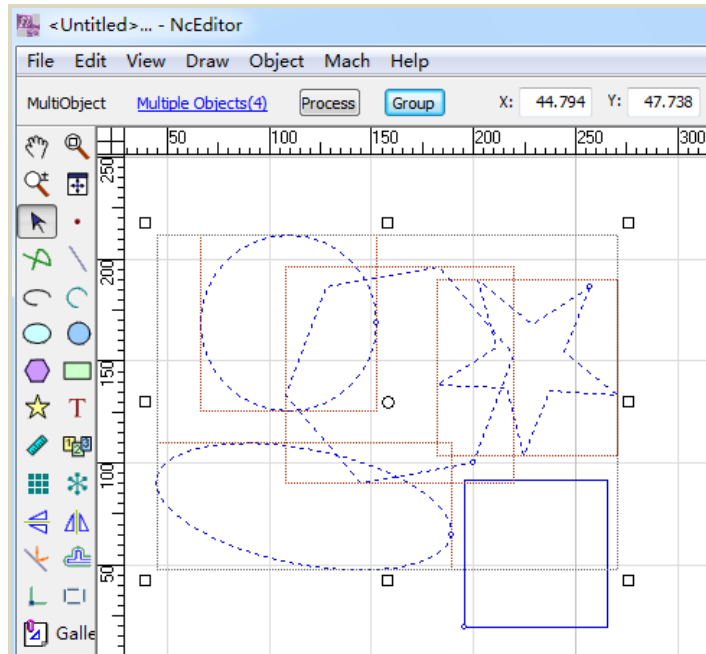


Fig. 4-10 After “Select Invert”

◆ **[Clear Selected (Shift + A)]**

Used for deselecting selected objects.

◆ **[Delete (Delete)]**

Used for deleting selected objects in “Object Editor Space”, also available on the right-click menu.

◆ **[Cut (Ctrl + X)]**

Used for cutting selected objects in “Object Editor Space”.

◆ **[Copy (Ctrl + C)]**

Used for copying selected objects in “Object Editor Space”.

◆ **[Paste (Ctrl + V)]**

Used for pasting objects in the clipboard into “Object Editor Space”. After selecting this item, click on “Object Editor Space” to decide the paste position. The click position is where the left-bottom vertex of circumscribed rectangle of objects to be pasted locates.

◆ **[Paste As Group]**

When there are two or more copied or cut objects, clicking this item will paste the copied or cut objects as a group into [Object Editor Space].

◆ [Clear Clipboard]

Its function is to clear all the contents in the clipboard, only valid for operation this time. After this item is selected, paste function will be invalid.


4.3. View Menu

View menu consists of such menu items as [Pan], [Zoom], [Zoom By Rect], etc, which will be introduced as follows:

◆ [Pan]



The user can reposition a figure to clearly view other parts of the figure. This command will not change the position or ratio of the figure in the coordinate system, only the view. The user can pan the figure up and down, left and right.


- Method one: open [View] menu, select the option [Pan];
- Method two: select the pan button  on the drawing toolbar.

Then hold down the left mouse button in the [Object Editor Space] while dragging the mouse to the aimed position, and then release the mouse.

◆ [Zoom]



The user can zoom in and zoom out a figure by menu + mouse or drawing toolbar + mouse; the actual size of the figure won't change, only the view will be enlarged or minified.

- Method one: open [View] menu, select the option [Zoom];
- Method two: select the [Zoom] button  on the drawing toolbar.

Sliding the mouse wheel in the [Object Editor Space] can also be used to scale objects. Sliding forward zooms in the object centered around the current cursor position, while sliding backward zooms out the object centered around the current cursor position.

◆ [Zoom By Rect]



“Zoom By Rect” command can enlarge part of an object to window size, but not change its coordinates.

- Method one: open [View] menu, select the option [Zoom By Rect];

- Method two: select the [Zoom By Rect] button  on the drawing toolbar.

◆ [Fit To Window (Num*)]



After zooming and translating, if the user wants to fit the view to window, this menu item can be used. This function can make the user get a general view without sliding the wheel, since this function can make the track view fit to window.

- Method one: open [View] menu, select the option [Fit to window];

- Method two: select the button  on the drawing toolbar.

◆ [Show Order]

This option is to display/ hide machining order of current objects.


- Method one: open [View] menu, select the option [Show Order];

- Method two: select the  button on the toolbar.

◆ [Show Start Point]

This option is to display/ hide start point of machining.

◆ [Show Direction]

This item, corresponding to the button  on the toolbar, is to display/hide machining direction.

◆ [Show Lead-in/out Line]

This item, corresponding to the button  on the toolbar, is to display/hide lead-in/out line.

◆ [Show Track]

This item is to display/hide machining trajectory.

◆ [Clear Track]

This item is to clear machining trajectory, with shortcut key as F12.

◆ [Show Current Point]

This item is to display/hide current machining point.

◆ [Middle Current Point (End)]

This item is to display current machining point in the middle of [Object Editor Space].

◆ [Wireframe Mode]

It is the default draw mode, under which all objects are displayed in wireframe.

◆ [Ordinary Mode]

Also called fill mode, ordinary mode shows objects belonging to “Fill” (under Object menu) filled with a color.

◆ [Set Origin]

Clicking this menu item will eject a dialog “Set Origin”, as shown in Fig. 4-11, in which workpiece origin can be set.

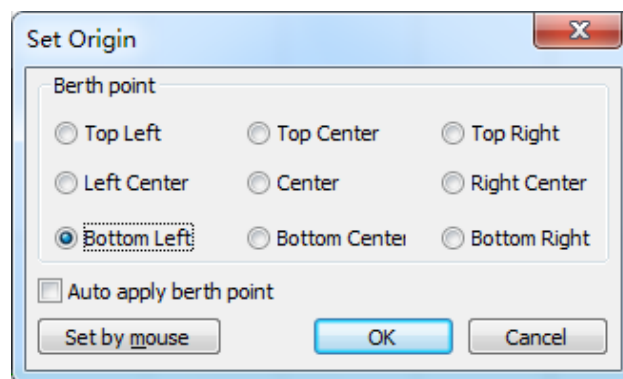


Fig. 4-11 Set origin

The user can set workpiece origin by a feature point, directly entering X and Y coordinates, or by mouse.

For the method to set workpiece origin by mouse, the software is available of catch function to help the user set workpiece origin on the exactly desired position.

The advantages of setting origin are as follows:

- The position of machining objects in WCS can be positioned more precisely;
- After a file is loaded, the position of workpiece in WCS can be fixed more precisely;
- It is more convenient to set origin as the start point of machining.


4.4. Draw Menu

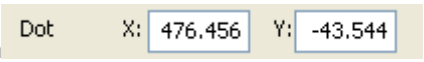
Draw menu encompasses such options as [Dot], [Line], [Arc], etc, which will be introduced as follows:




All the following drawn figures can be accurately positioned through toolbar after selected. The drawing is finished by left click.

◆ [Dot]

Select the option [Dot] under [Draw] menu or click the button  on the drawing toolbar, and then click the left mouse button in a selected place of [Object Editor Space] to draw a point.

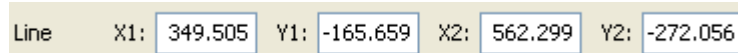
If the user needs to position the drawn point more precisely, he can input the coordinates in  on the toolbar, and then press [Enter].

◆ [Line]

If the user wants to draw a straight line, he can select the option [Line] under [Draw] or single click icon .

Two points can determine one straight line. Draw two points in [Object Editor Space] as the beginning and end points of a straight line.

After selecting a line, the user can input the beginning and end points coordinates in the dialog as following to position and redraw it accurately.




Line X1: 349.505 Y1: -165.659 X2: 562.299 Y2: -272.056

◆ [Arc]

If the user wants to draw an arc, he can select [Arc] under [Draw] or single click icon .

NcEditor ensures the position and size of an arc by radius, arc center, beginning angle and central angle.

After selecting an arc, the user can accurately position and redraw it by inputting its circle center coordinates, required radius, beginning angle and central angle in the following dialog.



Arc CenterX: 350 CenterY: 150 Radius: 51.624 StartAngle: 31.535 CentralAngle: 129.789



1 rad. = $180/\pi$ degree

◆ [Polyline]


A polyline refers to a curve connected end to end by different straight lines and arcs, which enables the user to reduce operation times of segments and improve the velocity of modeling via finishing manipulation of multiple arcs and segments once.

If the user wants to draw a polyline, he can select [Polyline] under [Draw] or single click icon .

During drawing, the user can right click to select the type of a polyline, i.e. line or tangent arc. After drawing finishes, right click to select the type to finish drawing, as following:

Confirm
Cancel
✓ Line
Tangent Arc
Close

◆ [Rectangle]

If the user wants to draw a rectangle, he can select [Rectangle] under [Draw] or single click icon . NcEditor determines the position and shape of a rectangle by the left-bottom vertex coordinates, angle of inclination, width and height.

After selecting a rectangle, the user can accurately position and redraw it by inputting the left bottom vertex coordinates, angle of inclination, height and width in the following dialog.

Rectangle	X:	<input type="text" value="22"/>	Y:	<input type="text" value="397"/>	H:	<input type="text" value="205"/>	W:	<input type="text" value="75"/>	Angle:	<input type="text" value="0"/>
-----------	----	---------------------------------	----	----------------------------------	----	----------------------------------	----	---------------------------------	--------	--------------------------------

◆ [Circle]

If the user wants to draw a circle, he can select [Circle] under [Draw] or single click icon .

NcEditor ensures the position and size of a circle by radius and circle center.

After selecting a circle, the user can accurately position and redraw it by inputting its circle center coordinates and radius in the following dialog.

Circle	CenterX:	<input type="text" value="-22"/>	CenterY:	<input type="text" value="240"/>	Radius:	<input type="text" value="48.847"/>
--------	----------	----------------------------------	----------	----------------------------------	---------	-------------------------------------

◆ [Ellipse]


If the user wants to draw an ellipse, he can select [Ellipse] under [Draw] or single click icon .

NcEditor ensures the position and size of an ellipse by circle center, angle of inclination, LongR (major semi-axis) and ShortR (minor semi-axis).

After selecting an ellipse, the user can accurately position and redraw it by inputting its circle center coordinates and radius, etc in the following dialog.

Ellipse	CenterX:	<input type="text" value="181"/>	CenterY:	<input type="text" value="221"/>	LongR:	<input type="text" value="50.774"/>	ShortR:	<input type="text" value="48.795"/>	Angle:	<input type="text" value="45.83"/>
---------	----------	----------------------------------	----------	----------------------------------	--------	-------------------------------------	---------	-------------------------------------	--------	------------------------------------

◆ [Ellipse Arc]

If the user wants to draw an ellipse arc, he can select [Ellipse Arc] under [Draw] or single click icon .

NcEditor ensures the position and size of an ellipse arc by circle center, angle of inclination, LongR (major semi-axis), ShortR (minor semi-axis), starting angle and central angle.

After selecting an ellipse arc, the user can accurately position and redraw it by inputting its circle center coordinates and radius, etc in the following dialog.

EllipseArc	CenterX: <input type="text" value="334"/>	CenterY: <input type="text" value="421"/>	LongR: <input type="text" value="111.629"/>	ShortR: <input type="text" value="82.928"/>	Angle: <input type="text" value="56.31"/>	StartAngle: <input type="text" value="109.492"/>	CentralAngle: <input type="text" value="347.32"/>
------------	---	---	---	---	---	--	---

◆ [Polygon]

If the user wants to draw a polygon, he can select [Polygon] under [Draw] or single click icon .

NcEditor ensures the position and size of a polygon by circumscribed radius, center X, center Y, angle of inclination and edges, etc.

After selecting a polygon, the user can accurately position and redraw it by inputting the related values in the following dialog.

Polygon	Edges: <input type="text" value="6"/>	CenterX: <input type="text" value="268"/>	CenterY: <input type="text" value="121"/>	CircumR: <input type="text" value="73.246"/>	InscribedR: <input type="text" value="63.433"/>	Angle: <input type="text" value="255.774"/>
---------	---------------------------------------	---	---	--	---	---

◆ [Star]


If the user wants to draw a star, he can select [Star] under [Draw] or single click icon .

NcEditor ensures the position and size of a star by circumscribed radius, inscribed radius, center X, center Y and angle of inclination, etc.

After selecting a star, the user can accurately position and redraw it by inputting the related values the following dialog.

Star	Vertexes: <input type="text" value="5"/>	CenterX: <input type="text" value="500"/>	CenterY: <input type="text" value="250"/>	CircumR: <input type="text" value="73"/>	InscribedR: <input type="text" value="27.884"/>	Angle: <input type="text" value="270"/>
------	--	---	---	--	---	---

◆ [Text]

If the user wants to write a section of text, he can select [Text] under [Draw] or single click icon .

After selecting [Text], left click in [Object Editor Space], and drag a text input box, in which input text.

Press "Enter" to finish inputting. During inputting, Ctrl + Enter can be used to make a line break.

After selecting a text, the user can accurately position and redraw it by inputting the related values in the following dialog.

Text	X: <input type="text" value="5.25"/>	Y: <input type="text" value="19.25"/>	Angle: <input type="text" value="0"/>	CharW: <input type="text" value="100"/>	CharH: <input type="text" value="100"/>	Font: <input type="text" value="Arial"/>
------	--------------------------------------	---------------------------------------	---------------------------------------	---	---	--

◆ [Gallery (Ctrl + G)]

This plasma cutting system is equipped with gallery function, holding dozens of machining shapes commonly used. The user can select one of them and set its corresponding parameters before adding it into a machining file, as shown in Fig. 4-12.

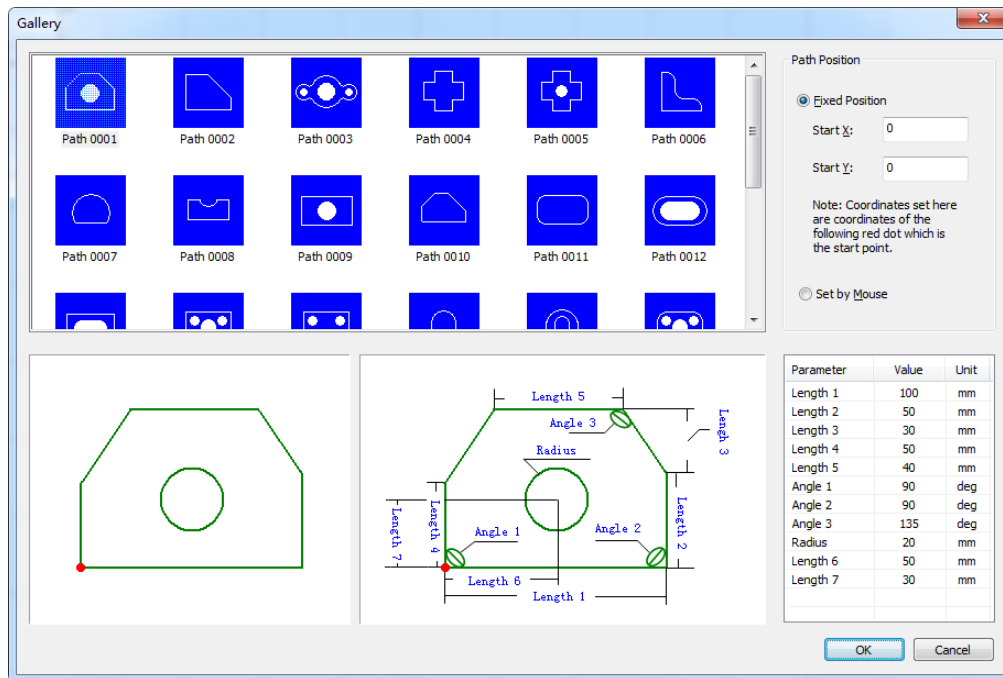


Fig. 4-12 Gallery

4.5. Object Menu

Object menu includes such menu items as [Translate], [Rotate], [Align], etc, which will be introduced in detail as following:

◆ [Translate]

There are two ways to translate an object:

- Method one: menu method. After selecting an object, select “Translate” menu item. The first click point is the start point of translation vector, while the second click point is the end point of translation vector; using this method can accurately position the end point of translation vector.
- Method two: mouse method. Click on an object, the current point on the object the start point of translation vector; hold down the mouse, and drag the object, the point where the mouse is released the end point of translation vector.

◆ [Rotate]

To rotate an object, there are two methods:

- Method one: after selection of an object, click the [Rotate] option under [Object] menu to enter rotation mode. The first click point is the center of rotation, and included angle between the positive X axis and the straight line connected by the second click point and first click point is the rotary angle.

- Method two: click on one of the small rectangles around the selected object, at the same time press Ctrl to enter rotation mode. With this method, the center of rotation is located in the center of the circumscribed rectangle of selected object by default, so the center position will remain the same.



Rotation changes position and direction of an object, with no change to its shape.

◆ [Align]

When there are two or more selected objects in [Object Editor Space], align menu item becomes available. With this menu item, selected objects in 2D plane can be aligned. “Align” menu item is also included in the right-click menu.

- Align Left

Left edges of selected objects are aligned on the basis of that of the general circumscribed rectangle of selected objects.

- Align Right

Right edges of selected objects are aligned on the basis of that of the general circumscribed rectangle of selected objects.

- Align Top

Top edges of selected objects are aligned on the basis of that of the general circumscribed rectangle of selected objects.

- Align Bottom

Bottom edges of selected objects are aligned on the basis of that of the general circumscribed rectangle of selected objects.

- Align Center Point

Centers of selected objects are aligned on the basis of that of the general circumscribed rectangle of selected objects.

- Align Horizontal Midline

Y coordinates of centers of selected objects are aligned on the basis of that of the general circumscribed rectangle of selected objects.

- Align Vertical Midline

X coordinates of centers of selected objects are aligned on the basis of that of the general circumscribed rectangle of selected objects.

➤ Distribute Horizontally

With this menu item, the horizontal distances become equal between center points of selected objects, and the positions of the two objects next to the horizontal edge are fixed. Three or more objects must be selected.

➤ Distribute Vertically

With this menu item, the vertical distances become equal between center points of selected objects, and the positions of the two objects next to the vertical edge are fixed. Three or more objects must be selected.

◆ [Group]

This option can set two or more selected objects as a group.

◆ [Break Group]

This option dismisses a selected group into multiple objects.

◆ [Combine (Ctrl + J)]

This option combines multiple objects, which should be unclosed (like lines, arcs, ellipse arcs and unclosed polylines), into one single-path object to realize integrated operations. It is recommended to open “Catch” before using “Combine”.

In combination, objects are combined following a certain criterion, so combine tolerance is offered. When the distance between selected objects is within combine tolerance ranging from 1e-009 to 10, objects will be combined. Selecting [Combine] will eject a dialog as shown in Fig. 4-13.

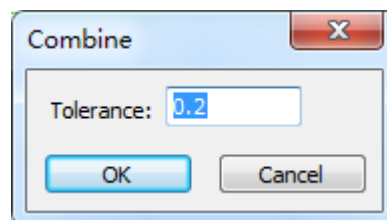


Fig. 4-13 Combine setting

◆ [Auto Set Machining Order (Ctrl + E)]

Selecting this item will eject a dialog as shown in Fig. 4-14 for setting parameters related to machining sequence.

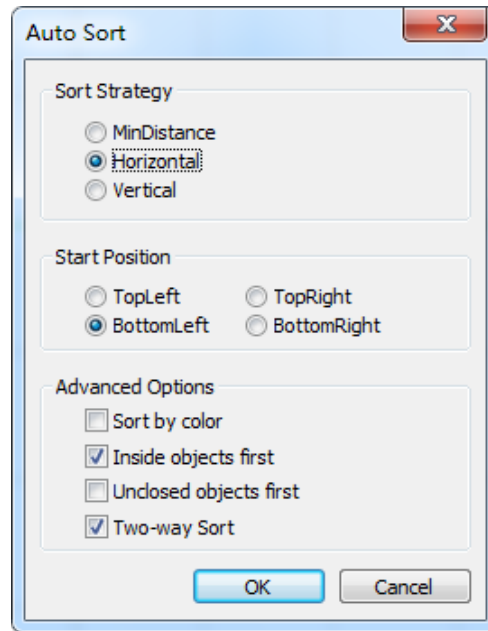
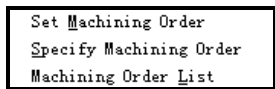



Fig. 4-14 Sort

◆ [Manual Set Machining Order]



Under [Manual Set Machining Order] menu item, included sub-menu items are

After “Set Machining Order” or the button  on the drawing toolbar is selected, +① is added near the cursor. At this time, clicking on any object will make its machining order become 1, while the order of left objects will change to 2, 3,... sequentially according to the original order.

If “Specify Machining Order” is selected, a dialog as shown in Fig. 4-15 will pop up.

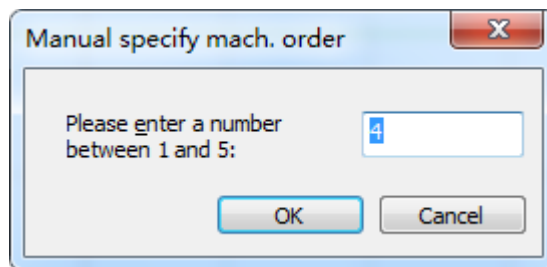


Fig. 4-15 Manually set machining order

In the above dialog, the machining order of the currently selected object can be set. Note that an error message as Fig. 4-16 will be displayed if more than one object is selected.

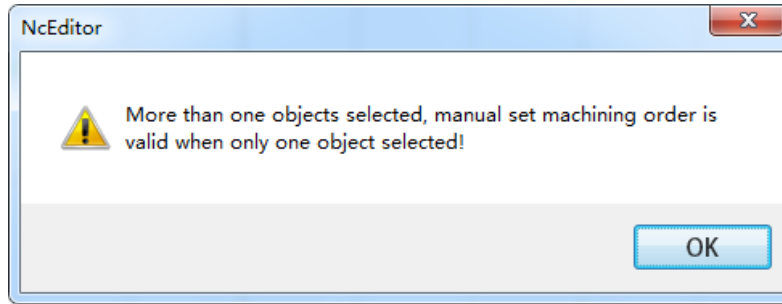


Fig. 4-16 Error message in setting machining order

If “Machining Order List” is selected, a dialog as Fig. 4-17 will pop up.

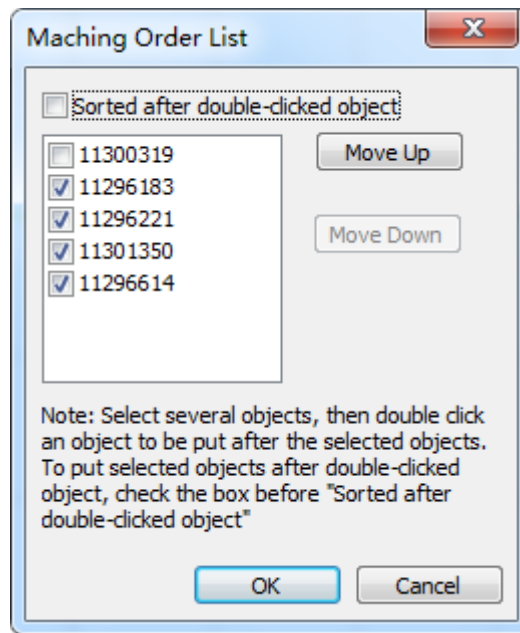


Fig. 4-17 Machining sequence list

In the above dialog, move down or up objects to set machining order.

◆ [Shape Check (Ctrl + T)]

This option is used to check selected objects in the currently loaded machining file to tell whether current path is normal and where are the abnormalities. As shown in Fig. 4-18, “Shape Check” includes “Closed Check”, “Self-cross Check”, “Intersection Check” and “Overlap Check”, any of which checked is about to be performed.

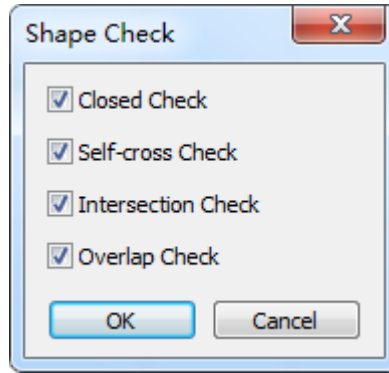


Fig. 4-18 Tool path detection

After "OK" is clicked, a dialog of shape check result will pop up, as shown in Fig. 4-19.

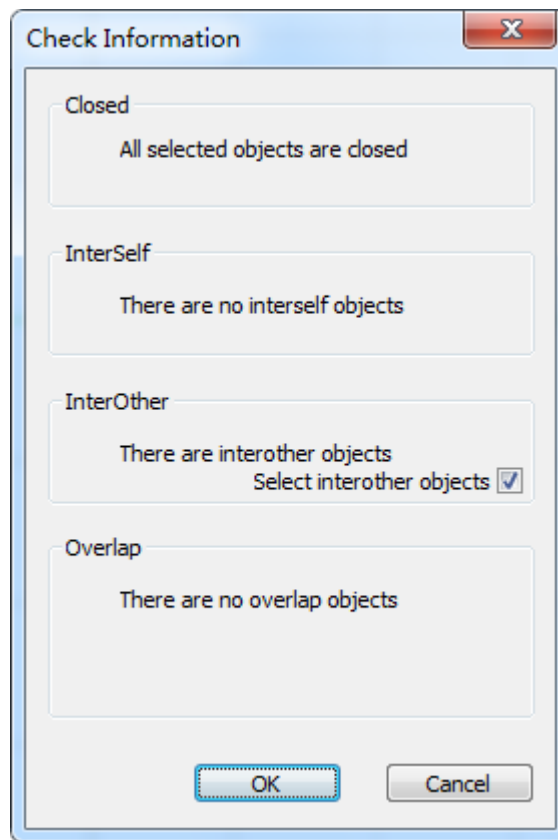


Fig. 4-19 Detection results of selected objects

In the above dialog, detection results of selected objects are displayed. In case of abnormalities, their abnormal type will be showed, and abnormal objects can be set as being selected after check.

◆ **[Measure]**

This option is used to measure a certain distance.

Click on this option, then left click to choose the start point of measurement, and then move the mouse, in the lower part of the cursor displayed are the distance between current point and the start point, X\Y offset, and the included angle of the positive X axis and the line connected by the start point and current point.

Click again to finish this time measurement. Then another measurement can be performed as the above-mentioned steps. To exit from “Measure”, right click.

◆ [Shape Pre-processing]

Before formal machining, there is a need to process the objects in the machining file. Shape pre-process function can process the selected objects automatically, like deleting overlap, joining (combination), deleting dots, deleting mini-circles, and deleting mini-curves, as shown in Fig. 4-20. After checking the pre-process items and setting the relevant parameters, click “OK” to execute these pre-processes on objects. If “Apply when import” is checked, objects will be pre-processed automatically when a machining file is loaded. At this time, there is no need to manually select objects and open this dialog.

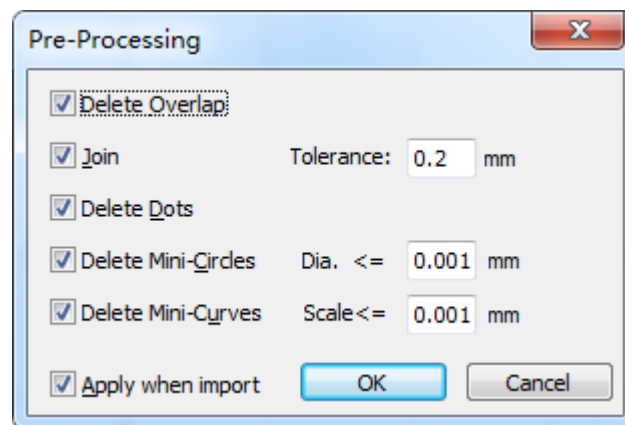


Fig. 4-20 Pre-processing

◆ [Clip Overlaps]

The same as “Delete Overlap” in “Shape Pre-Processing”.

◆ [Delete Shorties]

i.e. delete dots, mini-circles and mini-curves.


◆ [Smooth Curve]

This function executes smoothing on the curves. After smoothing, the curves become smoother, so does machining.



This function is only available for polylines, while unavailable for other objects.

◆ [Reverse Direction]

Clicking this option will reverse machining direction of selected objects. Select the icon  to display machining direction before using this option.

◆ **[Set Direction (Ctrl + D)]**

Click on this option to eject a dialog, as shown in Fig. 4-21, to set machining direction intelligently.

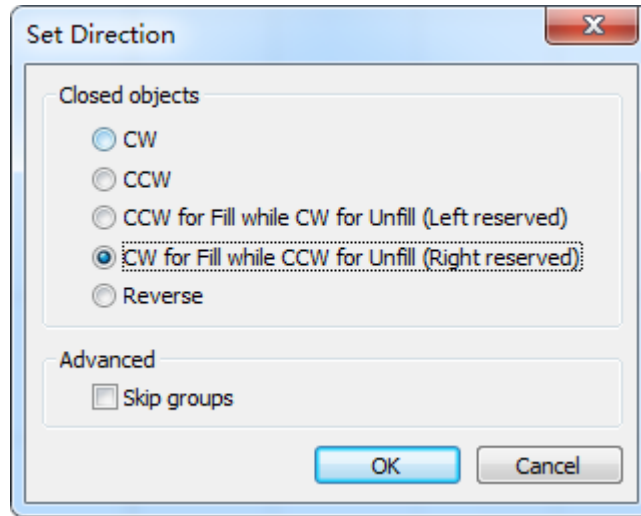


Fig. 4-21 Set direction intelligently

After an object is selected, its machining direction can be set clockwise, anticlockwise, clockwise or anticlockwise based on selection of “Fill” and “Unfill”, etc.

◆ **[Translate Text to Polylines]**

Clicking on this option will change a selected text to polylines.

◆ **[Start Cut Point (Ctrl + Q)]**

This item sets the start point of lead-in/out line manually.

◆ **[Fill]**

With this menu item, inside of object is preserved while outside is abandoned after machining.

◆ **[Unfill]**

With this menu item, outside of object is preserved while inside is milled after machining.

◆ **[Auto Set Fill]**

If this item is selected, “Fill” or “Unfill” will be selected automatically by the system according to the type of selected objects as outside ones or inside ones.

◆ **[Set Lead-in/out Line (Ctrl + W)]**

Select an object, then select this menu item under Object menu or under right-click menu, and then set the type of lead-in/out line in the following dialog.

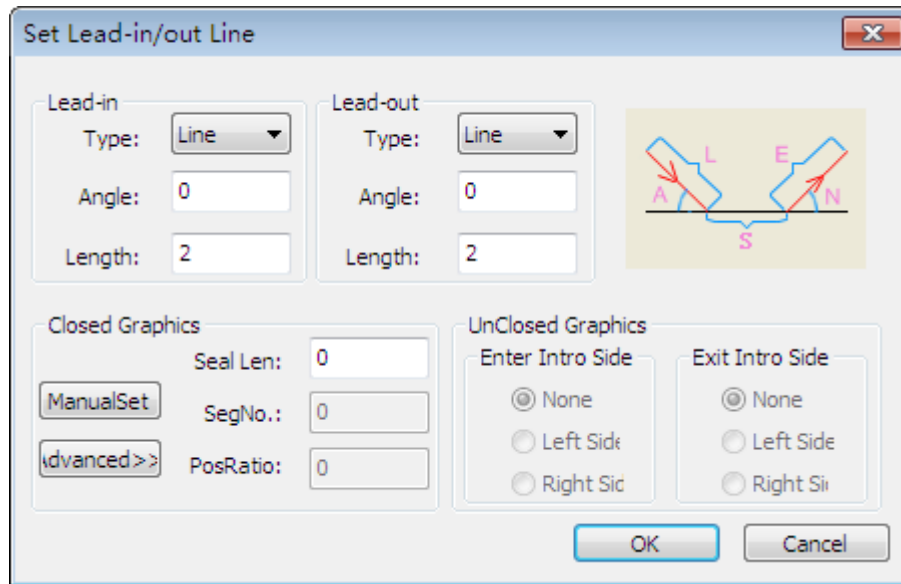


Fig. 4-22 Set lead-in/out line

There is no obvious boundary between line-type lead in/out and arc lead in/out in operation, so the two can be exchanged with each other. For instance, if users set arc-type lead in/ out to a rectangle, the system still calculates its line-type lead in/out automatically.



The type of lead-in/out line is chosen in terms of cutting technique; besides, the use of lead-in/out line is for precise machining, the user can decide whether to set it or not.

- Angle: included angle of two edges of lead-in/out line.
- Length: length of cut-in edge or cut-out edge of lead-in/out line.
- Seal Len: range of seal length is from -500 to 500.

Seal length decides whether lead-in/out line is cut-out or seal lead-in/out line.

In case of a negative value, under-cut will appear, i.e. this is a cut-out lead-in/out line.

In case of a positive value, over-cut will appear, i.e. this is a seal lead-in/out line.

- Cut Mode: fill, unfill and changeless (with no change to current cut mode) are available in cut mode.
- Seg No.: there are probable N straight lines (N is a natural number) on the selected object. "Segment No." refers to the sequence number of the segment on which the lead-in/out line is among all the segments of the selected object (It is used to fix the location of lead-in/out line on a certain segment).
- Pos Ratio: it refers to the ratio of the distance from the position of lead-in/out line on a segment to the beginning of this segment to the whole length of the segment, and its range is [0, 0.999].
- Simplified: this button is to switch between simplified and advanced setting. Under simplified mode, segment No. and position ratio are not available.
- Manual Set: after clicking this button, the position of lead-in/out line can be set manually.

In terms of position, lead-in/out line can also be divided into inner lead-in/out line and outer lead-in/out line, which depends on which part is to be reserved after machining.

If a selected object is under [Fill] mode, the system will set it as outer lead-in/out; if a selected object is under [Unfill] mode, the system will set it as inner lead-in/out.

◆ **[Set Intersecting Line]**

This option is to cut any shape on a circular tube. To cut a shape on a circular tube, the cylinder with this shape as the intersecting surface and the circular tube should be intersected, so cutting trajectory should be intersecting line of the two solids. The system gives cutting trajectory with the help of this item, so there is no need for the user to draw the intersecting line in the tool path.

After this option is selected, a dialog will pop up, as shown in Fig. 4-23.

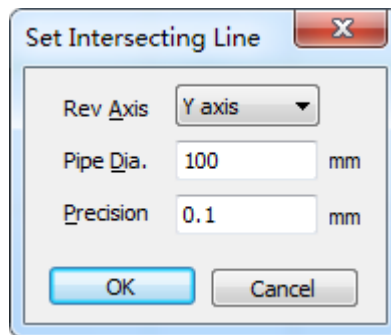


Fig. 4-23 Set intersecting line

Diameter of steel tube and cut precision can be set in the above dialog.



Diameter of steel tube must be larger than maximum height of selected shape.

◆ **[Set Kerf Compensation (Ctrl + R)]**

Kerf compensation is the amount of cutting path offset required to compensate for the material removed by the plasma cutting process. In unilateral cutting, the offset between dimensions of actually processed workpiece and theoretically processed workpiece is half of the kerf width; in bilateral cutting, the offset is the kerf width. With no kerf compensation, outer outline of actually processed workpiece becomes smaller while inner outline becomes bigger. The method of kerf compensation in our system is as follows:

- 1) Select an object to be compensated;
- 2) Select "Set Kerf Compensation" under "Object" menu or under right-click menu to eject a dialog as shown in Fig. 4-24.

