NK200 Integrated CNC System

Manufacturers' Manual

14th Edition

Weihong Electronic Technology Co., Ltd.

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Preface

About This manual

This manual is intended for manufacturers. 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 7 chapters, this manual can be divided into 5 parts, as follows:

1) Preface, introducing the precautions about transportation and storage, installation, wiring, debugging, usage and so on. You need to read them first carefully to ensure safe operations.
2) Hardware part, including chapter 1, 2 and 5. The first two introduce the product configuration, hardware information and ports specification of NK200 while chapter 5 lists driver parameter settings and wiring sketches of each brand.
3) Software part, including chapter 3. It illustrates detailed operations of single functionality and its corresponding interfaces, which will be an intuitional guidance to users and operators in real practice.
4) Maintenance part, including chapter 4. By reading the common troubleshooting, you can react to the target and take corresponding steps in case of problems.
5) Appendix part: last part of this manual, consisting of chapter 6 and chapter 7, listing parameter overview and the software license agreement respectively.

Applicable Product Model

This manual is applicable to NK200 integrated system. Refer to the table below for details.

Product Model	Remarks
NK200 Integrated CNC system	Herein referred to NK200 as abbreviation, supporting three-axis standard configuration and turn table configuration. In general, “the system” stands for NK200 integrated CNC system without special notice.

Contact Us

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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	R14	1) Contact information updated; 2) Wiring diagrams of Wise driver in section 5.3.1 updated; 3) Section 1.2.2 Mounting Dimensions added; 4) Section 2.1 updated; 5) Section 3.11.1 updated; 6) Fig. 3-44 Direction of Tool Compensation Updated; 7) Styles updated. 8) Other revisions.
2015.10	R12	The revisions are as below: 1) Update operation interface and instructions based on latest version; 2) Update the parameters information based on the latest version; 3) Update the operation system maintenance instructions; 4) Add new chapters, including extended coordinate system, tool compensation and pulse equivalent setting; 5) Add WISE and MITSUBISHI MR-JE driver parameter settings and wiring sketches; 6) Add system alarm specification part; 7) 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.

CAUTION: 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: 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;
- 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 equipments 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

WARNING

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 misoperation 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;
- 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.

Contents

1 Overview

1.1 System Configuration

NK200 integrated CNC system consists of the following components:

- One NK200 host;
- USB damper cable (80cm);
- Servo cable, brand and length custom (one with brake line, while the other two without brake line);
- Handwheel NK-MPG-06 (optional).

1.2 An Introduction to Hardware

1.2.1 Product Specification

- **A Picture of NK200 System**

Fig. 1-1 A Picture of NK200 System

- **Front View of NK200**

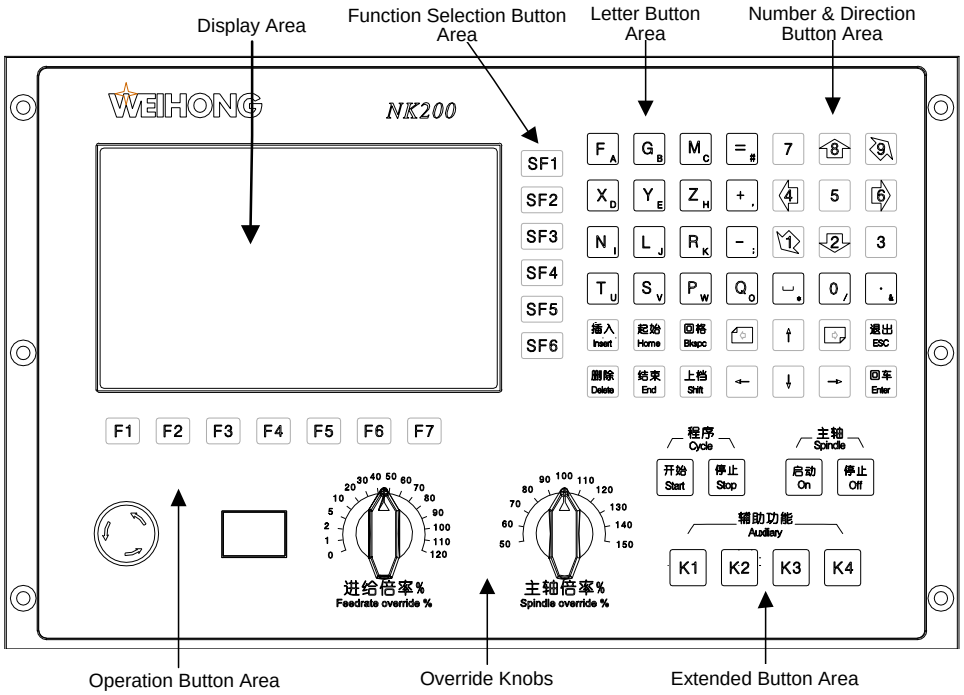


Fig. 1-2 Front View of NK200

- **Rear View of NK200**

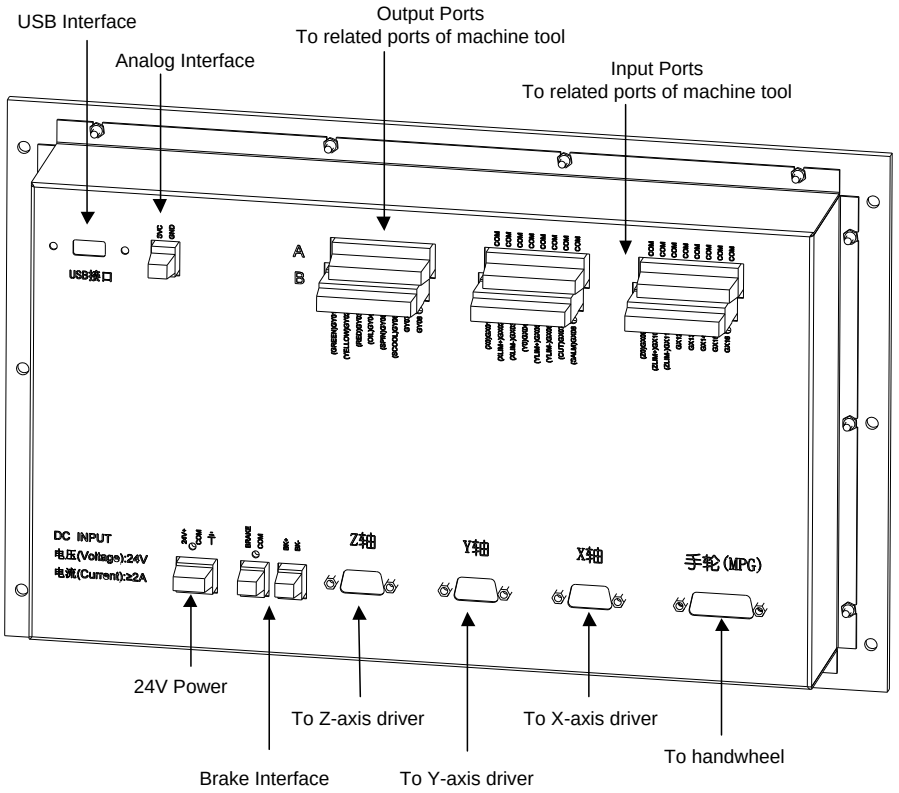


Fig. 1-3 Rear View of NK200

1.2.2 Mounting Dimensions

After NK200 is installed on the machine tool, 100 mm space should be preserved in its surrounding for convenience of wiring and ventilation in the cabinet.

The integral thickness of NK200 system is 108.7mm, including front panel and chassis. Hereinto, the thickness of front panel is 5mm, and the thickness of rear chassis is 55.2mm. And the mechanical dimension diagram of NK200 is as shown in Fig. 1-4 (Unit: mm). The cutout of NK200 is as shown in Fig. 1-5(Unit: mm).

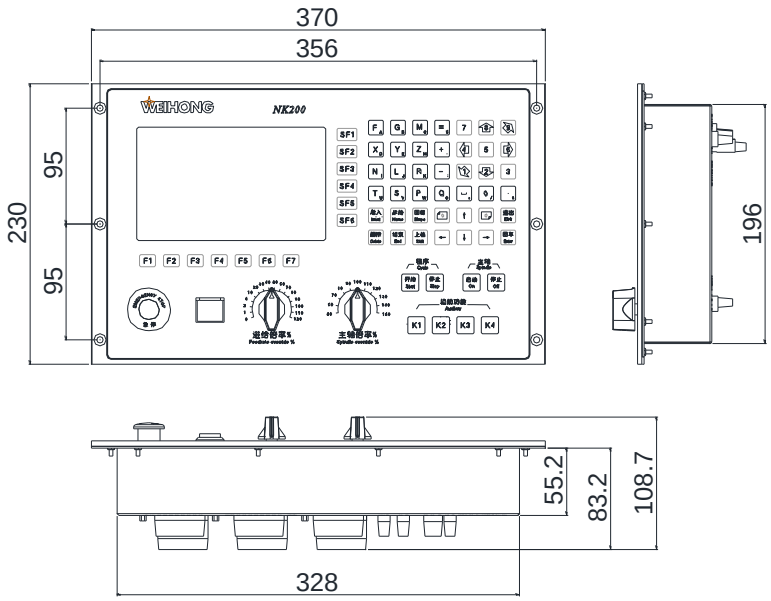


Fig. 1-4 Mounting Dimension of NK200

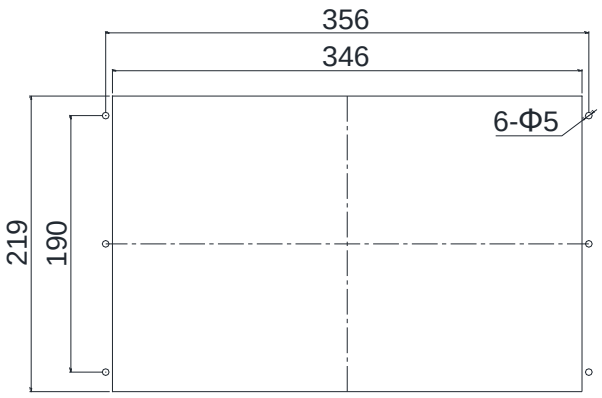


Fig. 1-5 Cutout of NK200

1.2.3 Connection Schematic Diagram

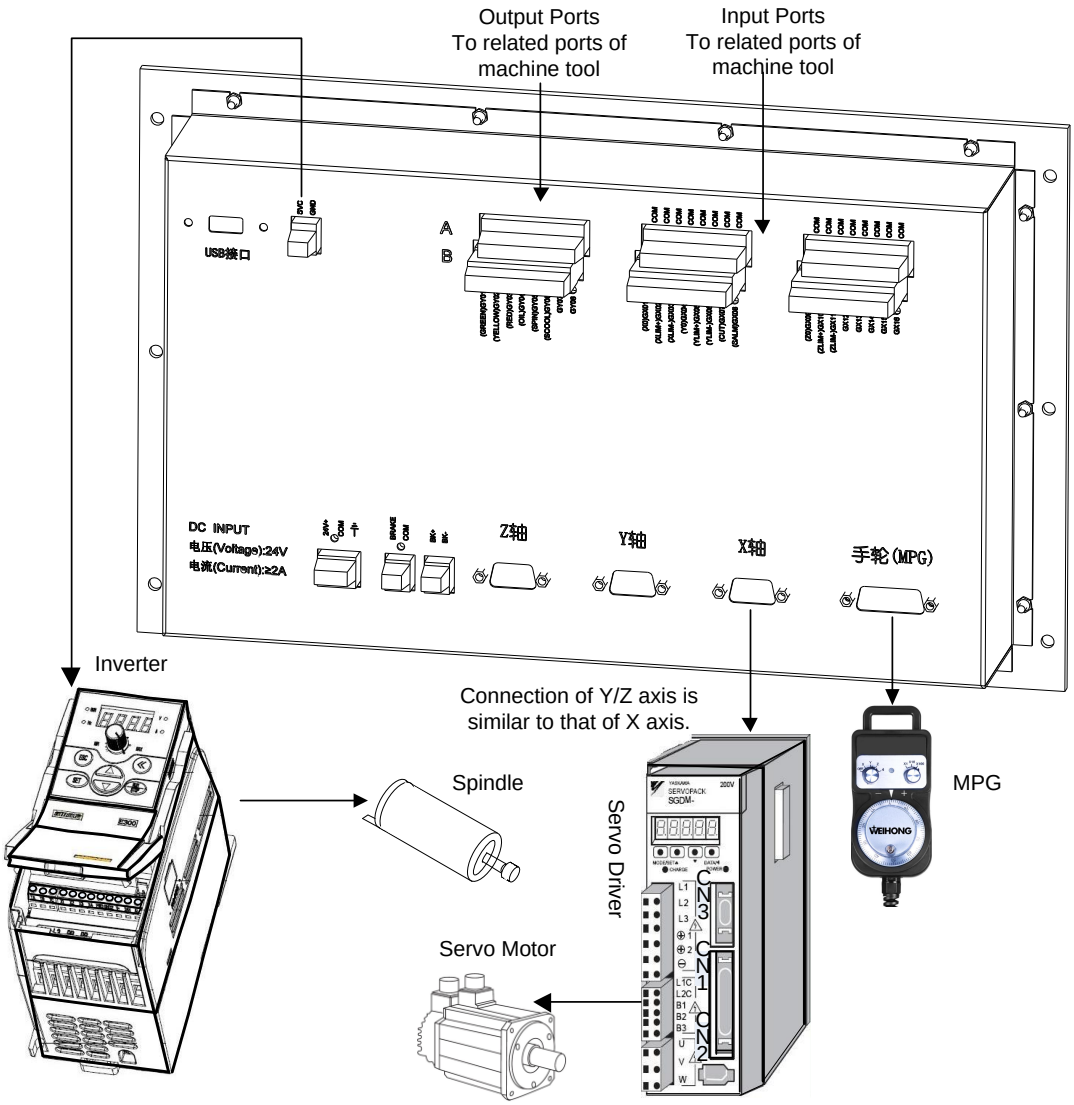


Fig. 1-6 Connection Schematic Diagram of NK200

2 Wiring

2.1 Signal Types

The signal in NK200 integrated system can be classified into four types: binary input signal, relay output signal, differential output signal and analog output signal.

2.1.1 Binary input signal

Binary input signal is active low and supports NO and NC input signals (through modifying input port polarity in the software). Conducting to GND (i.e. grounding signal) in NO connection means signal detected, and disconnecting with GND in NC connection means signal detected. (GND refers to GROUND signal).

2.1.1.1 Input Binary

- **Connection between binary input and external circuit**

The wiring method between binary input signal and a mechanical switch is shown in Fig. 2-1:

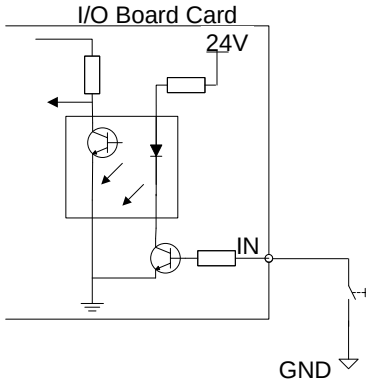


Fig. 2-1 Connection of Mechanical Switch and Binary Input

Binary input signal can be connected with a photoelectric switch or a proximity switch of NPN (NO or NC) type. Its joining method is as shown in Fig. 2-2.

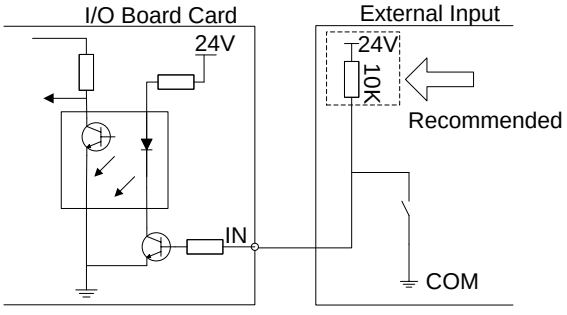


Fig. 2-2 Binary Input of NPN Type Connecting with Photoelectric Switch or Proximity Switch

- **Power requirement**

It is recommended to adopt DC24V/4.5A switch power for relays on the terminal board. If there are a great many DC 24V relays controlled by binary output signal, users can appropriately expand the power

source capacity or add extra power (forcibly sharing ground with external power supply). Z-axis brake and solenoid valve also need DC24V instead of external power to the greatest extent to reduce the interference to CNC device by solenoid valve, etc.

2.1.1.2 Output Binary

- **Signal signature**

The internal equivalent circuit of binary output is shown in Fig. 2-3.

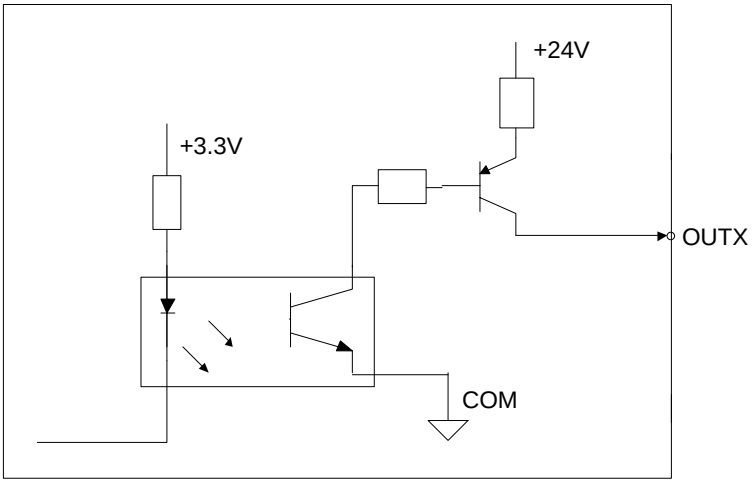


Fig. 2-3 Equivalent Circuit of Binary Output Interface

- **Technical parameter**

1) Supply voltage: 24VDC

2) Binary open-collector output

OC (open-collector) outputs drive capability with maximum allowable operating voltage 30VDC and maximum allowable current 20mADC; so when the output terminal is active low, the maximum allowable sucked current is 20mA.

- **Connection of binary output and external circuit**

The connection of solid-state relay and binary output is shown in Fig. 2-4.

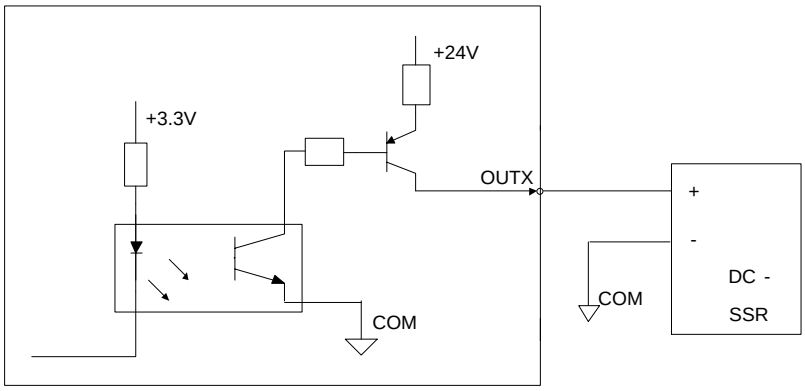


Fig. 2-4 Connection of Solid-state Relay and Binary Output

2.1.2 Relay output signal

The relay output contact points on the terminal board have load capacity: 10A/250VAC and 10A/30VDC, which can control 220V AC load of low power. If high power load is needed, a contactor can be used. Please see Fig. 2-5.

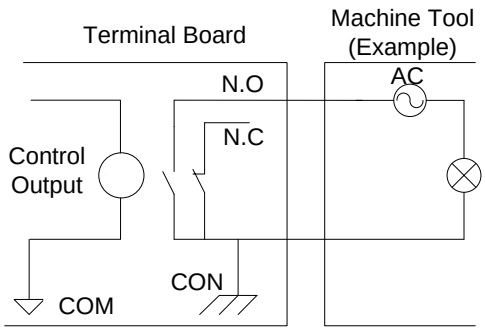


Fig. 2-5 Connection of Relay Output and Contactor

2.1.3 Differential output signal

Differential signal refers to two equivalent signals with opposite phases sent by driving end, and the voltage difference of these two signals is used for deciding whether the logical status of differential signal is “0” or “1”.

Pulse command format of controlling driver motion is pulse + direction, negative logic. And this signal adopts differential signal transmission mode.

2.1.4 Analog output signal

SVC is controllable voltage output of 0~10V and externally connected with analog voltage frequency command inputs of inverter. Therefore altering the controllable voltage leads to inverter frequency change and a change of inverter frequency will change the spindle speed.

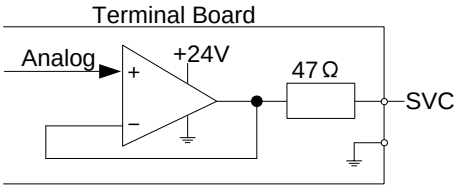


Fig. 2-6 Electric Circuit of Analog Output Signal

2.2 Terminal Introduction

2.2.1 Input Interface of +24V Power

+24V power input interface is for external connection of 24V power, whose pins definition is as Fig. 2-7.

And the symbol of ⏚ indicates connection with copper earth plate of machine tool, i.e., grounding.

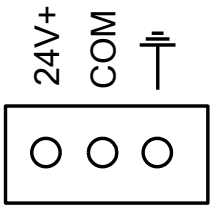


Fig. 2-7 Pins Definition of +24V Power Input Interface

2.2.2 Brake Interface

The brake interfaces on NK200 chassis can be divided into the following ones; (a) Brake output interface, (b) Brake input interface, and the definitions of pins are as Fig. 2-8 and Fig. 2-9 accordingly.

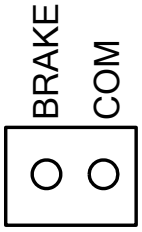


Fig. 2-8 Brake Output Interface

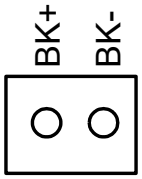


Fig. 2-9 Brake Input Interface

When “BK+” and “BK-” in Fig. 2-9 are connected, the voltage between “BRAKE” and “COM” in Fig. 2-8 will be between 22.8V and 25.2V. At the same time, the green LED lights up.

2.2.3 Driver Interface

NK200 system provides 3 pulses to feed the gang socket of driver interface, i.e. X, Y and Z respectively. The type of gang socket is 15-core D-shaped socket (DB15 pins). The pins definition is as shown in Fig. 2-10.

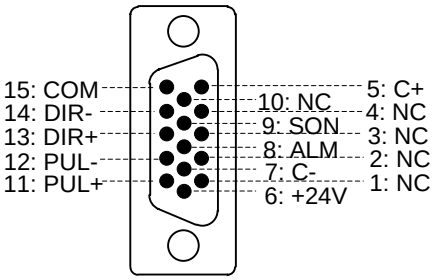


Fig. 2-10 Driver Interface Definition

Name	Definition	Input /Output	Description
C+, C-	Feedback signal of encoder phase C	Input, differential signal transmission mode	Used for detecting encoder origin
ALM	Driver alarm signal	Input	When breakdown occurs in driver, this output (transistor) switch will be closed or disconnected.
SON	Servo ON signal	Output	This signal is used for opening (power on) and closing (power off) servo motor. When this signal is connected to COM-, dynamic brake will be released and thus the driver is allowed to work (servo enabled).
PUL+, PUL-	Pulse output	Output, differential signal transmission mode	
DIR+, DIR-	Direction output	Output, differential signal transmission mode	
+24V, GND	DC 24V power	Output	Connected to driver

CAUTION

SON signal will be effective at 2 seconds after power on. Don't try to drive the motor through the external servo ON or servo OFF drive signal at any time, since the software will control the enabling state of the servo motor.

2.2.4 Handwheel Interface

NK200 is capable of externally connecting with manual pulse generator, with DB15 core dual-in-line holes joint. Its pin definition is as shown in Fig. 2-11.

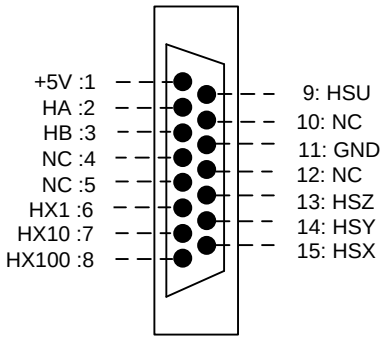


Fig. 2-11 Handwheel Interface Definition

Table 1 Handwheel Pin Definition Specification

Pin No.	Definition	Description
1	+5V	Power on handwheel encoder (+5V)
2	HA	Encoder phase A signal
3	HB	Encoder phase B signal
4	NC	
5	NC	
6	HX1	Selection of X1 override
7	HX10	Selection of X10 override
8	HX100	Selection of X100 override
9	HSU	
10	NC	
11	GND	Digital ground
12	NC	
13	HSZ	Selection of Z axis
14	HSY	Selection of Y axis
15	HSX	Selection of X axis

2.2.5 Analog Interface

The analog interface on NK200 chassis serves for analog output, with 2-core terminal socket, and the pins definition is as Fig. 2-12. SVC: analog signal (range: 0V~10V). GND: signal ground.

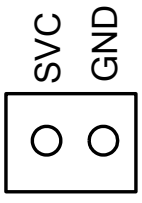


Fig. 2-12 Pin Definition of Analog Interface

2.2.6 USB Interface

The USB interface on NK200 chassis is used for the connection with external USB device (e.g. USB flash disk).

2.3 Port Specification of Terminal Board

As shown in Fig. 1-3, the rear of the chassis is equipped with two groups of input ports and one group of output ports, all used to connect corresponding ports of the machine tool. See the detailed port specification of terminal board as blow:

Table 2 Ports specification

Name	Port No.	Definition	Description
Input Ports			
Origin signal	X0(GX01)	X machine origin	Binary input, low level effective; connected to home switch of X-axis
	Y0(GX04)	Y machine origin	Binary input, low level effective; connected to home switch of Y-axis
	Z0(GX09)	Z machine origin	Binary input, low level effective; connected to home switch of Z-axis
	COM	Common port	Common port of digital signal
Limit signal	XLIM+(GX02)	X positive limit	Binary input, low level effective; connected to positive limit switch of X-axis
	XLIM-(GX03)	X negative limit	Binary input, low level effective; connected to negative limit switch of X-axis
	YLIM+(GX05)	Y positive limit	Binary input, low level effective; connected to positive limit switch of Y-axis
	YLIM-(GX06)	Y negative limit	Binary input, low level effective; connected to negative limit switch of Y-axis
	ZLIM+(GX10)	Z positive limit	Binary input, low level effective; connected to positive limit switch of Z-axis
	ZLIM-(GX11)	Z negative limit	Binary input, low level effective; connected to negative limit switch of Z-axis
	COM	Common port	Common port of digital signal
Spare input	GX12-GX16	Spare input ports	Used for custom reserved inputs
Output Ports			
Signal lamp	RED(GY03)	Red alarm lamp	Red light on when machining ends or during E-stop
	GREEN (GY01)	Green work lamp	Light on during normal working state of machine tool
	YELLOW (GY02)	Yellow work lamp	Yellow light on during idle state after machining ends or during waiting state
Commonly used output	OIL(GY04)	Lubrication on	Controlling auto lubrication with relay contact output, LED on during lubrication and off when lubrication stops
	SCOOL	Spindle cooling	Relay contact output; two terminals equaling to

Name	Port No.	Definition	Description
	(GY06)		a switch; connected to spindle cooling switch
Spindle control	SPIN	Spindle start/ stop	Relay output; its two terminals separately connected to the digital ground of converter (i.e. DCM) and the forward rotation input port of converter (i.e. FOR).
Reserved output	GY07-GY08	Reserved output ports	Used for custom reserved outputs

3 Operation

3.1 Debugging Steps

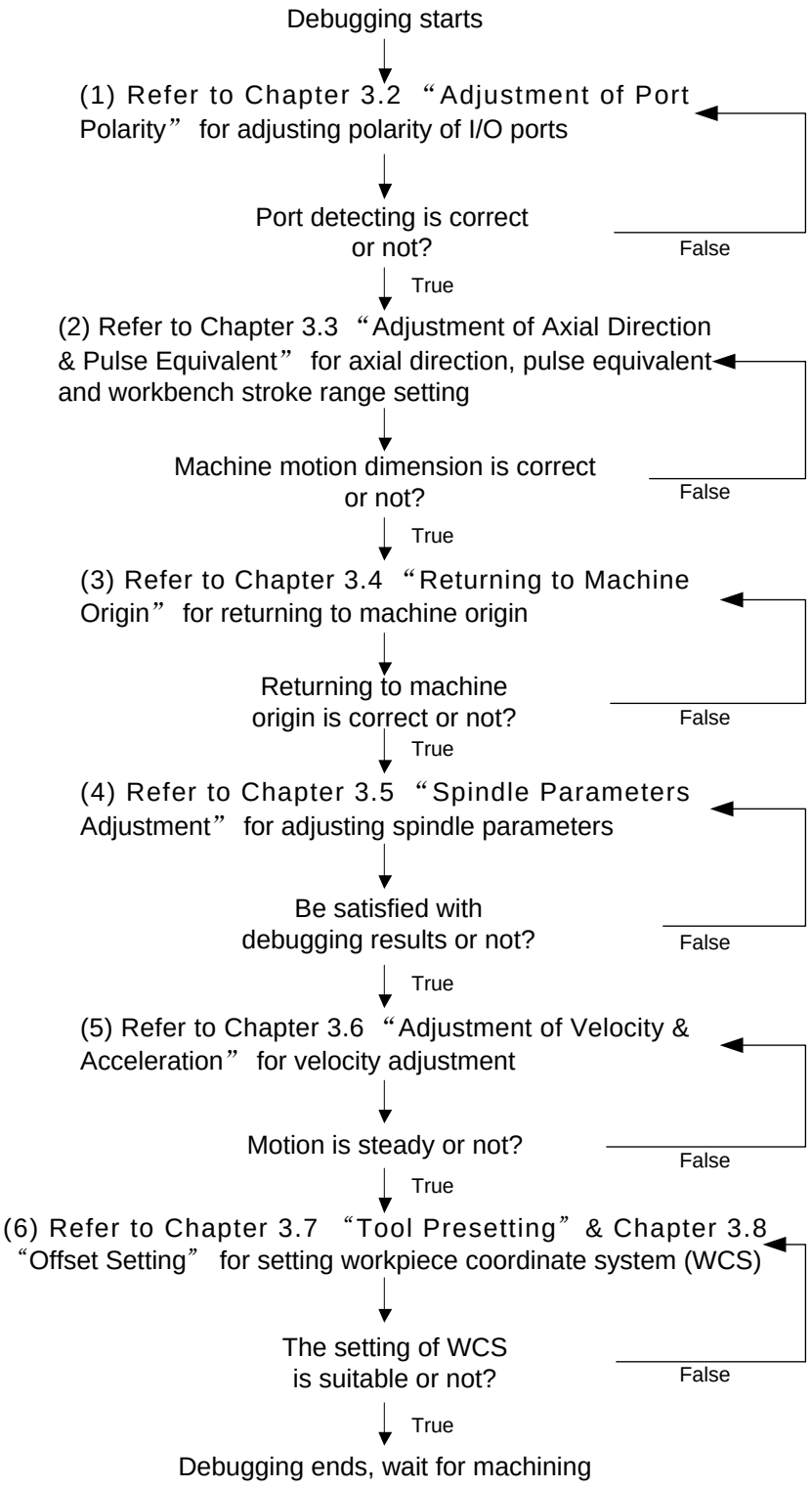


Fig. 3-1 Debugging Steps

3.2 Adjustment of Port Polarity

3.2.1 Ports Polarities

The polarities of input/ output ports in software are specified in terms of the switch type: the polarity of normally closed-type switch is “P”; the polarity of normally open-type switch is “N”. In the system interface, the ports with preceding filled dot ● are input ports, while the ones with hollow point ◎ are output ports. [Diagnosis] function section is as shown in Fig. 3-2.

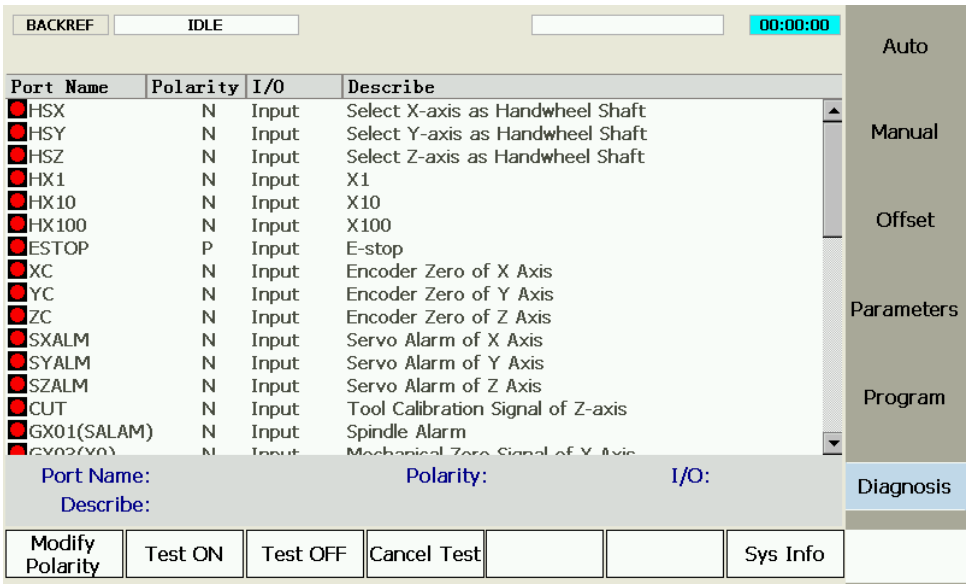


Fig. 3-2 Ports Screen

3.2.2 Manipulation Buttons

The manipulation buttons are as shown in Fig. 3-3.

Fig. 3-3 Manipulation Button Bar under [Diagnosis] Function Section

- **Modify Polarity**

The shortcut key is F1, only available under [Diagnosis] function section. After F1 is pressed, the interface is as shown in Fig. 3-4.

Press F1 to modify the port polarity between N (Negative) and P (Positive).

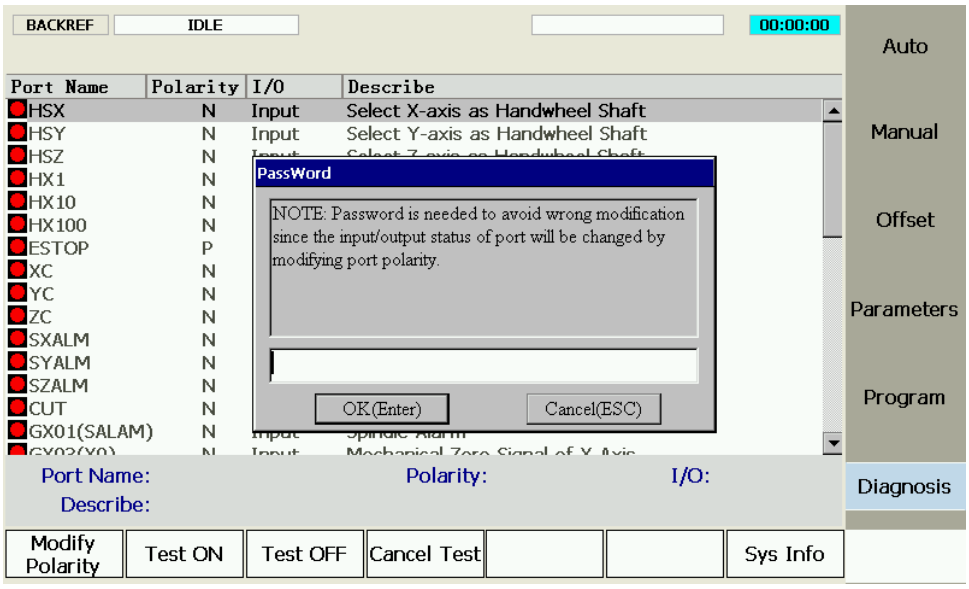


Fig. 3-4 Modify Polarity

- **Test On/Off**

The shortcut keys are F2 and F3 respectively, only available under [Diagnosis] function screen.

Pressing down F2 or F3 will eject a dialog asking to enter the password, as shown in Fig. 3-5.

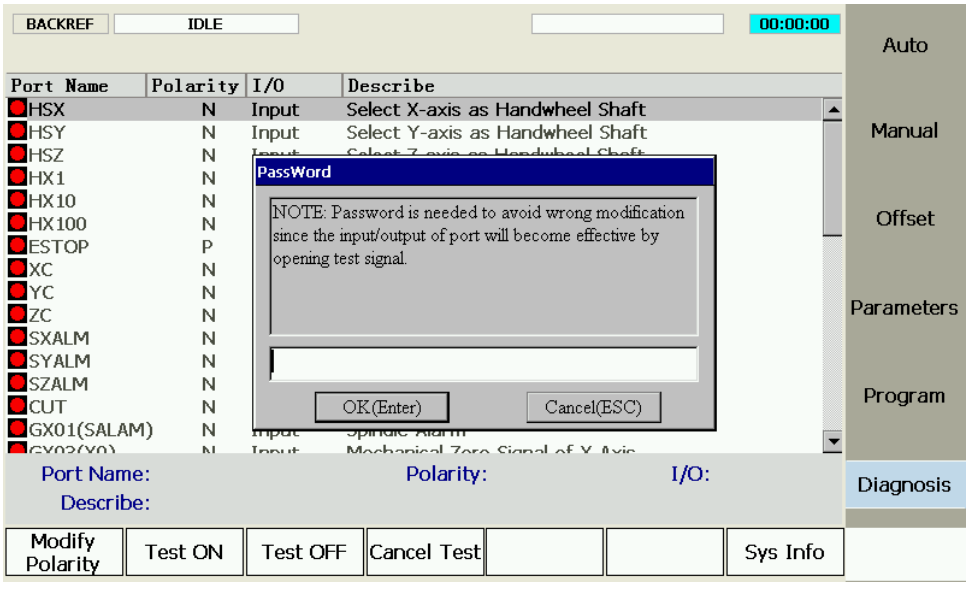


Fig. 3-5 Test On

After the password is correctly entered, the indicator light before the port selected will shift between green and red. And green light means there is signal in the port; red light means there is no signal in the port.

