GUIDE 6 OF 6

Your First Job and Test Cuts

A small sign: the word HELLO carved with a V-bit, then cut out with rounded corners. You will set up the job, draw it, make two toolpaths, check them, and run them. First in the air, then for real.

IN THIS GUIDE

- Job Setup: telling Carvio about the board
- Drawing the sign
- Two toolpaths: V-carve the letters, cut the outline with tabs
- Checking the toolpath list and the preview
- Running from Carvio, and what a tool change looks like
- Test cuts that catch mistakes before they cost a board
- A checklist for before you press Start

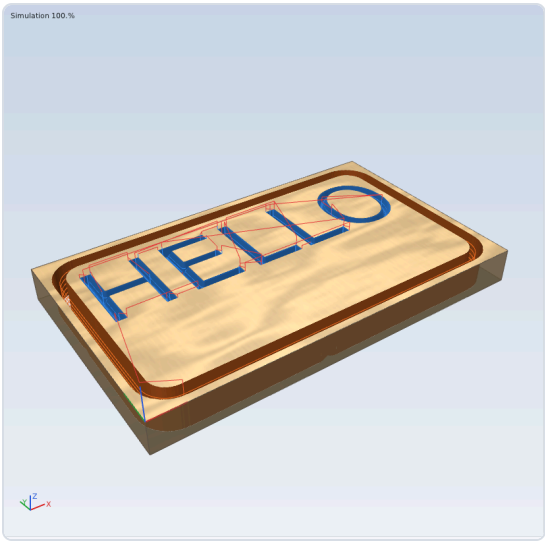
YOU WILL NEED

- A board about 200 × 120 × 18 mm (pine, plywood or MDF) and clamps
- A 6 mm or 1/4 inch end mill and a 60 degree V-bit, in the Tool Database (Guide 4)
- A machine you can connect, home and zero (Guide 5)

The plan

A sign is the classic first project because it uses the two toolpaths you will use most: a **V-carve** for the lettering and a **profile** to cut the shape out. Six steps, each a page or two:

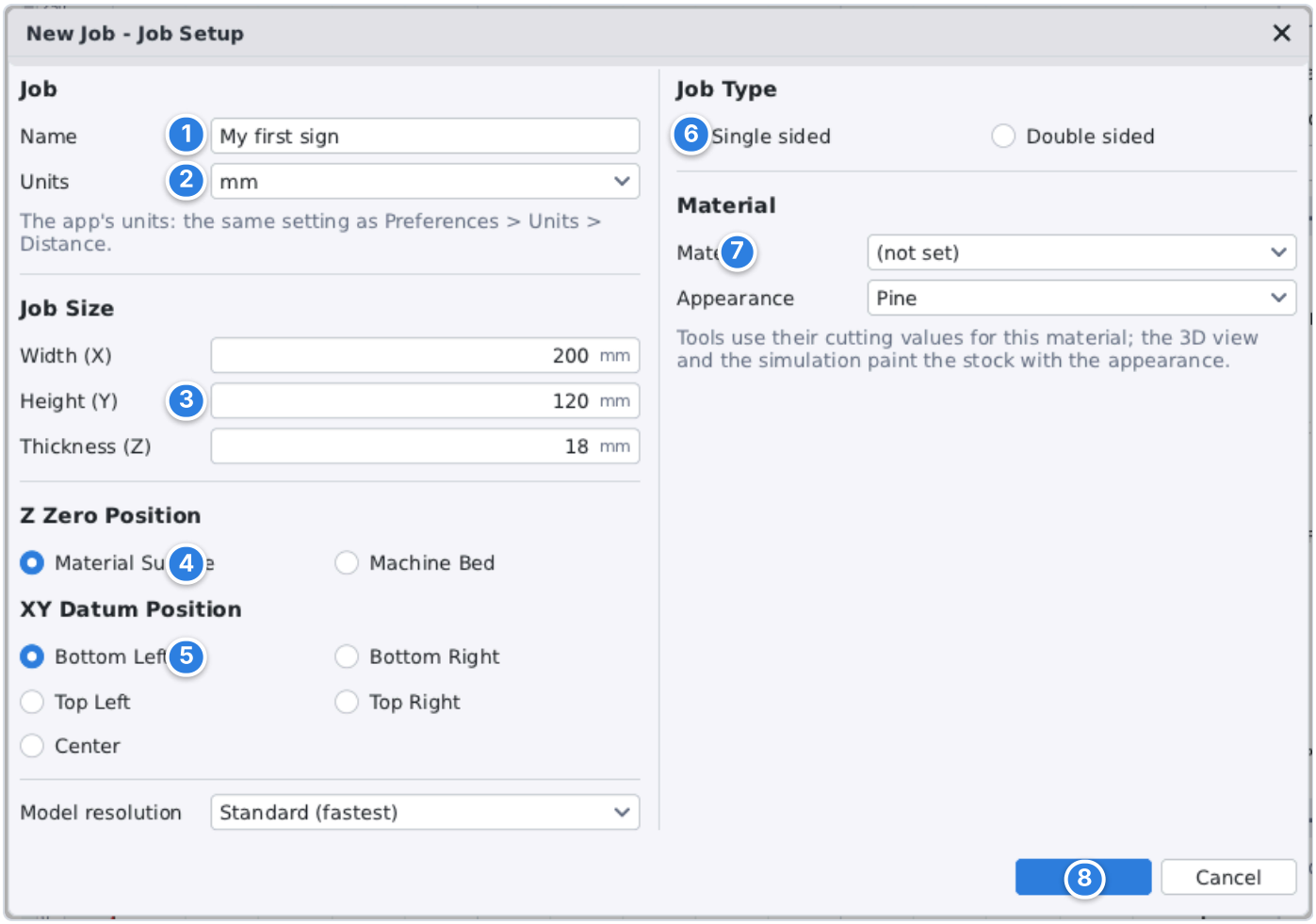
1. **Job Setup**: the board's size and where its zero is.
2. **Draw** a rounded rectangle and the word HELLO.
3. **Toolpaths**: carve the letters, cut the outline with tabs.
4. **Check** the list and the preview.
5. **Run** it from Carvio, or save a G-code file.
6. **Test cuts** and a checklist for next time.