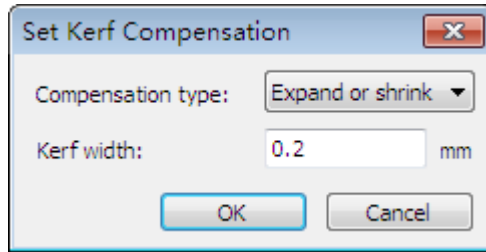


Fig. 4-24 Set kerf compensation

- 3) In the above dialog, set transfer type, kerf width and compensation type. If outside of workpiece is to be reserved, select compensation type as “Shrink”; if inside or workpiece is to be reserved, select compensation type as “Expand”.

When transfer type is selected as “Line”, various compensation results are as follows; texts should be changed to polylines before setting kerf compensation.

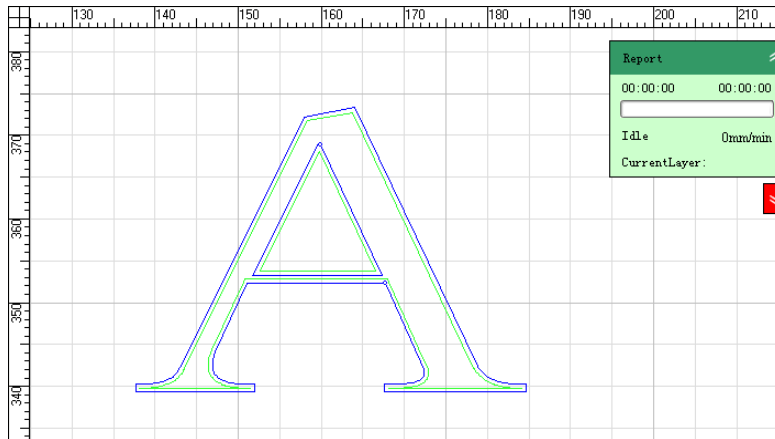


Fig. 4-25 Shrink compensation

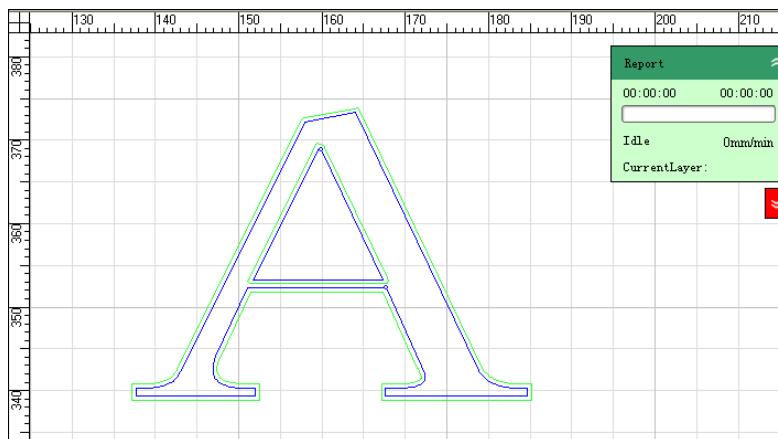


Fig. 4-26 Expand compensation

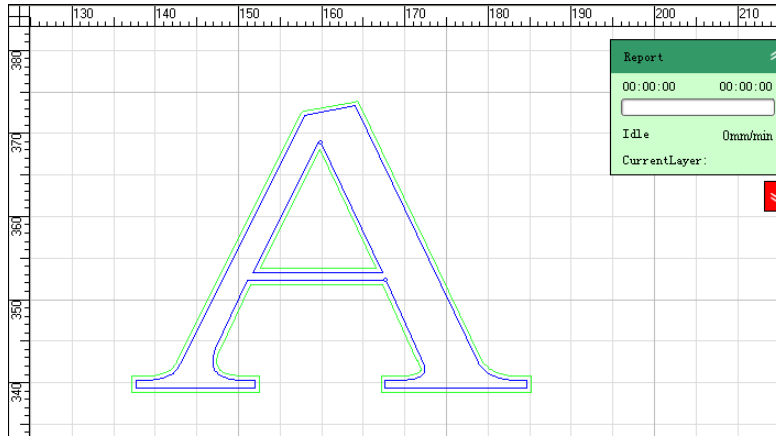


Fig. 4-27 Expand or shrink compensation

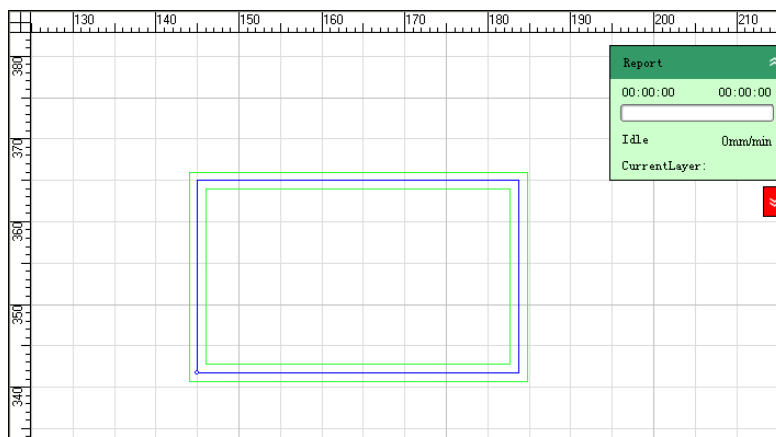



Fig. 4-28 Expand and shrink compensation

◆ **[Catch]**

This item opens or closes catch options, corresponding to the button  on the toolbar.

◆ **[Catch Options]**

[Catch Options] is used to find the object feature points more precisely during drawing so that they can be easily caught when approached.

Selecting [Catch Options] under [Object] menu or clicking the button  on the toolbar will eject the “Catch Options” dialog, as shown in Fig. 4-29.

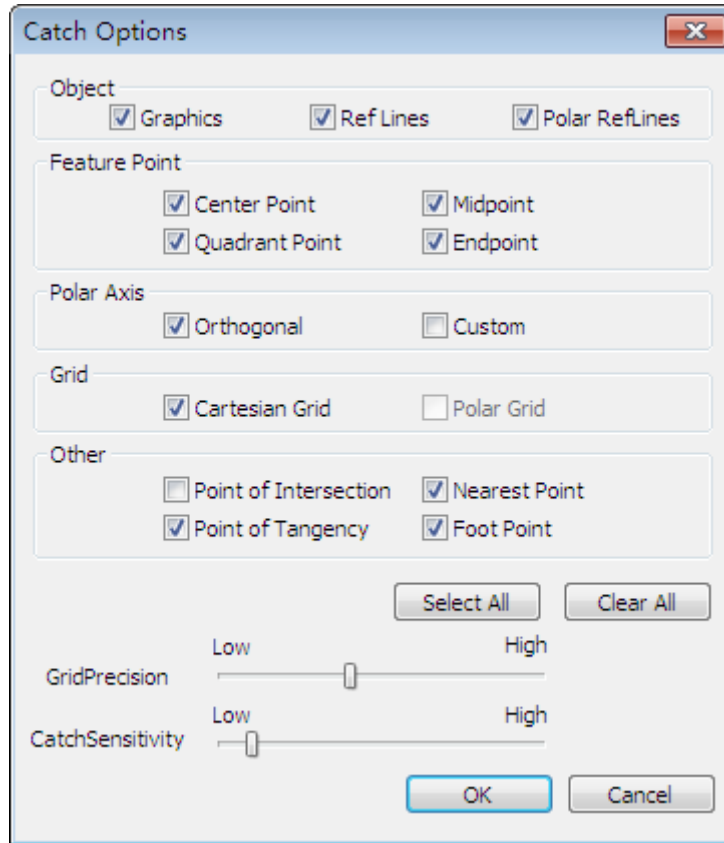


Fig. 4-29 Catch options

In the above dialog, any choice box checked, its corresponding item is displayed in the [Object Editor Space], otherwise, hidden.

➤ Feature point of each shape

- 1) The feature point of a spot: a point;
- 2) The feature point of a straight line: two endpoints and one midpoint;
- 3) The feature point of a polyline: every node and a circle center;
- 4) The feature point of a rectangle: four vertexes;
- 5) The feature point of a circle: four quadrant points and a circle center;
- 6) The feature point of an ellipse: four quadrant points and a circle center;
- 7) The feature point of an arc: a start point, an end point, a midpoint and a circle center.

➤ Advantages of opening [Catch Options]

The user can directly use the cursor to position to an above-mentioned feature points precisely without knowing the concrete coordinates, which is convenient for the accurate connection of objects in drawing. This function is always used together with [Combine] function.



To better use [Catch] function, it is recommended to uncheck “Grid” option.

- Grid precision and catch sensitivity

Sensitivity is used to specify the reflection intensity of catching when the cursor is approaching a feature point. Precision is used for controlling the grid density and improving the accuracy in catching.

◆ [Set IncAngle]

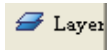
Use this item to catch a certain angle after checking “Custom Polar Axis” under “Catch Options” or “Open Custom PolarAxis” in the “Set IncAngle” dialog. For instance, choose “45”; in drawing a straight-line, after the first point is clicked, a red polar axis will be caught when the straight line to be drawn moves anticlockwise near 45 degree each time with the positive X axis as the start direction.

◆ [Layer Parameters]

There are altogether 8 numbered colors for selection in the color window, with each color corresponding to different values of such machining parameters as speed, power, etc.

In 2D mode, NcEditor software considers machining objects in the same color as sharing the same values of machining parameters. Therefore, if value of a machining parameter corresponding to a color is changed, all objects in this color will be changed their value of this machining parameter accordingly.

There are two ways to enter layer setup window:

- Method one: select [Layer Parameters] under [Object] menu;
- Method two: select the button  on the drawing toolbar.

Any one of the two above-mentioned methods executed, layer setup window, as shown in Fig. 4-30, will pop up.

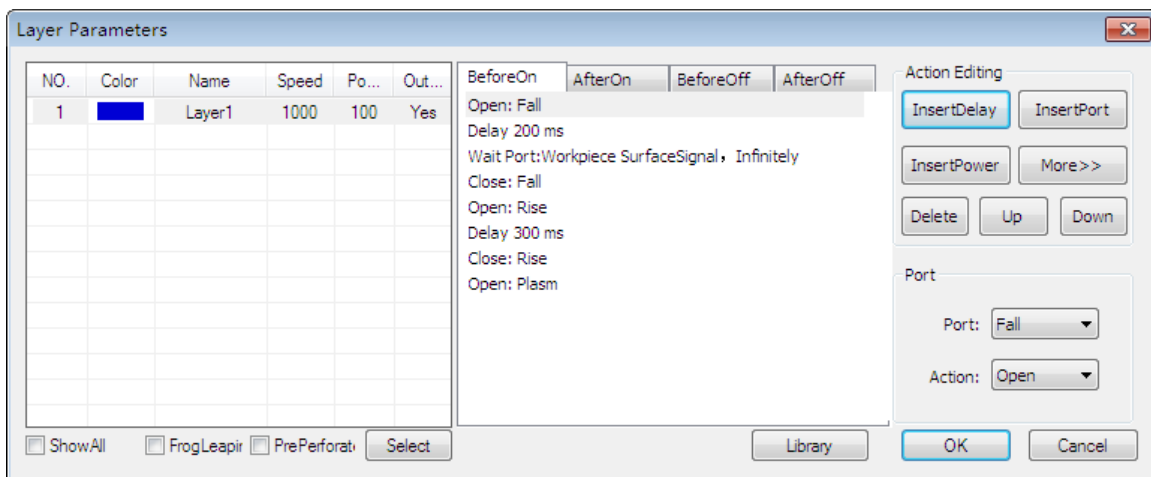


Fig. 4-30 Layer setup

As shown above, each layer can be set its speed, power, action before and after arc striking, action before and after arc closing.

For example, set action before arc striking as opening Z-axis cylinder after delay 300ms, and closing it after delay 100ms. The concrete operations are as follows: select the layer to be modified and then use buttons in “Action Editing” under “Before On”:

- 1) Select “Open” action and “Z-Cylinder” port in “Port” column;
- 2) Insert a delay and modify delay time to 300ms;
- 3) Select “Close” action in “Port” column;
- 4) Insert a delay and modify delay time to 100ms;
- 5) Move up or down the action sequence in terms of the actual situation.

In the column of “Action Editing”, clicking “Insert Delay” will insert a delay action before current action. The delay time can be modified with default value as 100ms. Clicking “Insert Port” will insert a port action with modifiable attribute before current action.

The material library function is added for the convenience of directly calling the set parameters of machining materials. This function can save N groups of parameters. After saving the set parameters of a certain material, next time machining the same material can call this group of parameters to save time and avoid mistakes.

As shown above, when the parameters of current layer is set, clicking “SaveLibrary” will eject the “Save to Library” dialog, as shown in Fig. 4-31, in which enter the name of this group of parameters, and then click “OK” to save parameters.

When there is a need to call the saved group of parameters, click “LoadLibrary” and then select the desired group, and then click “OK”.

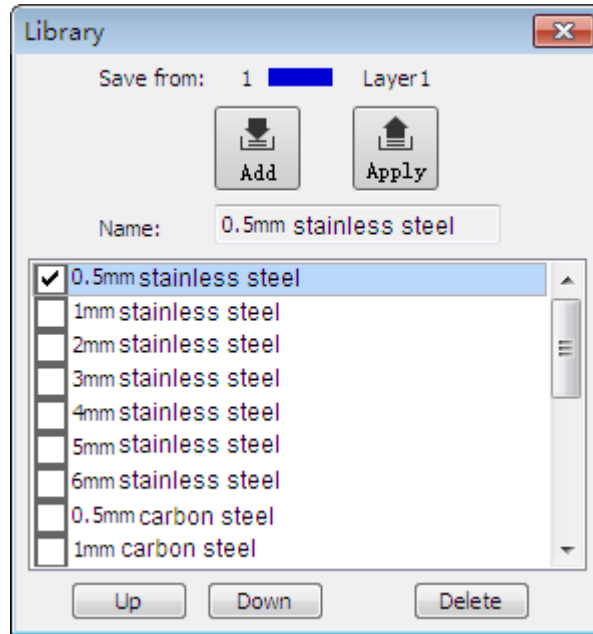


Fig. 4-31 Material library function



CAUTION

Multi-group of parameters can be saved in material library. Once they are saved, they cannot be deleted, but can be modified.

In addition, such functions are included on the drawing toolbar as “Rect Array”, “Circle Array”, “Horizontal Mirror”, “Vertical Mirror” and “Add Bridge”.

◆ [Pipe Cutting]


For more details, see chapter 5.8.

◆ [Instant Setting]

For more details, see chapter 6.5.

Besides, the following introduces [Rect Array], [Circle Array], [Vertical Mirror], [Horizontal Mirror] and [Add Bridge], which are on the drawing tool bar.

◆ [Rect Array]

Select one or multiple objects or groups (objects in different groups should be set as a group first) in [Object Editor Space]→ choose the button [Rect Array]  on the drawing toolbar→ input the array rows, columns, line space / offset, column pitch / offset into the pop-up dialog as shown in Fig. 4-32.

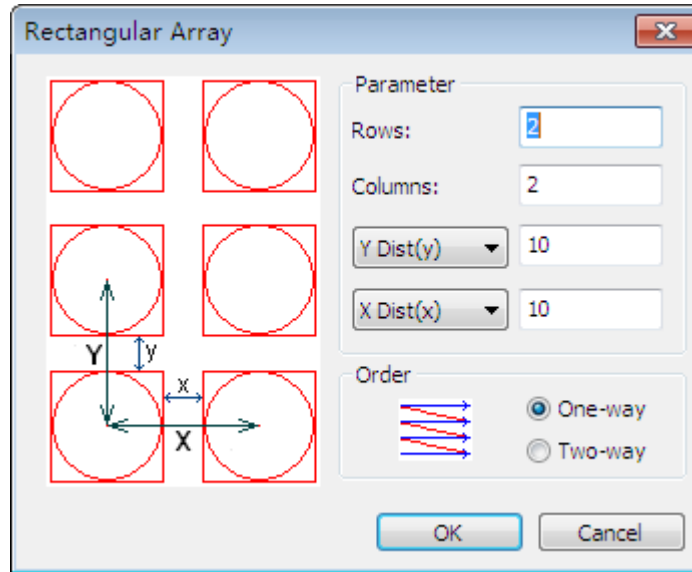



Fig. 4-32 Rectangular array dialog

◆ [Circle Array]

Select one or multiple objects or groups in [Object Editor Space] (objects in different groups should be set as a group first) → choose the button [Circle Array]  on the drawing toolbar → input center coordinates of rotation, array counts and array angle into the pop-up dialog as shown in Fig. 4-33.

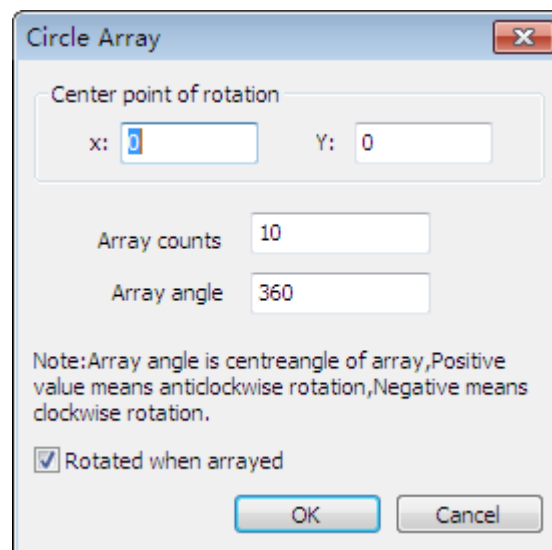




Fig. 4-33 Circle array dialog

◆ [Vertical Mirror]

Select one or multiple objects or groups in [Object Editor Space] (objects in different groups should be set as a group first) → choose the button [Vertical Mirror]  on the drawing toolbar to flip currently selected objects along X axis.

◆ [Horizontal Mirror]

Select one or multiple objects or groups in [Object Editor Space] (objects in different groups should be set as a group first) → choose the button [Horizontal Mirror]  on the drawing toolbar to flip currently selected objects along Y axis.

◆ [Add Bridge]

The bridge function is to make it more convenient for the user to manage processed parts. After processing, the parts will not fall off but remain in the original position.

[Add Bridge] is divided into [Bridge automatically] and [Bridge manually], and it is only available for a single object, unavailable for a group.

Currently, [Add Bridge] is available for a circle, an arc, a rectangle, a straight line, an ellipse, an ellipse arc and a polyline.

➤ [Bridge automatically]

Select an object, and then select the button  on the drawing toolbar to eject a dialog as shown in Fig. 4-34.

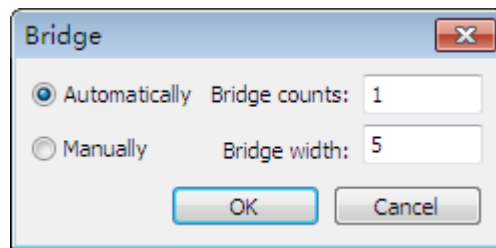


Fig. 4-34 Bridge automatically

In the above dialog, select bridge mode, input bridge counts and width, and then click [OK]. For example, select “Bridge automatically”, set “Bridge counts” as “3” and “Bridge width” as “10”, and then click [OK]. The output is as shown in Fig. 4-35.

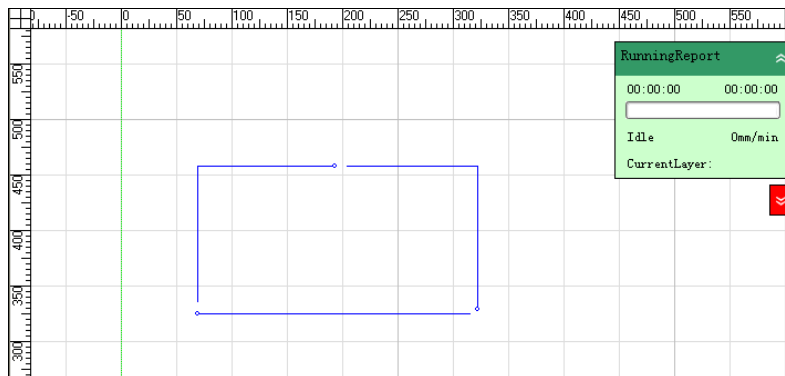


Fig. 4-35 Output after “Bridge automatically”

The bridge is located in the gaps shown above. During machining, these gaps will be skipped to keep this rectangle from falling off the surface of workpiece.

➤ [Bridge manually]

Check “Bridge manually” in the dialog shown in Fig. 4-34. Then enter bridge width and click [OK]. And then single click on an object. Clicked positions, which are user-defined, are where the bridges locate.

4.6. Mach Menu

Machine tool menu includes such menu items as [Machine Control Bar], [System Parameters], [Ports Setting], etc, which will be introduced as following:

◆ [Machine Control Bar]

This item is to display or hide the machine control bar in the main interface.

After the menu item is clicked, a “√” appears in front of “Machine Control Bar”, and the machine tool control bar is displayed in the main interface.

◆ [System Parameters (Ctrl + P)]

This option is to open system parameters, including operator parameters, manufacturer parameters and developer parameters.

◆ [Ports Setting (Alt + O)]

This item is to display input and output ports of the software.

◆ [Show Statistics]

The statistics in Report.

◆ [Cyclical Machining]

This function is used to set cycle times and interval time as well as to show processed times, as shown in Fig. 4-36.

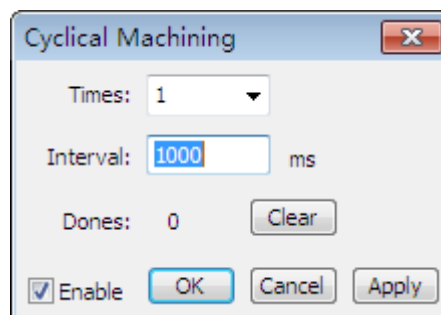


Fig. 4-36 Loop machining info



“Finish Times”, i.e. processed times, is shown in real time. After “Circle Times” is finished, “Finish Times” restores to 0 automatically.

◆ [Configs]

In 52C configuration, there are two configurations, including “Auto-H” and “Cylinder”; In 63A/62A software, there are three configurations, including “1Y (6A+EX22A)”, “2Y (6A+EX22A)”, “Yrev (6A+EX22A)”. For the wiring diagram of terminal board in each configuration, refer to Chapter 7.2.

Modification to configuration becomes valid after restart.

◆ [Go Home (Ctrl + Home)]

Machine coordinate system is the inherent coordinate system of a machine tool. Its origin, also known as machine origin, reference point, and home, is fixed after design, manufacture and debugging before leaving factory. After this software is booted, generally it is necessary to home all axes manually or automatically.



The necessity of homing:

Only after homing can the following functions be enabled, like software limit and set fixed point.

“Go Home” can be divided into “All Go Home”, “X Go Home” and “Y Go Home”. After one of them is selected, a dialog as shown in Fig. 4-37 will pop up to prompt confirmation for homing.

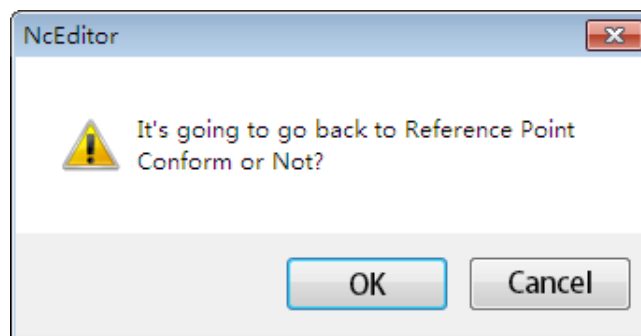




Fig. 4-37 Prompt box for homing

After homing is performed, the homing mark “” after “Axes” indicates that homing has already been successfully completed.

If the accuracy of current machine coordinates is ensured, and no abnormal conditions like “E-stop” occur, clicking “Set Directly” can set current machine coordinates as correct and accurate. When this operation completed, the homing mark “” appears after “Axes”.

When “Go Home Setting” is selected, a dialog as shown in Fig. 4-38 will pop up. If “This dialog pops up automatically when the software is started” is checked, this dialog will pop up automatically each time the software is opened. Otherwise, it needs to be manually opened.

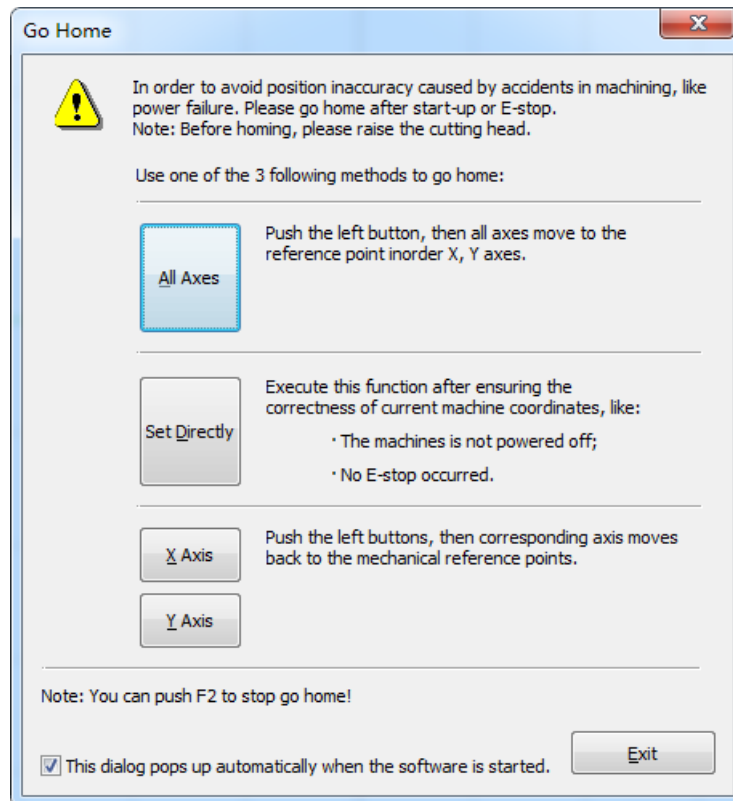


Fig. 4-38 Go home dialog


◆ [Back To WorkOrg (F6)]

The origin of workpiece coordinate system, namely workpiece origin, is fixed relative to a certain point on workpiece, while floating relative to machine origin. Workpiece origin should meet demands of simple programming, easy dimension conversion, and small caused machining error, etc.

◆ [Back to Fixed Point]

The user can set the coordinates of the fixed point in advance, so when plasma head is damaged or plasma head change is necessary, after this function is executed, the system will uplift the spindle and back to fixed point automatically. Then the user can complete other relative operations.

◆ [Set Directly]

When the user can ensure that current position is consistent with machine coordinates, and the machine tool does not meet such exception as “E-stop”, he can click on this item to directly set current machine coordinates as accurate machine coordinates, after which the homing mark  will appear after “Axes” on the machine control bar.

◆ [WCS Adjust]

The software supports manual edge finding function, which is the “WCS Adjust” option under “Mach” menu. Clicking on this option will eject a dialog, as shown in Fig. 4-39, including two-point positioning and three-point positioning.

Two-point positioning: set a point O' at the lower left of workpiece as the origin of new workpiece coordinate system, and then a point A in the positive direction of X axis; thus, the new X axis O'A is confirmed, the software automatically confirming the new Y axis by constructing a line perpendicular to line O'A through O'.

Three-point positioning: take the left bottom of workpiece as the temporary origin of new WCS, set a point A and B in the positive direction of X axis to confirm the new X axis, and then set a point C in Y axis, the software automatically confirming the new Y axis by constructing a line perpendicular to line AB through point C. The foot of perpendicular O' is the origin of new workpiece coordinate system.

Open the guide control when setting points in order to lead to the positioning position.



Point A, B and C should all be on the positive axis.

In three-point positioning, A should be confirmed before B; otherwise, the axis direction will be reversed.

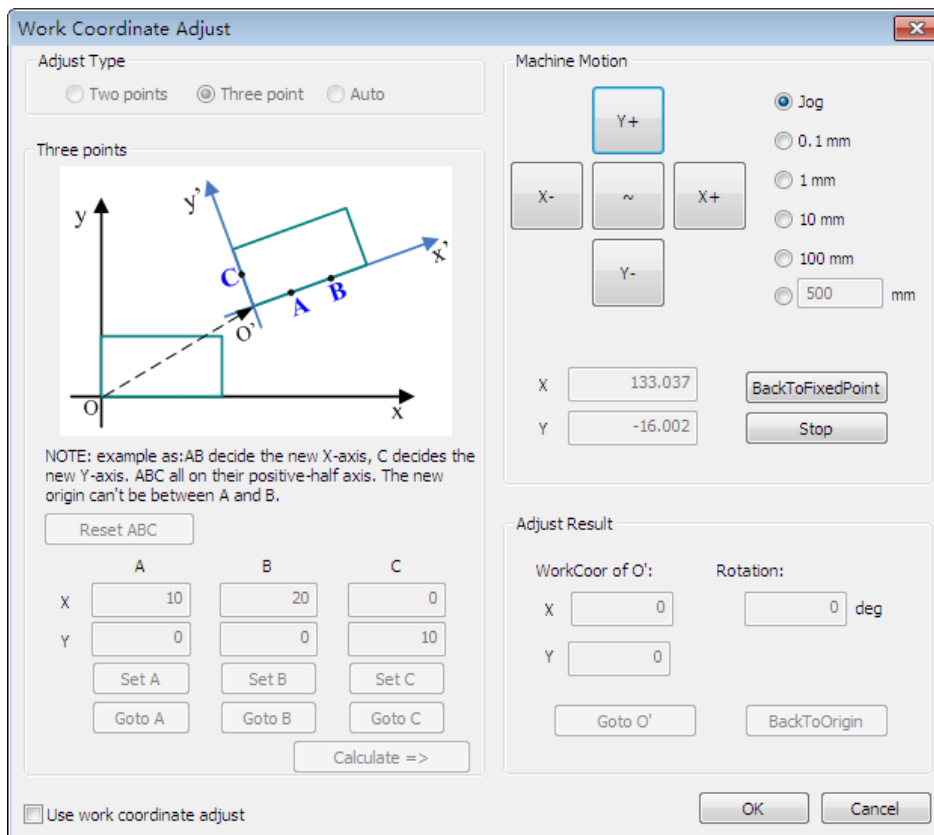


Fig. 4-39 Work coordinate adjust dialog

Take two-point positioning as an example, after selecting “Adjust Type” as “Two points”, manually move X and Y axes to point O’ at the lower left of workpiece, then click on the button “Set O” to set O’ as the origin of new WCS, and then move X axis towards positive direction to set point A, line O’A the X axis of new WCS. At this time, the software will confirm the new WCS automatically on the basis of point O’ and A. After the button “Calculate=>” is clicked, the software will automatically calculate the angle of rotation of current workpiece with respect to machine coordinate system, so that the software will automatically rotate the WCS in the tool path by the corresponding angle. If the rotation angle is larger than 15 degrees, it indicates that the workpiece is not put well, and the user needs to re-place the workpiece before edge finding again.

If the selected coordinates of O’ and A are not accurate or currently selected point needs to be deleted so as to choose a new point, clicking the button “Reset O’A” will restore the coordinates of O’ and A to the default.

Manually move coordinates in Jog or Incremental step mode. Number keys 4, 6, 2 and 8 on the keyboard are respectively corresponding to X-, X+, Y- and Y+. Combination key can also be used. For instance, when 0 and 4 are pressed simultaneously, the spindle moves towards the negative direction of X axis at rapid jogging speed. However, when 4 is pressed, the spindle moves toward the negative direction of X axis at jogging speed.



This function will be disabled automatically after machining ends normally, but the data of last edge finding will not be cleared in the software interface; to continue using these data for machining, select “Use work coordinate adjust” and then click “OK”.

If edge finding function is not desired before machining ends normally, uncheck the “Use work coordinate adjust” and then click “OK” to temporarily disable this function.

◆ [Start, Pause, Stop]

They correspond to Start, Pause and Stop button in the middle of machine control bar separately.

For Start, its shortcut key is F9; For Pause, F10; for Stop, F11.

◆ [Start For Selection (Ctrl + F9)]

After this item is clicked, the system will only process currently selected objects and ignore other objects.

◆ [Breakpoint Resume (Shift + F9)]

Corresponding to the Resume button on the machine control bar.

◆ **[Start for Near Point]**

If the job is not cut thoroughly in the process of cutting, manually move the cut head to the to-be-cut point, and then click this item to make the system resume machining from the point on the tool path nearest to the current point.

The default radius centered around the current point is 100mm, which cannot be modified by the user.

◆ **[Simulation (F8)]**

It corresponds to the Simu button on the machine control bar.

◆ **[Dry Run]**

It corresponds to the DryRun button on the machine control bar.

◆ **[Frame Check (F7)]**

After load of a machining file, clicking on this menu item will make the system move around along the circumscribed rectangle of the machining file to decide the machining range. Frame check is optional.

◆ **[Teaching]**

For the convenience of editing special-shaped tool path, the software is equipped with teaching function so as to help the user draw a machining path manually according to the shape and contour of workpiece.

Clicking “Teaching” will eject the following dialog, as shown in Fig. 4-40.

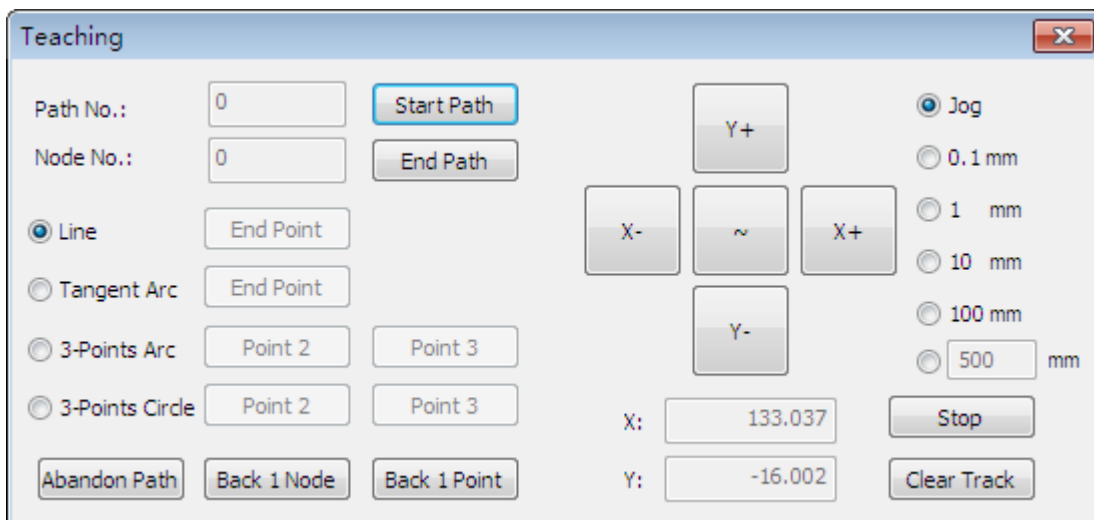


Fig. 4-40 Teaching dialog

The software automatically calculates “Path No.” and “Node No.”, which cannot be modified manually.

