NCstudio Controller

This document will provide a quick guide to the operation of the Techno BT1212 CNC Router equipped with a NCstudio Controller.

The BT1212 CNC Router is powered by high precision stepper motors and controlled by a hand-held NCstudio controller.

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Safety Instructions

READ THESE INSTRUCTIONS THOROUGHLY <u>BEFORE</u> OPERATING MACHINE. DO NOT OPERATE MACHINE IF YOU ARE UNFAMILIAR WITH THESE SAFE OPERATING INSTRUCTIONS. DO NOT OPERATE MACHINE WITHOUT KNOWING WHERE THE EMERGENCY STOP SWITCH IS LOCATED.

WARNING: IMPROPER OR UNSAFE OPERATION OF THE MACHINE WILL RESULT IN PERSONAL INJURY AND/OR DAMAGE TO THE EQUIPMENT.

1. Keep fingers, hands, and all other objects away from machine while power is on.

2. Disconnect power to all system components when not in use, when changing accessories, and before servicing.

3. Do not loosen, remove, or adjust machine parts or cables while power is on.

4. Exercise care with machine controls and around keyboard to avoid unintentional starting.

5. Make sure voltage supplied is appropriate to specifications of components.

6. Machines must be plugged into three-pronged grounded outlets. Do not remove the grounding plug or connect into an ungrounded extension cord.

7. Keep cables and cords away from heat, oil, and sharp edges. Do not overstretch or run them under other objects or over work surfaces.

8. Use proper fixtures and clamps to secure work. Never use hands to secure work.

9. Do not attempt to exceed limits of machine.

10. Do not attempt to use machine for purposes other than what is intended.

11. Use machine only in clean, well-lit areas free from flammable liquids and excessive moisture.

12. Stay alert at all times when operating the machine.

13. Always wear safety goggles.

14. Do not wear loose-fitting clothing when operating machine. Long hair should be protected.

15. Always maintain proper balance and footing when working around the machine.

16. 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.

17. Before using, check for damaged parts. An authorized service center should perform all repairs. Only identical or authorized replacement parts should be used.

18. Remove any adjusting <u>keys</u> and wrenches before turning machine on.

19. Do not operate the machine unattended.

20. Follow all safety instructions and processing instructions in the MSDS for the material being processed.

21. Use proper precautions with dust collection systems to prevent sparks and fire hazards.

22. Make sure to have proper fire extinguishing equipment on hand at all times.

PREVENT FIRE HAZARDS by using the proper feeds, speeds, and tooling while operating your Techno machine. For example, setting feeds and speeds too low and/or using dull tool bits creates friction at the material. The friction generates heat which can result in a fire that can be drawn through the vacuum table or dust collector without warning. Fire hazard from friction heating caused by dull tools is possible when cutting certain materials, especially composite material such as wood composites, MDF and Particleboard.   © 2015

Colleting Guidelines

Clamping the tools

The spindle (**3**) of the milling and grinding motor is equipped with a precision collet chuck (**2**) to hold the tools. The spindle locking button (**4**) enables you to tighten and loosen the collet nut (**1**)

▸ To clamp the tool, lock the spindle (**3**) by pressing the locking button (**4**)

▸ Tighten the collet nut (**1**) using a SW 17 open-ended spanner.

▸ To unclamp the tool, lock the spindle (**3**) by pressing the locking button (**4**)

▸ Loosen the collet nut (**1**) by turning the open-ended spanner. You can remove the tool by continually turning the open-ended spanner.

Attention!

perform a test run with an over-speed and make sure that no-one is within reach of the rotating insertion tool. Damaged tools usually break in this test period.

