

NK105 OWNER'S OPERATION MANUAL CNC ROUTER

G2 & G3 Edition



Safety Installation Operation Maintenance

Visit www.cancam.ca for more information.

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A MESSAGE FROM CANCAM

We thank you and congratulate you for choosing **CANCAM** quality CNC machines. **CANCAM** is a Canadian owned and operated CNC machine manufacturer. Our mis-sion is to provide our clients with quality technology that allows you to create, invent, and produce your products with confidence at an affordable cost.

This manual provides installation, operation, and safety guides, as well as maintenance procedures to keep your **CANCAM** machine running at its best.

We suggest that everyone operating a **CANCAM** machine reviews this manual carefully, including all health and safety warnings and notices, <u>BEFORE</u> operating any equipment. Serious personal injury and/or property damage will result from improper use. We also suggest that this manual is kept nearby the machine for convenient reference.

For the digital version of this manual as well as other helpful resources, please visit our web-site at **WWW.CANCAM.CA**.







IMPROPER OR UNSAFE OPERATION OF THE MACHINE WILL RESULT IN PERSONAL INJURY, INCLUDING DEATH, AND/OR DAMAGE TO THE EQUIPMENT.

BEFORE YOU BEGIN

TRAINING & AUTHORIZATION

Only trained and authorized personnel should work on this machine. Untrained operators present a hazard to themselves, others, and the machine. Improper operation will void the warranty.



SAFETY SYMBOLS

To avoid injury to yourself and others, as well as damaging equipment, follow all safety warnings. Improper use of this machine can and will cause serious injury up to and including death. The following symbols are used throughout these instructions:



Hazard MAY cause minor to moderate injury if ignored.



Hazard COULD cause death or serious injury if ignored.



Hazard WILL cause death or serious injury if ignored.







Operating this machine with worn out or damaged parts may cause serious injury or damage to the machine.

DAMAGED PARTS

Check for damaged parts and tools **<u>BEFORE</u>** operating the machine. Any part or tool that is damaged should be properly repaired or replaced by authorized personnel. Do not operate the machine if any component does not appear to be functioning correctly, and immediately contact your shop supervisor.

CONTRACTOR PROTECTIVE EQUIPMENT

Use appropriate eye and ear protective equipment while operating the machine, including safety goggles and ear protection.

SAFETY FEATURES

Do not operate the machine unless all safety features are installed and activated, including accessible **<E-STOP>** switches. Never bypass, override or deactivate a safety feature.



E-STOP SWITCH

The *<E-STOP* switch is the large, circular red switch located on the control panel. Pressing the *<E-STOP* will instantly stop all motion of the machine. Additional



switches can be installed to ensure operators have convenient access at all times regardless of shop layout. Each operator should be aware of all **<E-STOP>** locations and should ensure unobstructed access to them at all times.

ELECTRICAL PANEL

The electrical panel should be closed and the key and latches on the control cabinet should always be secured, except during installation and service.

MODIFICATIONS

DO NOT modify or alter this equipment in any way. If modifications are required, all modifications must be handled by CANCAM. Any modification or alteration of any CANCAM router could lead to personal injury and/or damage to the machine and will void your warranty.

LOCAL REGULATIONS

Consult your local safety codes and regulations before operating your CANCAM router.



SAFE OPERATING INSTRUCTIONS



This machine is automatically controlled and may start at any time.

1. Keep fingers, hands, and all other objects away from the machine while the power is on. Remove any adjusting keys, wrenches, and other tools or objects before turning the machine on.



- 2. The spindle head can drop without notice. Personnel must avoid the area directly under the spindle head.
- **3**.Make sure to have proper fire extinguishing equipment on hand at all times and be aware of this equipment's location.
- 4. Only use the machine in clean, well-lit areas that are free from flammable liquids and excessive moisture.
- 5. The electrical power must meet the specifications in this manual. Attempting to run the machine from any other source can cause severe damage and will void the warranty.



- **6**.Keep cables and cords away from heat, oil, and sharp edges. Do not overstretch cables or cords or run them under other objects or over work surfaces.
- 7. Exercise care with machine controls and around keyboard to avoid unintentional starting.
- 8. Use proper fixtures and clamps to secure work. <u>NEVER</u> use hands to secure work. Improperly clamped parts machined at high speeds/feeds may be ejected and cause personal injury and/or property damage. Machining oversized or marginally clamped parts is not safe.





- 10. Stay alert at all times when operating the machine.
- 11. Always maintain proper balance and footing when working around the machine. Keep work area organized and free of obstructions.
- 12. Do not attempt to use the machine for purposes other than what is intended. Do not attempt to exceed limits of the machine.





- 13.Follow all safety instructions and processing instructions in the MSDS for the material being processed. Do not process toxic or flammable material. Deadly fumes can be present.
- 14. Maintain equipment with care. Keep cutting tools clean and sharp. Lubricate and change accessories when necessary. Cables and cords should be inspected regularly. Keep controls clean and dry.



- 15.Use proper precautions with dust collection systems to prevent sparks and fire hazards.
- 16. Ensure that tools are properly aligned to avoid tool changer damage.
- 17. Do not attempt to operate the machine before all of the installation instructions have been completed.



18. Disconnect power to all system components when not in use, when changing accessories, and before servicing. Do not loosen, remove, or adjust machine parts or cables while power is on. Never service the machine with the power connected.



FIRE HAZARDS



Prevent fire hazards by using proper feeds, speeds, and tooling while operating your CANCAM router. Setting feeds and speeds too low and/or using dull tools creates friction at the material. The friction generates heat, which can result fire being drawn through the vacuum table or dust collector without warning. Certain materials, especially composite materials, increase the fire hazard from friction heating caused by dull tools.

NOTE:

The shop owner is responsible to make sure that everyone who is involved with installing and operating the machine is thoroughly acquainted with the installation, operation, and safety instructions provided with the machine <u>BEFORE</u> they perform any actual work.

The ultimate responsibility for safety rests with the shop owner and the individuals who work with the machine.

Please contact CANCAM any time safety issues need to be addressed. Safety is our top priority, and we are always eager to hear about suggestions to improve the safety of our machines.

You can reach us via our website, www.cancam.ca, or call us toll-free at 1-888-510-2295. We would be glad to hear from you.

STAY SAFE!

INTRODUCTION

INTRODUCTION TO NK105

The embedded IPC-based, independently-developed NK105 provides its user with a wide range of engraving solutions. The NK105 integrated machine consists of the host system and operation panel. The host system, also called the control box, integrates the system control card, terminal board, and additional components. The host system connects with the operation panel via 15-core extension cable.

The top and bottom areas at the back of the control box are used to inlay terminals while the left side includes USB and DB15 interfaces. The DB15 interface and operation panel are connected at the factory. The USB interface is for external connection with USB devices (e.g., USB flash disk).

The operation panel, also called the handheld box, is similar to a handwheel in size. Connecting to the host system via 15-core extension cable, it is concise and portable. The operation panel facilitates machine tool control independently of the distribution cabinet. Its moving distance is limited only by the extension cable's length.