This group of buttons is mainly used for analog hardware signal, which is for simulation test.

CAUTION

The indicator lights before ports are slightly different in test mode and in practice:

Green light in test mode: Red light in test mode:

Green light in practice: Red light in practice:

- **Cancel Test**

The shortcut key is F4, only available under [Diagnosis] function section.

Press F4 to cancel simulation test and signal to replace analog signal with real hardware signal.

3.3 Adjustment of Axial Direction and Pulse Equivalent

3.3.1 Axial Direction Adjustment

Firstly confirm the positive direction of each axis in terms of right-hand rule during the process of machine debugging, i.e. the feed motion direction of cutter is relative to the workpiece which is supposed to be still. The coordinate system of the right-hand rule is shown in Fig. 3-6.

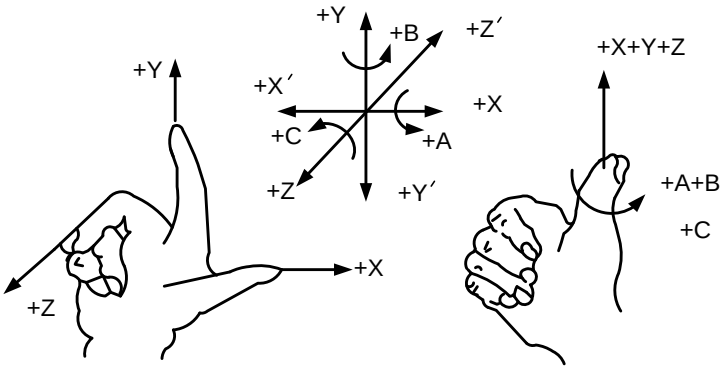


Fig. 3-6 The Coordinate System of the Right Hand Principle

The axial directions of machine are decided by both the type of machine tool and the layout of each component. The basic coordinate axes of engraving machine/ router are X, Y, and Z axis:

- Z-axis is coincidental with spindle axis and the direction of cutter moving away from workpiece is the positive direction of Z-axis (+Z).
- X-axis is perpendicular to Z-axis and parallel to the clamped surface of workpiece. For the single column vertical milling machine, if users face the spindle and look in the column direction, right moving direction is the positive direction of X-axis (+X).
- The positive direction of Y-axis (+Y) is the direction cutter moves away from the operator.

- **Related Parameters**

Parameter	Definition	Setting Range
X-axis output direction	It specifies the motion direction of X axis.	“1”, “-1” represents the two motion directions of X axis.
Y-axis output direction	It specifies the motion direction of Y axis.	“1”, “-1” represents the two

Parameter	Definition	Setting Range
		motion directions of Y axis.
Z-axis output direction	It specifies the motion direction of Z axis.	"1", "-1" represents the two motion directions of Z axis.
Fix the positive direction of each axis following the right-hand rules, and then manually operate the machine to check if the axis moves correctly. If the direction is opposite, please modify the corresponding parameter. Take X-axis as an example, manually move X axis, but X axis moves oppositely; at this time, users can just change the value of parameter "N1017" to "-1", if its value is "1" currently.		

3.3.2 Pulse Equivalent Adjustment

Pulse equivalent (p): the moving distance of workbench or rotation degree of rotary axis corresponding to one pulse sent by CNC device, the minimum available distance controlled by CNC system as well.

The smaller the pulse equivalent is, the higher the machining precision and surface quality will be. The larger, the faster feedrate will be. Therefore, lower pulse equivalent should be set under the condition of meeting the demand of feedrate. The relationship between Max. feedrate and pulse equivalent is as follows:

Max. Feedrate= Pulse Equivalent X 60 X Frequency

For example, the hardware frequency of NK200 is 320 KHz and provided the pulse equivalent is 0.001 mm/p, then:

Max. Feedrate=0.001 X 60 X 320000= 19.2m/min

Mechanical deceleration (m/n): the ratio of reducer input speed to output speed, equal to the ratio of the teeth number of driven wheel to that of driving wheel. When applied in CNC machines, it specifies the ratio of motor speed to screw speed.

$$\text{Mechanical Deceleration Ratio} = \frac{\text{Reducer Input Speed}}{\text{Reducer Output Speed}} = \frac{\text{Teeth No. of Driven Wheel}}{\text{Teeth No. of Driving Wheel}} = \frac{\text{Motor Rotational Speed}}{\text{Screw Roational Speed}}$$

Pitch (d): The axial distance between the corresponding points of two adjacent teeth on the threads.

The calculation of pulse equivalent varies with different motor systems.

- **Stepping Motor**

In general, firstly set the subdivision and then calculate the pulse equivalent. You can set the pulse equivalent before calculating subdivision. Their relationship can be shown as:

$$\frac{d}{p} = \frac{360}{\theta} \times x \times \frac{m}{n}$$

Hereinto, p stands for pulse equivalent, x for subdivision of stepping motor while θ refers to stepping angle. Therefore,

$$\text{Pulse Equivalent} = \frac{\text{Screw Pitch}}{\frac{360}{\text{Stepping Angle}} \times \text{Subdivision} \times \text{Mechanical Deceleration Ratio}}$$

For instance, the selected screw lead of X-axis for a certain type of machine tool is 5mm, and the stepping angle of stepping motor is 1.8 degree, with “10” subdivision and motor directly connected with screw by coupling. Thus, the pulse equivalent of X-axis is:

$$\text{Pulse Equivalent} = \frac{\text{Screw Pitch}}{\frac{360}{\text{Stepping Angle}} \times \text{Subdivision} \times \text{Mechanical Deceleration Ratio}}$$

- **Servo Motor**

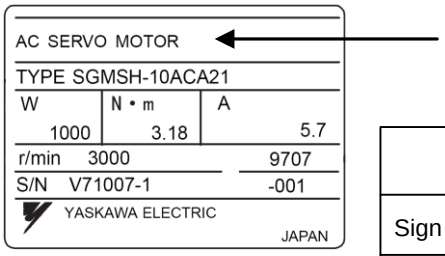
In general, set the default value of pulse equivalent as 0.001mm/p and calculate electronic gear ratio (B/A). Their relationship can be shown as:

$$\text{Electronic Gear Ratio } \frac{B}{A} = \frac{\text{Encoder Resolution}}{\frac{\text{Screw Pitch}}{\text{Pulse Equivalent}}} \times \text{Mechanical Deceleration Ratio}$$

Namely, $\frac{B}{A} = \frac{F \times p}{d} \times \frac{m}{n}$

Electronic gear ratio (B/A): the parameter of servo driver (take YASKAWA driver as an example, B is PN202 while A PN203). This ratio represents servo scales up or down the pulse frequency sent by CNC system. When B is larger than A, it means scaling up and vice versa. For example, provided the pulse frequency sent by CNC system is 100HZ, if the numerator of electronic gear ratio (B) is set as 1 while the denominator 2, the actual running speed of servo is 50HZ. On the contrary, if the numerator is set as 2 while denominator 1, the actual running speed turns to 200HZ.

Encoder Resolution (F): needed pulse number for one circle of servo motor. Please see the servo motor label plate and then refer to the corresponding manual to confirm its encoder resolution. A label plate of YASKAWA SGMSH type motor is as below, and the 4th character in motor type is the serial encoder specification, so the resolution of this motor is 2^{17}, i.e. 131072.



Motor Type：
TYPE SGMSH-1 0 A C A 2 1
(The 4th character)

The 4th character: serial encoder spec.		
Sign	Spec.	Remark
2	17-bit absolute	Standard
C	17-bit increment	Standard

Fig. 3-7 Name Plate of Servo Motor-encoder Resolution

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

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

- **Rotary Axis**

The pulse equivalent of rotary axis refers to the rotation degree of the axis clamping the workpiece corresponding to each pulse. The difference of rotary axis movement from linear axis movement lies in that the screw pitch of rotary axis is 360 degrees. Therefore, in calculating rotary axis pulse equivalent, you just need to replace screw pitch with 360.

➢ For Stepping Motor

$$\text{Pulse Equivalent} = \frac{360}{\frac{360}{\text{Stepping Angle}} \times \text{Subdivision} \times \text{Mechanical Deceleration Ratio}}$$

➢ For Servo Motor

$$\text{Electronic Gear Ratio } \frac{B}{A} = \frac{\text{Encoder Resolution} \times \text{ Pulse Equivalent}}{360} \times \text{Mechanical Deceleration Ratio}$$

- **Related Parameters**

Parameter	Definition	Setting Range
X-axis pulse equivelant	It refers to the displacement or angle generated on the X axis per control pulse.	0.0001~999
Y-axis pulse equivelant	It refers to the displacement or angle generated on the Y axis per control pulse.	0.0001~999
Z-axis pulse equivelant	It refers to the displacement or angle generated on the Z axis per control pulse.	0.0001~999

CAUTION

The setting value of pulse equivalent must be matching with that of the electronic gear ratio of servo driver or that of subdivision of stepping driver.

3.3.3 Upper & Lower Limit Setting of Workbench Range

Workbench range refers to the valid machining range of machine tool along X, Y, and Z directions, and the system will carry out software limit in terms of this range in order to protect the machine.

- **Related Parameters**

Parameter	Definition	Setting Range
Workbench range upper limit(X)	They set the upper limit for the working range of each axis.	0~100000
Workbench range upper limit(Y)		
Workbench range upper limit(Z)		
Workbench range lower limit(X)	They set the lower limit for the working range of each axis.	-100000~100000
Workbench range lower limit(Y)		

Parameter	Definition	Setting Range
Workbench range lower limit(Z)		

CAUTION

In the first setting of the upper & lower limit of workbench stroke, please verify the actual valid range of machine motion in case of accident.

3.4 Returning to Machine Origin

Origin of Machine Coordinate System (inherent coordinate system of machine tool), also called mechanical origin or mechanical zero, is fixed after design, manufacturing and debugging before machine tool leaving factory. After startup of control system, it is necessary to execute the operation of returning to machine origin automatically or manually.

These below functions will be available only after returning to machine origin: software limit enabled, setting the fixed point, and tool change.

3.4.1 Process of Returning to Machine Origin

The processes of returning to machine origin of X, Y, and Z axes are included and identical, shown in Fig. 3-8 (take X-axis as an example).

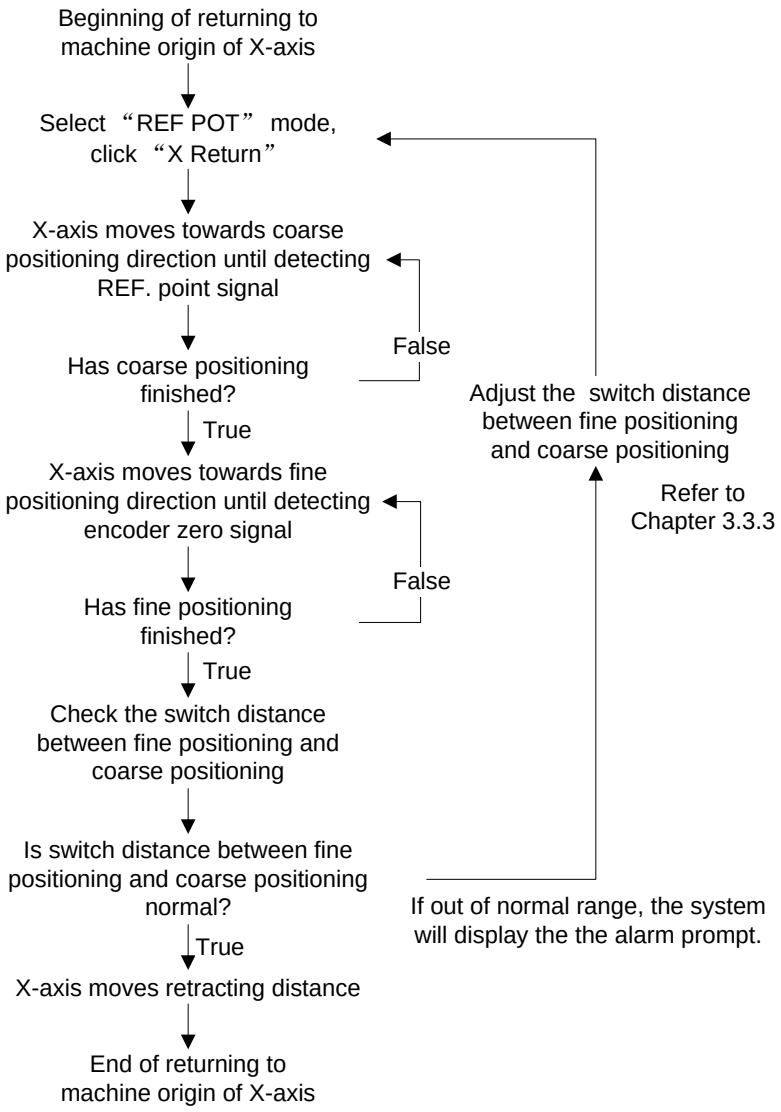


Fig. 3-8 The Process of Returning to Machine Origin (X-axis)

3.4.2 Principle of Returning to Machine Origin

The sketch map of returning to machine origin with servo motor is as below:

- **Coarse Positioning Stage**

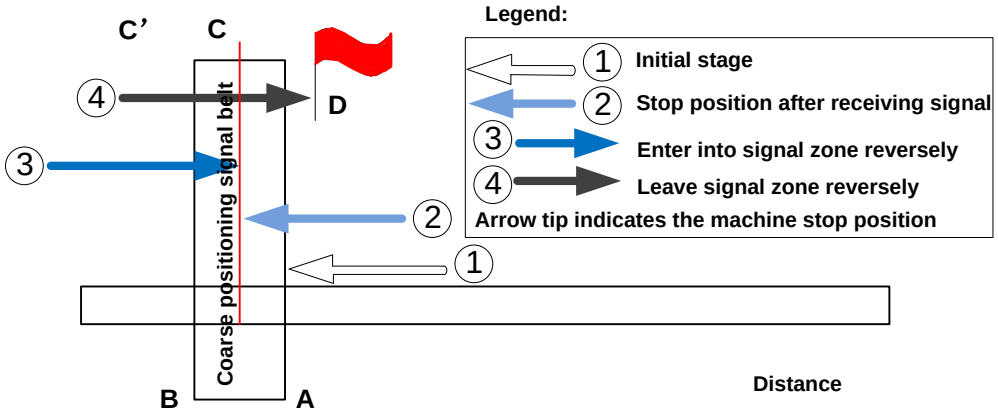


Fig. 3-9 Sketch map of coarse positioning (stopping within the signal belt after receiving coarse positioning signal)

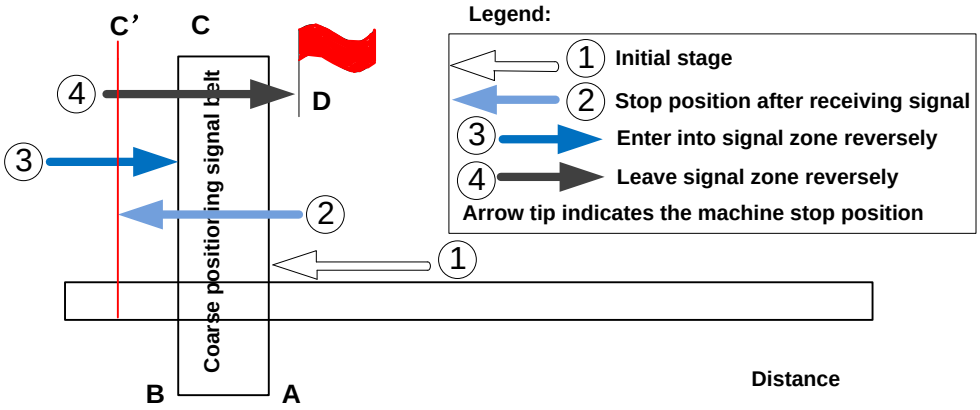


Fig. 3-10 Sketch Map of Coarse Positioning (Stopping out of the signal belt after receiving coarse positioning signal)

1) When the machine keeps moving until receiving origin signal at place A, it should stop immediately , but it may stop at place C or C' due to time lag and inertia.

2) The machine will keep moving reversely at one third of coarse positioning speed until receiving origin signal (if the machine has stayed within the signal belt in the above step 1, it will make no motion in this step).

3) The machine will keep moving reversely at one-ninth of coarse positioning speed until the origin signal disappears (across the signal belt).

4) The machine will halt at the flag place D after the end of this stage.

- **Fine Positioning Stage**

The process of fine positioning stage is identical with that of coarse positioning stage.

After coarse positioning, the machine will move to encoder origin rapidly, executing slow positioning several times.

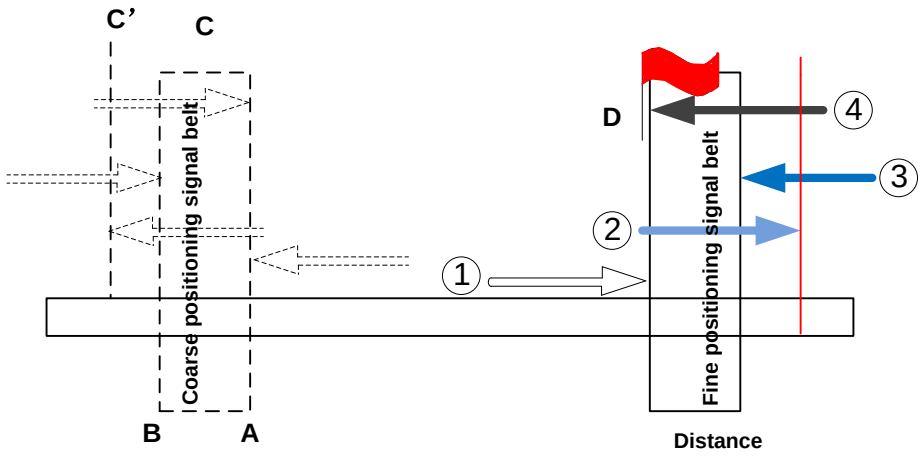


Fig. 3-11 The Process of Fine Positioning

- **Retracting Stage**

After finishing the fine positioning stage, the system will execute retracting motion once with the recommended retract distance as half of the screw pitch. The sketch map is shown in Fig. 3-12.

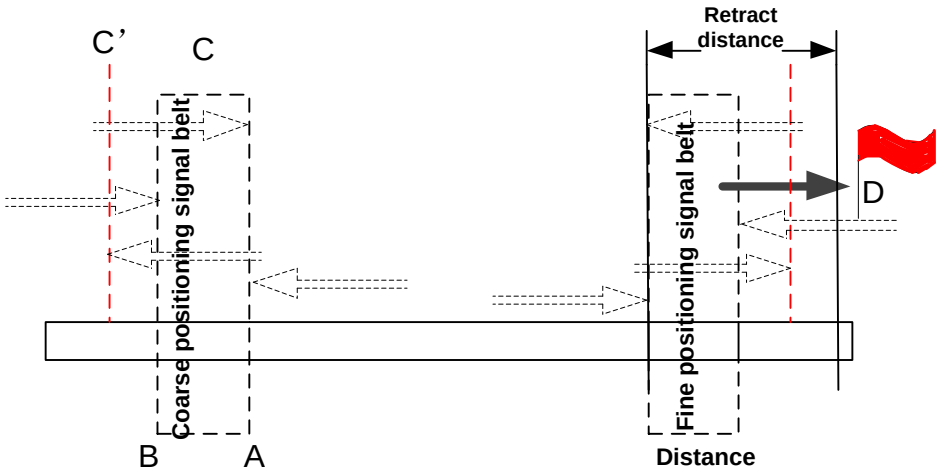


Fig. 3-12 Retracting Stage

3.4.3 Operation Interface of Backing to Machine Origin

The shortcut key for backing to machine origin is F7, only valid in function section Manual.

After F7 is pressed, the manipulation button bar and CNC status bar will change accordingly, and the system will switch to “BACKREF” (back to reference point) state, as shown in Fig. 3-13.

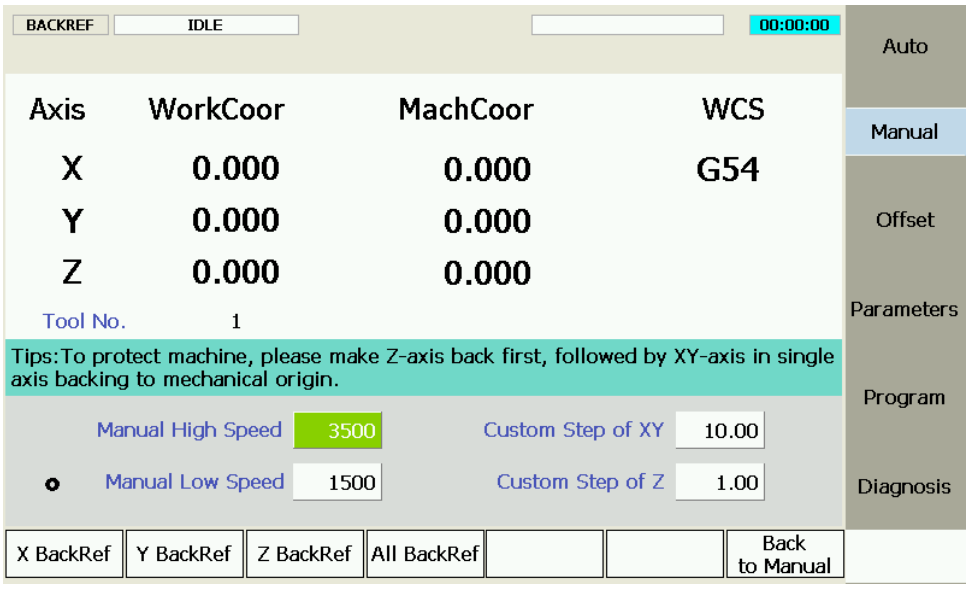


Fig. 3-13 Interface of Backing to Machine Origin

- **[X Back]**

The shortcut key is F1, only available under [Manual] function section.

After F1 is pressed, the system will execute the operation of backing to machine origin for X axis.

After this operation is finished, a mark of will appear before [X] axis indicating the finish of backing to machine origin.

- **[Y Back]**

The shortcut key is F2, only available under [Manual] function section.

After F2 is pressed, the system will execute the operation of backing to machine origin for Y axis.

After this operation is finished, a mark of will appear before [Y] axis indicating the finish of backing to machine origin.

- **[Z Back]**

The shortcut key is F3, only available under [Manual] function section.

After F3 is pressed, the system will execute the operation of backing to machine origin for Z axis.

After this operation is finished, a mark of will appear before [Z] axis indicating the finish of backing to machine origin.

- **[All Back]**

The shortcut key is F4, only available under [Manual] function section.

Similar to the above situations, after F4 is pressed, the system will execute the operation of backing to machine origin for all the three axes.

After this operation is finished, a mark of will appear before [X], [Y] and [Z] axis indicating the finish of backing to machine origin.

- **[Back to Manual]**

The shortcut key is F7, only available under [Manual] function section.

After F7 is pressed, the manipulation button bar will return to the previous one.

3.4.4 Parameters Specifications

- **Related Parameters of Safe Operations:**

Parameter	Definition	Setting Range
Back to refer before machining	Whether backing to machine origin before machining is a must or not.	True: Forced False: Not forced
Backing to the reference point mark whether cancelled after E-stop	Whether the mark of backing to the machine origin will be cleared or not once E-stop occurs.	True: Cleared False: Not cleared
Returning to the machine origin before machining can prevent machining offset, ensuring position precision. It is recommended to set “True” for parameter “Backing to the reference point mark whether cancelled after E-stop” so that once E-stop occurs, the mark will be cleared, and the system will remind users to back to machine origin. If parameter “Back to refer before machining” is set “True” and there is no mark “⊕” before each axis, the machine is not allowed to move until backing to machine origin is finished. And it can be set “False” when returning to machine origin is impossible due to origin switch error.		

- **Related Parameters in the Process of Backing to Machine Origin**

Parameter	Definition	Setting Range
X direction in back to refer	It sets the direction of X axis in coarse positioning stage of backing to machine origin.	-1;1
Y direction in back to refer	It sets the direction of Y axis in coarse positioning stage of backing to machine origin.	-1;1
Z direction in back to refer	It sets the direction of Z axis in coarse positioning stage of backing to machine origin.	-1;1
Retract distance of X-axis	It sets retract distance of X axis after fine positioning of backing to the machine origin.	-
Retract distance of Y-axis	It sets retract distance of Y axis after fine positioning of backing to the machine origin.	-
Retract distance of Z-axis	It sets retract distance of Z axis after fine positioning of backing to the machine origin.	-
X speed in back to refer	It is the speed of X axis at the stage of coarse positioning.	0.001~15000 mm/min
Y speed in back to refer	It is the speed of Y axis at the stage of coarse positioning.	0.001~15000 mm/min
Z speed in back to refer	It is the speed of Z axis at the stage of coarse positioning.	0.001~15000 mm/min

Parameter	Definition	Setting Range
X speed in exact positioning	It is the speed of X axis at the stage of fine positioning.	0.001~15000 mm/min
Y speed in exact positioning	It is the speed of Y axis at the stage of fine positioning.	0.001~15000 mm/min
Z speed in exact positioning	It is the speed of Z axis at the stage of fine positioning.	0.001~15000 mm/min
In order to establish a machine coordinate system correctly during machine working period, a machine reference point (measuring beginning) will be set within the moving range of each coordinate axis. In machine start-up, generally returning to the reference point will be executed automatically or manually, i.e. machine tool will return to its measuring beginning (X, Y, Z=0) to establish the machine coordinate system. Machine reference point can be coincident with the machine origin (in the default system setting), or not. When origin switch works normally, if spindle moves away from origin switch direction in the process of returning to the machine origin, the value of parameter “X/Y/Z direction in back to refer” (coarse positioning direction) should be modified, please refer to question 2 in section 3.4.5 when the moving direction of machine is incorrect during backing to the machine origin. The setting value of parameters parameter “X/Y/Z direction in back to refer” is opposite to the direction of fine positioning. If the speed of returning to the machine origin is quite slow, you can adjust values of parameter “X/Y/Z speed in back to refer” (coarse positioning speed) properly. “Trace back” (retract) refers to a certain distance away from origin to leave the signal sensitive zone of origin switch after backing to machine origin ends.		

- **Related Parameters of Positioning Switch Distance**

Parameters	Definition	Setting Range
X-axis screw pitch	It is used to analyze the switch distance of coarse positioning and fine positioning in homing.	0.001~9999.9 mm
Y-axis screw pitch		
Z-axis screw pitch		
Since screw pitch is related with the machine specification, users need to measure it before setting the parameters in actual operation.		

3.4.5 FAQ & Troubleshooting

1) Origin signal can not be detected in the process of returning to machine origin.

It is generally caused by origin switch. The debugging & adjusting steps are shown in Fig. 3-14.

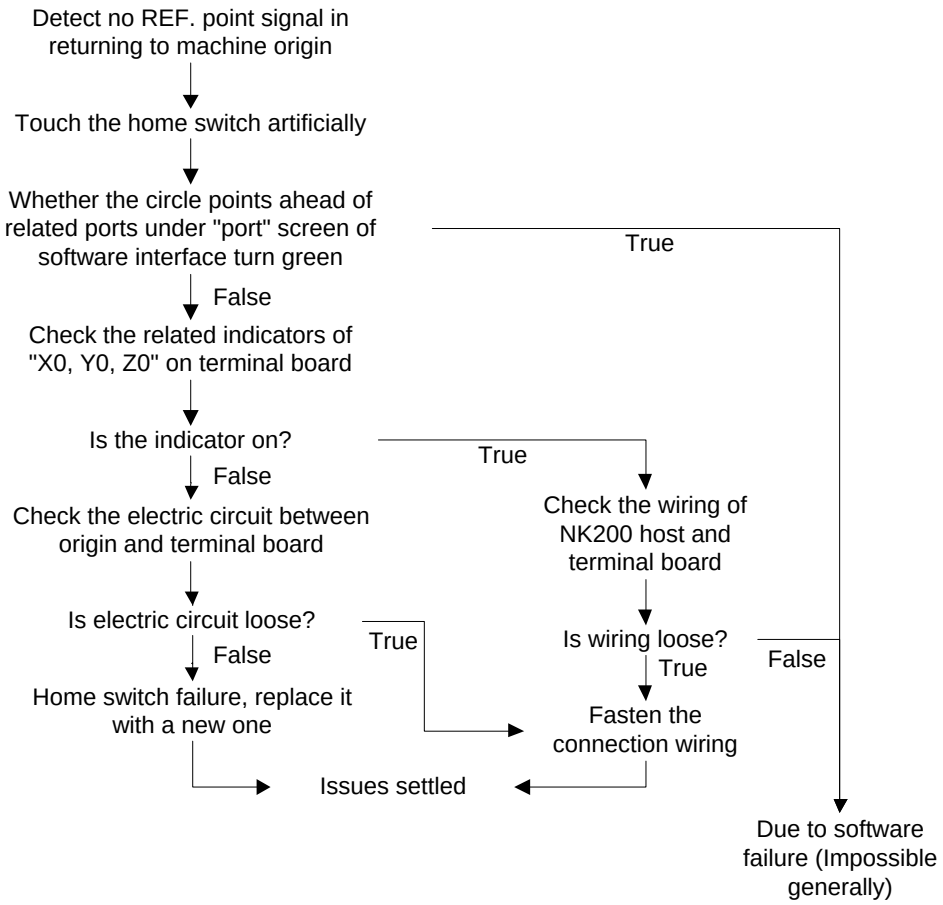


Fig. 3-14 Debugging Steps

2) Incorrect motion direction of machine in returning to machine origin may be caused by the following reasons:

- Incorrect polarity of origin signal: when the origin switch is normally open, the polarity is “NO”; when the origin switch is normally closed, the polarity should be “NC”.
- Incorrect parameter settings: please check the parameters “X/Y/Z direction in back to refer” and modify the corresponding parameters.

3) Low coarse positioning speed in returning to machine origin may be caused by the below reasons:

- The setting value of parameter “X/Y/Z speed in back to refer” is too small.
- The polarity setting of origin signal in software is mismatching with the origin switch type. If the NC-type origin switch is adopted and the polarity of origin signal is NO, the origin signal is valid at the beginning of backing to machine origin, so the machine will slowly move away from origin at the speed of fine positioning.

3.5 Spindle Parameters Adjustment

3.5.1 Spindle Speed Setting

Users can directly set spindle speed on the system interface.

In auto mode, press SF1 to enter [Auto] function section, as shown in Fig. 3-15.

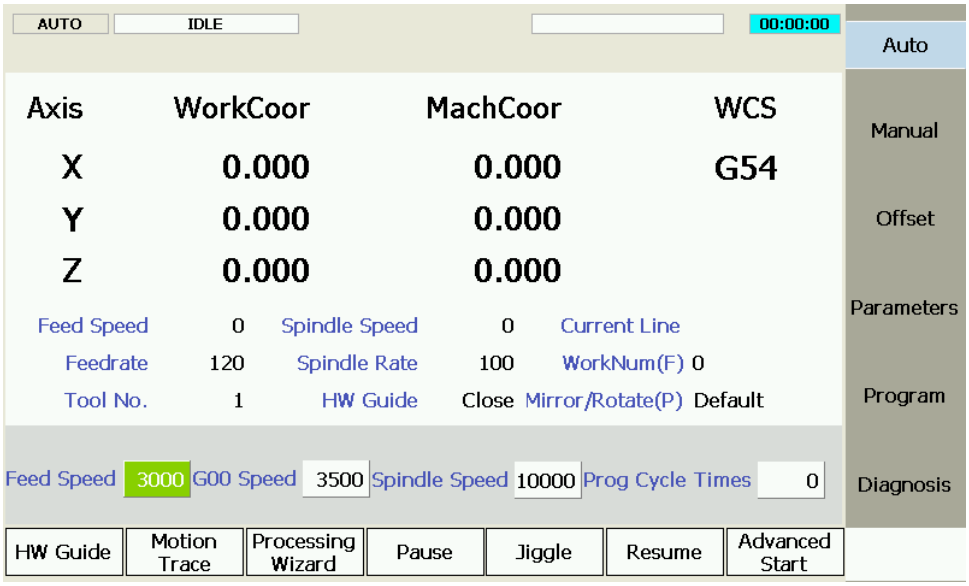


Fig. 3-15 Auto Function Section

Users can directly set the spindle speed in the parameters setting region above the manipulation button bar, shown in Fig. 3-16. When the parameter “Use default spindle speed” is set as “True”, spindle speed will adopt the value set in the system during auto processing, i.e. the value of “Spindle speed”; when set as “False”, spindle speed will adopt the value specified in the processing program.

Fig. 3-16 Parameters Setting Region-spindle Speed Setting

Press “→” “←” shift key to move to the corresponding parameter setting box, and then press Enter key to input the value into the pop-up parameter input box.

Spindle speed is controlled by adjusting current spindle override. The formula is as below:

$$\text{Current Spindle Speed} = \text{Spindle Speed} \times \text{Current Spindle Override}$$

Spindle override selection button is on the operation panel, shown in Fig. 3-17.

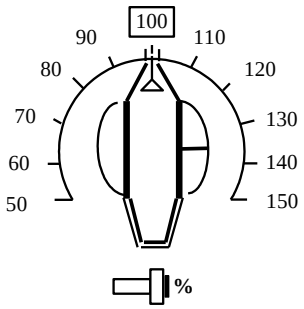


Fig. 3-17 Spindle Override Selection Switch

The least unit of ruler of spindle override is 10% (10% for each scale), and the setting range of spindle override is “50% ~ 150%”.

3.5.2 Parameter Specification

- **Related Parameters**

Parameter	Definition	Setting Range
Max spindle speed	The max. allowable rotation speed of spindle (matched with the setting value of converter)	0~60000 r/min
CenterSpindlerev	It specifies the spindle speed if spindle is enabled in centering. The value should be consistent with inverter setting.	0~24000 r/min
The value of ”Spindle speed” must be less than that of parameter “Max spindle speed”; the max. setting value of rotary speed of N1054 is corresponding to analog SVC 10V; when the converter reaches the max. voltage 10V, the corresponding rotary speed of converter is the value of parameter “Max spindle speed”. $\text{Real-time Voltage of Analog SVC} = \frac{\text{Spindle Setting Speed}}{\text{Max. Spindle Speed}} \times 10\text{V} \times \text{Spindle Override}$		

- **Related Parameters**

Parameter	Definition	Setting Range
Stop spindle while pausing	Whether to stop spindle automatically when machining pauses	True: Stop False: Not stop
Stop spindle while stopping	Whether to stop spindle automatically when machining finishes	True: Stop False: Not stop
Is open coolant while starting	Whether to open coolant at start	True: Open False: Not open
Is close coolant while stopping	Whether to close coolant at end	True: Close False: Not close
Spindle start/stop time	It is used to set the delay time for waiting spindle speed reaching the maximum value or zero.	0~60000 ms
Parameter “Spindle start/stop time “ sets the delay time of spindle on/ off, because a certain time is needed before spindle reaches the rated rotary speed since start-up or stops until reaching zero		

Parameter	Definition	Setting Range
speed; if machining begins before machine reaching the rated rotary speed or other operation is executed before spindle completely stops, it's possible to damage the tool or produce a scrap.		

3.6 Adjustment of Velocity & Acceleration

3.6.1 Feedrate Setting

Feedrate can be set directly on the system interface.

In the SF1 [Auto] function section, the feed rate can be directly specified on the parameters setting region above the manipulation button bar, shown in Fig. 3-18. When the parameter "Use default speed" is set as "True", the feedrate will adopt the value set in the system during file machining, i.e. the value of "Feed speed"; when set as "False", the feedrate will adopt the value specified in the programming file.

Fig. 3-18 Parameters Setting Section-feed Speed Setting

The feed rate is also related with current feedrate override, which can be controlled by adjusting the current feedrate override, and the formula is as below:

Current feed rate (feed speed) = Rated feed value X Current feedrate override

The feedrate override selection button is on the operation panel, shown in Fig. 3-19.

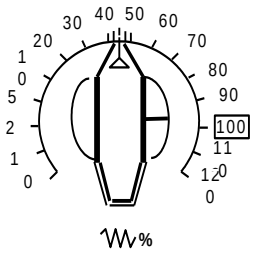


Fig. 3-19 Feedrate Override Selection Button

The adjusting range of feedrate override is "0% ~ 120%".

3.6.2 Traverse Speed Setting

Traverse speed refers to the running speed of machine tool under G00 command.

Similar to feed speed, traverse speed can also be set directly on the system interface, as shown in Fig. 3-20. When "Use default speed" is set as "True", the running speed of machine tool under G00 code is fixed by the value set in "Dry run speed"; when set as "False", the running speed of machine tool under G00 code is not fixed: if G00 speed is set in the processing file, this value will be adopted by the system for running; if not, the value of "Dry run speed" will be adopted.

Fig. 3-20 Parameters Setting Area-G00 Speed Setting

Its concrete setting method is the same as that of feed speed, which will be omitted.

3.6.3 Parameters Specification

Except the feed rate and traverse speed, the other involved parameters can be divided into following 4 types: velocity, acceleration, reference circle & circular speed limit, interpolation algorithm.