Changing the collet

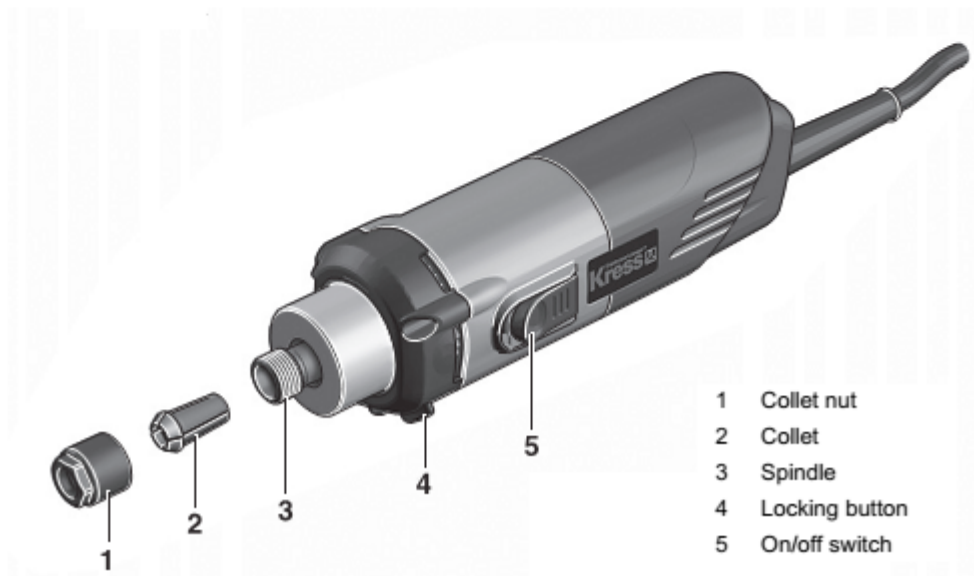Release the collet nut (**1**) and remove the tool using suitable cut protection (Caution - Danger of injury).

Unscrew the collet nut (**1**) with the collet (**2**)

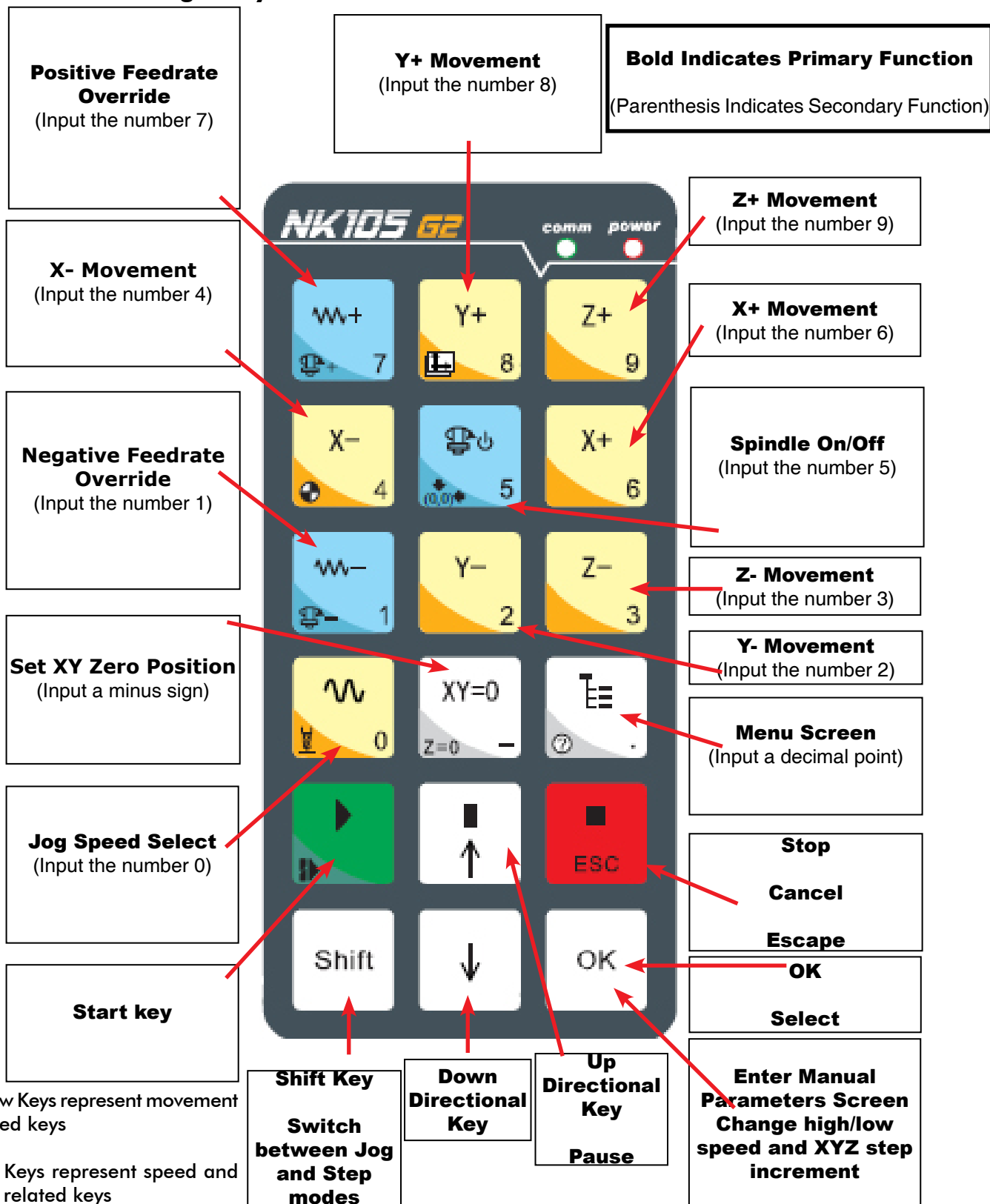Using your thumb and index finger, press the collet (**2**) together at the continuous slot.

