LONGMILL 48x30 SPOILBOARD
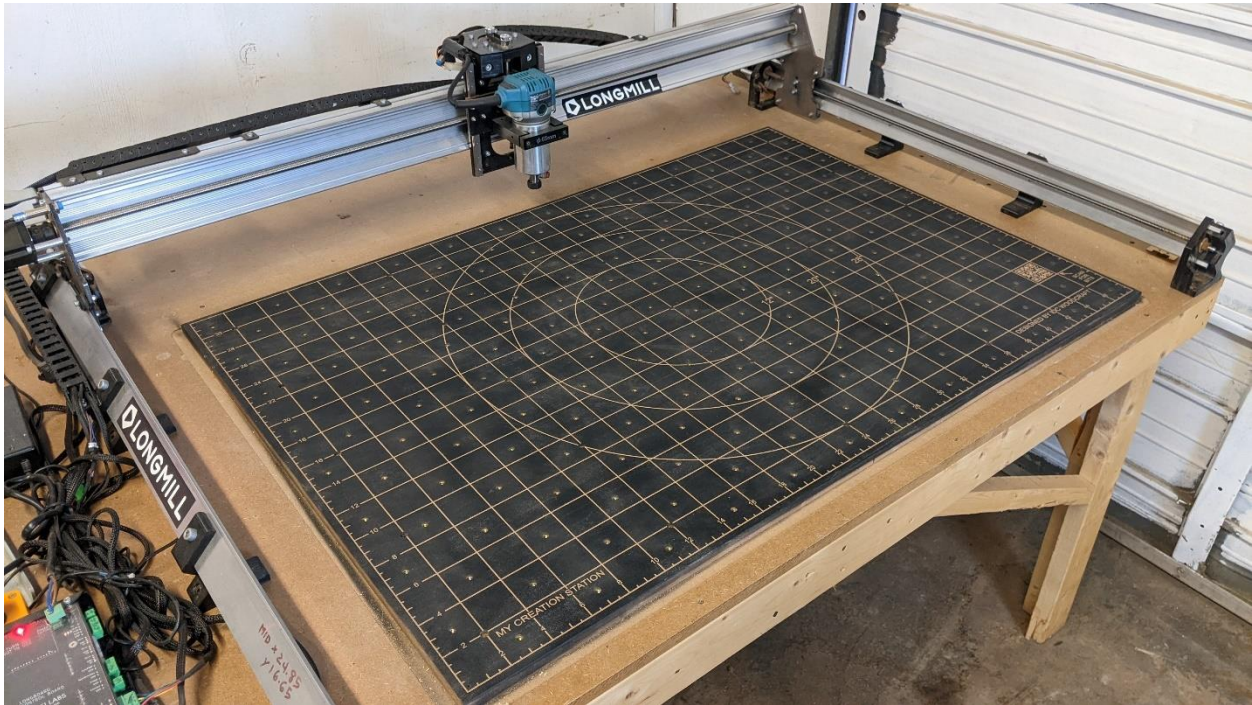
INSTRUCTIONS & G-CODE

Hello, my CNC brother or sister!

Congrats on getting your Longmill 30x48 CNC router! You've got it assembled. Now it's time to get your spoilboard made.

This document is going to walk you step by step through the whole process to make the spoilboard you got from IDC Woodcraft.

Before we begin, it is best to read through the entire instruction first to get a feel for how this is going to work. So be sure to do that before you start

These instructions assume your Longmill CNC router has been assembled and you have been able to get everything moving correctly. If not, contact Longmill to resolve any technical issues.

You will also want to be sire your router is trammed before you begin. This video is one way to tram your Longmill. But I do suggest you get the inclinometer from Amazon (see supplies page).

Watch this weekend video where I introduced the inclinometer

The most important tip to follow while making your Longmill 48x30 spoilboard is TAKE YOUR TIME. If you get stuck, go back through these instructions and watch the videos on the IDC Woodcraft YouTube channel.

Now that you've reviewed this document, you have an idea what we're going to do and what you will need to make sure you can complete the job completely.

Let's start with going down the list of everything you received.

WHAT YOU RECEIVED WITH THE LONGMILL SPOILBOARD G-CODE FILE SET

Here are the files you received when you downloaded your Longmill spoilboard design

- These instructions
- Vectric design file (Longmill MK2 30x48 Spoilboad Design File)
- 8 g-code files – ALL FILES HAVE BEEN VERIFIED BY MULTIPLE USERS
- Video instructions (linked throughout this document)

Be sure to put these files in a directory of their own where you will know where to find them.

Now lets' make sure you have everything needed so you don't have to stop in the middle of the project.

GO TO NEXT PAGE

WHAT YOU NEED TO MAKE YOUR SPOILBOARD

Before you begin, there are a few things you want to make sure you have. The following is a list of all the items you will need to complete the Longmill MK2 Spoilboard project.

If you do not have any of the items, links have been provided for you when possible. Simply click on the name and you'll go to a source where you can get them.

Router bits

- 1" surfacing bit
- 3/16" down cut endmill
- 1/8" drill bit
  - A standard high-speed steel drill bit is not recommended
- 60° v-bit

Materials

- 3/4" MDF board (minimum 48 x 54 inch)
- 196pcs ¼-20 rivet nuts (order 2 packs)

  -
- #8 all-purpose screws, 1" or longer

Tram

If you have not trammed your Longmill CNC router, see this video and this brief mention of an inclinometer

- Inclinometer

  -

Sealing The Spoilboard

- Whatever sealing compound you want to use. I explain what I use on the next page

SEALING THE SPOILBOARD (bottom side only)

It is best to seal the MDF to minimize humidity variations. MDF will swell and contract as the humidity changes.

You only need to seal one side before you start. We'll seal the other side later.

The technique I use is putting a coat of water-based Polycrylic on one side, dry it with a heat gun or hair dryer, then coat it 2 more times. You can get the Polycrylic at any hardware store.