- **Related Parameters (Velocity)**

Parameter	Definition	Setting Range
Manual high speed	There are two modes for option under manual mode: low speed and high speed, which can be switched by pressing acceleration key. The system default running speed mode is manual low speed	Manual low speed ~max. speed of axes
Manual low speed		0.001~Manual high speed
Dry running speed	The speed of machine tool in dry running	0.001~Max. Speed of machine tool
Machining speed	Gxx speed	0.0~Dry running speed
Startup speed	The max. achievable speed of stepping motor in startup without acceleration	0.001~Dry running speed
Max machining speed	The maximum feeding speed when machining	3000~15000 mm/min
Full feedrate for G00	When it is set as “True”, G00 override will be not controlled by the override switch	True: Not controlled False: Controlled
Feedrate is valid for manual mode	Feedrate override is valid under stepping and jog modes	True: Valid False: Invalid
Use default speed	It specifies whether to adopt the default G00 speed and Gxx speed, ignoring the file speed	True: Use False: Not use
Use default spindle speed	It specifies whether to adopt the default spindle speed, ignoring S commands in the file	True: Use False: Not use
Z down speed	It sets the plunge rate under G01	0~100000
Use Z down speed	Whether to use Z down speed under G01 plunge cut	True: Use False: Not use
Max Z-axis speed	It specifies the max. allowable speed of Z axis	0.001~100000 mm/min
Plunge speed option	The options of Z down speed	0:not disposed; 1:direct-Z-motion only; 2:general Z-down motion
Z deceleration distance	It is the distance from where the machine tool begins to decelerate to the target position during positioning	0~999 mm

Parameter	Definition	Setting Range
Z approach speed	Feed speed of cutter when spproachining the workpiece during the positioning	0~3000 mm/min
Max. X-axis speed	It is the maximum speed X-axis can achieve.	6~15000 mm/min
Max. Y-axis speed	It is the maximum speed Y-axis can achieve.	6~15000 mm/min
Max. Z-axis speed	It is the maximum speed Z-axis can achieve.	300~6000000 mm/min
Parameter “Startup speed” aims at the startup frequency of stepping & servo driver, and in servo driver this parameter should be set zero. The startup speed refers to the highest frequency of direct working startup without acceleration of motor. Reasonable selection of this parameter will improve the machining efficiency, and avoid the low speed segment with bad motion feature of motor. “Startup frequency” is generally included in the motor ex-factory parameters, but after installation, its value will vary especially in loading motion, thus, it should be set based on the actual measurement of motor power and inertia of machine tool. Parameter confirmation method: set a lower value at first, and repeatedly make the machine execute typical motions & multi-axis synchronization motion, gradually increase this value until reaching the max. startup speed. The actual setting value of this parameter is half of the max. startup speed, with general setting range “300 ~ 400”.		

- **Related Parameters (Acceleration)**

Parameter	Definition	Setting Range
Single axis acc	Description of the acceleration/ deceleration capability of a single feed axis, with unit “mm/s^2”	0.001 ~100000 mm/s^2
Acceleration of the handwheel	It specifies the acceleration of feeding axes when handwheel is used.	0~100000
“Single axis acceleration” is used to describe the acceleration/ deceleration capability of each feed axis, with unit “mm/s2”, depending on the physical feature of machine, such as the quality of motion part, torque, cutting load and resistance of the feed motor. The larger the value of the parameter is, the less time the machine will spend in acceleration/ deceleration during motion process, the higher the efficiency is. Generally, for servo motor system, it should be within “600 ~ 3500”. Set a smaller value at first, and then repeatedly execute typical motions for a period of time. If there is no abnormal situation, gradually increase the value. If abnormal condition occurs, reduce the value, with “50% ~ 100%” insurance allowance.		

- **Related Parameters(Reference Circle, Circular Speed Limit)**

Parameter	Definition	Setting Range
Reference circular speed	Whether to enable the reference circular speed	True: Enable False: Not enable
Reference circle speed	Reference circle is the reference in processing circular workpiece. The max. speed of reference circle refers to the max. allowable speed of machine in processing this circle without strong vibration	-
Limit max velocity for small lines	It is used for limiting frequency of acceleration and deceleration in order to guard against the oscillation	True: Valid False: Invalid

Parameter	Definition	Setting Range
	caused by frequent acceleration and deceleration of small segments	
Length for limit max velocity	It is used to tell whether the segment to be processed belongs to “small line”	0.001~100000 mm
Path smoothing time	Process path will shrink when slide time is too big	0~2 sec
Arc radius tolerance	-	0~999 mm
Enable IJK increment mode	If it is set as “True”, the coordinate of circle center is relative to the start point; otherwise, the coordinate of circle center is relative to workpiece origin.	True: Valid False: Invalid

After installation of machine, users can make the machine process an arc, in which vibration will occur due to centrifugal force. The higher the speed is, the stronger the vibration will be. Gradually increase the feed speed to see the state of vibration of machine tool until the max. circular speed is achieved, i.e. the max. allowable speed of machine tool without strong vibration. This arc is regarded as the reference circle, and its max. allowable speed is the max. speed of reference circle. Max. centripetal acceleration “a” can be calculated in terms of the reference circle radius and its max. speed. The formula is as follows: V_0 and R_0 are the speed and radius of reference circle respectively, while Vx and Rx are the speed and radius of the arc to be processed. After Rx is confirmed, when the arc processing speed is larger than Vx calculated, the system will limit the arc processing speed automatically to ensure it is within the debugging value, i.e. the vibration will not be stronger than that during ex-factory debugging.

$$a = \frac{V_0^2}{R_0} = \frac{V_x^2}{R_x}$$

In processing a circle with a small radius, even quite low feed speed of circle will generate very high centripetal acceleration, thus the machining speed will be quite low caused by circle speed limit to limit the centripetal acceleration. To ensure machining efficiency, when the speed calculated by the system is lower than the setting value of parameter “Reference circle speed”, which will be regarded as the machining speed.

- **Related Parameters(Interpolation Algorithm)**

Parameter	Definition	Setting Range
Max. angle of joining high speed	The maximum connection angle. If the angle od adjacent two lines is greater than this, the initial velocity of the next line is always set as start-up velocity	0~180 deg
Corner trace pretreatment options	-	0: Not disposed; 1: Curve smooth 2: Arc smooth
Corner tolerance	The corner trace pretreatment precisition	0~0.5
Connect speed	The distance used to calculate the connection	0~0.05 mm

Parameter	Definition	Setting Range
look ahead distance	angel and then decide the speed planning	
Predicted segment No.	The predicted segment number in calculating connetion speed	1~100
Whether to use type S algorithm	Whether to use S-type algorithm for interpolation.	True: Use S-type algorithm False: Not use
The parameter decides whether to use S-type algorithm. When type S algorithm is adopted, the max. acceleration of system will reach the twice of the single axis acceleration set in the system, so setting a smaller value for parameter “Single axis acc” is recommended.		

3.7 Tool Presetting

The process of tool presetting refers to the process of establishing the concrete position of workpiece coordinate system (WCS) in machine coordinate system (MCS).

With the help of tool sensor (also called tool presetter or calibrator), tool presetting is realized. As shown in Fig. 3-21, there are ports on the terminal board corresponding to CUT and COM on the tool sensor. If necessary, such ports as “Over-travel Protection” can be added to the terminal board according to customers’ needs. According to the different installation positions of tool sensor, tool presetting is divided into floating presetting and fixed presetting.

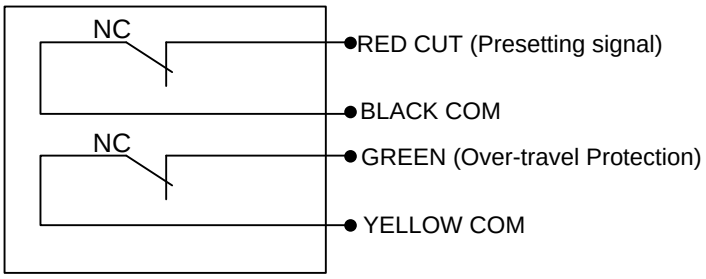


Fig. 3-21 Electrical Wiring Diagram of Tool Sensor

Fig. 3-22 is the sketch map for the using of tool sensor.

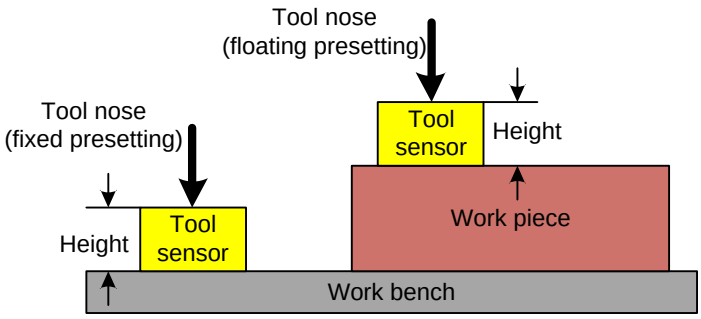


Fig. 3-22 Sketch Map of Using Tool Sensor

3.7.1 Software Interface

In Manual mode, press F6 to enter tool presetting interface, as shown in Fig. 3-23:

Fig. 3-23 Sub-screen of Tool Presetting

According to actual situation and needs, the adopted tool presetting method varies, with different operations. See more as below.

3.7.2 Floating Presetting

Floating presetting is to execute tool presetting under current position with the thickness of its tool sensor decided by the parameter " Cali block thickness". It can be used to set the workpiece origin of Z-axis. The system will automatically set the workpiece offset after floating presetting.

Workpiece offset= machine coordinate- thickness of tool presetter- public offset- tool offset

Generally, the default setting values of public offset and tool offset are both "0".

The sketch map of the process of floating presetting is shown in Fig. 3-24.

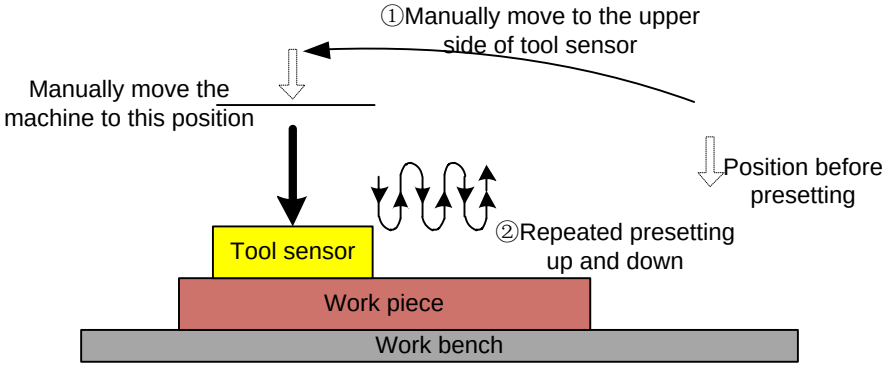


Fig. 3-24 The Process of Floating Presetting

- **Related Parameters**

Parameter	Definition	Setting Range
Cali block thickness	Height difference from the top surface of tool sensor to its bottom surface	0~100

The measurement method of this parameter is:

- Manually move the Z-axis to the certain point on workpiece surface→ shift down its tool nose until reaching the surface of workpiece→ the system will record the current coordinate Z1 of Z-axis.
- Uplift Z-axis→ put the tool sensor on workpiece surface→ shift down Z-axis slowly until reaching the tool sensor and getting the calibration signal→ the system will record the current coordinate Z2 of Z-axis
- Z2 subtracts Z1, and its result equals to the thickness of tool sensor. Enter the result into the parameter “Cali block thickness.”

3.7.3 Measure Tool Length/ Set Tool Length

The process of measuring tool length is similar to that of floating tool presetting, which calls floating presetting sub-programs however. The difference between the two lies in that when measuring tool length finishes the result is saved in the tool offset instead of workpiece offset. Users can press F7 under Parameter section to check the tool offset result when complete the measurement.

In machining, because of tool change caused by tool break or other reasons , the length and clamped position of tools must be different. Users need to execute tool length measurement to confirm tool offset again. This tool presetting method is often used in multi-tool mode.

In presetting, record the machine coordinate of tool nose contacting the tool sensor surface, and then minus the “floating tool sensor thickness” and set the calculated value into the tool offset.

Tool Offset=Machine Coordinate - Floating Tool Sensroe Thickness

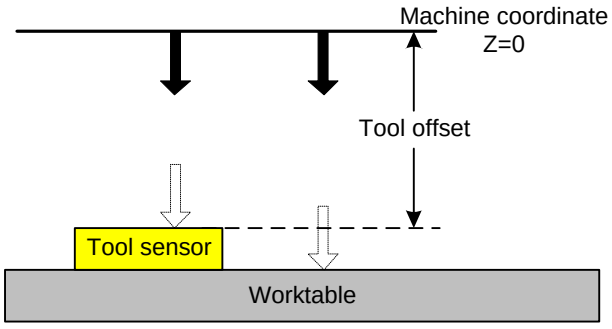


Fig. 3-25 Tool Offset Sketch Map

The steps of measuring tool length:

1) Select the tool according to its tool number;
2) Measure the tool length of the selected tool and record tool offset;

3) Repeat the above operation to each tool.

- **Related parameter**

Parameter	Definition	Setting Range
Cali Block Thickness	It specifies the height between tool sensor and work table.	0~100 mm

When there is no tool sensor, please move the tool manually to the workpiece surface and press F4 under [Tool Cali] interface, the current Z-axis machine coordinate recorded in tool offset directly. After that, users can check the set tool offset in [Tool View Table] under [Parameter] function section, shown as below:

Number	Diameter	Dia_Wear	Length	Len_Wear	X Offset	Y Offset	Z Offset
ToolNO1	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ToolNO2	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ToolNO3	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ToolNO4	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ToolNO5	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ToolNO6	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ToolNO7	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ToolNO8	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ToolNO9	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ToolNO10	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Fig. 3-26 Tool View Table

3.7.4 First Presetting/ Second Presetting

The operation steps are as below:

- Firstly, manually move Z axis to workpiece surface, and then confirm the workpiece origin by floating presetting or manual clear (the method for manual clear: press F1 [Clear], and then press F3 [Z Clear] in the new pop-up manipulation button bar).
- Secondly, press F6 [Tool Cali], and then press F1 [First Calli] to execute the first calibration in the new pop-up manipulation button bar, and then the system will record the current workpiece coordinate value of Z axis automatically, as shown in Fig. 3-27. The system ends this process automatically.

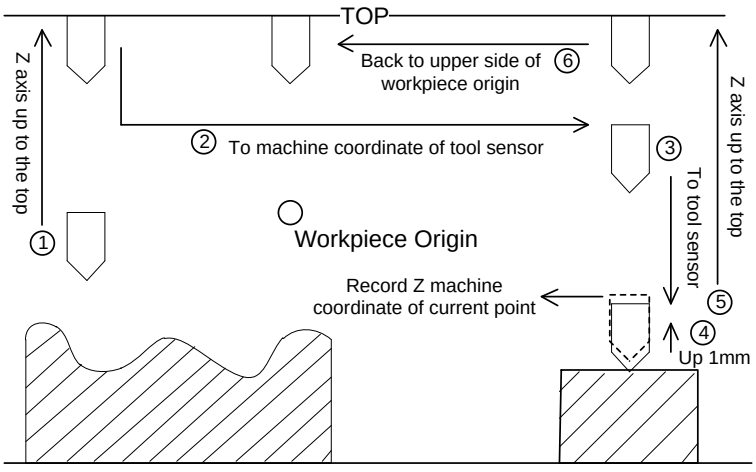


Fig. 3-27 First Presetting

- The first presetting finishes, and workpiece machining begins.
- After tool change or tool break, press F6 [Tool Cali], and then press F2 [Second Cali] in the new pop-up manipulation button bar to restore the Z workpiece coordinate value of current point, as shown in Fig. 3-28. The system ends this process automatically.

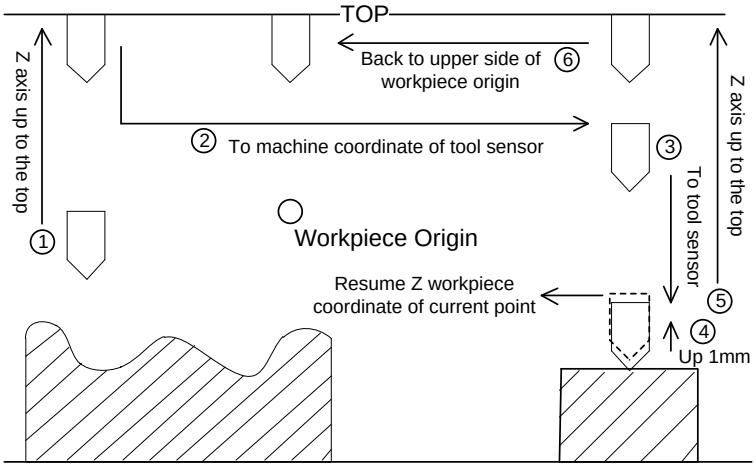


Fig. 3-28 Second Presetting

- Tool presetting ends, and workpiece machining begins.

3.8 Offset Setting

3.8.1 WCS (Workpiece Coordinate System)

In programming, programmers select one certain given point on workpiece as origin (also called programming origin) to establish a new coordinate system (i.e. workpiece coordinate system), also a set of right-hand coordinate system. The origin of WCS, i.e. workpiece origin, is fixed relative to a certain point on workpiece and floating relative to the machine origin. The selection of origin of WCS should meet the conditions of simple programming, simple dimensional conversion, and small caused machining error.

The corresponding coordinate systems of workpiece offset are G55, G56, G57, G58, G59 and G54 (the default coordinate system after the system is opened). Besides, the system also supports extended coordinate system ranging from G154 to G173. And the relationship of workpiece offset and mechanical coordinate system is shown in Fig. 3-29.

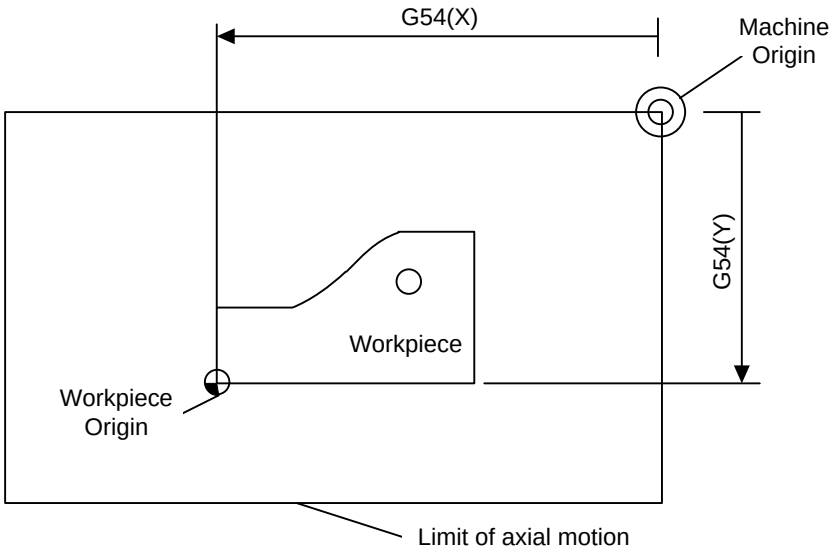


Fig. 3-29 The Relationship of Workpiece Offset and Mechanical Coordinate System

One, two or multi-workpiece offset can be used in machining program. As shown in Fig. 3-30, three workpieces are installed on the workbench, and each workpiece holds a workpiece origin relative to G code of WCS. The programming example is as follows: drill one hole on each of the three workpieces, with calculation depth as Z-0.14.

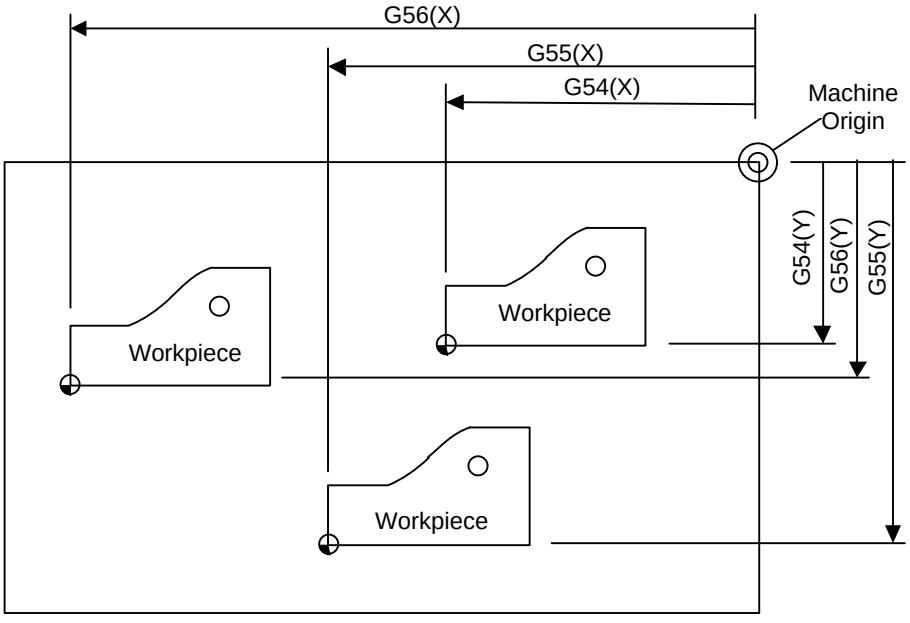


Fig. 3-30 Sketch Map

```
O1801
N1 G20
N2 G17 G40 G80
```

```
N3 G90 G54 G00 X5.5 Y3.1 S1000 M03        (Select G54)
N4 G43 Z0.1 H01 M08
N5 G99 G82 R0.1 Z-0.14 P100 F8.0
N6 G55 X5.5 Y3.1                          (Switch to G55)
N7 G56 X5.5 Y3.1                          (Switch to G56)
N8 G80 Z1.0 M09
N9 G91 G54 G28 Z0 M05                     (Switch to G54)
N10 M01
…
```

The program segment N3 ~ N5, within WCS of G54, is related to the first workpiece; Segment N6 will drill the hole on the second workpiece of the same batch in WCS of G55, while segment N7 will drill the hole on the third workpiece of the same batch in WCS of G56.

On account of all the coordinate systems, public offset is used for adjusting the workpiece origin of X-, Y-, and Z-axis, but will not change the offset value of “G54 ~G59”.

The related formula of workpiece offset, tool offset and public offset is as below:

Workpiece coordinate= Machine coordinate – Workpiece offset - Tool offset – Public offset

3.8.2 Extended Coordinate System

As mentioned before, NK200 supports 20 groups of extended coordinate system, including G154~G173, all of which are extended from G54. Under [Offset] function section, pressing ⇦ and ⇨ can switch the coordinate system views, as shown below:

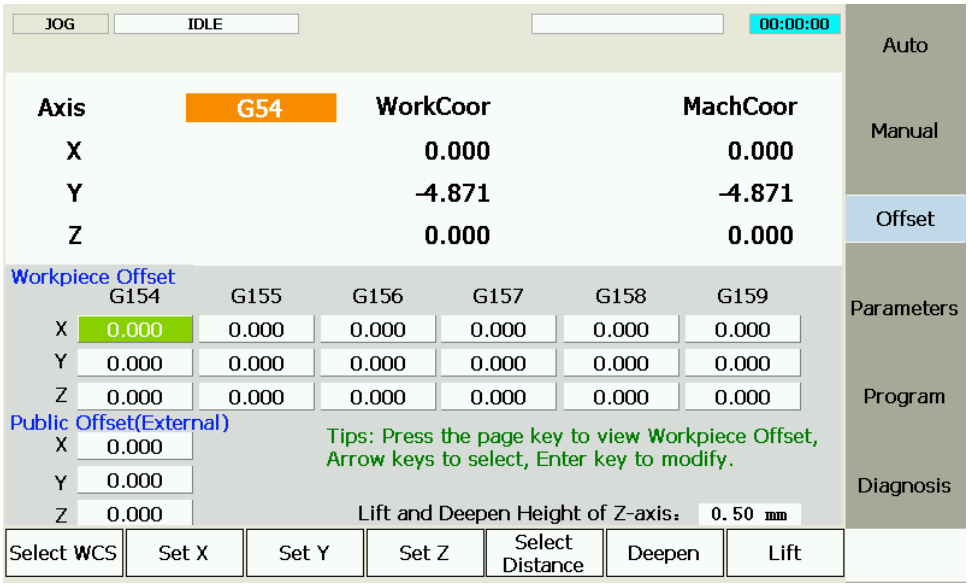


Fig. 3-31 Extended Coordinate System

G54 Px command can be used to specify the extended coordinate for current workpiece. See detailed instruction as follows:

G54 P0	Use extended coordinate system1	Select extended coordinate systemG154
G54 P1	Use extended coordinate system 2	Select extended coordinate systemG155
G54 P2	Use extended coordinate system 3	Select extended coordinate systemG156
G54 Px	Use extended coordinate system(x+1)	Select extended coordinate system(154+x)
G54 P19	Use extended coordinate system 20	Select extended coordinate systemG173

3.8.3 Software Interface

Press SF3 to enter [Offset] function section, as shown in Fig. 3-32. In this interface, users can see the workpiece coordinate currently edited, the corresponding workpiece offset and public offset.

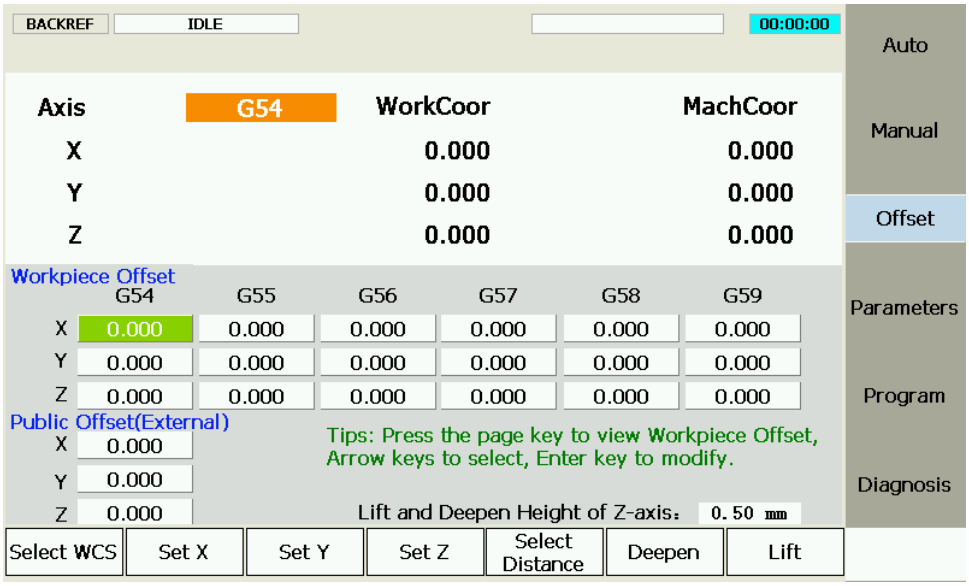


Fig. 3-32 [Offset] Function Section

Press shift key "↑" or "↓" to move to workpiece offset or public offset, and then press [Enter] key to modify; for the modification of Z-axis public offset, the more convenient way is to press [Deepen] or [Raise] button.

As for the manipulation buttons under this function section, they will be introduced in the following part.

- **[Select WCS]**

Press F1 "Select WCS" to select the desired workpiece coordinate system. Each time pressing F1 will select a WCS for G54 to G59 in the sequence of end-around ascending.

- **[Set_X], [Set_Y] and [Set_Z]**

After one of their shortcuts F2, F3 and F4 is pressed, the workpiece offset of workpiece coordinate of the corresponding axis (X/Y/Z) in the current WCS will be set as the value of current mechanical coordinate, while the corresponding YZ/XZ/XY will stay the same.

- **[Select Distance]**

The shortcut key is F5, only valid under [Offset] function section.

After F5 is pressed, the value of "Axis Z Deepening and Raising Distance" will be modified with 5 options: 0.01mm, 0.10mm, 0.50mm, 1.00mm, and 5.00mm.

- **[Deepen]**

After F6 is pressed, the workpiece origin of Z axis will move downward a specified distance, which is the value of “Axis Z Deepening and Raising Distance” specified by F5, in the workpiece coordinate system selected by F1. If F6 is pressed several times successively, the moving distance will be the accumulated value.

- **[Lift]**

After F7 is pressed, the workpiece origin of Z axis will move upward a specified distance, which is the value of “Axis Z Deepening and Raising Distance” specified by F5, in the workpiece coordinate system selected by F1. If F7 is pressed several times successively, the moving distance will be the accumulated value.

[Deepen] and [Raise] only modify the value of public offset.

3.9 Centering

NK200 provides two methods for manual centering, including line centering and circle centering. An edge finder can be used for accurate centering.

Before manual centering, users should press [Center Start] to make it turn to green and turn on spindle, spindle speed decided by the parameter “CenterSpindlerev”, whose value is 500 by default and should not be set too large.

3.9.1 Line Centering

Centering, i.e. two-point centering, refers to the process of locating the midpoint of a line connected by two points, mainly used for locating the center of a blank.

Under [Manual] function section, press F6 to enter [Tool Cali] screen and then press F6 to enter centering interface. See below:

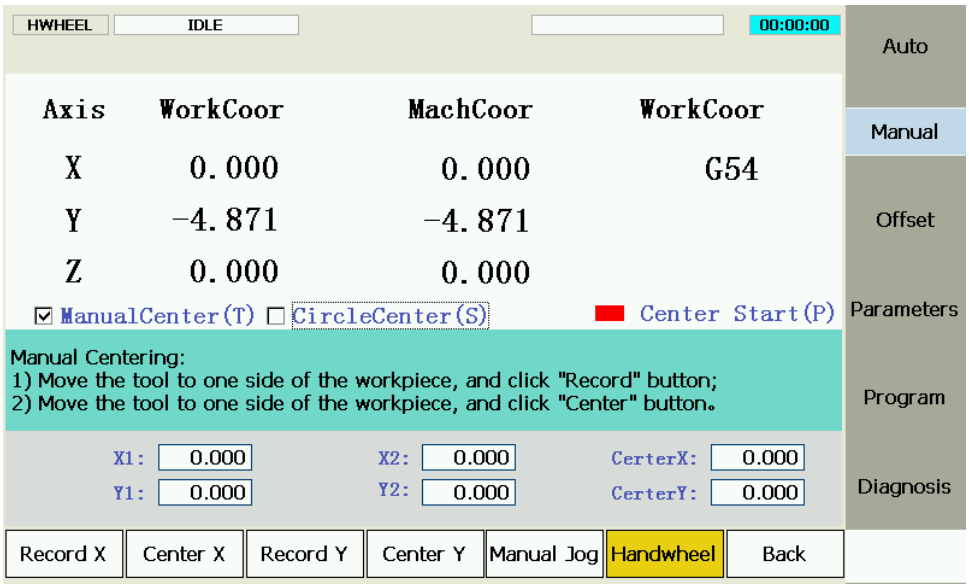


Fig. 3-33 Line Centering Interface

The operation steps are as below(taking X axis as an example):

1) Manually move the cutter (generally using the handwheel) to one side of workpiece, and then press F1 [Record X] to record the machine coordinate of current point.
2) Move the cutter to the other side of workpiece, and then press F2 [Center X] to calculate the midpoint coordinate based on the coordinate of current position and the last recorded value and set it as workpiece origin.

CAUTION

In the process of centering of a certain axis, the other coordinate axis should keep still.

3.9.2 Circle Centering

Circle centering, i.e. three-point centering, means automatic calculation of center point coordinates (generally set as workpiece origin) of a circular blank in terms of the three recorded circle coordinates.

In centering interface, press S to switch to the circle centering function, shown as below:

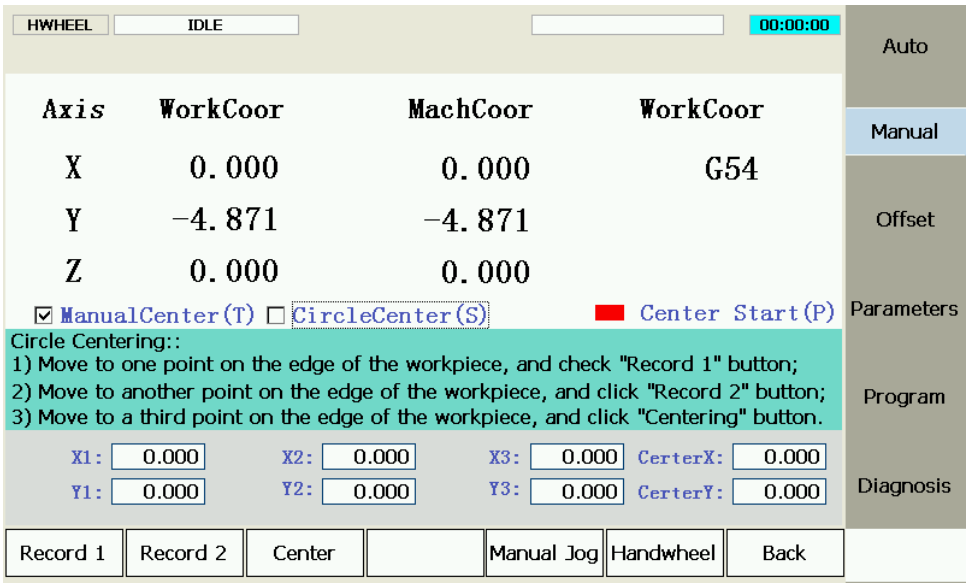


Fig. 3-34 Circle Centering Interface

The operation steps are as below (taking X axis as an example):

1) Manually move the cutter to one point on the circumference of a circular blank, and then press F1 [Record 1] to record the machine coordinates of current point as the first group of coordinate;

2) Move the cutter to another point on the circumference, and then press F2 [Record 2] to record the machine coordinates of current point as the second group of coordinate;

3) Move the cutter to the third point on the circumference, and then press F3 [Center] to calculate the circle center coordinates and set them as workpiece origin based on the current machine coordinates and the two groups of coordinate recorded previously.

CAUTION

The three points should be apart from each other as far as possible for the accuracy of the circle center.

3.10 Simulation and Track

3.10.1 Simulation

The function of simulating provides a fast but lifelike simulated processing environment for users.

Running under the mode of simulating, the system will not drive the machine tool to do the relative actions but only show the processing trace of the cutter in high speed in the trace window. By simulating, users see moving form of the machine tool in advance, avoiding machine tool damage due to programming mistakes in processing procedure. And they can also know other additional information.

The steps of simulation are as below:

1) Under [Program] section, select and load a machining file. For more details, see 3.13.3.

2) Press SF1 to enter [Auto] section→press F2 to enter simulation and track interface, as shown below:

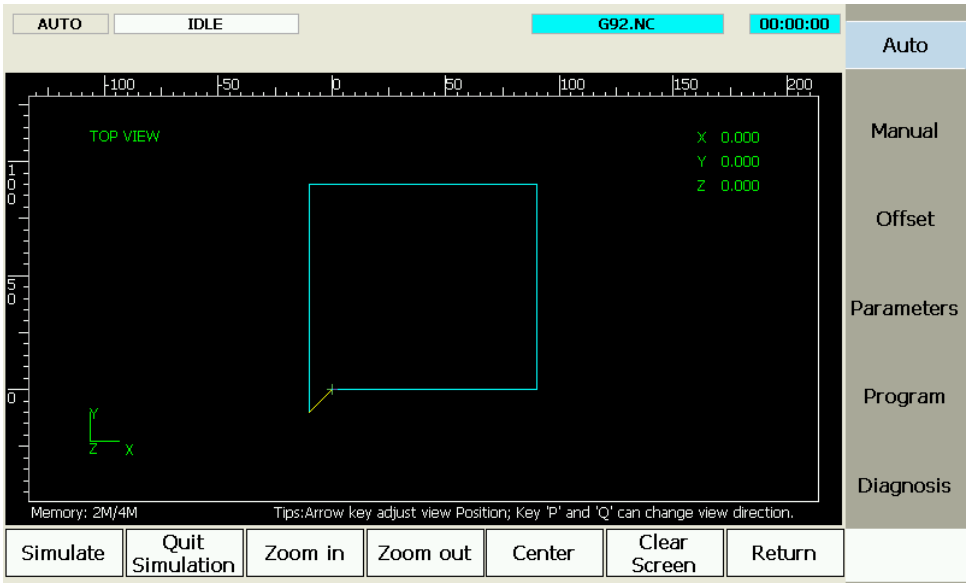


Fig. 3-35 Simulation and Motion Trace

3) In the interface shown above, press F1 to start simulation, with information displayed above the track.

4) Press F2 to exit from simulation state.

3.10.2 Track

[Motion Trace] screen can give a 3D display on the processing track followed in real time, with which users can view the tool path more intuitionally so as to ensure the accuracy of processing program. In 3D tracking mode, abundant operation methods are offered by the system for the convenience of users to view the motion track from different viewing angles and in an appropriate scaling. P and Q keys can be used to switch the angle of view.

F3~F6 buttons, shown as below, can also be used to execute operations including zooming in/ out, centering, clearing screen and so on.

Fig. 3-36 Simulation and Trace Manipulation Buttons

3.11 Compensation

3.11.1 Screw Error Compensation

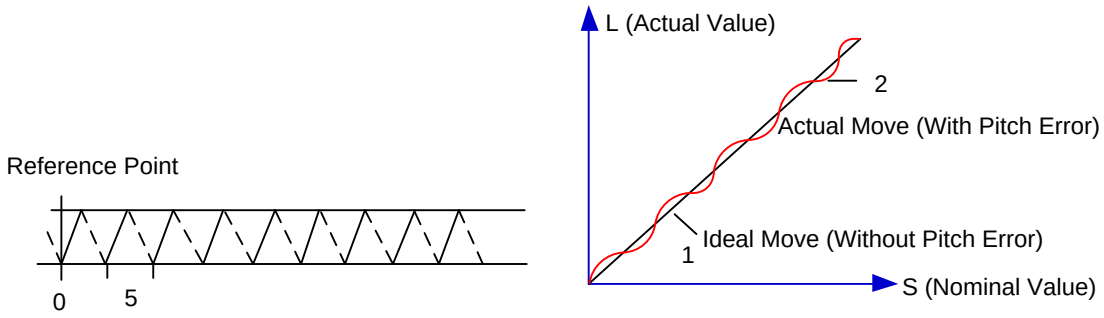
3.11.1.1 Causes of Screw Error and Compensation Method

Screw error consists of screw pitch error and errors caused by backlash. Generally, these two errors don't need compensation, but backlash compensation is needed in high precision required situation, if higher precision is required, both the two compensations are needed.