Tilt the collet (**2**) off and remove it from the collet nut (**1**)

1	Collet nut
2	Collet
3	Spindle
4	Locking button
5	On/off switch

Single Keystroke Functions on the Handheld Pendant

Y+ Movement
(Input the number 8)

Bold Indicates Primary Function

(Parenthesis Indicates Secondary Function)

Positive Feedrate Override
(Input the number 7)

Z+ Movement
(Input the number 9)

X- Movement
(Input the number 4)

X+ Movement
(Input the number 6)

Negative Feedrate Override
(Input the number 1)

Spindle On/Off
(Input the number 5)

Z- Movement
(Input the number 3)

Set XY Zero Position
(Input a minus sign)

Y- Movement
(Input the number 2)

Menu Screen
(Input a decimal point)

Jog Speed Select
(Input the number 0)

Stop

Cancel

Escape

OK

Select

Start key

Enter Manual Parameters Screen Change high/low speed and XYZ step increment

Yellow Keys represent movement related keys

Blue Keys represent speed and feed related keys

Shift Key

Switch between Jog and Step modes

Down Directional Key

Up Directional Key

Pause

Shift Commands / Combination Keystrokes

To use the shift commands, you must press and hold the shift key and then select
a second key to use the Shift Command function.

Key icon	Function
Shift + Y+ 8	Switch between work (relative) and machine (absolute)
Shift + X− 4	Go to XYZ home (mechanical origin)
Shift + 5	Go to current work (relative) origin
Shift + XY=0 Z=0	Set Z zero position manually not using Touch-Off pad
Shift + ▶	Resume from breakpoint M0 command
Shift +	Open help screen

III Operating Tutorials.

3.0- Switching Movement to Step or Jog.
There are two modes that allow the user to control the movement of the machine: Jog and Step. To switch between these modes press the "Shift" button. The mode will be displayed on the bottom left of the screen.

Jog- Also known as continuous mode. When a directional arrow is pressed, the machine will move in that direction until the button is released.

Stepping- Also known as step mode. When a directional arrow is pressed, the machine will move an exact amount, as dictated by the manual parameters page. To move again, you must release the button and press it again.

