GUIDE 5 OF 6

Connect, Jog, Home and Set Zero

The first time you move the machine from Carvio. By the end of this guide the machine knows where it is, you know how to move it safely, and the work zero is set on your board, ready for a job.

IN THIS GUIDE

- Practise everything on the demo machine first
- Connect, and what the greeting means
- Alarm, Unlock and Home
- Reading the Status section and jogging safely
- A first spindle test
- Setting X, Y and Z zero on the board, with paper or a touch plate
- The Console, and what each alarm means

YOU WILL NEED

- The machine profile from Guide 3
- A scrap board clamped to the bed
- A bit in the spindle (any end mill)
- A sheet of paper, or your touch plate and its clip
- Eye protection

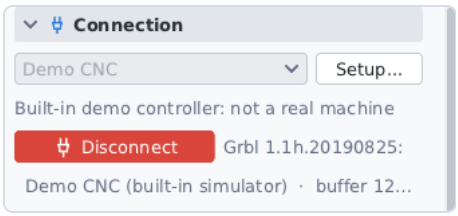
Before the machine moves

Know where the emergency stop is (or the power switch) and keep one hand near it the first few times. Nothing in this guide needs the spindle running except the short spindle test. Keep fingers, cables and clamps out of the way of the tool and the moving gantry.

Practise on the demo machine first

Carvio has a **Demo CNC** built in: a pretend controller that answers exactly like a real Grbl board. It connects, homes, jogs, probes and runs jobs, and nothing can break. Do this whole guide on it first. Then do it again on your own machine; every button is the same.

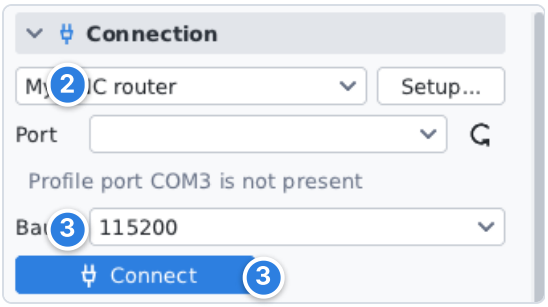
Open the **Machine** tab in the right-hand panel, pick **Demo CNC** in the Connection section and click **Connect**. The section shows "Grbl 1.1h" and the Status turns to **Idle**.



Connected to the demo machine.

Connect to your machine

1. Switch the machine on and plug in the USB cable. Wait a few seconds for the computer to notice it.
2. On the **Machine** tab, pick your profile in the list. If the port shows a warning, click the round-arrow button to look for ports again and choose yours.
3. Check **Baud** says 115200 and click **Connect**.
4. Many boards restart when the port opens: you may hear a click or see the lights blink. A second or two later the section shows the controller's greeting, for example **Grbl 1.1h**.



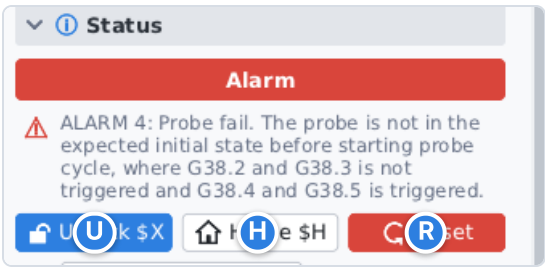
Before connecting. Here the profile's port is not plugged in, so Carvio says so.

The Status now says either **Idle** (ready) or **Alarm**. Alarm is normal and the next section clears it.

Alarm, Unlock and Home

A Grbl machine with homing switches starts in **Alarm** on purpose: it does not yet know where it is. The Status section shows the alarm's meaning and three buttons.

- **Home $H**: the machine drives each axis to its switches and then knows its position exactly. **Do this if you have switches.** Z goes up first, then X and Y together.
- **Unlock $X**: clears the alarm without homing. Use it on a machine without switches. The machine then does not know where it is, so jog carefully and stay away from the ends of travel.
- **Reset**: stops everything and restarts the controller. Use it when something has gone wrong.



An alarm, with its meaning and the **U**nlock, **H**ome and **R**eset buttons. This one came from a probe that did not touch anything.