- **Pitch Compensation**

Pitch error is caused by screw defect and long-term wear, etc. In order to improve precision, pitch compensation is needed to meet the requirement. The sketch of a screw is shown in Fig. 3-37(A). A coordinate system is established, based on "0" point on the screw as the reference point, nominal value as X-coordinate, and actual value as Y-coordinate. Then the ideal moving curve is as curve "1" in Fig. 3-37(B), however, the 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, the actual moving curve deviating from the ideal one, and their difference is called error, i.e.:

Error = Nominal Machine Coordinate – Actual Machine Coordinate



(A) Sketch of Screw (B) Picture of Moving Curve

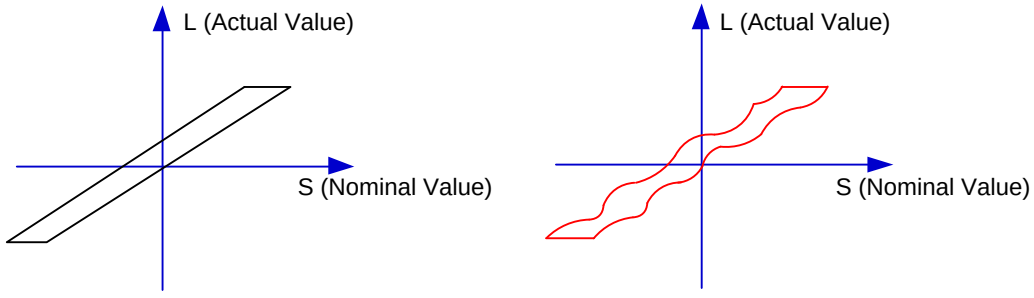
Fig. 3-37 Analysis of Pitch Error

- **Pitch Error Compensation Method**

In pitch compensation, generally pitch error value isn't related to feed direction. That is, when the pitch is too small in positive feed, additional pulse is needed, and thus, when negative feed passes the same position, the same amount of feed pulse should be added. But if the pitch is large, deduction of pulse is needed, and neither is the reducing amount related to feed direction. In software compensation, correction of each point on the error curve should be tabulated and saved to the system memory. Then auto compensation for coordinates of each point is available in running, so as to improve machine precision.

- **Backlash Compensation**

Hysteresis feature is caused by forward and reverse clearance. Assume that driving shaft drives driven shaft in negative (CW) rotation, 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 the 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. 3-38(A), in which the curve of horizontal section is during the idling of servo motor without worktable movement. The actual moving curve of worktable is shown in Fig. 3-38(B).



(A) Hysteresis Feature (B) Actual Moving Curve

Fig. 3-38 Analysis of Backlash

The popular explanation is: because spindle is generally fixed on the screw whose outer wire and the inner wire on the outer wire cannot be completely matched, backlash compensation compensates the

clearance between the screws of last direction that the spindle needs to finish after reversing its moving direction.

- **Measuring Method and Compensation Method**

Backlash can be measured by a specialized gauge. Firstly, fix the instrument nearby the spindle. Secondly, make the watch hand at the zero point position (machine origin). Thirdly, manually move “a” millimeter, then move back “a” millimeter, and then see the actual moving distance of watch hand “b” millimeter. Therefore, the backlash is measured, namely (a-b) millimeter.

If one axis moves from positive to negative, “+Q” pulse will be output before reversal; conversely, from negative to positive, “-Q” pulse will be output before reversal (Q is backlash, preset by the program).

3.11.1.2 Screw Error Compensation Operation

Actually the system has already combined the above two errors (screw pitch error and backlash) 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 coordinate of each coordinate axis are listed into the screw error compensation file.

The detailed operation is: save the measured value of compensation in file “axeserr.dat” in directory of USB disk which is sticked into NK200 system. The system will execute compensation as the file described immediately.

- **Screw Error Compensation File “axeserr.dat”**

The name of the screw error compensation file is “axeserr.dat”, found under the installation directory. Modification to the data in the 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 in the ascending order of nominal machine coordinate value. Refer to Table 3-1 for details.
3) Annotation: it must be in a separate line and started with a semicolon. Its syntax is:

;<Annotation contents>

Note that a semicolon must be the first character of the separate line, that is, no other character should be in front of the semicolon, even blank space.

Table 3-1 Explanation about Axis Error Sequence

Item	Specification
Axis Name	X, Y, Z, (Case-insensitive)
Nominal Machine Coordinate	It is the machine coordinate with a sign with respect to reference point, which is calculated by the given pitch and pulse equivalent (i.e. the length calculated based on the nominal pitch, not on the actual physical one), arranged in ascending order. Nominal machine coordinate must be within the stroke range,

Item	Specification
	or the compensation is invalid.
Backward	The error generated by the motion towards decreasing direction of coordinate
Forward Error	The error generated by the motion towards growing direction of coordinate value.

1. The style of writing of each axis error sequence:

[Axis Name]

<Nominal Machine Coordinate>, < Forward Error>, < Backward Error>

<Nominal Machine Coordinate>, < Forward Error >, < Backward Error >

<Nominal Machine Coordinate>, < Forward Error >, < Backward Error >

2. The sign of nominal machine coordinate and actual machine coordinate

Pay special attention to the sign of nominal machine coordinate and actual machine coordinate, especially when equipment like laser interferometer is used to measure the length. Calculate after the measured length is converted to the corresponding machine coordinates, or a wrong result may occur.

Table 3-2 Example of Screw Error Compensation File Format

Condition	Example	Remark
Common cases	;unit=mm [X] -570.025, 0.027, 0.083 -450.020, 0.025, 0.077 -330.015, 0.015, 0.068 -210.010, 0.000, 0.057	-
A certain axis only needs backlash compensation	;unit=mm [Y] 0.000, 0.000, 0.030 1000.00, 0.000, 0.030	Only the data of start point and end point of this axis needs writing down. If the backlash compensation on Y-axis is 0.03mm, the setting range is 0 → 1000.

- **Related parameters:**

Parameter	Definition	Setting Range
Screw error compensation	Whether to enable screw compensation and compensation options	0: No compensation; 1: Signal compensation; 2: Double compensation
Backlash compensation valid	Whether to enable backlash compensation	True: Enabled; False: Disabled

When “Screw error compensation” is set 0, and “Backlash compensation valid” is ste true, only backlash compensation is valid.

When “Screw error compensation” is set 1, and “Backlash compensation valid” is ste true, backlash and signle direction error are compensated. It applies to when backlash is stable.

When “Screw error compensation” is set 2, comprehensive compensation of positive error and

negative error is executed. It applies to when backlash is unstable.

3.11.1.3 Software Interface and Operation

Press SPF4 to enter function section [Parameter]. Under [Parameter] function section, press F6 to enter [Screw error compensate] interface shown as Fig. 3-39. See corresponding manipulation buttons function as follows.

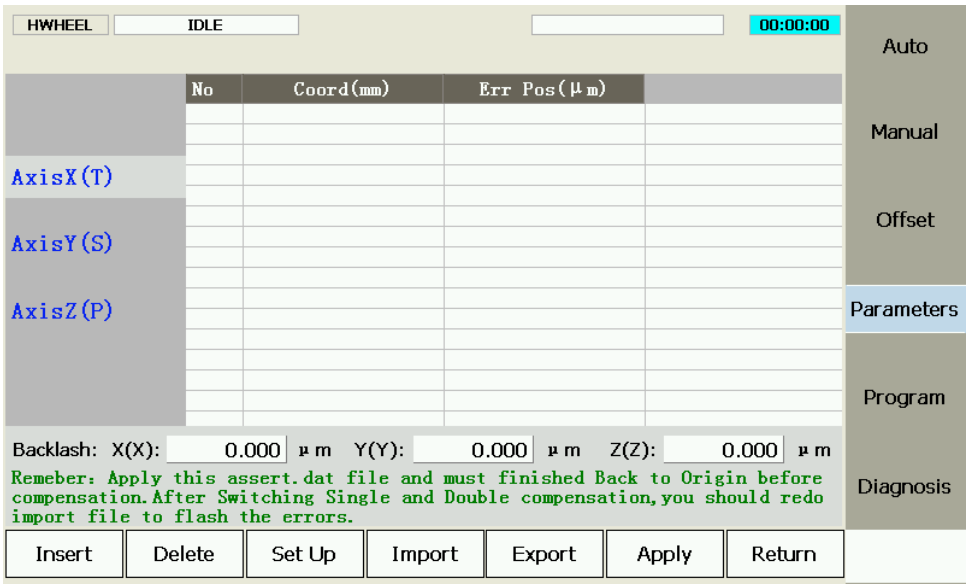


Fig. 3-39 Compensation Parameters Setting

- **Insert**

Used for inserting compensation data. This button pressed, users can insert a new group of data in the blank row. Note that continuous inserting of multi-blank-line is prohibited and next inserting is allowed after previous one is completed.

- **Delete**

Used for deleting the currently selected data.

- **Setup**

Press this button to open setup dialog box, as shown below. Please input start position, interval and amount to set compensation position as a whole. Used together with the laser measurement of program wizard, the compensation value calculated by the laser measurement can be set in this interface. See 3.13.1 for laser measurement introduction.

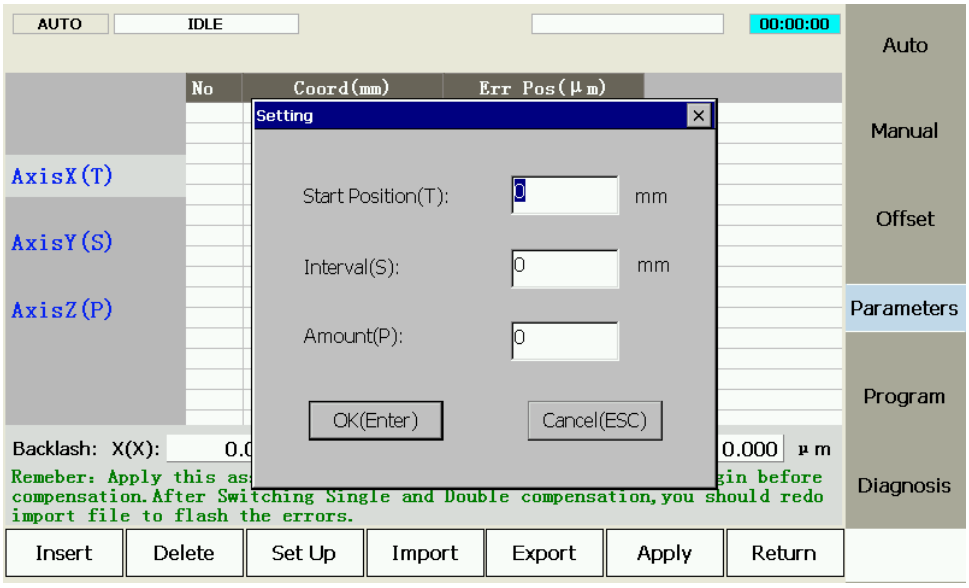


Fig. 3-40 Setup Dialog Box

- **Import & Export**

Compensation files can be copied from or to a U disk or other external storage.

- **Apply**

After parameters are set, press Apply before restarting the software. Reboot is needed to validate the modification of backlash data. If the system is not rebooted, the modified value does not take effect, while it is the previous backlash data that still works.

- **Return**

To return to the previous page, namely the [Parameter] function section.

CAUTION

1) The compensation data can be in an ascending or descending order. Positive interval indicates ascending order while negative interval descending order.
2) Backlash can only be set in unilateral compensation, and hidden in bilateral compensation.
3) Remember to press the Apply button after modification of screw error compensation data. Before machining, homing should be executed, because the system only sends the compensation data of the homed axes to the driver.
4) After switchover between unilateral compensation and bilateral compensation, it is necessary to load the desired file again and apply it. Otherwise, it is the previous compensation mode and data before modification that still work.

3.11.2 Tool Compensation

In CNC machining, the CNC system actually controls tool center or the related point of tool rest whose motion track is controlled directly to indirectly realize the profile processing for the actual parts.

The cutting part tools actually used are tool nose or cutting edge which has dimensional variation with tool center or the related point of tool rest, so the control system has to compute the corresponding coordinates of tool center or the related point of tool rest according to the actual coordinate position of tool nose or cutting edge (namely the actual coordinate position of parts profile), which is called tool compensation.

Input the new tool parameter values in [Compensation (=)] input interface (as shown in Fig. 3-41) if tool nose radius is altered after tool wear, tool sharpening or tool change, avoiding the trouble to modify the programmed processing procedure.

Number	Diameter	Dia_Wear	Length	Len_Wear	X Offset	Y Offset	Z Offset
ToolNO1	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ToolNO2	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ToolNO3	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ToolNO4	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ToolNO5	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ToolNO6	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ToolNO7	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ToolNO8	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ToolNO9	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ToolNO10	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Fig. 3-41 Tool Parameters Screen

To make tool compensation (including tool diameter compensation and tool length compensation) effective, parameter “turn on radius compensation” should be set as “true”. Code G43 (positive offset) and G44 (negative offset) are used for tool length compensation; G41 (left compensation) and G42 (right compensation) for tool radius compensation; G40 (cancel tool radius compensation) and G49 (cancel tool length compensation) are used for canceling tool compensation.

Only when tool compensation codes and G00/G01 are used together can the tool compensation be enabled.

- **Related Parameters:**

Parameter	Definition	Setting Range
Turn on radius compensation	Setting whether to perform tool compensation	True: Valid False: Invalid
Specify the type of tool compensation	1: General mode; 2: Intersect mode; 3: Insert mode	1~3
Diameter	Tool diameter	0.000~9999.000 mm
Dia_Wear	The system can compensate the tool diameter according to the input value of this parameter after measurement.	0.000~9999.000 mm
Length	Tool length	0.000~9999.000 mm

Parameter	Definition	Setting Range
Len_Wear	The system can compensate the tool length according to the input value of this parameter after measurement.	0.000~9999.000 mm

3.11.2.1 Tool radius compensation(G40~G42)

Tool radius compensation codes can move the tool just with the offset of tool radius, shown as Fig. 3-42.

To make the offset value the same with the radius value, the system needs to build up a offset vector (start tool), whose length equals to the tool radius.

The direction of the offset vector is perpendicular to that of tool motion, with part pointing at the tool center.

If linear interpolation or circular interpolation is schemed after tool start, tool offsets in certain vector and then starts machining.

Finally, cancel the tool radius compensation to move the tool back to the origin.

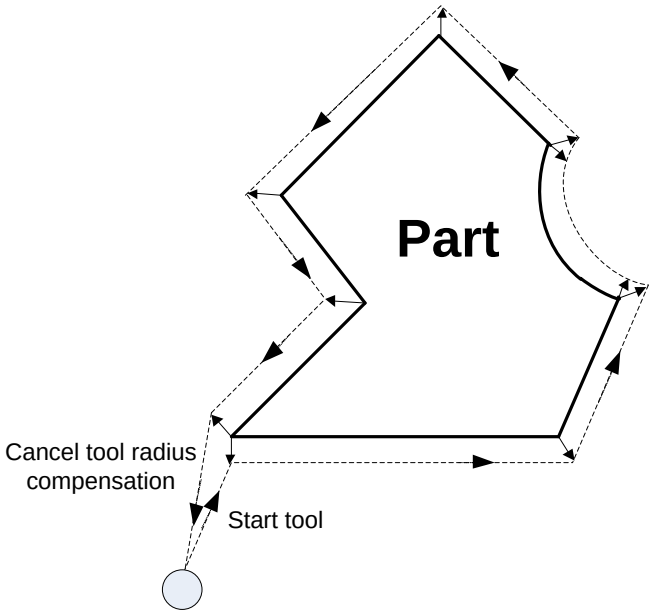


Fig. 3-42 Tool Radius Compensation Illustration

3.11.2.2 Tool compensation types

Tool (cutter) compensation should be established before executed and cancelled after workpiece machining completed. To establish tool compensation is to move the tool to the edge of workpiece in a reasonable way, while to cancel tool compensation is to move the tool to the specified point from the edge of workpiece.

Generally, establishment of tool compensation includes two establishing segments, as segment 1 and 2 in Fig. 3-43.This software offers 3 types of establishing tool compensation.

1) Normal type: the programming path is translated by 90 degrees to get the segment 2 for establishment, next, make the starting point of segment 2 the end point of the segment 1. Segment 1 and 2 constitute the tool nose path with tool radius compensated. Please note that this type is not

available to arc command.

2) Intersect type: the programming path is translated in parallel to get the segment 2 for establishment, next, make the starting point of segment 2 the end point of the segment 1. Segment 1 and 2 constitute the tool nose path with tool radius compensated. Please note that this type is not available to arc command.

3) Insert type: after the programming path is translated, figure out the intersection point of segment 1 and 2. Insert a line from the starting point of segment 1 before translation and the starting point of segment 1 after translation, to get the tool nose path. It is available to arc command as well, but machining efficiency will be affected since an extra segment needs to be completed..

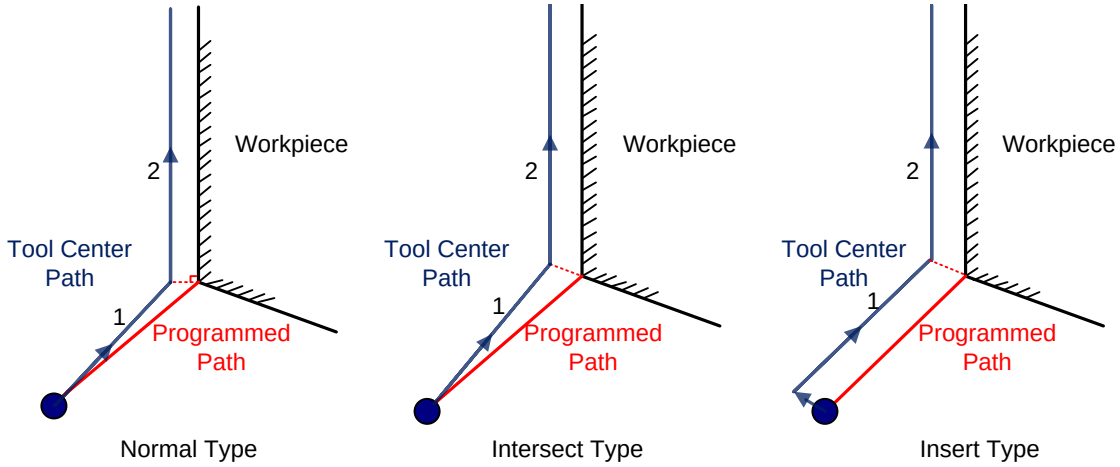


Fig. 3-43 Types of Enabling Tool Compensation

3.11.2.3 Direction of tool compensation

The schematic diagram of tool compensation direction is as shown in Fig. 3-44.

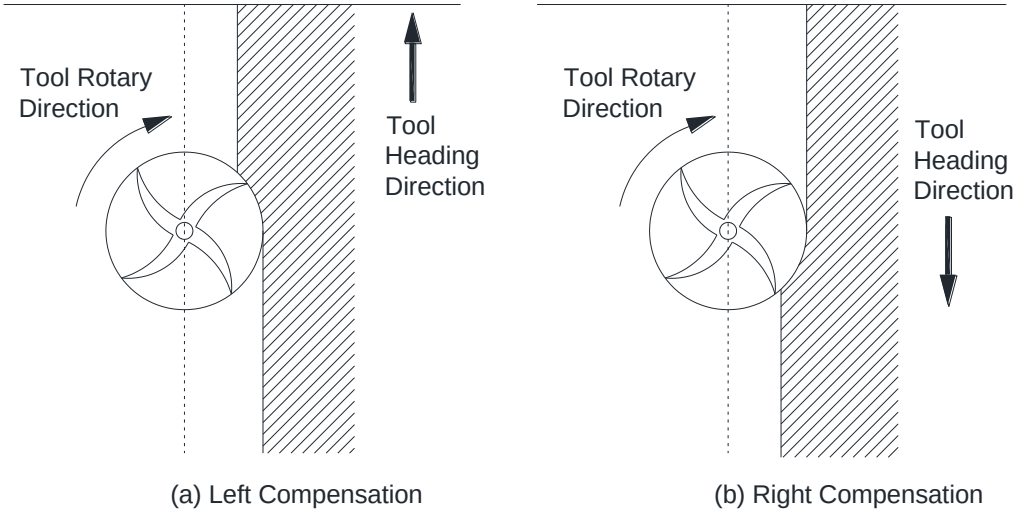


Fig. 3-44 Direction of Tool Compensation (a: Left compensation b: Right compensation)

Programming for tool radius compensation is as shown in Fig. 3-45:

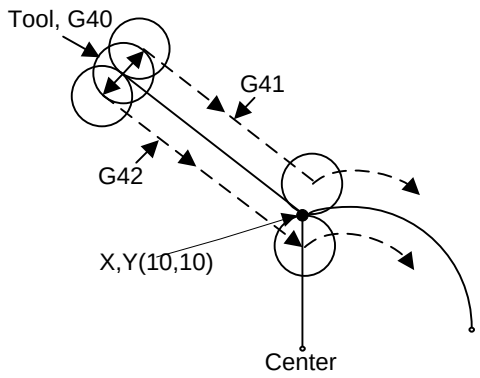


Fig. 3-45 Schematic Diagram of Tool Compensation Processing

```
G17 G01 G41(G42) X10 Y10 F1000 D01 ' linear interpolation and tool radius compensation
G02 X_ Y_ I_ J_   ' circular interpolation
```

Among the above in shadow, G41 means left compensation, namely the tool will deviate a distance towards the left side of tool heading direction and this distance is tool radius; G42 means right compensation, namely the tool will deviate a distance towards the right side of tool heading direction and this distance is tool radius. X10Y10 is the endpoint coordinates of linear motion. F1000 represents the tool moves at the speed of 1000 mm/min. D01 is the parameter of G41/G42, namely the tool compensation number. From D00 to D07, they have their own corresponding radius compensation value in the tool compensation table.

For the details of programming of tool compensation instruction, see *NC Studio Programming Manual*.

3.11.3 Across Quadrant Error (AQE) Compensation

When a circle is processed, distortion, like a spike, may occur at the transition position from one quadrant to another one. AQE (across quadrant error) compensation can solve this kind of distortion.

AQE compensation includes parameters to eliminate the spike near the transition position from one quadrant to another one in circular machining. The settings of each axis in positive and negative directions are all similar.

- **Related Parameters:**

Parameter	Definition	Setting Range
Enable AQE compensation	Whether to enable AQE compensation	True: enable False: disable
AQE compensation time	-	0 ~ 0.3 (sec)
AQE compensation length	-	0 ~ 10 (mm)
Delay time of AQE compensation	-	0 ~ 10 (sec)
Intensity of AQE compensation	-	0 ~ 1
To enable AQE compensation, set parameter “Enable AQE compensation” as “True”. **Compensation time:** the larger the value is, the larger the compensation-affected area will be. Recommended value is 0.02 sec. **Compensation length:** the larger its value is, the more obvious the compensation result will be. However, note that too large value will make the arc concaved, while too small value will not		

Parameter	Definition	Setting Range
suppress the spike effectively. It is suggested to measure the actual height of the spike with a laser interferometer or other measuring device in debugging, and then set this parameter as 0.3 to 3 times of spike height. Compensation result is also related with compensation time and intensity. **Compensation delay time:** the spikes may not appear exactly at the four quadrant positions due to mechanical properties of machine tool, but a little distance away from the quadrant points. Estimate the time to travel this distance and then set the time as the value of this parameter. **Compensation intensity:** the larger the value is, the more obvious the compensation result will be.		

3.12 Log

Under [Diagnosis] function section, press F7 to enter [Sys info] sub-function screen and then press F5 to enter log interface, as shown in Fig. 3-46.

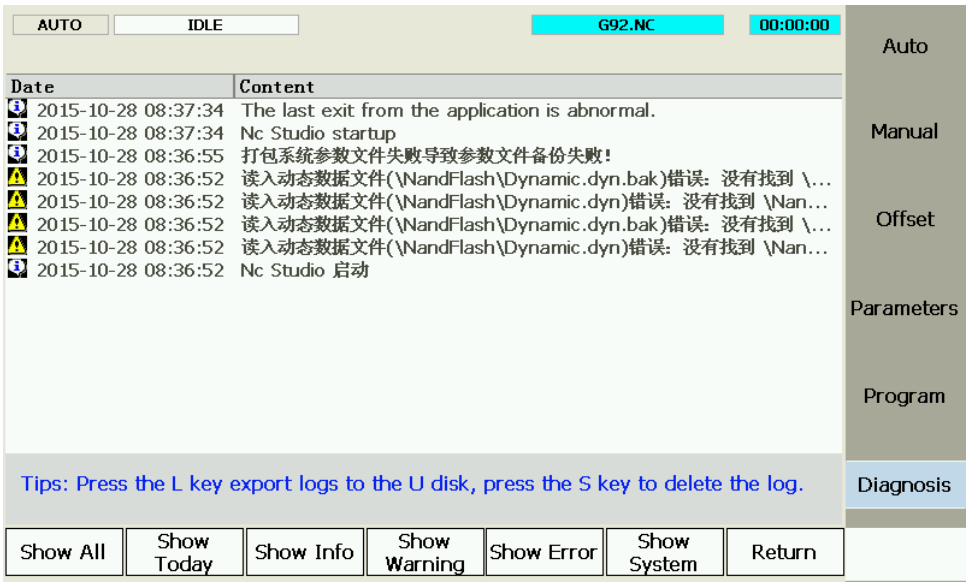


Fig. 3-46 Log Screen

[Log] screen records important operations and system events, and users can not only browse the log information since this time start-up but also view the history records. Besides, pressing L can export log to external equipment such as USB while pressing S deletes it. The introduction to the manipulation buttons at the bottom is as follows:

- **Show All / Show Today**

Their shortcut keys are F1 and F2 respectively.

The two buttons correspond to two kinds of information, that is all the log information and today's log information.

- **Show Info / Show Warning / Show Error / Show System**

Their shortcut keys are F3, F4, F5 and F6 respectively.

System information can be divided into three types, including general information, alarm information and error information.

- **Return**

Pressing shortcut key F7 will return to the previous interface.

3.13 Program File Management

Program file management manages the processing files in the system, related to the operations of processing program.

3.13.1 Program Wizard

NK200 offers 5 basic processing program wizards: circular frame, circular pocket, rectangular frame, rectangular pocket and laser measure. Users just need to input some simple parameters to complete the milling operation of circular frame and rectangular frame, etc. Take laser measure as example:

Under SF1 [Auto] function section, press F3 to enter [Program wizard] and then press shortcut key L to switch to laser measure screen, as shown below. Users can set parameters for the selected object as required to achieve the desired result.

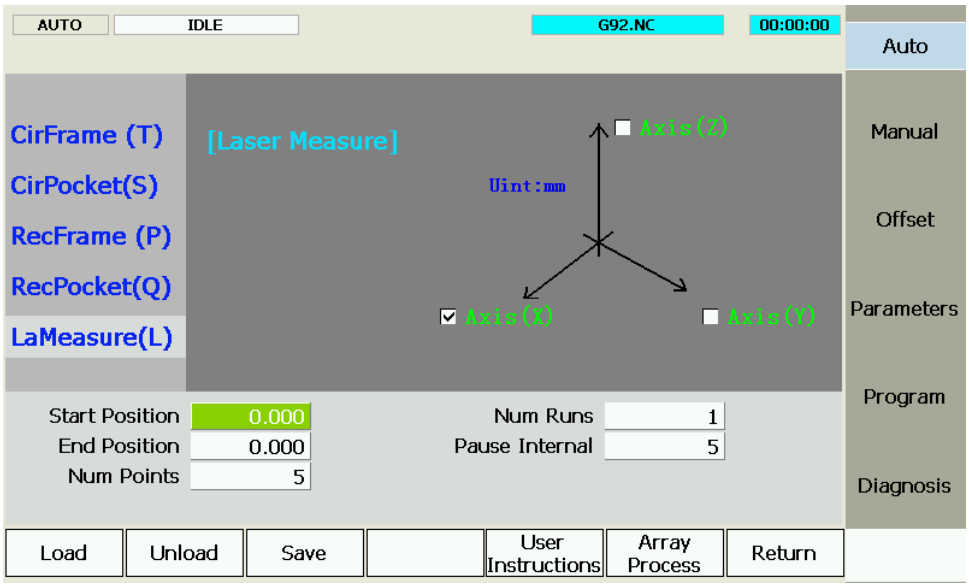


Fig. 3-47 Laser Measure

[LaMeasure]: the wizard for screw error measured by a laser interferometer. The data file generated with this wizard can be used for backlash compensation.

After the input of Start Position, End Position, Num Points, Num Runs and Pause Interval, the system will automatically record the error of each num point (measure point) and then output the compensation file by the laser interferometer.

After parameter values are entered, press F3 to save them, the system automatically generating the program, then press F1 to load the program, and then press “Program Start” to begin measuring.

CAUTION

1) Select an axis first, and only one axis can be selected at one time.
2) Start Position and End Position should be both within the stroke range, and the latter one should be larger than the former one.
3) One Num Run refers to the process from Start Position to End Position and to Start Position again. The laser interferometer will record a group of data in each Num Run. The screw error compensation file uses their average value.
4) Measuring interval = (End Position – Start Position)/ (Num Points -1). If precise measuring is needed, Start and End Position should be calculated accurately so as to ensure the coordinates of measured points are integers.

Checking inner circle of circle frame refers to milling the inner area while outer circle for milling the outer frame. Circle pocket requires setting the X and Y workpiece coordinates. The operation method and parameter setting principle of round bottom milling, rectangular frame milling and round frame milling are the same as those of rectangular bottom milling, except for some parameters to be set. Their corresponding interfaces are shown as below:

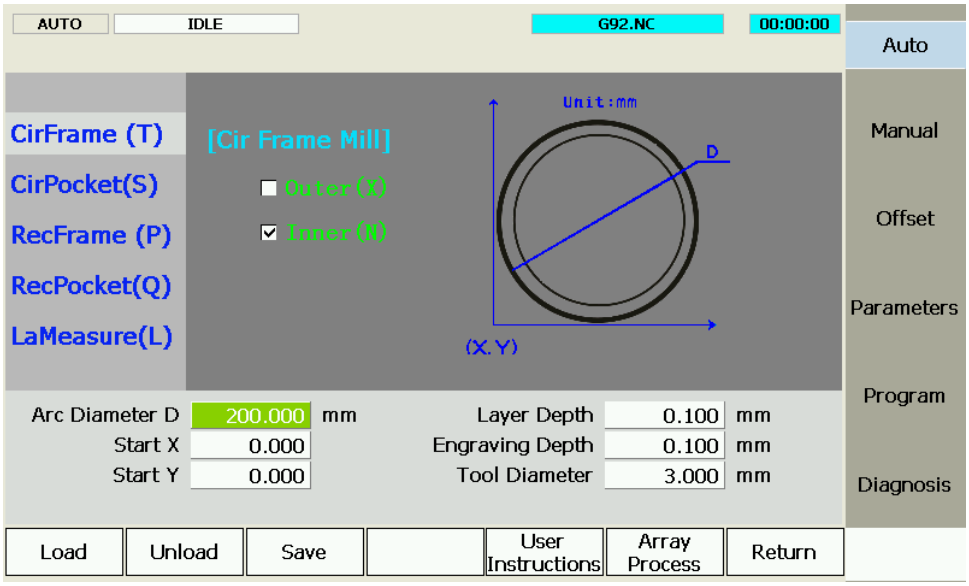


Fig. 3-48 Circle Frame

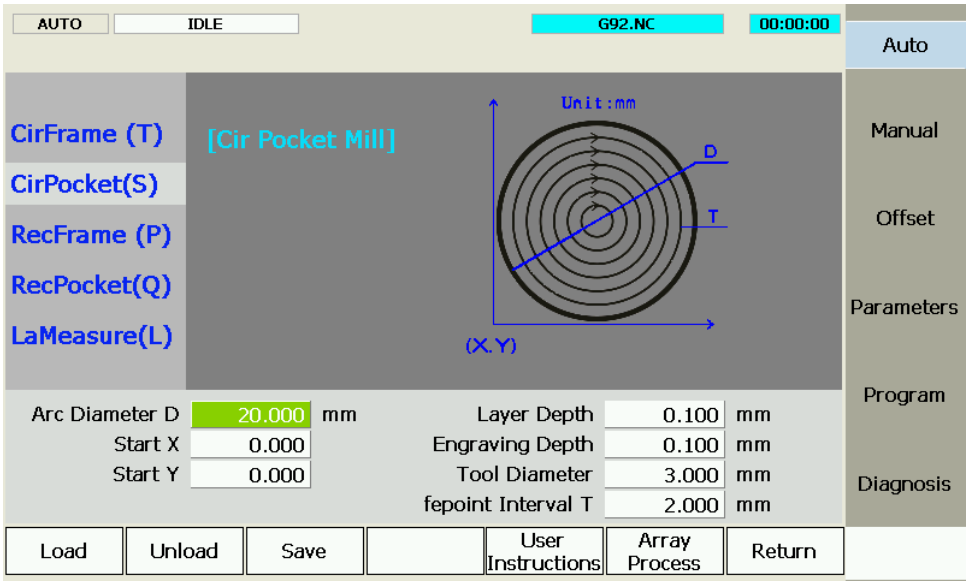


Fig. 3-49 Circle Pocket

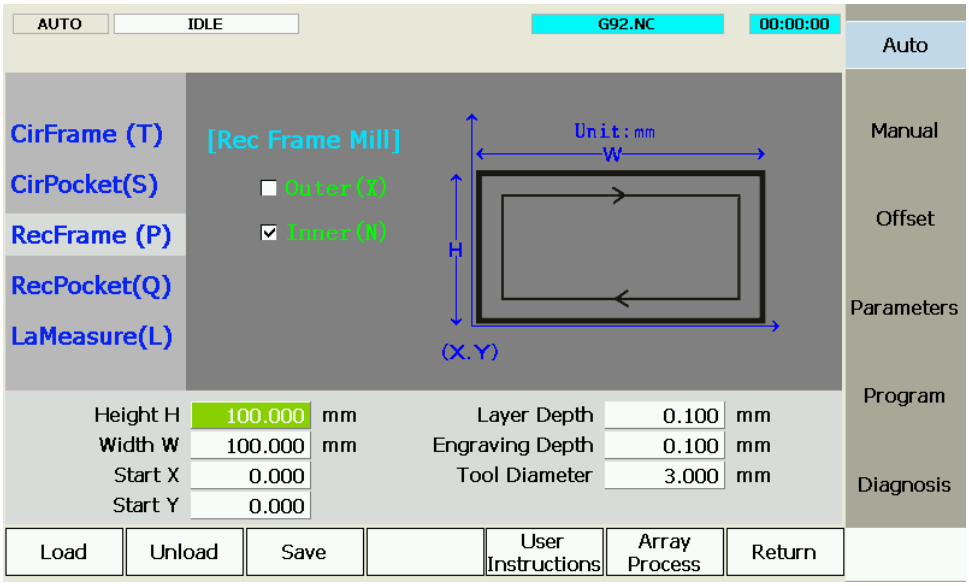


Fig. 3-50 Rectangular Pocket

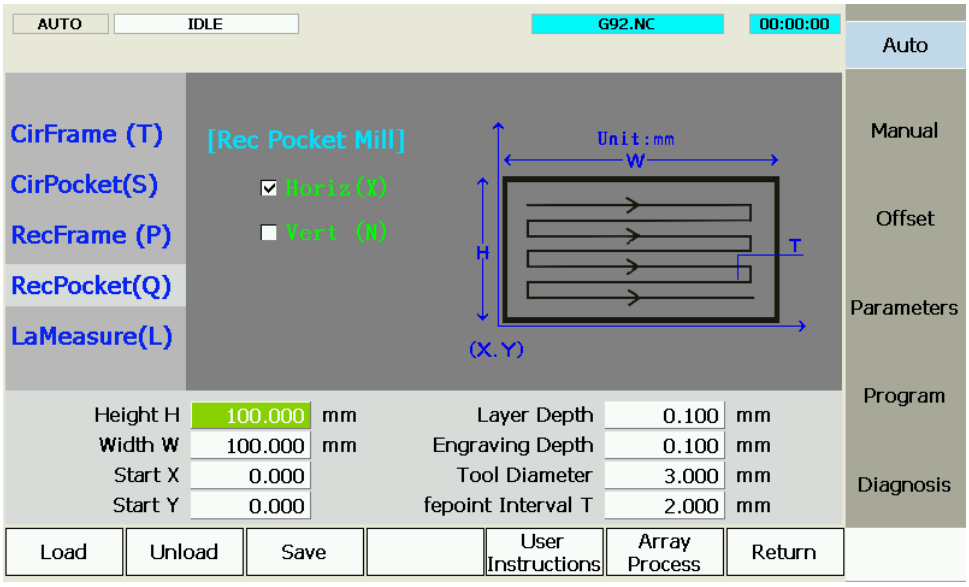


Fig. 3-51 Rectangular Pocket

3.13.2 Array Processing

The system supports array processing on the same program.

Press SF1 to enter [Auto] function section → press F3 to switch to the program wizard interface → press F6 to enter array processing, as shown below.

