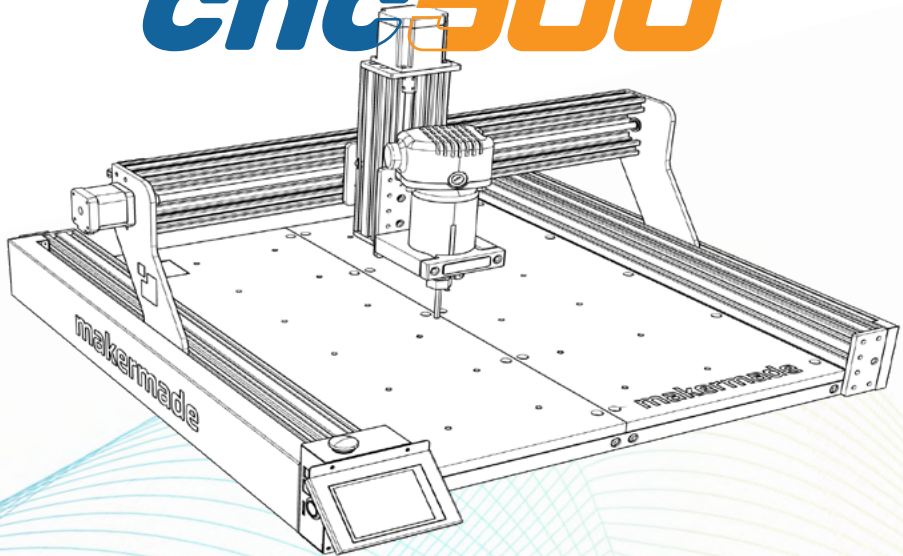


 makermade

cnc500



ASSEMBLY GUIDE

**Bring Your Ideas To Life With The
MakerMade cnc500**

V1 | 2023 ©MAKERMADE, LLC

Safety Warnings:

1. During set up, please make sure the machine is on a solid surface.
2. In case of emergency, press the emergency stop button quickly.
3. Wear safety glasses when operating the machine.
4. Please use a brush to remove debris, do not blow on the machine.
5. Use caution when handling sharp objects on the machine.
6. When attaching the router bits to the router, be sure they are properly secured prior to use.
7. Turn off the machine if you are loading/unloading, attaching the spindle, measuring or cleaning.
8. Do not wear cotton gloves during operation.
9. Do not place measuring tools or other items on the machine during use.
10. Clamp the project material securely to the waste board. Do not cut or engrave if the material is not secured.

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SECTION

01

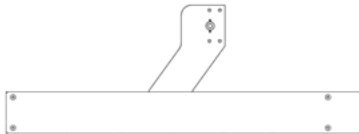
What's in the Box?

<input type="checkbox"/>	HARDWARE BAG 1	M5*20 4PCS BASE FRAME
<input type="checkbox"/>	HARDWARE BAG 2	M5*20 16PCS WASTEBOARD FIXED
<input type="checkbox"/>	HARDWARE BAG 3	M5*20 4PCS BASE FEET SCREWS
<input type="checkbox"/>	HARDWARE BAG 4	M5*20 4PCS Z AXIS MOUNT
<input type="checkbox"/>	HARDWARE BAG 5	M5*7 4PCS 775 MOTOR CLAMP
<input type="checkbox"/>	HARDWARE BAG 6	M5*15 8PCS X ALUMINUM RAILS
<input type="checkbox"/>	HARDWARE BAG 7	M3*4 2PCS CONTROL BOX
<input type="checkbox"/>	HARDWARE BAG 8	M3*4 6PCS X AXIS TRACK MOUNT
<input type="checkbox"/>	HARDWARE BAG 9	M3*6 4PCS X-AXIS MOTOR
<input type="checkbox"/>	HARDWARE BAG 10	M3*14 4PCS X-AXIS TRACK CONNECTOR
<input type="checkbox"/>	HARDWARE BAG 11	M6*50 12PCS FIXTURE SCREW AND NUTS
<input type="checkbox"/>	HARDWARE BAG 12	TOOL BAGS

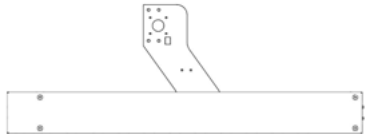
Components:



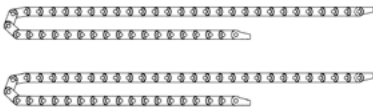
Left Y-Axis Shield*1



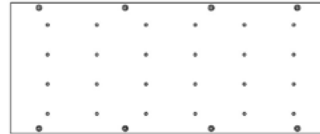
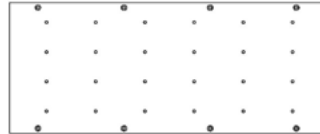
Right Y-Axis Assembly*1