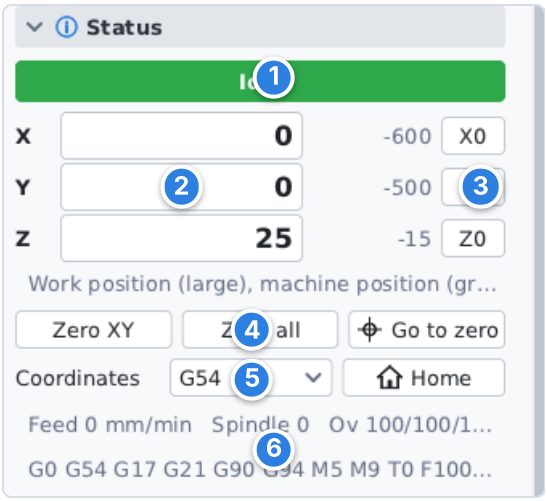
While homing, the Status badge says **Home**. Watch the machine the first time: if an axis drives **away** from its switch, press stop and see the troubleshooting table (the homing direction is set in the controller).

> **Home every time you switch the machine on**
>
> After homing, the work zero you set last time is still where you left it, even across a power cut. Without homing, every restart means zeroing again.

Read the Status section

1. The machine's **state**: Idle (ready), Jog, Run, Hold (paused), Alarm, Home, Check, Door.
2. The big numbers are the **work position**: where the tool is measured from your work zero. The small grey numbers are the **machine position**, measured from the home switches. Guide 2 explains the difference.
3. **X0**, **Y0**, **Z0**: make the tool's current position zero on that one axis.
4. **Zero XY** and **Zero all** do the same for two or three axes at once. **Go to zero** lifts to the safe height and travels to X0 Y0.
5. **Coordinates**: leave it on **G54**. **Home** runs the homing cycle.
6. The current feed, spindle speed and overrides, and the controller's modes. You can ignore this line for now.

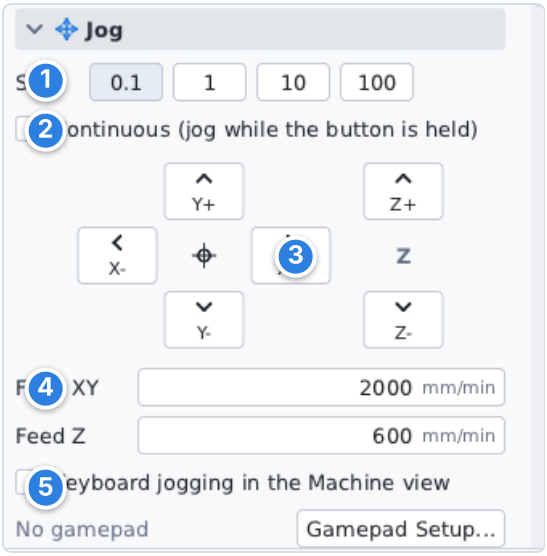
Tip: click a work position number, type a value and press Enter, and the tool moves there along that axis.



The Status section, connected and idle.

Jogging: moving the machine by hand

1. **Step**: how far one click moves the tool. Start with **1**, use **10** to cross the bed, and **0.1** when you are close to the board.
2. **Continuous**: the tool keeps moving while you hold a button, and stops when you let go. Handy for long moves; leave it off until you are confident.
3. The **arrows**: X+ moves the tool to the right, Y+ away from you, Z+ up. The centre button is **Go to zero**.
4. **Feed XY** and **Feed Z**: how fast jogging moves. Keep Feed Z slow.
5. **Keyboard jogging** lets the arrow keys and Page Up / Page Down jog while the Machine view is showing. A **gamepad** can jog too (Gamepad Setup...).



The Jog section.

Try this on the demo, then for real

Pick step 10 and click X+ three times, Y+ three times, X- three times, Y- three times: the tool draws a square in the air and ends where it began. Then pick 1 and do it again. Watch the work position count up and down as you go.

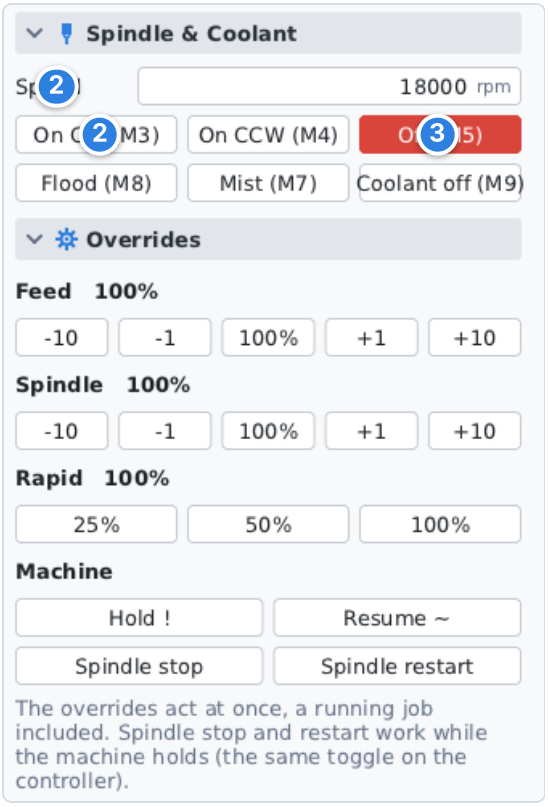
If the machine jogs the **wrong way** (X+ goes left, or Z+ goes down), stop: the direction of that motor is set in the controller, not in Carvio. See the troubleshooting table.