Let sit for six hours to cure, then sand with 220 grit sandpaper

The spray paint is used on the top side of the board before engraving the grid and text. This is explained later in the instructions
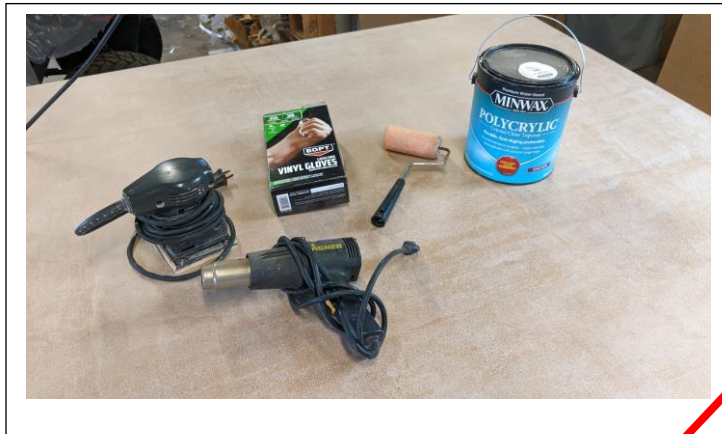
I like to use Rust-oleum flat black fast dry

PREPARATION

Let's make sure you can run through the entire project without having to stop to order something.

→ Order the items you need

→ Be sure to level your table as best as you can

Tram your Longmill

If you have not trammed your Longmill CNC router, see this video.

Also see this brief video that will make tramming easier using an inclinometer

- Inclinometer

  ○

→ All screws holding your tabletop to the table frame must be recessed so the spoilboard will sit flat on the tabletop. I like to recess mine by 1/8" or more

CUT THE SPOILBOARD BLANK

Cut your MDF so it fits between the side legs of the machine. It should be roughly 54" wide by 48" deep.

If your width is different than 54", don't worry. As long as it is within an inch of each leg, you'll be fine.

Be sure it is flush against the front of the table.

It is best to be within 1" of touching the inside of the legs.

If you plan on sealing the board, do not fasten it to the table yet (see next page for sealing instructions)

Your spoilboard blank should take up this space

It should sit like this

DO NOT SECURE THE BOARD TO THE TABLE YET
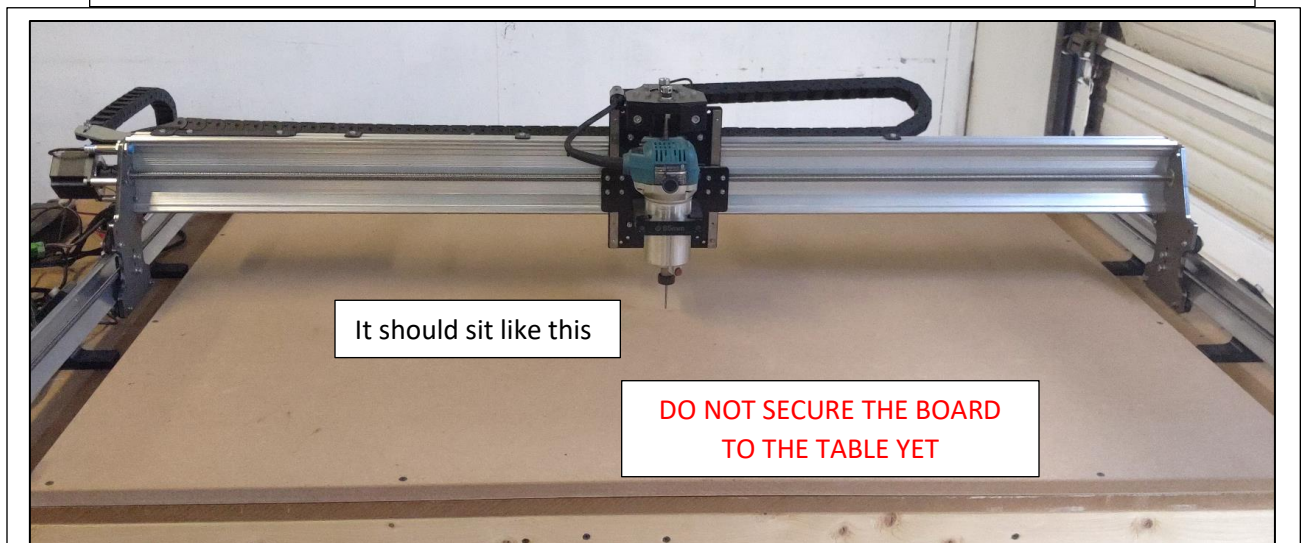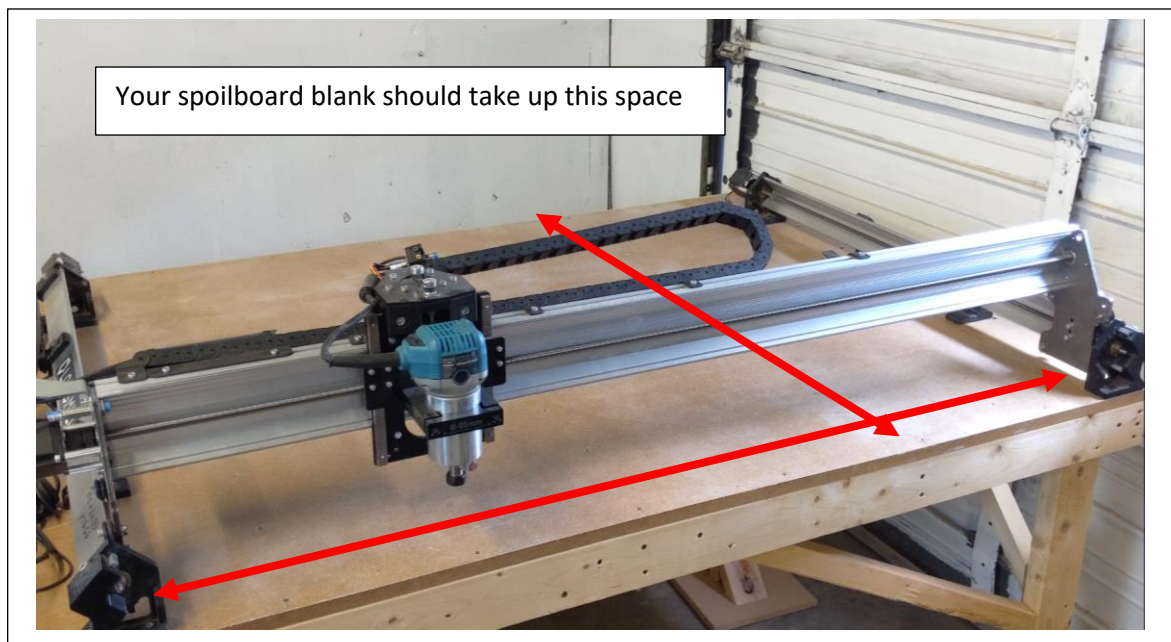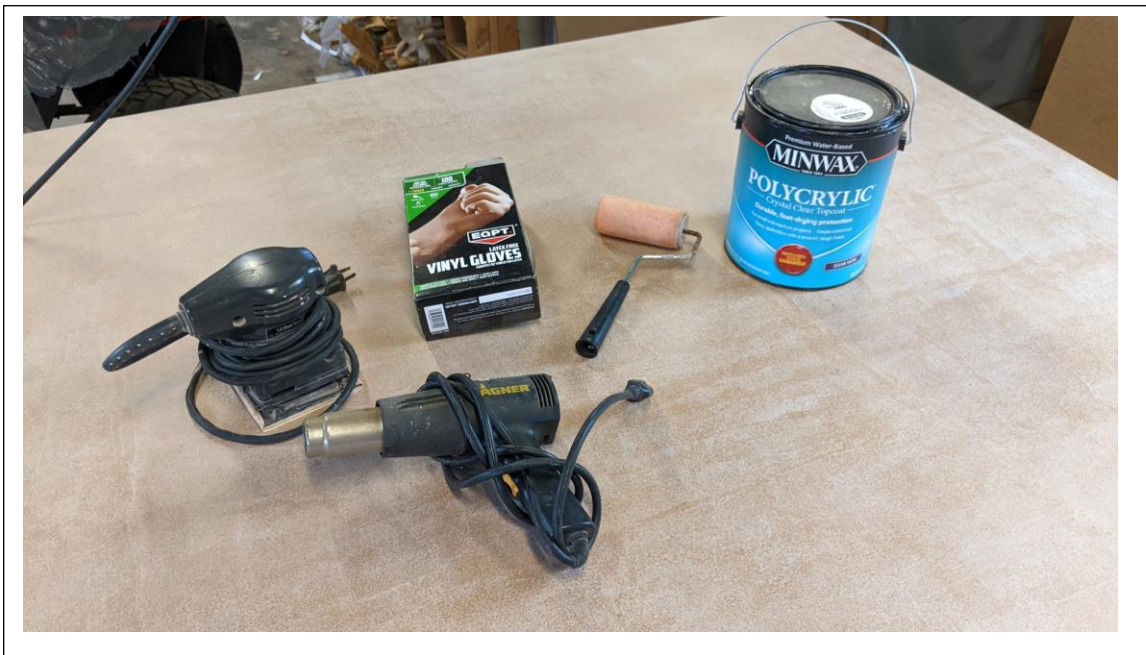
SEALING YOUR SPOILBOARD