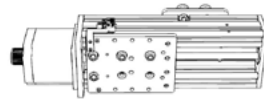
Left Y-Axis Assembly*1



ESP32 Control Box + Drag Chain*1



Density Plate*2



Z-Axis assembly



2020 Rear Crossmember*1



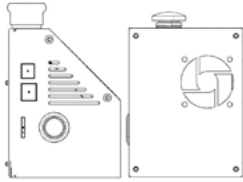
2020 Rear Crossmember*1



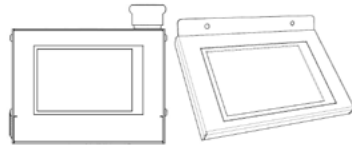
2020 Bottom Crossmember*2



2040 Bottom Crossbeam*1



ESP32 Control Box*1



TS35 Touch Screen Kit*1



ER-11 6mm Collet *1



775 Spindle Motor*1



775 Motor Chuck*1



Motor Mounting Bracket*1



Coupling*1



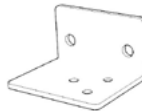
Rubber Foot Pad*4



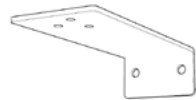
Mainboard Fixing Piece*2



Fixture*6



Drag Chain Support



X-Axis Limit Trigger Plate*2

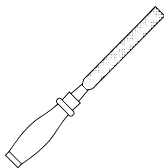
SECTION

01.1

Tools you need



Scissor



File



Oblique Flier



One-way Screwdriver



Safety Goggles



Open-end Wrench

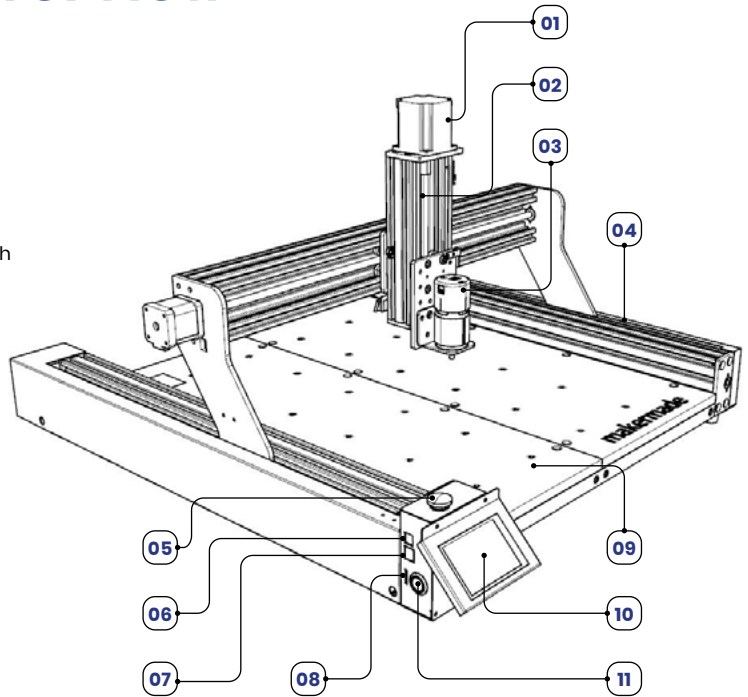


Hexagonal Wrench

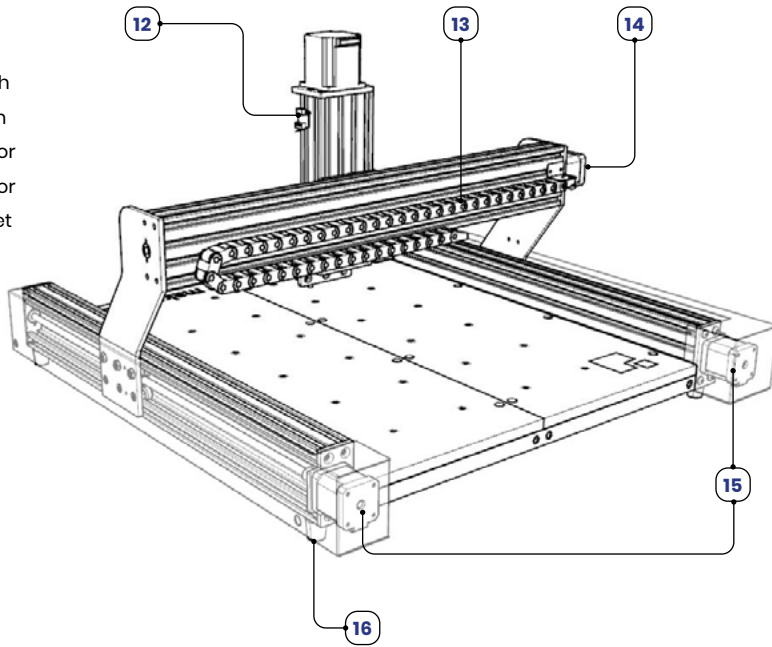
SECTION
01.2

Machine Overview

1. Z-Axis Motor
2. T8-4 Screw
3. 775 Spindle Motor
4. 4080U Side Profile
5. Emergency Stop Switch
6. DC Power Interface
7. USB Interface
8. TF Card Slot
9. Engraving Platform
10. TS35 Touch Screen
11. Power Switch



- 12. Limit Switch
- 13. Drag Chain
- 14. X-Axis Motor
- 15. Y-Axis Motor
- 16. Rubber Feet



SECTION
02

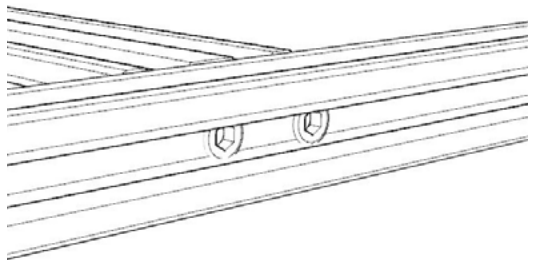
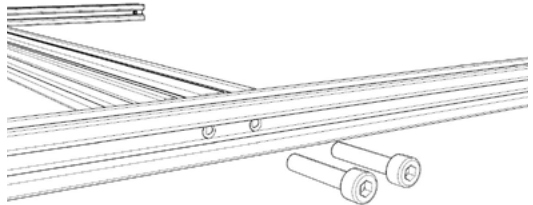
Assembling the cnc500

Step 01:

FRAME INSTALLATION

Make sure holes with notches are facing out on each side extrusion.

Use 4mm Allen wrench to attach four base frame screws.



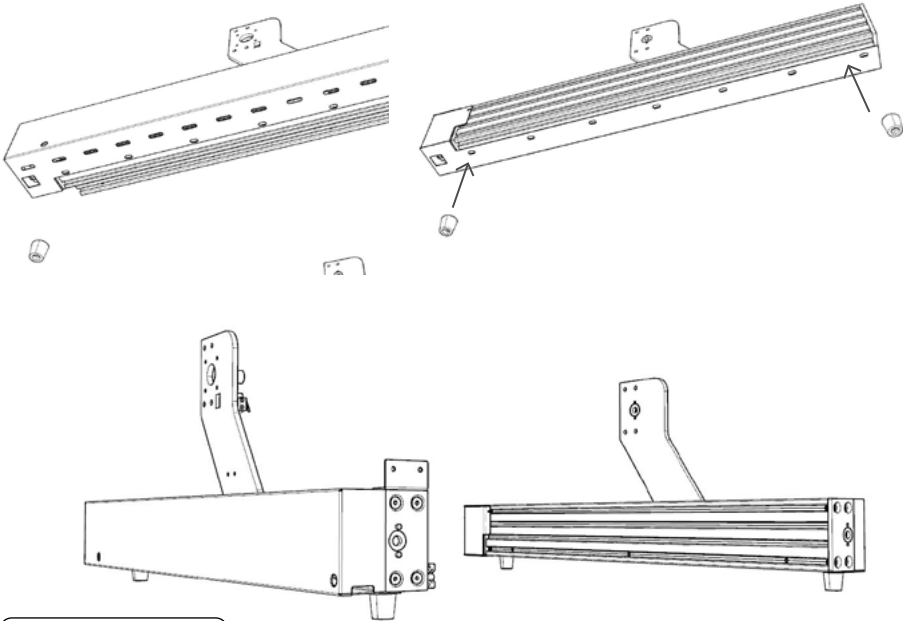
REQUIRED PARTS:

- 4 pcs - Base frame screws
- 2 pcs - 2020 Aluminum Extrusion
- 1 pcs - 2040 Aluminum Extrusion

Step 02:

ATTACH RUBBER FEET TO SIDE ASSEMBLIES

Attach two rubber feet to
bottom of each side assembly
using M5x20 screws



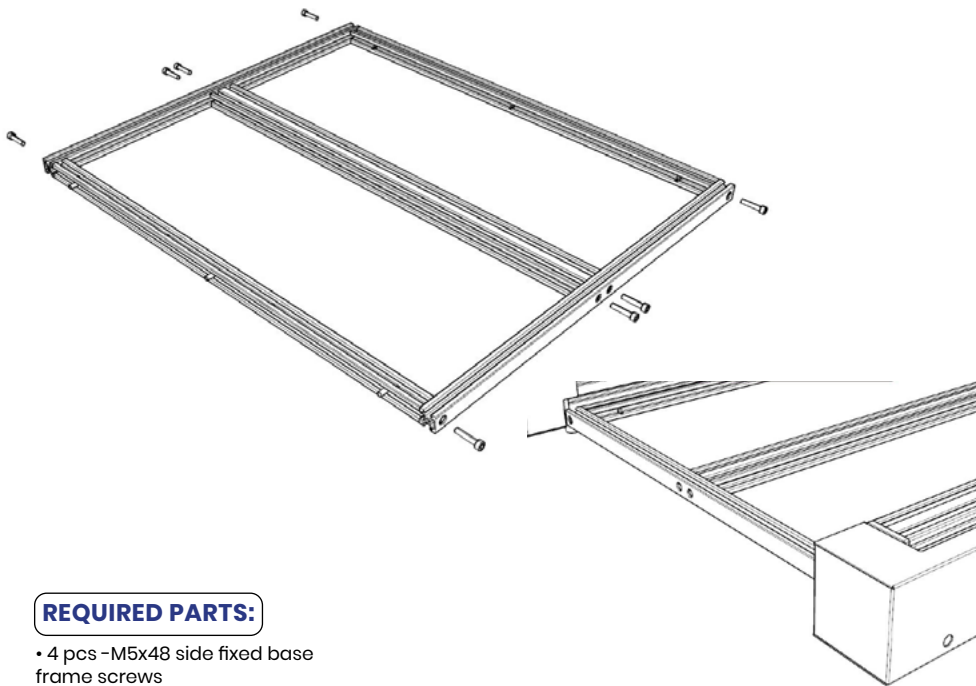
REQUIRED PARTS:

- 4 pcs - Rubber feet
- 4 pcs - M5x20 screws
- 2 Side Assemblies

Step 03:

ATTACH BOTTOM FRAME TO SIDE ASSEMBLIES

When the frame is installed with the profile plane facing upwards, pay attention to the direction of the left side 2020 profile.



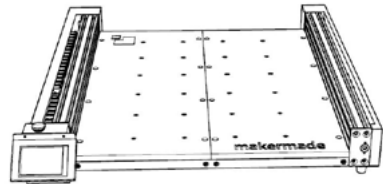
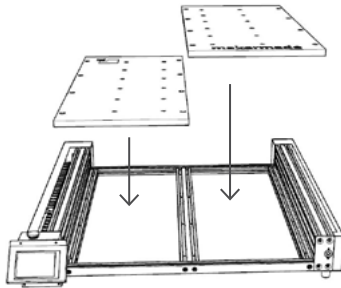
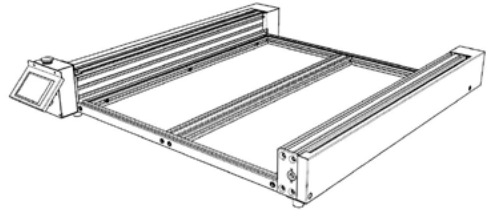
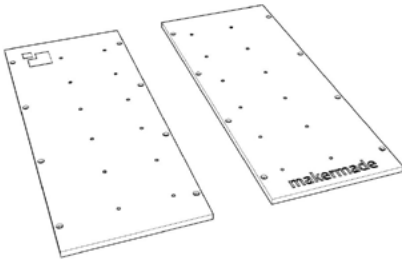
REQUIRED PARTS:

- 4 pcs - M5x48 side fixed base frame screws
- Side Assemblies

Step 04:

WASTE BOARD INSTALLATION

With the surface of the density plate facing upward, screw 20 screws through the density plate into the profile.

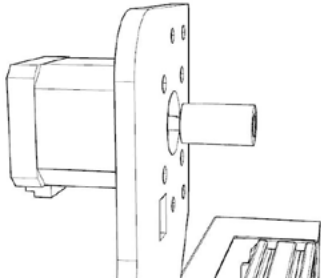


REQUIRED PARTS:

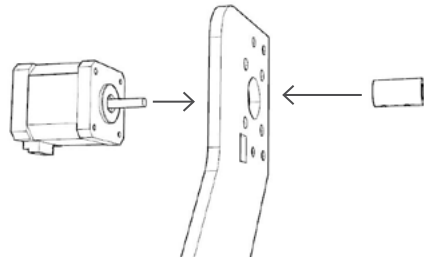
- 16 pcs - M5 x 20 screws
- 2 pcs - Waste Board

Step 05:

X-AXIS MOTOR INSTALLATION



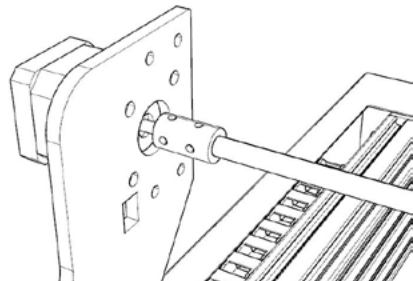
Attach stepper motor to
Left Y-Axis assembly



Attach coupling to stepper motor
shaft with set screws. One set screw
should go on flat side of shaft

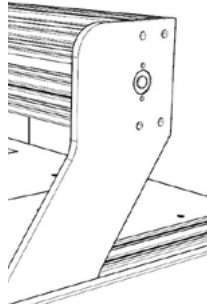
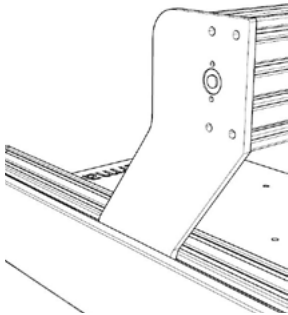
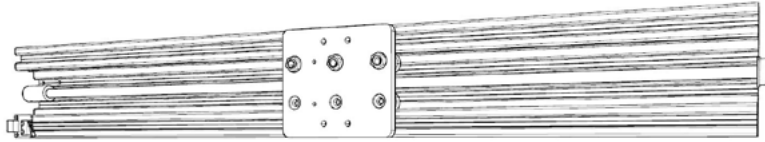
REQUIRED PARTS:

- 1 pcs - X-Axis stepper motor
- 4 pcs - M3 x 6 X-Axis motor screws
- 1 pcs - Coupling



Step 06:

X-AXIS INSTALLATION

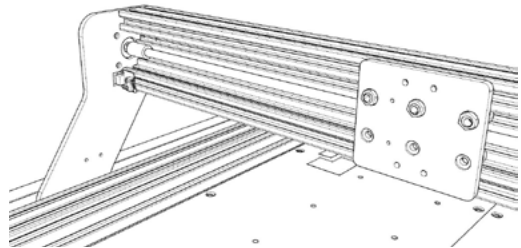


Use four M5 X 12 screws to attach the X-Axis

Note the orientation of the X-Axis with the nut end facing up to the Right Y-Axis assembly

REQUIRED PARTS:

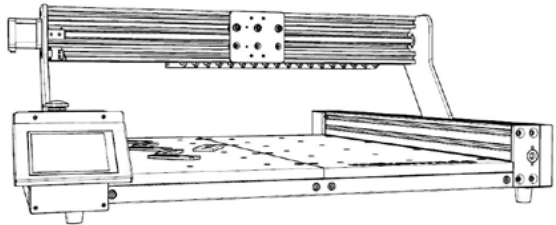
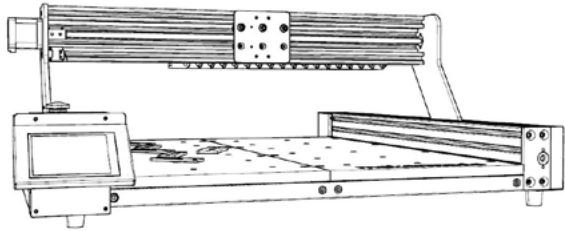
- 4 pcs - M5X12 screws
- X-Axis Assembly
- 3mm wrench



Step 07:

X-AXIS INSTALLATION CONTINUED

1. From the back of the machine push the X-axis carriage to the left so the lead screw goes through the bearing hole on the right Y-axis assembly
2. Manually turn the left Y-axis lead screw to align left and right Y-axis