MECHANICAL DIMENSION

The integral thickness of the NK105 host system is 218.3mm with terminals embedded at its top and bottom.

A diagram of the NK105 control box is shown in Fig. 2-1 (unit: mm).





Fig. 2-1 Diagram of NK105 control box (mm)



TERMINAL SPECIFICATION OF NK105 CONTROL BOX

NK105 terminals are inlayed at the top and bottom of the control box. The detailed wiring diagram is as shown in Fig. 2-2. Table 1 and Table 2 explain the terminal pin signals.

			0410 (T)
			GX15
010			GX14 ()
GND			GX13
0 0710			GX12
O GV18			GX11
0.011			GX10
GND	1/		GND
O GY17(S_0)	4	S ⊜	+24V OUT
O 0Y16(5_1)	2	j ž	
O GY15(8_2)		S	GX09(ZLM-)
GY14(5P+)	2	S E	GX08(ZLM+)
() GY13(SP-)	<	Č ji	GX07 (ZORG)
GND		ž	GND
GY12(ZP+)		xes	*24V OUT
GY11(ZP-)		A.	GX06 (YLM-)
GY10(2D+)		LG6	GX05 (YLM+)
GY09(ZD-)	()	f	GX04 (YORG)
CHD	ž		GND
GY08(YP+)	5		+24V OUT
GY07(YP-)	2		GX03 (XLM-)
GY06(VD+)			GX02 (XLM+)
GY05(YD-)			GX01 (XORG)
	- B		GND
GND			+24V OUT
GY04 (XP+)			
GY03 (XP-)	0		+24V IN ()
GY02(XD+)			GND
GY01(XD-)			GND





TABLE 1: OUTPUT PORT SIGNAL EXPLANATION

Terminal Name	Corresponding Signal	Νοτε	
GY01(XD-)	Negative differential signal along X-axis	XD+ and XD- are differential pair signals along X-axis.	
GY02(XD+)	Positive differential signal along X-axis		
GY03(XP-)	Pulse negative differential signal of X-axis	XP+ and XP- are differential pair signals of X-axis pulse.	
GY04(XP+)	Pulse positive differential signal of X-axis		
GY05(YD-)	Negative differential signal along Y-axis	YD+ and YD- are differential pair signals along Y-axis.	
GY06(YD+)	Positive differential signal along Y-axis		
GY07(YP-)	Pulse negative differential signal of Y-axis	YP+ and YP- are pulse differ- ential pair signals of Y-axis	
GY08(YP+)	Pulse positive differential signal of Y-axis		
GY09(ZD-)	Negative differential signal along Z-axis	ZD+ and ZD - are differential pair signals along Z-axis.	
GY10(ZD+)	Positive differential signal along Z-axis		
GY11(ZP-)	Pulse negative differential signal of Z-axis	ZP+ and ZP- are pulse differ- ential pair signals of Z-axis.	
GY12(ZP+)	Pulse positive differential signal of Z-axis		
GY13(SP-)	Spindle reverse rotation control port		
GY014(SP+)	Spindle forward rotation control port		
GY15(S_2)	2nd gear output port of spindle speed	Multi-step spindle gear con- trol ports provide at most 8- gear speed control; in wiring, COM of spindle needs joining to GND of terminal.	
GY16(S_1)	1st gear output port of spindle speed		
GY17(S_0)	Oth gear output port of spindle speed		
GY18	Work piece cooling output port		
GY19	Spindle coolant output port		
GY20	Auto lubricant output port		
+24V OUT	+24V output	It is connected with +24V power, available of use.	

INTRODUCTION



TABLE 2: INPUT SIGNAL EXPLANATION

Terminal Name	Corresponding Signal	Νοτε	
GND	Power GND or COM port	The two GND on power terminal are connected with power GND and ground respectively, while GND on other terminals can be used as COM signal.	
+24V IN	+24V DC power input	External connection with +24V DC power.	
GX01(XORG)	Mechanical origin signal of X-axis	External connection with	
GX02(XLM+)	Positive limit signal of X-axis	proximity switch.	
GX03(XLM-)	Negative limit signal of X-axis		
GX04(YORG)	Mechanical origin signal of Y-axis		
GX05(YLM+)	Positive limit signal of Y-axis		
GX06(YLM-)	Negative limit signal of Y-axis		
GX07(ZORG)	Mechanical origin signal of Z-axis		
GX08(ZLM+)	Positive limit signal of Z-axis		
GX09(ZLM-)	Negative limit signal of Z-axis		
GX10	Extended input 0		
GX11	Extended input 1		
GX12	Extended input 2		
GX13	Extended input 3		
GX14	Extended input 4		
GX15	E-stop alarm signal input	External connection with E-stop button of machine tool.	
GX16	Tool calibration input		



INPUT INTERFACE OF +24V POWER

The input interface of +24V power is for external connection with 24V power.

Its pin definition is shown in Fig. 2-3, in which it is connected to the grounding copper plate of the machine tool.

24V+ COM



Fig. 2-3 Pin definition of +24V power input interface

INSTALLATION

UNPACKING AND MACHINE IDENTIFICATION

NOTE:

All CANCAM machines are shipped assembled and secured to a wooden pallet.

Unpack all items that shipped with your machine. Check the items against the packing slip to be sure nothing was left out. Notify CANCAM immediately if you are missing any piece of your shipment or if any damage has occurred during the shipping process.



Fig 3-1 Forklift tubes.

Please note the 4 forklift tubes on the front and rear of the machine (shown in Fig 3-1). There are 4 forklift tubes on the sides of the machine as well.



MEASURING FORKS AND FORKLIFTING MACHINE



DO NOT OPERATE FORKLIFT WITHOUT

PROPER CERTIFICATION AND TRAINING.

The distance between the forks is 32" while the forklift tubes are 7.25" wide and 2.5" high (shown in Fig. 3-2).



Fig 3-2 Fork distance.

Centre forks in the front of the machine and move forklift slowly when close to the machine. Take care not to damage the valves on the front of the machine (shown in Fig 3-3).





Fig 3-3 Vacuum table valves.



RAISED LOADS MAY SUDDENLY FALL WITHOUT NOTICE.

DO NOT LIFT OR MOVE MACHINE USING GANTRY

For safety and to prevent damage to the machine and cables, ONLY lift machine using forklift tubes.

Forklift capacity must be adequate to safely lift the load.

NOTE:

We recommend forklift extensions to help support the weight of the machine.

Slowly lift up your machine from the floor, and then remove the wooden pallet without placing any body parts directly under the lifted load.



ELECTRICAL CONNECTIONS



Ensure that all electrical connections are performed by a qualified electrician.

Improper electrical connections will result in damage to the equipment, fire, and potentially death.

ELECTRICAL SPECIFICATIONS

ATTACH KEYBOARD

Once the machine has been unpacked, attach the keyboard shelf to the front of the machine. With the shelf in place, lead the mouse and keyboard cables through the small hole in the front of the machine. Plug the cables into an available USB connection on the PC.

HOUSING CABINET

All of the machine's electronics are located in the housing cabinet. Do not open these doors when power is applied to the machine.