If you live in a high-humidity area, or your shop will be subject to humidity fluctuations, it is suggested to seal your spoilboard. We will do this in 2 stages.

Start by sealing the bottom side of your board. I use the technique listed in this video.

This side does not need to be painted since it is the bottom of the spoilboard.

The other side will be done later after you surface it.

- Put 3 coats of water-based polycrylic on one side of your board. Use the heat gun each time to dry each coat.
- Let six for 6 hours to cure
- Sand surface with 220 grit sandpaper

While the spoilboard is curing, we will move on. Do not mount the spoilboard to your machine until instructed

FINDING THE CENTER OF YOUR LONGMILL

*This can be done while your spoilboard is curing.*

All g-code files run from the center of the machine, so we will need to identify this location and set the XY zero points.

Once you have found center and zeroed your machine, **DO NOT change the XY zero position until you are completely done making your spoilboard.**

Be sure the couplings that connect the motors to the lead screws are tight before you start this operation.
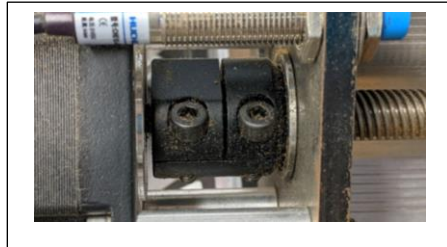
Step 1 -If you have limit sensors on your machine, remove the sensors from the machine and disconnect the X, Y & Z them from the control box. Also, disable homing in gSender firmware settings if you enabled them for your machine.
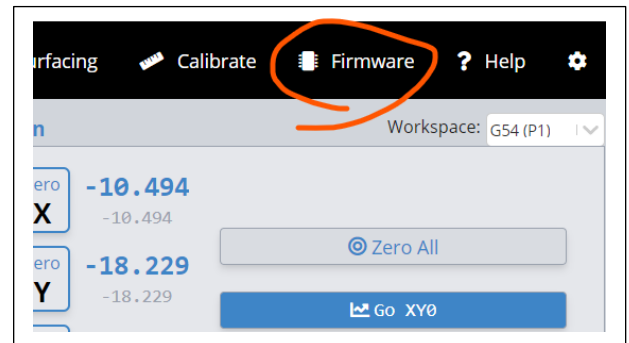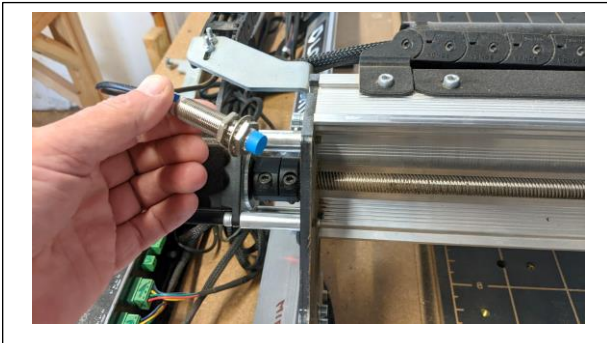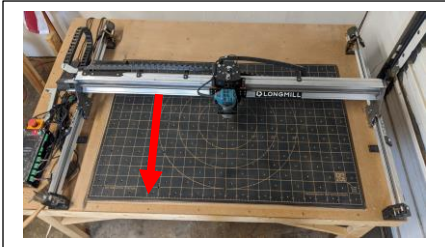