The sign in Carvio's preview: 180 × 100 mm, letters 40 mm tall, cut out of an 18 mm board.

Job Setup: tell Carvio about the board

Measure the board with calipers, especially its **thickness**: "18 mm" plywood is often 17.5. Then click **New** on the welcome page (or **File > New Job...**).

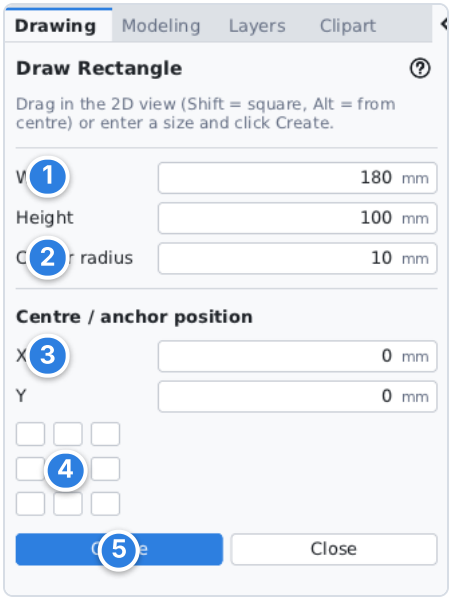


Job Setup for the sign. **Job Setup** on the Toolpaths tab or the Drawing tab brings it back any time.

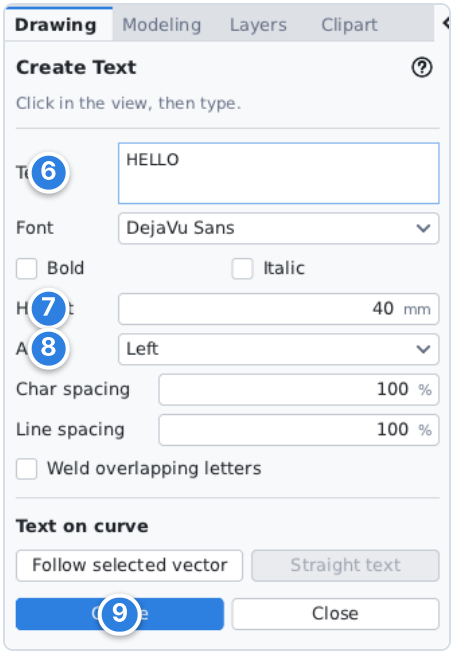
1. **Name**: "My first sign".
2. **Units**: mm or inches, the same as the rest of the app. These guides use mm.
3. **Job size**: the board. 200 wide (X), 120 high (Y), and the measured thickness (Z). A design larger than this is flagged.
4. **Z Zero Position**: **Material Surface**. You will set Z zero on the top of the board, as in Guide 5.
5. **XY Datum Position**: **Bottom Left**. You will set X0 Y0 on the front-left corner of the board. Guide 2's matching rule: what you choose here is what you do at the machine.
6. **Job Type**: Single sided.
7. **Material**: Softwood (or whatever the board is). It picks the bit's cutting values for that material and paints the preview.
8. **OK**. The 2D view shows the board as a rectangle with the datum at its bottom-left corner.