POWER-IN CONNECTOR

Lead the main power cable in through the hole at the bottom of the cabinet. Attach L1, L2, L3 (if applicable), and the ground wire to the connector plate (as shown in Fig. 3-4).





Fig. 3-4 Connector plate.

PNEUMATIC CONNECTIONS

Various components on the machine require air pressure. For the machine to function correctly, it requires 90psi of air.

AIR INPUT

Attach an air hose to the air input on the back of the machine.

NOTE:

If your shop hose does not fit the adapter supplied, the adapter can be removed and a suitable one attached.

The threading on the machine is standard 3/8 female. A male threaded 3/8 fitting to attach to your factory air hose can be purchased at most hardware stores.

VACUUM PUMP CONNECTIONS

Have a qualified electrician connect AC power (220 or 440 VAC) as specified on the unit to the motor starter.

Take the silver connector from the Starter Box and connect it to the female connector on the main electronic unit.



Attach the hoses from the machine to the T-connectors and attach them to the pump.

Turn on individual sections of the vacuum table by turning the manifold handles in the front of the machine (as shown in Fig. 3-5).



Fig. 3-5 Vacuum table valves.

Vacuum on and off functions are controlled by the OSAI controller and can only be turned on from the computer screen.

To test the motor, press the reset button on the starter box once all connections are made.





RUNNING THE PUMP/BLOWER CONTINUOUSLY IN THE WRONG DIRECTION WILL DAMAGE THE VANES.

Briefly start motion and check rotation (arrow on casing).

Exchange phases if rotation is incorrect.



BASIC CONFIGURATION OF NCSTUDIO

Memory: 128M

Flash: 256M

Monitor: 128 x 64 graphic LCD module

NCSTUDIO SYSTEM UPDATE

The NK105 comes ready to use with all necessary software installed. To resolve some issues, the system can be updated using the following procedures:

CONFIGURATION UPDATE:

Prepare a USB flash disk (>1G) with the system image and application to be updated.

SYSTEM MIRROR UPDATE:

1. Insert the USB flash disk, with the system mirror "EBOOT 105.nb0," "NK105.nb0," and system application to be updated within the USB flash disk's root directory, into the USB interface of the NK105 control box.

2. Power on NK105, and then press the "Menu" key to enter update selection interface automatically.

3. Press "3" to select "OS" to start updating system image (which may take about three minutes to complete).

4. After write-in finishes, "USB Available Now!" will be displayed on the screen. Press **<OK>** key to enter update system interface and then select "Delete parameters."

5. After configuration files are deleted, select "Update System" to start updating the system application.

After update completes, the system will reboot automatically.

INSTALLATION



EX-FACTORY PARAMETERS:

Ex-factory parameters must be restored after each system update. If "Delete parameters" is not selected during the update process, it must be restored to ex-factory parameters after updating the system. Use the following procedure to restore ex-factory parameters:

- **1.** After the system is rebooted, press **b** to enter menu page
- 2. Select "6. Param Upkeep," "3. Factory Params" sequentially, and then
- **3.** Follow the on-screen prompts.

SYSTEM APPLICATION UPDATE:

A system application update is included in the system image update process. If the system image does not need updating, the system application can be updated directly using the following procedure:

1. Insert the USB flash disk, with the system application to be updated within the USB flash disk's root menu, into the USB interface of NK105 control box.

2. Power on NK105

3. After entering the system interface, press **1** to enter the menu page.

4. Select "7. System Upkeep and "3. System Update" in turn, and then follow the on-screen prompts until "USB Available Now" appears.

5. Press "OK" key to enter update system interface, then select "Delete parameters."

6. After configuration files are deleted, select "Update system" to start updating the system application.

After update completes, the system will reboot automatically.



NOTE:

If "Delete parameters" is not selected during the update process, it must be restored to ex-factory parameters after updating the system.

Use the above instructions to restore ex-factory parameters.

BASIC CONCEPTS OF NK105

The NK105 system employs various concepts, such as the workpiece coordinate system, mechanical coordinate system, operation mode, and operation state. It is important for operators to understand these concepts *BEFORE* operating the NK105 machine.

OPERATION MODE AND STATE

OPERATION MODE:

The machine has several operation modes, each described below.

AUTO MODE

Under automatic operation mode, the machine tool generates motions through the procedure loaded in advance. Therefore, the processing procedure must be loaded *BEFORE* operation in Auto Mode.

MANUAL MODE

To meet the requirements of manual motion under different situations, the system provides "jog" and "step" motion modes.

Jog motion mode: there is no concrete data control under this mode. This mode is for tuning the mechanical coordinates roughly.

Step motion mode: this motion mode is applicable to accurately tuning the mechanical coordinates of the machine.



OPERATION STATE:

In terms of the motion mode of the machine tool, each operation mode can be divided into the following types of operation states:

IDLE STATE

Idle state is the most common state. Under this state, the machine has no motion to output, but is ready to accept any new task.

ESTOP STATE

This is an abnormal state. When there is an error in the hardware of the machine tool. The system will enter into this state and implement the predetermined protection actions, such as closing spindle motor and cooling pump. Under this state, the machine tool is locked and cannot carry out any new action.

RUNNING STATE

When the machine tool is implementing any action, the system enters into Running State.

PAUSE STATE

When the machine tool is running, if the user presses the combination key of "pause during processing," the system will enter into the PAUSE State and wait for further instruction. At this time, the user can press the "Start" key to make the system enter into the RUNNING State, or press the "Stop/Cancel" key to make the system stop.

LOCK STATE

The LOCK State is an internal state occurring when software limits operation of the machine.

MACHINE COORDINATE SYSTEM

The coordinate system describes the motion of the machine tool. For the sake of uniformity, the standard coordinate system adopts the right-hand rule as shown in Fig. 4-1.





Fig. 4-1 The coordinate system conforming to the right-hand rule.

For milling machines, the orientation of machine axes is determined by both the type of machine tool and the layout of each component. The basic coordinate axes of milling machines are X-axis, Y-axis, and Z-axis:

Z-axis is coincidental with the spindle axis and the direction of the cutter moving away from the workpiece is its positive direction (+Z).

X-axis is perpendicular to Z-axis and parallel to the clamped surface of the workpiece. For the single column vertical milling machine, if the user faces the spindle and looks in the direction of the column, the positive direction (+X) is to the right.

Y-axis is perpendicular to both the X-axis and the Z-axis. For the single column vertical milling machine, if the user faces the spindle and looks in the direction of the column, the direction the user is facing is the positive direction (+Y).

X-axis, Y-axis and Z-axis constitute the coordinate system adhering to the right-hand rule.



MECHANICAL COORDINATE SYSTEM (MCS):

Mechanical coordinate system (MCS) is a set of the fixed right-hand coordinate system. Its coordinate origin is a fixed position that corresponds to the machine tool. Therefore, at any time, any given point in space can be exclusively described by MCS.

The MCS requires that the machine is able to "home" back to the mechanical origin, or the machine will be unable to execute the software commands.