- Path No.: a path is confirmed after started and ended.
- A node is a control point of a curve to control the shape of the curve, including linear node and circular node.

When drawing a line (i.e. a segment), each time clicking on “End Point” will confirm a linear node, while when drawing a tangent arc or a three-point arc, each time clicking on “End Point” or “Point 3” will confirm a circular node.

- Tangent arc: two arcs tangent to each other with only one point of intersection.
- Three-point arc: confirming an arc through three points.

Take “3 Points Arc” as an example to illustrate the concrete operation and usage:

- 1) Select “3 Points Arc”, and then click “Start Path” to set current XY coordinates as the first point. If the current point is not the desired one, move XY axes to the desired position before clicking “Start Path” in order to set the desired position as the first point.
- 2) After the first point is set, move XY axes to the next target position, then click “Point 2” to confirm the second point, then move XY axes to the third target position, and then click “Point 3” to confirm a three-point arc, meanwhile, point 3 is also the first point of the next arc. Then operate the same to confirm the second and third point of second, third...nth arc as confirming the second and third point of the first arc until clicking “End Path” to complete this path.
- 3) During drawing, if the user needs to delete the selected point 2, he can click “Back 1 Point”. But when an arc is confirmed after clicking “Point 3”, the user has to click “Back 1 Node” to delete the current third point because now the third point is a node and “Back 1 Point” is invalid. “Back 1 Node” cancels the third and second drawn point, with the first point remained. To cancel the first point, the user has to click “Abandon Path”.



After “End Path” is clicked, “Abandon Path” becomes ineffective.

After drawing, the user has to click “End Path”, or the drawn path will not be saved.

Move axes in Jog and Incremental step mode. In Jog mode, jogging speed and rapid jogging speed can be switched by pressing a number key or combination key (a number key and acceleration key). In Incremental step mode, “Stop” button is used to stop the currently moving axis.

“Clear Track” is used to clean the redundant red trajectory during drawing and keep the useful blue path trajectory.

◆ [Adjust Light]

This function is used to adjust the laser power in jog and incremental mode to ensure an appropriate power in cutting.

After the “Jog” is checked and “Laser” is clicked, the plasma port in the machine control bar will open for a while and then close. But if the “Jog” is not checked, clicking “Laser” leads to continuous laser output from the plasma port on the right side and clicking it again will stop the output.

◆ **[Screw-Err Compensation Guide]**

For more details, see chapter 6.1.

4.7. Help Menu

This menu is used for register, language switchover, viewing shortcut key info and displaying system info, etc.

◆ **[Language]**

The user can switch between Chinese and English on line by this menu item.

◆ **[Log]**

The log screen records the important user operation and system events. Users can not only view the log information after the last startup, but also review the history log recorded before.

◆ **[Shortcut Key Information (F1)]**

After this item is selected, the shortcut key information window will pop up. For details, see Appendix of Shortcut Keys.

◆ **[User Manual]**

This submenu clicked, users can view the users' manual.

◆ **[Daily Tips]**

This function introduces each function and its user guide briefly in the sequence of software operation. Click "Prev" and "Next" to view the tips in order. "Show daily tips on startup" checked, daily tips dialog box will pop up at each system startup, or users need to manually click the submenu to eject it.

◆ **[Weihong Introduction]**

This submenu provides the Weihong introduction, by which users can learn more and contact us.

◆ **[About NcEditor]**

After this option is selected, a dialog pops up, as shown in Fig. 4-41.

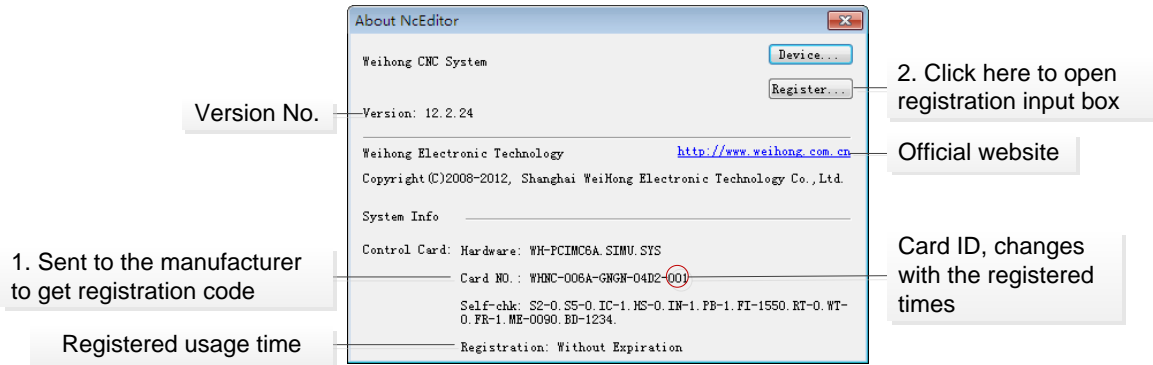
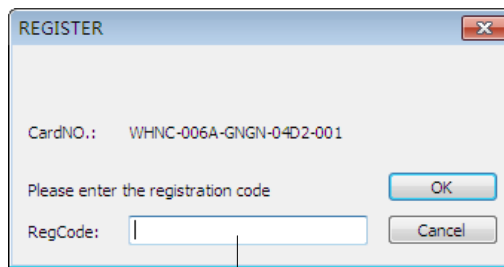


Fig. 4-41 About NcEditor

In the above dialog, the user can view such info as version, control card, manufacturer, etc. Clicking on the website will login to our official website directly.

Register function is used for limiting the system usage time. When the usage time is used out, the user can write down the Card No. and send it to his manufacturer to get a registration code. Then click on the button [Register...] to eject the registration code input box, as shown in Fig. 4-42. And then input the received code into the following dialog, and click “OK” to finish register.



Input the code received from the manufacturer here

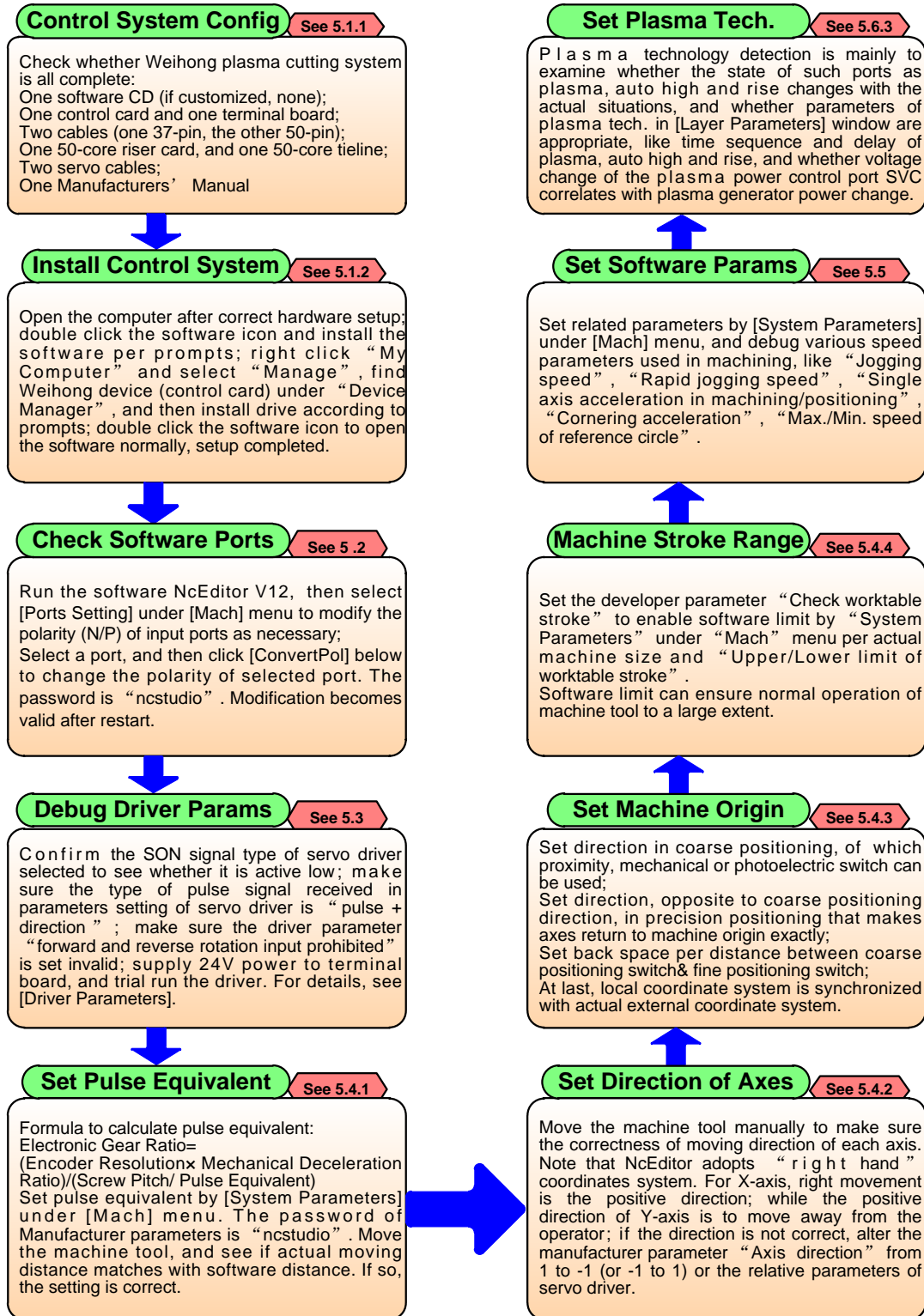
Fig. 4-42 Register



Card ID changes with registered times, reflected in the last three numbers of Card No.. When registered times is 0, the last three numbers are 000; when 1, the last three numbers 001.

5. Machine Tool Debugging

Flow Chart of Machine Tool Debugging



5.1. Control System Installation

5.1.1. Control System Configuration

Independently developed by Weihong Electronic Technology Co., Ltd., PM63A/62A motion control cards, mating with NcEditor motion control software, are applied to the motion control of plasma cutting.

The standard configuration of a PM63A/62A control system is as follows:

- One PM63A/62A servo control card
- A CD of NcEditor motion control software (unnecessary if the manufacturer has already customized one.)
- One terminal board of EX22A3 or of other type
- One DB37M/F cable (1.5m)
- One DB50-CONNECT card
- One FC50-FC50 cable (25cm)
- One HD50F-CN50 Cable (1.5m)
- One MPG flat cable FC16-DB15F (35cm, with rail block), for connecting MPG (optional)
- A handwheel of NK-MPG-05 or NK-MPG-06 (optional)

5.1.2. Installation of Control Card

- 1) Insert the software CD into the CD driver of computer, and then double click “setup. exe” for installation of the software until finished;
- 2) Power off the computer, then open the computer chassis, and then insert the control card into a PCI slot (white) and fasten the screw of rail block (if there is an extended flat cable, its rail block screw should also be fastened), and then lid the computer case;
- 3) Power on the computer. The computer will find the new hardware-device and install its driver automatically;
- 4) Double click the shortcut icon of NcEditor on the desktop; if it runs normally, installation is over (if not, please check whether the control card is well inserted and whether the gold finger is clean).

5.1.3. Installation Detection of Control Card

- 1) Join the terminal board to port JP1 on the control card with a DB37M/F cable, to DB50 interface on the control card with a HD50F-CN50 cable, provide 24V power supply for the terminal board, and power on the machine signal system (proximity switch, etc).
- 2) Examine the input signal LEDs of the terminal board: for example, if the origin switch connected is normally closed, at this time, two LEDs of X0 and Y0 are on; trigger the origin switch through artificial imitation. (For a travel switch, artificial press can be used to observe whether the signals can be received. For a photoelectrical switch, artificially obstruct the light to see if the signals can be gotten. For a metal proximity switch, artificially approach it with a metal block to see if the signals can be gotten.) If the corresponding LED is out, it indicates the origin signals have been sent to the terminal board. If the origin switch connected is normally open, LEDs should be usually out, and by artificially touching the switch, LEDs should become light, which shows the origin signals have been sent to the terminal board. The same method can be taken to test other input ports to ensure the correctness of the wiring between the terminal board and the machine tool, greatly shortening the debugging time.

5.2. Description of Ports Wiring

5.2.1. Ports Diagnosis of Software

- 1) Power on the computer, run NcEditor software, and then open "IOPorts" window displaying many input and output signals by [Ports Setting] under [Mach] menu. Solid dots represent input signals, while hollow dots represent output signals.
- 2) Dots in red indicate the signals are invalid at the time (with no input or output), while dots in green indicate the signals are valid at the time. The "IOPorts" window is as shown in Fig. 5-1. (It is for reference only. Ports displayed in "IOPorts" window will vary with different software versions and hardware board card types. The actual situation is in line with shipment).

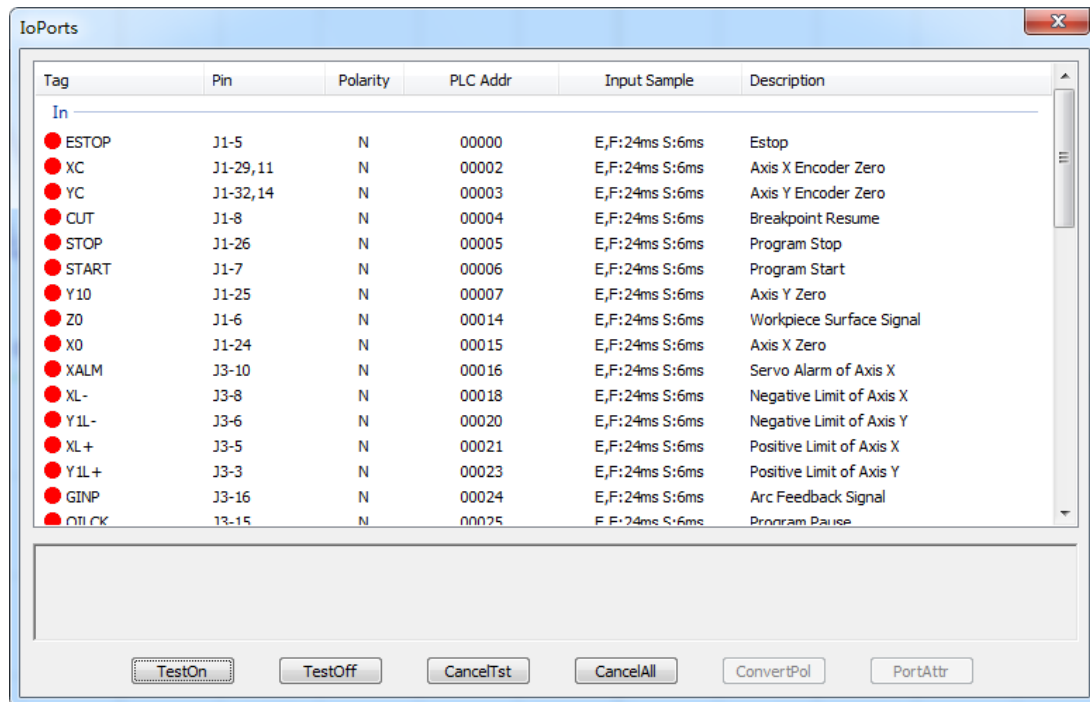


Fig. 5-1 IO ports window

- Alter the input port polarity in the software in terms of such buttons selected as origin switch and E-STOP button: the polarity of NO input ports is N; the polarity of NC input ports is P. The way to alter polarity in the plasma cutting software NcEditor is as follows: select the port to be modified its polarity, and then click the manipulation button [ConvertPol]. The password to modify polarity is ncestudio. After all the polarity modification has been finished, shut down and restart NcEditor to validate polarity modification.

5.2.2. Ports Diagnosis of Terminal Board

- Electrify the electrical box. At this time, the dots in front of such input signals as zero signals of the two axes, E-STOP signal and program start/stop signals should be in red, indicating all these signals are invalid. Otherwise, it is necessary to check the correctness of electrical circuitry and signals polarity. If electrical circuitry is correct, alter the corresponding signal polarity to ensure the dots in front of the above-mentioned signals show in red.
- Press the button [Start], and observe whether the dot color of “program start” signal changes. When the button is being pressed, the dot color should show in green, and in red after released. If there is no change to the dot color, please turn to 5.1.3 above to check whether the LED on the terminal board works normally when the button is being pressed. If the terminal board works normally, it indicates that the software has not collected the signals from the terminal board. Examine the connection of cable DB37M/F and DB50M/F with the control card and the terminal board. Similar method can be taken to examine program stop signal and emergency stop signal.
- In accordance with the above method, open IOPorts window and simulate to trigger the zero signals, observing whether the dot in front of the zero signal turns into green when an origin button is being triggered. Be sure that both the origin signals of X and Y axes can be gotten.

For detailed wiring diagram of terminal board, see Chapter 7.2.

5.3. Driver Parameters Settings

5.3.1. Servo Driver Interface

The socket of servo driver joint is three-row DB15 holes. Its pins definition is shown in Fig. 5-2.

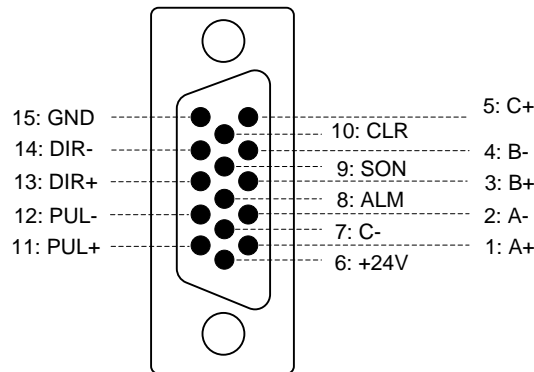


Fig. 5-2 Definition of driver interface

- +24V, GND: supplying 24V DC power to the servo driver;
- SON: servo ON, outputting servo drive enable signals;
- ALM: alarm, receiving alarm signals of servo driver;
- CLR: alarm clearance, releasing alarm signals, only effective for the alarms that can be cleared;
- P+, P-: pulse (PULS), differential output signals;
- D+, D-: direction (DIR), differential output signals;
- A+, A-, B+, B-, C+, C-: three-phase input signals of encoder for detecting encoder zero.

For wiring diagram of a specific driver, see Chapter 7.3.

5.3.2. Common Driver Parameter Settings

Regarding parameter setting of such servo drivers as YASKAWA, PANASONIC, MITSUBISHI, DELTA, FUJI, HITACHI, SANYO and KT, please refer to Chapter 7.4.

5.3.3. Driver Parameter Settings of Other Brands

Pay attention to the following matters:

- 1) Firstly confirm the SON signal type of servo driver selected to see whether it is active low (i.e. servo is ON when SON and GND of 24V power is conducted);

- 2) Then make clear the level of servo driver alarm output port when there is no alarm. If it is normally low-level, the input port polarity of servo alarm should be “P” in “IOPorts” window of software; if it is low-level when alarm occurs, the port polarity should be “N”; for polarity setting, refer to Ports Detection part;
- 3) Make sure the type of pulse signal received in parameters setting of servo driver is “pulse + direction”; make clear whether there is external emergency stop signal input in the input terminal of servo driver, and the logic of this signal;
- 4) Before the trial run of the driver, 24V power supply must be provided for the terminal board, because the 24V power for the driver is indirectly provided through the terminal board; if the driver can't rotate, make sure the driver parameter “forward and reverse rotation input prohibited” is set invalid.

5.4. System Parameter Settings

5.4.1. Pulse Equivalent Setting

Select [System Parameters] under [Mach] menu to eject “System Parameter” window, then click [Manufacturer] button and find the parameter [Pulse equivalent] of the two axes. The password of manufacturer parameters is “ncstudio”. The smaller the pulse equivalent is, the higher the resolution will be. The value of pulse equivalent will affect the maximum feed speed. Generally speaking, regarding the pulse equivalent of mold machines, 0.001mm/p (the corresponding maximum feed rate is 9600mm/min) or 0.0005mm/p (the corresponding maximum feed rate is 4800mm/min) can be taken into consideration; for users who are not very critical of the accuracy, the pulse equivalent can be set a little larger, such as 0.002mm/p (the corresponding maximum feed rate is 19200mm/min) or 0.005mm/p (the corresponding max. feed rate is 48000mm/min). When pulse equivalent is confirmed, calculate the electronic gear ratio of servo driver in terms of value of pulse equivalent. Please refer to Chapter 5.7 for the calculation of electronic gear ratio.

5.4.2. Axis Direction Setting

Move the machine tool manually to make sure the correctness of moving direction of each axis. Note that NcEditor adopts “right hand” coordinates system. For X-axis, right movement is the positive direction; while the positive direction of Y-axis is to move away from the operator (if the movement of Y-axis is the movement of worktable, the positive direction is the worktable moving towards the operator). If the direction is not correct, alter the manufacturer parameter “Axis direction” from 1 to -1 (or -1 to 1) or the relative parameters of servo driver.

5.4.3. Machine Origin Setting

- 1) Homing is a procedure to synchronize local coordinate system with actual external coordinate system via control system. In other words, since the concrete position of each axis is not detected in the system, after system start-up, it will control the motion of each axis and detect the switch signal pre-installed on each axis during the motion (the control system has already known the installation position of these switches). Thus, once these switch signals are found, the system will acquire the machine tool has reached the pre-specified position and then set the coordinate of this position as current coordinates, namely, the local coordinate system is synchronous with the actual one.
- 2) Coarse positioning is used to drive X/Y axis around the machine origin. And the following switches can be adopted in coarse positioning, involving proximity switch, mechanical switch, photoelectric switch, etc. Due to the limit of these switches on precision and repetition in positioning, the X/Y axis is unable to return to machine origin exactly in coarse positioning, thus, fine positioning is compulsory.
- 3) Fine positioning, with various methods, is used to make each axis return to machine origin exactly by regarding encoder origin as fine positioning switch, i.e. the axis is searching for machine origin in the motion via detecting encoder origin. Due to one origin signal sent per revolution of encoder, fine positioning signal is periodic.
- 4) Set manufacturer parameters “1.2 Bkref” in the software according to the installation positions of zero sensors of the two axes. When the setting is correct, run “Go Home” under [Mach] menu.

5.4.4. Worktable Stroke Range

After confirming machine origin and moving direction of each axis, set the developer parameters “Lower & Upper limit of worktable stroke” and “Check worktable stroke” according to the actual size of a machine tool, so as to enable software limit function.

N26	Check worktable stroke	NO		Restart	Whether to check
N27	Lower limit of worktable stroke	-10000.000	mm	Restart	Lower limit of work
N28	Upper limit of worktable stroke	10000.000	mm	Restart	Upper limit of work

5.5. Speed Setting

Open NcEditor, then select [Mach], [System Parameters] and [Developer] sequentially to eject the interface as shown in Fig. 5-3, in which [3.1 Speed/Acc] can be set.

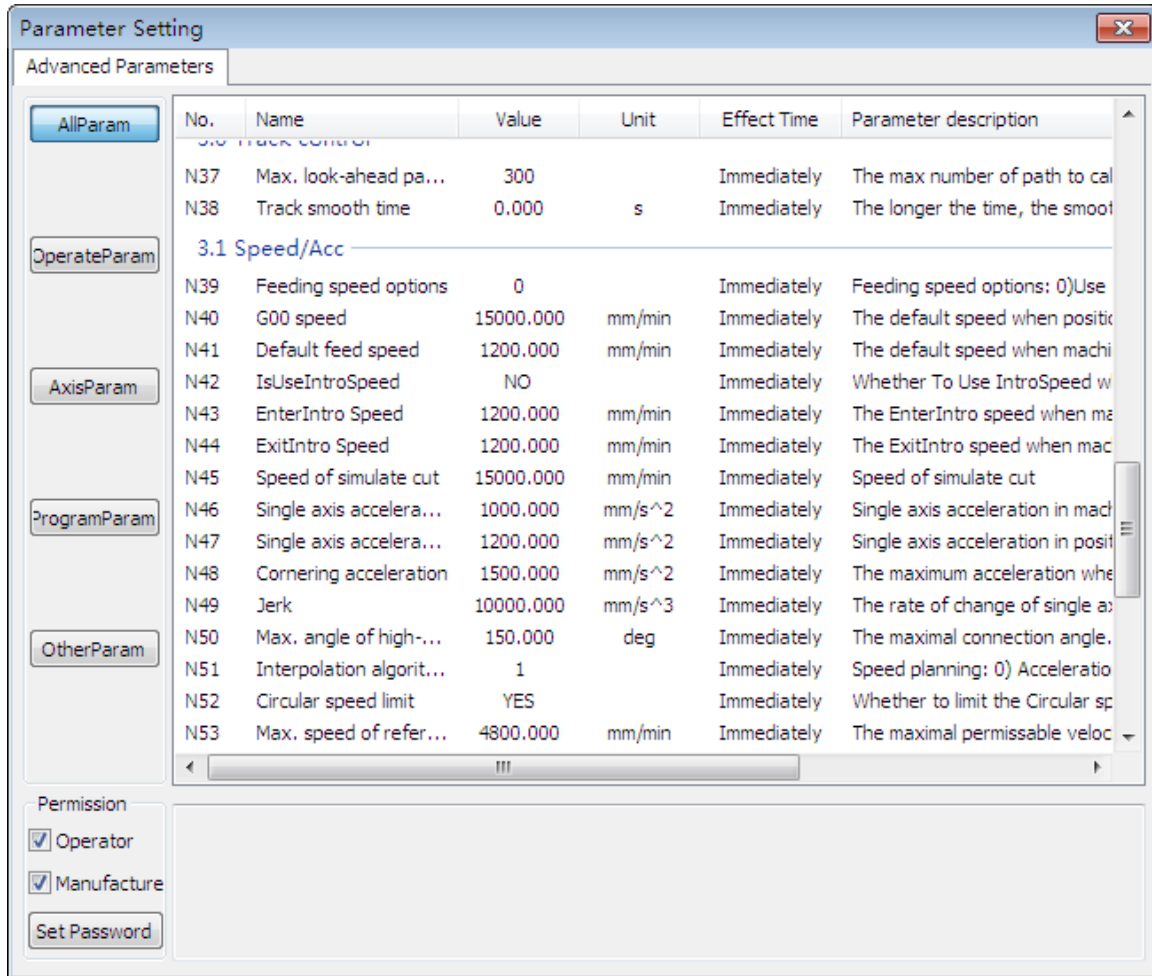


Fig. 5-3 System parameter list

5.5.1. Single Axis Acceleration

It is used to describe the acceleration / deceleration ability of a single axis, with unit mm/s^2 . The value is determined by the physical characteristic of a machine tool, such as quality of movement part, torque, resistance, cutting load of feed-motor, and so on. The larger the value is, the less time spent in the process of acceleration / deceleration will be, and the higher the efficiency will be. Generally, for servo motor systems, the value is between 400 and 1200. Set the value smaller at the beginning; make the machine tool perform various typical movements for a period of time, and carefully observe it; if there is no abnormal situation, increase the value gradually; otherwise, decrease the value and reserve 50% ~ 100% insurance allowance.

5.5.2. Cornering Acceleration

It is used to describe the acceleration/deceleration ability in synchronized motion of multi-feed-axis, with unit mm/s^2 . The value limits the maximum speed of a machine tool in circular movement. The larger this value is, the higher the maximum allowable speed on circular movement of the machine tool

will be. Generally, for servo motor systems, the value is between 1000 and 5000; for heavy machine tools, the value should be smaller. Set the value smaller at the beginning; make the machine tool perform various typical movements for a period of time, and carefully observe it; if there is no abnormal situation, increase the value gradually; otherwise, decrease the value and reserve 50% ~ 100% insurance allowance.

5.5.3. Maximum Speed of Reference Circle

Maximum speed of reference circle corresponds to arc speed limit function. When a machine tool processes an arc, it will vibrate due to centripetal force. To reduce this kind of vibration, the software limits machining speed during machining an arc in terms of centripetal acceleration. Take default setting as an example, the maximum line velocity of the reference circle (Diameter:10mm) is 1800mm/min.

The formula to calculate centripetal acceleration is as following:

$$a = \frac{v^2}{r}$$

Among the formula, $r = (10/2)mm$; $v = 1800mm/min$;

Thus centripetal acceleration a can be calculated; when other arcs are processed, this centripetal acceleration is the maximum allowable centripetal acceleration. Arc speed will be limited, if it is too large causing centripetal acceleration larger than a calculated in this formula.

5.5.4. Minimum Speed of Reference Circle

Minimum speed of reference circle also corresponds to arc speed limit function. a calculated in the above formula is not the only criterion for arc speed limit function.

$$a = \frac{v^2}{r}$$

According to the above formula, in processing an arc with small radius, the line speed will be limited quite low caused by arc speed limit, which will be a waste of time. Therefore, the software provides the parameter "Min. speed of reference circle", which is the minimum speed for circular motion. However small the arc radius is, the machining speed will not be smaller than the value of this parameter.

Usually, given the drive ability of servo motor, friction of machine assembly, and endurance capacity of mechanical components, the maximum speed of the two axes in actual using can be limited by modifying the manufacturer parameters "Max. speed" of each axis.

5.6. Machine Setup Detection

5.6.1. Check Electronic Gear Ratio and Pulse Equivalent

To examine whether the value of electronic gear ratio matches with that of pulse equivalent, make a mark on any axis of the machine tool and set this marked point as the workpiece origin in the software. Drive this marked axis to move a fixed distance by direct command input, jog or handwheel, and so on. Measure the actual moving distance with a vernier caliper and compare whether the measured result is equal to the distance shown in the software.

5.6.2. Examine If Any Pulse Is Lost

Direct method: mark a little dot on the surface of a workpiece blank; set this point as the workpiece origin; repeatedly move the two axes; and then back to the workpiece origin; mark a little dot again to observe whether this dot completely coincides with the marked dot. For servo systems, there is a more precise method: set servo driver mode as “input pulse count mode” of the “surveillance mode” (for example, the parameter of YASKAWA servo is UN00C); regulate the servo driver to display the lower 4 bits (with “L ” before the count value) in count value (hexadecimal system); set workpiece origin and then write down the pulse count value at this time, then repeatedly dry run a procedure, then back to workpiece origin and see whether the pulse count value at this time is the same with the original value. For YASKAWA servo, as long as the value difference of pulse count value is no more than 4 (the frequency of host controller is 1/4 times the frequency of pulse sent by servo drive), indicating that the main controller sends pulses within the tolerance of 1 pulse, the control system runs normally; otherwise, please check the pulse signal type of servo driver, and make the pulse type received by servo in accord with the pulse type sent by the card.

5.6.3. Plasma Technology Detection

Plasma technology detection is mainly to examine whether the state of such ports as plasma, rise, fall and cylinder changes with the actual situations, and whether parameters of plasma technology in [Layer Parameters] window are appropriate, like time sequence and delay of plasma (arc striking), rise, fall and cylinder and whether voltage change of the plasma power control port SVC correlates with plasma generator power change.

5.7. Electronic Gear Ratio

5.7.1. Electronic Gear

Electronic Gear: assume that the host controller sends 5000 pulses per revolution of servo motor. When doubling revolutions of servo motor driven by the same amount of pulses is needed, there are two methods available, “set servo parameters” and “addition of mechanical gear between motor spindle and load-spindle”. Using circuit to realize the functions of mechanical gear is called electronic gear, viz. pulse frequency multiplication function.

5.7.2. Electronic Gear Functions

Regarding “Electronic Gear”, it refers to a proportional control factor of output displacement to motor when a certain amount of pulses is input. For the “senior device” issuing pulses, it can be regardless of encoder pulse No. and mechanical deceleration ratio in controlling.

Functions of electronic gear: it can set the command unit freely (the displacement of lead screw corresponding to one pulse sent by host controller). Frequency reduplication can be used to amplify the frequency of pulse issued by mater controller.

Electronic gear ratio= encoder resolution × command unit × mechanical deceleration ratio / pitch

Please see the servo motor label plate and then refer to the corresponding driver manual to confirm its encoder resolution. Fig. 5-4 is a label plate of YASKAWA SGMSH motor, and the 4th character in motor type is the serial encoder specification, so the resolution of this motor is 2^{17} , i.e. 131072.

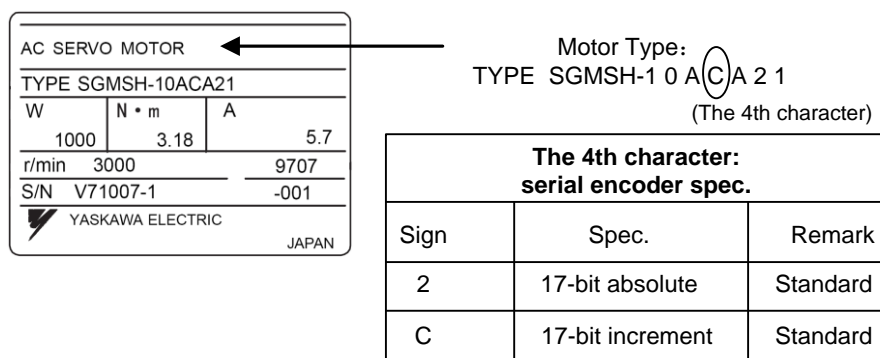


Fig. 5-4 Name plate of servo motor-encoder resolution

For instance: (an example of YASKAWA servo) lead screw pitch of a certain type machine is 5mm, with 17 bit encoder resolution, “0.0001mm/p” pulse equivalent and “1:1” deceleration ratio.

$$\text{Electronic gear ratio} = \frac{PN202}{PN203} = \frac{2^{17}}{5/0.0001} \times 1 = \frac{131072}{5/0.0001} \times 1 = \frac{8192}{3125}$$

The conversion of electronic gear ratio is as shown below.

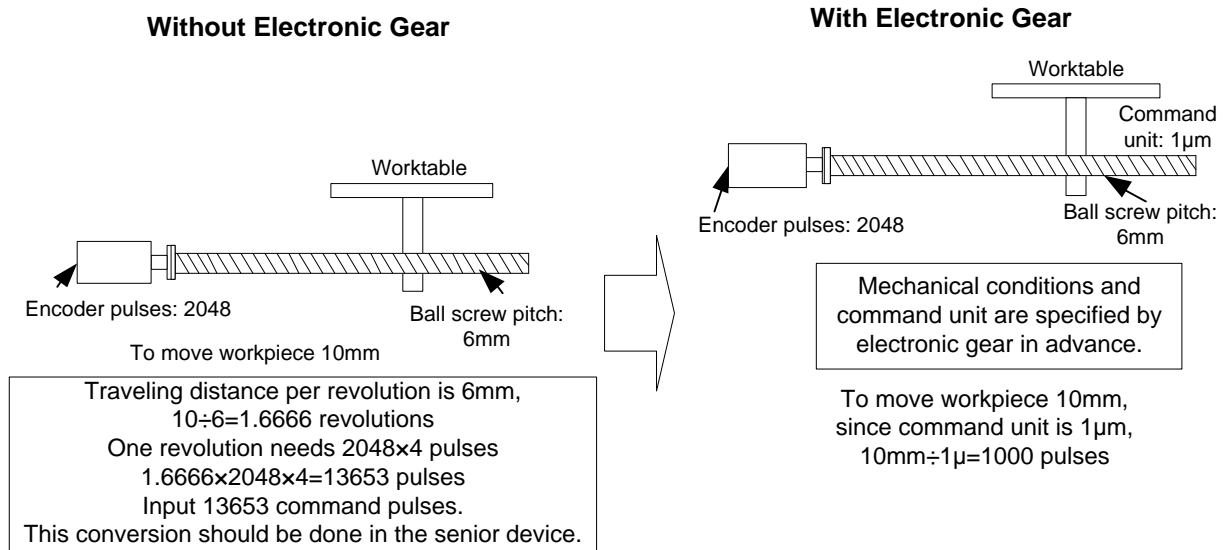


Fig. 5-5 Schematic conversion of electronic gear ratio

5.7.3. Computing Method of Electronic Gear Ratio

The setting of electronic gear ratio should be in accordance with the specification of equipment.