3.1- Jogging the machine and changing from High/Low Jog Speed.
To Jog the machine, hold down one of the Yellow directional keys on the keypad while in Jog mode. The keypad has X+,X-,Y+,Y-,Z+,Z- printed on the keys to indicate direction.

The machine has two speeds, High and Low.
When the machine starts it will be in the Low speed.
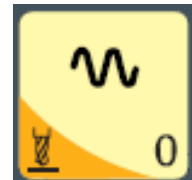
To toggle between low and high speed press the Jog Speed Select Button. You can only toggle speed when in Jog Mode.
The LCD will display High or Low on the right of the screen.

Press 'OK' to change high and low speeds, see section 3.3.

Select between high and low Jog speeds

3.2- Stepping the machine.
To move the machine in increments, press down one of the Yellow directional keys on the keypad while in Stepping mode. The keypad has X+,X-,Y+,Y-,Z+,Z- printed on the keys to indicate direction.

This will move the machine in predetermined increments in the axis selected.
By default, the X and Y axes will move in .005 inches and the Z axis will move in .001 inches.

Press 'OK' to change step size, see section 3.3

3.3- Modifying the Jog Speed and Step Size
The machine can be jogged at two speeds, low and high. You can also change the increments in which the machine will move in Step mode. These speeds are set in the Manual Parameters page.

To access the Manual Parameters page press OK from the Main Screen

OK

Low Speed

High Speed
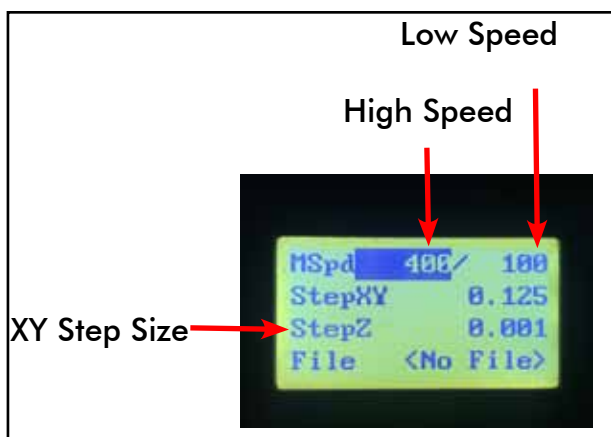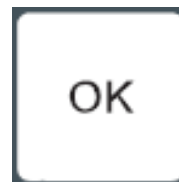
To move the cursor, use the Up and Down directional arrows.
Enter a new value.
Press OK to accept that value.

XY Step Size

```
MSpd    400/  100
StepXY       0.125
StepZ        0.001
File    <No File>
```

Set the High and Low speed to a suitable value.
Adjust the Step value as needed.

To Exit out of this screen and return to the main menu press ESC.

ESC
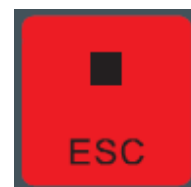
Warning: Adjust the step size carefully. If you set the step size to an excessive value, the machine will move by that value and could damage the machine.

When inputting a decimal increment, you must enter the value as 0.###
Zero+decimal+(your increment)

3.4- Feedrate Override.
While running a G-Code file, the user can manually override the feedrate or cutting speed of the program. The range of the override goes from 10% to 120% of the original feedrate.

The user can override the feedrate using the following keys:
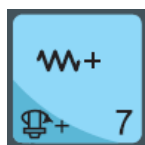
| Increase Feedrate | OR | Decrease Feedrate |

3.5- Adjusting the XYZ Zero position/WCS/User Origin.

XYZ zero position, Working Coordinate System (WCS), and User Origin are all the same thing.

Different CAM systems and users just name the concept differently. For convenience XYZ zero position will be used in the rest of this manual.

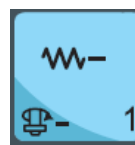XYZ zero position is the location point on a drawing in a CAD/CAM package where X,Y and Z all equal zero.