Draw the sign

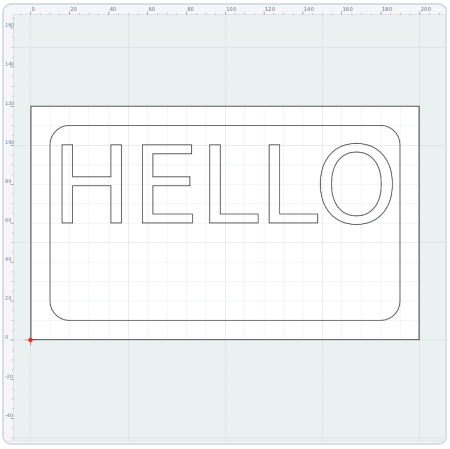
The **Drawing** tab on the left holds the drawing tools. Two of them are enough for the sign: **Rectangle** and **Text**. Every tool opens a small form; **Create** makes the shape, Esc closes the form.



Draw Rectangle.



Create Text.



The drawing: the outline and the word, with the datum at the bottom left.

1. Click **Rectangle**. **Width** 180, **Height** 100: the sign is 10 mm inside the board on every side.
2. **Corner radius** 10 for rounded corners.
3. Position **X** 100, **Y** 60: the middle of the board.
4. Click the **centre** box of the anchor grid, so X and Y mean the rectangle's centre.
5. **Create**, then Esc.
6. Click **Text** and type HELLO. Pick a plain bold font if you like.
7. **Height** 40: the capital letters are 40 mm tall.
8. **Align** Center, then click in the middle of the board to place it; the **Move** tool (or the arrow keys) nudges it afterwards.
9. **Create**, then Esc. **Zoom Extents** (in 2D View Control) shows the whole board.

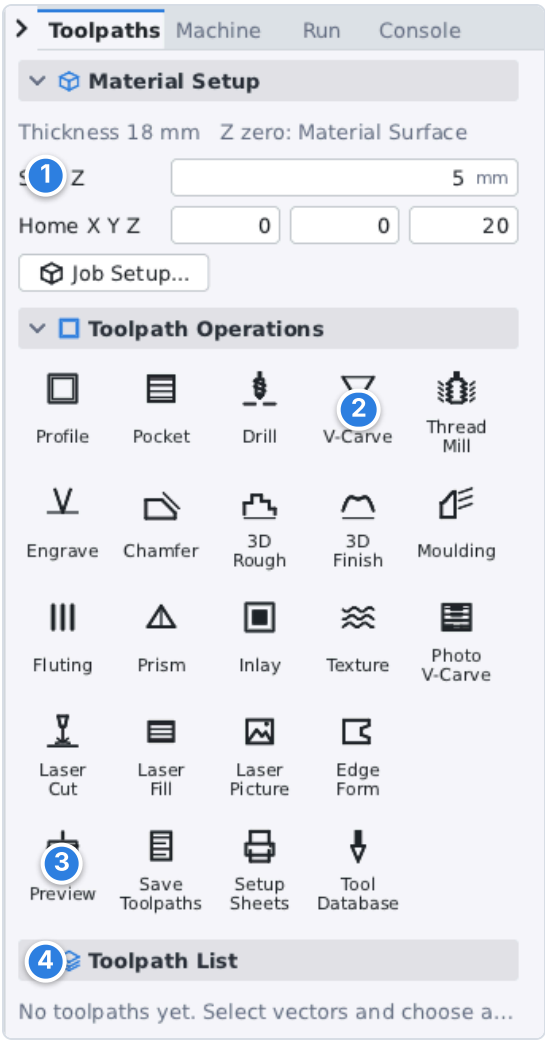
Selecting things

The **Select** tool (the arrow) is the normal state: click a shape to select it, drag a box to select several, click empty space to deselect. Toolpaths work on what is selected, so get used to selecting the outline or the word on purpose. The status bar at the bottom says what is selected.

The Toolpaths tab

1. **Material Setup** repeats the job's thickness and Z zero, and adds two heights: **Safe Z**, how high the bit flies between cuts (5 mm is right unless clamps stand higher than that), and **Home X Y Z**, where the bit goes at the start and end of the program (0, 0, 20 is fine: above the datum corner, 20 mm up).
2. **Toolpath Operations**: each button opens a form. You need **V-Carve** and **Profile**.
3. **Preview**, **Save Toolpaths**, **Setup Sheets** and the **Tool Database**.
4. The **Toolpath List**: every toolpath you make, in cutting order.

> **Carve first, cut out last**
>
> Make the V-carve before the profile. The list order is the cutting order, and a sign should be carved while the board is still solid, then cut free at the end. (Drag a row in the list to change the order later.)