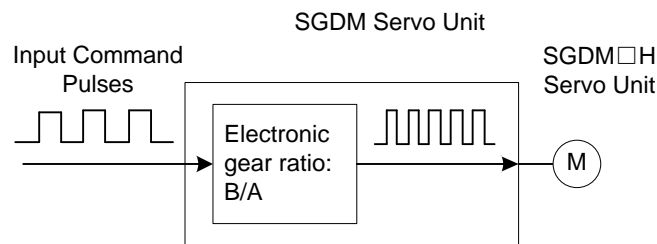


Fig. 5-6 Schematic diagram of electronic gear ratio function

$$\text{Electronic Gear Ratio } \frac{B}{A} = \frac{Pn202}{Pn203} = \frac{\text{Encoder Pulses} \times 4}{\text{Amount of movement per revolution of bearing axle}} \times \frac{m}{n}$$

$\frac{m}{n}$ is mechanical deceleration ratio.

5.7.4. Samples of Electronic Gear Ratio Setting

◆ **Sample One**

As lead screw pitch= 6mm (lead screw travels 6mm per revolution of bearing axle), “2048” ($2^{13}/2^2$) pulses will be generated per revolution of servo motor with 13-bit incremental encoder.

Command unit= 0.001mm (lead screw moves 0.001mm per pulse generated by host controller)

Amount of movement per revolution of bearing axle= 6mm/0.001mm=6000

Ball Screw

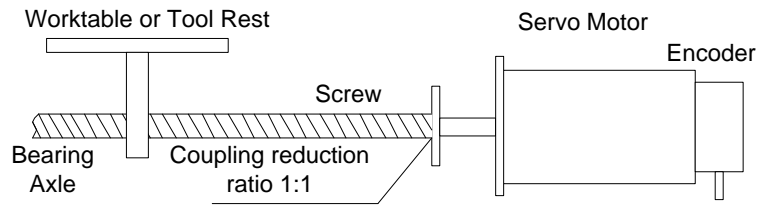


Fig. 5-7 Servo motor sharing the same axle with lead screw (without reduction gearbox)

Servo motor and lead screw are sharing the same axle (without reduction gearbox), and one revolution of motor will lead to one rotation of lead screw.

$$\text{Electronic Gear Ratio } \frac{B}{A} = \frac{2048 \times 4}{6000} \times \frac{1}{1} = \frac{8192}{6000} = \frac{\text{Pn202}}{\text{Pn203}}$$

(Note: for YASKAWA servo, "4" should be multiplied by the numerator.)

Table 1 Parameters setting value

Parameters	PN202	PN203
Setting Value	8192	6000

◆ **Sample Two**

Round Table

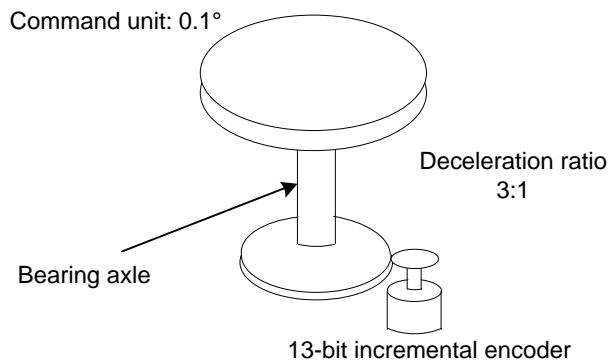


Fig. 5-8 Sample of round table

Pulses generated per revolution of motor= $2^{13}/2^2=2048$

Angle of rotation per revolution= 360°

Command unit= 0.1°

Amount of movement per revolution of bearing axle= $360^\circ / 0.1^\circ=3600$

$$\text{Electronic Gear Ratio } \frac{B}{A} = \frac{2048 \times 4}{3600} \times \frac{3}{1} = \frac{\text{Pn202}}{\text{Pn203}}$$

Table 2 Parameters setting value

Parameters	PN202	PN203
Setting Value	24576	3600

◆ Sample Three

Belt + Pulley

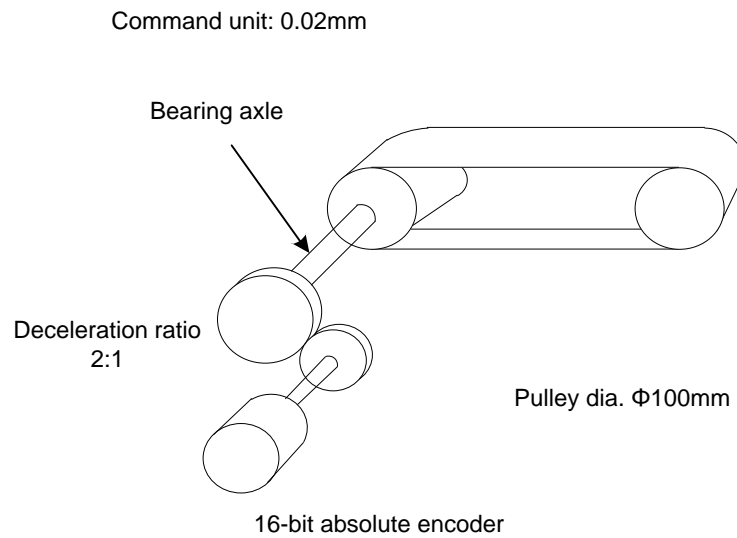


Fig. 5-9 Sample of belt + pulley

Pulses generated per revolution of motor= $2^{16}/2^2=16384$

Pulley diameter=100mm

Command unit=0.02mm

Amount of movement per revolution of bearing axle= $3.14 \times 100\text{mm} / 0.02\text{mm} = 15700$

$$\text{Electronic Gear Ratio } \frac{B}{A} = \frac{16384 \times 4}{15700} \times \frac{2}{1} = \frac{\text{Pn202}}{\text{Pn203}}$$



If the calculation result is out of setting range, both the numerator and denominator should be divided by their common divisor.

Table 3 Parameters setting value

Parameters	PN202	PN203
Setting Value	131072	15700

5.8. Settings of Round Tube Cutting

Currently, existing intersectional cutting equipment, with simple functions, is complex to operate and cannot meet the demands of actual processing technology and industrial production. Therefore, our system provides round tube cutting to meet high-precision demand of intersection of pipe and pipe.

Round tube cutting includes circle and rectangle cutting.

5.8.1. Circle Cutting

The dialog of circle cutting is as shown in Fig. 5-10.

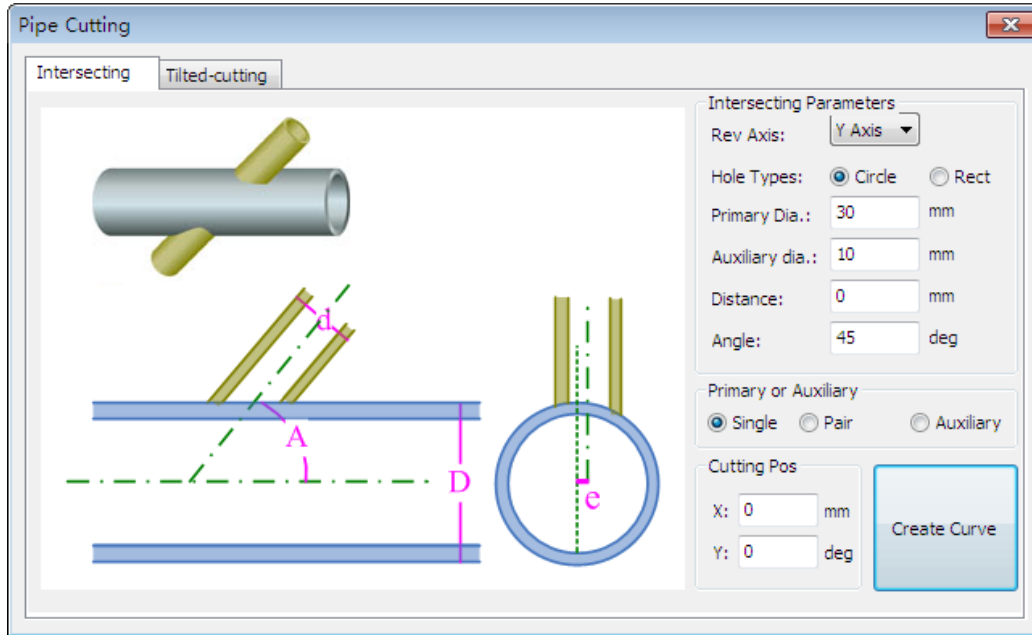



Fig. 5-10 Intersectional cutting of primary pipe-circle cutting

Rev Axis: under rotary table configuration, rotary axis is fixed.

Circle cutting parameters are as follows:

- Primary Dia.: the diameter of primary pipe, like “D” in the above picture. Under rotary table configuration, its value can be changed by clicking  behind, synchronizing with the system parameter “Rotation Diameter”.
- Auxiliary Dia.: the diameter of auxiliary pipe, like “d” in the above picture. Manually enter the auxiliary diameter which must be less than or equal to primary diameter, when cutting the primary pipe.
- Distance: the offset between central line of primary pipe and central line of auxiliary pipe, like “e” in the above picture.

$$\text{Distance} = \pm \frac{\text{Primary Dia.} - \text{Auxiliary Dia.}}{2}$$

- Angle: the tilt angle ([5, 175]) between intersected primary pipe and auxiliary pipe, like “A” in the above picture.

After entering the above parameters and clicking “Create Curve”, the motion trajectory of cutting primary pipe will be generated automatically according to the data, as shown in Fig. 5-11.

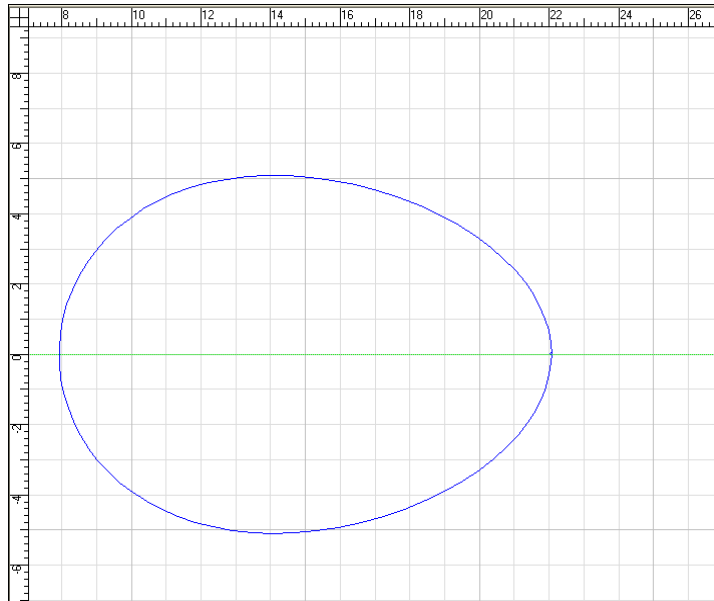


Fig. 5-11 Trajectory of cutting primary pipe

“Cutting Pos” can be used to cut multiple circular holes or rectangular holes on a round tube by clicking “Create Curve”. Under “YRevB” configuration, value of Y refers to the angle Y axis rotates in rapid traverse with respect to the first cut hole, while value of X means the length X axis moves (i.e. to the next cut position) in rapid traverse with respect to the first cut hole. The trajectory of cutting several circular holes is as shown below.

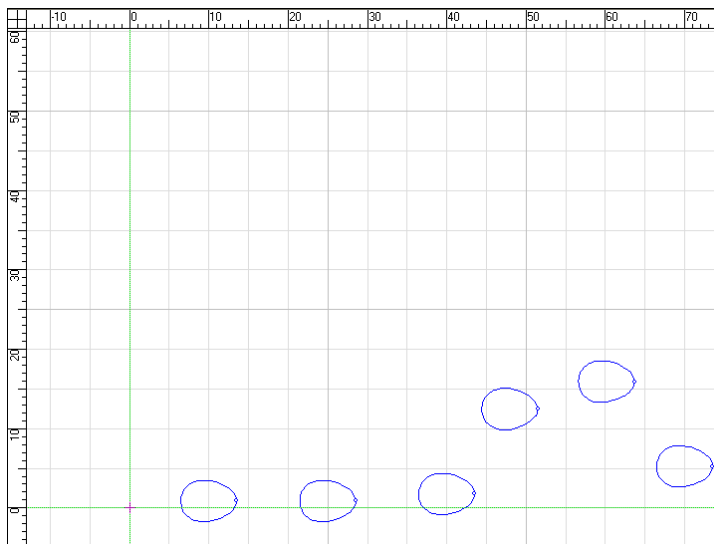


Fig. 5-12 The trajectory to cut several circular holes on a primary tube

5.8.2. Rect Cutting

Rect (rectangle) cutting is similar to circle cutting, except for some different parameters, as shown in Fig. 5-13.

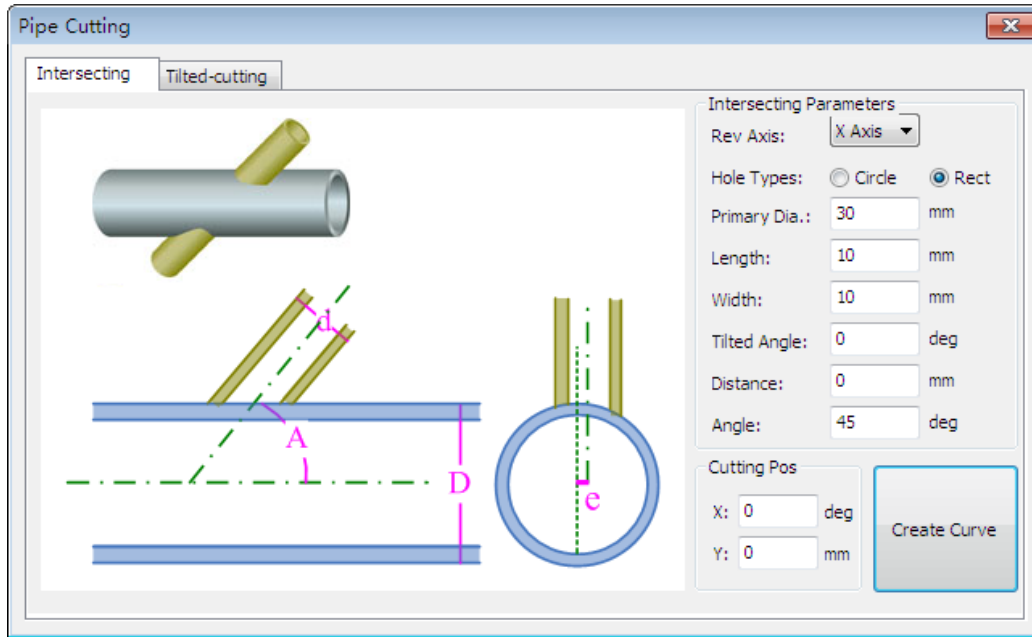


Fig. 5-13 Intersectional cutting-rectangle cutting

- Length: the size of rectangle edge parallel to the edge of round tube.
- Width: the size of rectangle edge perpendicular to the edge of round tube.
- Titled Angle: tilt angle of “Length” edge with respect to the central line of round tube, which can be used to cut multiple rectangle holes on different parts of round tube at different angles. If “Tilted Angle” is positive value, tilt goes CCW; if negative, title goes CW.

Other parameters are the same as those of circle cutting. The trajectory to cut several rectangle holes on a primary tube is as shown below.

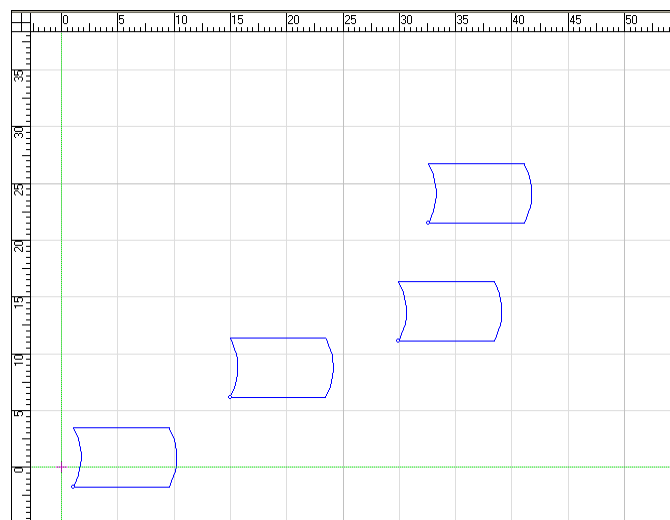


Fig. 5-14 The trajectory to cut several rectangle holes on a primary tube

5.8.3. Tilted Cutting

The operation interface for pipe tilted cutting is as shown in Fig. 5-15.

- Rev Axis: the rotary axis under current rotary table configuration.
- Tube Dia: the value set in the system parameter “Rotation Diameter”.
- Angle: the angle ([5, 175]) included by cutting face and pipe central line, like “A” in the below picture.

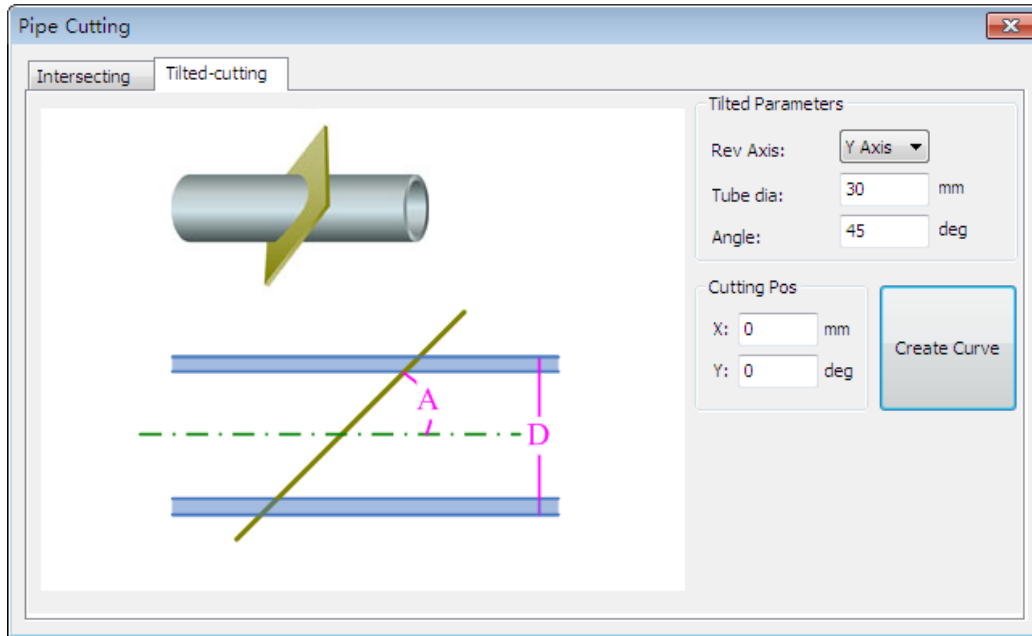


Fig. 5-15 Truncated cutting of round tube

After all the above parameters are set, the system will generate a motion trajectory automatically, as shown in Fig. 5-16.

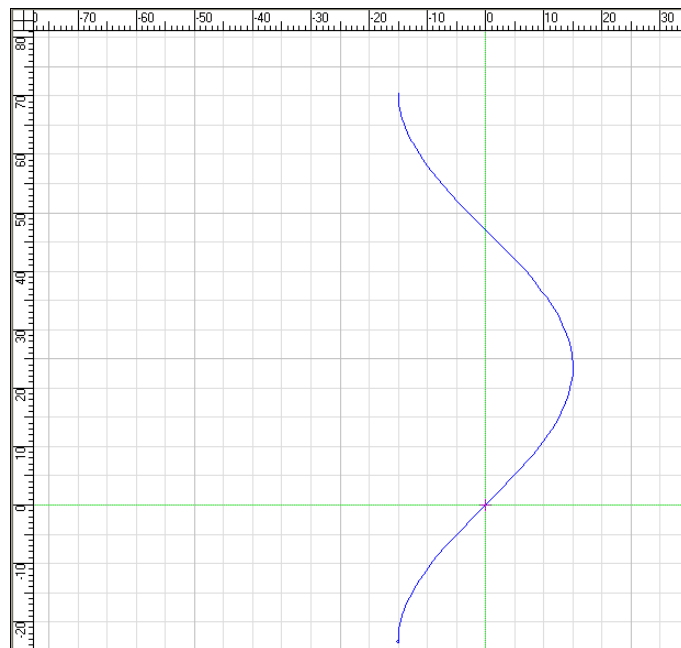


Fig. 5-16 Motion trajectory of pipe tilted cutting

5.8.4. Multi-cutting of Round Tube

Our software supports cutting multiple objects on a round tube, with the concrete methods as following:

- 1) Draw or import the objects to be cut, as shown in Fig. 5-17.

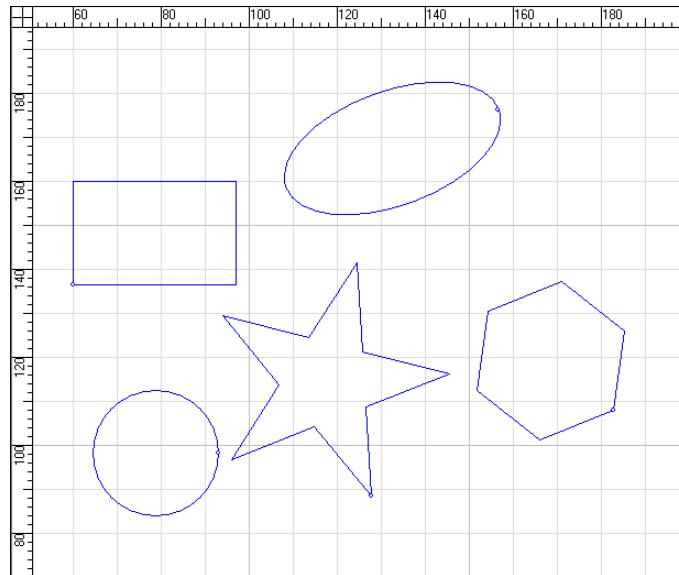


Fig. 5-17 Draw objects of pipe multi-cutting

- 2) Select all the objects and then select “Set Intersecting Line” under “Object” menu or under right-click menu. (Setting “Intersecting Line” for each object is also ok, but too tedious.) A dialog as following pops up.

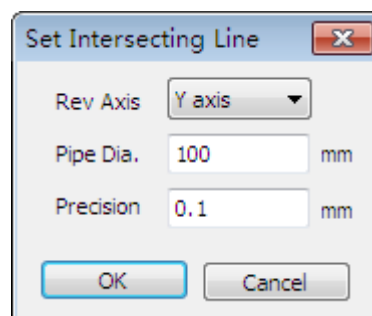


Fig. 5-18 Setting intersecting line

In the above picture:

- Rev Axis: consistent with current rotary table configuration.
- Pipe Dia.: the diameter of current pipe, which must be larger than the max. height of all objects, or an error prompt will pop up.
- Precision: the contact ratio of actual cutting path and pre-estimated path; the smaller the Precision is, the smaller the error will be.

- 3) After setting the above parameters, click OK to automatically generate the motion trajectory, as following.

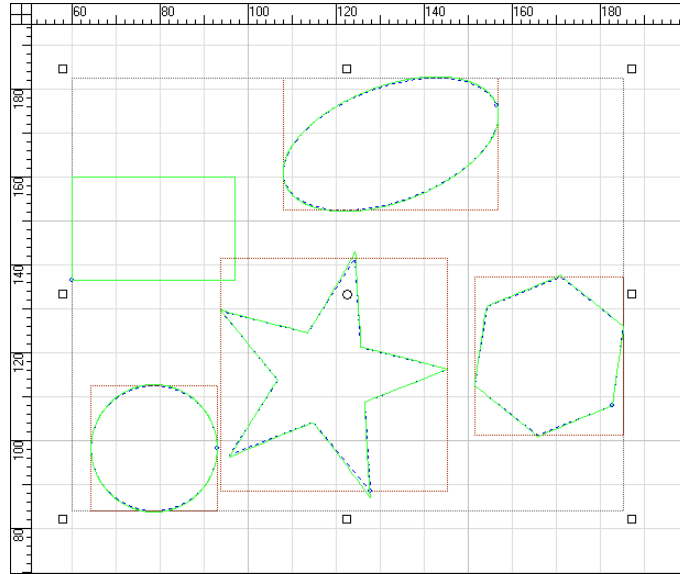


Fig. 5-19 Path of pipe multi-cutting

After all above operations finished, the system will cut the required object holes on the round tube according to the motion trajectory.

6. Advantageous Functions

6.1. Lead Screw Error Compensation

6.1.1. Causes of Lead Screw Error

Lead screw error consists of screw pitch error and errors caused by backlash.

◆ **Screw Pitch Error**

Pitch error is caused by defect in manufacturing of lead screw and long-term wear, etc. In order to improve precision, pitch compensation is needed to meet the requirement. The sketch of lead screw is shown in Fig. 6-1. A coordinate system is established, based on point “O” on the lead screw as the reference point, nominal value as X-coordinate, and actual value as Y-coordinate. Then ideal moving curve is as curve “1” in Fig. 6-2 however, actual curve will be curve “2” due to pitch error. That is to say, the Actual value is not the same as its corresponding Nominal value, actual moving curve deviating from the ideal one, and their difference is called error, i.e.:

$$\text{Error} = \text{nominal mechanical coordinate} - \text{actual mechanical coordinate}$$

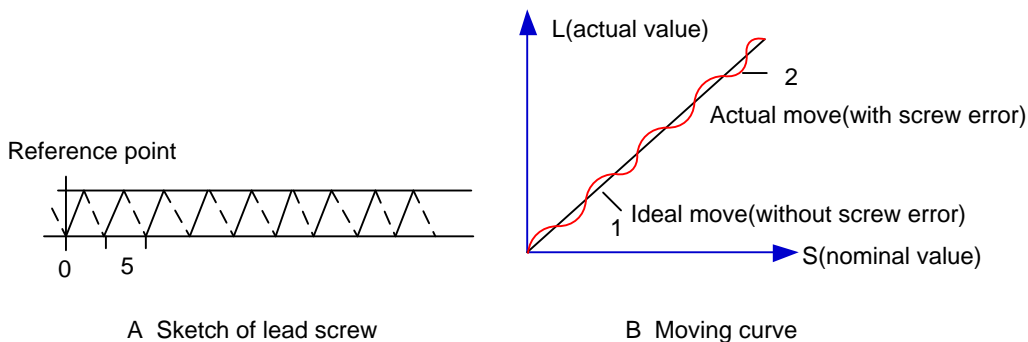


Fig. 6-1 Screw error principle illustration

◆ **Backlash Error**

Hysteresis feature is caused by forward and reverse clearance. Assume that the driving shaft drives the driven shaft in negative (CW) rotation, the servo motor will be idling without moving worktable because of mechanical driving chain backlash when the driving shaft suddenly begins CCW rotation (positive motion). After staying at a certain position for some time, the worktable will move backward with the driving shaft. When the direction of driving shaft changes again, the situation is the same, which is called Hysteresis. If pitch error doesn't exist, under ideal condition, the moving curve of

worktable is shown in Fig. 6-2, and the curve of horizontal section is during the idling of servo motor, while worktable has no movement. The actual moving curve of worktable is shown in Fig. 6-4.

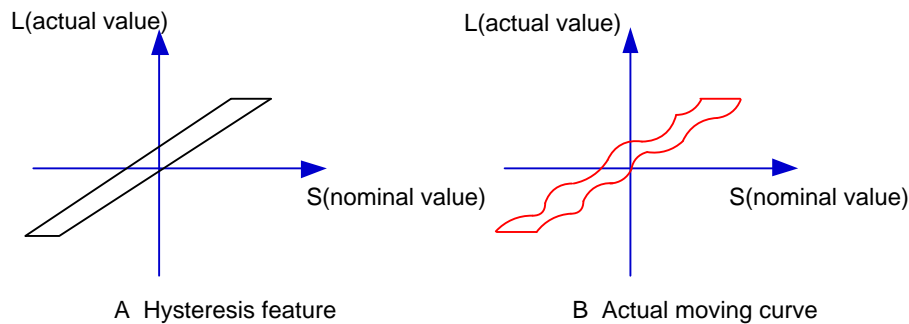


Fig. 6-2 Backlash error principle illustration

The popular explanation is: because the slider is generally fixed on a lead screw whose outer wire and inner wire can not be completely matched, backlash compensation compensates the clearance between the lead screw of last direction that the slider needs to finish after reversing its moving direction.

6.1.2. Method for Lead Screw Error Compensation

Actually the system has already combined the above two errors to deal with and will execute error compensation automatically based on the error data in the file after the backward error and forward error of the corresponding nominal coordinates of each coordinate axis are listed into the lead screw error compensation file.

◆ Lead Screw Error Compensation File

The name of lead screw error compensation file is *axeserr.dat*, found under Tools folder of the installation directory (like C:\Program Files\Weihong). Modification to the data in the lead screw error compensation file will become valid after the software is restarted.

The file format is:

- 1) Firstly specify length unit, currently the supported length unit is mm and the style of writing is: unit=mm
- 2) Then specify error sequence of each axis. To work properly, the contents in this sequence must be arranged in the ascending order of position value from small to large, as follows:

[Axis.<Axis Name>]

<Position>, <Forward Error>, <Backward Error>

<Position>, <Forward Error>, <Backward Error>

<Position>, <Forward Error>, <Backward Error>

Among them, <Axis Name> is X, Y, Z... (Case-insensitive)

Position: nominal value, i.e. the theoretically arrived position driven by the pulses sent by the system when there is no compensation;

Measured Value (P): the actually arrived position driven by the pluses sent by the system to move forward when there is no compensation.

Measured Value (N): the actually arrived position driven by the pulses sent by the system to move reversely when there is no compensation.

◆ **Lead Screw Error Compensation Tool**

AxesErrEditor.exe is in Tools folder under installation directory (for example C:\Program Files\Weihong) after software installation.

The main interface of AxesErrEditor.exe is as shown in Fig. 6-3:

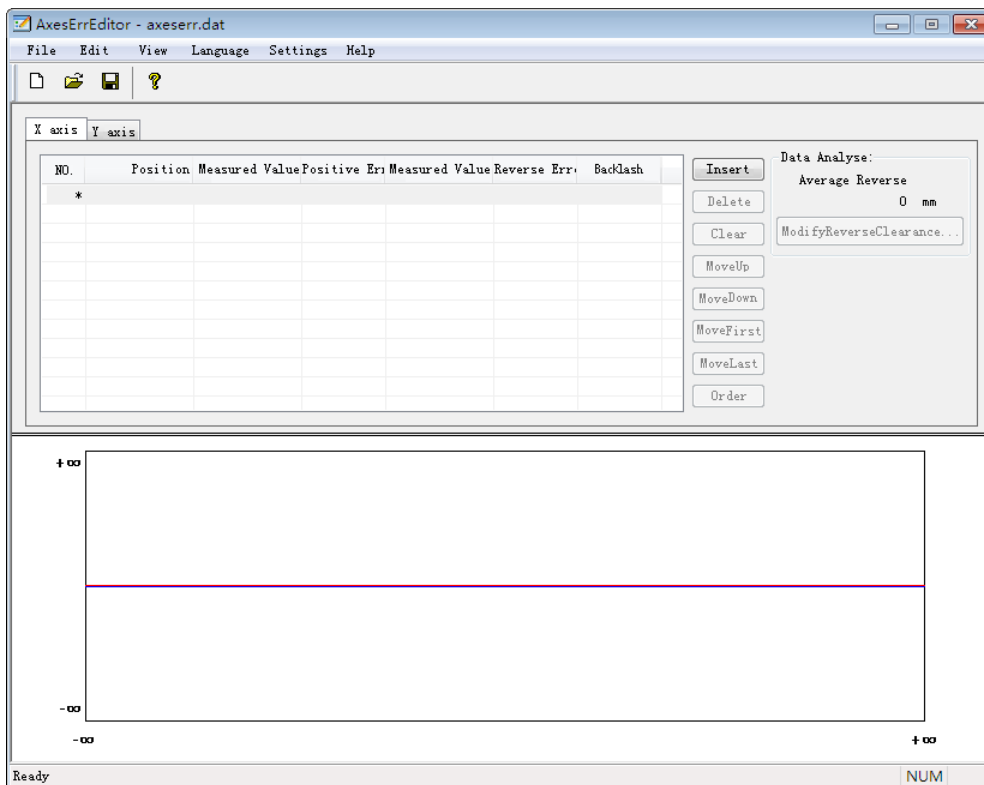


Fig. 6-3 Main interface of AxesErrEditor.exe

Generally the value of lead screw error compensation can be measured by a laser interferometer, with two ways for compensation.

- 1) File compensation. Select [Import File] under [File] menu, choose the compensation data recorded by a laser interferometer to be imported in the pop-up dialog, and then save the data file to corresponding configuration folder (for standard configuration, save the file to “6B_std” under “config” folder, for double-Y configuration, save it to “6A_2Y”). In this way, automatic compensation will be performed during machining in terms of the data in the file. Currently, only .lin files are supported.

- 2) Directly setting compensation on the interface. Enter position, positive measured value and negative measured value in the interface as shown in Fig. 6-3, positive error, reverse error and reverse clearance calculated automatically. Then save the data file under the corresponding configuration folder. In this way, automatic compensation will be performed during machining according to the value in the file.

A visualized path graph, as shown in Fig. 6-4, will be generated according to the input data.