WORKPIECE COORDINATE SYSTEM (WCS):

As a set of the right-hand coordinate system, the workpiece coordinate system (WCS) is used in programming to describe motion relative to the origin (also called program origin, offset, or home). To establish WCS, the operator must identify a given point on the workpiece as the origin. The origin of WCS is fixed relative to a certain point on the workpiece, so the machine can translate the relative commands of the program to the fixed origin of MCS.

The operator can identify multiple workpiece origins, or offsets, for various subroutines. Work piece offsets correspond to the coordinate systems G54, G55, G56, G57, G58, and G59. The default coordinate system is G54.

The origin of WCS should be selected with consideration for simplified programming and dimension conversion, as well as avoiding machining errors.

The relation between workpiece offset and MCS is shown in Fig. 4-2.




Fig. 4-2 The relation between workpiece offset and MCS.



Fig. 4-3 Multiple workpiece offsets.

One, two, or several workpiece offsets can be used in the machining program, as shown in Fig. 4-3, three workpieces are installed on the work table, so each workpiece has a work piece origin corresponding to the G-code WCS.

To drill a hole on each of the workpieces with calculation depth as Z-0.14, the programming example would be:



```
N1 G20
N2 G17 G40 G80
N3 G90 G54 G00 X5.5 Y3.1 S1000 M03 (Use G54)
N4 G43 Z0.1 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
```

Program segment N3 through N5 relates to the first workpiece, within the G54 WCS.

Program segment N6 drills the hole in the second workpiece of the same batch within the G55 WCS.

Program segment N7 drills the third hole in the third workpiece of the same batch within the G56 WCS.

Aiming at all the coordinate systems, public offset is used to adjust the workpiece origin of X, Y, and Z-axes without changing the offset value of G54 through G59.

Workpiece offset, tool offset, and public offset meet the following expression:

Workpiece Coordinate =

Mechanical Coordinate - Workepiece Offset - Tool Offset - Public Offset

OPERATION INSTRUCTIONS

MACHINE START-UP

POWER ON

1. Turn the **<MAIN POWER>** switch on the electrical cabinet to the "ON" position, as shown in Fig. 5-1.



Fig. 5-1 Main power switch.

NOTE:

An electrician should have installed an appropriate rated plug and wire for the machine's power needs.



The red light on the front of the machine will light up (as shown in Fig. 5-2). This indicates that the power is available to the machine.



Fig. 5-2 Power is available.

2. Press the green **<POWER ON>** button to send power to the cabinet and machine. The green light (as shown in Fig. 5-3) indicates that the cabinet and machine are receiving power. The machine and controller should be booting up.



Fig. 5-3 Cabinet and machine receiving power.

NOTE:

Machine and controller will not boot if any <E-STOP> switch is activated. Some machines have additional safety features that prevent start-up, such as light curtains and door sensors. Check that all <E-STOP> switches are released and all other safety features are in operational mode.



CONTROLLER START-UP

MECHANICAL HOMING

When the controller is finished booting up, the controller will prompt the user to mechanically home the machine, as shown in Fig. 5-4. Press < OK > and the machine will home itself. It is important to home the machine before use to avoid any limit errors and machine crashing during use.

Back to R]int'≓

Fig. 5-4 Homing prompt.

If the prompt in Fig. 5-4 does not appear during start-up, follow the steps below to begin homing the machine. Otherwise, move onto Button Familiarity.



HOMING (WITHOUT PROMPT)

1. Press the **<MENU>** button to access more options, as shown in Fig. 5-5.



Fig. 5-5 Menu button.

2. Select "3. Operations" by pressing **<OK>**.





3. Select "1. Back REF Point" by pressing **<OK>**...

.Back REF Poi 2.Rect Machining .Select Line 4. Machining Info

4. Select "1. All Home" by pressing **<OK>**.

	Ll Home
2.2	Home
З.Х	Home
4.1	Home

The machine will now begin to home.



G2 PANEL KEYS

G2 PANEL KEYS LAYOUT



Fig 5-6 Panel Keys.

NOTE:

For G3 panel keys, skip to the next section.



G2 SINGLE KEY FUNCTIONS

Кеү	Ναμε	FUNCTION	
	Start	Start machining.	
ESC	Stop/ESC	Stop machining; cancel various selections, inputs and operations.	
	Pause/Up	Pause machining; up direction.	
V	Down	Down direction.	
∰⊍ ৻০ঁ০)ক 5	Spindle Start/Stop	Toggle spindle start/stop in manual mode; input number 5.	
Ē∎ ⊘ .	Menu	Enter menu page; input decimal point; during system start-up, enter image update page.	
XY=0 z=0 -	XY Clearing	Clear X & Y axes; input minus.	
X+ 6	X+	Move X axis toward positive; input number 6.	



Key	Ναμε	FUNCTION	
X− ● 4	Х-	Move X axis toward negative; input number 4.	
Y+ ➡ 8	Y+	Move Y axis toward positive; input number 8.	
Y- 2	Y-	Move Y axis toward negative; input number 2.	
Z+ 9	Z+	Move Z axis toward positive; input number 9.	
Z- 3	Z-	Move Z axis toward negative; input number 3.	
₩+ ₽+ 7	Override+	Increase feedrate override; input number 7.	
₩- ₽- 1	Override-	Decrease feedrate override; input number 1.	
	Speed Switchover	Toggle between manual high/low speed; input number 0.	



G2 KEY COMBO FUNCTIONS

Кеу Сомво	FUNCTION	
Shift	Resume from breakpoint.	
Shift _ Ē≣	Enter help page.	
Shift + 4	Return to Mechanical Origin.	
Shift	Return to Workpiece Origin.	
Shift	Toggle between Machine and Working coordinates.	
Shift + + 7	Increase spindle gear.	
Shift + - 1	Decrease spindle gear.	
Shift $xY=0$	Clear Z axis.	
Shift	Floating preset.	



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G3 PANEL KEYS

G3 PANEL KEYS LAYOUT



Fig 5-7 G3 Panel Keys.



G3 SINGLE KEY FUNCTIONS

Кеү	Ναμε	FUNCTION	
•	Start	Start machining.	
Ш	Pause	Pause machining.	
	Stop	Stop machining.	
ᠿ	Spindle ON/OFF	Toggle spindle ON/OFF in manual mode.	
Ē	Menu	Enter menu page; during system start-up, enter image update.	
ESC	ESC	Returning to the previous page.	
XY=0 x=0	XY Clearing	Clear X & Y coordinates.	
Z=0	Z Clearing	Clear Z coordinate.	



Кеү	ΝΑΜΕ	FUNCTION	
Shift	Shift	Auxiliary key; switch between stepping mode and jog made under machining page.	
₩+ \$+ -	Override+	Increase feedrate override.	
₩- ₽-	Override-	Decrease feedrate override.	
(0, 0)↓ (x,y) 0	Back to Workpiece Origin	Move X & Y axes to Workpiece Origin.	
X+ 6	X+	Move X axis toward positive; input number 6.	
X- 4	Х-	Move X axis toward negative; input number 4.	
Y+ 8	Y+	Move Y axis toward positive; input number 8.	
Y- 2	Y-	Move Y axis toward negative; input number 2.	