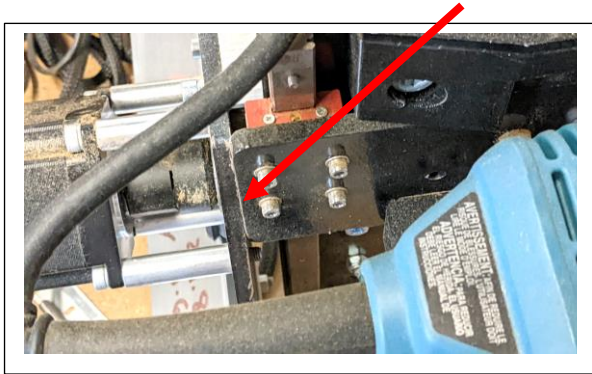Step 1 – Raise Z until it hits the upper physical limit of travel.
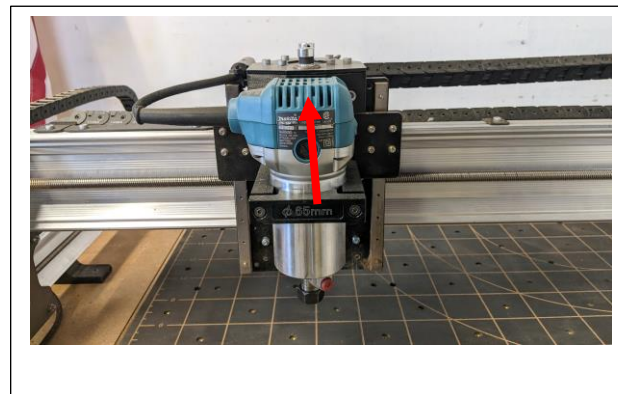
Move Y forward until both sides hit the front legs
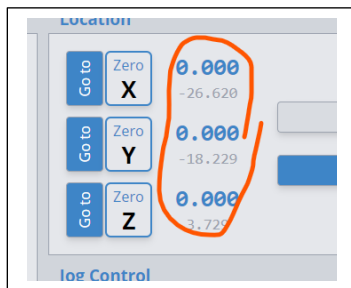
Move X to the left until it hits the end bracket
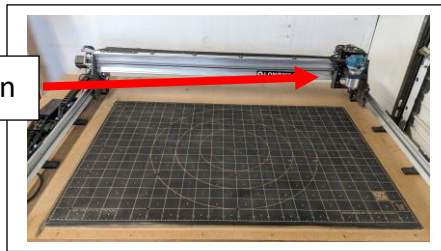
You should now be set up like this

Zero X, Y & Z

Now, manually move X and Y to the opposite corner (back right).

Move Y as close as possible to back **without** hitting the back leg

Move X as close as possible to the right bracket **without** hitting it

If you hit either the right or the back, start over at front left

You should now be in this position

Read the X and Y numbers and divide by 2

49.9 / 2 = 24.95

33.44 / 2 = 16.72

Ignore the small numbers

Manually move X and Y to those positions as closely as you can to the divided numbers

Zero X & Y

You should now be located at the center of your Longmill like the picture below
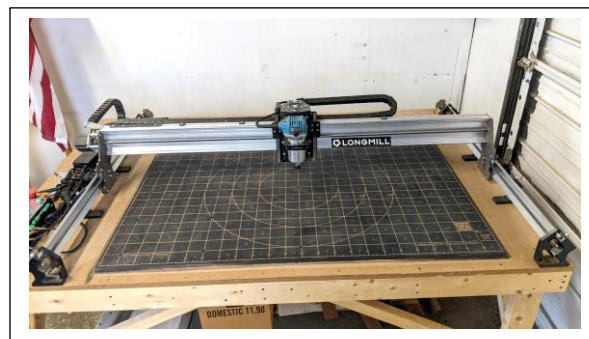
LET'S VERIFY THE G-CODES WILL RUN CORRECTLY

I this section, you will confirm that the programs I gave you will run without issue. You will do this by running a test program.

This is going to take a little time because you are going to run all the g-code programs first without any tooling in the router

BE SURE TO REMOVE ANY ROUTER BITS YOU HAVE IN THE MACHINE FOR THIS OPERATION

Load the first g-code file "1 Fit Check - NO TOOL IN MACHINE"

It will look like this in gSender
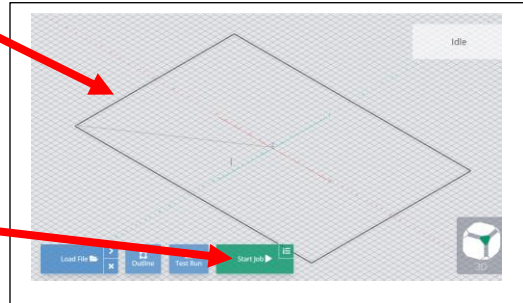
Press the green start button

When you start this cycle, the machine will run around the perimeter of the Longmill 48x30. It should not hit any of the ends of travel. If it does, go back through the centering routine above.

If the machine made its journey around the table without hitting the end of travel anywhere, you are now ready to make your spoilboard!

FROM THIS POINT ON, DO NOT CHANGE THE ZERO LOCATIONS OF X AND Y.