A first spindle test

Only if your spindle is switched on and off by the controller (most spindles with a VFD, and routers wired through a relay). A trim router with its own switch is simply switched on by hand before a job and off after.

1. Put on eye protection. Make sure the bit is tight and nothing is near it. Jog Z up so the bit is well above the board.
2. In the **Spindle & Coolant** section set **Speed** to something low, say 8000 rpm, and click **On CW (M3)**.
3. The spindle should start and, seen from above, turn **clockwise**. Click **Off (M5)**.

If it does not start, or turns the wrong way, see the troubleshooting table. Below this section, **Overrides** lets you slow a running job down or speed it up, and **Hold** pauses it: more about those in Guide 6.



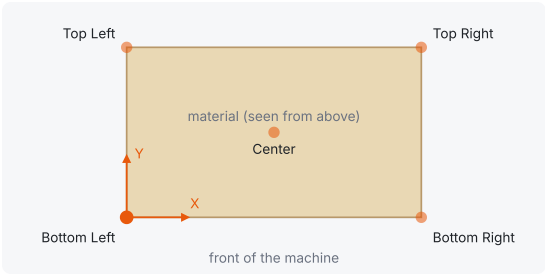
The Spindle & Coolant and Overrides sections.

Set the work zero on your board

This is the one thing you will do before **every** job, so it is worth learning well. Work zero is the point on the board that the design's corner (its **XY datum**, chosen in Job Setup) sits on. These guides always use the **front-left corner** of the board, with Z zero on its **top surface**.

X and Y

1. Clamp the board to the bed with its edges square to the machine. Keep the clamps outside the area you will cut.
2. Jog the tool over the **front-left corner** of the board: big steps first, then 1 and 0.1. Lower Z until the bit is a few millimetres above the board so you can sight it from the front and from the side.
3. When the centre of the bit is over the corner, click **Zero XY**. X and Y read 0.



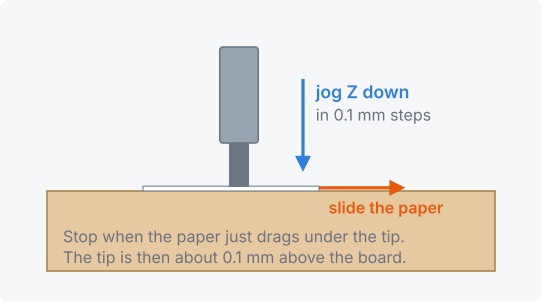
The XY datum: the design's corner, which you put on the board's corner.

A corner does not have to be perfect to a tenth of a millimetre: a design that is a little inside the board is fine. What matters is that the whole design lands on the board.

Z with a sheet of paper

No touch plate needed, and accurate to about 0.1 mm.

1. Jog the tool somewhere over the board and lay a sheet of ordinary paper under the bit.
2. Lower Z in 1 mm steps until the bit is close, then in **0.1** steps, sliding the paper back and forth each time.
3. The moment the paper **drags** but still moves, stop. The bit is about 0.1 mm above the board. Click **Z0**.
4. Jog Z up 10 mm and take the paper away.

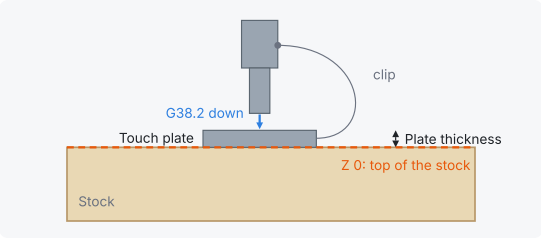


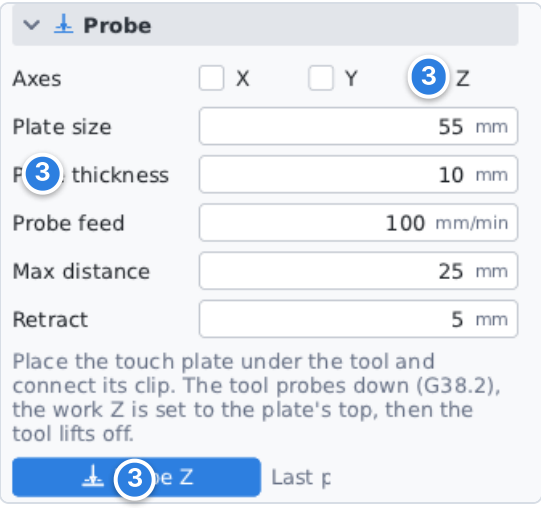
Lower the bit until the paper just drags.