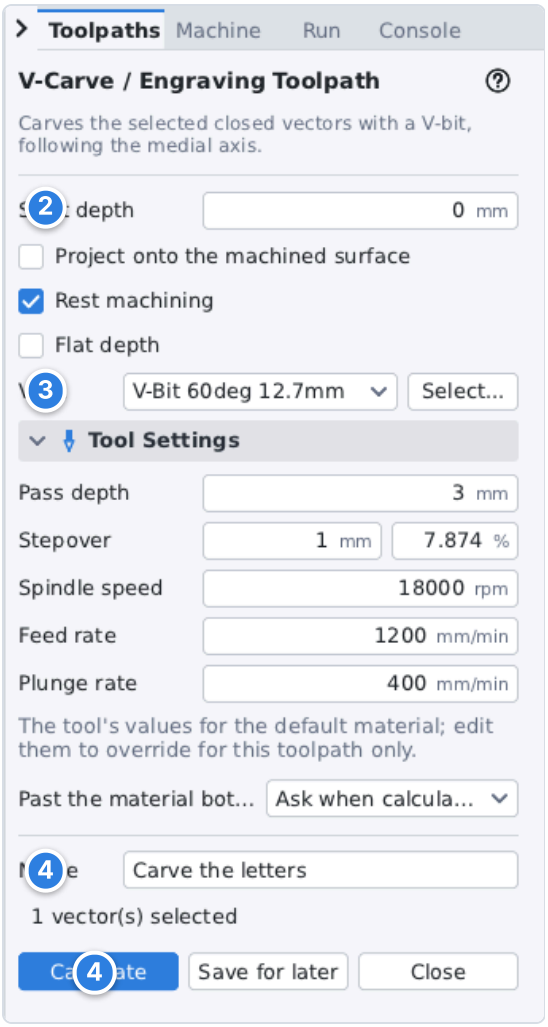


The Toolpaths tab before any toolpath exists.

Toolpath 1: carve the letters

1. With the Select tool, click the word so it is selected (and nothing else).
2. Click **V-Carve**. Leave **Start depth** at 0 and **Flat depth** unticked: the bit goes as deep as each letter's width needs.
3. **V-Bit**: pick your 60 degree bit. **Tool Settings** fills in from the Tool Database; leave them.
4. **Name** it "Carve the letters" and click **Calculate**. The toolpath appears in the list and as lines on the letters.

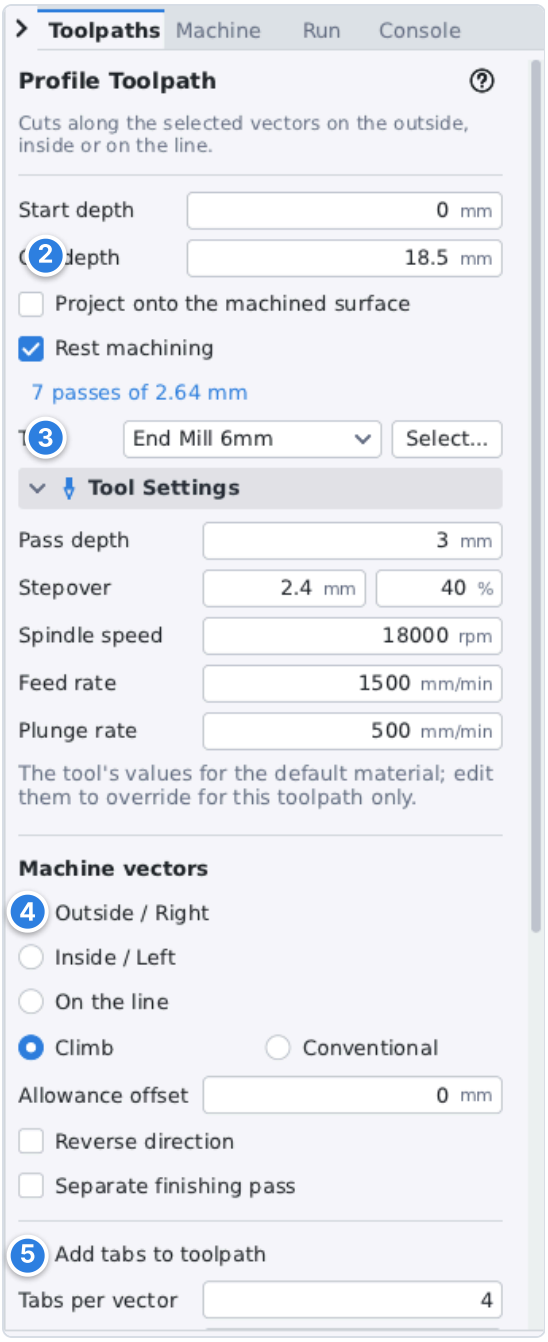
Deepest point of a 40 mm HELLO with a 60 degree bit: about 5 mm, in the wide strokes. A thinner font carves shallower.