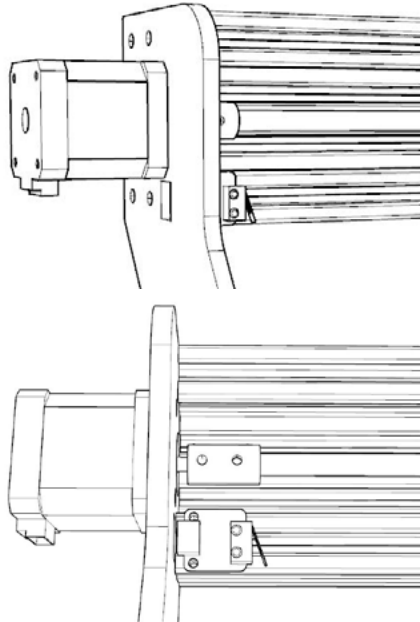
REQUIRED PARTS:

- 4 pcs - M5X12 screws
- X-Axis Assembly
- 3mm wrench

Step 07:

X-AXIS INSTALLATION CONTINUED

3. Use four M5 X 15 screws to attach the right side of the X-axis profile.
4. From the back of the machine push the X-axis carriage to the right, insert the lead screw into the coupling and tighten the two set screws on the coupling.



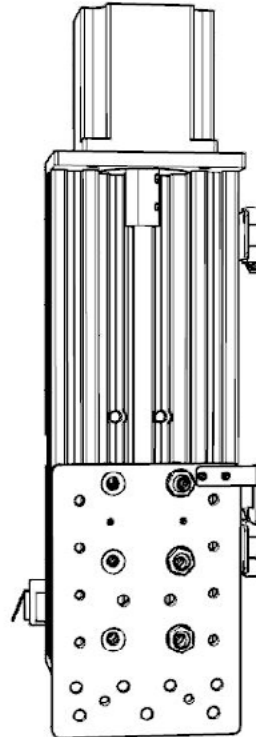
Step 08:

Z-AXIS INSTALLATION

1. Use 2 mm Allen wrench to loosen the two set screws on the coupling
2. Move the carriage down to find the top two holes to attach the assembly
3. Use 4 mm Allen wrench to attach assembly using two M5X20 screws. Tighten the screws

REQUIRED PARTS:

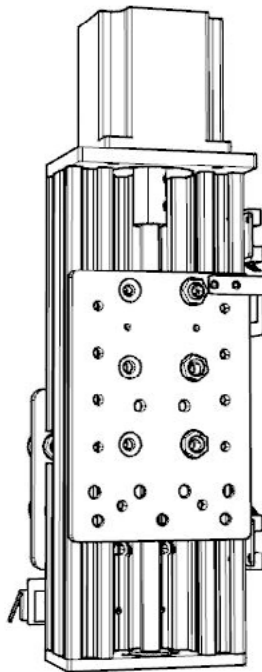
- 4 pcs -M5X20 screws
- Z-Axis Assembly
- 4 mm wrench
- 2 mm wrench



Step 08:

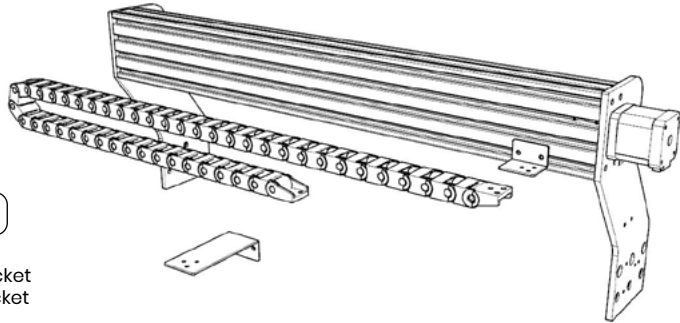
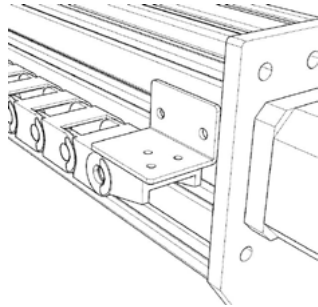
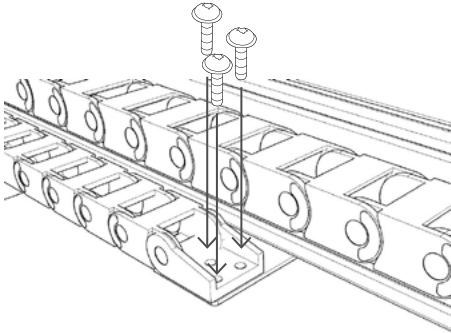
Z-AXIS INSTALLATION

4. Move the carriage up to find the bottom two holes to attach the assembly
5. Use 4 mm Allen wrench to secure assembly using two M5X20 screws. Tighten the screws
6. Insert the lead screw back into the coupling and tighten up the two set screws



Step 09:

DRAG CHAIN INSTALLATION

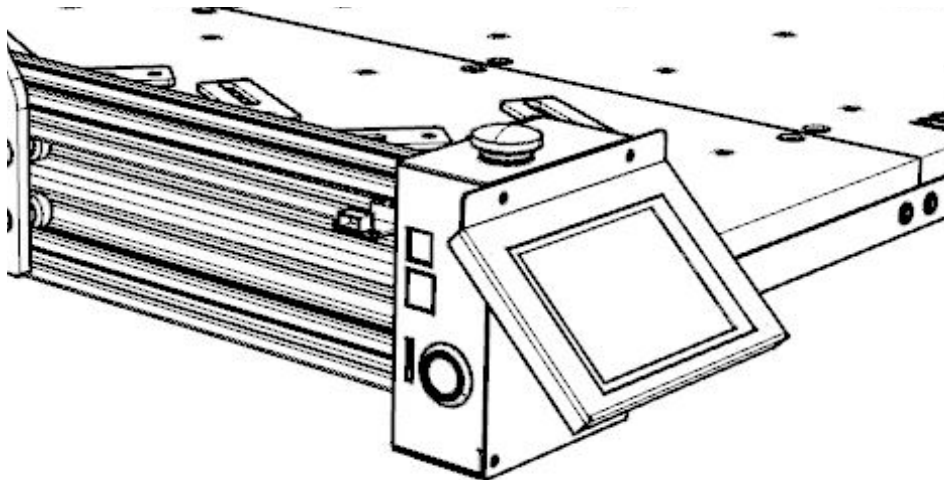


REQUIRED PARTS:

- 4 pcs -M4X6 screws
- Upper drag chain bracket
- Lower drag chain bracket
- 2.5 mm allen wrench
- 2 mm allen wrench

Step 10:

TOUCH SCREEN INSTALLATION



First, screw the M5X6 screw through the motherboard fixing piece, and then screw in the T-nut.

Insert it into the profile slot and tighten it slightly. Lock M3X5 screw first, and then tighten M5X6 screw.