Z with a touch plate

A touch plate is a small metal plate with a wire: when the bit touches it the controller notices and stops. Its **thickness** must be in the machine profile (Guide 3); Carvio allows for it.

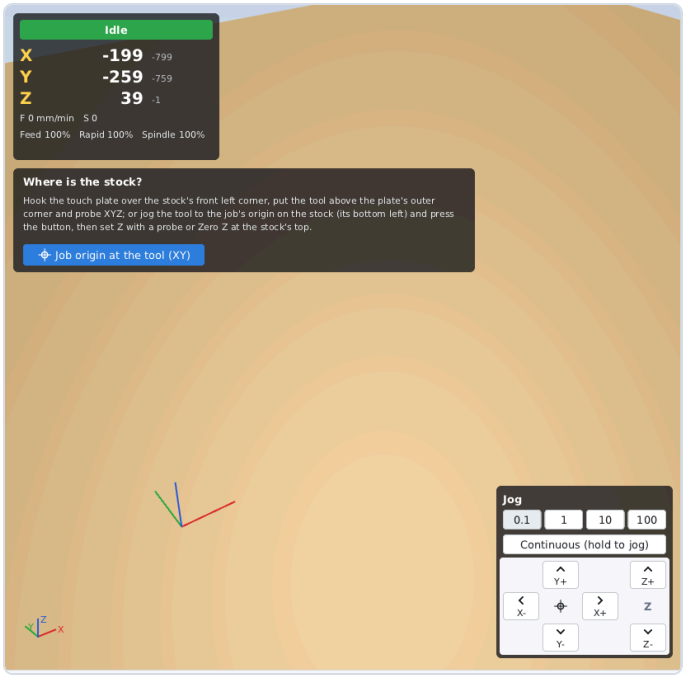
1. Lay the plate on the board under the bit and attach the clip to the bit (or the collet). Jog Z down until the bit is about 10 mm above the plate.
2. Test the circuit: touch the plate to the bit by hand. The Status section shows **Pins: P** while they touch. If it does not, check the clip.
3. In the **Probe** section tick only **Z**, check the plate thickness, and click **Probe Z**. The bit creeps down, touches, Z zero is set to the top of the board, and the bit lifts off.
4. Take the plate and clip away. Keep the clip's wire clear of the tool.



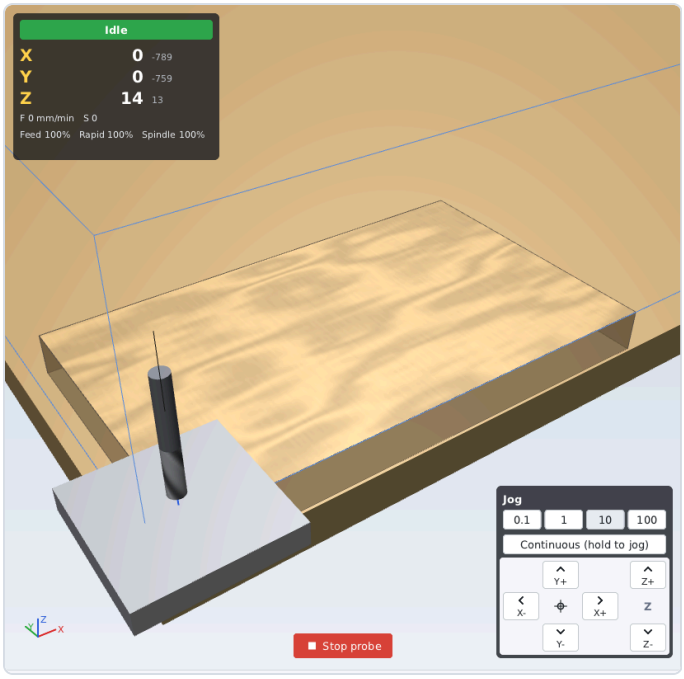


The Probe section: tick Z, check the thickness, Probe Z.

Check it in the Machine view



Before you zero, the Machine view asks where the stock is. The **Job origin at the tool (XY)** button is the same as Zero XY.



After zeroing, the board appears under the tool. During a probe the plate is drawn too.