The V-Carve form.

Toolpath 2: cut the sign out, with tabs

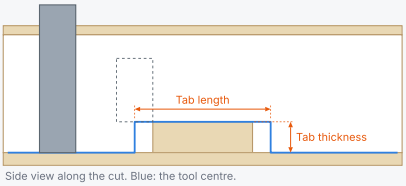
1. Select the rounded rectangle only, and click **Profile**.
2. **Cut depth**: the board thickness plus 0.5 mm, so the cut goes right through (18.5 for an 18 mm board). Carvio asks what to do about the extra half millimetre: **cut into the spoilboard**. The form tells you how many passes that makes.
3. **Tool**: the 6 mm end mill.
4. **Machine vectors**: **Outside / Right**, so the bit runs around the outside of the line and the sign keeps its full size. (Inside is for holes and pockets' walls.) Leave **Climb**.
5. Tick **Add tabs to toolpath**: 4 tabs, 10 mm long, 3 mm thick. Scroll down, name it "Cut out the sign", and click **Calculate**.



The Profile form (the Name and Calculate are further down).

Why tabs?

When the last pass cuts through, the sign would be loose: free to shift, hit the spinning bit and fly. **Tabs** are small bridges of wood the bit leaves in place, holding the part to the board. Cut them with a chisel or a flush-cut saw afterwards and sand the stubs. Four tabs are plenty for a part this size.



A tab, seen from the side along the cut.

Check before you cut

Two things to look at every time, before the machine is involved.

The Toolpath List. Both toolpaths are there, ticked, in the right order: carve first, cut out second. The total machining time is a sanity check: if a sign says six hours, something is wrong (usually the feed rate or the pass depth).

The Preview. Click **Preview**: the 3D view shows the board with the cuts simulated. Drag with the left mouse button to turn it round, the wheel to zoom, and look for:

- Letters carved where you expect, not too deep, no stray cuts.
- The outline cut all the way round, with four tabs showing as small bridges.
- Nothing cut outside the board.

To change a toolpath, double-click it in the list: its form opens, change a value and **Calculate** again.



The Toolpath List with both toolpaths.



The preview: the carve and the cut-out with tabs.

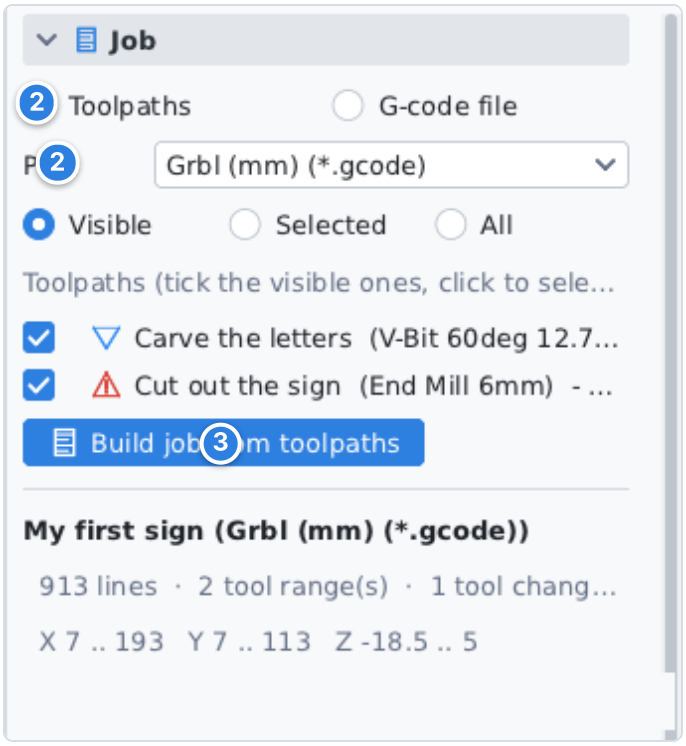
Two ways to run the job

You can run the job **from Carvio**, on the Run tab, or **save a G-code file** and run that. Running from Carvio is simpler: it shows the job in the Machine view and walks you through tool changes. Saving a file is for machines that read files from a card or run with another sender program.