OPERATION INSTRUCTIONS



Key	ΝΑΜΕ	FUNCTION	
Z+ 9	Z+	Move Z axis toward positive; input number 9.	
Z- 3	Z-	Move Z axis toward negative; input number 3.	
√ ₅	Speed Switchover	Toggle between jog speed and rapid jog speed in jog mode; input number 5.	
IV+ 7	IV+	Move extended axis toward positive; input number 7.	
IV- 1	IV-	Move extended axis toward negative; input number 1.	



G3 KEY COMBO FUNCTIONS

Кеу Сомво	FUNCTION
Shift +	Resume from breakpoint.
Shift	Open help page.
Shift + XY=0	Clear X axis.
Shift Z=0	Clear Y axis.
Shift	Increase spindle gear.
Shift ⊕-	Decrease spindle gear.
Shift $(0, 0) \leftarrow (0, $	Move X & Y axes back to fixed point.
Shift	Home all axes.

OPERATION INSTRUCTIONS



Кеу Сомво	FUNCTION	
Shift + Y+	Toggle between Machine and Working coordinates.	
Shift	Movable tool measurement.	
Shift +	Jiggle function.	
Shift + 2	First tool measurement.	
Shift	Measurement after tool change.	



CORRECT COLLETTING GUIDELINES

Read these instructions thoroughly **<u>BEFORE</u>** operating machine.



UNBALANCED EQUIPMENT WILL DAMAGE SPINDLE. AIR SUPPLY MUST BE FILTERED AND DRY.

CORRECT COLLET

The end of the collet should be flush with the bottom surface of the collet nut (as shown in Fig. 5-8). You will hear and feel a "SNAP" as the collet properly moves into place within the collet nut. Once assembled, "SCREW" the collet nut onto the threaded spindle end.



Fig. 5-8 Correct collet.



INCORRECT COLLET

Any gap or angle between the collet and the collet nut indicates that the assembly is incorrect (as shown in Fig. 5-9). If the collet is not flush to the end of the collet nut, correct the assembly before using.



Fig. 5-9 Incorrect collet.



DO NOT PUSH THE COLLET INTO THE SPINDLE AT ANY TIME! Only insert the proper assembly onto the spindle.

NOTE:

FOR TOOLCHANGE AND FIXED COLLET SPIN-DLES:ONLY USE TOOLHOLDERS, COLLET NUTS AND TOOLS THAT ARE BALANCED TO MEET OR EXCEED THE MAX RATED SPEED OF THE SPINDLE.



SECURING STOCK MATERIAL

All stock material must be well secured in place before operating the machine. Loose material will cause inaccuracies and may result in projectiles that cause damage to the machine and serious injury, including death.



UNSECURED WORK WILL CAUSE DAMAGE TO THE MACHINE

AND SERIOUS PERSONAL INJURY

NEVER SECURE WORK BY HAND

There are many methods for securing stock material. Two common methods include clamping or vacuum hold down.

VACUUM HOLD DOWN

If your machine is equipped with a vacuum table, simply lay stock material on top of the spoil board and align it properly. To activate the vacuum, press the **<VACUUM PUMP>** button located on the electrical cabinet (as shown in Fig. 5-10). Check that the material is secure before machining.





Fig. 5-10 Vacuum Pump button.

CLAMPING

If your machine is equipped with a T-slot table, insert clamps into these slots and clamp at least four corners of the stock material. Use more clamps if needed. Check that the material is secure before machining.

NOTE:

Ensure the pressure from the clamps is as uniform as possible. The further from the corners, the less pressure on that area. Inadequate pressure causes inaccurate work, especially for precise machining.



TOOL CALIBRATION

Once the material is secured, the tool can be calibrated. The calibrator is shown in Fig. 5-11 and should be placed on top of the stock material or on the spoil board if your stock material thickness has been accounted for while creating your tool path. Then jog the tool over to the calibrator and position it roughly 2-3" above the calibrator.



Fig. 5-11 Calibrator.

To activate the calibration process, the secondary function of the **<SPEED>** button must be used. To access this, press the **<SPEED SWITCHOVER>** button while holding the **<SHIFT>** button to activate **<TOOL MEASUREMENT>**.

These buttons are highlighted in Fig. 5-12.







Fig. 5-12 Calibration keys (G2 & G3).

Once the tool calibration is activated, the spindle head will begin to lower (Fig. 5-13). Align the calibrator directly underneath the tool so that the tool touches it when it lowers. When the tool touches the calibrator, the spindle will stop lowering and retract to an appropriate height.

To double check that the tool is calibrated properly, manually lower the spindle head to just above the surface of the stock material. Reference the controller screen and if the Z-axis value is close to zero, then the calibration is accurate.







SETTING ORIGIN

To set the origin, align the tool bit to the desired point on the material and press the **<XY CLEARING>** button highlighted in Fig. 5-14. This will set the work piece origin and will be the starting point of the g-code program.



Fig. 5-14 Origin button (G2 & G3).



LOADING G-CODE PROGRAM

To load the g-code program, insert a USB drive containing the program into the USB port on the cabinet (as shown in Fig. 5-15).



Fig 5-15 USB port.

Press the **<MENU>** button and select "2. USB FILES" from the options shown in Fig. 5-16 to access the .NC g-code files on the USB drive.





Fig. 5-16 Menu options.

Select the file you want to run by pressing **<OK>** on the file and then press "1. Load" so the controller registers the program.



RUNNING G-CODE PROGRAM

To run the g-code program, simply press the **<PLAY>** button shown in Fig. 5-17. Monitor the machine when it is cutting. To begin, set the feedrate to about 50-60% of what is programmed and then gradually increase once you are comfortable with the cutting speed.



Fig 5-17 Play button (G2 & G3).



TOOL CHANGES

Tool changes are done manually. Tool changes must be programmed into the g-code. Example Tool #1 for roughing and Tool #2 for finishing.

The controller will then prompt the user when it is time for a tool change. Insert the new tool and then recalibrate it to the top of the stock material. Ensure that the XY coordinates are NOT cleared and that the stock material is NOT moved to keep the tool path consistent with what has already been completed.

Once the tool calibration is completed, the program must be resumed from the breakpoint. To do this, press the **<PLAY>** button while holding the **<SHIFT>** button (as shown in Fig. 5-18).









MENU PAGE

SUMMARIZATION

The default mode after system start-up is manual mode. The processing page is the current page, including coordinate axis, coordinate value, operation state, spindle state, type of manual speed, and processing mode, as illustrated in Fig. 5-19



Fig. 5-19 The processing page.

Various operation prompts are displayed at the lowest part of the processing page.

If the **<E-STOP>** is pressed during processing, other keys become invalid except the menu key. The user can press the menu key to modify contents.

COORDINATE AXIS:

The coordinate axis is comprised of the machine coordinate system (MCS) and workpiece coordinate system (WCS). The user can press the combination key **<SHIFT>** and **<Y+>** to switch between these two coordinate systems. After returning to the mechanical origin, an asterisks ("*") will appear after the corresponding axis in MCS.