If you need to stop for some reason at any time while making your spoilboard, be sure to return the machine to the center position. You can then turn the machine off at that point and disconnect.

When you return, and power things back up, be sure the first thing you do is make sure X and Y are zeroed, and you will be good to go with the next cycle.

DRY RUN ALL G-CODE FILES

We want to be sure all the files run properly for you, and also so you will know what they will do. So you will run every g-code file *BEFORE* you put any router bits in.

Here is what each does.

- File name → *1 Fit Check - NO TOOL IN MACHINE*
  - Checks to make sure all programs will run without hitting the ends of the machine travel
  - No router bit is used during this cycle
  - Approximate run time in minutes – 1
- File name → *2A Square Check 18dr*
  - Makes sure your Longmill MK2 is mounted square
  - 1/8" drill bit is used here
  - Approximate run time in minutes – 1
  - This video shows what the program does
- File name → *2B Square Check 18dr*
  - Second time if you needed to adjust your machine mounting
  - 1/8" drill bit is used here
  - Approximate run time in minutes – 1
- File name → *3 Mount & Alignment Holes 18dr*
  - Drills the holes where the mounting screws will be
  - 1/8" drill bit is used here
  - Approximate run time in minutes – 10
- File name → *4 Mount Holes C-bore & Cutout 316dc*
  - This will cut the counter sink holes for your mounting screws and it will cut out the spoilboard to size
  - 3/16" down cut endmill is used here
  - Approximate run time in minutes – 15
- File name → *5 Rivet Holes Side 2 316dc*
  - Makes the holes for the rivet nuts
  - 3/16" down cut endmill is used here
  - This cycle will be done on the bottom side of the spoilboard
  - Approximate run time in minutes – 20

- File name → 6 Surfacing Profile 1 Inch Surfacing Bit
  - Back to the top side. This routine will flatten your spoilboard
  - 1" surfacing bit is used here
  - Approximate run time in minutes – 20
- File name → *7 Text & Grid 60v (the last file)*
  - This is the final program. It will cut the grid and text on the top
  - 60° v-bit is used here
  - Approximate run time in minutes – 50

Load each g-code file and run it. Do not worry about the Z axis for now. Just watch what each file does.

Please note, this will take some time but is good exercise and experience. And we want your spoilboard to come out right the first time.

LET'S MAKE SURE YOUR MACHINE IS MOUNTED PROPERLY

[Watch this video](#)

For your spoilboard to come out best, your Longmill MK2 will need to be square within an 1/8".

We are going to check to see if you mounted your Longmill square to the table. If it is out of square, you will need to reposition it.

By square, we are going to make sure your Longmill is not positioned like the image below

Longmill has a square check in gSender, but the code I provide will be easier to work with.

Be sure the working area of the Longmill is clear

- For this operation, the spoilboard blank should not be on your CNC router. We are going to do a little work on the table beneath.
- G-Code program for this step - *2A Square Check 18dr*
- If this cycle needs to be run a second time, use *2B Square Check 18dr*
- Bit needed - 1/8" drill

Load the g-code file named *2A Square Check 18dr*

- It will look like this in gSender
- Insert your drill bit into the collet
- Zero Z from the table surface
- Raise Z it up a bit
- Press start
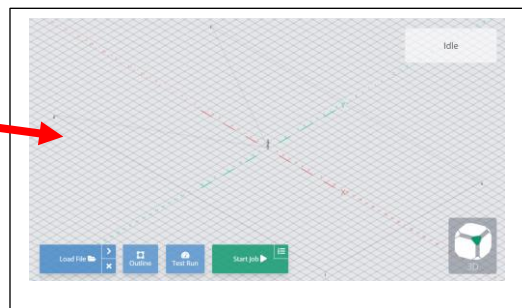
The CNC router will go to each corner, drill a hole, then return to center.

Stick a 1/8" pin in the holes on opposing corners (you can use 1/8" shank bits)

Measure across the diagonal. Then stick the pins in opposite corners and measure again. If you are within 1/4", you are good. If not, adjust the machine according to Longmill's website instructions.

SECURE YOUR SPOILBOARD BLANK TO THE TABLE

Watch this video

We will now put the spoilboard blank on the table and secure it.

First, remove the 1/8" drill bit. We will use it for the next operation, but you don't want to hit it while installing the spoilboard. It will break.

The video explains this segment well enough for your spoilboard to come out best, your Longmill MK2 will need to be square within an 1/8".

This is how your spoilboard will look after this operation
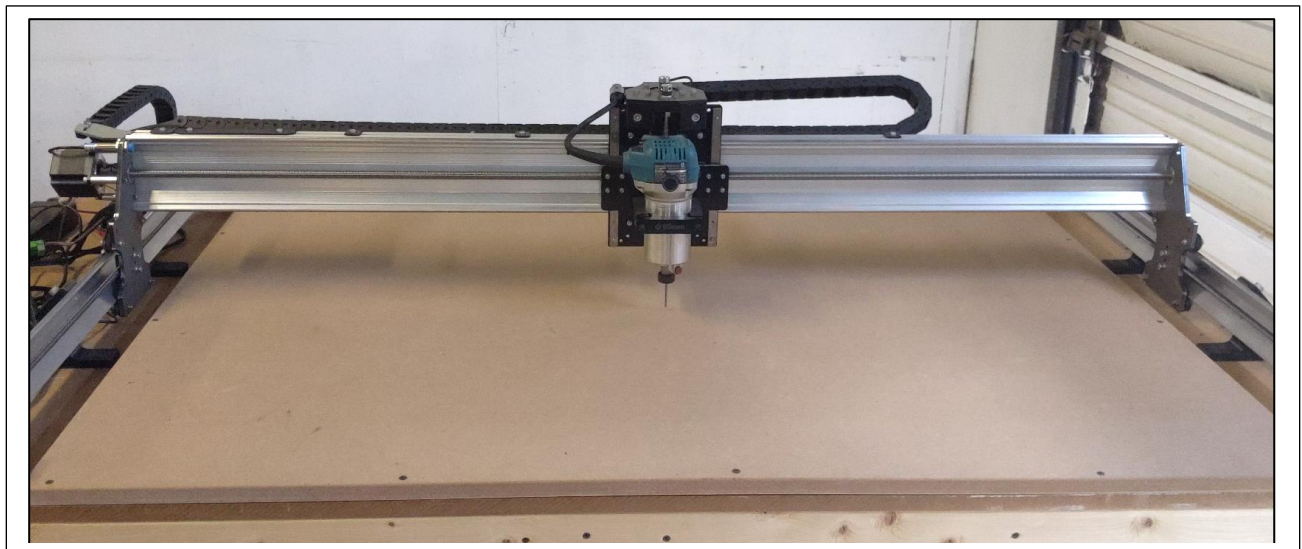
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DRILLING THE MOUNTING AND ALIGNMENT HOLES