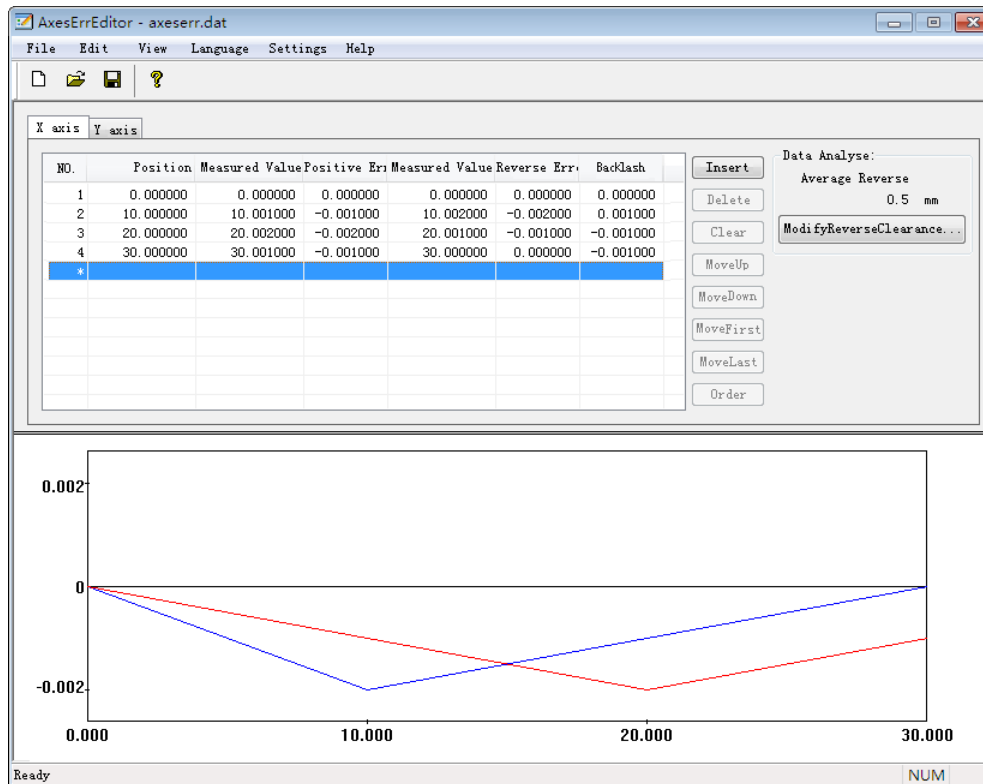


Fig. 6-4 Lead screw error compensation generation interface

In the above picture, the red line indicates the path of positive motion; the blue line the path of reverse motion; the middle gray line the ideal path.

Currently, this tool can save the lead screw error compensation file as two versions: V9 and V12, which can be switched under [Settings] menu.

V9 version supports X, Y and Z axes while V12 version, its interface as shown in Fig. 6-3, supports X and Y axes.

6.1.3. Effect of Lead Screw Error Compensation

Composed of unidirectional error correction, traditional compensation adds backlash compensation simultaneously in reverse motion to improve moving precision. Although this kind of compensation can improve the control precision of a semi-closed machine tool to some extent, the precision after compensation of a point which is located precisely before compensation can not be ensured according to experiments.

Weihong control system realizes bidirectional screw pitch error compensation and can confirm the correction of forward and backward direction by one measure of machine tool precision, which greatly reduce work load of machine tool measurement and improve positioning accuracy, while for traditional compensation, backlash value and screw pitch error value are measured separately with compensation table made afterwards.

It has been found that lead screw error compensation greatly improves positioning accuracy and repeated positioning accuracy of CNC machine tools.

6.2. Power Failure Resume

Apart from breakpoint resume function, the software is also in possession of power failure resume function.

6.2.1. Function of Power Failure Resume

Given the problem of sudden power failure, our system holds power failure resume which can avoid damaging system files due to sudden power failure. Owing to breakpoint resume and accurately returning to machine origin, etc, it is reliable to recover machining site to improve machining efficiency and reduce losses.

6.2.2. Usage of Power Failure Resume

- 1) Home all axes before machining.
- 2) Home all axes again after restarting the system in case of sudden power failure during machining.
- 3) Use "Breakpoint Resume" function on the software to continue machining from the position where power failure happens.



To achieve accurate power failure resume, it is essential to back to machine origin first.

6.3. Frog Leaping Function

6.3.1. Function of Frog Leaping

When there is no frog leaping function, the cutting process of a cutter is divided into three parts: after finishing cutting a curve, the machine moves up perpendicularly in the Z axis, then moves the cutting

head to the next cut point horizontally, and then lowers the cutting head for the next cutting. However, with the help of frog leaping, the cutting head will move up while moving horizontally until reaching the height set by Z-up delay time, and then move down to the cut point in a curve set by the follow-up delay, so the whole process is completed in a curve, which saves G00 time and improves cutting efficiency.

6.3.2. Usage of Frog Leaping

At the moment, frog leaping function only exists in Double Y configuration.

Check “FrogLeaping” in the “Layer Parameters” dialog, indicating enabling frog leaping function in the cutting process. If not checked, the cutting head moves up following the parameters set in the current layer.

6.4. Instant Setting Function

Instant setting function (under “Object” menu) is added to reduce operation steps.

In the “Instant Setting” dialog, as shown in Fig. 6-5, included settings are fill or unfill, machining direction, lead-in/out line, machining order, and kerf compensation, which are above-mentioned. Set these parameters according to actual needs and then click OK to finish the setting of these functions in only one step.

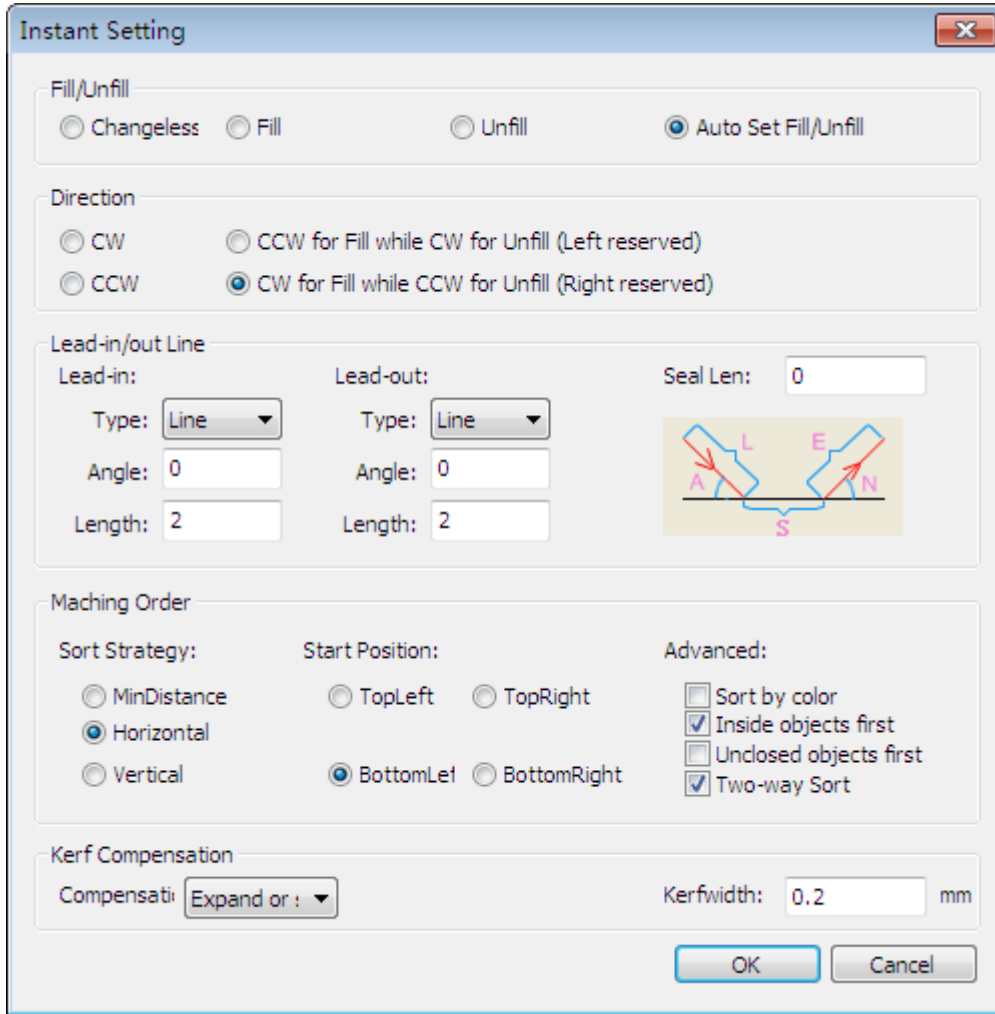


Fig. 6-5 Instant setting dialog

6.5. Shortcut Keys

6.5.1. Function of Shortcut Keys

The software offers easy-to-remember shortcut keys for some functions to help the user get away from mouse operations and fulfill machining actions accurately in the shortest time, which gives the user a feel of freely mastering the software.

6.5.2. Usage of Shortcut Keys

The operation method of shortcut keys: for example, after the software opened, pressing Ctrl + I will eject "Open" dialog to import a file. And then select a machining file. Another example is to manually draw a circle, press Alt + D to choose [Draw] menu, then press the shortcut key C, and then draw a circle on [Object Editor Space].

6.5.3. Details of Shortcut Keys

F1	Help, show shortcut key information
F2	E-stop
F3	Go backward
F4	Go forward
F5	Set workpiece origin
F6	Back to workpiece origin
F7	Frame check
F8	Simulation
F9	Start
F10	Pause
F11	Stop
F12	Clear track
...	...

For more shortcut keys, refer to Chapter 7.7.

7. Appendix

7.1. Remote Control of Wireless Handwheel

7.1.1. Function of Wireless Handwheel

The software is available of remote control of wireless handwheel to help the user walk around freely within the range of 10m instead of confined to the front of a computer. It reduces labor cost, improves work efficiency and adds workpiece positioning precision to increase the utilization rate of machining materials to a large extent.

7.1.2. Installation of Wireless Handwheel

The installation of wireless handwheel:

- 1) If it is an upgrade, exit from wireless handle drive first, then click XHC-HB05-X.exe for installation, and then operate as per the prompts. (Install according to the default prompts, and it's better not to install it to Program Files directory.)
- 2) After installation, open XHCV9.exe under its installation folder.
- 3) After run, this program will be registered into registry as a startup autorun object. If there is firewall, allow the register.
- 4) This handwheel can be only inserted into its customized USB controller to work normally.

7.1.3. Introduction to Wireless Handwheel

With a concise and portable operation panel, this wireless handwheel is compatible with our software to control a machine tool. Through this handwheel, a lot of operations can be performed, like backing to workpiece origin, breakpoint resume, one-key open or close of such ports as plasma and rise. In addition, its band switch can be used to adjust cutting override and manually control X/Y axis movement, and its LCD displays current machine coordinate, workpiece coordinate, feedrate override, retracts, etc.

7.2. Wiring Diagram of Terminal Board

7.2.1. Wiring Diagram of Auto-H (6B-EX1D7)

PM52C is equipped with terminal board EX23A3 as standard. With dimension as 155mm*72mm (L, W), EX23A3 has many auxiliary functions, which can be connected or not according to actual needs. Its wiring diagram is as follows:



Terminal board EX23A3 is the upgraded version of 6B-EX1D7. The two share the same ports except for the opposite position of +24V and COM. Note that the following wiring diagram takes the EX23A3 as an example.

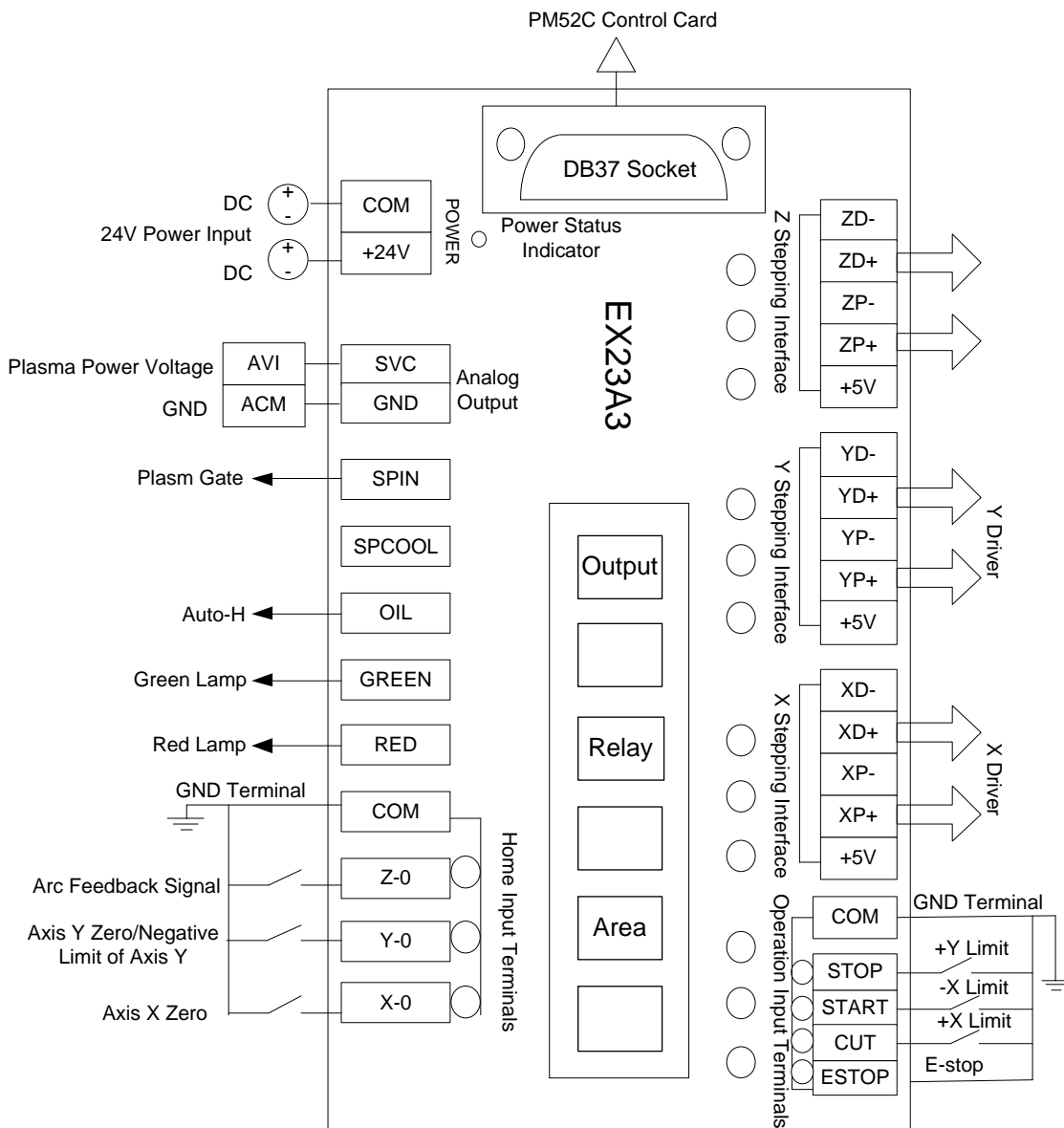


Fig. 7-1 Wiring diagram of EX23A3 terminal board in Auto-H

Table 4 Pin signals of terminal board EX23A3 in Auto-H

Silk-printed Name	Signal	Remarks
24V	DC 24V power	DC 24V power supply, current $\geq 3A$; all 24V ports on terminal board are ON.
COM	Common port	All COM ports on terminal board are ON.
ESTOP	Emergency stop	Binary input signal; commonly connecting a NC button; when it disconnects with COM, machining stops.
CUT	Positive limit of X axis	Binary input signal; active low; connecting the positive limit switch of X axis.
STOP	Positive limit of Y axis	Binary input signal; active low; connecting the positive limit switch of Y axis.
START	Negative limit of X axis	Binary input signal; active low; connecting the negative limit switch of X axis.
Z0	Arc feedback signal	When it opens, the system will execute arc feedback detection.
Y0	Y origin/negative limit	Binary input signal; active low; connecting the zero switch or negative limit switch of Y axis.
X0	X origin	Binary input signal; active low; connecting the zero switch of X axis.
GREEN	Green light	On when machine tool in normal work status.
RED	Red light	On when E-stop occurs or when machining finishes.
OIL	Auto-H	Binary output signal, active low.
SPIN	Plasma gate	External connection with plasma power.

7.2.2. Wiring Diagram of Cylinder (6B-EX1D7)

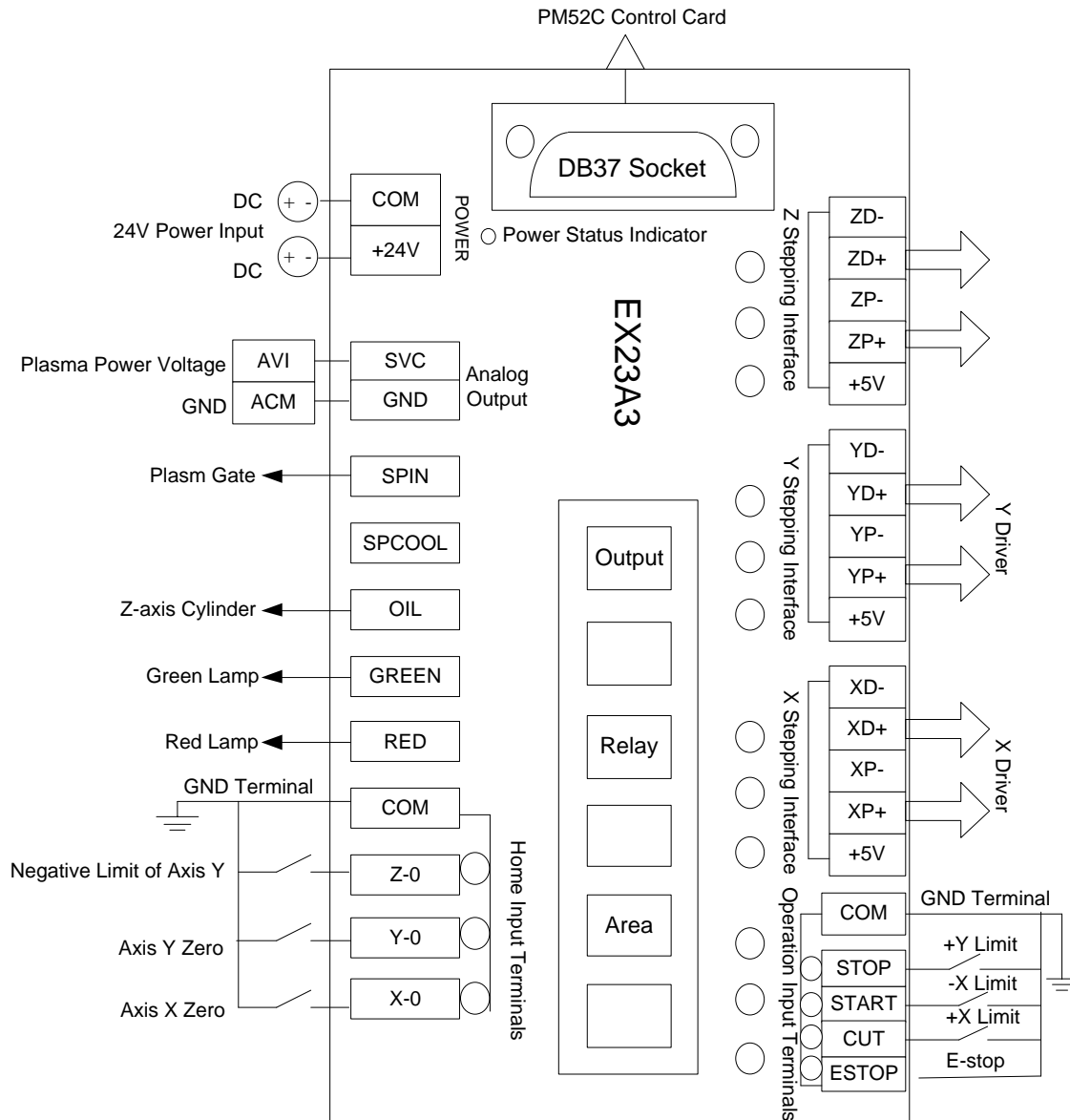


Fig. 7-2 Wiring diagram of terminal board EX23A3 in Cylinder

Table 5 Pin signals of terminal board EX23A3 in Cylinder

Silk-printed Name	Signal	Remarks
24V	DC 24V power	DC 24V power supply, current $\geq 3A$; all 24V ports on terminal board are ON.
COM	Common port	All COM ports on terminal board are ON.
ESTOP	Emergency stop	Binary input signal; commonly connecting a NC button; when it disconnects with COM, machining stops.
CUT	Positive limit of X axis	Binary input signal, active low, connecting the positive

Silk-printed Name	Signal	Remarks
		limit switch of X axis.
STOP	Positive limit of Y axis	Binary input signal, active low, connecting the positive limit switch of Y axis.
START	Negative limit of X axis	Binary input signal, active low, connecting the negative limit switch of X axis.
Z0	Negative limit of Y axis	Binary input signal, active low, connecting the negative limit switch of Y axis.
Y0	Y origin	Binary input signal; active low; connecting the zero switch of Y axis.
X0	X origin	Binary input signal; active low; connecting the zero switch of X axis.
GREEN	Green light	On when machine tool in normal work status.
RED	Red light	On when E-stop occurs or when machining finishes.
OIL	Z-axis cylinder	External connection with the cylinder switch.
SPIN	Plasma gate	External connection with the plasma power.

7.2.3. Wiring Diagram of Terminal Board EX22A2 in 1Y

The basic wiring of terminal board EX22A3 for PM63A/62A control card, when used in signal-Y configuration, is as follows (dimension: 330mm long and 107mm wide).



Terminal board EX22A3 is the upgraded version of EX22A2. The two share the same ports. Note that the following wiring diagram takes the EX22A3 as an example.

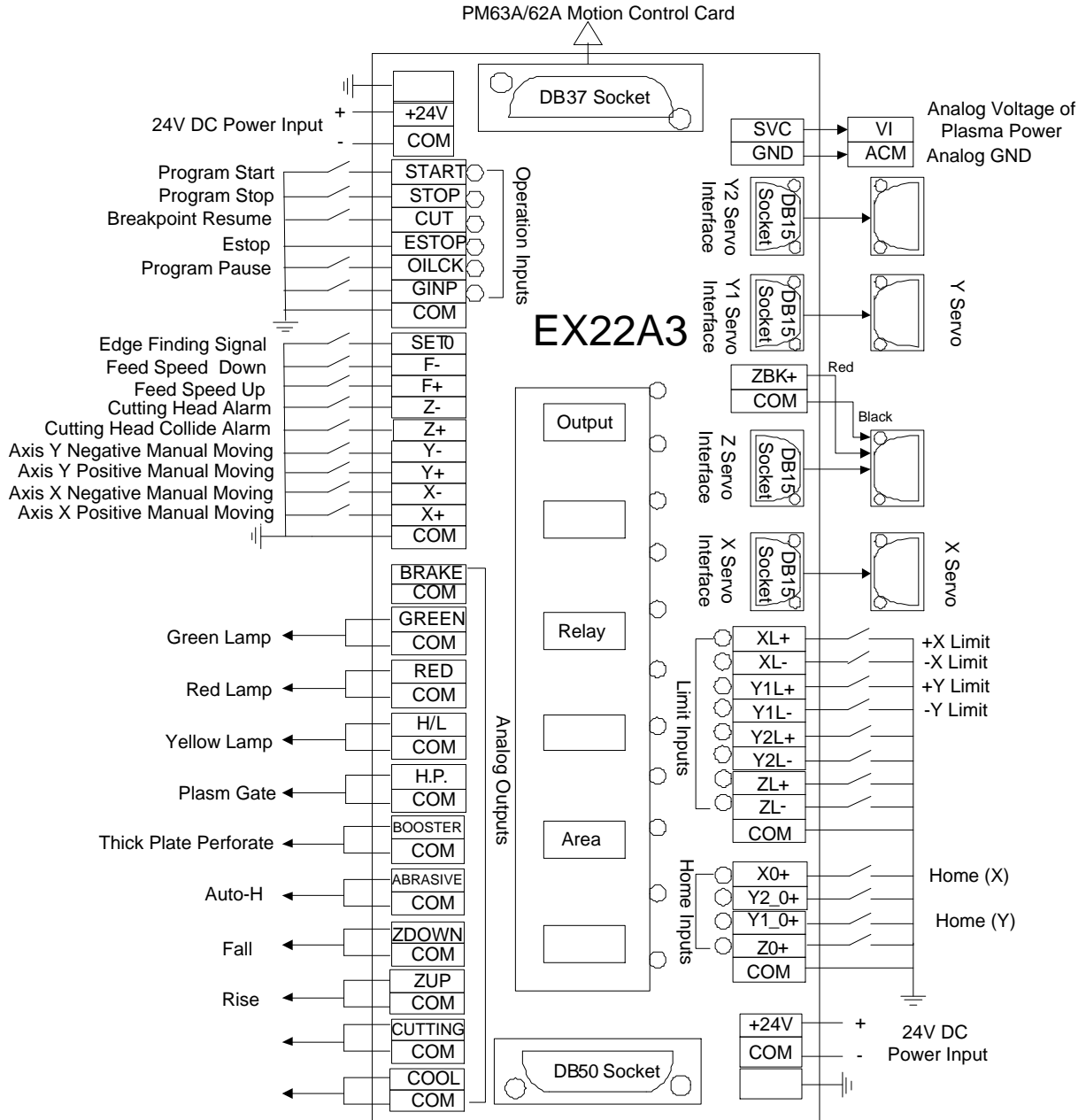


Fig. 7-3 Wiring diagram of terminal board EX22A3 in 1Y configuration

Table 6 Pin signals of terminal board EX22A3 in 1Y configuration

Silk-printed Name	Signal	Remarks
24V	DC 24V power	DC 24V power supply, current $\geq 3A$; all 24V ports on terminal board are ON.
COM	Common port	All COM ports on terminal board are ON.
START	Program start	External connection with reset switches.
STOP	Program stop	
CUT	Breakpoint resume	
ESTOP	E-stop	External connection with an E-stop switch
Z-	Cutting head alarm	Feeding back cutting head alarm to the software.
Z+	Cutting head collide alarm	
ESTOP	Emergency stop	External connection with an E-stop switch.
OILCK	Program pause	Binary input
F-	Feed speed -	External connection with reset switches.
F+	Feed speed +	
Y-	Manual motion along -Y axis	
Y+	Manual motion along +Y axis	
X-	Manual motion along -X axis	
X+	Manual motion along +X axis	
SVC	Analog voltage (+)	Connection with plasma supply power to control plasma generator output power.
GND	Analog voltage (-)	
GREEN	Green light	Binary signal, no voltage output.
RED	Red light	
H/L	Yellow light	
H.P	Plasma gate	
BOOSTER	Thick plate punch signal	
ABRASIVE	Auto high	
XL+	Positive limit of X axis	External connection with mechanical, photoelectric or proximity switches, etc.
XL-	Negative limit of X axis	
Y1L-	Negative limit of Y axis	
Y1L+	Positive limit of Y axis	
X0	X origin	
Y1_0	Y origin	

7.2.4. Wiring Diagram of Terminal Board EX22A2 in 2Y

The basic wiring of terminal board EX22A3 for PM63A/62A control card, when used in dual-Y configuration, is as follows.

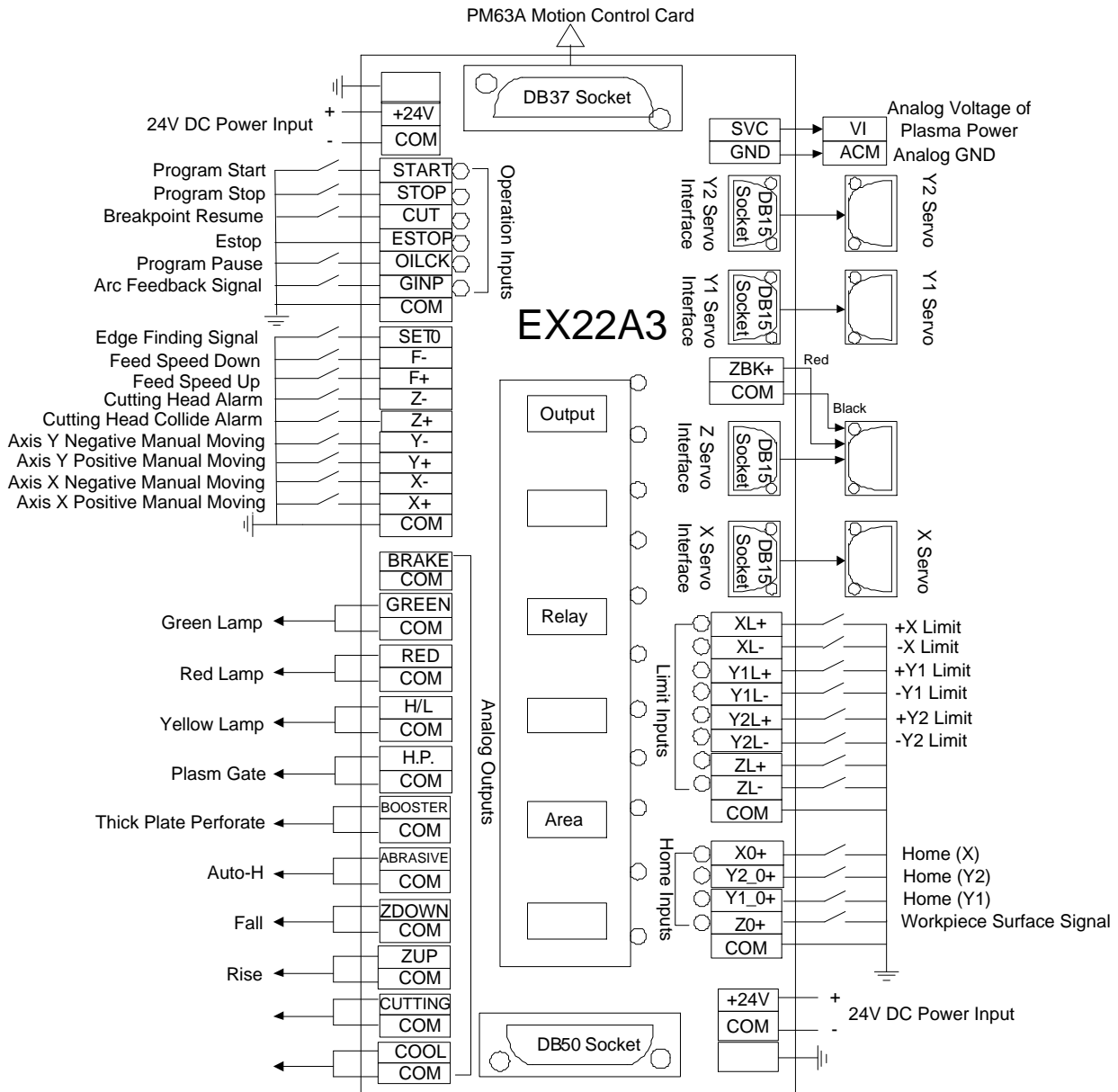


Fig. 7-4 Wiring diagram of terminal board EX22A3 in 2Y configuration

Table 7 Pin signals of terminal board EX22A3 in 2Y configuration

Silk-printed Name	Signal	Remarks
24V	DC 24V power	DC 24V power supply, current $\geq 3A$; all 24V ports on terminal board are ON.
COM	Common port	All COM ports on terminal board are ON.
START	Program start	External connection with reset switches.
STOP	Program stop	
CUT	Breakpoint resume	
Z-	Cutting head alarm	Feeding back cutting head alarm to the software.
Z+	Cutting head collision alarm	
ESTOP	Emergency stop	External connection with an E-stop switch.
OILCK	Program pause	Binary input
GINP	Arc feedback signal	Arc feedback detection after plasma port opened.
F-	Feed speed -	External connection with reset switches.
F+	Feed speed +	
Y-	Manual motion along -Y axis	
Y+	Manual motion along +Y axis	
X-	Manual motion along -X axis	
X+	Manual motion along +X axis	
SVC	Analog voltage (+)	Connection with plasma supply power to control plasma generator output power.
GND	Analog voltage (-)	
GREEN	Green light	Binary signal, no voltage output.
RED	Red light	
H/L	Yellow light	
H.P	Plasma	
BOOSTER	Thick plate punch signal	
ABRASIVE	Auto high	
ZDOWN	Fall	
ZUP	Rise	
XL+	Positive limit of X axis	External connection with mechanical, photoelectric or proximity switches, etc.
XL-	Negative limit of X axis	
Y1L-	Negative limit of Y1 axis	
Y1L+	Positive limit of Y1 axis	
Y2L-	Negative limit of Y2 axis	
Y2L+	Positive limit of Y2 axis	
X0	X origin	
Y1_0	Y1 origin	
Y2_0	Y2 origin	
Z0	Workpiece surface signal	The cutting head rises after the software receives workpiece surface signal.

7.2.5. Wiring Diagram of Terminal Board EX22A2 in YrevB

The basic wiring of terminal board EX22A3 for PM63A/62A control card, when used in YrevB configuration, is as follows.