Generally, XY zero is on the bottom left corner and Z zero is the top of the part. In fig 3.3a the letters are located away from the XY zero, all points representing positive integers.
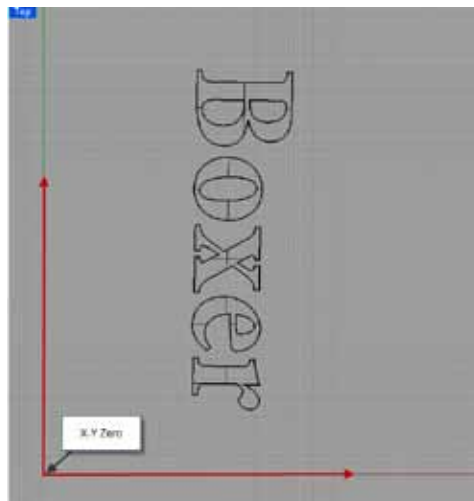

Fig. 3.3a

In Fig 3.3b the object represents the material the letters will be cut from. The machine should be jogged to the corner of the material by using the directional arrows on the keypad. Once the machine is in location press to set XY zero. The coordinates on the controller will change to 0,0.XY zero is now set.
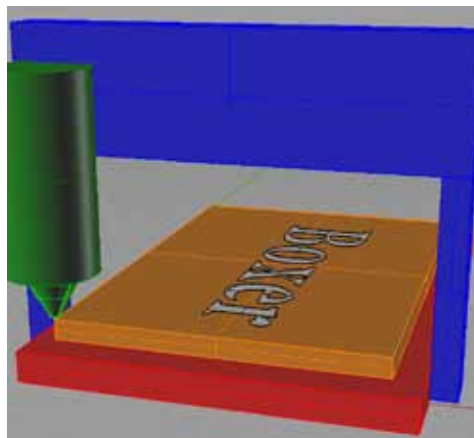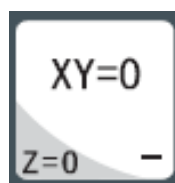
Fig.3.3b

There are two methods for setting the Z-axis zero position:

1. Manual Method: Use the Z-axis directional arrows on the keypad to move the router to the top of the material. Switch to Step Mode to slowly move the machine into position. When the router bit is in position press shift/aux and the Z=0 button as shown.
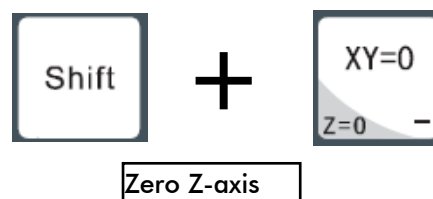
2. Tool Calibration Block: Place the touch off block on top of the material and under the cutter. Press shift/aux and 0 simultaneously. The spindle will slowly move down until it touches the touchpad. The Z axis will now be set to the top of the material.
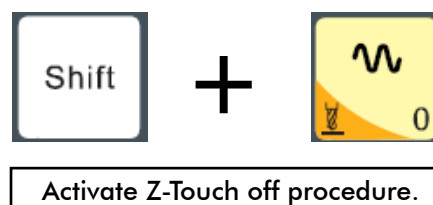
The Z coordinate will now read 'Z 0.000'