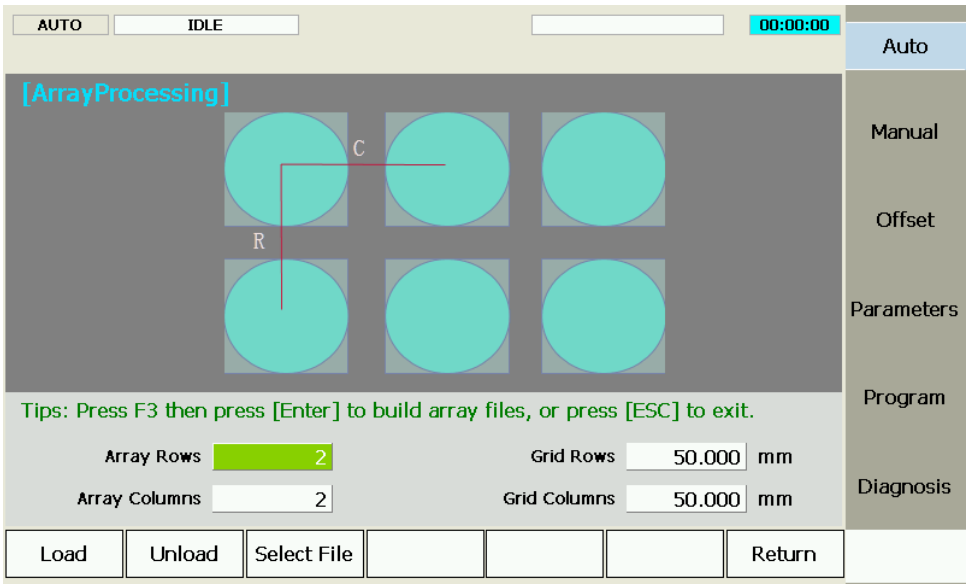


Fig. 3-52 Array Processing

First press F3 to select file to be array processed, and then set array rows, array columns, grid rows and grid columns and press Enter to generate array files.

Press F1 to load the generated array files into the system; press F2 to unload the current file; press F7 to return to the previous interface.

CAUTION

The array processing does not support such command as G65 and G92, or sub-programs in tool path. When they exist in tool path, the system wiil prompt to delete manually or automatically.

3.13.3 Program File

Press SF5 to enter [Program] function section, as shown in Fig. 3-53.

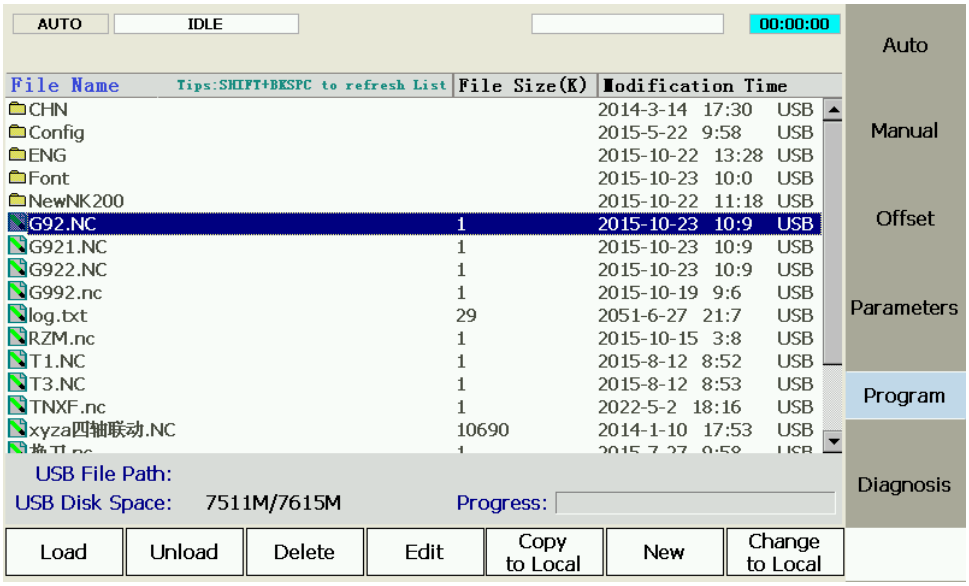


Fig. 3-53 Program File Interface (Before loading a program)

On the upper part of this screen, processing files in the system are displayed with their size and modification time; on the lower part, currently loaded file is displayed with its size, total line and file loading progress. After a processing file is loaded, the screen is as shown in Fig. 3-54.

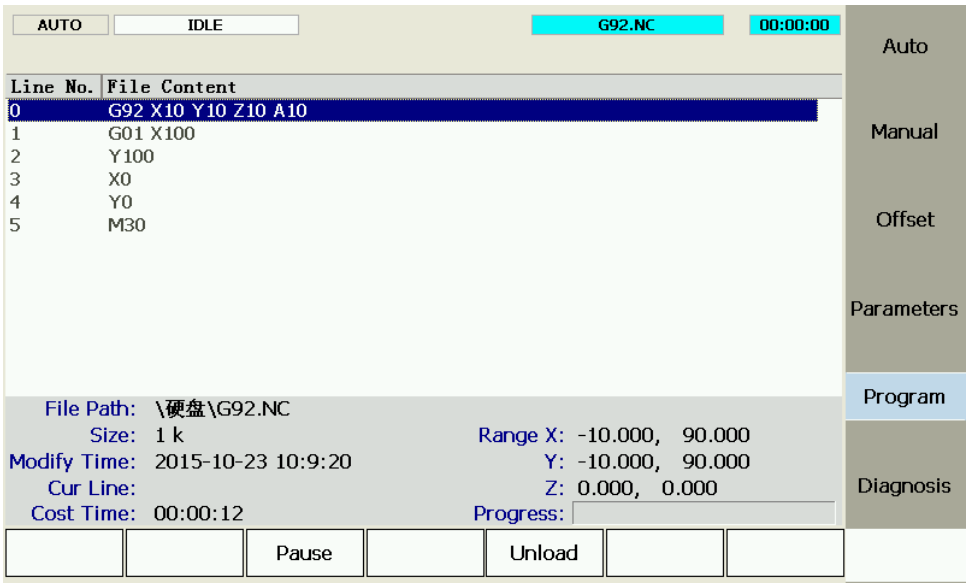


Fig. 3-54 Program File Interface (After loading a program)

- **Load**

The shortcut key is F1, only valid under [Program] function section.

After the processing file is selected (press "↑" or "↓" key to move cursor to the target file), pressing shortcut key F1 will make the system load the file automatically, [File Loading…] displaying the loading progress. At the same time, the system will check the file being loaded automatically; if there is an error in the file, an error prompt will be displayed in the information prompt bar to prompt the concrete error position. After loading finishes, other operations are available.

If parameter N1101 "Select tool for ENG" is set as "True", when an ENG file to be loaded has multi- tool, a dialog will pop up when it is being loaded, as shown in Fig. 3-55.

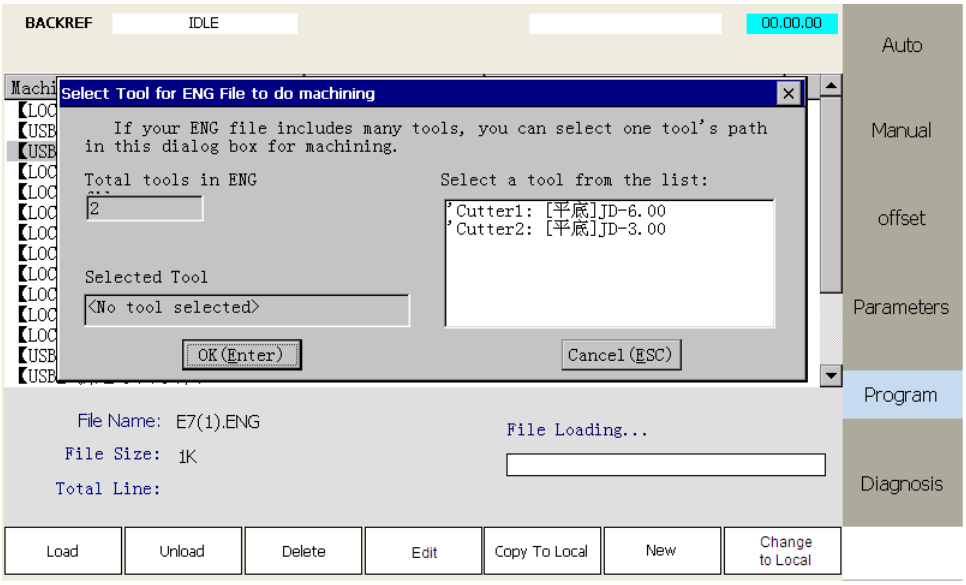


Fig. 3-55 File lLoading Interface

Users can select a tool according to their own needs. Press "Up" and "Down" keys to select a tool, and then press [OK] key to load the file. In case of tool change prompt after processing, end the program first, and then reload the processing file and select the appropriate tool.

- **Unload**

The shortcut key is F2, only valid under [Program] function section. This function is only available for the loaded file.

After a file is loaded, the interface will be shown as Fig. 3-54. At this time, pressing F2 will unload the file currently loaded automatically. Note that "Unload" button in Fig. 3-53 is invalid.

After the file is loaded, its information will be displayed. After F6 "Parse Prog Info" is pressed, the system will not drive the machine tool to do the relative mechanical and electronic actions, but only parse the file processing range and predicted processing time. With this function, users can learn the details of processing program in advance and make corresponding adjustments.

If the processing file is too large or enough information is acquired without the completion of parsing, users can press F7 to stop parsing and start machining.

- **Edit File**

The shortcut key is F4, only valid under [Program] function section.

After F4 is pressed, users can edit the current file on the integrated system.

- **Delete**

The shortcut key is F3, only valid under [Program] function section.

Select the file to be deleted, and then press F3 to eject a prompt box, as shown in Fig. 3-56.

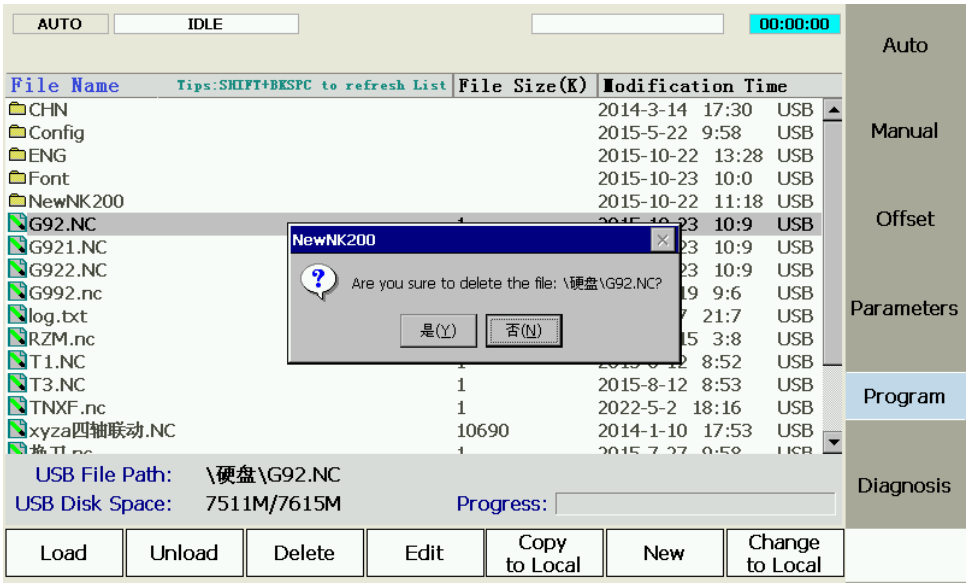


Fig. 3-56 Information Prompt Dialog

Pressing the letter Y will delete this program file. (Note: the system will delete this file from the default system disk. To avoid data loss, if necessary, copy this file to a mobile disk for backup.)

- **Copy to local**

The shortcut key is F5, only valid under [Program] function section.

Pressing F5 will copy the selected file to the mobile disk on the premise that a mobile disk is inserted.

- **Change to local**

The shortcut key is F7.

Pressing F7 will open the program file list in the mobile disk on the premise that a mobile disk is inserted.

- **New**

The shortcut key is F6.

After F6 is pressed, the system will create a new file for compiling a new program.

- **Related parameters (DXF file)**

Parameter	Definition	Setting Range
Tool lifting height	It sets the tool lifting height during rapid traverse.	0~100000 mm
Machining depth	It specifies the processing depth for 2D files.	-100000~0 mm
Use first point as zero point	It sets whether to set the firstly met coordinate point as zero point when DXF file is processed.	True: Use the first point as zero point False: Not use the first point as zero

Parameter	Definition	Setting Range
		point
Shape separate processing_valid	It sets whether the system will completely process the last shape before machining the next one(s).	True: Valid False: Invalid
Bottom machining valid	Valve operation is enabled only when [3D cutting] is on the workpiece surface.	True: Valid False: Invalid
Use dxf file as metric size	It forcibly sets dxf file as metric size.	True: Forcibly set as metric size False: Not forcibly set as metric size
Translation parameters of DXF file are applied to translation for DXF files, including “Tool lifting height”, “Machining depth”, “Layer depth”, “Use first point as zero point” and “Shape separate processing _valid”, etc. When processing Dxf files, the system treats the action of tool lifting as the separate mark for the adjacent shapes. If there is no tool lifting, the system will consider only one shape is being processed. If tool lifting occurs, it indicates the processing of a complete shape is finished. For example, process several circles adjacent to each other. The depth of each circle is 10mm, and each feed depth of Z axis is 2mm. If parameter N1092 is set as true, machine tool will process the current circle 5 times, then uplift the tool, and then go to process the next circle. If it is set as false, machine tool will process the current circle once, then lift its tool, and then go to process the other circles. After all the circles are processed once, this process will be re-executed 4 times to finish processing all the shapes.		

- **Related parameter (ENG File)**

Parameter	Definition	Setting Range
Select tool for ENG	Need to reload the file	True: Valid False: Invalid
Select tool for ENG	Need to reload the file. Take effect only in ENG 5.50 or 5.53	True: Valid False: Invalid
Tool change prompt	If it is set as true, when tool change command is encountered, machine tool will suspend processing and uplift its Z axis, and prompt bar in the system will prompt tool change. At this time, users can perform the operation of tool change. If it is set as false, when tool change command is encountered, machine tool will not suspend processing, but the prompt bar in the system will still prompt tool change.	False: Invalid True: Valid
Tool lifting height	Tool lifting height in rapid traverse	0~100000 mm
Retract amount	The retract amount after each feed when high-speed reciprocating chip removal is adopted to drill deep holes.	0~100000 mm

Parameter	Definition	Setting Range
Cycle times of ENG processing	The needed cycle processing times in processing ENG files.	None
Deep hole machining	Deep hole machining manner:0:reciprocating chip removal; 1: high speed reciprocating chip removal	0, 1
Translation parameters of ENG file are applied to translation for ENG files, including “Tool lifting height”, “Tool change prompt”, etc.		

- **Related parameter (PLT file)**

Parameter	Definition	Setting Range
Tool lifting height	Tool lifting height in rapid traverse	0~100000 mm
Plt unit	In normal situation, 1plt=40mm.	0~100000 mm
Tool step	It refers to tool space in PLT machining and should be confirmed by tool diameter. Only when adjacent tool paths have overlapping part can the workpiece be machined thoroughly.	0~100000 mm
Machining depth	Machining depth in plt files.	-
PLT file translation parameters are applied to translation of PLT files. PLT is a format of 2D machining files defined by an American company Hewlett Packard (HP), usually used in embossment and advertising carving, including such parameters as “retract”, “PLT units”, “tool offset” and “cutting depth”. At the same time, PLT is a kind of unit. Normally, 1plt=40.195mm, which can be magnified or reduced by setting the parameter “Plt unit”.		

3.14 Handwheel Operation

3.14.1 Handwheel Mode

The system supports three operation modes: auto mode, reference point mode and manual mode, and manual mode is subdivided into jog, stepping and handwheel.

Under [Manual] function section, press F2, F3, F4, F5 to enable different operation modes. And F5 corresponds to handwheel mode.

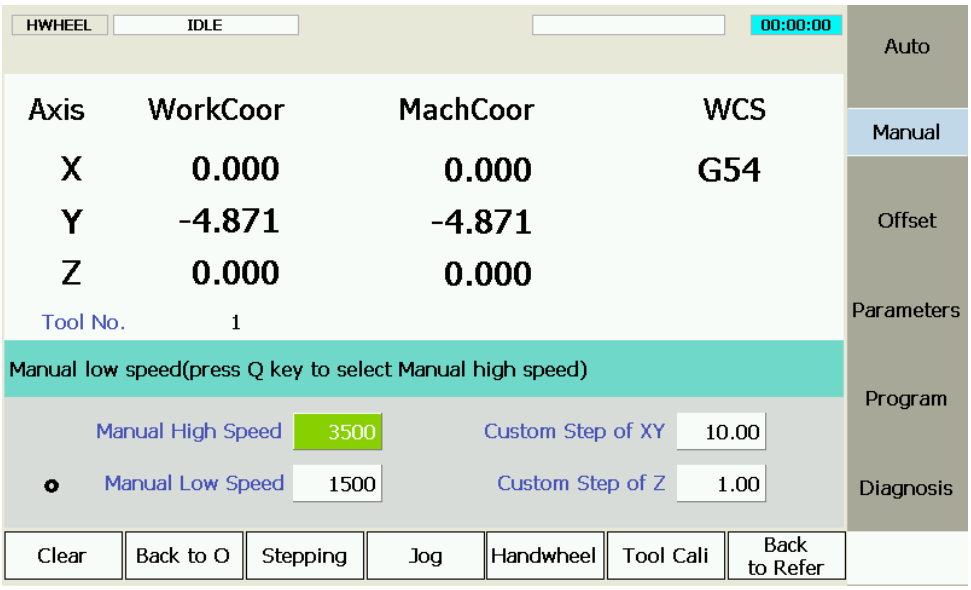


Fig. 3-57 Handwheel Interface

Under handwheel mode, users can configure a handwheel to control the machine tool. As shown in Fig. 3-58, select the motion axis by rotating “Axis selection button”, select handwheel override gear by rotating “Gear selection button”, and control the selected axis running at the selected handwheel override gear by rotating “Handwheel control rotation disk”. Handwheel override gear regulates the displacement (linear displacement or rotation angle) of moving parts of machine tool per each grid turning of handwheel.

Fig. 3-58 Handwheel

- **Related parameters**

Parameter	Definition	Setting Range
Handwheel output direction	This parameter set to -1 means the output direction is in the opposite direction of the axis output.	1: Same direction -1: Opposite direction
Handwheel in strict accordance with the pulse counting exercise	When set “Yes”, the machine moves the exact pulses generated by handwheel; otherwise the machine stops when handwheel stops turning	Yes: Valid; No: Invalid
Acceleration of the handwheel	It specifies the acceleration of handwheel operation. The smaller the value is, the more stable the motion will be	0~100000
When “Handwheel in strict accordance with the pulse counting exercise” is valid and handwheel moves fast, the machine tool still runs certain distance even handwheel stops because the driver will receive all the pulse signals sent by handwheel. When invalid, however, the system responds retatively quicker to the handwheel motion. But too fast rotation of the handwheel may lead to discrepency between maching motion distance and that indicated by the handwheel.		

3.14.2 Handwheel Guide

NK200 system supports handwheel guide. Handwheel guide refers to a way of operation that the automatic execution speed of machining program is manually controlled during auto processing so as to guard against such problem as “tool damage” and dangers caused by wrongly loaded program or inappropriate tool path. Fig. 3-59 is the software interface of handwheel guide.

Under Auto mode, press F1 [HW Guide] button to activate handwheel guide. After machining starts, the system will execute the processing program with clockwise turning of handwheel and stop processing with the stop of handwheel. Processing speed varies with the handwheel turning speed.

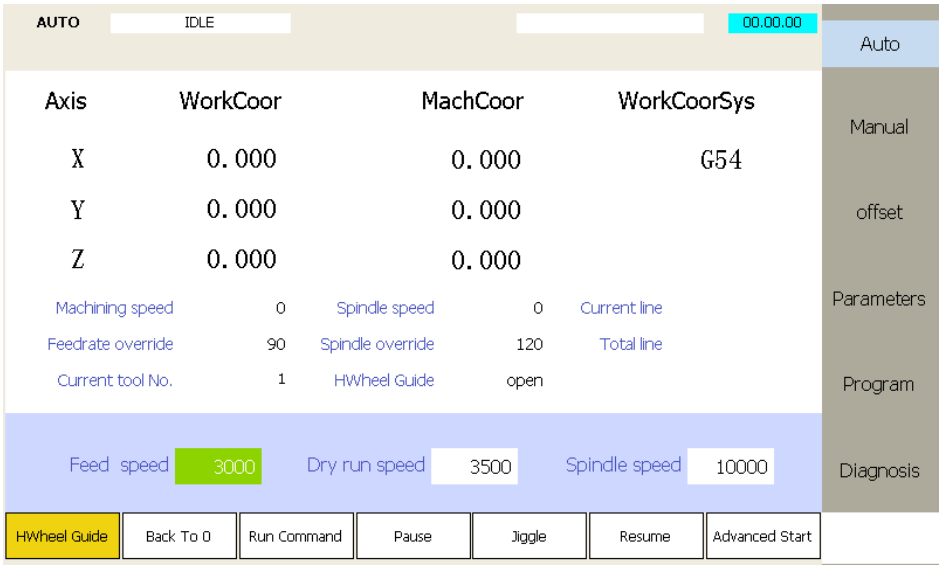


Fig. 3-59 Handwheel Guide Interface

3.15 System Management

3.15.1 System Info

Under [Diagnosis] function section, press F7 [System Info] to switch to system information interface, as shown in Fig. 3-60, which displays the related information of NK200.

Fig. 3-60 System Information Interface

3.15.2 Register

In [System Info] screen of [System] function section, “registration code” can be used to register the system and limit the system service time. Registration code is generated by the registration code maker. Its generation steps are:

1) Double click the registration code maker “GetRegCode.exe”, and then enter the password “ncstudio” (revisable) in the dialog box as shown in Fig. 3-61. Then press “OK”, input control card serial number and limited service time, and then click “Generate” to generate a new code displayed at the lower part, as shown in Fig. 3-62. If service time is not limited, input “-1” in the “limited time” bar to generate an unlimited code. Service time is registered by days.

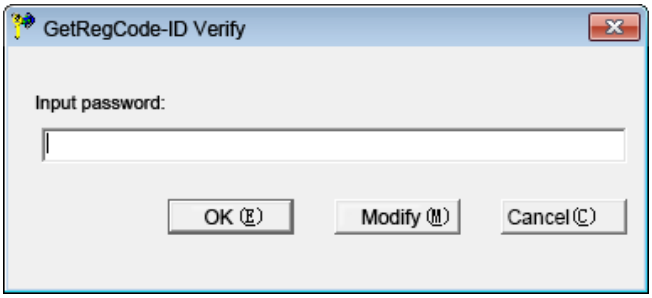


Fig. 3-61 Registration Code Maker-1

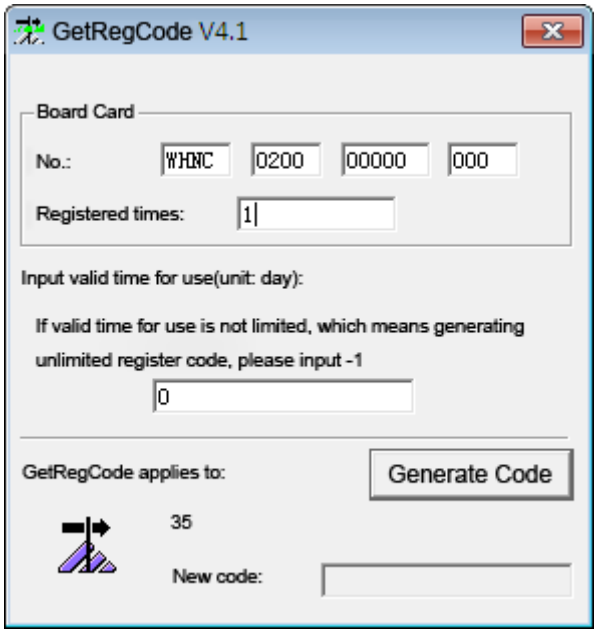


Fig. 3-62 Registration Code Maker-2

2) Under this interface, press F1 [Register] to eject a dialog, as shown in Fig. 3-63. Then input the registration code generated in the first step into the pop-up dialog, and then click “OK”.

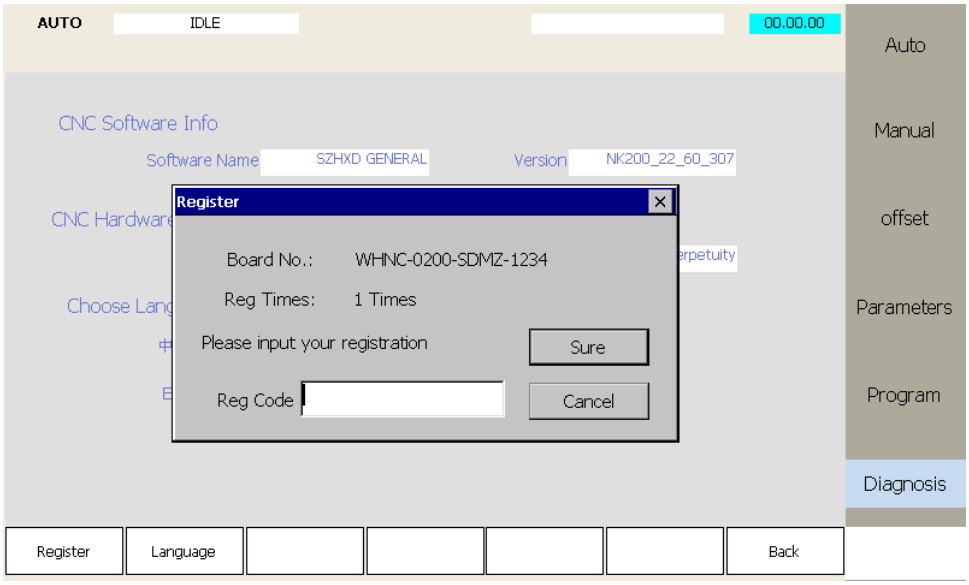


Fig. 3-63 Registration

3) System prompts “register successfully”.

CAUTION

The ID of NK260 varies with the change of registration times, reflected by the last three figures of serial number. When registration times is “0”, the last three figures are “000”; when “1”, the last three figures are “001”.

ID (registered times) must be entered.

3.15.3 Language

Under the interface shown in, pressing F3 can switch languages. At present, NK200 supports Chinese and English and the selected language is the current system language. After F3 is pressed, a dialog box pops up to ask whether to switch to another language. Select Yes to confirm and reboot the system, the language changed successfully.

3.15.4 System Update

Under system info screen, press F2 to update system. A prompt box ejects first to ask whether to update system with system software, shown as below.

Fig. 3-64 System Update

3.15.5 Configuration Option

NK200 supports “Standard configuration” and “Turntable configuration”, which can be switched by setting the parameter “Enable Y revolving axis”. When it is set as “True”, “Turntable configuration” is employed (for the setting of pulse equivalent at this time, refer to section 3.3.2); when “False”, “Standard configuration” is employed.

- **Related Parameters**

Parameter	Definition	Setting Range
Enable Y revolving axis	It sets whether Y axis is CNC turntable.	True: Valid False: Invalid
Y revolving pulse unit	The pulse equivalent of Y axis when it is set as rotary axis	None
Revolving axis unit	It decides the unit of revolving axis.	True: mm False: deg
Revolving workpiece radius	Programming radius of the workpiece to be	None

Parameter	Definition	Setting Range
	processed under turntable mode	
Start up speed of revolving	The max. speed of stepping motor to start working directly without acceleration	None
Acceleration speed of revolving	Under any circumstance, the acceleration of rotation axis will not surpass this value. Its value is decided by mechanical and electrical characteristic of machine tool.	None
Max speed of revolving	Under any circumstance, the velocity of rotation axis will not surpass this value. Its value is decided by mechanical and electrical characteristic of machine tool.	None
Under turntable mode, Y axis acts as rotary axis. The parameter “Revolving axis radius” refers to the radius of the workpiece to be processed, related with the programming diameter in the processing file. If the value of this parameter is set incorrectly, the actual machining dimension will be affected. Parameters “Acceleration speed of revolving” and “Max speed of revolving” set the acceleration and max. speed of rotary axis, related with mechanical characteristic of machine tool. The parameter “Revolving axis unit” decides the unit for rotary axis, related with the unit in the file programming. If “deg” is used in the programming, this parameter should be set as “False”; if “mm” is used in the programming, this parameter should be set as “True”.		

3.16 Auxiliary Function

3.16.1 Jiggle

Coordinate axes can be jiggled during processing with the help of “Jiggle” function. Only valid in auto machining or pause state, this function is used to realize the fine tuning without stopping the machining. Under [Auto] function section, pressing F5 will eject a dialog, as shown below.

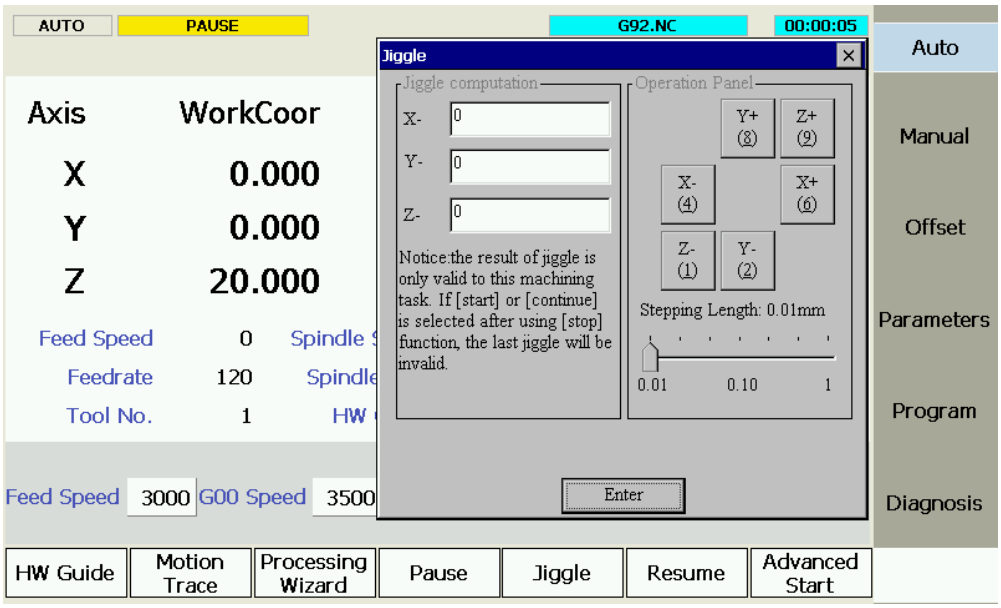
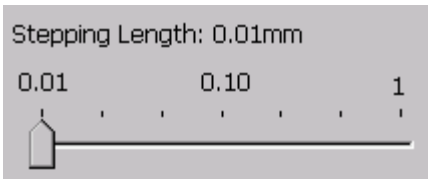


Fig. 3-65 Jiggle

Take positive direction of X axis as an example. When “X+” button (or number 6) is pressed, X axis will move a step along its positive direction. If “X+” is pressed continuously, X axis will keep moving toward its positive direction until this button is released.

The value of step can be adjusted by the slider in the jiggle dialog.



Note that jiggle operation is only valid for current processing task. If stop function is used, jiggle result will be invalid after processing restarts.

3.16.2 Breakpoint Resume

Press F6 [Resume] in [Auto] function section to select this function, and then the system will continue processing from the last stop line number.

If power failure or emergency stop occurs during processing, and users are sure about the accuracy of the workpiece coordinates, they can select this function to make the machine tool rapidly move to the breakpoint for continuing processing, which can save them processing time.

3.16.3 Advanced Start

It is also called selected machining. Under [Auto] function section, press F7 to select this function to realize block skip.

After F7 is pressed, a dialog will pop up, as shown in Fig. 3-66.

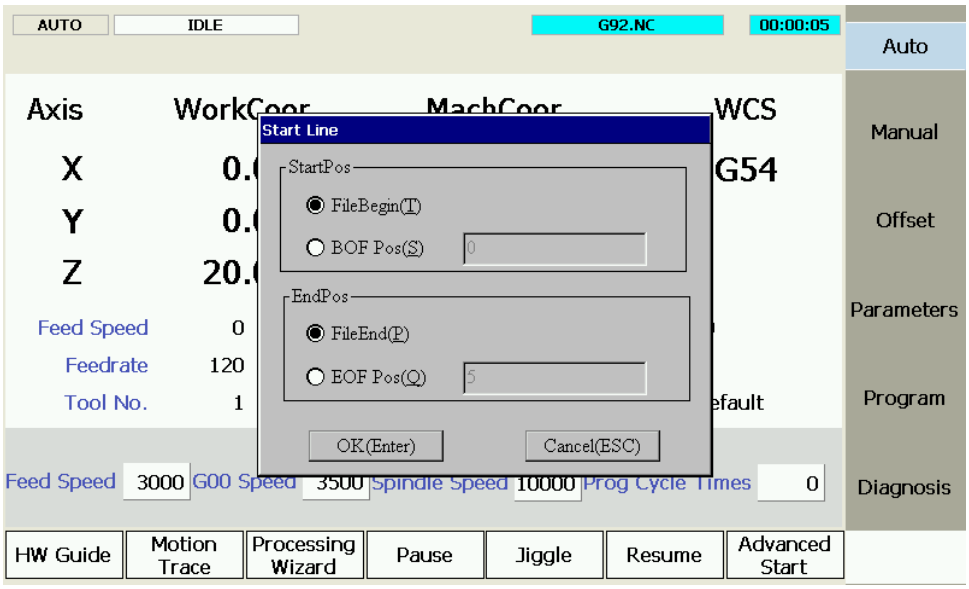


Fig. 3-66 Advanced Start

In this dialog, users can set the initial point and end position of machining according to their actual needs.

Note that homing all axes before processing is required. Or a dialog will pop up as a reminder.

3.16.4 Parameter Backup

The system supports parameter backup function and users can execute one-click restore, import and export functions on the parameters that has been backed-up.

Press SF4 to enter parameter interface and under this screen pressF4 to enter parameter backup interface, as shown in Fig. 3-67.

Fig. 3-67 Parameter Backup Interface

Parameter back up list displays the parameters that have been backed up in different times, and clicking "↑" and "↓" direction keys can select the parameters to be restored.

Press F1 to restore the parameters; press F2 and F3 to export/import parameters to/from the external equipment including USB; press F6 to delete the backed-up parameters while press F7 to return to the previous operation interface.

3.16.5 User Instruction

Under Auto function section, press F3 to enter program wizard interface and then click F5 to switch to the code input screen, as shown below.

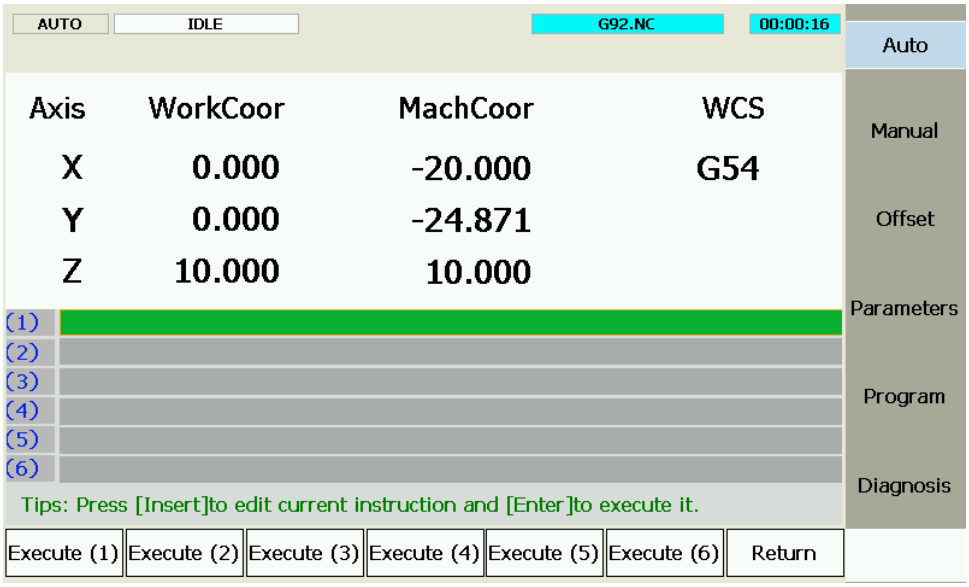


Fig. 3-68 User Instruction Interface

Users can input G code under the prompt to test the correctness of system functions and parameters.

Click “Insert” to open edit dialog box and input code. After that, press Enter to execute current command. The manipulation buttons F1~F6 at the bottom also provide a quick way for command execution.