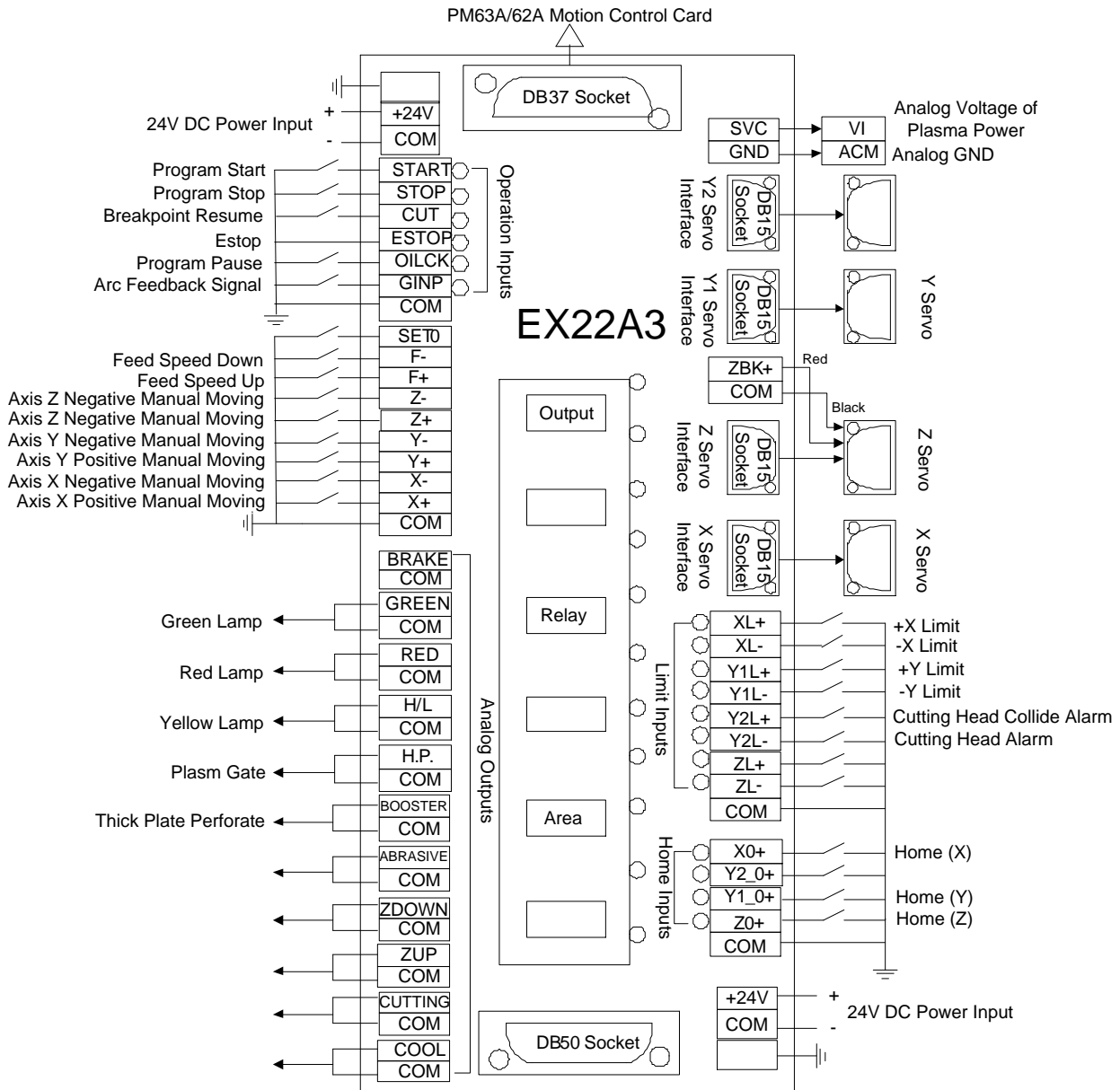


Fig. 7-5 Wiring diagram of terminal board EX22A3 in Y rotary B configuration

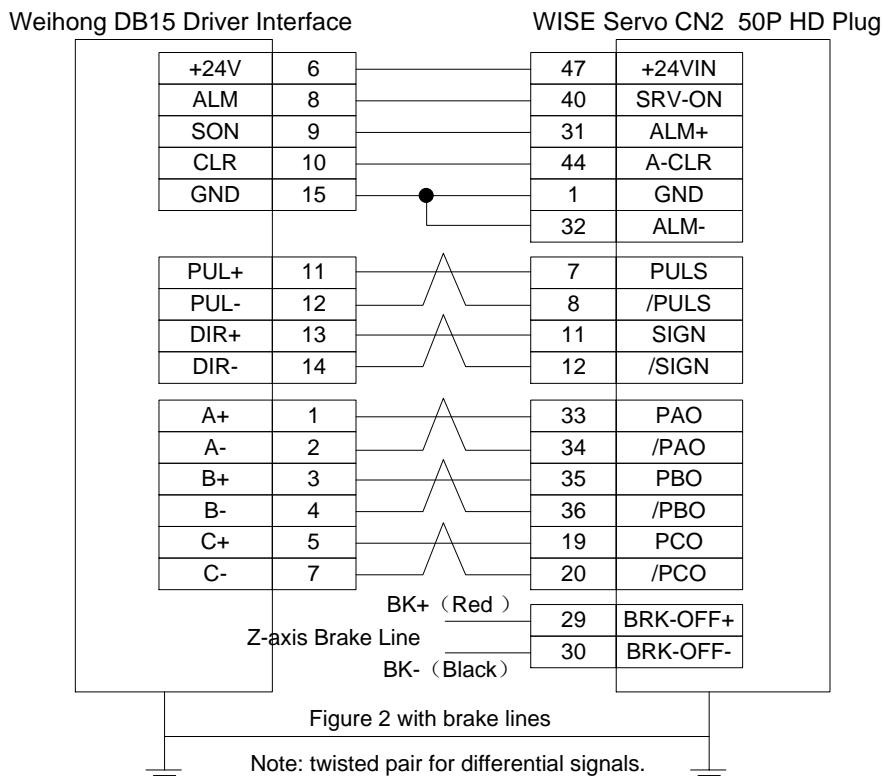
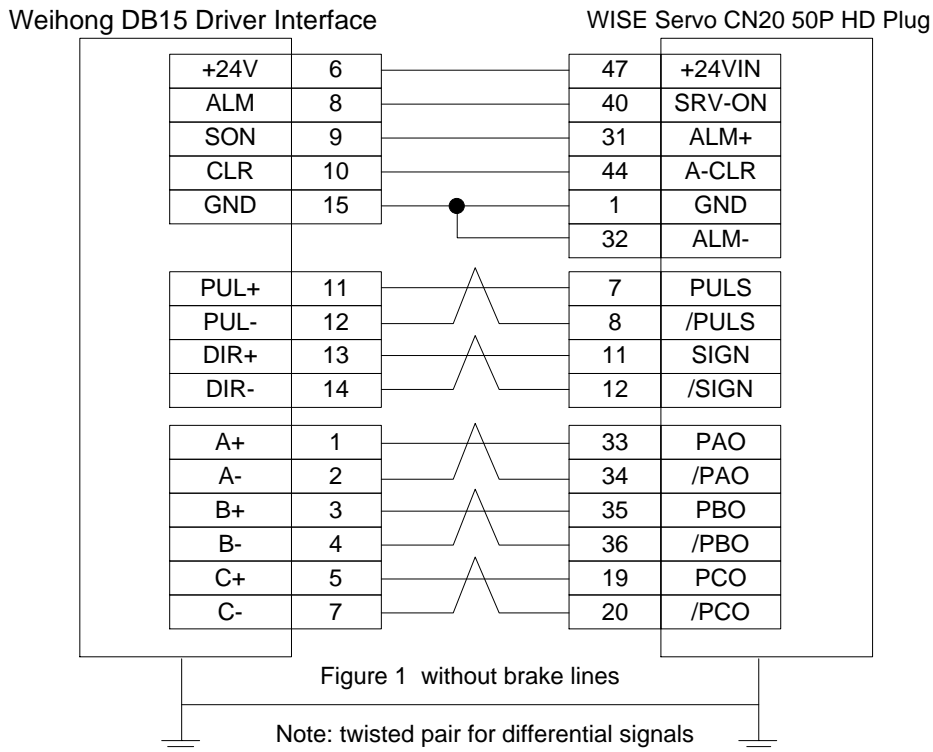
Table 8 Pins definition of terminal board EX22A3 in Y rotary B configuration

Silk-printed Name	Signal	Remarks
24V	DC 24V power	DC 24V power supply, current ≥ 3A; all 24V ports on terminal board are ON.
COM	Common port	All COM ports on terminal board are ON.
START	Program start	External connection with reset switches.

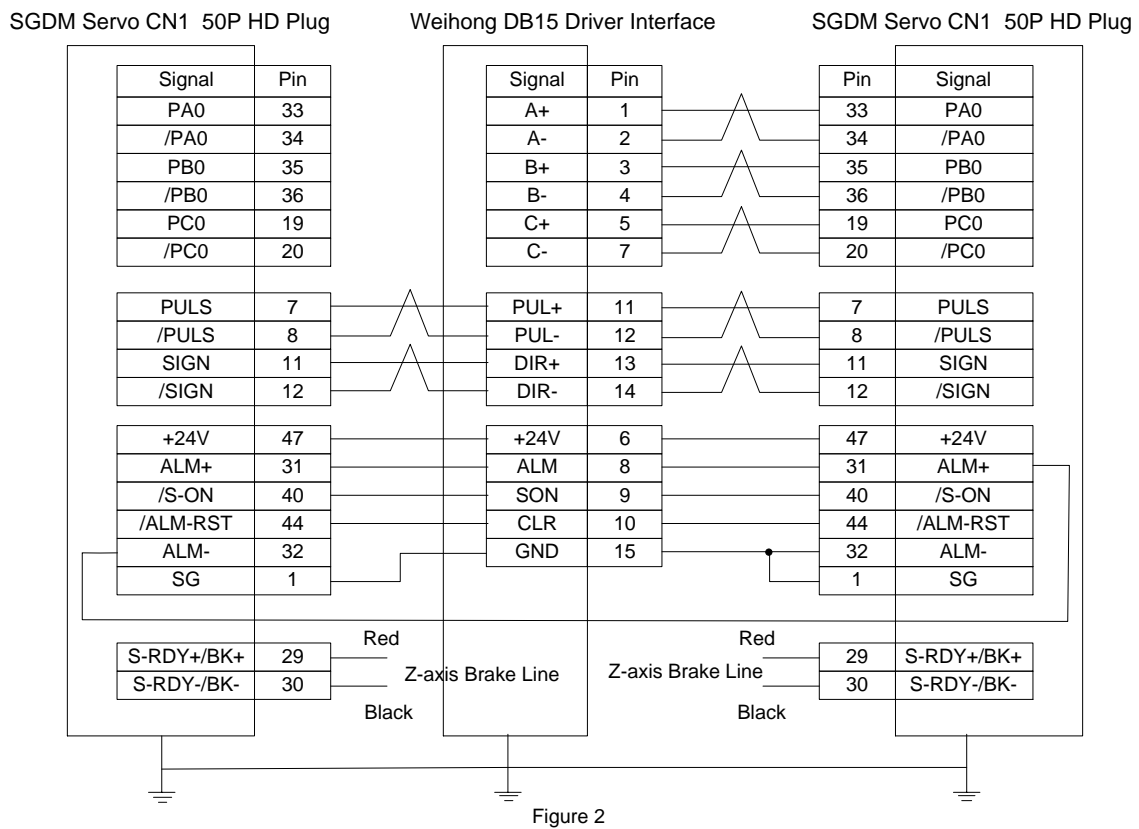
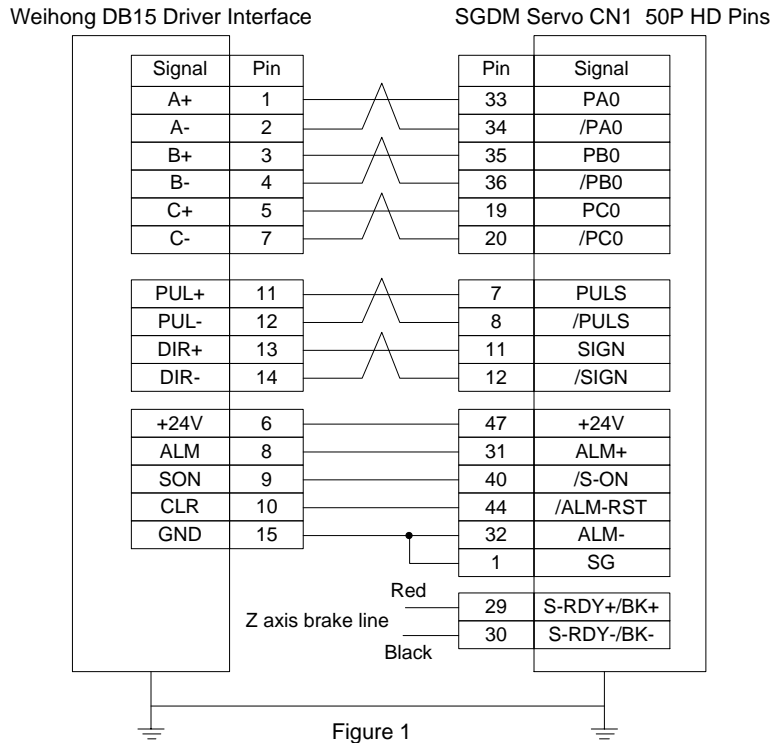
Silk-printed Name	Signal	Remarks
STOP	Program stop	
CUT	Breakpoint resume	
ESTOP	Emergency stop	External connection with an E-stop switch.
OILCK	Program pause	Binary input
GINP	Arc feedback signal	Arc feedback detection after plasma port opened.
Y2L-	Cutting head alarm	Feeding back cutting head alarm to the software.
Y2L+	Cutting head collision alarm	
F-	Feed speed -	External connection with reset switches.
F+	Feed speed +	
Z-	Manual motion along -Z axis	
Z+	Manual motion along +Z axis	
Y-	Manual motion along -Y axis	
Y+	Manual motion along +Y axis	
X-	Manual motion along -X axis	
X+	Manual motion along +X axis	
SVC	Analog voltage (+)	Connection with plasma supply power to control plasma generator output power.
GND	Analog voltage (-)	
GREEN	Green light	Binary signal, no voltage output.
RED	Red light	
H/L	Yellow light	
H.P	Plasma gate	
BOOSTER	Thick plate punch signal	
COOL	Blow nitrogen	
XL+	Positive limit of X axis	External connection with mechanical, photoelectric or proximity switches, etc.
XL-	Negative limit of X axis	
Y1L-	Negative limit of Y axis	
Y1L+	Positive limit of Y axis	
Z-	Negative limit of Z axis	
Z+	Positive limit of Z axis	
X0	X origin	
Y1_0	Y origin	
Z0	Z origin	

7.3. Wiring Diagram of Servo Driver

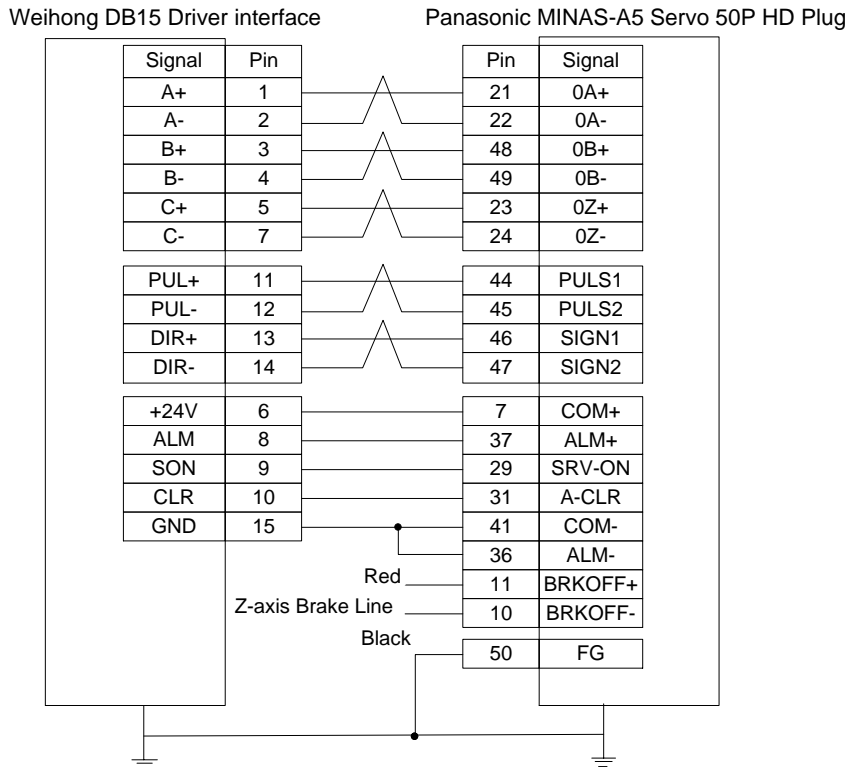
7.3.1. Wiring Diagram of WISE Servo Driver



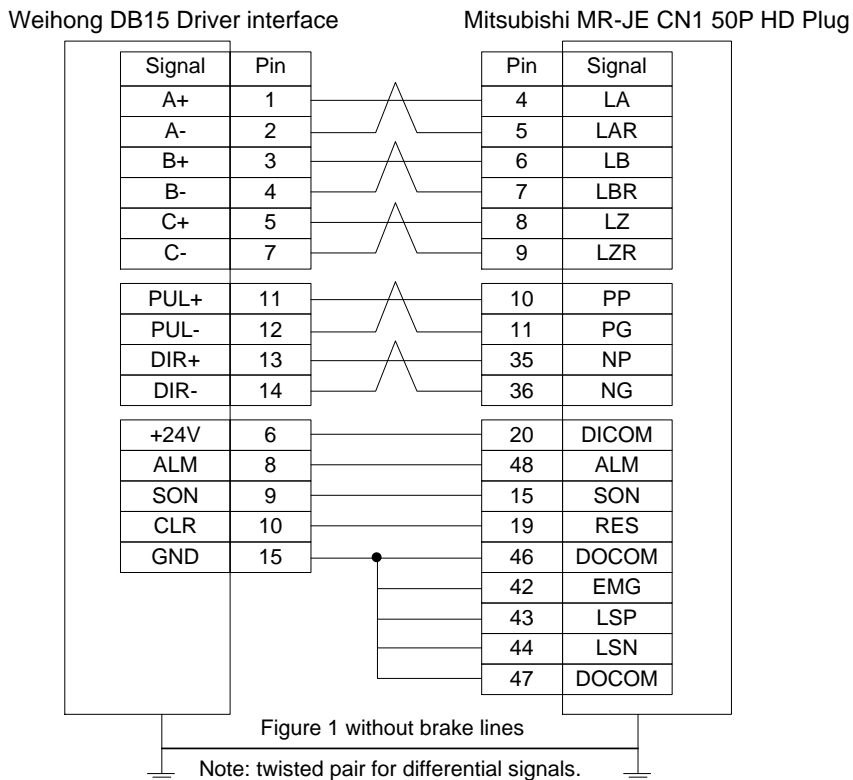
7.3.2. Wiring Diagram of YASKAWA AC Servo Driver

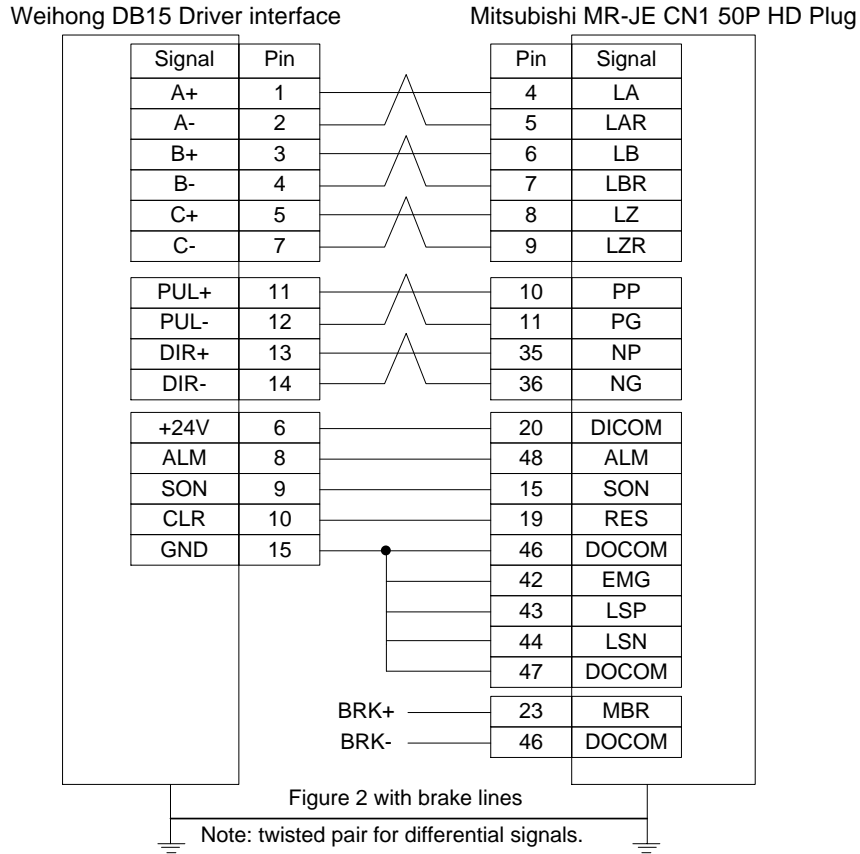


7.3.3. Wiring Diagram of PANASONIC AC Servo Driver

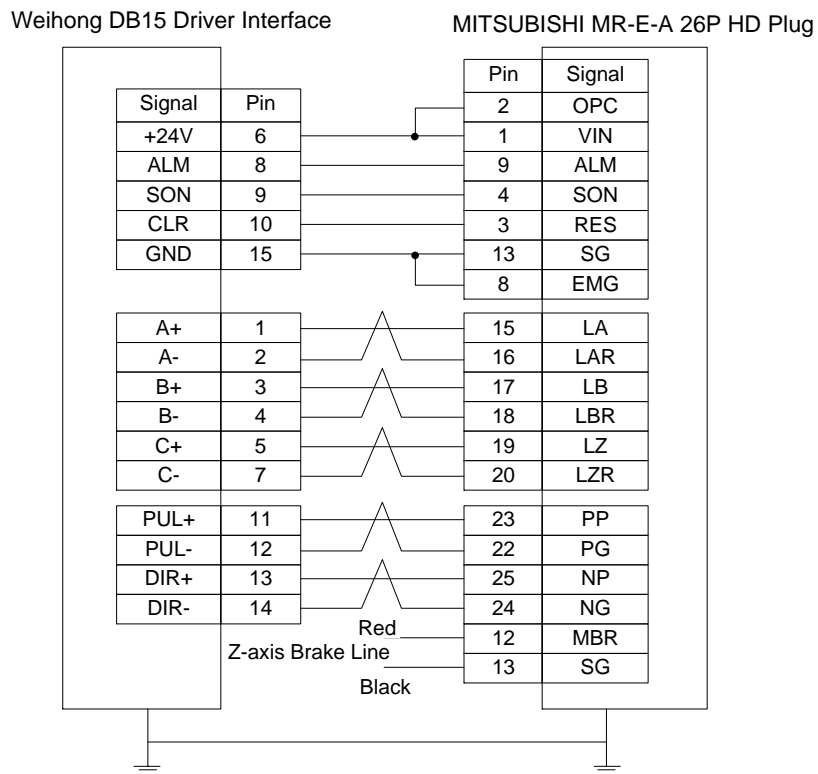


7.3.4. Wiring Diagram of MITSUBISHI MR-JE Servo Driver



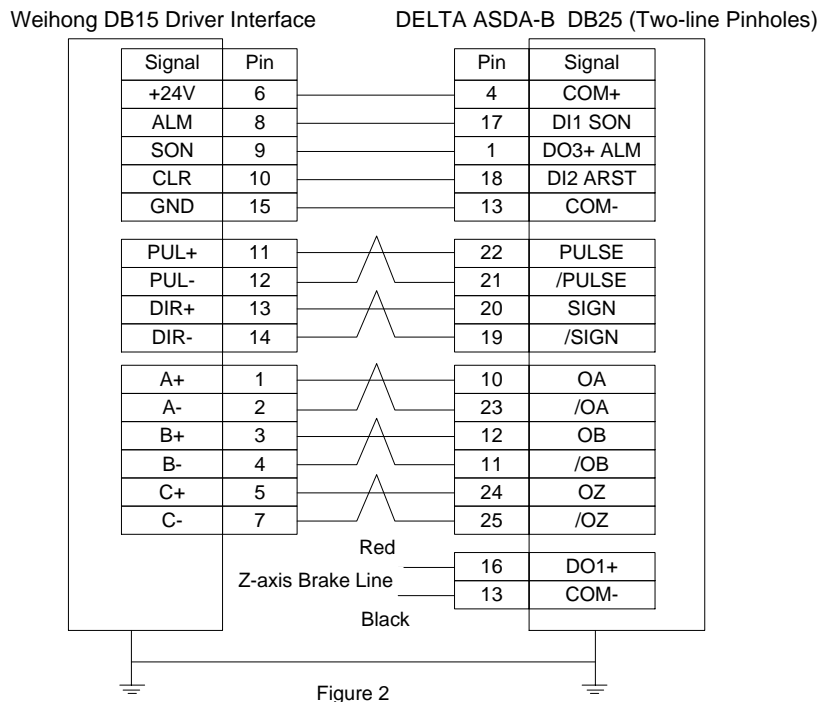
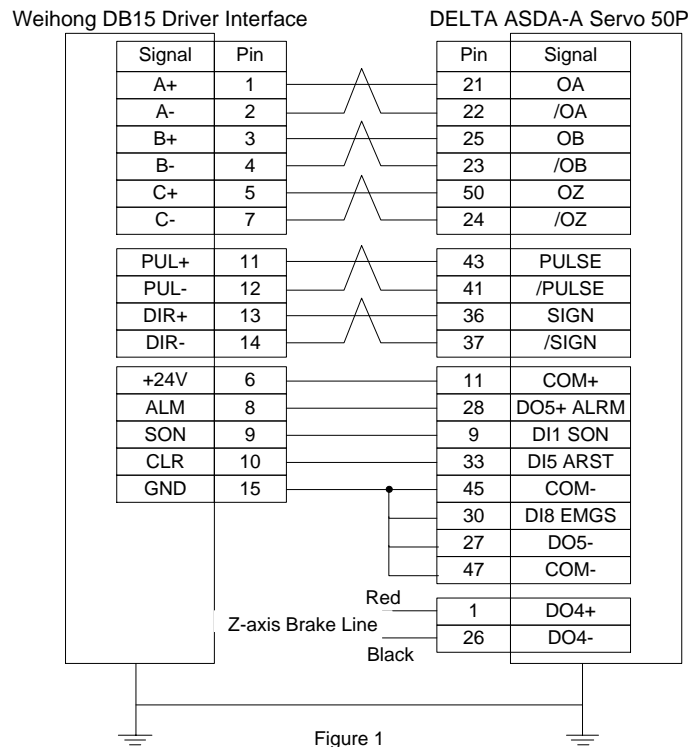


7.3.5. Wiring Diagram of MITSUBISHI MR-E Servo Driver



7.3.6. Wiring Diagram of DELTA Servo Driver

DELTA ASDA-A, ASDA-A2 and ASDA-AB use the same cable. Among them, the wiring pins of ASDA-A2 and ASDA-AB are totally the same. As for ASDA-A, with PULSE as 41 and /PULSE as 43, its pulse signal pins are opposite to those of ASDA-A2 and ASDA-AB, but the other wiring pins are totally the same. For the detailed parameters settings, see chapter 7.4.8 and chapter 7.4.9.



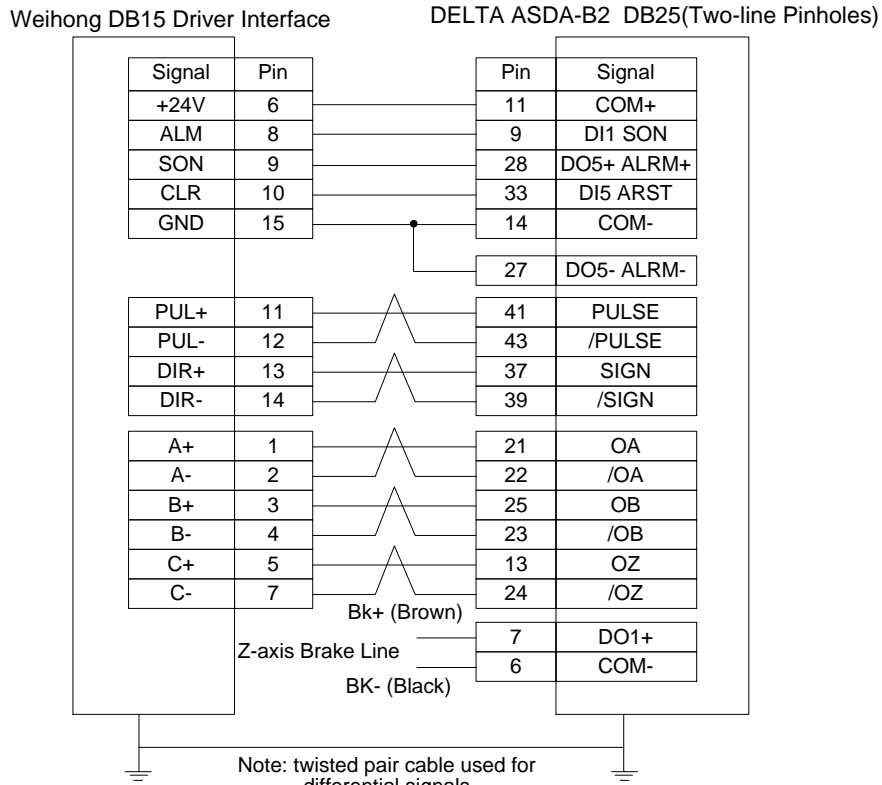


Figure 3

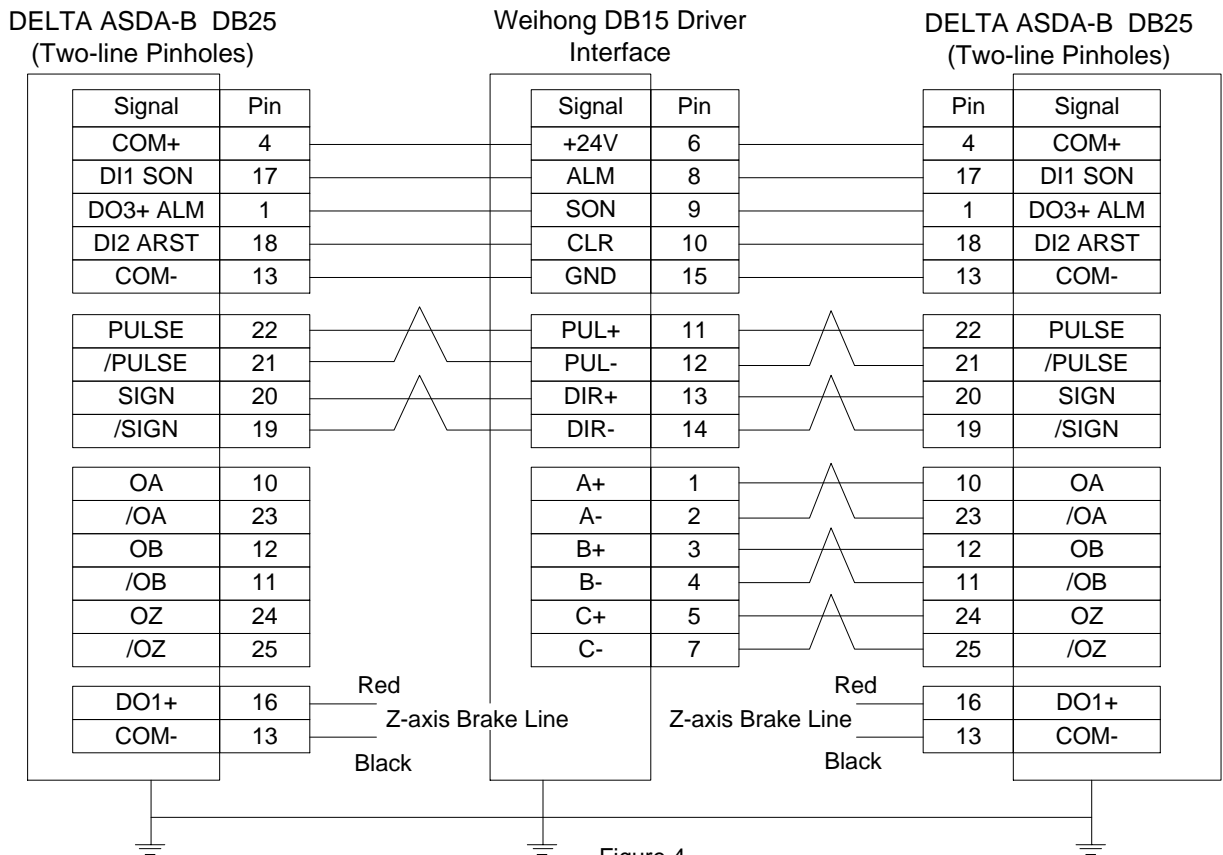
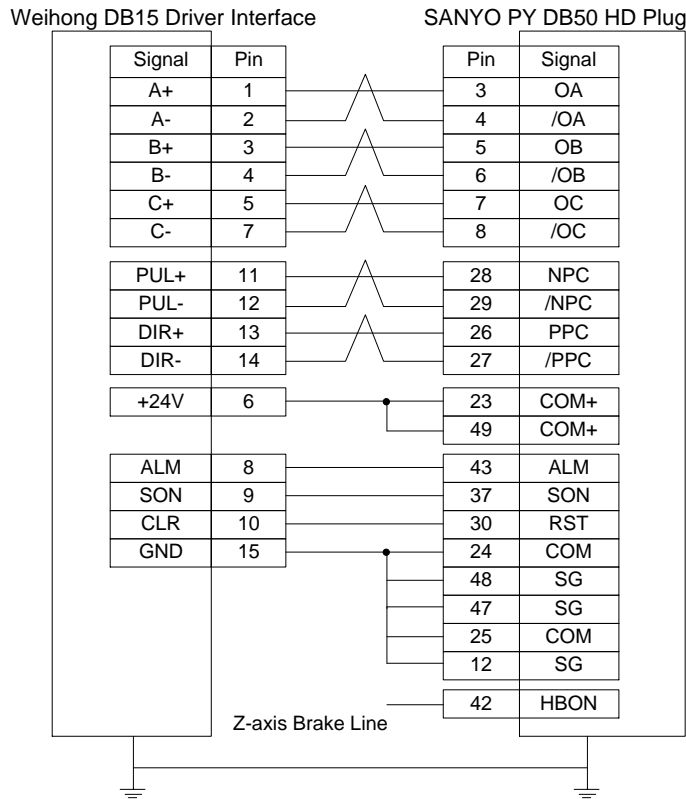
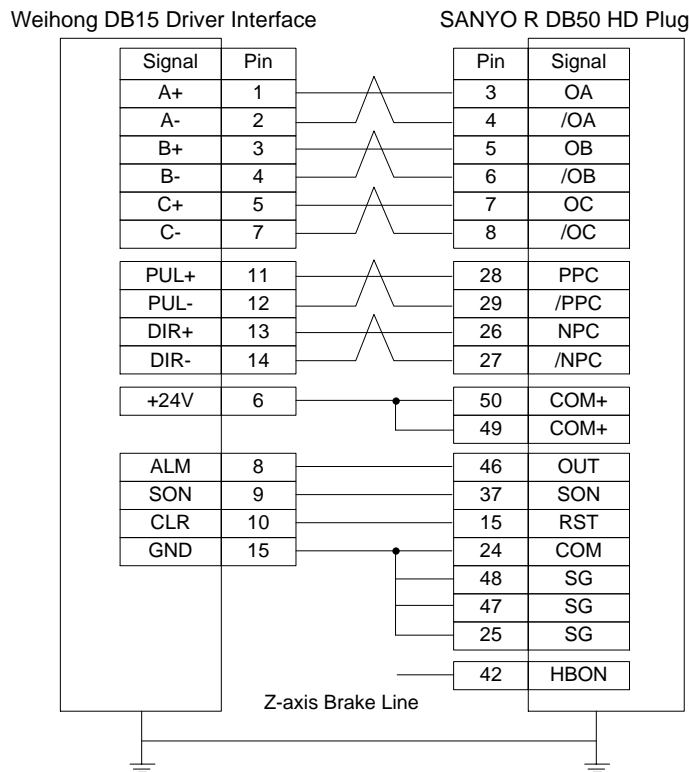


Figure 4

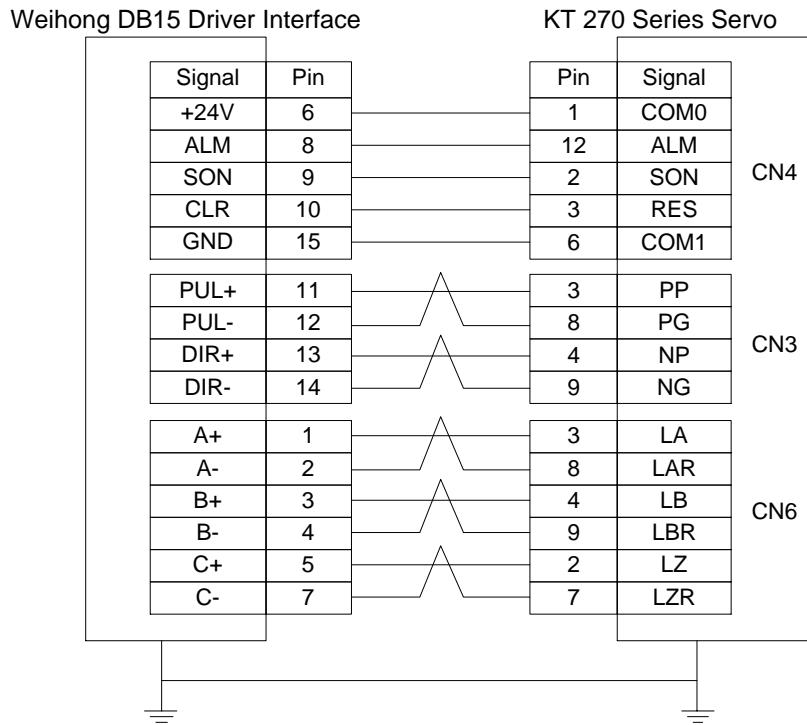
7.3.7. Wiring Diagram of SANYO PY Servo Driver