Zero Z-axis

Activate Z-Touch off procedure.
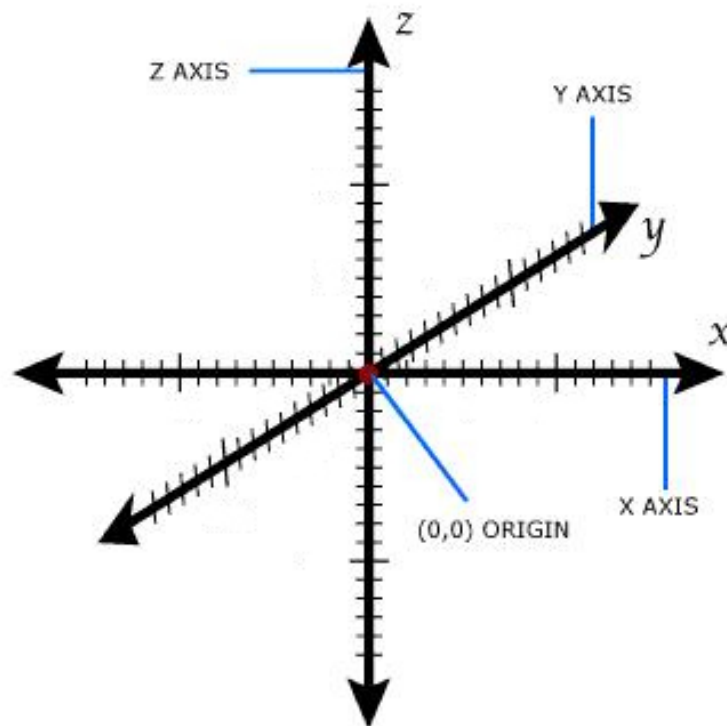
3.6- Loading a G-code File.

Press the Menu button.

Select "2.USB files" to access the flash drive.
Only a G-code file with an "nc" extension with show.

Scroll through the files with ⏸↑ and ↓

Select file by pressing OK.
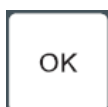
Then load the file by pressing 1.
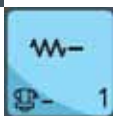
Note:
Files can be copied from this USB to the controller using the "2" button
Local disk space is limited!

Once a file is copied locally, it can also be selected from the jog speed /step size screen

3.7- Running a G-code file.

Once the XYZ origin has been set as per section 3.5 and the file has been loaded as per section 3.6 the user is ready to run the G-code file.

To run the G-code file simply press the start button

Once the spindle has reached speed the machine will move into position to start the first cut.

The file can be paused while running by pressing

To resume the file press   To abort the file at any time press

Note:
When the machine pauses, the spindle will stop and the Z axis will move to the Z clearance/ Safe height to allow inspection of the part.

If the machine is jogged off the part during a pause, it will lose its position and when the file is resumed it will start from the new position.

When using multiple tools it is best to create separate files for each tool.

The last file can be resumed at a breakpoint by pressing.

IV. Advanced Tutorials.

4.1- Alternating between Override and Programmed Feedrates.

The controller can run G-code files with speed set by the user on the keypad, override speed, or with speed set in the CAM package/G-code file, programmed speeds.

To determine what speed protocol will be used, do the following:

In the main screen, press menu [menu icon] to enter the menu screen .

Use the [pause/up key] [down key] key to scroll the cursor and highlight 4. oper param

Press OK to select.

Use the [pause/up key] and [down key] key scroll the cursor and highlight 8. ignore F code

9. ignore S code

Press OK to select.

Note:
The F or S Option.
F stands for Feed rates, and S stands for Spindle RPMS.

Note:
"No" means speed in the G-code file will be obeyed.

"Yes" means speed will be overrode by the controller.

4.2 Setting the Override Speed for a G-code file.

From the main screen, press Menu
to access the Menu screen.

Use the arrow keys to move the cursor and
highlight   4. oper param

Press OK to select this option and enter the Operations Parameters screen

Use the arrow keys to move between each option and
press enter to select the option.

Press OK to edit the data and use the number keys to enter data.

Press OK to save data and Cancel to exit out of the screen.

Keep pressing cancel until you return to the main screen.

G00 Speed is the rapid speed, or the speed the machine moves when the cutter is above
the material.

GXX Speed is the speed the machine moves when the cutter is in the material. This speed
will vary with cutter size, material, cutter type, etc.

More parameters in

5. MFR param

4.3 Setting the Table Size.

From the main screen, press Menu to access the Menu screen.

Use the arrow keys to move the cursor and
highlight   5. MFR param

Press OK to select.

Password: 33587550

The MFR parameters screen will now open.