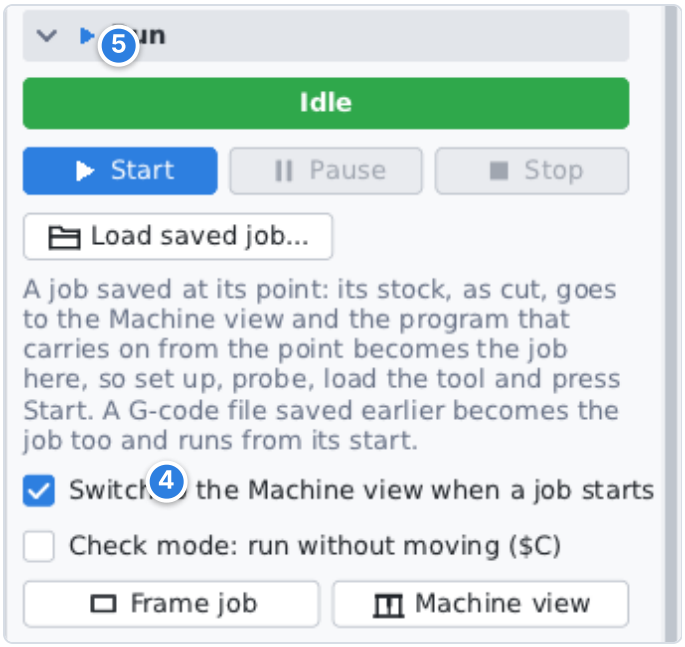
Run from Carvio

1. Connect, home, clamp the board and set the zero (Guide 5). Put the **V-bit** in: it is the first toolpath's tool. Set its Z zero on the board.
2. On the **Run** tab choose **Toolpaths** and a **Post** for your controller: **Grbl (mm)** for Grbl and grblHAL.
3. **Visible** runs the ticked toolpaths. Click **Build job from toolpaths**. The summary shows the lines, the tool changes and the time.
4. Click **Frame job**: the bit traces the job's outline in the air at the safe height. Watch that it stays over the board and clear of the clamps.

5 Spindle on (if it has its own switch), eye protection on, and click **Start**. The Machine view opens and shows the board being cut. Stay with the machine.



The Job section of the Run tab with the job built: its lines, tool change and time.

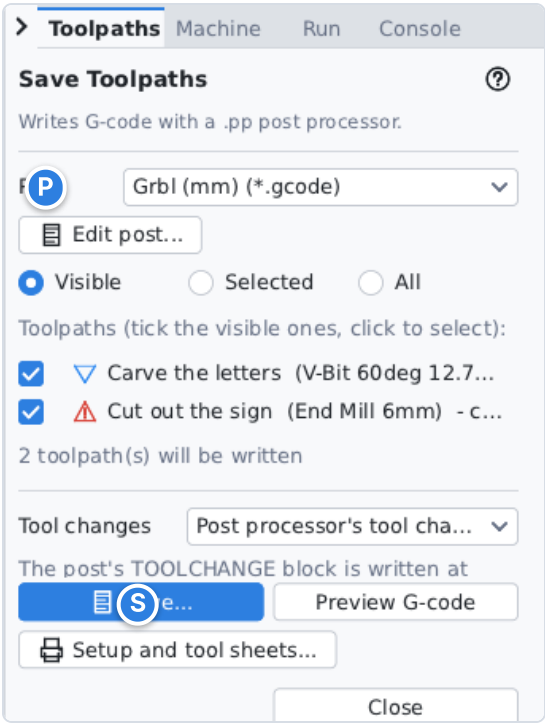


The Run section: Start, Pause, Stop, and **Frame job**.

Or save a G-code file

Click **Save Toolpaths** on the Toolpaths tab. Pick the **Post** (Grbl (mm)), keep **Visible**, and click **Save...**. One file holds both toolpaths with a tool change between them; **Tool changes** can instead write one file per tool, which suits a sender that cannot pause for a change.

To run the file from Carvio later, choose **G-code file** on the Run tab and open it.

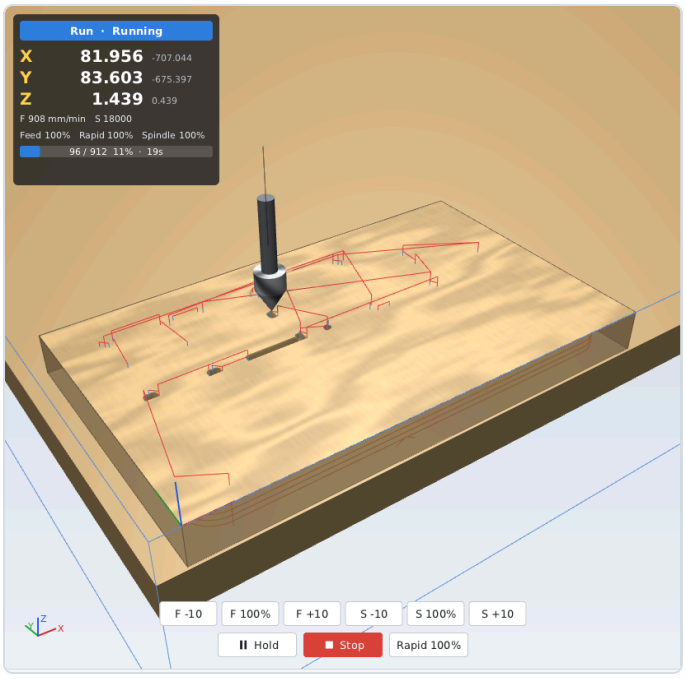


Save Toolpaths: the Post and Save (the middle of the form, left out here, sets tool changes and probing).