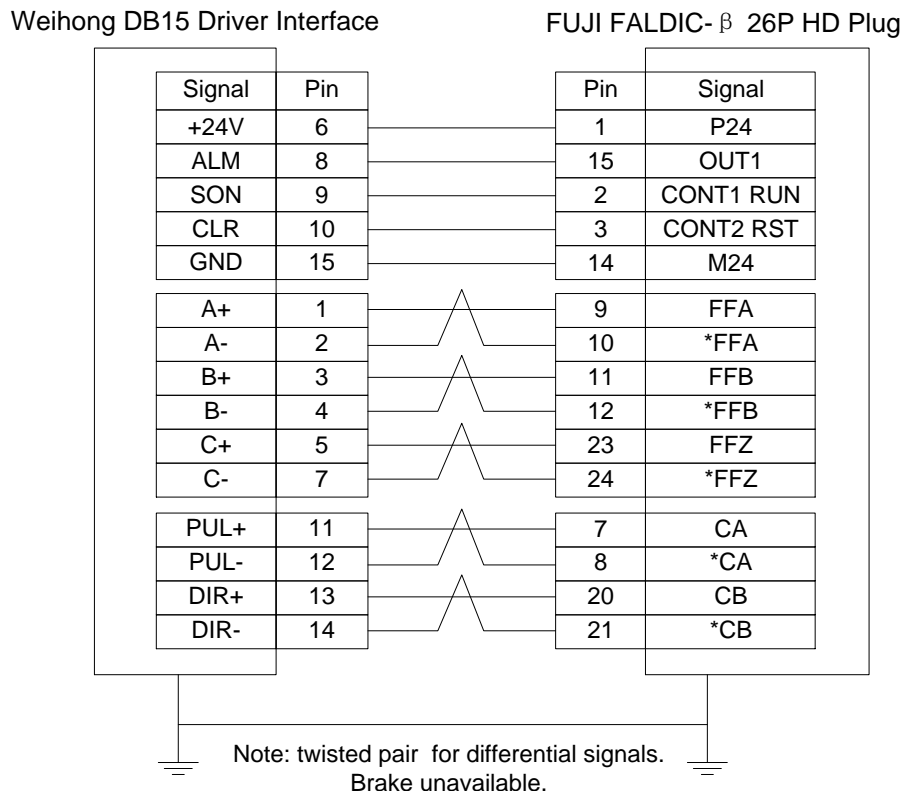
7.3.8. Wiring Diagram of SANYO R Servo Driver



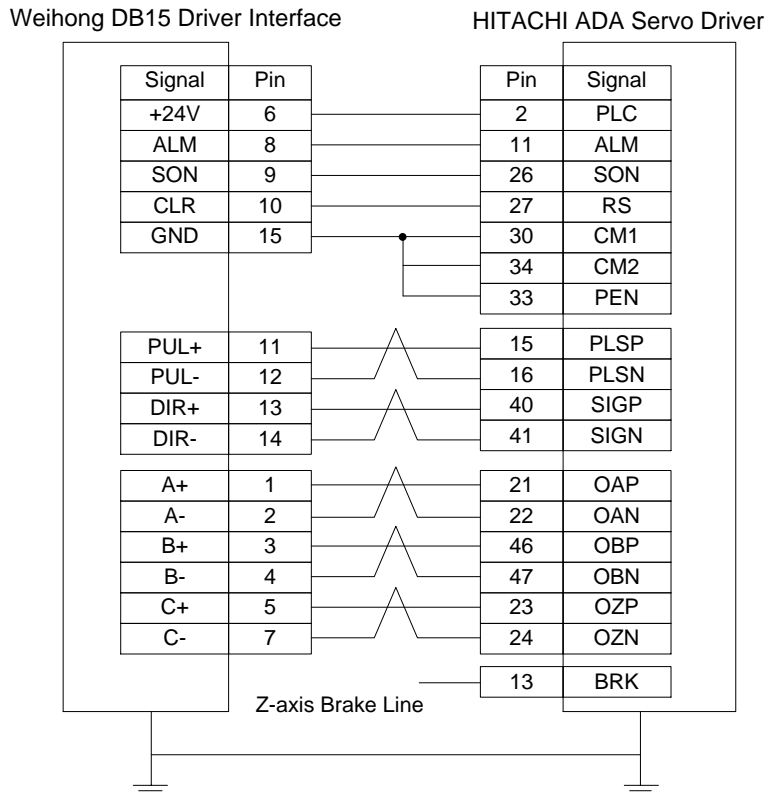
7.3.9. Wiring Diagram of KT270 Servo Driver



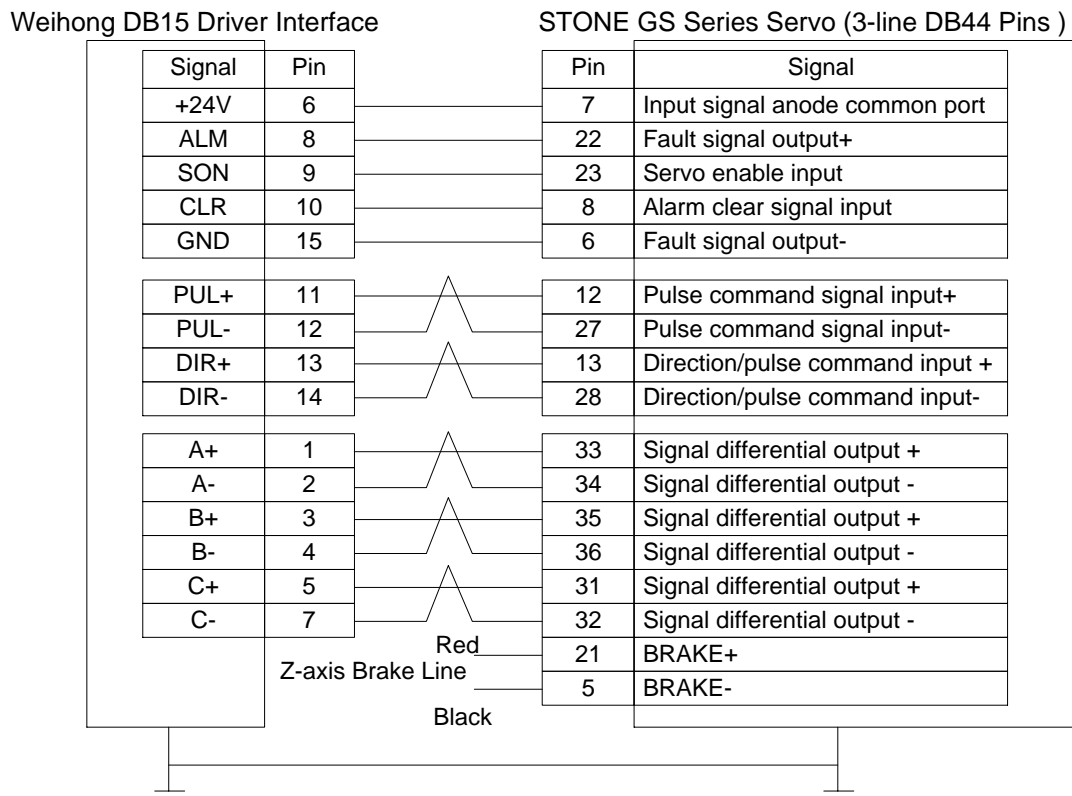
7.3.10. Wiring Diagram of FUJI Servo Driver



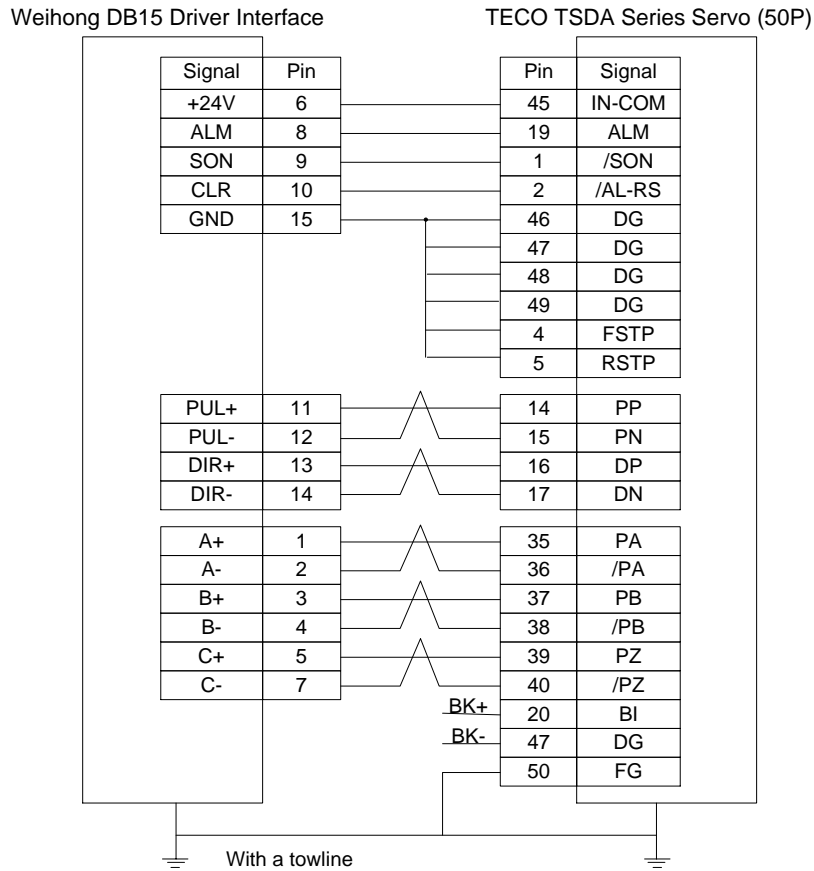
7.3.11. Wiring Diagram of HITACHI Servo Driver



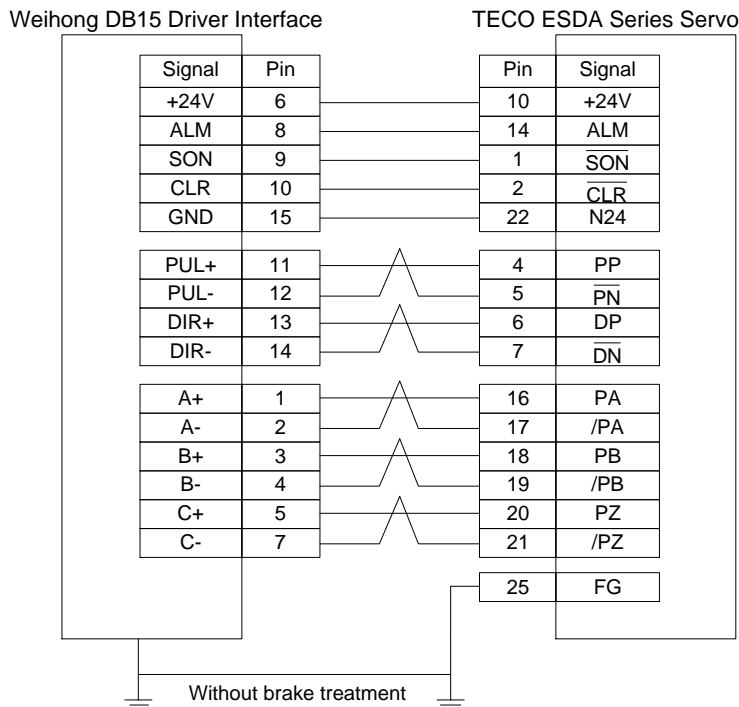
7.3.12. Wiring Diagram of STONE GS Servo Driver



7.3.13. Wiring Diagram of TECO TSDA Servo Driver



7.3.14. Wiring Diagram of TECO ESDA Servo Driver

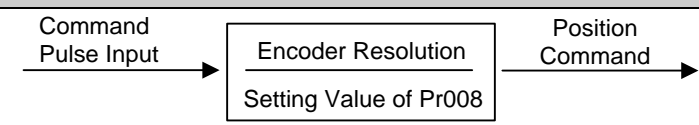
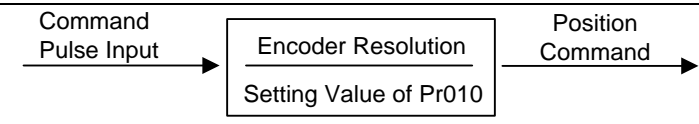
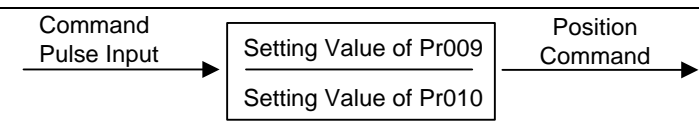


7.4. Driver Parameters

7.4.1. Parameter Setting of WISE Servo Driver

Para. No.	Function	Value	Description
Pr528	LED initial status	6	Monitor if the number of sent and received pulses is correct by setting this parameter. In Weihong control system, the correct quantity of pulse sent by control card is detected by pulse inspection in order to determine whether there is electrical interference.
Pr008	Command pulse No. per motor circle	0	When it is set to "0", parameters Pr009 and Pr010 are valid.
Pr009	1st numerator of command pulse frequency division/multiplication	Need calculation $0 \sim 2^{30}$	Range: $0 \sim 2^{30}$ Typical value: pitch 5 mm, encoder resolution 10000, deceleration ratio 1:1, pulse equivalent 0.001 mm: Pr009=10000 Pr010=pitch 5mm/ pulse equivalent 0.001mm=5000 Pr009/Pr010=10000/5000=2/1
Pr010	Denominator of command pulse frequency division/multiplication	Need calculation $0 \sim 2^{30}$	
Pr100	1st position loop gain	480 (default)	Unit: 0.1/s. Set it according to the actual situation.
Pr101	1st velocity loop gain	270 (default)	Unit: 0.1Hz. Set it according to the actual situation.
Pr102	1st velocity loop integrated time constant	210 (default)	Unit: 0.1ms. Set it according to the actual situation.
When the value of Pr0.08 is not "0", it can be calculated in terms of the following formula: $\text{Command pulse No. per motor circle} = \frac{\text{Screw pitch}}{\text{Pulse equivalent} \times \text{Mechanical deceleration ratio}} = \frac{5\text{mm}}{0.001\text{mm/p}} = 5000$ When screw pitch is 5mm and pulse equivalent 0.001, the value of Pr0.08 is "5000".			

◆ Attached list: the relationship among parameters Pr0008, Pr0009 and Pr010

Pr008	Pr009	Pr010	Description
0~2 ²⁰	— (no influence)	— (no influence)	 <p>As shown above, the process is undergone in terms of the setting value of Pr008, not affected by the settings of Pr009 and Pr010.</p>
0	0	0~2 ³⁰	 <p>When the values of Pr008 and Pr009 are both set to “0”, as shown above, the process is undergone in terms of the setting value of Pr010.</p>
	0~2 ³⁰	0~2 ³⁰	 <p>When the value of Pr008 is “0”, but the value of Pr009 is not “0”, as shown above, the process is undergone in terms of the setting values of Pr009 and Pr010.</p>

7.4.2. Parameter Setting of YASKAWA Σ-II Servo Driver

Para. No.	Function	Value	Description
Fn010	Set password (to prevent arbitrary modification to parameters)	0000	Set [0000]: modification to user parameters [PnXXX] and part of auxiliary function parameters [FnXXX] permitted; Set [0001]: modification to user parameters [PnXXX] and part of auxiliary function parameters [FnXXX] prohibited.
Un00C	Surveillance mode	LXXXX (hexadecimal system)	Monitor if the number of sent and received pulse is correct by setting this parameter. In Weihong control system, the correct quantity of pulse sent by control card is detected by pulse inspection in order to determine whether there is electrical interference.
Pn000	Direction selection Control mode selection	0010	Bit 0: Set 0, “CCW” rotation is forward rotation (viewed from the load end of screw ball); Set 1, the rotation direction of the motor is reversed. Bit 1: Set 1, position control mode (calculate pulse instruction all the time).

Para. No.	Function	Value	Description
Pn200	Select pulse instruction mode	0005	Bit 0: Set 5, select the instruction input mode as “pulse + direction”, negative logic. Bit3: Set 0, input differential signal into filter.
Pn50A	Selection function	8100	Bit 1: Set 0, Servo ON /S-ON, input from the 40th pin; Set 7, Servo ON all the time. Bit 3: Set 8, forward rotation not used and signal input (P-OT) prohibited.
Pn50B	Selection function	6548	Bit 0: Set 8, reverse rotation not used and signal input (N-OT) prohibited.
Pn50F	Selection function	0300	Set it when servo motor with brakes. Bit 2: Set 3, brake interlock signal “/BK” is output from CN1-29, CN1-30 to control 24V relay for brake.
Pn50E	Selection function	0211	Set it when servo motor with brakes. To avoid of CN1-29 and CN1-30 being used for other function and leading to brake ineffective, “3” is not allowed to appear in the 4 digits.
Pn506	Servo off, time delay of brake when motor stops	Depended	Set it when motor with brakes. Default setting is “0”, setting unit is 10ms.
Pn202	Electronic gear ratio (numerator)	Need Calculation	Pn202 = pulse No. of each encoder circle × 4 × mechanical deceleration ratio. Pn203 = (lead screw pitch/ pulse equivalent). Typical value: pitch 5mm, encoder 17-bit, coaxial connection between motor and screw, pulse equivalent 0.001mm, Pn202=16384; Pn203=625.
Pn203	Electronic gear ratio (denominator)	Need Calculation	Pitch 5mm, encoder 17-bit, coaxial connection between motor and screw, pulse equivalent 0.0005mm, Pn202=8192; Pn203=625.

7.4.3. Parameter Setting of YASKAWA Σ -V Servo Driver

Para. No.	Function	Value	Description
Fn010	Parameter input prohibition setting	0000	Set [0000]: modification to user parameters [PnXXX] and part of auxiliary function parameters [FnXXX] permitted; Set [0001]: modification to user parameters [PnXXX] and part of auxiliary function parameters [FnXXX] prohibited.
Pn000	Function selection basic switch 0	0010	Bit 0: Set 0, positive rotation at positive rotation command. Bit 1: Set 1, position control mode (pulse sequence command).
Pn200	Format selection switch of position control command	0005	Bit 0: Set 5, select the instruction mode as “pulse + direction”, negative logic.
Pn50A	Input signal selection 1	8100	Bit 1: Set 0, Servo ON /S-ON, input from the 40 th pin; Set 7, Servo ON all the time. Bit 3: Set 8, positive rotation not used and signal input (P-OT) prohibited.
Pn50B	Input signal selection 2	6548	Bit 0: Set 8, negative rotation not used and signal input (N-OT) prohibited.
Pn50F	Output signal selection 2	0300	Set it when servo motor with brakes. Bit 2: Set 3, brake interlock signal “/BK” is output from CN1-29, CN1-30 to control 24V relay used for brake.
Pn50E	Output signal selection 1	0211	Set it when servo motor with brakes To avoid of CN1-29 and CN1-30 being used for other function and leading to brake ineffective, 3 is not allowed to appear in the 4 digits.
Pn506	Brake instruction-servo OFF time delay	Depended	Set it when motor with brakes Default setting is “0”, setting unit is ms.
Pn20E	Electronic gear ratio (numerator)	Need Calculation	Pn20E = pulse No. of each encoder circle × 4 × mechanical deceleration ratio. Pn210 = (lead screw pitch/ pulse equivalent). Typical value: pitch 5mm, encoder 17-bit, shaft coupler direct drag, pulse equivalent 0.001mm, Pn20E=16384; Pn210=625.
Pn210	Electronic gear ratio (denominator)	Need Calculation	Pitch 5mm, encoder 17-bit, shaft coupler direct drag, pulse equivalent 0.0005mm, Pn20E=8192; Pn210=625.

7.4.4. Parameter Setting of PANASONIC MINAS A4 Servo

Driver

Para. No.	Function	Value	Description
Pr01	LED initial status	12	Monitor if the number of sent and received pulse is correct by setting this parameter. In Weihong control system, the correct quantity of pulse sent by control card is detected by pulse inspection in order to determine whether there is electrical interference.
Pr02	Select control mode	0	0: position mode 1: velocity mode 2: torque mode
Pr40	Selection of command pulse input	1	1: input by differential exclusive circuit
Pr42	Select command pulse input mode	3	Set command pulse input mode: pulse + direction, negative logic
Pr48	1st numerator of command pulse frequency multiplication	Need calculation Range: 1~10000	Typical value: pitch 5 mm, encoder resolution 10000, shaft coupling direct drag, pulse equivalent 0.001 mm: Pr48=10000 Pr4B=pitch 5mm / pulse equivalent 0.001mm=5000 Pr48/Pr4B=10000/5000=2/1
Pr4B	Denominator of command pulse frequency multiplication	Need calculation Range: 1~10000	

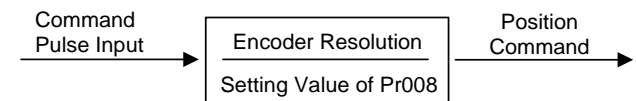
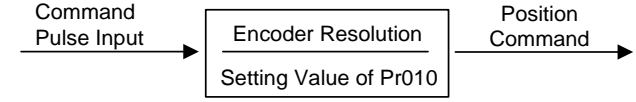
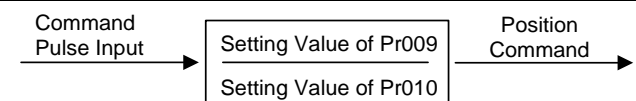
7.4.5. Parameter Setting of PANASONIC MINAS A5 Servo

Driver

Para. No.	Function	Value	Description
Pr5.28	LED initial status	6	Monitor if the number of sent and received pulse is correct by setting this parameter. In Weihong control system, the correct quantity of pulse sent by control card is detected by pulse inspection in order to determine whether there is electrical interference.
Pr0.01	Select control mode	0	0: position mode 1: velocity mode 2: torque mode

Para. No.	Function	Value	Description
Pr0.05	Selection of command pulse input	XX	0: Photo-coupler input (PULS1, PULS2, SIGN1, SIGN2) 1: Exclusive input for line driver (PULSH1, PULSH2, SIGNH1, SIGNH2) Note: generally, "1" is selected for this parameter.
Pr0.07	Command pulse input mode setup	3	Set command pulse input mode: pulse + direction, negative logic.
Pr0.08	Command pulse counts per one motor revolution	0	When it is set as "0", parameters Pr0.09 and Pr0.10 are valid.
Pr0.09	1st numerator of command pulse frequency multiplication	Need calculation Range: 0~2 ³⁰	Typical value: pitch 5 mm, encoder resolution 10000, shaft coupling direct drag, pulse equivalent 0.001 mm: Pr0.09=10000 Pr0.10 = pitch 5mm/ pulse equivalent 0.001mm = 5000 Pr0.09/Pr0.10=10000/5000=2/1
Pr0.10	Denominator of command pulse frequency multiplication	Need calculation Range: 0~2 ³⁰	
<p>When the value of Pr0.08 is not "0", it can be calculated in terms of the following formula:</p> $\text{Command pulse No. per motor circle} = \frac{\text{Screw pitch}}{\text{Pulse equivalent}} = \frac{5\text{mm}}{0.001\text{mm} / p} = 5000$ <p>When screw pitch is 5mm and pulse equivalent 0.001, the value of Pr0.08 is "5000".</p>			

◆ Attached List: the relationship among parameters Pr0.08, Pr0.09 and Pr0.10.

Pr0.08	Pr0.09	Pr0.10	Description
0~2 ²⁰	— (no influence)	— (no influence)	 <p>As shown above, the process is undergone in terms of the setting value of Pr0.08, not affected by the settings of Pr0.09 and Pr0.10.</p>
0	0	0~2 ³⁰	 <p>When the values of Pr0.08 and Pr0.09 are both set as "0", as shown above, the process is undergone in terms of the setting value of Pr0.10.</p>
	0~2 ³⁰	0~2 ³⁰	 <p>When the value of Pr0.08 is "0", but the value of Pr0.09 is not "0", as shown above, the process is underdone in terms of the setting values of Pr0.09 and Pr0.10.</p>

7.4.6. Parameter Setting of MITSUBISHI MR-JE Servo Driver

Para. No.	Code	Function	Value	description
PA01	*STY	Operation mode	XXX0	__ _x: select position control mode.
PD24	MBR	Output assignation to CN1-23 pin	XX05	_ _ xx: select MBR (electromagnetic brake interlock).
PA06	CMX	Electronic gear numerator	Need calculation	$CMX/CDV = \text{command unit} \times \text{servo motor resolution} \times \text{mechanical deceleration ratio} / \text{pitch of screw}$. E.G., pitch 5 mm, encoder resolution 10000, deceleration ratio 1:1, pulse equivalent 0.001 mm, $CMX/CDV = 10000 \times 0.001 / 5 = 2/1$; When pulse equivalent = 0.0005mm, $CMX/CDV = 1/1$. Electronic gear ratio range: 1/50 ~ 500
PA07	CDV	Electronic gear denominator	Need calculation	
PC36	*DMD	Status display selection	00XX	__xx: status display selection at power-on. This is used to select a status display shown at power-on. 00: cumulative feedback pulses 01: servo motor speed 02: droop pulses 03: cumulative command pulses 04: command pulse frequency
PA13	*PLSS	Command pulse input form	0011	Set command pulse input form: pulse train+ sign, negative logic.
PD03	*DI1L	Input assignation to CN1-15 pin	XX02	_ _xx: select SON under position control mode.

7.4.7. Parameter Setting of MITSUBISHI MR-E Servo Driver

Para. No.	Code	Function	Value	Description
0	*STY	Control mode selection and regenerative fittings	X0X0	Bit 0: set 0: select position control mode. Bit 1, select motor series: 0: HC-KFE; 1:HC-SFE; Bit 3, select regenerative apparatus, set 0: not use. Bit 4, select motor power.
1	MBR	Function selection 1	001X	Bit 0: input signal filter. If external input signal causes chattering due to noises, etc., input filter is used to suppress it. Bit 1: CN1-12 function selection, set "1": electromagnetic brake interlock (MBR); set "0": zero speed detection signal.

Para. No.	Code	Function	Value	Description
3	CMX	Electronic gear numerator	Need calculation	$CMX/CDV = \text{command unit} \times \text{servo motor resolution} \times \text{mechanical deceleration ratio} / \text{pitch of lead screw}$. E.G., pitch 5 mm, encoder resolution 10000, shaft coupling direct drag, pulse equivalent 0.001 mm, $CMX/CDV = 10000 \times 0.001 / 5 = 2/1$; When pulse equivalent = 0.0005mm, $CMX/CDV = 1/1$. Electronic gear ratio range: 1/50 ~ 500
4	CDV	Electronic gear denominator	Need calculation	
18	*DMD	Status display selection	00XX	3: cumulative command pulses E: load inertia When the parameter is set [3], monitor if the number of sent and received pulse is correct by setting this parameter. In Weihong control system, the correct quantity of pulse sent by control card is detected by pulse inspection to determine if there is electrical interference.
21	*OP3	Function selection 3 (command pulse format selection)	0001	Set pulse command input form: pulse train+ sign, negative logic
41	*DIA	Signal input SON-ON, LSP-ON and LSN-ON automatically selection	0110	Bit 0: Servo-ON selection. [0]: servo on by external input; [1]: servo on all the time inside. Bit 1: last signal of positive rotation range (LSP): [1]: auto servo on inside, without external wiring. Bit 3: last signal of negative rotation range (LSN): [1]: auto servo on inside and no need of external wiring.

7.4.8. Parameter Setting of DELTA ASDA-A Servo Driver

Para. No.	Function	Format & Range	Value	Description
P0-02	Driver status display		02	Monitor if the number of sent and received pulse is correct by setting this parameter. In Weihong control system, the correct quantity of pulse sent by control card is detected by pulse inspection to determine if there is electrical interference.
P1-00	External pulse input type	ZYX	102	X=2: pulse + direction; Z=1: negative logic
P1-01	Control mode setup	ZYX1X0	0000	Z=0: during control mode switching, DIO is maintaining the set value. Since switching control mode is not used, Z=0 Y=0: forward rotation (CCW) (in terms of load); Y=1: the rotation direction is reversed. X1X0=00: position control mode.
P1-32	Motor stop mode selection	YX	00	Y=0: when there is no servo enabled, motor dynamic brake occurs; Y=1: motor is free. X=0: motor stops instantly, X=1: motor stops with deceleration.
P1-44	Electronic Gear Ratio (Numerator)(N1)	1~32767	Need calculation	$N1/M = \text{encoder pulses} \times 4 \times \text{pulse equivalent} \times \text{mechanical deceleration ratio} / \text{pitch}$ Representative value: encoder pulses=2500, pitch=5mm, pulse equivalent=0.001, deceleration ratio=1, calculation as below: $N1/M = 2500 \times 4 \times 0.001 / 5 = 2 / 1$, N1=2, M=1; When the multi-electronic gear ratio is not used, P2-60~ P2-62 are not required.
P1-45	Electronic Gear Ratio (Denominator) (M)	1~32767	Need calculation	
P2-10	Digital Input Pin DI1	X2X1X0	101	X1X0=01: digital input (DI1=SON) corresponds to 9th pin of CN1. X2 = 1: set DI1 input as NO (normally open) a-contact point.

Para. No.	Function	Format & Range	Value	Description
P2-15	Digital Input pin DI6	X2X1X0	100	Default factory setting of DI6 and DI7 are NC (normally closed) limit signal input pins; driver can't run without being connected to pin 32 and pin 31 of CN1. X2=1: set DI6 and DI7 inputs as NO (normally open) a-contact points; X1X0=00, limit signal input of the driver is not used.
P2-16	Digital Input Pin DI7	X2X1X0	100	
P2-17	Function setting for digital input pin DI8	X2X1X0	100	External EMG stop input is not used.
P2-21	Function setting for digital output pin DO4	X2X1X0	108	DO4 corresponds to pin 1 & pin 26, used as clamping-position brake signal of Z-axis; X2=1: set DO4 output as NO (normally open) a-contact point; X2=0: set DO4 output as NC (normally closed) b-contact point; X1X0=08: set pin 1 and pin 26 as BK+ and BK- respectively.
P2-22	Function setting for digital output pin DO5	X2X1X0	007	DO5 corresponds to pin 28 & pin 27, used as servo alarm signal. X2=0: set DO5 output as NC (normally closed) b-contact point. X1X0=07: set pin 28 and pin 27 as ALRM+ and ALRM- respectively.
P2-51	Servo ON (SON) setup		0	0: Servo ON must be triggered by numerical input signal. 1: when servo is powered, if there is no alarm signal, servo will be automatically on. Set 1 when there is no SON signal wire.

7.4.9. Parameter Setting of DELTA ASDA-A2 Servo Driver

Para. No.	Function	Format & Range	Value	Description
P0-02	Driver status display		02	Monitor if the number of sent and received pulse is correct by setting this parameter. In Weihong control system, the correct quantity of pulse sent by control card is detected by pulse inspection in order to determine whether there is electrical interference.
P1-00	External pulse train input type	ZYX	102	X=2: pulse + direction; Z=1: negative logic.
P1-01	Set control mode	ZYX1X0	0000	Z=0: during control mode switching, DIO is maintaining the set value. Since switching control mode is not used, Z=0; Y=0: positive rotation (CCW) (from the view of load); Y=1: negative rotation (CCW) X1X0=00: position control mode
P1-44	Electronic Gear Ratio (Numerator)(N1)	1~32767	Need calculation	$N1/M = \text{mechanical deceleration ratio} \times 4 \times \text{encoder pulses} \times \text{pulse equivalent} / \text{pitch}$.
P1-45	Electronic Gear Ratio (Denominator)(M)	1~32767	Need calculation	Representative value: encoder pulses=2500, pitch =5mm, pulse equivalent=0.001, deceleration ratio = 1, calculation as below: $N1 / M = 2500 \times 4 \times 0.001 / 5 = 2/1$, N1=2, M=1; When the multi-electronic gear ratio is not used, P2-60 ~P2-62 are not required.
P2-10	Digital Input Pin 1 (DI1)	X2X1X0	101	X1X0=01: digital input (DI1 = SON) corresponds to 9th pin of CN1. X2=1: set DI1 input as NO (normally open) a-contact point.
P2-15	Function setting for digital input pin DI6	X2X1X0	100	Default factory setting of DI6 and DI7 is NC (normally closed) limit signal input; driver can't run without being connected to pin 32 and pin 31 of CN1. X2=1: set DI6 and DI7 inputs as NO a-contact points. X1X0=00, limit input of driver is not used.

Para. No.	Function	Format & Range	Value	Description
P2-16	Function setting for digital input pin DI7	X2X1X0	100	
P2-17	Function setting for digital input pin DI8	X2X1X0	100	External EMG stop input is not used.
P2-21	Function setting for digital output pin DO4	X2X1X0	108	DO4 corresponds to pin 1 & pin 26, used as clamping-position brake signal of Z-axis; X2=1: set DO4 output as NO (normally open) a-contact point; X2=0: set DO4 output as NC (normally closed) b-contact point; X1X0=08: set pin 1 and pin 26 as BK+ and BK- respectively.
P2-22	Function setting for digital output pin DO5	X2X1X0	007	DO5 corresponds to pin 28 & pin 27, used as servo alarm signal. X2=0: set DO5 output as NC b-contact point. X1X0=07: set pin 28 and pin 27 as ALRM+ and ALRM- respectively.