Use the arrow keys to move the cursor and highlight.
    4. Machine stroke

Press OK to select.

Use the arrow keys to highlight a value, press OK to edit the value, and
press OK to save it.

Press Cancel when the value is highlighted to abort the edit.

Use the arrow keys to scroll down the screen until the negative values
are displayed.

When all the edits are complete, press Cancel to exit out of this screen.
Keep pressing cancel until you return to the main screen.

The asterisk * on this setting indicates that the machine must be powered down and the
axes homed in order for these new values to take affect.

If these values are incorrect it will effect the running of the machine.

If the values are too small, the machine will stall/stop when it reaches the value entered.

If the value is too big, it is possible for the machine to hit the end of travel and damage
could occur.

Changing to a Different Offset (a new X Y Zero location)

There are 6 available X Y Zero locations that can be set up.

The offset number is displayed to the left of the Z X Z display 1 through 6 as shown below

Press Menu

> **Operations**

> > Select **WCS**

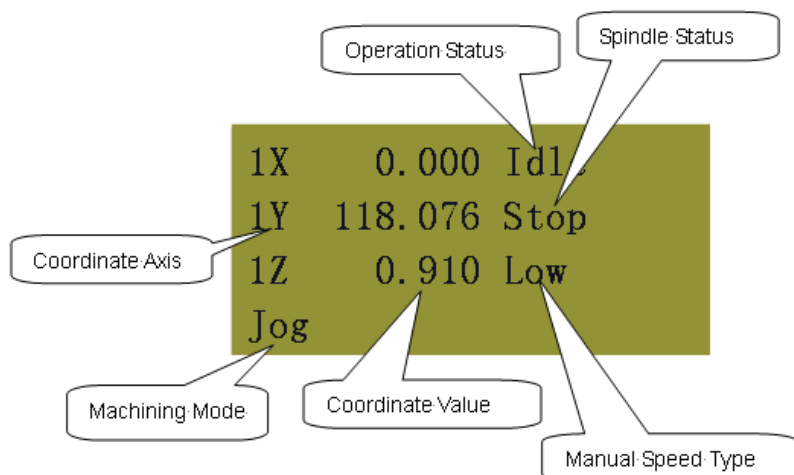|	
G54	**Origin 1**
G55	**Origin 2 . . .**

Each offset can have it own X Y and Z Zero

These additional offsets can be used to locate parts on different locations on the table

however for ease of use you can use just one offset as we did in training.

If the machine ever starts to cut in what appears to be the wrong location on the table, there is a

chance you have accidentally selected a different offset.

Pulse Equiv (scale factors)

X : 0.0012500
Y : 0.0012500
Z : 0.0012500

Notes On the G-code File

If a part requires multiple tools, it is best to output a different file for each part.

If the G-code file references a tool number higher than T10, then the controller will give an error at the start of the file. M6 T1 to M6 T10 are allowed.

In general it is best to remove T commands by telling the CAM package that the machine is not a tool changer machine, or insuring that the Tool number does not exceed 10.

G92 is the Axis presetting command, when this command is encountered in the G-code file the XYZ zero position is set at the position the machine is in at that time.

In general it is best to remove this from the G-code file, or if it is in the G-code file, make sure the machine is at the origin before you press start.

The controller will recognise G54 to G59 offset commands.

See the NK105 G2 manual for more details on these commands.

Acceleration Set

Under the menu MFR Params, there is a sub menu called Velocity.

This menu controls the acceleration and cutting motion of the machine.

The Defaults for these parameters are:
Jerk   310
Single Axis Acc   25
Max Turn Acc   100

A low Max Turn Acc will result in arcs that move in a jerky motion or at a slow speed.

Using the 4th Axis on the Techno BT1212 Machines

Note: The 4th axis on the Techno BT1212 machine is not a true 4th axis. You can only use this to do "wrapping" tool paths. This means that the file is designed as a regular, flat, 3-axis file, which is scaled so that the width matches the circumference of round stock. Then, instead of cutting flat, the rotary is substituted for the Y-axis and the cut follows the circumference of the stock, as if it is being "wrapped" around it.