PROCESS MODE:

Process mode includes jog and stepping modes, which can be switched by pressing **<SHIFT KEY>**.

OPERATION STATE:

Operation state includes idle, e-stop, running, pause, and lock states.

SPINDLE STATE:

Spindle state includes spindle gears and spindle stop, which can be switched by **<SPINDLE START/STOP>** under idle state. During processing, press

<SHIFT> + <OVERRIDE +> Or <SHIFT> + <OVERRIDE ->

to increase or decrease the spindle gear. 1S represents rotate speed of the first gear, with nS representing the rotate speed of the nth gear.

TYPE OF MANUAL SPEED:

Manual speed can be divided into two types: manual high speed and manual low speed, which can be selected by pressing **<SPEED SWITCHOVER>**.

MENU PAGE:

Press **<MENU>** to enter the menu page. Altogether, there are eight parameter items in the menu, but the LCD can only show four of them at a time, as shown in Fig. 5-20.







On the menu page, press **<UP>** or **<DOWN>** to select the desired item and then press **<OK>** to enter the corresponding sub-menu.

BROWSE LOCAL FILES/USB FILES

The file browsing interface is shown in Fig. 5-21, in which the user can load, delete or copy a file. Only one file can be loaded to the system at a time. If several files are selected at the same time, a prompt dialog will appear.

NOTE: after **<Z->** is pressed to select "(3) Copy," a dialog box will pop up. Press **<OK>** to start copying. When the file is large, the system interface will display "Copying...". Please do not press any key on the operation panel at this time and wait patiently.



Fig. 5-21 File browsing example.



OPERATIONS



Fig. 5-22 The sub-menus under "Operations."

Press **<MENU>** key.

Select "3. Operations" by pressing **<UP>** or **<DOWN>**.

Press **<OK>** to enter its sub-menus.

Then select the desired menu item, also by pressing **<UP>** or **<DOWN>**.



OPERATOR PARAMETERS ("OPER PARAM")

VELOCITY PARAMETERS

Parameter	Meaning	Setting range
G00 Speed	G00 speed, which can be set in this parameter or in the program file	Related with machine tool G00 speed ≤ the max. velocity of machine tool)
Gxx Speed	Gxx speed	Related with machine tool
Ratio ON Manu Whether manual operations affected by feedrate override		Yes: affected No: Not affected
The max. velocity of machine tool is related with the setting of pulse equivalent. For the detailed		

expression, see chapter 6.1.2.

The relation between real feedrate and feedrate override is:

Real feedrate= Feedrate × Feedrate override

The least unit of feedrate override is 0.1, i.e. the override will increase (decrease) 0.1 after each press

of or , and the feedrate override displayed on the screen will increase (decrease) 10.

The adjustment range of feedrate override is 0.0~1.2. When the feedrate is adjusted, the value of feedrate will also change accordingly.

Manual high speed and manual low speed are set under main interface; G00 speed \geq processing speed, and manual high speed \geq manual low speed > 0.06

PROCESSING PARAMETERS

Parameter	Meaning	Setting range		
	Whether to back to mechanical	Yes: must back		
Dack KEP First	origin forcibly before machining	No: Not forced		
Lifts on Pause	Lifting amount on pause	0~10000		
Cycle Process				
Cuala Presses	Whether to enable quale process	Yes: enabled		
Cycle Process	whether to enable cycle process	No: not enabled		
Cuelo Timos	Cycle processing times, valid when	1~0000		
Cycle Times	"Cycle Process" is set as "Yes"	1~9999		
Cycle Interval	Interval of cycle processing	0~3600000		
C Off in Interv		Yes: valid		
S_OIT IN Intev	whether spindle stops in the interval	No: invalid		
G73_G83	Retracting or spacing amount of	0-100000		
Retract	G73_G83 command	0~100000		
Patio ON Manu	Whether manual operations affected	Yes: affected		
Ratio ON Manu	by feedrate override	No: Not affected		



Backing to mechanical origin before processing can prevent processing deviation, ensuring position accuracy. It is recommended to set "Back REF First" as "Yes" to disable machine tool to run automatically if backing to mechanical origin is not executed before processing. When backing to mechanical origin can not be executed due to origin fault, "Back REF First" can be set as "No". G73_G83 Retract: the retract amount after each feed under G73 command; under G83 command, the distance between the point from fast drilling to peck during each descending of tool interrupted feed and the descending point of last cutting feed.

OFFSET PARAMETERS

Parameter	Meaning	Setting range	
Public Offset	Aiming at all the coordinate systems, used for adjusting workpiece origin of X, Y and Z axes	-10000~10000	
Work Offset	D-value of WCS origin and MCS origin	-10000~10000	
For the detailed information, refer to chapter 4.2.			
The relation of workpiece offset, tool offset and public offset is as following:			
Workpiece coordinate = Mechanical coordinate - Workpiece offset - Tool offset - Public offset			

SPINDLE PARAMETERS

Parameter	Meaning	Setting range			
Spindle Stop					
SOff at pause	Whether to stop spindle at pause	Yes: stop	No: not stop		
SOff at Stop	Whether to stop spindle at stop	Yes: stop	No: not stop		
SOff at End	Whether to stop spindle when processing finishes	Yes: stop	No: not stop		
This group of parameters sets whether to stop spindle under various forms of stop state.					



FILE PARAMETERS

Parameter	Meaning	Setting range			
Eng Params					
	It sets the tool lifting height of Z axis during				
Lifting Height	rapid traverse of machine tool when an ENG	0~99999			
	file is being processed.				
	It sets whether to pause and prompt tool				
Tool Change Tip	change when tool change command is	Yes: valid No: invalid			
	encountered during ENG file processing.				
Cycle Times	It sets the cycle times to process an Eng file.	0~100000			
Deep Hole Mode	Mode selection for deep hole machining	0: reciprocating chip removal			
		1: high-speed reciprocating chip			
		removal			

Retract Amount	Retract amount after each feed in high-speed reciprocating chip removal mode	0~99999999		
Select Tool No.	If this parameter is set as "Yes", the machining will go on in terms of the specified tool No. in the machining file and only this file will be processed.	Yes: valid No: invalid		
Dxf Params				
Lifting Height	It sets the tool lifting height of Z axis during rapid traverse of machine tool when a DXF file is being processed.	0~99999		
Process Depth	It specifies the processing depth for 2D files.	-99999~0		
1 st Point as 0	It sets whether to set the first point as workpiece origin when DXF file is processed.	Yes: valid No: invalid		
Shape Process	The system will not process the next shape until the last shape is finished.	Yes: valid No: invalid		
Bottom Process	Valve operation is enabled only when [3D cutting] is on the workpiece surface.	Yes: valid No: invalid		
Metric Size	It forcibly sets dxf file as metric size.	Yes: metric size No: imperial size		



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These two groups of parameters are specially aiming at ENG files and DXF files. The system treats each tool lifting as a process step. if several shapes, with each shape including several steps, are to be machined, the second step will not be machined until the first step of all the shapes are finished under the condition of the parameter "Shape Process" set as "No." If the parameter "1st Point as O" is set as "no," the zero coordinate of DXF file will be regarded as the work piece origin in processing; if "Yes," the self-defined point in the DXF file will be treated as workpiece origin.