Watch this video – Note…the video indicates a lot of holes. You will drill 29 holes in this cycle

This is where the real spoilboard making begins. The first thing we're going to do is drill several 1/8" holes.

There are 2 sets of holes that will be drilled. They are:

- The mounting holes that will secure the spoilboard when it is complete
- Alignment holes
  o These holes are used to properly align the spoilboard when we flip it to do work on the back side.

STEPS

- Install the 1/8" drill bit
- Zero it to the surface of the spoilboard
- Load program titled *3 Mount & Alignment Holes 18dr*
- It will look like this in gSender
- Run the program
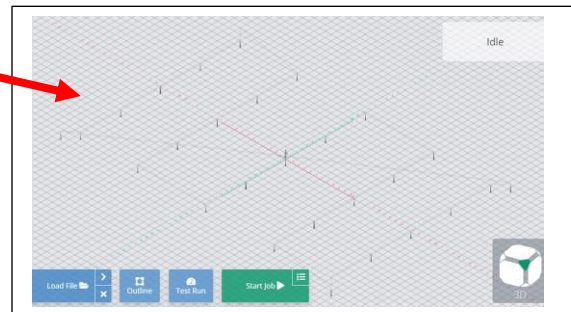
www.idcwoodcraft.com

CUTTING THE MOUNT HOLE C-Bores AND BOARD CUTOUT

[Watch this video](#)

This routine will cut the counter bore holes for the mounting holes and will cut out the spoilboard to size

STEPS

- Install the 3/16" down-cutting endmill bit
- Zero it to the surface of the spoilboard
- Load program titled **4 Mount Holes C-bore & Cutout 316dc**
- It will look like this in gSender
- Run the program
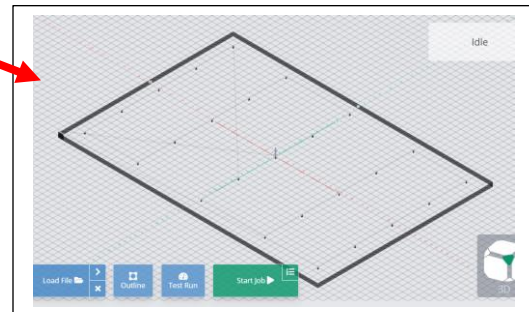
NOTE: The 3/16" down cut endmill will be used in the next operation. Please be careful when removing the spoilboard for the next step. It is advisable to remove the bit and reinstall it when you are ready to run the next cycle.
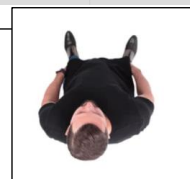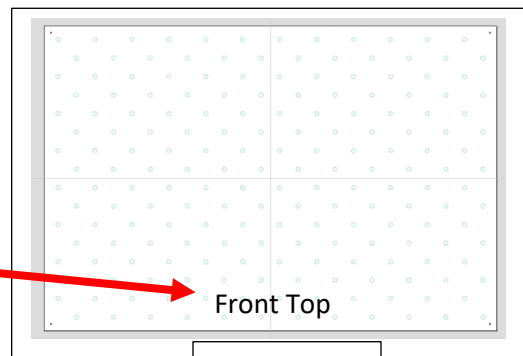
IMPORTANT NOTE: Always clean the collet whenever a bit is changed out

Before you remove the cutout, mark the front top of the board "front top" as the video explains. This is important as you will need to know this is the final position of the board when it is finished.

When complete, remove all the screws holding the outer piece. Remove that piece, it is no longer needed.

Clean the spoilboard completely and the tabletop


Write "Front Top" here

Front Top

CUTTING THE RIVET NUT HOLES

[Watch this video](#)

This routine will cut the 196 holes on the bottom of the spoilboard. These are for the rivet nuts which will be inserted after the holes are made.

- File name → **5 Rivet Holes Side 2 316dc**
    - Makes the holes for the [rivet nuts](#)
    - This cycle will be done on the bottom side of the spoilboard
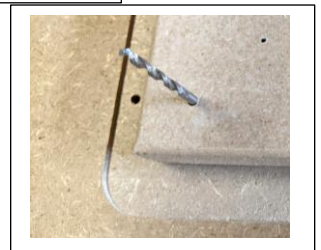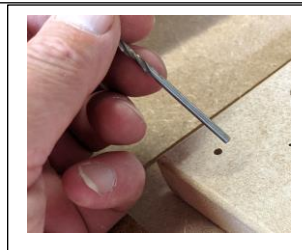   - Approximate run time in minutes – 30
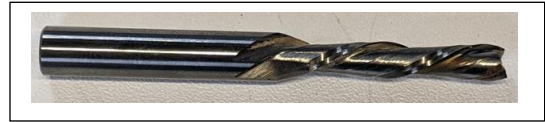
STEPS

- Clean the spoilboard completely. Also clean all holes
- **IMPORTANT**: Flip board front to back so the "Front Top" mark is to the back and facing down
   - DO NOT FLIP SIDE TO SIDE

- Align the spoilboard with the alignment holes
    - You only need to align with 2 holes

- Secure the board with all-purpose screws through several mount holes as shown.
    - Be sure the set (the heads of the screws will be above the surface. This is ok)
    - Be sure the board is pulled down to the surface of the table so there are no gaps