To change from normal 3-axis operation to rotary operation, you must change some settings in the controller:

1. Press the menu button on the keypad. Go to and press OK to select "*5. MFR Param*". The password is 33587550.
2. Go to and press OK to select "*3. Pulse Equiv*". Make note of the Y-axis value, it should be .00125.
3. Calculate the new pulse equivalent value based on the diameter of the cylindrical stock being used through the following equation:

$$\textit{Rotary Pulse Equivalent} = (25.4 * \pi * D) / 12000$$

   Where D is the diameter of the rotary stock in inches.

4. Enter the calculated value for *Rotary Pulse Equivalent* in the location for Y under Pulse Equiv. To input a decimal number, please press 0 (zero) first, then the button for the decimal point and then the numbers.
5. Exit the menu and restart the machine. The new settings will now be applied.
6. Now jog to your starting point and set your X and Y origin. This position should be above the rotary part. *Note: The Y-axis will most likely move at a different speed than normal and the coordinates will not look right.*
7. Flip the switch in the front of the machine into Rotary mode.
8. Run your part

To revert back to normal 3-axis operation, follow the first two steps and then put the original value, .00125, into the Y-axis pulse equivalent variable, then reboot the machine to apply the changes.

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All Techno CNC Systems, LLC., mechanical components are warranted against manufacturer's defects in material and workmanship for a period of one (1) year from the time of shipment from Techno CNC Systems, LLC., facilities. All Techno CNC Systems, LLC., electrical components are similarly warranted for a period of one (1) year from the time of shipment from Techno CNC Systems, LLC., facilities. Techno CNC Systems, LLC.,'s sole obligation under this warranty is limited to repairing the product or, at its option, replacing the product without additional charge, provided the item is properly returned to Techno CNC Systems, LLC., for repair as described below. The provisions of this warranty shall not apply to any product that has been subjected to tampering, abuse, improper setup or operating conditions, misuse, lack of proper maintenance, or unauthorized user adjustment. Techno CNC Systems, LLC., makes no warranty that its products are fit for any use or purpose to which they may be put by the customer, whether or not such use or purpose has been disclosed to Techno CNC Systems, LLC., in specifications or drawings previously or subsequently provided, and whether or not Techno CNC Systems, LLC.,'s products are specifically designed and/or manufactured for such a purpose. NOTE: Drive motors (servo or stepper) are considered "mechanical components".

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Before returning any equipment in or out of warranty, the customer must first obtain a return authorization number and packing instructions from Techno CNC Systems, LLC.,. No claim will be allowed nor credit given for products returned without such authorization. Proper packaging and insurance for transportation is solely the customer's responsibility. After approval from Techno CNC Systems, LLC., the product should be returned with a statement of the problem and transportation prepaid. If, upon examination, warranted defects exist, the product will be repaired or replaced at no charge, and shipped prepaid back to the customer. Return shipment will be by common carrier (i.e., UPS). If rapid delivery is requested by customer, then such transport is at the customer's expense. If an out-of-warranty situation exists, the customer will be notified of the repair costs immediately. At such time, the customer must issue a purchase order to cover the cost of the repair or authorize the product to be shipped back as is, at the customer's expense. In any case, a restocking charge of 20% will be charged on all items returned to stock.

FIELD SERVICE

Repairs are ordinarily done at Techno CNC Systems, LLC.,'s Ronkonkoma, New York facility, where all necessary instrumentation is available. This instrumentation is difficult to transport, so field service is severely limited, and will only be supplied at Techno CNC Systems, LLC.,'s discretion. If field service is required and is performed at Techno CNC Systems, LLC.,'s sole discretion, all relevant expenses, including transportation, travel time, subsistence costs, and the prevailing cost per hour (eight hour minimum) are the responsibility of the customer.

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