For instance, when drawing a picture with CAD, the user can define a point (this point will not be processed) freely in the picture (it's better if the point is near or within the picture); and then the system will treat it as a workpiece origin. If there are several points in the DXF, the system will assume the first drawn point is a workpiece origin.

Parameter	Meaning	Setting range			
Tool Change					
ATC Capacity	Capacity of tool magazine	1~20			
Current Tool No.	Tool No. currently used	1~value of ATC Capacity			
Tool Offset	Modification to the tool offset along each axis	X/Y/Z: -10000~10000			
Tool Change Tip	Whether to send prompt when there is tool change command in the file	Yes: valid No: invalid			

TOOL CHANGE PARAMETERS


COMMAND IGNORING

Parameter	Meaning	Setting range
Ignore E Code	Whether to use the feedrate command	Yes: use the feedrate in the system
ignore r code	in the program	No: use the feedrate in the file
		Yes: use the spindle command in the
Impore & Code	Whether to use the spindle command	system
ignore 5 code	in the program	No: use the spindle command in the
		file

MANUAL PROCESSING

MODE SELECTION OF MANUAL PROCESSING

To satisfy the requirements of manual motion under different situations, this system provides two kinds of manual motion modes: "Jog" and "Stepping," which can be selected by pressing **<SHIFT>**. The user can view the current motion mode through "Processing Mode" at the bottom of the screen.

JOG MOTION MODE

There is no concrete data control under job motion mode. The user can press a motion direction key to move the machine tool accordingly under this mode. The machine tool will not stop until the direction key is released. The motion speed is determined by the current type of speed (manual high speed and manual low speed). This motion mode is suitable for coarse tuning of the position within the mechanical coordinates.

STEPPING MOTION MODE

When the user presses a motion direction key in the stepping motion mode, the machine tool will move a specific length, which is determined by the step length. This motion mode is suitable for fine tuning of the position within the mechanical coordinates.



PARAMETER SETTING OF MANUAL PROCESSING

Basic parameters of manual processing include: manual high speed (i.e. "High shown in the processing page), manual low speed (i.e., "Slow" shown in the processing page), X\Y step and Z step.

Parameter	Meaning	Setting range
MSpd (High)	Two types of speed under manual processing,	0.06~max. speed of machine
MSpd (Slow)	processing	0.06~manual high speed
Step XYZ	The motion distance of the corresponding axis when a direction key of X\Y\Z is pressed once	0.001~10000mm

The max. speed of machine tool is related with the setting of pulse equivalent. For the concrete
expression, see chapter 6.1.2.
Manual high speed and manual low speed can be switched by pressing
The concept of stepping (also called as gridding in some other systems) is introduced for the purpose
of processing and debugging accuracy. When stepping is current manual motion mode, the step is
the motion distance of the corresponding axis when a direction key of X\Y\Z is pressed once.

Under the main interface, press **<OK>** to enter the parameter setting interface of manual processing, as shown in Fig. 5-23.

MSpd	3000/1500
StepXY	10.000
StepZ	1.000
File	<no file=""></no>

Fig. 5-23 Parameter setting interface of manual processing.



Press **<UP>** or **<DOWN>** to select the desired parameter and then press **<OK>** to confirm. Note that modifications should be within the parameter range. The current file name is displayed at the bottom line. Press **<UP>** or **<DOWN>** to move the cursor to this line, and then press **<OK>** to enter the file list of C: disk, as shown in Fig. 5-24. Within this interface, the user can only load files, not delete or copy them.



Fig. 5-24 Load file prompt.

If there is no file in C: disk, the prompt "File Not Found, Show USB File?" will appear; press **<OK>** to enter the file list of the USB flash disk.

To switch between USB file list and C: file list, press **<SPEED SWITCHOVER>**.

AUTOMATIC PROCESSING

Automatic processing refers to the system processing system files and the files in the USB flash disk in terms of instructions (also called file processing). All the parameters of the machine tool and system should be set correctly before automatic processing starts.

LOAD FILES

LOAD AN ORDINARY FILE

Press **<MENU>** to enter the menu page. Press **<UP>** and **<DOWN>** to select "Local Files" or "USB Files." Press **<OK>** to enter the corresponding file list interface. Press **<OK>** to select the processing file to be machines. Press **<OVERRIDE ->** to load the selected file.



LOAD AN ENG FILE WITH TOOL SELECTION FUNCTION

Enter the file list according to the method for loading an ordinary file, and then press **<OK>** to select ENG file to be machined. Press **<OVERRIDE** -> to enter tool selection interface automatically as shown in Fig. 5-25.

Number of tools: 2 Tool No.: 0 Cutter 1: [Flat Bottom]JD-6.00

Fig. 5-25 Tool selection interface.

Number of tools: the number of tools in this ENG file.

Tool No.: the current tool No., select with <UP> and <DOWN>.

Cutter: selected by pressing the **<UP>** and **<DOWN>**, displaying tool sequence number and name.

After the parameters are set, press **<OK>** to load the file. After loading, the system will return to the processing page automatically.



ADJUSTMENT DURING AUTOMATIC PROCESSING

FEED RATE OVERRIDE ADJUSTMENT

Feed rate override can be adjusted by pressing either **<OVERRIDE +>** or **<OVERRIDE ->** during file processing. The feed rate changes with the feed rate override. The relation between actual feed rate and feed rate override is as follows:

ACTUAL FEED RATE = FEED RATE X FEED RATE OVERRIDE

The lowest unit of feed rate override is 0.1. The override increases (or decreases) 0.1 after each press of **<OVERRIDE +>** or **<OVERRIDE ->**. At the same time, the screen displays the feed rate override increases (decreases) 10(%). The range of feed rate override is 0.0 (stopped) to 1.2. The display of feed rate value changes with the feed rate override.

SPINDLE SPEED ADJUSTMENT

Press <SHIFT> + <OVERRIDE +> or

SHIFT> + **STATE** + **S**

SUSPEND PROCESSING AND JIGGLE

Suspend processing by pressing **<UP>** during processing. The running status at the top right corner of the screen will display "Pause." At the same time, the machine tool will stop. Whether the spindle stops or not is decided by the setting of parameter "SOff at Pause." Whether spindle stops or not, at this time, the three axes can be jiggled, and the system default state is "Stepping Mode." Each press of a direction key will make the corresponding axis move a specific step.





CONTINUE PROCESSING AFTER PAUSE

When the system is in the paused state, pressing **<START>** will continue processing from the pause position. The running status at the top right corner of the screen will change from "Pause" to "Run" and the machine tool will start machining.

SOFTWARE LIMIT TREATMENT

A software limit occurs when a processing axis exceeds the setting of "Machine Stroke" during processing, and the system will display a limit dialog as shown in Fig. 5-26.



Fig. 5-26 Software limit alert.

Press **<OK>** or **<ESC>** to exit from this warning dialog and enter processing page, and then manually move the axis reaching software limit towards the reverse direction to release limit.