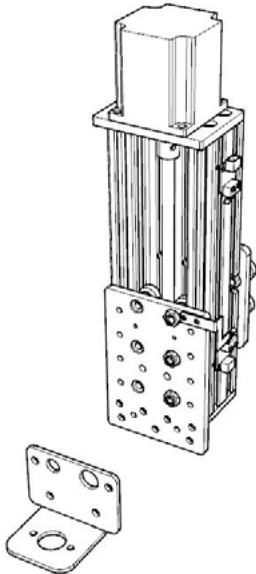
REQUIRED PARTS:

- M3X5 Screws*2
- M5X6 Screws*2
- T-Nut 20-M5*2
- Mainboard Fixing Piece*2
- 2.0 Hexagonal Wrench
- 3.0 Hexagonal Wrench

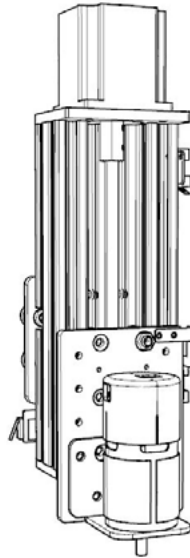
Step 11: INSTALLING THE MILLIE

REQUIRED PARTS:

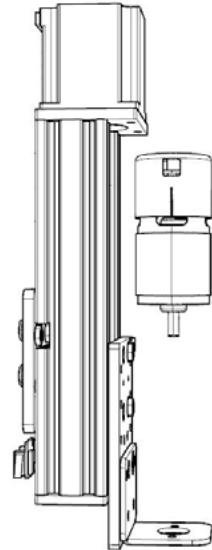
Z-Axis Motor Cable
X-Axis Limit Switch Cable



1. Attach the motor mount to the Z-Axis assembly using the (4) M5X6 screws



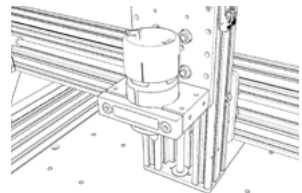
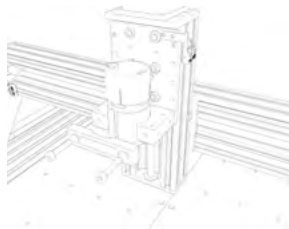
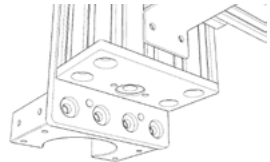
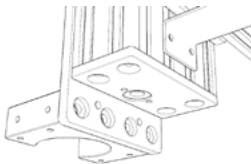
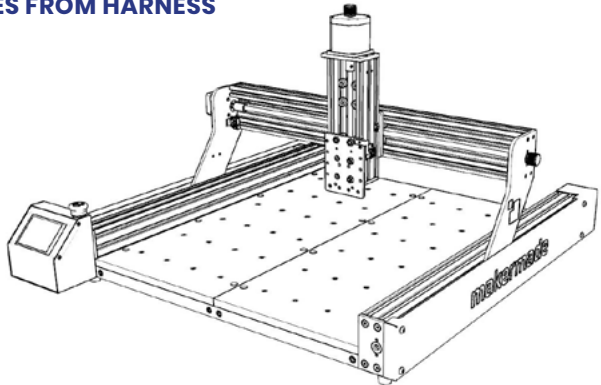
2. Attach the motor to the motor mount using the (2) M4X6 screws.



3. Attach the chuck with ER-11 collet to the spindle by tightening set screws on chuck.

Step 11.1 (Conditional): INSTALLATION OF CABLES FROM HARNESS

1. Plug in the Z-axis motor cable and X-axis limit switch cable.
2. Plug in the 775 motor cable (Optional)



REQUIRED PARTS:

Z-Axis Motor Cable
X-Axis Limit Switch Cable

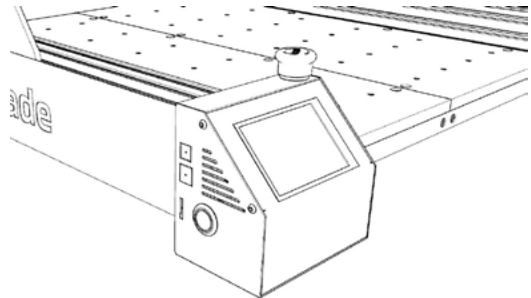
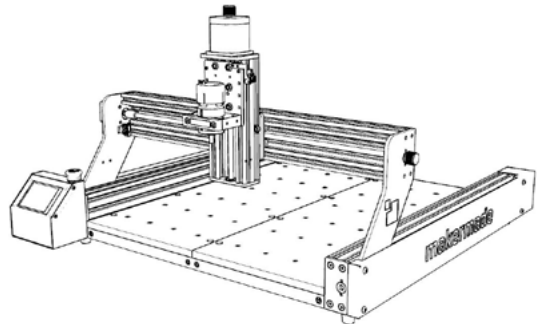
OPTIONAL PARTS:

775 Motor
775 Motor Cable

Step 12:

TEST

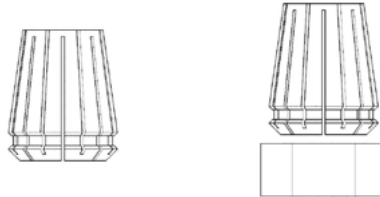
1. Make sure the emergency stop switch is popped up by lightly twisting it to the right, then plug in the power and press the metal power switch.
2. The green light will turn on. If the screen lights up, the touch screen is functioning properly.
3. Next, click the "Control" button, and move the XY-axis to the bottom left corner of the machine. Click XY, Clear, and Z Clear.
4. Then, move the XY axis away from the corner using the X/Y jog controls.
5. Click "NEXT", and click "Home" to return to the corner. The XYZ axis will return to the bottom left corner of the machine.
6. Click "Spindle" to rotate the spindle. Click "Spindle" again to stop the spindle. (Only applies to the 775 motor spindle)



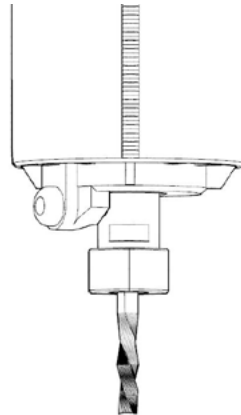
Step 13:

INSTALLATION OF ROUTER BIT TO ER-11 COLLET

Warning: To reduce the risk of injury, turn unit off and disconnect it from power source before installing and removing accessories, before adjusting or when making repairs. An accident start-up can cause injury.



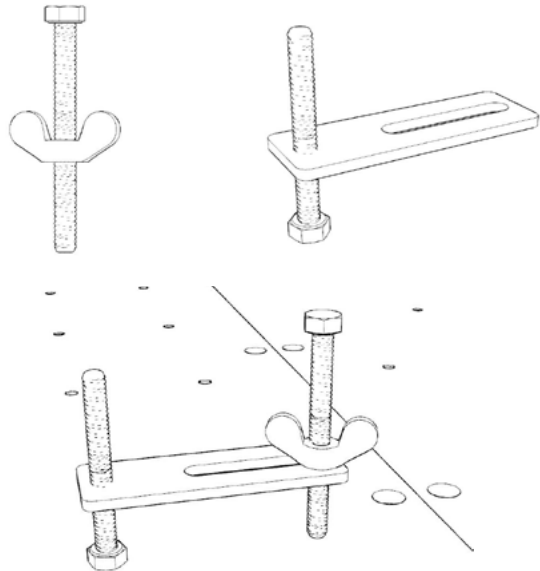
1. Choose the correct collet size for your bit and add the nut.
2. Insert the collet into the nut.
3. Insert the bit into the collet/nut assembly. Press the shaft lock in (located on the side of the shaft) and tighten collet nut.