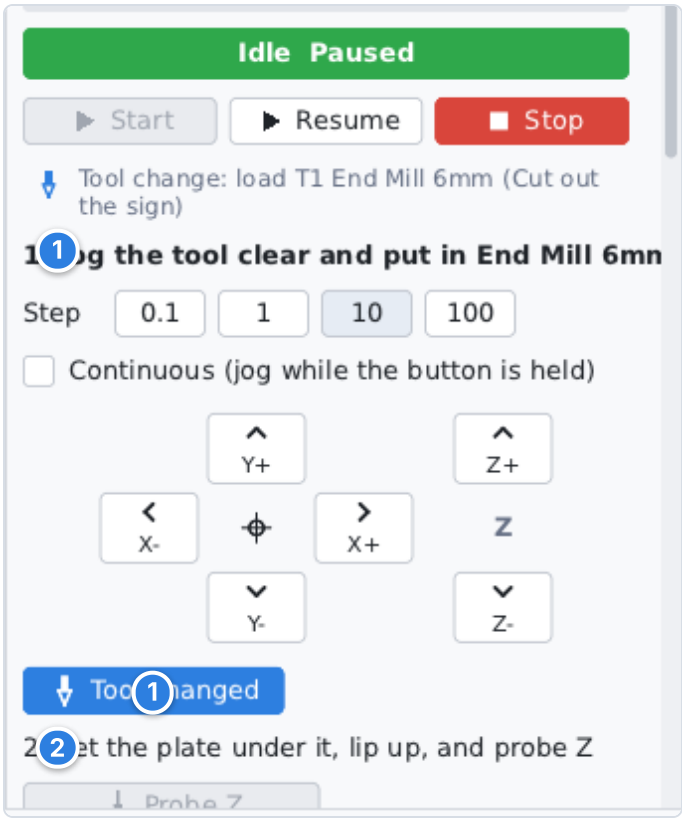
Print a setup sheet

Setup and tool sheets... prints a page with the job size, the datum, the Z zero, the bits and the cutting order. Pin it at the machine.

While it runs: the tool change



The job running. The buttons along the bottom slow the feed or the spindle down (F -10, S -10), pause (**Hold**) and **Stop**.



The Run tab at the tool change.

When the letters are carved the job pauses, lifts the bit and says which tool to load. The Run tab (and the bottom of the Machine view) walks you through it:

1. Switch the spindle off if it has its own switch. Jog the bit clear with the small jog pad, change to the **6 mm end mill**, tighten the collet, and click **Tool changed**.
2. The new bit is a different length, so Z zero must be measured again: put the touch plate under it and click **Probe Z**. Without a plate, jog Z down to the paper and click **Z0** in the Machine tab's Status section.
3. Take the plate away, spindle on, and click **Tool change complete: resume**. The bit lifts to the safe height and carries on with the cut-out.

> **If anything looks wrong**
>
> **Hold** pauses on the spot; **Resume** carries on. **Stop** ends the job (the machine is reset, so home afterwards). If a cut sounds bad but is not dangerous, **F -10** slows the feed by ten percent at a time.

Test cuts: catch mistakes before they cost a board

Do these the first time, and whenever something changes (a new bit, a new material, a new machine). Each takes a few minutes.

1 Air cut

Set Z zero 20 mm **above** the board (jog up 20 after the paper, click Z0) and run the whole job with the spindle off. Everything happens in the air: you see the moves, the tool change and the speeds, with nothing at stake. Then set Z zero on the board again.

2 Frame job

Before every real job. The bit traces the job's edges at the safe height. If it goes near a clamp or off the board, fix the zero or the clamps.

3 A shallow scratch

Draw a 50 mm square on a scrap board, make a Profile toolpath with **Cut depth** 1 mm, and cut it. Measure the depth with calipers: 1 mm means your Z zero and plate thickness are right. Measure the square: 50.0 mm means the bit's diameter is right. If it is 49.6, the bit is 0.4 mm smaller than the Tool Database says; type the measured size there.

4 A test letter

V-carve a single letter 1 mm deep from the Tool Database values. Clean edges and a steady sound mean the feeds are fine. Burning: go faster. Chatter: shallower passes (Guide 4's table).

5 Then the sign

Run the real job. Keep one hand near the stop until the first pass of each toolpath has gone round once.