7.4.10. Parameter Setting of DELTA ASDA-B Servo Driver

Para. No.	Function	Format & Range	Value	Description
P0-02	Driver status display		02	Monitor if the number of sent and received pulse is correct by setting this parameter. In Weihong control system, the correct quantity of pulse sent by control card is detected by pulse inspection in order to determine whether there is electrical interference.
P1-00	External pulse train input type	ZYX	102	X=2: pulse + direction; Z=1: negative logic
P1-01	Set control mode	YX1X0	000	Y=0: forward rotation (CCW) (from the view of load); Y=1: the rotation direction is reversed. X1X0=00: position control mode

Para. No.	Function	Format & Range	Value	Description
P1-32	Motor stop mode	YX	00	Y=0: when there is no servo enabled, motor dynamic brake occurs; Y=1: motor is free. X=0: motor stops instantly; X=1: motor stops with deceleration.
P1-44	Electronic Gear Ratio (Numerator)(N1)	1~32767	Need calculation	N1/M= mechanical deceleration ratio \times 4 \times encoder pulses \times pulse equivalent / pitch. Representative value: encoder pulses=2500, pitch =5mm, pulse equivalent=0.001 mm/p, deceleration ratio = 1, calculation as below: $N1 / M = 2500 \times 4 \times 0.001 / 5 = 2 / 1$, N1=2, M=1; When the multi-electronic gear ratio is not used, P2-60 ~P2-62 are not required.
P1-45	Electronic Gear Ratio (Denominator)(M)	1~32767	Need calculation	
P2-10	Digital Input Pin 1 (DI1)	X2X1X0	101	X1X0=01: digital input (DI1 = SON) corresponds to 17th pin of CN1. X2=1: set DI1 input as NO (normally open) a-contact point.
P2-15	Function setting for digital input pin DI6	X2X1X0	100	Default factory setting of DI6 is NC (normally closed) limit signal input; driver can't run without being connected to pin 32 and pin 31 of CN1. X2=1: set DI6 input as NO a-contact point. X1X0=00, limit input of driver is not used.
P2-18	Function setting for digital output pin DO1	X2X1X0	108	DO1 corresponds to the 16th pin, as clamping-position brake signal of Z-axis; X2=1: set DO1 output as NO a-contact point; X2=0: set DO1 output as NC b-contact point; X1X0=08: set the 16th pin as BK+.
P2-20	Function setting for digital output pin DO3	X2X1X0	007	DO3 corresponds to pin 1, used as servo alarm signal. X2=0: set DO3 output as NC b-contact point. X1X0=07: set pin 1 as ALRM+.

7.4.11. Parameter Setting of DELTA ASDA-B2 Servo Driver

Para. No.	Function	Format & Range	Value	Description
P0-02	Driver status display		02	Monitor if the number of sent and received pulse is correct by setting this parameter. In Weihong control system, the correct quantity of pulse sent by control card is detected by pulse inspection in order to determine whether there is electrical interference.
P1-00	External pulse train input type	ZYX	102	X=2: pulse + direction; Z=1: negative logic
P1-01	Set control mode	ZYX1X0	0000	Z=0: during control mode switching, DIO is maintaining the set value. Since switching control mode is not used, Z=0; Y=0: forward rotation (CCW) (from the view of load); Y=1: the rotation direction is reversed. X1X0=00: position control mode
P1-44	Electronic Gear Ratio (Numerator)(N1)	1~32767	Need calculation	N1/M= mechanical deceleration ratio \times 4 \times encoder pulses \times pulse equivalent / pitch. Representative value: encoder pulses=40000, pitch =5mm, pulse equivalent=0.001, deceleration ratio = 1, calculation as below: $N1 / M = 40000 \times 4 \times 0.001 / 5 = 32 / 1$, N1=32, M=1; When the multi-electronic gear ratio is not used, P2-60 ~P2-62 are not required.
P1-45	Electronic Gear Ratio (Denominator) (M)	1~32767	Need calculation	
P2-10	Digital Input Pin DI1	X2X1X0	101	X1X0=01: digital input (DI1 = SON) corresponds to 9th pin of CN1. X2=1: set DI1 input as NO (normally open) a-contact point.
P2-15	Function setting for digital input pin DI6	X2X1X0	000	Default factory setting of DI6 and DI7 is NC (normally closed) limit signal input; driver can't run without being connected to pin 32 and pin 31 of CN1. X2=1: set DI6 and DI7 inputs as NO a-contact point. X1X0=00, limit input of driver is not used.

Para. No.	Function	Format & Range	Value	Description
P2-16	Function setting for digital input pin DI7	X2X1X0	000	
P2-17	Function setting for digital input pin DI8	X2X1X0	000	External EMG stop input is not used.
P2-18	Function setting for digital output pin DO1	X2X1X0	108	DO1 corresponds to pin 6 & pin 7, used as clamping-position brake signal of Z-axis; X2=1: set DO1 output as NO (normally open) a-contact point; X2=0: set DO1 output as NC (normally closed) b-contact point; X1X0=08: set pin 6 and pin 7 as BK- and BK+ respectively.
P2-22	Function setting for digital output pin DO5	X2X1X0	007	DO5 corresponds to pin 28 & pin 27, used as servo alarm signal. X2=0: set DO5 output as NC b-contact point. X1X0=07: set pin 28 and pin 27 as ALRM+ and ALRM- respectively.

7.4.12. Parameter Setting of SANYO PY Servo Driver

Para. No.	Abbr.	Name	Standard Value	Setting Range	Unit	Remark
1-2	EGER	Electronic gear ratio	4/1	1/32767 to 32767/1		Depends on specific encoder resolution. The formula of electronic gear ratio of servo driver is as below: Electronic gear ratio numerator = mechanical deceleration ratio × 4 × pulse No. per encoder circle; Electronic gear ratio denominator = (screw pitch / pulse equivalent) E.G. In Weihong system, the default pulse equivalent is 0.001mm/p, screw pitch is 5mm, pulse number per

Para. No.	Abbr.	Name	Standard Value	Setting Range	Unit	Remark																																									
						encoder circle is 2000 shaft coupling direct drag, so currently the numerator of the electronic gear ratio is 8, and the denominator is 5. (Select incremental type encoder)																																									
1-16	MENP	Pulse amount of the motor encoder 1. Set the pulse amount of the motor encoder; 2. Standard configuration of the encoder pulse No. is as below. Incremental encoder omitting wiring: --2000P/R Absolute encoder:--2048P/R		500 to 65535	P/R																																										
2-0	PMOD	<p>Pulse format of position command: Our system uses: direction + pulse format, the parameters are shown as following:</p> <p>PMOD: 7 6 5 4 3 2 1 0</p> <p>When bit 7=0</p> <table border="1"> <thead> <tr> <th>Bit 1</th> <th>Bit 0</th> <th>Command Pulse Input Digital Filter Min. Pulse Width</th> </tr> </thead> <tbody> <tr><td>0</td><td>0</td><td>0.8μs</td></tr> <tr><td>0</td><td>1</td><td>0.2μs</td></tr> <tr><td>1</td><td>0</td><td>0.4μs</td></tr> <tr><td>1</td><td>1</td><td>1.6μs</td></tr> </tbody> </table> <p>When bit 7=1</p> <table border="1"> <thead> <tr> <th>Bit 1</th> <th>Bit 0</th> <th>Command Pulse Input Digital Filter Min. Pulse Width</th> </tr> </thead> <tbody> <tr><td>0</td><td>0</td><td>3.2μs</td></tr> <tr><td>0</td><td>1</td><td>0.8μs</td></tr> <tr><td>1</td><td>0</td><td>1.6μs</td></tr> <tr><td>1</td><td>1</td><td>6.4μs</td></tr> </tbody> </table> <table border="1"> <thead> <tr> <th>Bit6</th> <th>Bit5</th> <th>Command Pulse Format</th> </tr> </thead> <tbody> <tr><td>1</td><td>0</td><td>Direction + Pulse</td></tr> </tbody> </table> <p>Switch of Digital Filter</p> <table border="1"> <thead> <tr> <th>Bit</th> <th>Speed</th> </tr> </thead> <tbody> <tr><td>0</td><td>High Speed</td></tr> <tr><td>1</td><td>Low Speed (1/4)</td></tr> </tbody> </table>	Bit 1	Bit 0	Command Pulse Input Digital Filter Min. Pulse Width	0	0	0.8μs	0	1	0.2μs	1	0	0.4μs	1	1	1.6μs	Bit 1	Bit 0	Command Pulse Input Digital Filter Min. Pulse Width	0	0	3.2μs	0	1	0.8μs	1	0	1.6μs	1	1	6.4μs	Bit6	Bit5	Command Pulse Format	1	0	Direction + Pulse	Bit	Speed	0	High Speed	1	Low Speed (1/4)			
Bit 1	Bit 0	Command Pulse Input Digital Filter Min. Pulse Width																																													
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Bit	Speed																																														
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1	Low Speed (1/4)																																														
4-3	TYPE	Control mode: *Select one control mode from position, velocity, and torque modes.			6 types	Our system selects position control mode.																																									

Para. No.	Abbr.	Name	Standard Value	Setting Range	Unit	Remark
		Selection Item	Content			
		Position	Position control mode			
		Velocity	Velocity control mode			
		Torque	Torque control mode			
		Velo ↔ Torq	Velocity ↔ Torque switch mode			
		Posi ↔ Torq	Position ↔ Torque switch mode			
		Posi ↔ Velo	Position ↔ Velocity switch mode			
		Referring to the switch type, the requisite control mode can be selected from pin 36 or 35 of the CN1. Func3, set Bit7 as 0: pin 36 is enabled. set Bit7 as 1: pin 35 is enabled. \$ \$ \$: standard value varies with the reset setup (leave factory setting).				

7.4.13. Parameter Setting of SANYO R Servo Driver

Para. No.	Parameter Name	Set Value	Remarks
Group 0, parameter setting of tuning mode			
00	Setting of the tuning mode	00	Set as auto tuning mode
Group 8, setting of the control parameters			
00	Polarity of position input	00	Position command mode: forward rotation effective
11	Input command mode	02	Pulse + negative logic
15	Setting of electronic gear	8/5	It depends on the resolution of specific encoder. E.G.: incremental encoder 2000, the motor needs 2000 × 4 = 8000 pulses per circle. When pulse equivalent of Weihong control card is 0.001mm/p, it needs 1000 pulses to move 1mm along line, in other words, if the screw pitch is 5, so, to move 5mm along line needs 5000 pulses, so $F = 8000/5000 = 8/5$.
Group 9, setting of function effective			
05	Servo ON selection	02	Select servo ON state
02	Servo alarm elimination	10	Make the function of servo alarm effective
Setting of the system parameters			

Para. No.	Parameter Name	Set Value	Remarks
02	Encoder selection	00	Standard incremental encoder. The parameter depends on specific situation, what we list is only a representative one.
03	Encoder resolution	2000	500—65535, set the encoder resolution manually.
08	Control mode selection	02	Select position control mode.

7.4.14. Parameter Setting of SANYO Q Servo Driver

Para. No.	Parameter Name	Set Value	Remarks
Group 1			
GER1	Electronic gear ratio 1	1/1	Set electronic gear ratio for position command pulse. E.G., incremental encoder 2000, motor needs 2000 ×4=8000 pulses per circle. If pulse equivalent of Weihong control card is 0.001mm/p, it needs 1000 pulses to move 1mm along line, in other words, if the screw pitch is 5, so, to move 5mm along line needs 5000 pulses, so $F=8000/5000=8/5$.
GER2	Electronic gear ratio 2	1/1	This setting is the same as that of electronic gear ratio 1 and activated during electronic gear switching.
Group 4			
PA400	Command pulse selection	00H	Set position command pulse as “pulse + direction”.
Group 8			
S-ON	Servo ON	02H	Select servo ON state
AL-RST	Alarm reset	10H	Make the function of servo alarm effective
Setting of the system parameters			
01	Encoder selection	00	Standard incremental encoder. The parameter depends on the specific situation, what we list is only the representative one.
03	Incremental encoder resolution	2000	500—65535, set the encoder resolution manually.
08	Control mode selection	02	Select position control mode

7.4.15. Parameter Setting of KT270 Servo Driver

Para. No.	Parameter Name	Value	Description
PA4	Control mode selection	0	The control mode of the driver can be set through this parameter: 0: position control mode; 1: speed control mode; 2: trial run control mode; 3: JOG control mode.
PA12	Numerator of position command pulse ratio	2	Set the ratio of position command pulse (electronic gear). Under position control mode, with the setting of the PA12 and PA13, it is convenient to match with pulse source of each type, which can reach users' perfect control resolution (that is angle/pulse) Expression: $P \times G = N \times C \times 4$ P: pulse amount of the input command; G: electronic gear ratio, G=ratio numerator / ratio denominator. N: circle number that the motor rotates; C: each circle line number of photoelectric encoder, C of our system =2500. E.G.: input 6000 command pulses to make the servo motor rotate one circle, $G = \frac{N \times C \times 4}{P} = \frac{1 \times 2500 \times 4}{6000} = \frac{5}{3}$ So set PA12 as 5 and PA13 as 3. The recommended range of electronic gear ratio is: $\frac{1}{50} \leq G \leq 50$
PA13	Denominator of position command pulse ratio	1	Refer to parameter PA12.
PA14	Input mode of the position command pulse	0	Set the input mode of the position command pulse; there are three following modes which can be selected by setting the parameter: 0: pulse + symbol; 1: forward rotation pulse/reverse rotation pulse; 2: two orthogonal pulses inputs The setting of our system is "0": pulse + sign, negative logic.

Para. No.	Parameter Name	Value	Description
PA20	Invalid input on the end of the stroke	1	<p>0: Valid stroke end of LSP, LSN forward rotation, reverse rotation. When switch LSP is connected, driving of the forward rotation is allowed; When switch LSP is disconnected, driving of the forward rotation is prohibited (torque of the forward direction is 0). LSN is the same as LSP. If LSP and LSN are both disconnected, the abnormal alarming of driving prohibited (NO.7) will occur.</p> <p>1: Invalid stroke end of LSP, LSN forward rotation, reverse rotation. No matter which state of the switch LSP and LSN is in, driving of forward rotation and reverse rotation are both allowed. Simultaneously, even if LSP and LSN are both disconnected, abnormal alarming of driving prohibited (NO.7) will not occur.</p> <p>2: Invalid stroke end of LSP, LSN forward rotation, reverse rotation, and SON is forced to be effective. (Note: SON forcedly effective is only used for motor debugging. In normal use, we suggest controlling the state of SON by input port.)</p> <p>3: Valid stroke end of LSP, LSN forward rotation, reverse rotation. When switch LSP is connected, driving of the forward rotation is allowed; When switch LSP is disconnected, driving of the forward rotation is prohibited (the speed of forward direction is 0, but the torque is not 0). LSN is the same as LSP. When LSP and LSN are both disconnected, abnormal alarming of driving prohibited (NO.7) will not occur.</p>

7.4.16. Parameter Setting of FUJI FALDIC- β Servo Driver

Para. No.	Name	Value	Description
01	Command pulse numerator α	Need calculation 1~32767	Command pulse numerator and denominator are equal to those of the electronic gear ratio. $\alpha / \beta = \text{encoder resolution} \times \text{pulse equivalent} \times \text{mechanical deceleration ratio} / \text{screw pitch}$. Typical value: encoder resolution 65536, pitch 5mm, pulse equivalent 0.001, mechanical deceleration ratio 1, $\alpha / \beta = 65536 \times 0.001 / 5 = 8192 / 625$, So $\alpha = 8192$, $\beta = 625$.
02	Command pulse denominator β	Need calculation 1~32767	
03	Pulse string input form	0	Set the input mode of pulse string as: instruction + symbol, that is 'pulse + direction'.
04	Direction of rotation switch	0 or 1	Set 0: Positive direction: Forward rotation (CCW) Set 1: Positive direction: Reverse rotation (CW)
10	CONT1 signal distribution	1	CONT1 is distributed as RUN (i.e. SON); if not distributed, CONT1 will be auto ON if there is no alarming when powered.
11	CONT2 signal distribution	2	CONT2 is distributed as RST (i.e. servo alarming clearance CLR). When 12, 13, 14 are 0, that is CONT3, CONT4 and CONT5 can't be distributed as OT over-travel or EMG (external emergency stop).
15	OUT1 signal distribution	1	Set 1, OUT1 is distributed as a-contact point of alarming output; Set 2, OUT1 is distributed as b-contact point of alarming detection.
27	Parameter write-protection	0 or 1	Set 0, write-enable. Set 1, write-protected.
74	CONT always ON 1	1	Initial value: 0. when set "1", servo is activated (RUN).

7.4.17. Parameter Setting of STONE GS Servo Driver

Para. No.	Para. Name	Value	Description																							
F0f	Electronic gear ratio numerator	2	Electronic gear ratio of position mode: 4x pulse frequency fed back by servo encoder = command pulse frequencyx F0f / F10; value of F0f / F10 must be within 1/100~100. (calculation with pitch 10mm)																							
F10	Electronic gear ratio denominator	1																								
F00	Control mode selection	2	<p>0: External speed running mode; make sure the value and direction of motor speed according to the external analog -10V ~ +10V signal of CN2-16, 17;</p> <p>1: Internal speed running mode; make sure the value and direction of motor speed according to the setting of parameter F33, F35, F37, F39 and the port status of CN2-9, CN2-25;</p> <p>2: Position pulse running mode; accept the input of external position pulse and direction level signal;</p> <p>3: Jog mode; make sure the motor speed in terms of parameter setting of F3b, and control the rotation direction by the direction keystroke ▼ and ▲;</p> <p>4: Torque mode; make sure the value and direction of motor torque according to the external analog -10V ~ +10V signal of CN2-43, 1;</p> <p>5~10: Mixed mode; select mode according to the port input status of CN2-24:</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th rowspan="2">F00 Value</th> <th colspan="2">CN2-24 Interface Status</th> </tr> <tr> <th>OFF (Mode One)</th> <th>ON (Mode Two)</th> </tr> </thead> <tbody> <tr> <td>5</td> <td>Position Pulse Mode</td> <td>External Speed Running Mode</td> </tr> <tr> <td>6</td> <td>Position Pulse Mode</td> <td>Internal Speed Running Mode</td> </tr> <tr> <td>7</td> <td>Position Pulse Mode</td> <td>Torque Mode</td> </tr> <tr> <td>8</td> <td>Internal Speed Running Mode</td> <td>External Speed Running Mode</td> </tr> <tr> <td>9</td> <td>Internal Speed Running Mode</td> <td>Torque Mode</td> </tr> <tr> <td>10</td> <td>External Speed Running Mode</td> <td>Torque Mode</td> </tr> </tbody> </table>	F00 Value	CN2-24 Interface Status		OFF (Mode One)	ON (Mode Two)	5	Position Pulse Mode	External Speed Running Mode	6	Position Pulse Mode	Internal Speed Running Mode	7	Position Pulse Mode	Torque Mode	8	Internal Speed Running Mode	External Speed Running Mode	9	Internal Speed Running Mode	Torque Mode	10	External Speed Running Mode	Torque Mode
F00 Value	CN2-24 Interface Status																									
	OFF (Mode One)	ON (Mode Two)																								
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8	Internal Speed Running Mode	External Speed Running Mode																								
9	Internal Speed Running Mode	Torque Mode																								
10	External Speed Running Mode	Torque Mode																								
F2e	Pulse input mode selection	2	<p>Command pulse string mode selection of position mode:</p> <p>1 - Single pulse train positive logic Pulse 12 27 Direction 13 28 </p> <p>2 - Single pulse train negative logic Pulse 12 27 Direction 13 28 </p> <p>3 - Double pulse train positive logic CCW 12 27 CW 13 28 </p> <p>4 - Double pulse train negative logic CCW 12 27 CW 13 28 </p> <p>5 - Orthogonal pulse positive logic Phase A 12 27 Phase B 13 28 </p> <p>6 - Orthogonal pulse negative logic Phase A 12 27 Phase B 13 28 </p>																							

7.4.18. Parameter Setting of TECO TSDA Servo Driver

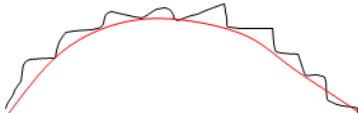
Para. No.	Function	Value	Description		
Pn010-1	Set control mode	1	Control mode		
			Value	CN1 Pin12 open circuit	CN1 Pin12 closed circuit
			0	Speed control	Speed control
			1	Position control	Position control
			2	Torque control	Torque control
			3	Speed control	Speed control
			4	Position control	Position control
Pn010-2	Set the pulse input format under position control mode	0	Value	The format of pulse input	
			0	Pulse + direction	
			1	Dipulse	
			2	A/B phase difference	
Pn010-3	Set rotation direction of motor	1	Value	Function	
			0	Input positive order, motor rotates anti-clockwise.	
			1	Input positive order, motor rotates clockwise.	
Pn021	Electronic gear ratio numerator	Need calculation	The input pulse amount will be multiplied by this ratio before output. Ratio range of parameter 21 to 22: $1/127 < \text{parameter 21} / \text{parameter 22} < 127$		
Pn022	Electronic gear ratio denominator	Need calculation			
Pn011-4	Set the value of Pin20 of CN1	1	Value	Function	
			0	Output of "0" speed signal	
			1	Output of brake signal	
Pn013-1	Set the maximum pulse frequency received by the driver under position control mode	7	It can correct the phenomenon of unauthorized over-travel. Received frequency is divided into 8 segments from 500Kpps to 200Kpps. "0" indicates 500Kpps while "7" 200Kpps.		



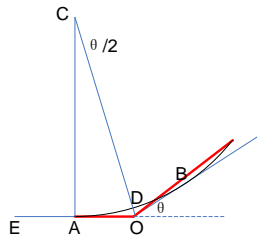
For parameter setting of a specific driver, refer to the driver manual.

7.5. List of System Parameters

Parameter Name	Setting Range	Default	When Enabled
Manu			
Rapid jogging speed	1 ~ Min. value of max. speed of all axes (mm/min)	1800	Immediately
Jogging speed	0.06 ~ Min. value of max. speed of all axes (mm/min)	1200	Immediately
Stepping speed	0.06 ~ Min. value of max. speed of all axes (mm/min)	1200	Immediately
MaxJogSpeedBeforeBackToRef Point	1~5000 mm/min	3000	Immediately
Fixed Point			
X machine coordiante	-99999~99999(mm)	0	Immediately
Y machine coordiante	-99999~99999(mm)	0	Immediately
Z machine coordiante	-99999~99999(mm)	0	Immediately
Bkref			
Force homing before machining	Yes: Force;No: Not force	No	Immediately
X direction in coarse positioning	1: Positive; -1: Negative	-1	Immediately
Y direction in coarse positioning	1: Positive; -1: Negative	-1	Immediately
Z direction in coarse positioning	1: Positive; -1: Negative	-1	Immediately
X speed in coarse positioning	0.06 ~ 9000(mm/min)	1800	Immediately
Y speed in coarse positioning	0.06 ~ 9000(mm/min)	1800	Immediately
Z speed in coarse positioning	0.06 ~ 9000(mm/min)	1800	Immediately
X speed in precision positioning	0.06 ~ 6000(mm/min)	60	Immediately
Y speed in precision positioning	0.06 ~ 6000(mm/min)	60	Immediately
Z speed in precision positioning	0.06 ~ 6000(mm/min)	60	Immediately
Back space of X	0 ~ 1000(mm)	2	Immediately
Back space of Y	0 ~ 1000(mm)	2	Immediately
Back space of Z	0 ~ 1000(mm)	2	Immediately
XAxis Param			
Axis direction	1: Positive; -1: Negative	1	After restart
Pulse equivalent	0.00000001 ~ 1000 (mm/p)	0.001	After restart
Check worktable stroke	Yes: Enable; No: Disable	Yes	After restart
Lower limit of worktable stroke	-999999 ~ Upper limit(mm)	-1000	After restart
Upper limit of worktable stroke	Lower limit ~ 999999(mm)	1000	After restart
Starting speed	0 ~ Max. speed(mm/min)	0	After restart
Max. speed	0 ~ Max. speed supported by hardware(mm/min)	9000	Immediately
Max. acceleration	0 ~ 100000(mm/s ²)	400	After restart
Max. jerk	0 ~ 100000(mm/s ³)	10000	Immediately

Parameter Name	Setting Range	Default	When Enabled
YAxis Param			
Rotation diameter	1~3000 (mm)	10	After restart
Axis direction	1: Positive; -1: Negative	1	After restart
Pulse equivalent	0.00000001 ~ 1000(deg/p)	0.01	After restart
Check worktable stroke	Yes: Enable; No: Disable	Yes	After restart
Lower limit of worktable stroke	-999999 ~ Upper limit(mm)	-1000	After restart
Upper limit of worktable stroke	Lower limit ~ 999999(mm)	1000	After restart
Starting speed	0 ~ Max. speed(mm/min)	0	After restart
Max. speed	0 ~ Max. speed supported by hardware(mm/min)	7853.98163 4	Immediately
Max. acceleration	0 ~ 100000(mm/s ²)	400	After restart
Max. jerk	0 ~ 100000(mm/s ³)	10000	Immediately
ZAxis Param			
Axis direction	1: Positive; -1: Negative	1	After restart
Pulse equivalent	0.00000001 ~ 1000(mm/p)	0.001	After restart
Check worktable stroke	Yes: Enable; No: Disable	Yes	After restart
Lower limit of worktable stroke	-999999 ~ Upper limit(mm)	-1000	After restart
Upper limit of worktable stroke	Lower limit ~ 999999(mm)	1000	After restart
Starting speed	0 ~ Max. speed(mm/min)	0	After restart
Max. speed	0 ~ Max. speed supported by hardware(mm/min)	9000	Immediately
Max. acceleration	0 ~ 100000(mm/s ²)	400	After restart
Max. jerk	0 ~ 100000 (mm/s ³)	10000	Immediately
Compensation			
Lead screw compensation mode	0: No compensation; 1: Backlash compensation; 2: Screw error compensation	0	After restart
Backlash X	0 ~ 0.1	0	After restart
Backlash Y	0 ~ 0.1	0	After restart
Backlash Z	0 ~ 0.1	0	After restart
Track Control			
Max. look-ahead paths	1 ~ 1000	300	Immediately
Track smooth time	0 ~ 0.064(s)	0	Immediately
<p>“Track smooth time” works as post-acceleration/ deceleration. The larger the value is, the more ambiguous the details of workpiece are, i.e. the workpiece is smoother. But it will lead to reduction of arc radius in machining an arc. And it will also dwarf wave peak in machining workpiece resembling waves, as following.</p>			
			
Fig. 7-6 Track smooth			

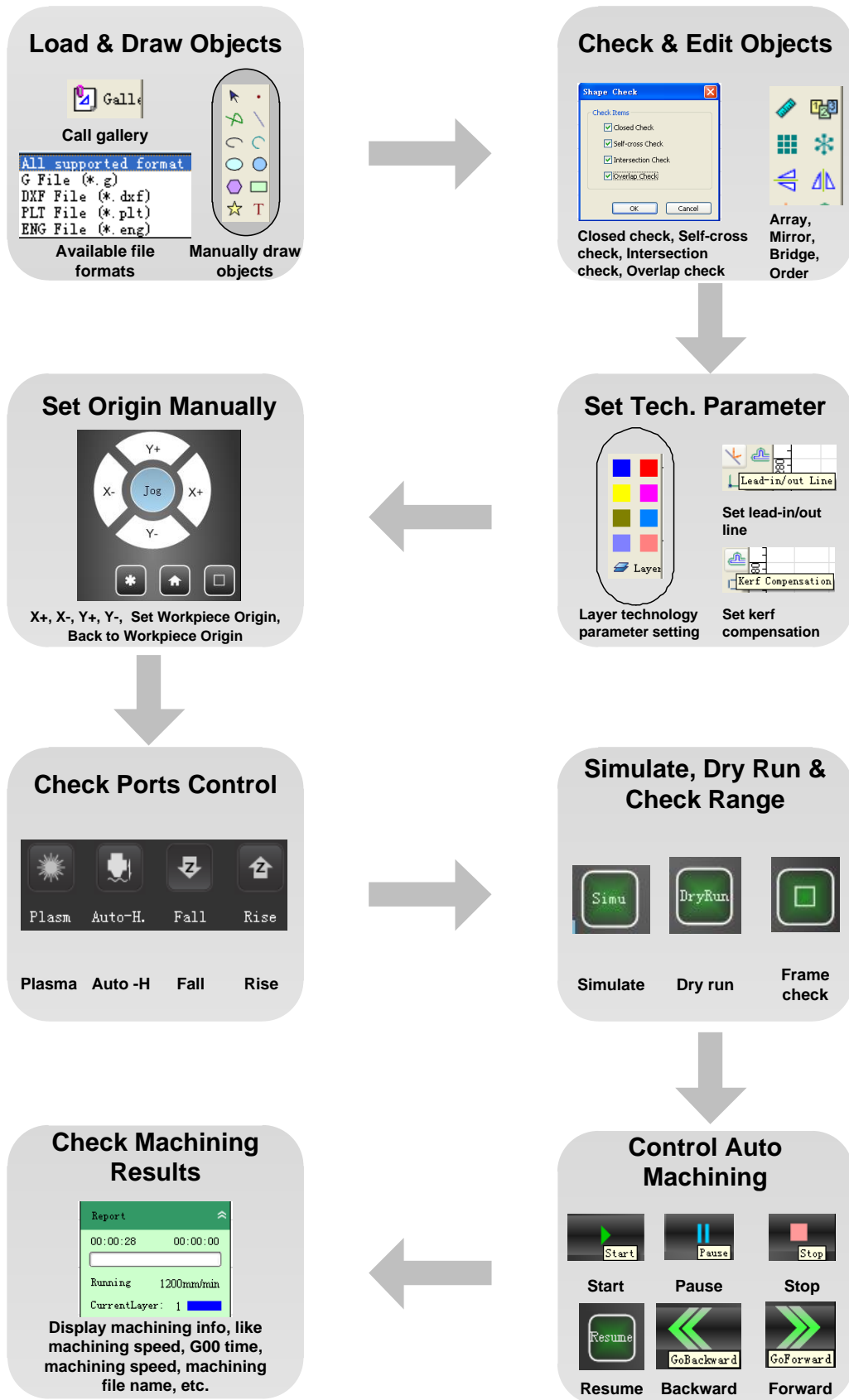
Parameter Name	Setting Range	Default	When Enabled
Speed/Acc			
Feeding speed options	0: Use file speed 1: Use default speed	0	Immediately
G00 speed	0.06 ~ Min. value of max. speed of each axis (mm/min)	3000	Immediately
Default feed speed	0.06 ~ Min. value of max. speed of each axis (mm/min)	1200	Immediately
IsUseIntroSpeed	Yes: Enable; No: Disable	No	Immediately
EnterIntroSpeed	0.06 ~ Min. value of max. speed of each axis (mm/min)	1200	Immediately
ExitIntro Speed	0.06 ~ Min. value of max. speed of each axis (mm/min)	1200	Immediately
Speed of simulate cut	0 ~ 9000 (mm/min)	3000	Immediately
Single axis acceleration in machining	100 ~ 100000(mm/s ²)	400	Immediately
Single axis acceleration in positioning	100 ~ 100000(mm/s ²)	400	Immediately
Cornering acceleration	0.001 ~ 100000(mm/s ²)	1000	Immediately
Jerk	0.001 ~ 9999999(mm/s ³)	10000	Immediately
Jerk refers to growth rate of acceleration, i.e. the increment of acceleration in unit time, with unit "mm/s ³ ". It is available for S_type and LEP_type acceleration & deceleration, used to mitigate the bad effect caused by abrupt acceleration & deceleration of machine.			
Max. angle of high-speed connection	0 ~ 180(deg)	90	Immediately
During machining, if the angle of two adjacent segments are larger than "Max. angle of high-speed connection", the speed of machining joint is "0"; if smaller than "Max. angle of high-speed connection", an appropriate connection speed will be calculated according to the connection angle.			
Interpolation algorithm	0 ~ 2	2	Immediately
0: straight line for acceleration, trapezoid speed; 1: triangle for acceleration, S-type speed; 2: straight line for jerk, trapezoid acceleration For trapezoid algorithm, its acceleration is a straight line and speed a trapezoid. For S-type algorithm, its acceleration is a triangle and speed an S-type. For acceleration trapezoid algorithm, its jerk is a straight line and acceleration a trapezoid. The machining efficiency of trapezoid algorithm and S-type algorithm is high. When S-type algorithm is adopted, the max. acceleration of the system can reach 2 times of single axis acceleration set in the system. Thus, it is recommended to make down the value of parameter "Single axis acceleration in machining" when S-type algorithm is selected. Acceleration trapezoid algorithm means the curve of acceleration is a trapezoid. The relation between acceleration and time is acceleration will increase to its max. value at jerk and then keep constant and then decrease to "0" at jerk.			

Parameter Name	Setting Range	Default	When Enabled
Circular speed limit	Yes: Enable; No: Disable	Yes	Immediately
Only when "Circular speed limit" is enabled can parameters "Max. look-ahead paths", "Max. speed of reference circle", and "Min. speed of reference circle" work.			
Max. speed of reference circle	Min. speed of reference circle ~ Min. value of max. speed of all axes (mm/min)	1800	Immediately
Min. speed of reference circle	0.06 ~ Max. speed of reference circle(mm/min)	180	Immediately
Others			
Additional action when ended	0~2	0	Immediately
Additional action after machining finishes normally; for abnormal stop, this parameter does not work. 0: None; 1: Back to fixed point; 2: Back to workpiece origin.			
Min. angle of arc transition	0 ~ 175 (deg)	5	After saved
The position where the corner is smaller than the value of this parameter will not be performed closed-angle smoothing.			
Max. angle of arc transition	5 ~ 180 (deg)	175	Immediately
The position where the corner is larger than the value of this parameter will not be performed closed-angle smoothing.			
Precision of arc transition	0.001 ~ 10(mm)	0.01	Immediately
The precision for closed-angle smoothing, i.e. the length of OD shown in Fig. 7-7. The larger the value is, the larger the angle of round-fillet is, the larger the error will be, while the smaller the value is, the smaller the angle of round-fillet is, the smaller the error will be.			
			
Fig. 7-7 Fillet closed-angle to arc			
Min. length when arc transition	0.001 ~ 1000(mm)	0.001	Immediately
Max. cut length when arc transition	0.01 ~ 10(mm)	10	Immediately
This length is the max. length for closed-angle smoothing. As shown in Fig. 7-7, if the max. smoothing length is OE , the length of AO should be smaller than that of OE .			
Delay time of wait arc feedback	0~600000(ms)	10000	Immediately
Check of arc feedback signal	1: Check; 2:Uncheck	1	Immediately



The parameter No. of each parameter is not fixed. Under different configurations, parameter list is slightly different. This parameter list includes all parameters under all configurations.

7.6. Software Operation Procedure



7.7. Shortcut Keys

Shortcut Key	Function	Shortcut Key	Function
F1	Help, show shortcut key information	Ctrl+D	Set machining direction
F2	E-stop	Ctrl+E	Auto set machining order
F3	Go backward	Ctrl+R	Set kerf compensation
F4	Go forward	Ctrl+Q	Set origin of lead-in/out line
F5	Set workpiece origin	Ctrl+W	Set lead-in/out line
F6	Back to workpiece origin	Ctrl+T	Shape check
F7	Frame check	Ctrl+G	Gallery
F8	Simulation	Ctrl+P	System parameters
F9	Start	Ctrl+I	Import file
F10	Pause	Ctrl+J	Combine
F11	Stop	Ctrl+N	New
F12	Clear Track	Ctrl+O	Open file
Alt+0	Show Ports window	Ctrl+S	Save file
Alt+1	Arc striking	Ctrl+Z	Undo
Alt+2	Auto high	Ctrl+Y	Redo
Alt+3	Fall	Ctrl+A	Select all
Alt+4	Rise	Ctrl+Shift+A	Select invert
Num+	Zoom in	Ctrl+X	Cut
Num-	Zoom out	Ctrl+C	Copy
Num*	Fit to window	Ctrl+V	Paste
Num0	Rapid jogging speed	Ctrl+Home	Back to machine origin (Go home)
Shift+F9	Resume breakpoint	Ctrl+F9	Start for selection
Shift+A	Clear selection	Delete	Delete
End	Middle current point		

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