Step 14:

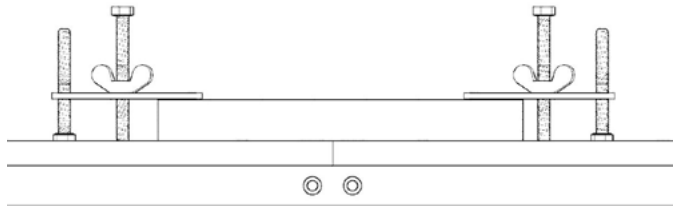
CLAMPING WORKPIECE

1. Use Two bolts per clamping piece.
2. Insert 1st bolt into butterfly nut.
3. Insert 2nd bolt into clamping piece for enough to equal the thickness of the workpiece with the head of the bolt facing down.
4. Insert 1st bolt into screw hole on waste board.
5. Tighten butterfly nut to secure workpiece.



REQUIRED PARTS:

- Clamping Pieces
- Bolts and Butterfly Nuts



SECTION
03

Wiring Connection Guide



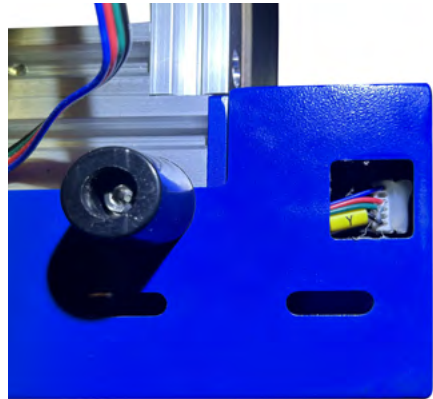
Z AXIS MOTOR



**UPPER Z AXIS
LIMIT SWITCH**



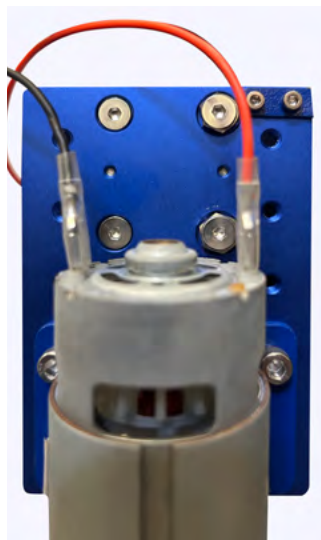
**TOUCHSCREEN
CONNECTION CABLES**



**Y MOTOR
PREASSEMBLED**



**X AXIS MOTOR
AND X AXIS LIMIT
SWITCH**



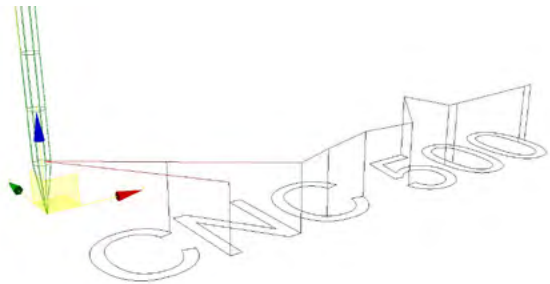
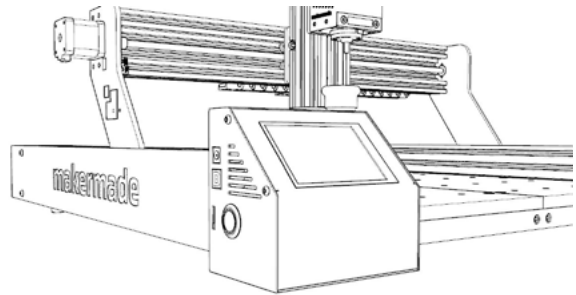
**SPINDLE WIRING
CONNECTION**

SECTION

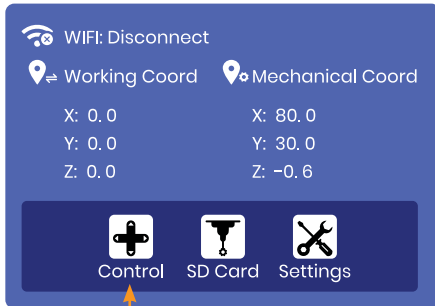
04

Operation

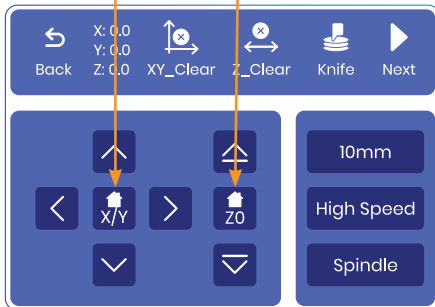
1. Save the NC file to SD card, power on.
2. Click SD card button choose NC file.
3. Move the XYZ-axis to the origin. Click XY Clear and Z Clear.
4. Click 'Start Job' button again start engraving.
5. Option to start or stop the program.
6. Click 'Adjustment' button you can change the rate and speed.



NAVIGATION



Click "Control" to go to navigation panel.



Soft Home button

Setting up the controls:

Click on the Control button and move the X-axis to the left corner and the Y-axis to the bottom and hit XY Clear.

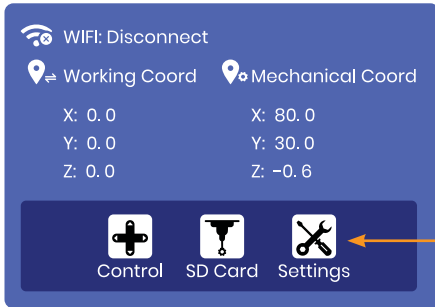
Next is to move your Z-axis to your desired position. (This depends on the thickness of your material) and click Z-clear.

- 10mm **Moving distance**
- High Speed **Moving speed**
- Spindle **Turn on/off the spindle**

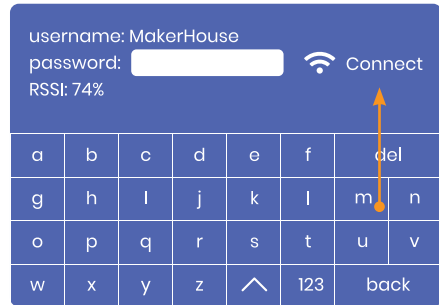
Step 01:

CONNECTING THE CNC500 TO WI-FI

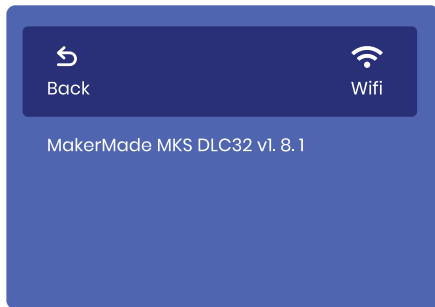
1. Push Settings icon on touch screen.