Screws in these holes

Make sure no gaps
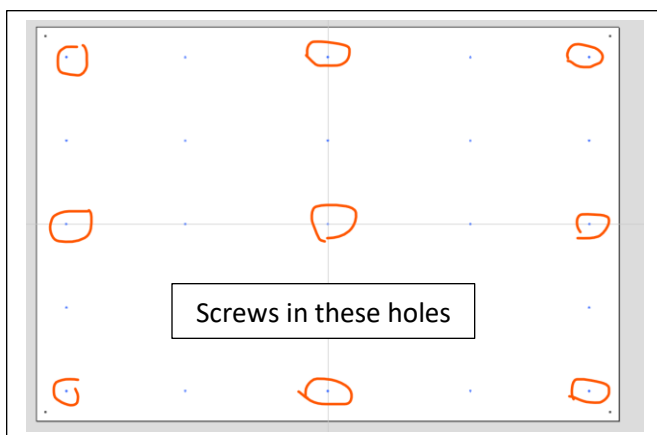
This Step Continued On Next Page

Once the board is secured, install the 3/16" down cut endmill and zero Z off the spoilboard surface

Load the g-code file *5 Rivet Holes Side 2 316dc*

Press go

When complete, you will have 196 holes that look like this

Remove the board and clean everything up. Also clean the holes.

Now it's time to install all the rivets

Use a screw. Be sure the rivet heads are fully seated (not above the surface)

Clean all surfaces completely

This operation is done

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FLIP THE BOARD RIGHT SIDE UP AND SECURE

Watch this video

It is almost time to secure your spoilboard for the final operations, but not yet.

First, we need to drill holes in your table

- *Why are we doing this? Sometimes clamp bolts can hit the table before they seat the clamp properly. This will give the bolt clearance, so it does not pull up on the spoilboard*

IMPORTANT: Place the spoilboard back on the table so the "Front Top" is in the original position facing you.

Use the alignment pins to position the board (DO NOT SECURE IT DOWN YET)

Make a mark thru each rivet hole on the table below

When all 196 marks are made, remove the spoilboard and drill *through* the tabletop with a ¼" drill bit.

Front Top
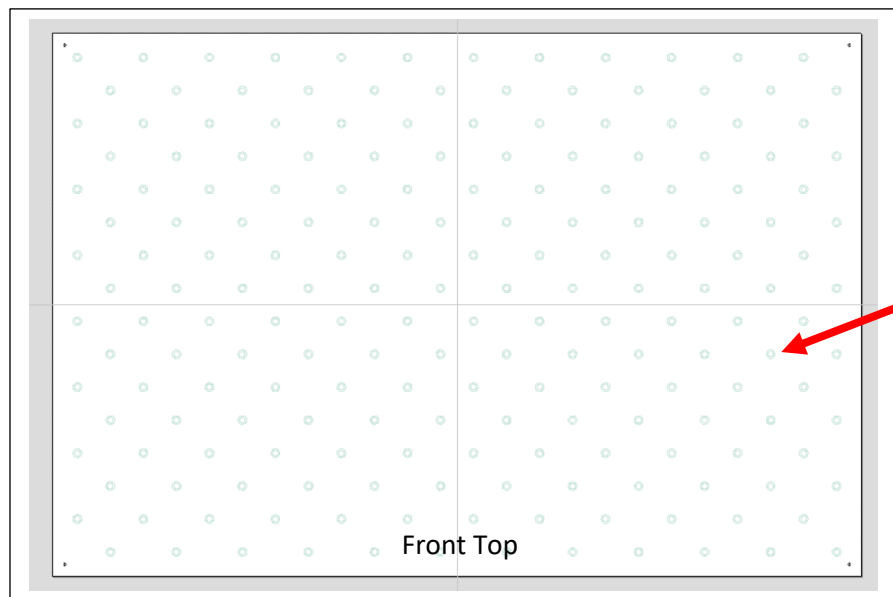
Make a mark on the table THRU the rivet holes. Then drill thru the table with ¼" drill bit

You

Now that you have drilled all the holes, put the spoilboard back on the table, align it with the alignment pins.

Screw the board down in all 25 mounting holes. Be sure all screws seat in the C-bore so they are below the surface of the spoilboard

Front Top

Do not put screrws in 4 alignment holes
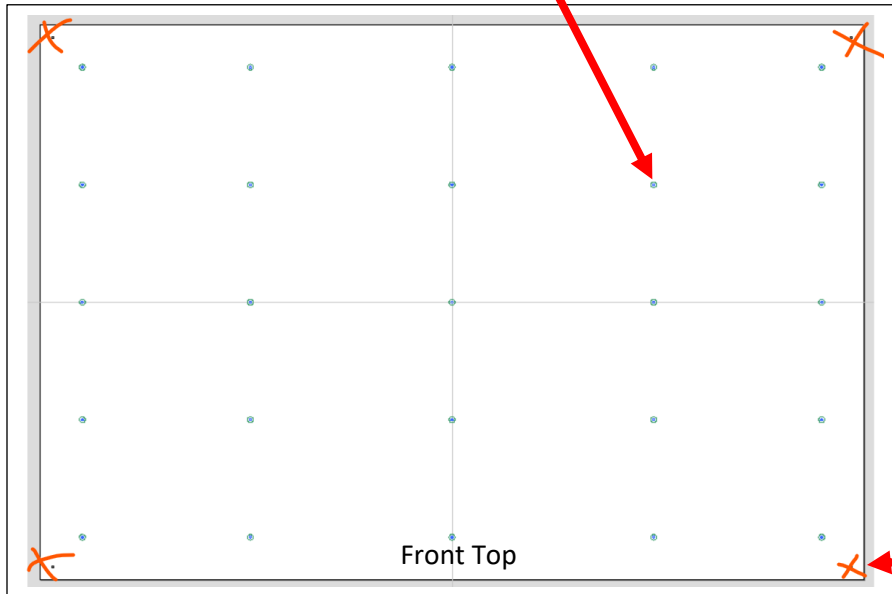
You