3.16.6 Coordinate Backup

Under parameter function section, press F5 to enter coordinate backup interface, as shown below:

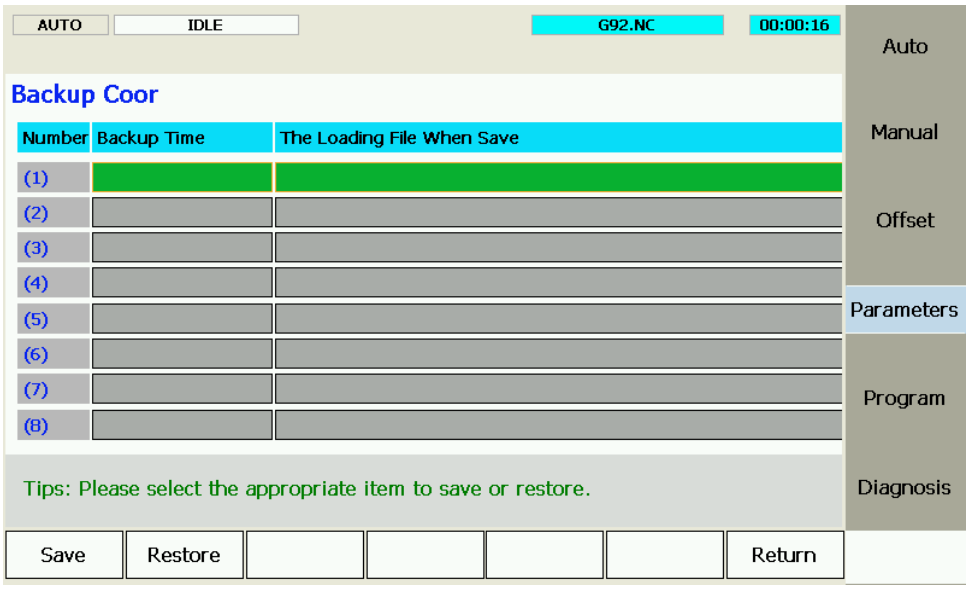


Fig. 3-69 Backup Coordinate Screen

In this screen, press F1 to save current workpiece offset into the system. After machining files loaded into the system, you can press "↑" and "↓" to select the desired workpiece offset, and then press F2 to load the selected offset into the current workpiece coordinate system. See below:

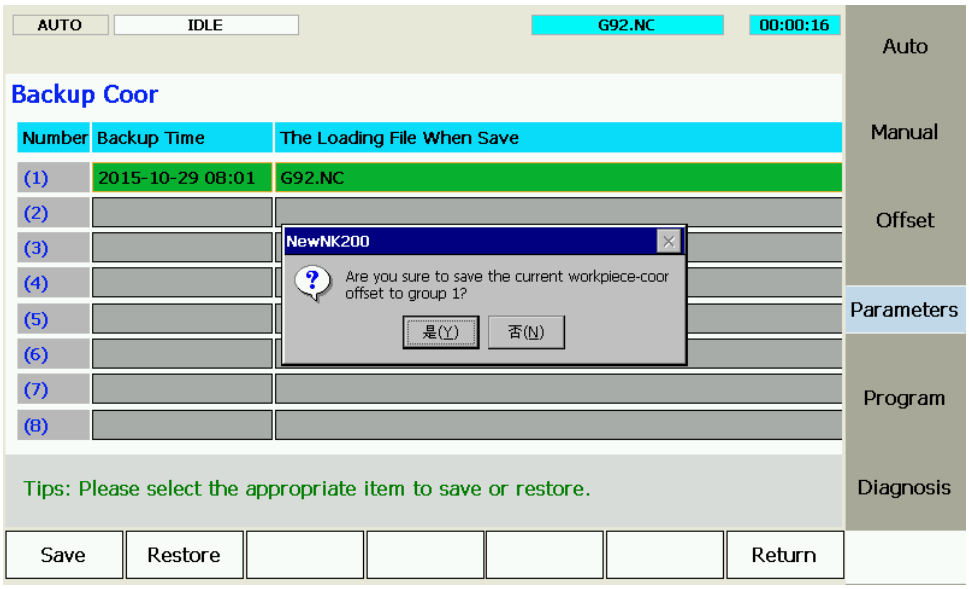


Fig. 3-70 Coordinate Restore Screen

If Z-axis offset coordinate needs to be modified, select "Yes". Otherwise, the system only restores the offset coordinates of other axes.

3.17 Tool Magazine

3.17.1 Automatic Tool Change of Linear Tool Magazine

Linear tool magazine stores tools in the form of array. Taking the magazine equipped with 12 tools for example, you can select a 1-line 12-row tool magazine, or a 2-line 6-row tool magazine. To realize auto tool change, our programming is done according to the related information provided by you in advance (realized in public.dat). The system offers multi-tool coordinate positions, which will not be listed here.

See for the process of auto tool change for linear tool magazine (taking multi-workpiece and a tool magazine parallel to X axis as an example).

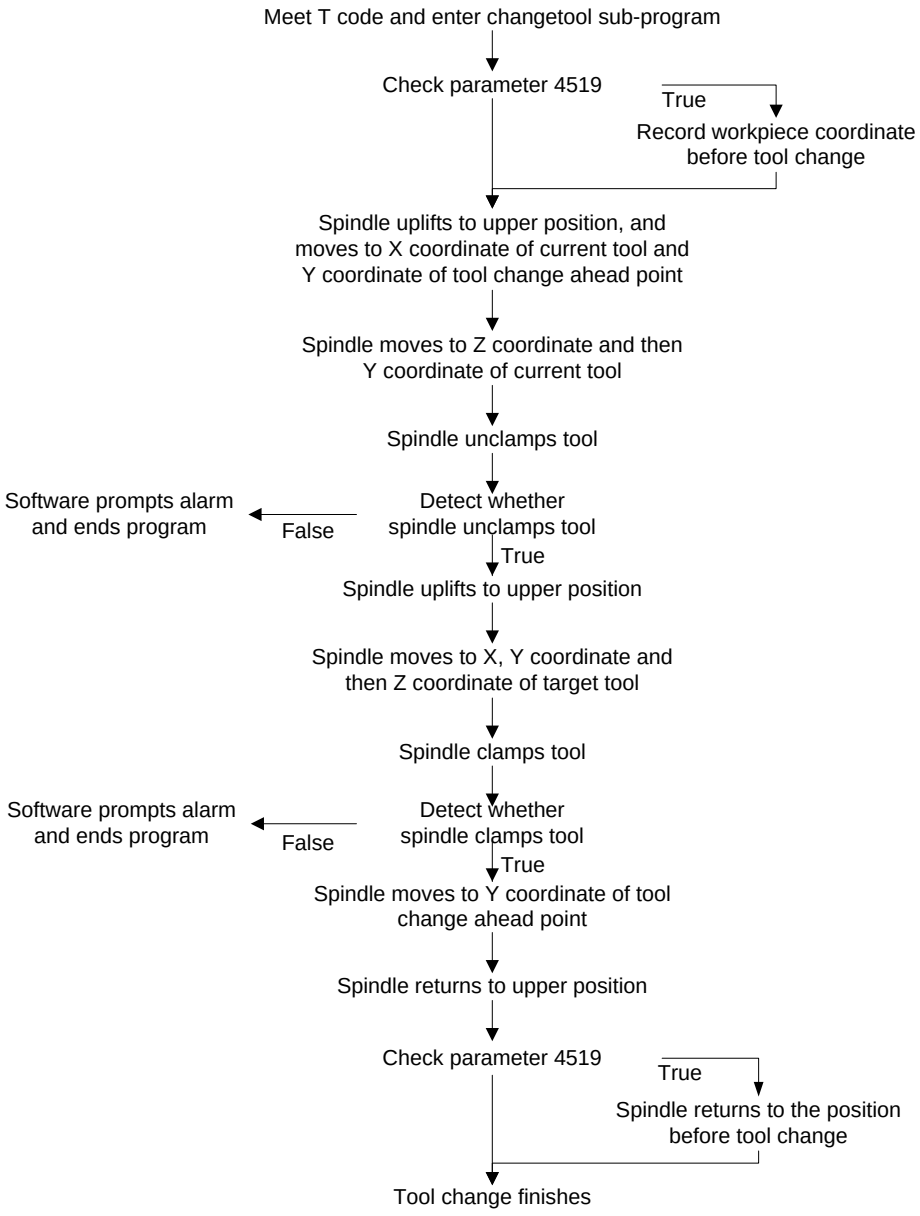


Fig. 3-71 Process of Auto Tool Change for Linear Tool Magazine

3.17.2 Automatic Tool Change of Circular Tool Magazine

When machine tool is with function of circular tool magazine and automatic tool change is needed during file machining, the process of automatic tool change is as follows:

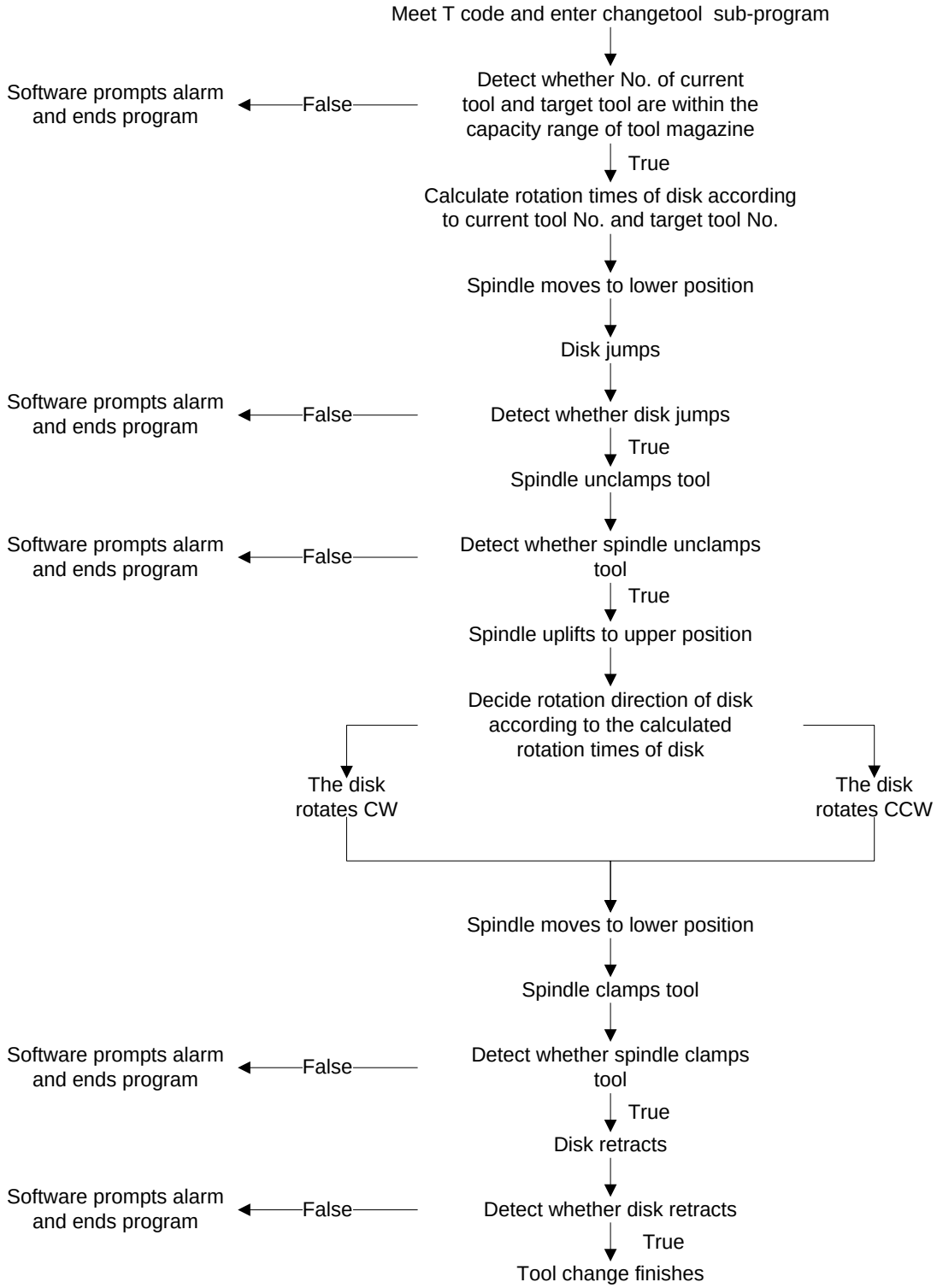


Fig. 3-72 Process of Auto Tool Change for Circular Tool Magazine

CAUTION

Since mechanical configuration of tool magazine varies, the process mentioned above is just applied to the general situation. In case of any difference, please turn to manufacturer to make corresponding adjustment based on actual situation.

3.17.3 Tool Change Parameters

Parameter	Definition	Setting Range
X-axis change tool range upper limit	X-axis machine coordinate of table travel upper limit in tool change	Change tool range lower limit~67108.864
Y-axis change tool range upper limit	Y-axis machine coordinate of table travel upper limit in tool change	
Z-axis change tool range upper limit	Z-axis machine coordinate of table travel upper limit in tool change	
X-axis change tool range lower limit	X-axis machine coordinate of table travel lower limit in tool change	-67108.864~ change tool range upper limit
Y-axis change tool range lower limit	Y-axis machine coordinate of table travel lower limit in tool change	
Z-axis change tool range lower limit	Z-axis machine coordinate of table travel lower limit in tool change	
Tool magazine capacity	The maximum tool quantity saved in tool magazine. After tool capacity is modified, please reboot system before setting corresponding tool coordinates	1~20
Current tool no.	The tool number of the tool currently used	1~tool magazine capacity
Currently tool pan no.	The tool number of the tool dispaly in magazine	1~tool magazine capacity
Tool change prompt	Whether to pause and prompt in case of tool change command	False :Invalid True: Valid
Calibrate cutter after tool change	Whether to preset automatically after tool change	False :Invalid True: Valid
T0 handle mode	0: invalid; 1: to be no-tool state; 2: first tool index is 0	0; 1; 2
Tool change upper position	Z machine coordinate of tool change upper position	-
Tool change lower position	Z machine coordinate of tool change lower position	-
X change tool position	X-axis machine coordinate of spindle in tool change, generally used in disk magazine parameter settings	-

Parameter	Definition	Setting Range
Y change tool position	Y-axis machine coordinate of spindle in tool change, generally used in disk magazine parameter settings	-
X coordinate of tool change ahead position	X coordinate of deceleration position before entering tool magazine	-
Y coordinate of tool change ahead position	Y coordinate of deceleration position before entering tool magazine	-
Z coordinate of tool change ahead position	Z coordinate of deceleration position before entering tool magazine	-
Tool change speed	Spindle speed in tool change	0.001~max. speed of each axis mm/min
Z-axis CT up and CT down speed in tool change	The speed of Z moving to the upper position and lower position in tool change	0.001~tool change speed mm/min
Traversing speed in/out tool magazine	In machine tool change, the speed is used for traversing in/out tool magazine.	0.001~tool change speed mm/min
Tool change delay	Pause time in tool change	0~600000 ms
MovetoOrigPositionAfterChangeTools	After tool change, back to the position where the tool stood before tool change	False: Not back True: Back

4 Maintenance

4.1 Operating System Maintenance

Before a NK200 integrated system is delivered, the system has already been well installed and can be used directly. In case of failure, you can restore it to leave factory state by system recovery. And system upgrade will update the software.

If the system is damaged and cannot be started, it is time to update the mirror image. However, if the system can still be started, updating or re-installing the software is required.

4.1.1 Software Upgrade

The system update steps are as below:.

1) Insert the USB flash disk with *.weihong* the system update file into NK200.

2) Power on and start NK200, while pressing key G several times to enter the system update interface. See Fig. 4-1, USB being recognized.

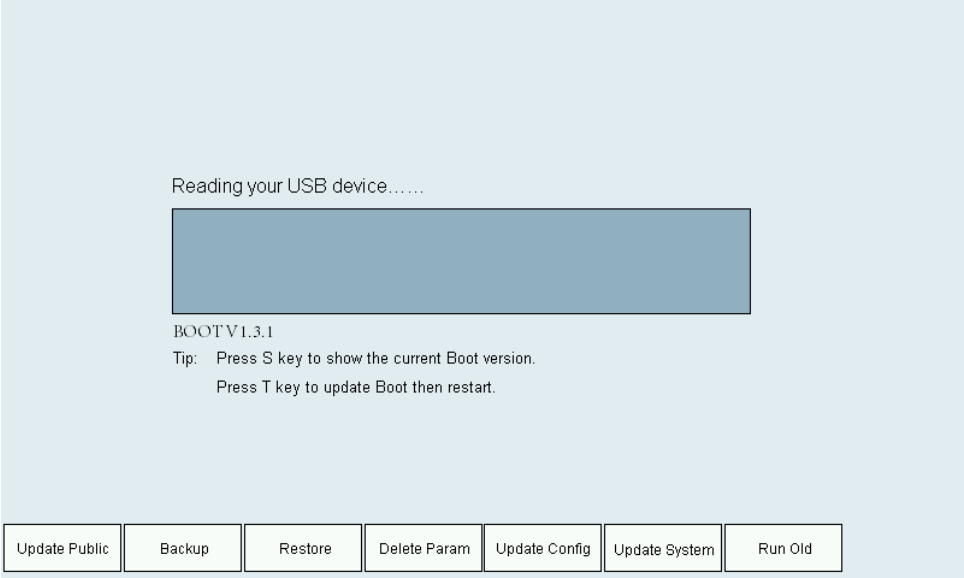


Fig. 4-1 System Update Interface

3) After the USB is recognized, press F6 to eject software update dialog box. And then press "↑" and "↓" keys to select the needed software.

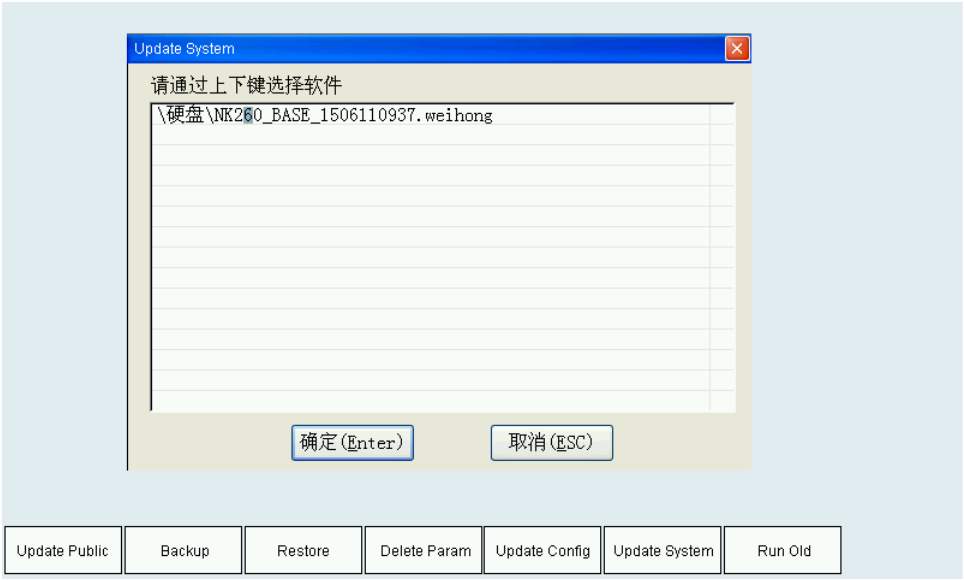


Fig. 4-2 Update System List

4) Press “Enter” after selection and start software update. The updating process is shown as below.

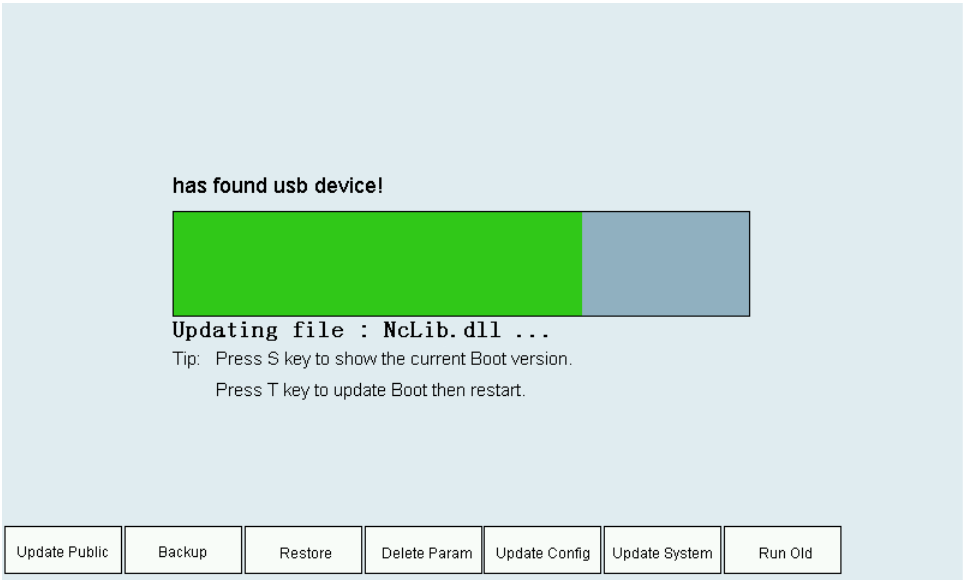


Fig. 4-3 System Update Procedure

5) The new software interface will be switched to automatically after system update completed.

CAUTION

The following gives the method to enter software update interface after USB with *.weihong* file is inserted into NK200 on the condition that the previous software can be normally opened.

Under Diagnose function section, press F7 to enter system info interface and then click F2 to enter software update interface. For more details, see 3.15.4.

4.1.2 Mirror Upgrade

When the system is damaged and can not be booted, mirror update is required. The steps are as follows:

1) Insert the USB flash disk with the system mirror image file *NK200_NK_RX.X.X.nb0* and*.weihong* format software into NK200.
2) After power-on and system start-up, keep pressing M until the system enters Eboot interface. For the introduction to Eboot interface, see
3) Press T to start mirror update. The whole process lasts about 3 minutes.
4) After the mirror update is completed, reboot the system. It will enter the software update interface automatically.
5) In this screen, press F6 to start software upgrade. Repeat the steps of software update.
6) Software installed, the whole process ends.

CAUTION

1) Mirror update and software upgrade should be done simultaneously. Except mirror image file *NK200_NK_RX.X.X.nb0, NK200_*******.weihong* format file also should be saved in the USB root directory or in the NK200 file folder.
2) In software update and installation, the software saved in the USB root directory or in the NK200 file folder must be in the format of *NK200_*******.weihong,* or the system can't recognize it.

The precondition of the two points above: mirror image version should be above R4.0.3 (Boot version V1.1.6). if mirror image version is under V3.9(Boot version V1.0), instead of *NK200_*******.weihong* format file, *nk.nb0* mirror image file and five file folders including "CHN", "Config", "ENG", "Font", and "NewNK200" should be saved in the USB root directory.

4.1.3 System Eboot

Power on NK200 while pressing M key several times until entering system Eboot interface as shown in Fig. 4-4, which includes 8 kinds of update.

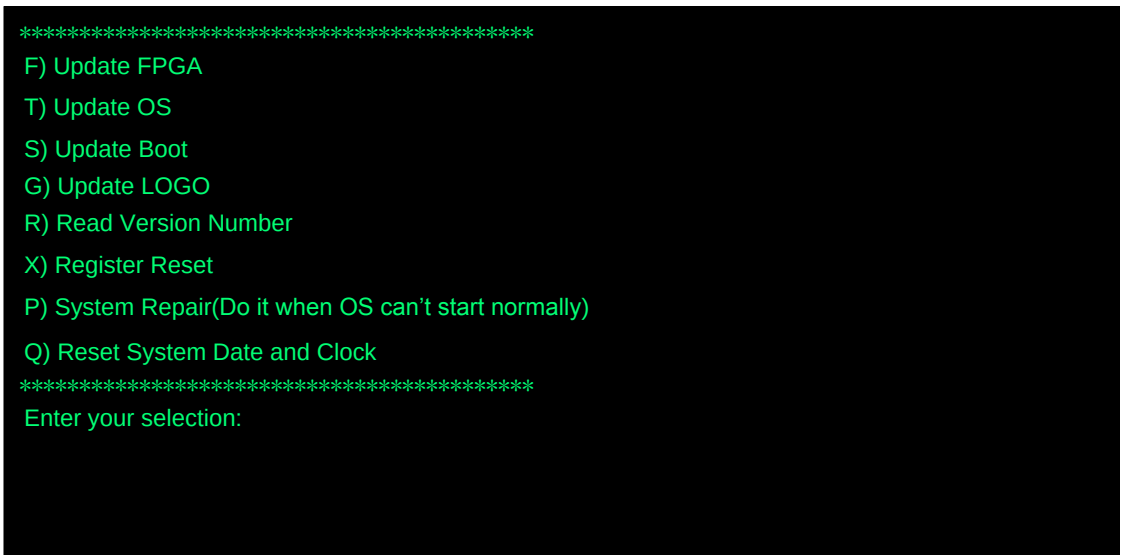


Fig. 4-4 Eboot Interface

- **F) Update FPGA**

Update FPGA program.

- **T) Update OS**

It refers to mirror update, the update used when the system is damaged and can't be booted.

- **S) Update Boot**

Update Boot program.

- **G) Update LOGO**

Update the LOGO shown at the system start up.

- **R) Read Version Number**

Read current BOOT program version number and OS version number.

- **X) Register Reset**

Clear written system registry content and restore it to the default when leaving the factory.

- **P) System Repair**

This function can be done if the system can't enter the interface normally at start up. The system will restore itself and then enter the interface after power-off and reboot.

- **Q) Reset Syste, Date and Clock**

Reset the date and time on display.

4.1.4 Software Upgrade Interface

Since the software upgrade interface is indispensible in mirror image update and software upgrade, a brief introduction to it is given as below:

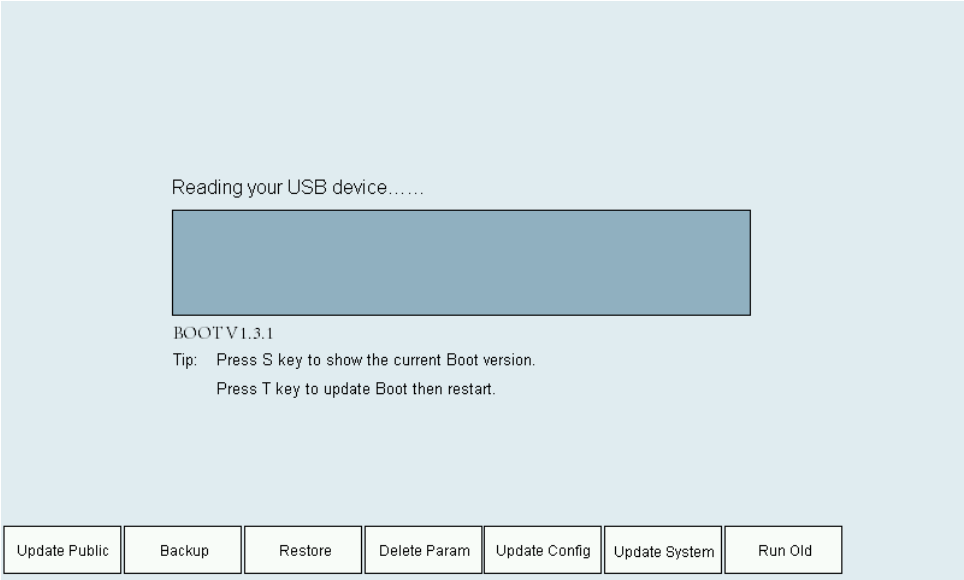


Fig. 4-5 Software Upgrade Interface

- **Update public file**

Update p, namely update the new PUBLIC file, which is saved in CHN\files and ENG\files folders in USB root directory (or NK200 file folder).

- **Export system backup**

It refers to exporting the backup parameter files and their corresponding software to the NK200 Backup file folder in USB root directory (or NK200 file folder).

- **Restore system**

This button pressed, the list displays the backed-up software, i.e. the backed-up software in NK200Backup file folder. It is used to restore system.

- **Delete parameter**

In software upgrade or installation, the parameter setting of the previous software is deleted. If you need to save the set parameters, they don’t have to delete parameter files.

- **Update configuration**

Use the new system configuration, namely the Config file.

- **Update system**

It refers to updating the software or installing new software. New Boot mirror image can only recognise the .weihong format software.

- **Run Old**

Boot the previous system.

4.2 Alarm Information

Type	Warning Content	Cause	Solution
Warning message			
Limit alarm	Positive (negative) limit of X (Y\Z) axis	The polarity of X-axis positive limit port is wrong.	Enter [Port] function screen under [System], and modify the port polarity (refer to section 3.5.1).
		X-axis runs into limit switch directly during motion.	Manually move X-axis away from limit switch.
		There is an error in limit switch itself.	Check if limit switch works normally.
Servo alarm	Servo alarm of X (Y\Z) axis	The polarity of X-axis servo alarm port is wrong.	Enter [Port] function screen under [System], and modify the port polarity (refer to section 3.5.1).
		There is an error in X-axis servo driver itself.	Check if X-axis servo driver works normally.
E-stop alarm	E-stop button is pressed.	The polarity of E-stop port is wrong.	Enter [Port] function screen under [System], and modify the port polarity (refer to section 3.5.1).
		The E-stop button is pressed.	Turn the E-stop button clockwise to make it bounced.
Oil level alarm	Oil level alarm	The polarity of oil level alarm port is wrong.	Enter [Port] function screen under [System], and modify the port polarity (see section 3.5.1).
		When the oil level line in the oil pump is below a certain value, a signal will be sent to the system to give an alarm.	Check if the oil mass is too small in the oil pump.
Spindle alarm	Spindle alarm	The polarity of spindle alarm port is wrong.	Enter [Port] function screen under [System], and modify the port polarity (see section 3.5.1).
		There is an error in inverter.	Find the reason based on the alarm type of inverter.
Error message			

Type	Warning Content	Cause	Solution
Related operations of backing to machine origin	The system has not retuned to the machine origin, failed to execute the operation!	The system has not returned to machine origin. Whether the system has to back to machine origin is decide by parameter 1065 “Back to reference point before mach”. If it is set as “true”, it is a must to back to the machine origin before machining.	Use this function after executing backing to machine origin.
Related errors of state	The system is busy, this operation can’t be executed.	Some illegal operations are performed under machining state.	Stop machining, and execute some operations under idle state.
	Please exit from simulation mode in the status page before changing the state!	It is possible that some illegal operations are performed under simulation mode, like modifying a parameter or pressing some shortcut keys.	Stop simulation and execute some operations under idle state.
	Please switch to Auto mode first.	Perform some operations only available under Auto mode in Manual and Reference Point modes, like pressing “Program Start” under Manual mode.	Switch to Auto mode and then perform the corresponding operation.
	Breakpoint resuming can’t be executed under current state.	“Breakpoint Resuming” button is pressed in the process of machining.	Breakpoint resuming can be performed to continue machining in case of power failure, manually pressing “Program Stop” button, and E-stop in machining.
File error	There is no file loaded in the current parser.	Start file machining with no file loaded in the system.	Load a machining file before start machining.
	Failed to read the machining file, and check if the path of this file is changed.	The file loaded originally is deleted.	It is necessary to re-load the machining file.

4.3 Common Troubleshooting

4.3.1 What should you do if the spindle does not rotate?

1) Check if there is an error in the software. Press [Spindle Start] button and see if the dot before the output port “spindle start-up” in [Diagnosis] function section becomes green. If it does, the software works normally.

2) Test whether the analog voltage output is normal between SVC and GND with a multimeter. If not, check if the connection cable of terminal board becomes loose. If not loose, check if there is an error in the system.

3) Check whether the parameter setting of transducer is right, the spindle and transducer has been damaged and the wiring of the spindle and transducer is correct.

4.3.2 What should you do if an axis does not move?

1) Check if the parameter setting of servo driver is correct (like setting control mode as position control, selecting pulse input port for Panasonic driver, etc.).

2) Check if the servo cable of this axis is well contacted at the joint with system host machine and servo driver.

3) Check if something is wrong with servo driver, motor cable, servo cable or control system (e.g. exchange servo cable and servo driver with those of other axes working normally).

4.3.3 What should you do if servo motor of Z brake can’t be opened?

Start the system and power on machine tool (eliminating system alarm signal), and see if the brake output indicator lamp on the terminal board turns light.

1) If so, test whether there is 24V voltage between brake output ports (BRAKE-COM) with a multimeter. If there is 24V voltage, check whether the wiring of motor brake cable is correct. The motor brake cable should be connected to brake output port on terminal board directly.

2) If not, directly conduct the brake input ports (BK+, BK-) with a conducting wire. If it lights at this time, check whether the servo driver is enabled, the parameter setting related to brake output of servo driver is right, and break output line of driver is correctly wired to terminal board (black line is wired to BK-, and only BK+ is connected to with only one line).

4.3.4 What should you do if machine tool returns to machine origin abnormally?

- Limit alarm or servo driver alarm occurs during backing to machine origin.

1) Check if the software can receive the origin signal of this axis. The method is: trigger the origin switch, and then see if the color of the dot before the "× machine origin" changes from red to green in [Diagnosis] function section. If there is no color change, it indicates the software can't receive the origin signal, needing to check if there is an error in the origin switch or in the wiring of origin switch. To see if the system failure occurs, make the origin signal on the terminal board and COM port into conduction directly with a conducting wire, and then check whether the color of the dot before "× machine origin" changes in [Diagnosis] function section.

2) Check whether the position of origin switch is appropriate to avoid the following three situations: the distance between origin switch and limit switch is too small; the origin switch is installed behind the limit switch; or the position of origin switch is out of the mechanical stroke of machine tool.

- When backing to machine origin, the machine tool motions towards a certain direction at a relatively low speed (ninth of the coarse positioning speed) until limit is triggered.

See if the polarity of "× machine origin" input port is correct in [Diagnosis] function section. When this origin switch is triggered, i.e. there is signal input, the color of the dot should be green. Otherwise, it is red.

- A certain axis moves a very long distance or keeps moving at a rather low speed towards the reverse direction after coarse positioning during backing to machine origin.

The cause of the above phenomenon is that the system can't detect the encoder origin signal of this axis.

1) See if the servo cable of this axis is well contacted at the joints with system host machine and servo driver.

2) Set the value of driver parameter "pre-scaler (frequency divider) of encoder" as 1/2 or 1/4 of the original one if YASKAWA or TECO, etc. driver is used.

3) Check if there is an error in the driver, servo cable, motor cable or the control system (e.g. exchange servo cable and servo driver with those of other axes able to return to machine origin normally).

4.3.5 What should you do if the machine tool motions upward after arriving at the position of tool presetter during presetting?

View and tell whether the polarity of "tool presetting signal" is right in [Diagnosis] screen. The color of the dot before the "tool presetting" signal is red when the system does not receive tool presetting signal.

5 Driver

5.1 Driver Parameters

Parameters listed in this part can make the machine work normally without ensuring machining results. Relevant parameters need adjusting according to the specific machine type.

5.1.1 Parameters 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 0~230	Range: 0~230 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/multiplic-ation	Need calculation 0~230	
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
0~220	_ (no influence)	_ (no influence)	Command Pulse Input → Encoder Resolution / Setting Value of Pr008 → Position Command As shown above, the process is undergone in terms of the setting value of Pr008, not affected by the settings of Pr009 and Pr010.
0	0	0~230	Command Pulse Input → Encoder Resolution / Setting Value of Pr010 → Position Command 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.
	0~230	0~230	Command Pulse Input → Setting Value of Pr009 / Setting Value of Pr010 → Position Command 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.

5.1.2 Parameters Setting of YASKAWA Σ–Ⅱ Servo Driver

Para. No.	Function	Value	Description
Fn010	Set password (to prevent arbitrarily 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	Pulse counter of input command	LXXXX (Hexadeci-mal 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” 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).

<table>
<tr><th>Para. No.</th><th>Function</th><th>Value</th><th colspan="3">Description</th></tr>
<tr><td>Pn200</td><td>Select pulse instruction mode</td><td>0005</td><td colspan="3">Bit 0: Set 5, select the instruction input mode as “pulse + direction”, negative logic.
Bit 3: Set 0, input differential signal into filter.</td></tr>
<tr><td>Pn50A</td><td>Selection function</td><td>8100</td><td colspan="3">Bit 1: Set 0, Servo ON /S-ON, input from 40th pin; Set 7, Servo ON all the time.
Bit 3: Set 8, positive rotation not used and signal input (P-OT) prohibited.</td></tr>
<tr><td>Pn50B</td><td>Selection function</td><td>6548</td><td colspan="3">Bit 0: Set 8, reverse rotation not used and signal input (N-OT) prohibited.</td></tr>
<tr><td>Pn50F</td><td>Selection function</td><td>0300</td><td colspan="3">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</td></tr>
<tr><td>Pn50E</td><td>Selection function</td><td>0211</td><td colspan="3">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.</td></tr>
<tr><td>Pn506</td><td>Servo off, time delay of brake when motor stops</td><td>Depended</td><td colspan="3">Set it when motor with brakes
Default setting is “0”, setting unit is 10ms.</td></tr>
<tr><td rowspan="4">Pn201</td><td rowspan="4">Encoder cycle-divided ratio (Pulse output No. per motor cycle by encoder after cycle-divided)</td><td rowspan="4">Right-side</td><td rowspan="4">Gain Encoder</td><td>Type</td><td>Encoder Pulse No. per Motor Circle (pulses/ revolution)</td></tr>
<tr><td>A</td><td>13bit 2048</td></tr>
<tr><td>B</td><td>16bit 16384</td></tr>
<tr><td>C</td><td>17bit 32768</td></tr>
<tr><td>Pn202</td><td>Electronic gear ratio (numerator)</td><td>Need Calculation</td><td colspan="3" rowspan="2">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.
Pitch 5mm, encoder 17-bit, coaxial connection between motor and screw, pulse equivalent 0.0005mm, Pn202＝8192; Pn203＝625.</td></tr>
<tr><td>Pn203</td><td>Electronic gear ratio (denominator)</td><td>Need Calculation</td></tr>
</table>

5.1.3 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; Bit3: Set 0, input differential signal into filter.
Pn50A	Input signal selection 1	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, 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 and 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). Both numerator and denominator of electronic gear ratio can be reduced, they are integers within “1~65536”. Typical value: pitch 5mm, encoder 17-bit, shaft coupler direct drag, pulse equivalent 0.001mm, Pn20E＝16384; Pn210＝625. Pitch 5mm, encoder 17-bit, shaft coupler direct drag, pulse equivalent 0.0005mm, Pn20E＝8192; Pn210＝625.
Pn210	Electronic gear ratio (denominator)	Need Calculation	

5.1.4 Parameter Setting of PANASONIC MINAS A4 Servo Driver

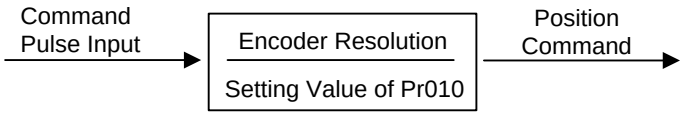
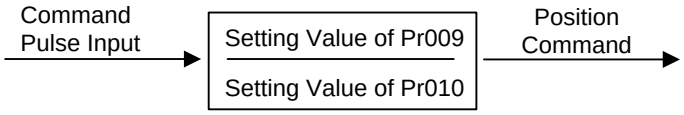
Para. No.	Function	Value	Description
Pr01	LED initial status	12	Monitor if the number of sent and received pulse is correct by setting this parameter. In Weihong control system, the correct quantity of pulse sent by control card is detected by pulse inspection in order to determine whether there is electrical 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: command pulse + command 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 the command pulse frequency multiplication	Need calculation Range: 1~10000	

5.1.5 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
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: command pulse + command direction, negative logic.
Pr0.08	Command pulse No. per motor circle	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: $0\sim2^{30}$	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: $0\sim2^{30}$	

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

Pr0.08	Pr0.09	Pr0.10	Description
$0\sim2^{20}$	- (no influence)	- (no influence)	Command Pulse Input → Encoder Resolution / Setting Value of Pr008 → Position Command 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.