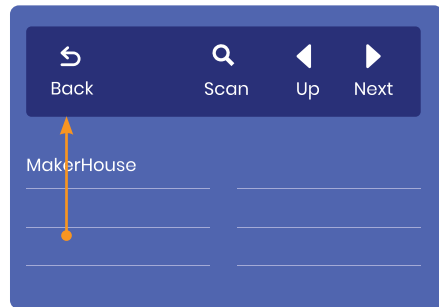
3. Choose Network, enter Network password, then push Connect icon



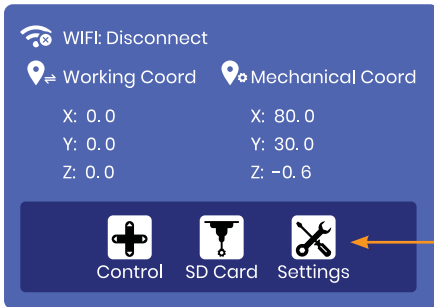
2. Next, push Wifi icon (this should show available networks)



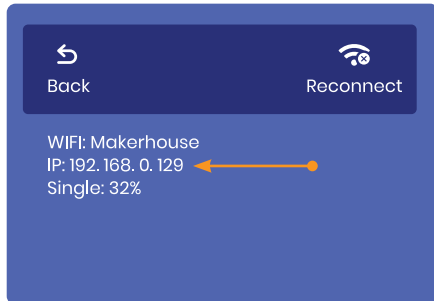
4. Push Back button once OR go back to Settings from main menu



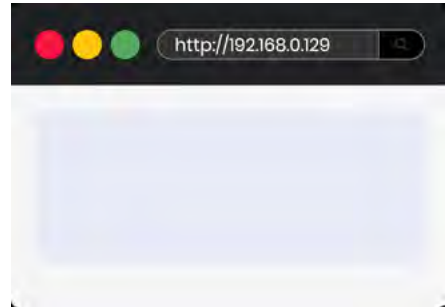
5. Push Settings icon on touch screen.



6. Next, push Wifi icon (this time it should show the network the machine is connected to and IP address for cnc500)



7. Open a browser on your computer and enter `http://(your IP address here)` in the address bar



8. ESP-32 WEB Control page should load in browser



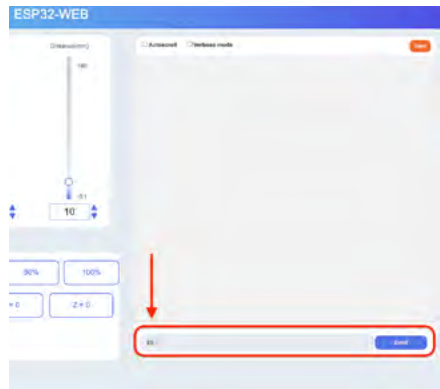
Step 02:

ACCESSING CNC500 GRBL SETTINGS VIA WEB BROWSER

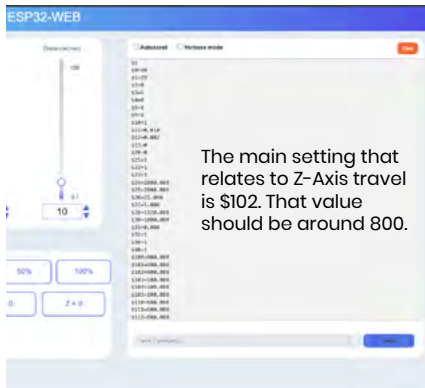
1. Once you have the ESP32-WEB page open, Uncheck the Autoscroll and Verbose mode for now



2. In the blank area where it says Send Command, type \$\$ then click Send or press Enter



- The values that come up are the GRBL settings for the machine currently.



- To change that value to 800, type \$102=800 and click Send or press Enter



- To see that the value has changed, type \$\$ then click Send or press Enter.

The values should come up and \$102 should be changed to 800.



For a complete list of GRBL Settings and what they mean, please see GRBL Pocket Guide below.

GRBL SETTINGS

COMMAND	DEFINITION	EXPLANATION						
\$\$	View Settings	Displays current GRBL settings stored in EEPROM (memory) of the Arduino						
\$0=10	Step Pulse Length (usec)	This sets the length of the step pulse delivered to the stepper motors. The goal is to have the shortest step pulse your motors can reliably recognize. The data is available on some stepper motor data sheets otherwise 10 is a good default.						
\$1=25	Step Idle Delay (msec)	Sets the time delay in milliseconds that GRBL will power the stepper motors after a motion command is complete. A setting of 255 tells the motors to stay powered on to hold position.						
\$2=0	Step Pulse Configuration	Defines the step signal sent to the stepper motor drivers. By default the step signal starts low and goes high to denote a step event. See Axis Config. Table below.						
Axis Config. Table	Setting Value	Reverse X	Reverse Y	Reverse Z	Setting Value	Reverse X	Reverse Y	Reverse Z
	0	NO	NO	NO	4	NO	NO	YES
	1	YES	NO	NO	5	YES	NO	YES
	2	NO	YES	NO	6	NO	YES	YES
	3	YES	YES	NO	7	YES	YES	YES
\$3=6	Axis Direction	Changes axis motion direction without changing wiring. See Axis Config. Table above.						
\$3=6	Step Enable Invert	Controls the signal sent to the enable pin of your stepper drivers. \$4=1 sets the enable pin to high. (Invert)						
\$5=0	Limit Pins Invert	This refers to the limit switch pins which by default are set to high using the Arduino's internal pull up resistors. Grounding the pin tells GRBL the limit switch is tripped. For the opposite behavior use the setting \$5=1 which tells the system that a high is the limit switch trigger. You must also install external pull down resistor with the \$5=1 setting.						

COMMAND	DEFINITION	EXPLANATION	
\$6=0	Probe Pin Invert	This refers to the probe pins which by default are set to high using the Arduino's internal pull up resistors. Grounding the pin tells GRBL the probe is tripped. For the opposite behavior use the setting \$6=1 which tells the system that a high is the probe trigger. You must also install external pull down resistor with the \$6=1 setting.	
\$10=3	Status Report	Defines the real time data sent to the user. By default GRBL reports running state which cannot be turned off, machine position & work position. The table to the right details the settings. Note to send a combination of status reports, simply add the values of the desired report types and send this value to GRBL. For Example, say I want Work Position (2) & Limits (16), I would send \$10=18.	
		Report Type	Value
		Machine Position	YES
		Work Position	YES
		Planner Buffer	YES
		RX Buffer	YES
		Limit Pins	16
\$11=0.020	Junction Deviation (mm)	Think of this as cornering speed. A high value allows for fast motion around corners but increases the risk of missed steps resulting in decreased accuracy. Conversely, lower values reduce the speed around a corner decreasing the risk of missing steps while potentially improving accuracy.	
\$12=0.002	Arc Tolerance (mm)	GRBL treats curves as a collection of small straight lines. This setting defines how smooth the curves will be. The default is .002mm and will not likely need to be changed as this value is below the accuracy of most machines.	
\$13=0	Feedback Units	Sets position feedback units from mm to inches. \$13=1 for inches or \$13=0 for mm	
\$20=0	Soft Limits (Enable/Disable)	Requires "Homing" be enabled and checks to see if gCode commands will exceed the travel limits of the machine. \$20=1 Enable \$20=0 Disable	