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SURFACING THE SPOILBOARD

Watch the video

We're getting close to being done! This routine will surface the spoilboard
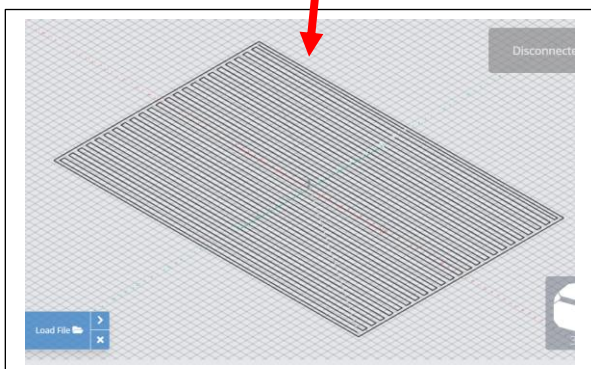
NOTE: This is where tramming of your CNC router is important. If you are getting uneven cuts like the image below, <u>and you can feel them</u>, this means your Longmill is not in tram and you will have to tram it before moving on. If the lines are only slight, you are good to go.

- File name → *6 Surfacing Profile 1 Inch Surfacing Bit*
- Bit → 1" surfacing bit
- Approximate run time in minutes – 40

It will look like this in gSender

STEPS

- Clean the collet
- Install the surfacing bit
- Zero the surfacing bit to the spoilboard surface
- Load the g-code program *6 Surfacing Profile 1 Inch Surfacing Bit*
- Press go

The machine will take light passes to surface the board. If the spoilboard surface does not completely clean up on the first surfacing cycle, reset the Z zero to the uncut surface and run the cycle again. Repeat this until the entire surface has been smoothed out

NOTE: This is where tramming of your CNC router is important. If you are getting uneven cuts like the image below, <u>and you can feel them</u>, this means your Longmill is not in tram and you will have to tram it before moving on. If the lines are only slight, you are good to go.
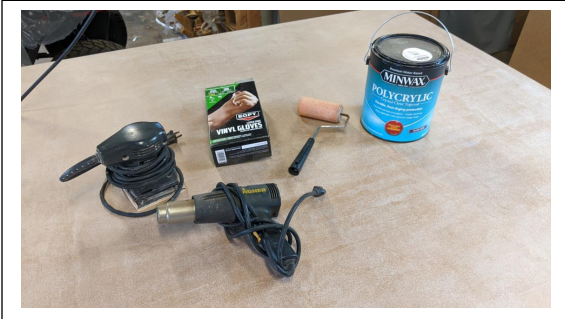
SEAL THE SPOILBOARD

After the board is completely surfaced, you will want to seal it. Use the same method you used to seal the bottom side.

I do not recommend the spoilboard be removed for sealing. Seal it while it is on the machine.

Be sure to let the acrylic cure for 6 hours before sanding

If you want to paint the board black as I have, I suggest [Rust-oleum fast dry flat black](#)

- I do not recommend painting unsealed MDF. It will not look good.

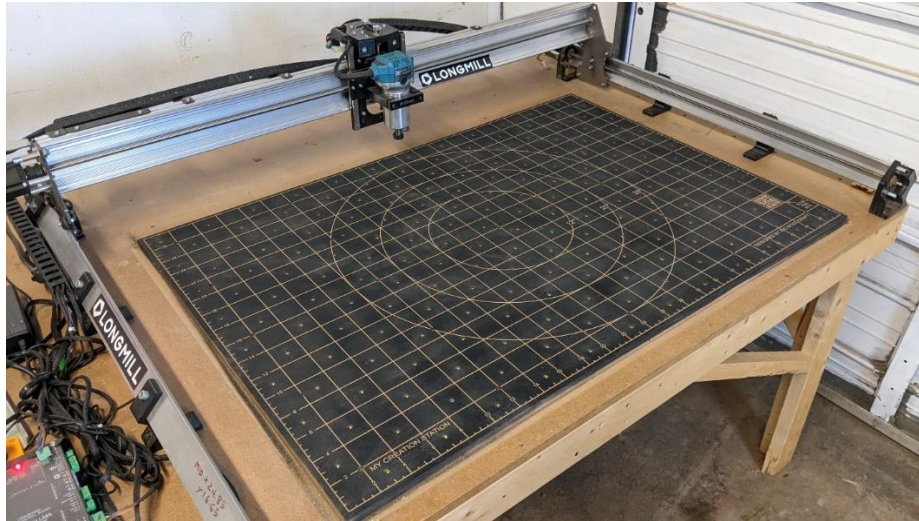After the paint is dry, you are ready to do the last operation.

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ENGRAVING THE GRID AND TEXT

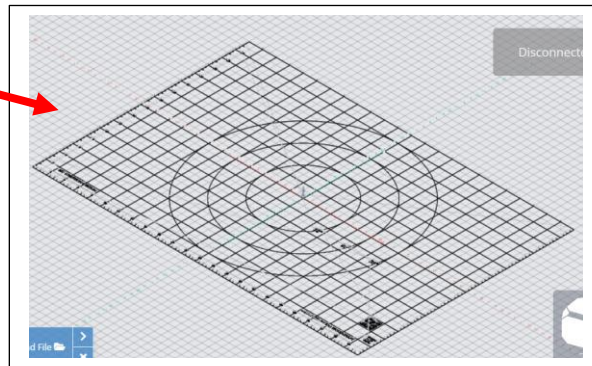Congrats! You have made it to the final step, and the fun part.

Watch this video to see how this g-code will do the text and grid

What you need

- File name → **7 Text & Grid 60v**
- 60° v-bit
- Approximate run time in minutes – 45

It will look like this in gSender

STEPS

- Clean the collet
- 60° v-bit
- Zero the bit to the spoilboard surface
- Load the g-code program **7 Text & Grid 60v**
- Press go and let 'er run!

That's it. YOU ARE DONE!!!

Now start creating that first amazing project….