Pr0.08	Pr0.09	Pr0.10	Description
0	0	0~2^{30}	 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.
	0~2^{30}	0~2^{30}	 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.

5.1.6 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=command unit × servo motor resolution × mechanical deceleration ratio / pitch of screw. E.G., pitch 5 mm, encoder resolution 10000, deceleration ratio 1:1, pulse equivalent 0.001 mm, CMX/CDV=10000×0.001/5 = 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	XX02	_ _xx: select SON under position control mode.

Para. No.	Code	Function	Value	Description
		to CN1-15 pin		

5.1.7 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.
3	CMX	Electronic gear numerator	Need calculation	CMX/CDV=command unit × servo motor resolution × mechanical deceleration ratio / pitch of lead screw. E.G., pitch 5 mm, encoder resolution 10000, shaft coupling direct drag, pulse equivalent 0.001 mm, CMX/CDV=10000×0.001/5 = 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.

5.1.8 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	002	X=2: pulse + direction; Z=0: positive 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 calculatio-n	N1/M= encoder pulses × 4× pulse equivalent× mechanical deceleration ratio/ pitch. Representative value: encoder pulses =2500, pitch=5mm, pulse equivalent=0.001mm/p, deceleration ratio=1, calculation as below: N1/M= 2500×4×0.001/5 = 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 calculatio-n	
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	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
P2-16	Digital Input Pin DI7	X2X1X0	100	

Para. No.	Function	Format & Range	Value	Description
				open) a-contact points; X1X0=00, limit signal input of the driver is not used.
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.
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.

5.1.9 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	002	X=2: pulse + direction; Z=0: positive 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 × 4 × encoder pulses × pulse equivalent / pitch. Representative value: encoder pulses=2500, pitch =5mm, pulse equivalent=0.001 mm/p, deceleration ratio = 1, calculation as below: N1 / M = 2500×4×0.001/5 = 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	Function setting for digital input pin 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 the driver is not used.
P2-18	Function setting for digital output pin DO1	X2X1X0	108	DO1 corresponds to 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 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 as NC b-contact point. X1X0=07: set pin 1 as ALRM+.

5.1.10 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	002	X=2: pulse + direction; Z=0: positive 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 calculatio-n	N1/M= mechanical deceleration ratio × 4 × encoder pulses × pulse equivalent / pitch. Representative value: encoder pulses=2500, pitch =5mm, pulse equivalent=0.001, deceleration ratio = 1, calculation as below: N1 / M = 2500×4×0.001/5 = 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 calculatio-n	
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 input as NO a-contact points. X1X0=00, limit input of driver is not used.
P2-16	Function setting for digital input pin DI7	X2X1X0	100	

Para. No.	Function	Format & Range	Value	Description
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.

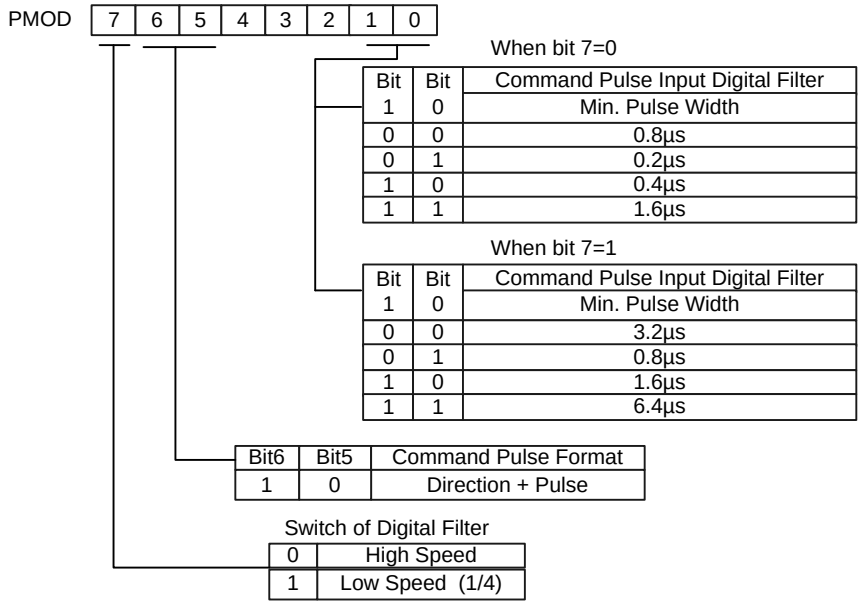
5.1.11 Parameter Setting of DELTA ASDA-B2 Servo Driver

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	002	X=2: pulse + direction; Z=0: positive 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 calculatio-n	N1/M= mechanical deceleration ratio × 4 × encoder pulses × pulse equivalent/ pitch Representative value: encoder pulses =40000, pitch =5mm, pulse equivalent=0.001, deceleration ratio = 1,
P1-45	Electronic Gear Ratio	1~32767	Need calculatio-	

Para. No.	Function	Format & Range	Value	Description
	(Denominator) (M)		n	calculation as below: N1 / M = 40000×4×0.001/5 = 32/1, N1=32, M=1; When the multi-electronic gear ratio is not used, P2-60 ~P2-62 are not required.
P2-10	Function setting for 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	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 input as NO a-contact points. X1X0=00, limit input of the driver is not used.
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.
P2-18	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.

5.1.12 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		Depend on the 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 encoder circle is 2000 shaft coupling direct drag; so 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	Pulse format of position command:				

<table>
<tr><th>Para. No.</th><th>Abbr.</th><th>Name</th><th>Standard Value</th><th>Setting Range</th><th>Unit</th><th>Remark</th></tr>
<tr><td></td><td></td><td colspan="5">Our system uses: direction + pulse format, the parameters are shown as follows:
 
</td></tr>
<tr><td>4-3</td><td>TYPE</td><td>Control mode:
*Select one control mode from position, velocity, and torque modes.
<table><tr><th>Selection Item</th><th>Content</th></tr><tr><td>Position</td><td>Position control mode</td></tr><tr><td>Velocity</td><td>Velocity control mode</td></tr><tr><td>Torque</td><td>Torque control mode</td></tr><tr><td>Velo ↔Torq</td><td>Velocity ↔ Torque switch mode</td></tr><tr><td>Posi ↔Torq</td><td>Position ↔Torque switch mode</td></tr><tr><td>Posi ↔Velo</td><td>Position ↔Velocity switch mode</td></tr></table>
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).</td><td>6 types</td><td>Our system selects position control mode.</td></tr>
</table>

5.1.13 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: positive rotation effective
11	Input command mode	02	Pulse + negative logic
15	Setting of electronic gear	8/5	It depends on the resolution of the specific encoder. E.G.: incremental encoder 2000, motor needs 2000 ×4=8000 pulses per circle. When pulse equivalent of Weihong control card is 0.001mm/p, i.e. 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			
02	Encoder selection	00	Standard incremental encoder. The parameter depends on the specific situation, what we list is only the representative one.
03	Encoder resolution	2000	500－65535, set the encoder resolution manually.
08	Control mode selection	02	Select position control mode

5.1.14 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. When pulse equivalent of Weihong control card is 0.001mm/p, i.e. 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

5.1.15 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.

Para. No.	Parameter Name	Value	Description
PA12	Numerator of position command pulse ratio	2	Set the ratio of the 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 photo electricity encoder, C of our system =2500. E.G.: input command pulse with number of 6000 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. We recommend the range of electronic gear ratio as: $\frac{1}{50} \le G \le 50$
PA13	Denominator of the 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 following three modes can be selected by setting the parameter: 0: pulse + symbol; 1: positive rotation pulse / negative rotation pulse; 2: two orthogonal pulses inputs Default setting is 0: pulse + symbol, negative logic.
PA20	Invalid input on the end of the stroke	1	0: Valid stroke end of LSP, LSN positive rotation, negative rotation. When switch LSP is connected, driving of the positive rotation is allowed; When switch LSP is disconnected, driving of the positive rotation is prohibited (torque of the positive direction is 0). LSN is the same as LSP. If LSP and LSN are both disconnected, the abnormal alarming of driving prohibited will occur (NO.7).

Para. No.	Parameter Name	Value	Description
			1: Invalid stroke end of LSP, LSN positive rotation, negative rotation. No matter which state of the switch LSP and LSN is in, driving of positive rotation and negative rotation are both allowed. Simultaneously, even if LSP and LSN are all disconnected, abnormal alarming of driving prohibited will not occur (NO.7). 2: Invalid stroke end of LSP, LSN positive rotation, negative 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.) 3: Valid stroke end of LSP, LSN positive rotation, negative rotation. When switch LSP is connected, driving of the positive rotation is allowed; When switch LSP is disconnected, driving of the positive rotation is prohibited (the speed of positive 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 will not occur (NO.7).

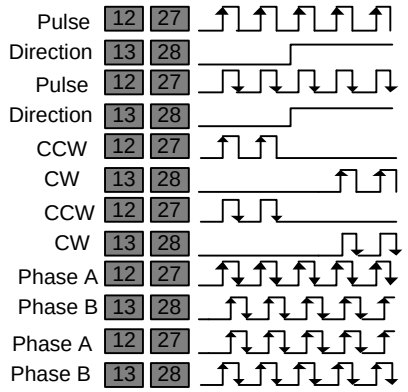
5.1.16 Parameter Setting of FUJI FALDIC-β Servo Driver

Para. No.	Name	Value	Description
01	Command pulse numerator α	Need calculation 1~32767	Command pulse numerator and denominator are also equal to those of the electronic gear ratio. α/ β=encoder resolution× pulse equivalent× mechanical deceleration ratio / screw pitch. Typical value: encoder resolution 65536, pitch 5mm, pulse equivalent 0.001, mechanical deceleration ratio 1, α / β=65536×0.001 / 5=8192 / 625, So α=8192, β=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	1	CONT1 is distributed as RUN (i.e. SON); if not distributed, CONT1 will be auto ON if there is no alarming when powered.

Para. No.	Name	Value	Description
	distribution		
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	Its initial value is 0, and it is set "1" here to enable servo (RUN).

5.1.17 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: 4× pulse frequency fed back by servo encoder = command pulse frequency× F0f / F10; value of F0f / F10 must be within 1/100~100. (calculation with pitch as 10mm)
F10	Electronic gear ratio denominator	1	
F00	Control mode selection	2	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; 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; 2: Position pulse running mode; accept the input of external position pulse and direction level signal; 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 ▲; 4: Torque mode; make sure the value and direction of motor torque according to the external analog -10V ~ +10V signal of CN2-43, 1;

<table>
<tr><th>Para. No.</th><th>Para. Name</th><th>Value</th><th>Description</th></tr>
<tr><td></td><td></td><td></td><td>5~10: Mixed mode; select mode according to the port input status of CN2-24:
<table>
<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>
<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>
</table></td></tr>
<tr><td>F2e</td><td>Pulse input mode selection</td><td>2</td><td>Command pulse string mode selection of position mode:
1 – Single pulse train positive logic
2 – Single pulse train negative logic
3 – Double pulse train positive logic
4 – Double pulse train negative logic
5 – Orthogonal pulse positive logic
6 – Orthogonal pulse negative logic
 
</td></tr>
</table>

5.1.18 Parameter Setting of TECO TSDA Servo Driver

<table>
<tr><th>Para. No.</th><th>Function</th><th>Value</th><th colspan="3">Description</th></tr>
<tr><td rowspan="7">Pn010-1</td><td rowspan="7">Set control mode</td><td rowspan="7">1</td><td rowspan="2">Value</td><td>Control mode</td><td></td></tr>
<tr><td>CN1 Pin12 open circuit</td><td>CN1 Pin12 closed circuit</td></tr>
<tr><td>0</td><td>Speed control</td><td>Speed control</td></tr>
<tr><td>1</td><td>Position control</td><td>Position control</td></tr>
<tr><td>2</td><td>Torque control</td><td>Torque control</td></tr>
<tr><td>3</td><td>Speed control</td><td>Speed control</td></tr>
<tr><td>4</td><td>Position control</td><td>Position control</td></tr>
<tr><td>5</td><td>Torque control</td><td>Torque control</td></tr>
<tr><td rowspan="4">Pn010-2</td><td rowspan="4">Set the pulse input format under position control mode</td><td rowspan="4">0</td><td>Value</td><td colspan="2">The format of pulse input</td></tr>
<tr><td>0</td><td colspan="2">Pulse + direction</td></tr>
<tr><td>1</td><td colspan="2">Dipulse</td></tr>
<tr><td>2</td><td colspan="2">A/B phase difference</td></tr>
</table>

Para. No.	Function	Value	Description	
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	5	The input pulse amount will be multiplied with this number before output. Ratio range of parameter 21 to 22: 1/127＜parameter 21/ parameter 22＜127	
Pn022	Electronic gear ratio denominator	1	The input pulse amount will be multiplied with this number before output. Ratio range of parameter 21 to 22: 1/127＜parameter 21/ parameter 22＜127	
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. 7 means frequency received is 200Kpps.	

CAUTION

For the parameter setting of driver of various brands, refer to the driver manual of specific brand.

5.2 Wiring Diagram of NK200 and Differential Input Stepping Driver

There are X-, Y- and Z-axis interfaces at the rear of NK200. To connect a servo driver, just connect an axis interface to the corresponding port through the matched servo cable of the brand. However, to connect a stepping driver, weld four wires to the four pins of WEIHONG DB15 interface (11PUL+, 12PUL-, 13DIR+ and 14DIR-), connected to P+, P-, D+ and D- ports of the driver respectively.

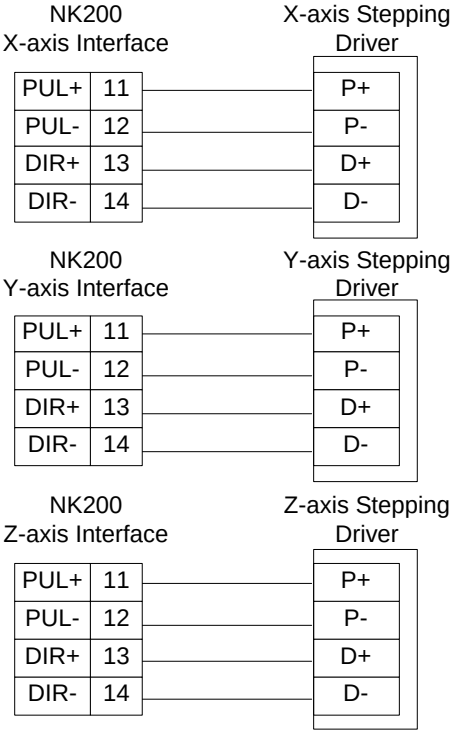


Fig. 5-1 Connection between NK200 and differential input stepping driver

5.3 Wiring Diagram of NK200 and Servo Driver

Wiring diagrams in this part are the wiring diagrams of control system-axes control-driver motion. When you want to use one axis of the control system to control the motion of two drivers, the wiring diagram is as shown in Figure 2 in section 5.3.1 and Figure 3 in section 5.3.6 (take YASKAWA driver and DELTA driver as an example; for YASKAWA server, its alarm signal wiring is NC type, while for DELTA server, its alarm signal wiring is NO type).

5.3.1 Wiring Diagram of WISE Driver

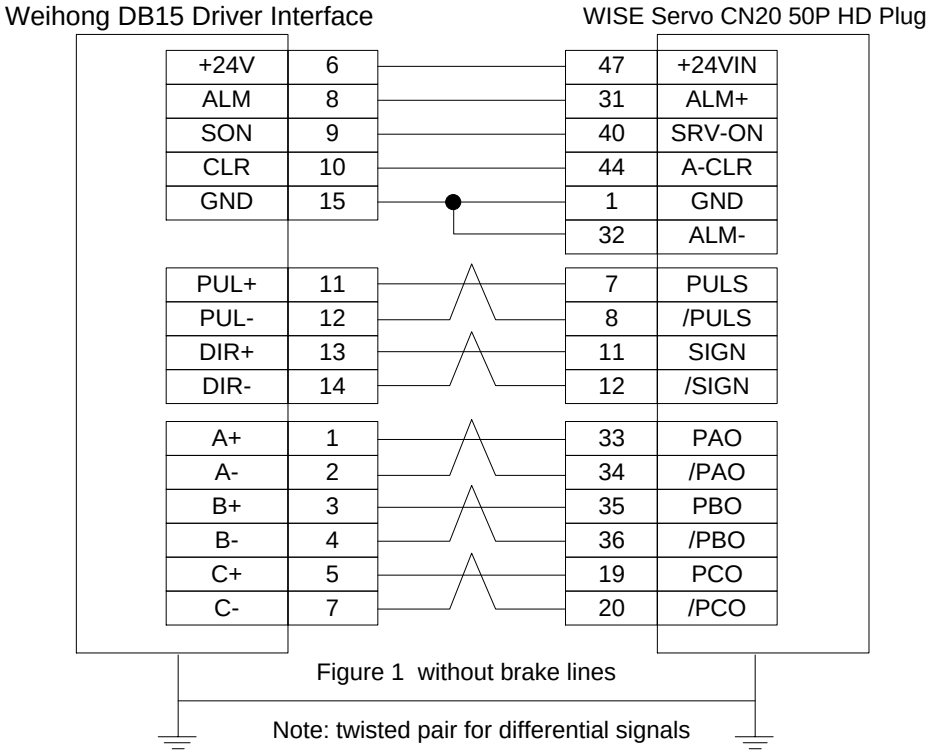


Figure 1 without brake lines

Note: twisted pair for differential signals

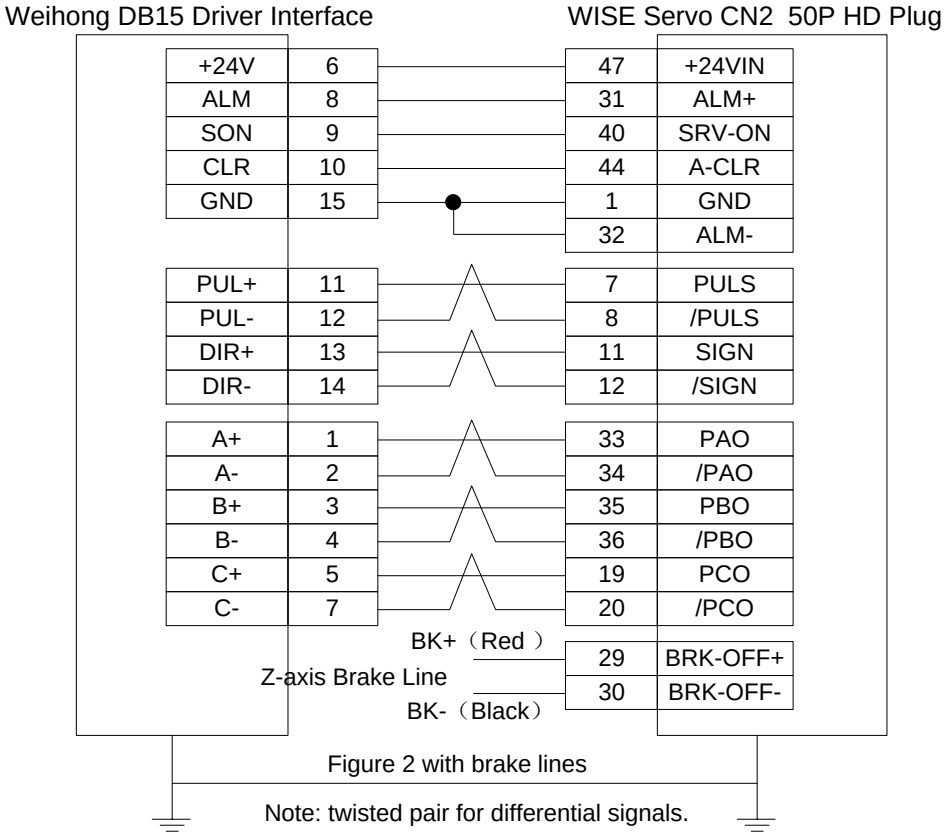


Figure 2 with brake lines

Note: twisted pair for differential signals.

5.3.2 Wiring Diagram of YASKAWA AC Servo Driver

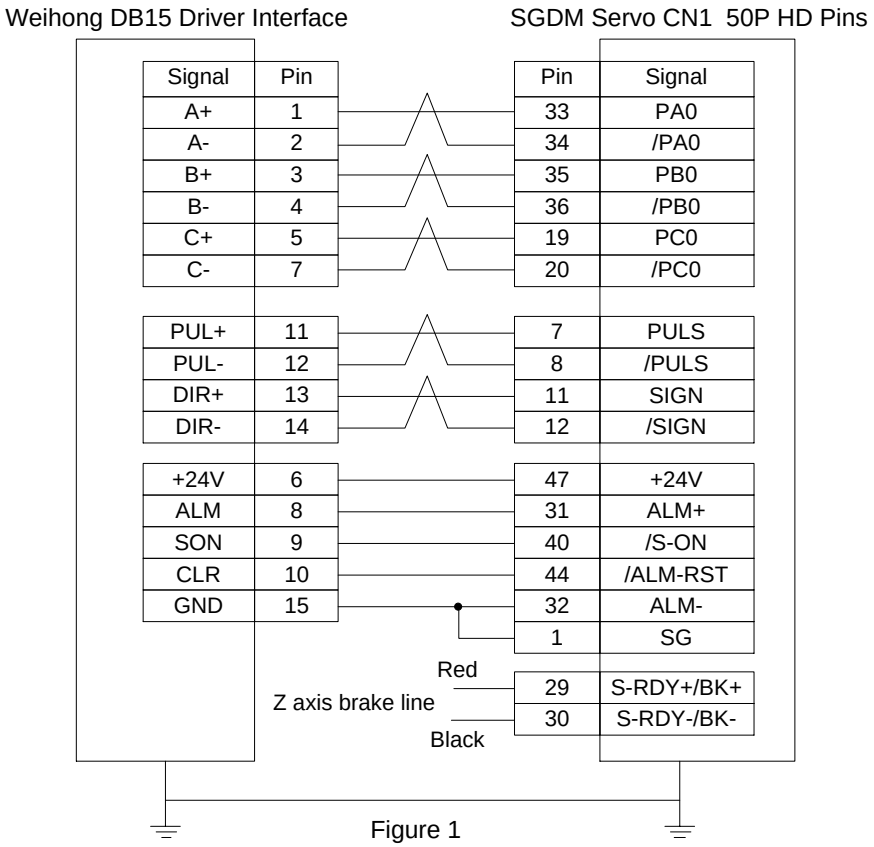


Figure 1

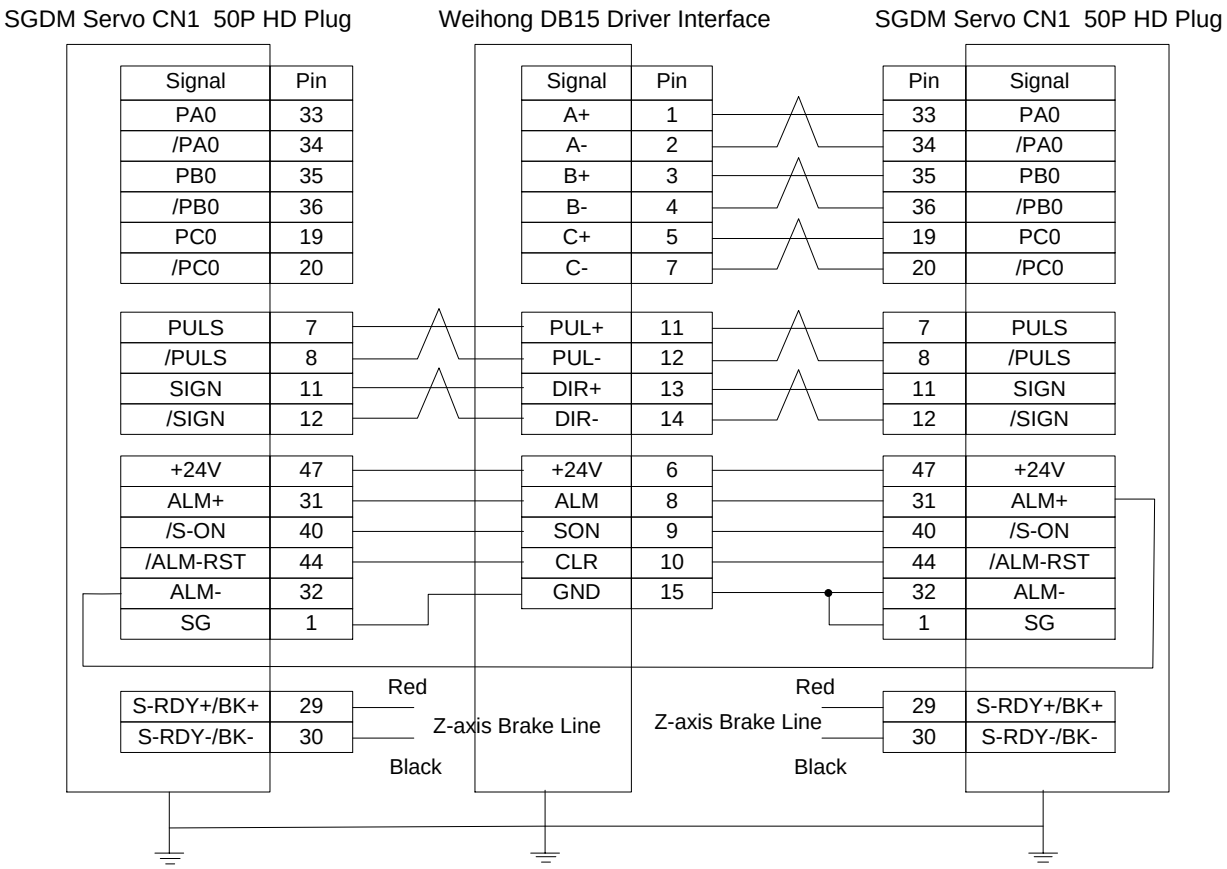
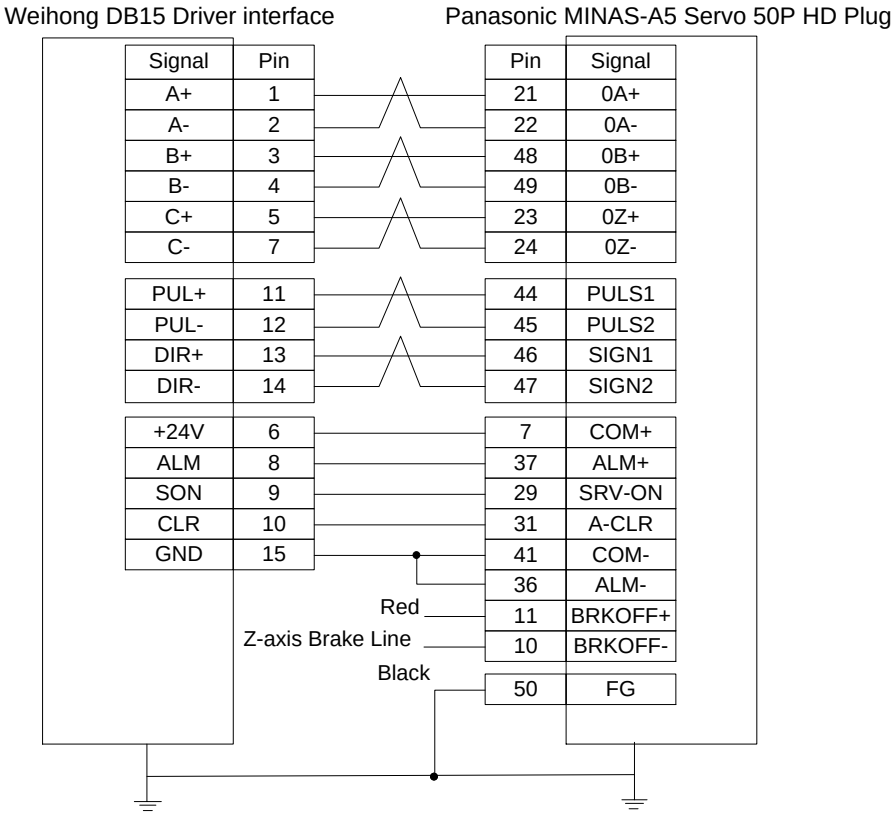


Figure 2

5.3.3 Wiring Diagram of PANASONIC AC Servo Driver



5.3.4 Wiring Diagram of MITSUBISHI MR-JE Servo Driver

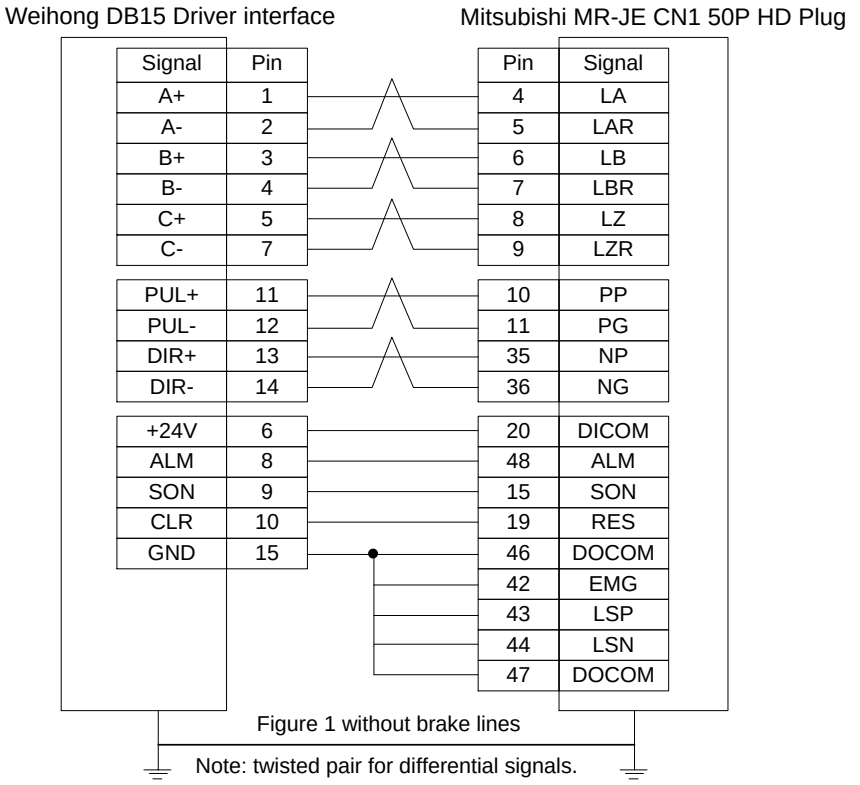


Figure 1 without brake lines

Note: twisted pair for differential signals.

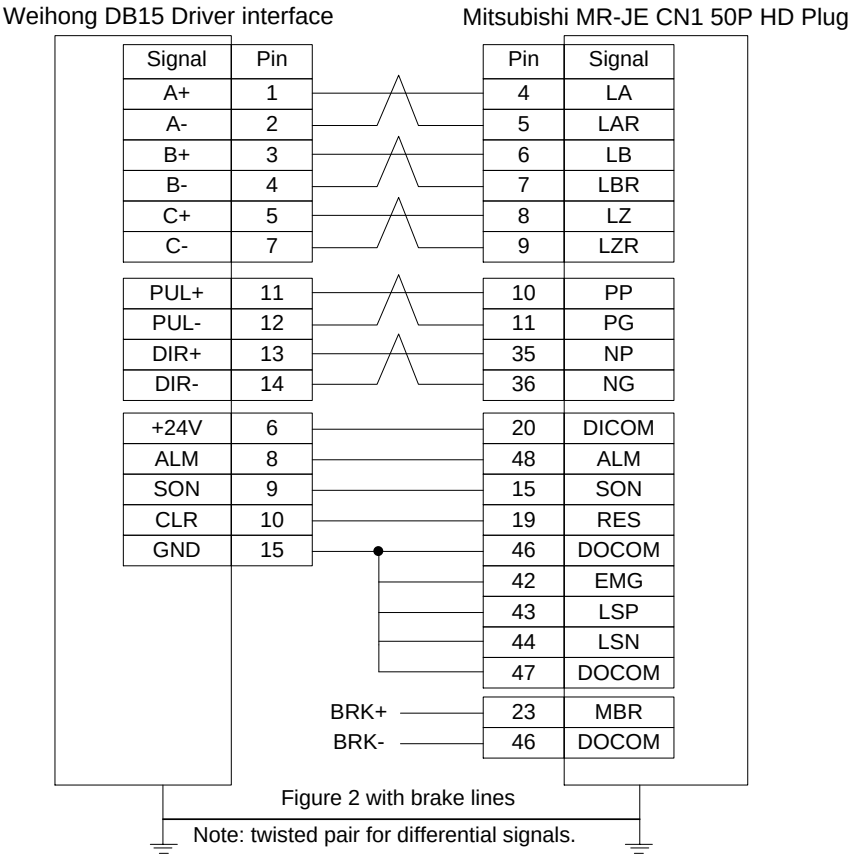
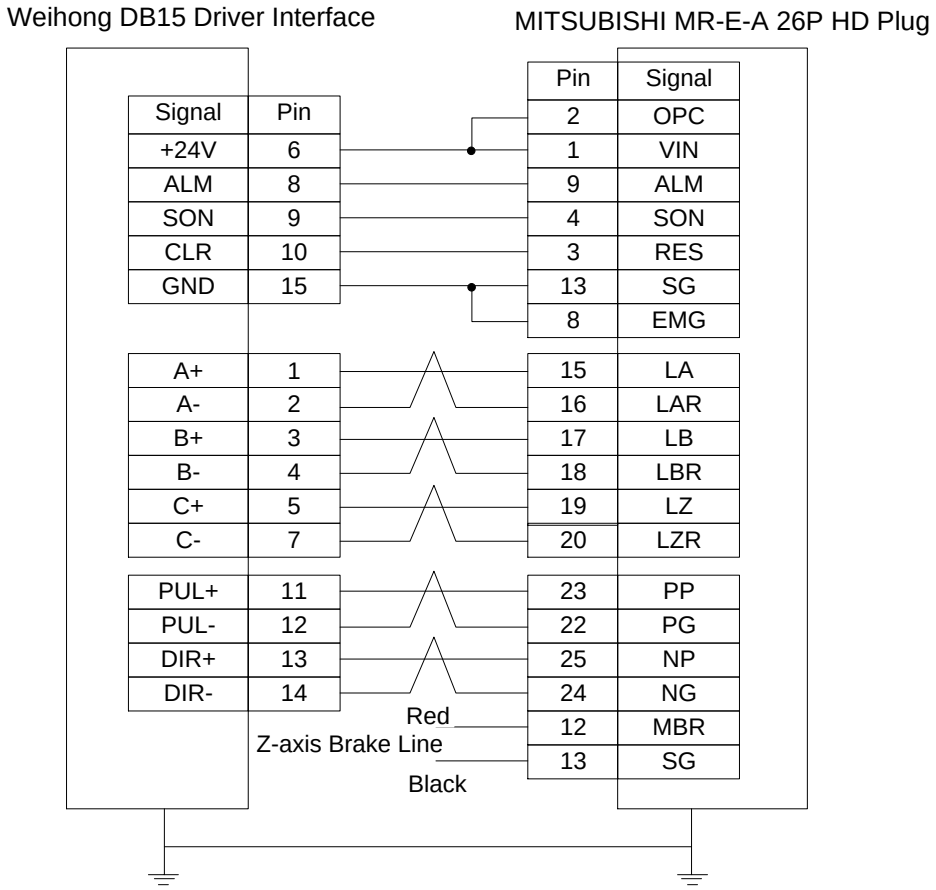


Figure 2 with brake lines

Note: twisted pair for differential signals.

5.3.5 Wiring Diagram of MITSUBISHI MR-E Servo Driver



5.3.6 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 section 5.1.6 and section 5.1.8.