COMMAND	DEFINITION	EXPLANATION
\$21=0	Hard Limits (Enable/Disable)	Requires limit switches be installed and looks for one of the limit switches to be activated which triggers "Alarm" mode. In this mode, all machine motion, the spindle and coolant are shutdown.
\$22=0	Homing Cycle (Enable/Disable)	Requires limit switches be installed. Enabling this will lock out all gCode commands until a "Homing" cycle is run.
\$23=1	Homing Cycle Direction	Allows the user to change the direction of the homing cycle us the values from the Axis Config. Table on page 36.
\$24=50.000	Homing Feed (mm/min)	Feed rate used in the "Homing" cycle once the limit switches are located. The lower the value the more repeatable the zero position.
\$25=635.000	Homing Seek (mm/ min)	Feed rate used in the "Homing" cycle to locate the limit switches. Set this to the highest value that does not cause the machine to crash into the limit switches.
\$26=250	Homing Debounce (msec)	Length of the software delay in milliseconds that minimizes switch noise. A value between 5 an 25 is typical.
\$27=1.000	Homing Pull-off (mm)	Tells the machine how far to move away from the limit switches after finding the "Home" position so as not to trigger the hard limits.
\$100=314.961	X (steps/mm)	Tells GRBL how many steps are required to move the machine a given distance. Steps/mm = (Steps per Revolution)*(Microsteps) / (mm per Revolution)
\$101=314.961	Y (steps/mm)	
\$102=314.961	Z (steps/mm)	<ol style="list-style-type: none"> Steps per Revolution = 200 Typical - This is the number of steps required for your stepper motor to make 1 complete revolution. Microsteps - 1,2,4,8,16 - Is a setting on your stepper motor driver. A higher value means lower torque but higher accuracy. mm per Revolution - Determined by your machine setup. (lead screw pitch)

COMMAND	DEFINITION	EXPLANATION
\$I10=635.000	X - Max Rate (mm/min)	Defines the maximum speed for a given axis. This is found experimentally for each axis by incrementally increasing the value and then sending a test gCode command to move the axis. Be sure the command allows the axis to move enough to reach the maximum rate. You will know the maximum speed when the stepper motors stalls. Reduce the value by 10-20% These values may be different for each axis.
\$I11=635.000	Y - Max Rate (mm/min)	
\$I12=635.000	Z - Max Rate (mm/min)	
\$I20=50.000	X - Max Acceleration (mm/sec ²)	Defines the maximum acceleration for a given axis. This is found experimentally for each axis by incrementally increasing the value and then sending a test gCode command to move the axis. Be sure the command allows the axis to move enough to reach constant motion. If you decide to use a jog command make sure the jog increment is several inches. You will know the maximum value when the stepper motors stalls. Reduce the value by 10-20% These values may be different for each axis.
\$I21=50.000	Y - Max Acceleration (mm/sec ²)	
\$I22=50.000	Z - Max Acceleration (mm/sec ²)	
\$I30=225.000	X - Max Travel (mm)	Used when soft limits are enable to tell GRBL the maximum travel for each axis. This also requires the use of a homing cycle.
\$I31=125.000	Y - Max Travel (mm)	
\$I32=170.000	Z - Max Travel (mm)	

GRBL Commands

\$#	View gCode Parameter	Lists work coordinate offsets (G54-G59), Predefined positions (G28 & G30), Coordinate offset (G92), Tool Length Offset (TLO) & Probing cycle (PRB).
\$G	View Parser State	Displays the active gCode modes in the GRBL parser. Example - [G0 G54 G17 G21 G90 G94 M0 M5 M9 T0 S0.0 F500.0]

\$I	View Build Info	Shows the GRBL version and source code build date.
\$N	View Startup Blocks	Displays the startup blocks run each time GRBL is powered on or reset.
\$NO=line \$NI=line	Save Startup Block	Command used to save startup blocks. Substitute valid gCode commands for the "line" portion and these will be executed each time GRBL is powered on or reset.
\$x=value	Save GRBL Setting	Command used to save a GRBL setting. Replace the "x" with a number from the list above and the "value" with the corresponding setting.
\$C	Check gCode Mode	Processes all incoming gCode commands but does not move the axis, spindle or coolant so the user can check a gCode program.
\$X	Kill Alarm Lock	Overrides the alarm lock to allow for axis movement.
\$H	Run Homing Cycle	Executes the homing cycle.
Real Time GRBL Commands		
~	Cycle Start	Starts buffered gCode commands. Used to resume cutting after a "Feed Hold."
!	Feed Hold	Stops active cycle by controlled deceleration preventing position loss from missed steps.
?	Current Status	Returns the active GRBL state & current machine & work positions.
ctrl-x	Reset GRBL	Soft reset command retains machine position without powering down the Arduino.

SECTION

05

Support and Customer Service

THE GUARANTEED WARRANTY PERIOD IS 12 MONTHS FROM THE DATE OF PURCHASE.

1. Missing/Damaged/Defective Parts

For 30 days after the date of purchase, we will replace any parts free of charge.

2. Customer Damaged Parts These items will not be covered under the warranty and may include a purchase cost and shipping fee.
3. Courier loss, missing, damaged, and defective parts.
 - a. Lost or damaged shipments must be reported to the carrier within the carrier's claim window. Please notify us within 7 days of the date of receipt by submitting a ticket here: <https://makermade.freshdesk.com/support/tickets/new>.
 - b. For any parts lost or damaged during shipping, you may be required to take photos or video and send them to us in a support ticket. Our support tickets can be submitted here: <https://makermade.freshdesk.com/support/tickets/new>.
 - c. For missing parts, you will be required to fill out a service ticket.
 - d. For damaged parts, you will be required to fill out a service ticket and send us photos or video of the damage.



Product Warranty

Customer Name:

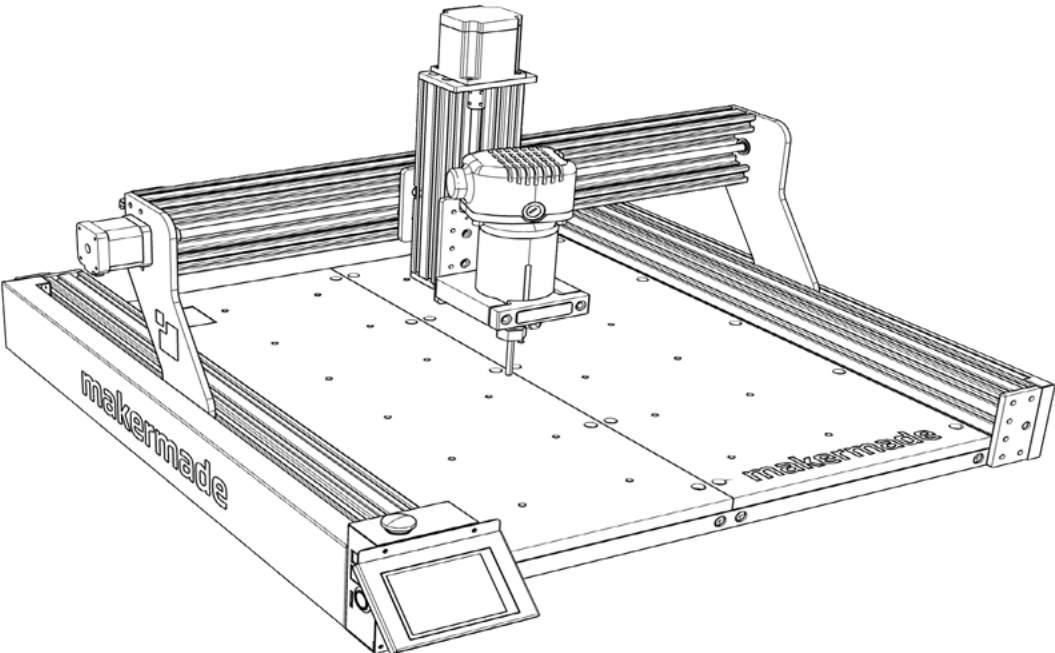
Address:

Model Number:

Serial Number:

Purchase Date:

Invoice Number:



The MakerMade logo consists of a blue square icon with a white square inside, followed by the word "makermade" in a lowercase, black, sans-serif font.

makermade

cnc500