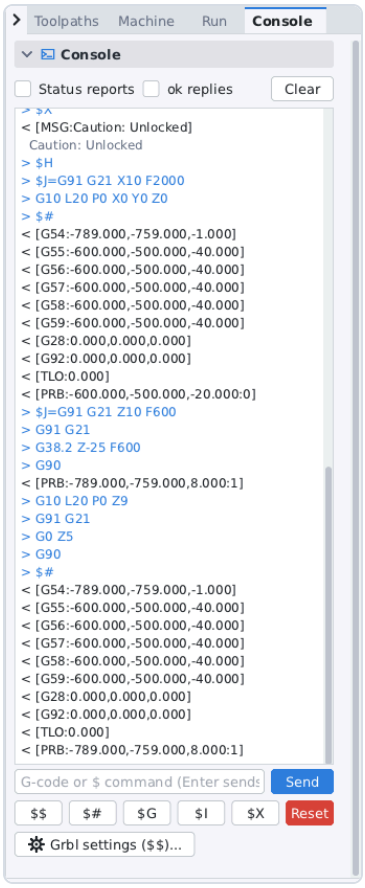
Press F7 (or **Machine > Machine View**) to see the machine in 3D. Once X and Y are zeroed the board is drawn where the job will cut it. Click **Go to zero**: the tool lifts to the safe height, travels to the corner, and the picture should match what you see on the machine. If it does not, zero again.

The Console

The **Console** tab shows every command Carvio sends and every answer the controller gives. You will not need it often, but it is where you look when something is odd, and it is how you talk to the controller directly.

- Type a G-code line or a `$` command in the box at the bottom and press Enter or **Send**.
- **$$** lists the controller's settings; the **Grbl settings ($$)...** button shows them in a readable list with their meanings, where you can change a homing direction or a jog direction.
- **Reset** is the same soft reset as the one in the Status section.

Blue lines are what Carvio sent; the others are the controller's replies. **Clear** empties the log.



The Console after a homing cycle and a Z probe.

⚠ If something goes wrong

What you see	What to do
Connect waits, then nothing, or the Console shows nonsense characters	Wrong port or wrong baud rate (Guide 3's troubleshooting table).
Nothing happens when you click a jog button	The machine is in **Alarm** (unlock or home) or **Hold** (click Resume). Jogging works only when the state is Idle.
An axis jogs the wrong way	Open **Grbl settings ($$)...** on the Console and change **$3 Direction invert** for that axis. Carvio never flips directions itself. If an axis moves the wrong way while **homing**, change **$23 Homing direction invert** instead.
Homing drives an axis to the end and grinds, or ALARM:8 / ALARM:9	The switch was not seen: wrong homing direction ($23), a switch not wired or not working, or the search distance too short. Press stop, fix the switch, and home again. Test a switch by pressing it by hand and watching **Pins** in the Status section.

ALARM:1 Hard limit	The machine hit a limit switch while moving. Unlock, then jog **away** from the switch. Carvio's travel sizes (Guide 3) help it warn you before that happens.
ALARM:2 Soft limit	A move was asked for beyond the machine's travel. Unlock; nothing moved.
ALARM:3 Reset while moving	The controller was reset mid-move and lost its position. Home again.
ALARM:4 or ALARM:5 Probe fail	The probe did not touch within **Max distance**, or the plate was already touching when it started. Unlock, check the clip, start closer to the plate, and probe again.
Probing drives the bit into the plate and keeps pushing	The circuit is not seen. Stop at once. Test with the plate against the bit: **Pins: P** must show. Check the clip, the wire and the probe pin on the board.
Every cut is too deep or too shallow by the same amount	The **Plate thickness** in Machine Setup is wrong. Measure the plate with calipers and type the real number.
The spindle does not start from the button	The spindle may have its own switch (a trim router): switch it on by hand. Otherwise the controller's spindle output is not wired to the spindle or VFD; the machine's manual shows the wiring, and the controller's **$30 Max spindle speed** must match the spindle.
The spindle turns the wrong way	For a VFD spindle, swap any two of the three motor wires (with the power off). Clockwise seen from above is right for ordinary bits.
The position numbers look wrong after reconnecting	The board restarted when the port opened, and without homing switches it has forgotten where it is. Home, or jog to the corner and zero again.
The Status says **Door**	The safety door input is open on the board. Close the door, or if there is none, the input is wired or set wrong (**$21** and the door pin).
Carvio says the machine is in **Check** mode	Check mode runs programs without moving. Untick **Check mode** on the Run tab, or send `$C` in the Console.

Next: Guide 6, Your First Job and Test Cuts: draw a sign, make the toolpaths and cut it.

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