After a software limit occurs, the system prohibits the limit axis from moving towards the limit direction.

HARDWARE LIMIT TREATMENT

The system detects hardware limit periodically within the main interface. The prompt dialog shown in Fig. 5-27 appears whenever a hardware limit occurs.





Fig. 5-27 Hardware limit alert.

At this time, press **<OK>** to make the system return to the main interface under "Jog Mode" with "Limit RIs." displayed at its bottom right corner.

Or, you can press **<ESC>** key to go directly back to the main interface under "Jog Mode."

Move the machine tool away from the limit position, where "Limit RIs." disappearing. The prompt interface of limit goes back to the normal main interface.

SHUTDOWN & REBOOT

Pressing **<ESC>** for approximately three seconds in the main interface launches a prompt to either reboot or shutdown the system, as shown in Fig. 5-28.

Press:	
0	Reboot
1	Shutdown
OK	Cancel

Fig. 5-28 Shutdown/Reboot prompt.

The system will then go blank. If you want to enter the system again, you need to power off and re-power the system.



MAINTENANCE

As the CNC machine produces lots of dust and debris, maintenance is important to lengthen service life and improve production efficiency. First, you should have a general understanding of the structure and working style of the CNC router by reading this operation manual to better understand the motion of the guide rails, rack and pinion, etc.

It is important that the guide rails are cleaned frequently to ensure the gantry moves smoothly and to avoid deviations in your work. Key components, such as the motor, can wear, causing failure and inaccuracy. As time passes, the screw rod can become deformed, which will seriously affect the accuracy of the machine.

Through a basic understanding of the components, it is easy to grasp the key points of maintenance. The following are important aspects of maintenance.

LUBRICATION

Some series of the products our company producers do not have an automatic oil supply system, so they need to be cleaned manually before and after machining.





Fig. 6-1 Grease nipple

Pump lithium grease into the lubrication point (aka, grease nipple) with the application gun, as shown in Fig. 6-1.

RECOMMENDED LUBRICANTS

Lithium Based Grease: Alvania Grease No. 2 (Shell) or equivalent.

Oil: Vactra No. 2s (mobile) Waylube Viscosity of 68

LUBRICATING THE X-Y RACK AND PINION

Lubrication is important for rack and pinion gearing systems. A thin film of grease should always be present on the contacting tooth flanks to minimize metal-to-metal contact. We recommend lithium grease lubrication over oil, as the oil lubrication will flow away from tooth flanks. The grease should be applied to the racks at regular intervals, depending on the usage of the machine. Use a small brush to coat both racks on the side of the Y-axis and the single rail across the X-axis, as shown in Fig. 6-2.







LUBRICATING THE X-Y-Z RAILS

The rail carriage bearings are sealed and protected with wipers. The rails should be lightly greased to allow smooth operation. Avoid a build up of debris on the rails by blowing them off with air, or wiping them down with a rag. The rails do not need to be lubricated as often as the rack, once a month should be sufficient.



6-3 Rails.



DAILY MAINTENANCE

Check the machine before beginning any machining and clean it after use every day.

Check all wires for damage and connectivity prior to powering up the machine; most importantly, the communication line and power line.



<u>NEVER</u> stand on the machine and keep a safe distance away while under automatic control. Failure to follow these instructions will put the operator at risk of being severely injured or even killed.

Keep the area around the machine free from chips, dust and coolant to avoid creating slip hazards for the machine.

Check to ensure chips and dust are not caught in the X, Y or Z linear guide rails or rack and pinion/ball screw. Dislodge all chips and thoroughly clean dust.

Lubricate after thorough cleaning.

Clean accumulated chips, dust and coolant off the table to maintain vacuum pump suction.

NOTE:

Always power down machine when cleaning guide rails, rack and pinions and ball screw assemblies to avoid injuries.

Ensure there an adequate amount of mister coolant if machine is equipped with Unist system.

At the end of the work day, remove the tool and loosen the spindle chuck and lock nut; this will help lengthen the service life of the spindle chuck. Clean the worktable with a brush, clearing any dust or fragments off the guide rails (if exposed).

OPERATION INSTRUCTIONS



Clean the sensors (optical coupler, safety limit switch) to prevent dust and oil from influencing its sensitivity or to avoid setting it off by accident.

Stop the machine with the spindle in a position where it is less likely to get in the way and to avoid collision or leaked oil if over-lubed, and then turn off the power.

REGULAR MAINTENANCE

For regular maintenance, it is best to maintain and perform a comprehensive checklist of procedures to be carried out at specified intervals to eliminate potential danger and to restore the machine to its optimal operating state. Generally, this maintenance should be completed every month or 160 hours for two reasons: first, the moving parts of the worktable may loosen or displace over time from regular operation; secondly, grime or fine powders may form during machining, sticking to the lubrication oil and accumulating on the rack and pinion or guide rail, which over time can result in an overload of key components or abnormal grinding. There are three key steps for regular maintenance against the above problems:

STEP ONE: INSPECTION

CHECK the connecting bolts of each component in case they have loosened over time. Key components with bolts would be: guide rail, gantry, support column, bearing block, and machine nose. Adjust fastening bolts to eliminate potential failures.

CHECK that the connecting lines near the operating surface (sensors/motors) are not burnt, damaged, or corroded by chemicals/abnormal use. Find and solve these problems in time to avoid machine damage due to short-circuiting.

CHECK if the rack and pinion on each axis has an axial gap during motion. This process is very important, because dislocation in carving, character deformation, and deviation in "back to relative origin" are all related to this problem. Reasons for axial movement are generally loosening of lock nuts on both sides of the guide rail and damage to bearings. It should first be cleaned prior to adjusting.



CHECK for abnormal noises during operation, and troubleshoot for the potential failure to position, which could be caused by the wearing of the guide rail bearings on both sides.

STEP TWO: COMPREHENSIVE CLEANING

Clean grime and any accumulated lubricating oil off the guide rail and bearing blocks.

Turn on power to the machine and move it to clean and lubricate everywhere along the guide rail and rack and pinion.

STEP THREE: LUBRICATION

Lubricate linear guide rails, rack and pinions and ball screw assemblies monthly to ensure peak mechanical performance. Thoroughly clean components of any excess lubrication before fresh coating. Using gloves or a stiff brush, evenly smear a thin layer of No. 2 lithium-based grease on the rack and pinion. Linear guide rails should be lubricated with way lube. Rack and pinion should be lubricated with white lithium grease. Ball screw assemblies should be lubricated via the grease nipple using a grease gun.

Below is a sample maintenance schedule for your use. Fill in the date and year of scheduled maintenance. Technicians can initial completed tasks.



Month DD/YY	FEB	MAR	APR	MAY	JULY	AUG	SEP	OCT	NOV	DEC
XY rack and pin- ion thorough cleaning and lu- brication (white lithium grease)										
XYZ linear guide rails thorough cleaning and lubrication (way lube)										
Z axis ball screw lubrication (via grease nipple)										
Cleaning of cab- inet from built up dust/debris										
Cleaning of con- troller hand- held/keyboard										







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