Setup sheets are for this

Write the measured numbers on the setup sheet: real bit diameter, real plate thickness, the feeds that worked. Next time you cut the same material, you start from those.

⚠ If something goes wrong

What you see	What to do
Start is greyed out	The machine is in Alarm or not connected (unlock or home), or no job is built yet (click **Build job from toolpaths**). The free trial runs jobs on the demo machines only: a real machine needs a licence or a free trial licence (Help > Licence).
Carvio warns the job is **outside the machine travel**	With the zero where it is, part of the job would go past the machine's limits. Move the board (and the zero) towards the middle, or check the Travel sizes in Machine Setup.
The whole job is cut off to one side, or off the board	The XY datum in Job Setup and the corner you zeroed on do not match (Guide 2's rule), or you zeroed on the wrong corner. Zero again on the front-left corner.
The design comes out mirrored or rotated	An axis runs backwards on the machine. Jog X+ and Y+ and check the directions (Guide 5); fix **$3** in the controller settings.

Cuts are too deep or too shallow by the same amount	Z zero is off: wrong plate thickness, or the paper test done with the spindle running. Repeat the Z zero. Check the board thickness in Job Setup too.
The bit cut into the spoilboard on the first pass, or dived	Z zero was set above the board (an air-cut zero left in place), or Z zero Position is **Machine Bed** while you zeroed on the top. Make the two match.
The letters are far too deep, or the V-bit went through the board	Wrong bit: a 60 degree job run with a 30 degree bit, or the wrong angle in the Tool Database. Check the bit and its angle; use **Flat depth** to cap the depth.
The part broke loose during the cut-out	Tabs too thin or too few, or a tab was cut by a second toolpath. Use 3 mm tabs, add more, and keep the profile as the last toolpath.
The bit hit a clamp	Safe Z is lower than the clamps. Raise Safe Z in Material Setup (and in Machine Setup for Carvio's own moves) and keep clamps outside the job's edges. Frame the job first.
The job stopped partway and Carvio says the connection was lost	The computer went to sleep, or the USB port was switched off to save power. Turn off sleep and USB power saving while cutting, and keep the cable away from the spindle's power lead.
The spindle was not running when the bit reached the board	A spindle with its own switch must be switched on before Start. A controlled spindle gets a pause to spin up (set in the post processor); the **Spindle & Coolant** test in Guide 5 proves it responds.
After the tool change the second toolpath cut at the wrong depth	Z zero was not measured again for the new bit. Always **Probe Z** (or paper and Z0) at every tool change.
The machine stops with the job paused and a message	A pause written into the program (M0). Read the message on the Run tab, do what it asks, and click Resume.
The finished part is the wrong size	A constant error (every size 0.4 mm small): the bit diameter in the Tool Database. A proportional error (100 mm comes out 98): the controller's steps per mm (**$100** to **$102**), set from the machine's manual.

Before you press Start

In Carvio

- [ ] Job Setup: the board's real width, height and **measured thickness**.
- [ ] Z Zero Position = Material Surface, XY Datum = Bottom Left (or whatever you will do at the machine).
- [ ] Every toolpath uses the **bit you will actually load**, with the right diameter and angle.
- [ ] Cutting order: carve and pocket first, profile (cut-out) last, with tabs.
- [ ] Toolpath list: the machining time looks sensible.
- [ ] Preview: nothing outside the board, nothing deeper than it should be.
- [ ] Safe Z is higher than the clamps.
- [ ] Post processor: Grbl (mm) for Grbl and grblHAL.
- [ ] Job built; the summary shows no travel warning.

At the machine

- [ ] Board clamped at its edges, flat, clamps outside the cut.
- [ ] First bit in, collet clean and tight, right collet size.
- [ ] Machine connected and **homed**.
- [ ] X0 Y0 set on the front-left corner of the board.
- [ ] Z0 set on the top of the board with **this** bit (paper or touch plate), plate and clip removed.
- [ ] **Frame job** done: the bit stayed over the board and clear of the clamps.
- [ ] Spindle on (if it has its own switch), dust extraction on.
- [ ] Eye protection on, hair and sleeves tied back, nothing loose on the bed.
- [ ] Hand near the stop for the first pass.

At each tool change

- [ ] Spindle off, bit changed, collet tight, **Tool changed**.
- [ ] Z0 measured again for the new bit (**Probe Z**).
- [ ] Plate and clip removed, spindle on, **Resume**.

That is the end of the Beginner Guides. From here, the Help inside Carvio (F1, or the ? on any form) explains every option, and the forum at carviocnc.com is where to ask.

The Carvio Beginner Guides: 1 Start Here · 2 Know Your Machine · 3 Set Up Your Machine in Carvio · 4 Set Up Your Tools · 5 Connect, Jog, Home and Set Zero · 6 Your First Job and Test Cuts