Weihong DB15 Driver Interface

Signal	Pin
A+	1
A-	2
B+	3
B-	4
C+	5
C-	7
PUL+	11
PUL-	12
DIR+	13
DIR-	14
+24V	6
ALM	8
SON	9
CLR	10
GND	15

DELTA ASDA-A Servo 50P

Pin	Signal
21	OA
22	/OA
25	OB
23	/OB
50	OZ
24	/OZ
43	PULSE
41	/PULSE
36	SIGN
37	/SIGN
11	COM+
28	DO5+ ALRM
9	DI1 SON
33	DI5 ARST
45	COM-
30	DI8 EMGS
27	DO5-
47	COM-
1	DO4+
26	DO4-

Red
Z-axis Brake Line
Black

Figure 1

Weihong DB15 Driver Interface

Signal	Pin
+24V	6
ALM	8
SON	9
CLR	10
GND	15
PUL+	11
PUL-	12
DIR+	13
DIR-	14
A+	1
A-	2
B+	3
B-	4
C+	5
C-	7

DELTA ASDA-B DB25 (Two-line Pinholes)

Pin	Signal
4	COM+
17	DI1 SON
1	DO3+ ALM
18	DI2 ARST
13	COM-
22	PULSE
21	/PULSE
20	SIGN
19	/SIGN
10	OA
23	/OA
12	OB
11	/OB
24	OZ
25	/OZ
16	DO1+
13	COM-

Red
Z-axis Brake Line
Black

Figure 2

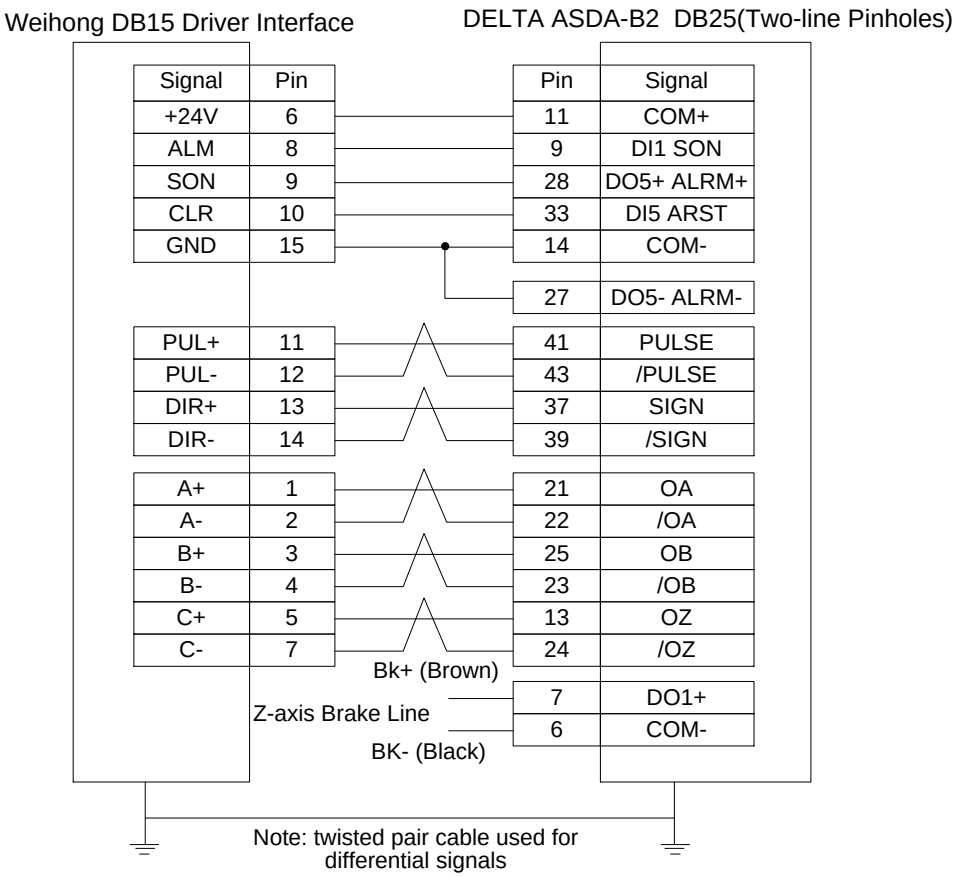


Figure 3

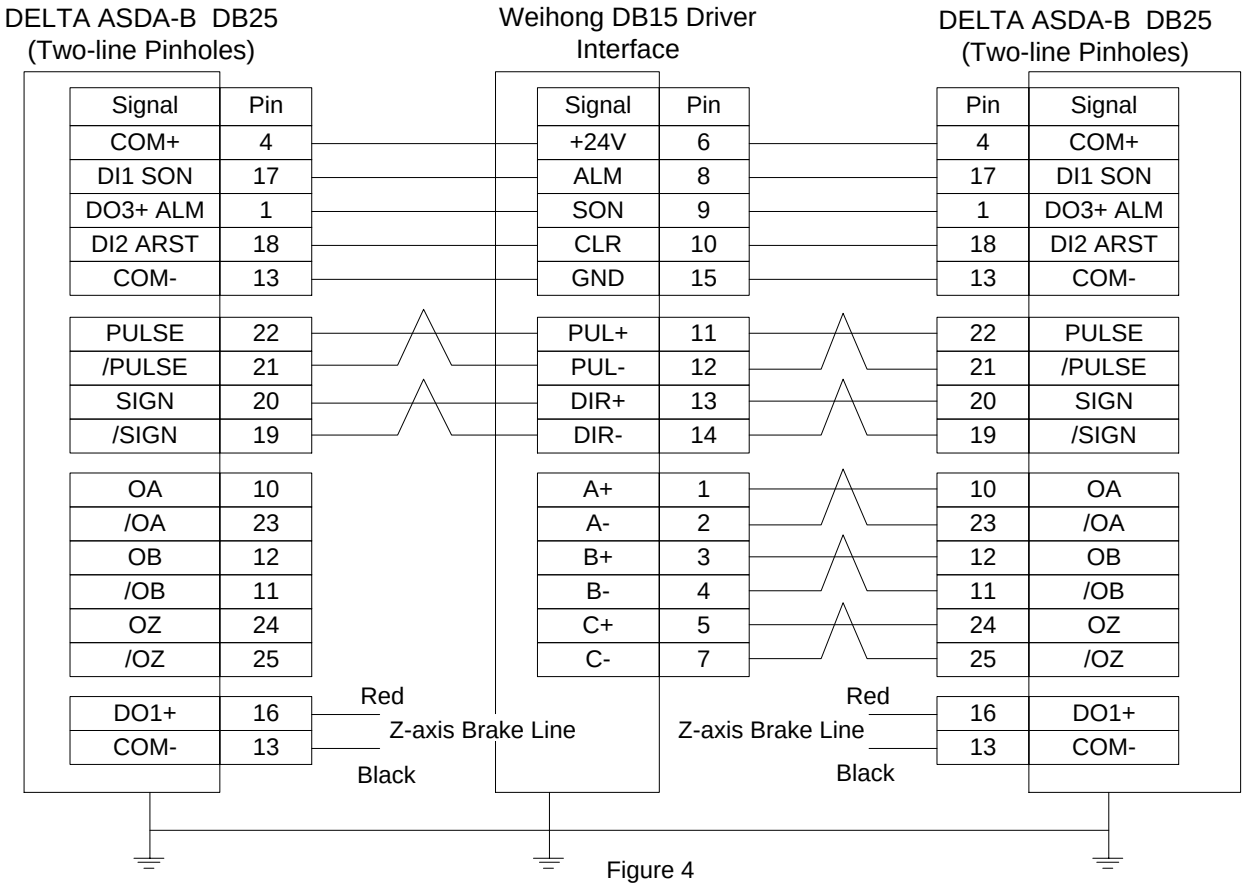
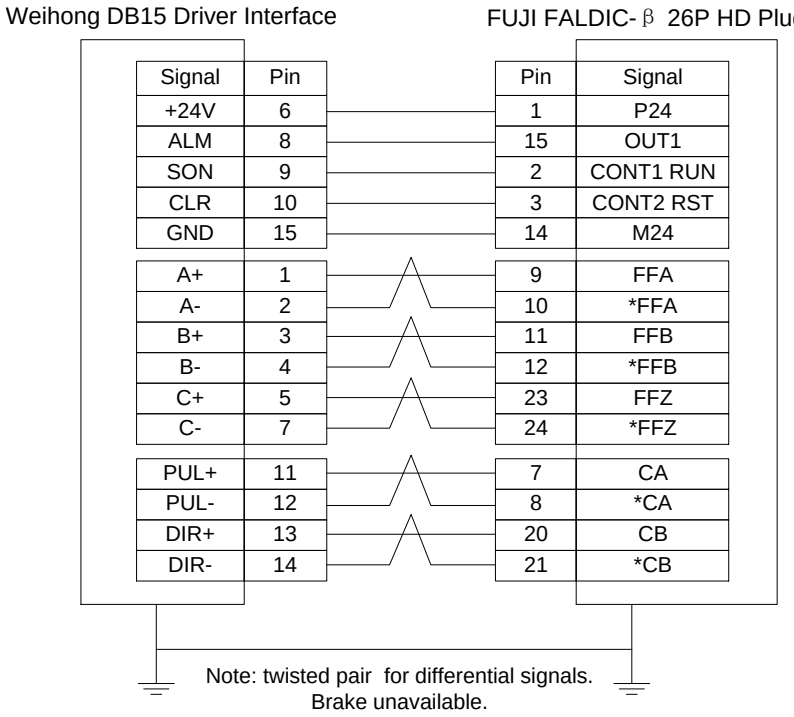
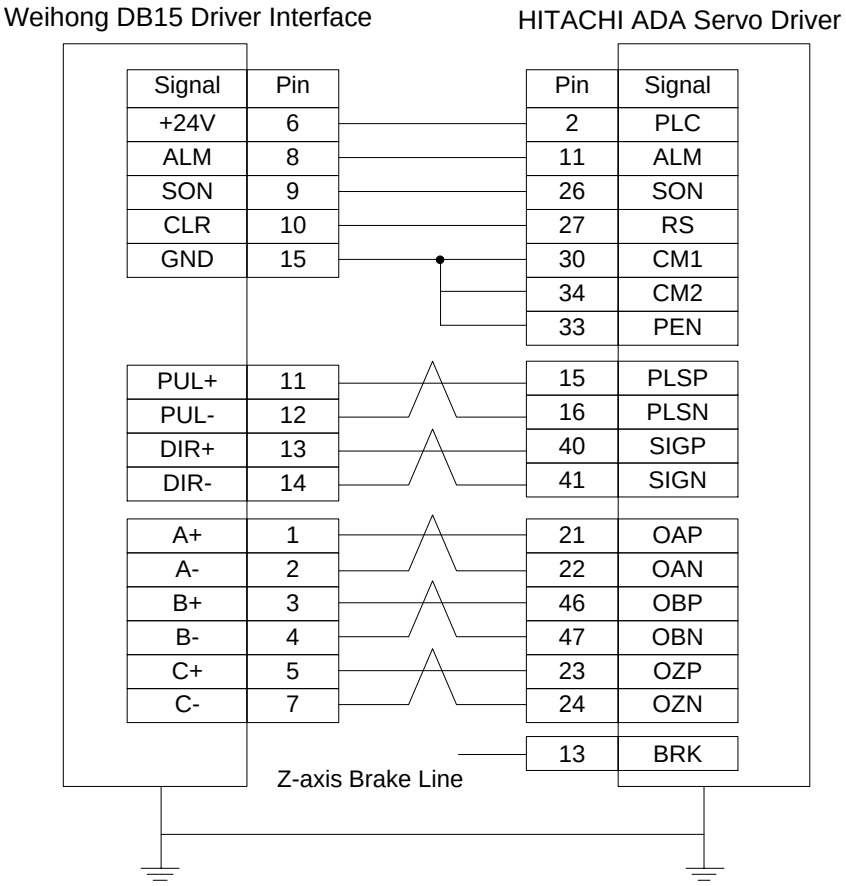


Figure 4

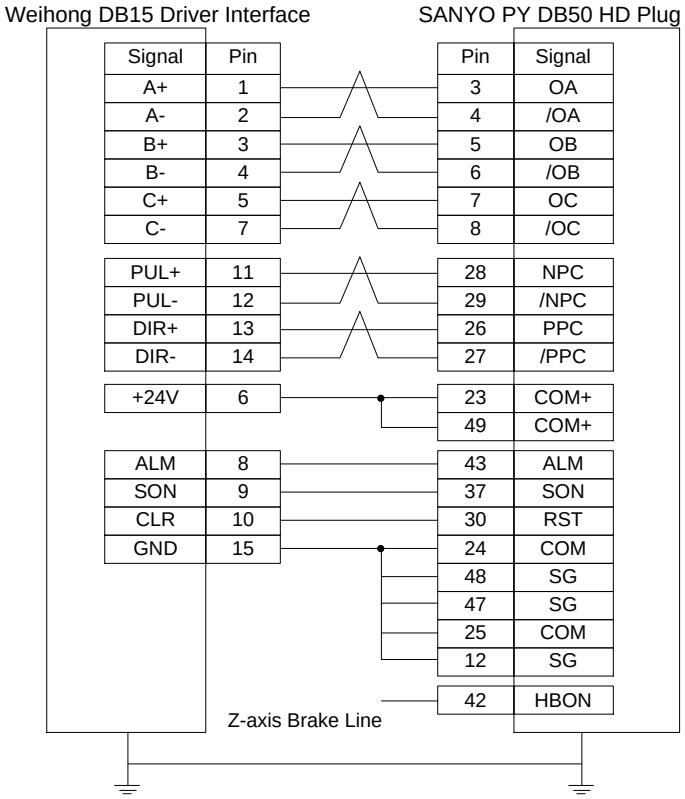
5.3.7 Wiring Diagram of FUJI Servo Driver



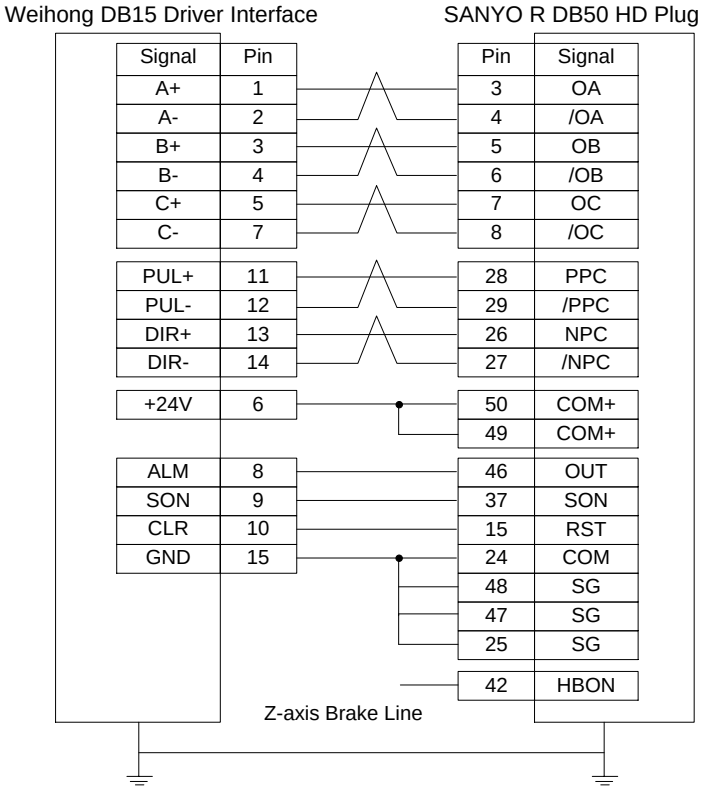
5.3.8 Wiring Diagram of HITACHI Servo Driver



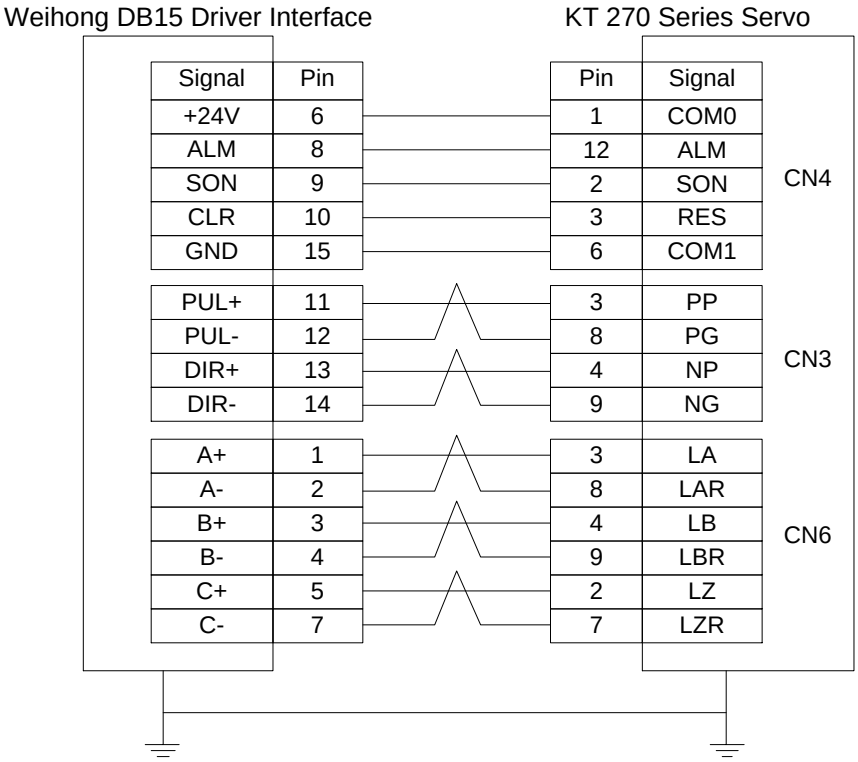
5.3.9 Wiring Diagram of SANYO PY Servo Driver



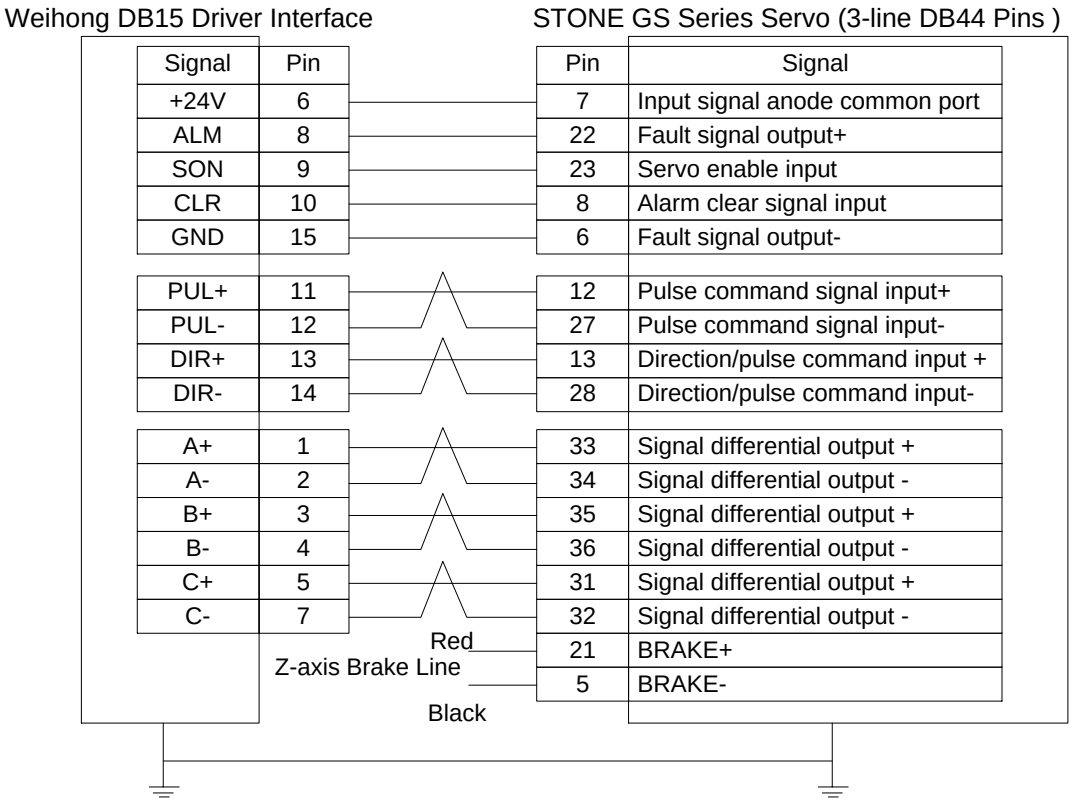
5.3.10 Wiring Diagram of SANYO R Servo Driver



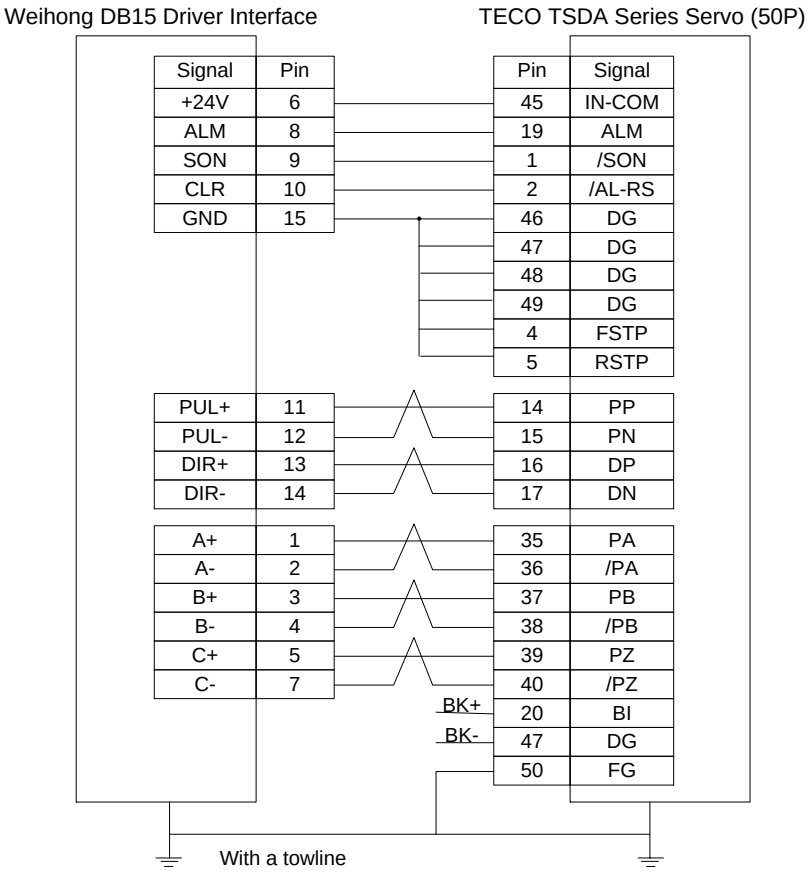
5.3.11 Wiring Diagram of KT270 Servo Driver



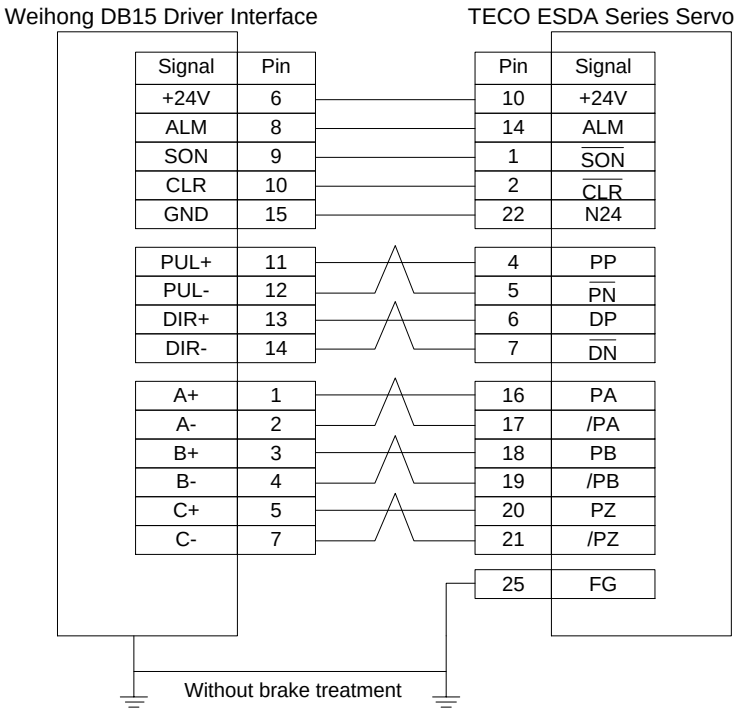
5.3.12 Wiring Diagram of STONE GS Servo Driver



5.3.13 Wiring Diagram of TECO TSDA Servo Driver



5.3.14 Wiring Diagram of TECO ESDA Servo Driver



6 Parameter Overview

Since the parameter number in NK200 is not fixed and varies with the software upgrade or system update, it is recommended to locate the needed parameters by its name.

Name	Setting Range	Default	Effect Time	Reference
3. Operation parameter				
Manual high speed	Manual low speed~ max speed of each axis mm/min	3500	Immediately	3.6.1
Manual low speed	0~Manual high speed mm/min	1500	Immediately	3.6.1
Dry running speed	Defalut feeding speed~ max speed of each axis	3500	Immediately	3.6.2
Machining speed	0.001~Dry running speed	3000	Immediately	3.6.2
Safe height	0~500 mm	10	Immediately	3.6.3
Single axis acc	0.001~100000 mm/s^2	800	Immediately	3.6.3
The delay time of cute angle motion	-	0	Immediately	3.6.3
Startup speed	0~	0	Immediately	3.6.3
Max machining speed	Machining speed~max speed of each axis mm/min	10000	Immediately	3.6.3
Rough speed of cali	1~ manual high speed mm/min	400	Immediately	3.7
Cali block thickness	0~100 mm	10	Immediately	3.7
X mechanical coor of fixed cali	X/Y/z workbench lower limit~X/Y/Z workbench upper limit	0	Immediately	3.7
Y mechanical coor of fixed cali		0	Immediately	3.7
Z mechanical coor of fixed cali		-1	Immediately	3.7
Handwheel output direction	1:handwheel output direction same with feeding direction -1:hanwheel output direction opposite to feeding direction	1	After reboot	3.14
Handwheel in strict accordance with the pulse-counting exercise	Yes: Valid; No: Invalid	No	After reboot	3.14

Name	Setting Range	Default	Effect Time	Reference
Acceleration of handwheel	0~100000	200	After reboot	3.14
Full feedrate for G00	Yes: Use; No: Not use	Yes	After reboot	3.14
Feedrate is valid for manual mode	Yes: Valid; No: Invalid	Yes	After reboot	3.14
Use default speed	Yes: Valid; No: Invalid	Yes		3.6.1
Use default spindle speed	Yes: Valid; No: Invalid	Yes	Immediately	3.5.1
Back to reference point before machining	Yes: Valid; No: Invalid	Yes	Immediately	3.4.4
Whether to cancel the mark of backing to the reference point after E-stop	Yes: Valid; No: Invalid	Yes	Immediately	3.4.4
Is reset SVON when estop	Yes: Valid; No: Invalid	No	Immediately	3.4.4
Max angle of joining high speed	0~180.001 deg	120	Immediately	3.6.3
Corner trace pretreatment options	0:Not disposed; 1:Curve smooth; 3:Arc smooth	0	Immediately	3.6.3
Corner tolerance	0~0.5001 mm	0.1	Immediately	3.6.3
Conner speed look ahead distance	0~0.05 mm	0	Immediately	3.6.3
Predicted segment No.	0~100	50	Immediately	3.6.3
Whether to use type S algorithm	Yes: Use; No: Not use	1	Immediately	3.6.3
Plunge speed option	0: Not disposed; 1: Direct Z motion only; 2: General Z down motion	0	Immediately	3.6.3
Z down speed	0~ Max Z-axis speed	300	Immediately	3.6.3
Z deceleration distance	0~999 mm	10	Immediately	3.6.3
Z approach speed	0~default feeding speed mm/min	600	Immediately	3.6.3

Name	Setting Range	Default	Effect Time	Reference
Max X-axis speed	6~15000 mm/min	15000	After reboot	3.6.3
Max Y-axis speed	6~15000 mm/min	15000	After reboot	3.6.3
Max Z-axis speed	Z down speed~15000 mm/min	15000	After reboot	3.6.3
Reference velocity	0.1667~10000 mm/min	500	After reboot	3.6.3
X axis reference velocity in corner	0.1667~10000 mm/min	500	After reboot	3.6.3
Y axis reference velocity in corner	0.1667~10000 mm/min	500	After reboot	3.6.3
Z axis reference velocity in corner	0.1667~10000 mm/min	500	After reboot	3.6.3
Reference circular speed	Yes: Valid; No: Invalid	Yes	Immediately	3.6.3
Reference circle speed	-		Immediately	3.6.3
Limit max velocity for small lines	Yes: Valid; No: Invalid	Yes	Immediately	3.6.3
Length for limit max velocity	0.001~100000 mm	2	Immediately	3.6.3
Path smoothing time	0~2 sec	0	Immediately	3.6.3
Arc radius tolerance	0~999 mm	2	Immediately	3.6.3
Enable IJK increment mode	Yes: Valid; No: Invalid	Yes	Immediately	3.6.3
Stop spindle while pausing	Yes: Valid; No: Invalid	Yes	After reboot	3.5
Stop spindle while stopping	Yes: Valid; No: Invalid	Yes	After reboot	3.5
Is open coolant while starting	Yes: Valid; No: Invalid	No	After reboot	3.5
Is close coolant while stopping	Yes: Valid; No: Invalid	No	After reboot	3.5
Whether to stop spindle at end	Yes: Stop; No: Not stop	Yes	Immediately	3.5
Max. spindle speed	10000~999999 r/min	24000	After reboot	3.5
Spindle start/ stop time	0~60000 ms	5000	Immediately	3.5
Center spindle rev	0~ Max. spindle speed r/min	500	Immediately	3.5

Name	Setting Range	Default	Effect Time	Reference
The action of spindle after processing	0: Stop; 1: Back to fixed point; 2: Back to workpiece origin	0	Immediately	3.5
Prompt after machining ends	0: No prompt; 1: Red light for 3 seconds; 2: always red light until custom has keyboard	0	Immediately	3.5
The X axis coordinate of the fixed point	-67108.864~67108.864 mm	0	Immediately	3.5
The Y axis coordinate of the fixed point	-67108.864~67108.864 mm	0	Immediately	3.5
The Z axis coordinate of the fixed point	-67108.864~67108.864 mm	-1	Immediately	3.5
G73G83retract amount	0~9999.9 mm	0	Immediately	-
This parameter is used under both G73 command and G83 command with different meanings. When G73 command is used, this parameter means the uplifting distance after each peck. When G83 is executed, this parameter refers to the distance between the feed plane where the cutter changes from G00 to Gxx and the previous peck depth. See Programming Manual for the details of G73 and G83.				
Pause Z offset	0~10000 mm	10	After reboot	-
Open auto lubrication	Yes: Valid; No: Invalid	No	Immediately	-
Interval of opening lubrication	0~34560000 sec	18000	Immediately	-
Opening time of lubrication pump	0~34560000 sec	5	Immediately	-
Cycle machining interval	0~34560000 sec	0	Immediately	-
4. Axis parameter				
X-axis pulse equivalent	0.0001~999 mm/p	0.001	After reboot	3.2.2
Y-axis oulse equivelant		0.001	After reboot	3.2.2
Z-axis oulse equivelant		0.001	After reboot	3.2.2
X-axis workbench	workbench lower limit~67108.864	400	After reboot	3.3.3

Name	Setting Range	Default	Effect Time	Reference
upper limit				
Y-axis workbench upper limit		400	After reboot	3.3.3
Z-axis workbench upper limit		0	After reboot	3.3.3
X-axis workbench lower limit	-67108.864~ workbench upper limit	0	After reboot	3.3.3
Y-axis workbench lower limit		0	After reboot	3.3.3
Z-axis workbench lower limit		-100	After reboot	3.3.3
X-axis change tool range upper limit	change tool range lower limit~67108.864	400	After reboot	3.3.3
Y-axis change tool range upper limit			After reboot	3.3.3
Z-axis change tool range upper limit		0	After reboot	3.3.3
X-axis change tool range lower limit	-67108.864~ chanege tool workbench upper limit	0	After reboot	3.3.3
Y-axis change tool range lower limit			After reboot	3.3.3
Z-axis change tool range lower limit		-100	After reboot	3.3.3
X-axis output direction	1; -1	1	Restart	3.3.1
Y-axis output direction	1; -1	1	Restart	3.3.1
Z-axis output direction	1; -1	1	Restart	3.3.1
Enable Y as revolving axis	Yes: Valid; No: Invalid	No	After reboot	3.15.5
MM as revolving axis unit	Yes: mm; No: deg	No	After reboot	3.15.5
Pulse equivalent of Y revolving axis	0~100000 deg/p	0.006	After reboot	3.15.5
Revolving workpiece radius	0~100000 mm	20	After reboot	3.15.5
Startup speed of revolving	0~100000 rad/s	0.2909	Immediately	3.15.5

Name	Setting Range	Default	Effect Time	Reference
Accleration speed of revolving axis	0.001~100000 mm/s^2	6.9813	Immediately	3.15.5
Machining speed of revolving	0.06~250 r/min(related with pulse equivalent setting)	30	Immediately	3.15.5
Screw error comp	0: No compensation; 1: Single compensation; 2: Double compensation	0	After reboot	3.11
Backlash compensation valid	Yes: Valid; No: Invalid	No	After reboot	3.11
Enable AQE compensation	Yes: Valid; No: Invalid	No	After reboot	3.11
AQE compensation time	0.3015 sec	0	After reboot	3.11
AQE compensation length	0~10 mm	0	After reboot	3.11
Delay time of AQE compensation	0~10 sec	0	After reboot	3.11
Intensity of AQE compensation	0~1	0.75	After reboot	3.11
5. File parameter				
Dxf file translation parameters				
Tool lifting height	0~99999 mm	1	Immediately	3.13
Machining depth	-99999~0 mm	-1	Immediately	3.13
Use first point as zero point	Yes: Valid; No: Invalid	Yes	Immediately	3.13
Shape seperate processing valid	Yes: Valid; No: Invalid	No	Immediately	3.13
Bottom machining valid	Yes: Valid; No: Invalid	No	Immediately	3.13
Use dxf file as metric size	Yes: Metric size; No: Inch size	No	Immediately	3.13
Eng file translation parameters				
Select tool foe ENG	Yes: Valid; No: Invalid	Yes	Immediately	3.13
Select tool for ENG	Yes: Use; No: Not use	Yes	Immediately	3.13
Tool change prompt	Yes: Valid; No: Invalid	Yes	Immediately	3.13

Name	Setting Range	Default	Effect Time	Reference
Tool lifting height	0~100000 mm	1	Immediately	3.13
Retract amount	0~100000 mm	1	Immediately	3.13
Cycle times of ENG processing	-	1	Immediately	3.13
Deep hole machining manner	0: Reciprocating shp removal ; 1: Highspeed reciprocating ship removal	0	Immediately	3.13
Plt file translation parameters				
Tool lifting height	0~100000 mm	5	Immediately	3.13
Plt unit	0~100000 mm	40	Immediately	3.13
Tool step	0~100000 mm	0.025	Immediately	3.13
Machining depth	-	-1	Immediately	3.13
6. Origin parameter				
X direction in backing to reference point	-1; 1	-1	Immediately	3.4.4
Y direction in backing to reference point	-1; 1	-1	Immediately	3.4.4
Z direction in backing to reference point	-1; 1	1	Immediately	3.4.4
Retract distance of X-axis	-	2	Immediately	3.4.4
Retract distance of Y-axis	-	2	Immediately	3.4.4
Retract distance of Z-axis	-	-2	Immediately	3.4.4
X speed in backing to reference point	0.001~ Max X-axis speed mm/min	1800	Immediately	3.4.4
Y speed in backing to reference point	0.001~ Max Y-axis speed mm/min	1800	Immediately	3.4.4
Z speed in backing to reference point	0.001~ Max Z-axis speed mm/min	1500	Immediately	3.4.4
X speed in exact positioning	0.001~ Max X-axis speed mm/min	200	Immediately	3.4.4
Y speed in exact positioning	0.001~ Max Y-axis speed mm/min	200	Immediately	3.4.4
Z speed in exact	0.001~ Max Z-axis speed mm/min	100	Immediately	3.4.4

Name	Setting Range	Default	Effect Time	Reference
positioning				
X-axis screw pitch	0.001~9999.9 mm	5	Immediately	3.4.4
Y-axis screw pitch	0.001~9999.9 mm	5	Immediately	3.4.4
Z-axis screw pitch	0.001~9999.9 mm	5	Immediately	3.4.4
7. Tool magazine parameter				
Turn on radius compensation	Yes: Valid; No: Invalid	No	Immediately	3.11.2
Specify the type of tool compensation	1: Normal type; 2: Intersect type; 3: Insert type	1	Immediately	3.11.2
Tool magazine capacity	1~20	10	After reboot	3.17.3
Current tool No.	1~ Tool magazine capacity	1	Immediately	3.17.3
Currently tool pan No.	1~ Tool magazine capacity	1	Immediately	3.17.3
Tool change prompt	Yes: With prompt No: Without prompt	No	Immediately	3.17.3
Calibrate cutter after tool change	Yes: Calibrate; No: Not calibrate	No	Immediately	3.17.3
To handle mode	0: Invalid; 1: To be no-tool state; 2: First tool index is 0	0	After reboot	3.17.3
Tool change upper postition	-	-1	Immediately	3.17.3
Tool change lower position	-	0	Immediately	3.17.3
X change tool position	-	0	Immediately	3.17.3
Y change tool position	-	0	Immediately	3.17.3
X coordinate of tool change ahead position	-	0	Immediately	3.17.3
Y coordinate of tool change ahead position	-	0	Immediately	3.17.3
Z coordinate of tool change ahead	-	0	Immediately	3.17.3

Name	Setting Range	Default	Effect Time	Reference
position				
Tool change speed	0.001~max.speed of each axis mm/min	3000	Immediately	3.17.3
Z-axis CT up and down speed	0.001~ Tool change speed mm/min	60	Immediately	3.17.3
Traversing speed in/out tool magazine	0.001~ Tool change speed mm/min	60	Immediately	3.17.3
Tool change delay	0~600000 ms	500	Immediately	3.17.3
Move to origin position after change tools	Yes: Valid; No: Invalid	No	Immediately	3.17.3
X-axis machine coordinate of tool 1	-	0	Immediately	3.17.3
Y-axis machine coordinate of tool 1	-	0	Immediately	3.17.3
Z-axis machine coordinate of tool 1	-	0	Immediately	3.17.3

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