

A/B Axis: Rotational axis that is used for a rotary device. A is pivoted at the Y-Axis, and B is pivoted on the X Axis.

Absolute Coordinate(s) (System) (Positioning): A coordinate system that does not take into consideration the position of any axis zero position. You should use the absolute coordinate system when you are having the machine travel to a set point as it will not move based on your XYZ zero point (example middle back, to move the machine out of the way so you can manipulate something on your waste board.) G90 in G-Code. See Incremental coordinate for the obverse.

(Tapered) Ball Nose: Best used for 3d work

Chip load: The resulting outcome of the Feed and Speed or F&S

You don't want too small of a chip load otherwise your creating sawdust

You don't want too large of a chip load otherwise your tearing material

You want it to be in the middle.

Refer to the bits manufacturer settings for target chip load and associated feed/speed, the onefinity is capable of safely managing a chip load of 0xx

Climb cut: an unnatural way for a router to move thru material, clockwise. In CNC it is perfectly safe to do a climb cut. See conventional for the obverse.

Collet: The nut that holds the bit in the router or spindle.

Always use two wrenches, and never rely on a stop button. Should be tight but don't put a lot of muscle behind it. Think of a screw you don't want to strip.

Compression Bit: A best of both worlds for upcut and downcut bits. A portion of the bottom of the bit will be in the upcut configuration, and the remaining cutting heads will be in the downcut configuration. Only effective if on the first pass your DOC is deep enough so the downcut portion will remove material on the surface otherwise you might as well run an upcut bit (See also Upcut / Downcut / Straight bit)

Computer Aided Drafting/Design (CAD): CAD is your design software. Photoshop is technically cad software, but in CNC context this is the software you create your tool paths in.

Examples include: Fusion 360, Atom3d, Vectric Suite (V-Carve, V-Carve Pro, Aspire), Carveco (Carveco Maker, Maker+)

Computer Aided Machining (CAM): CAM is the software used to execute the tool paths that were created in CAD.

Examples include the Buildbotics controller or Masso Controller

Controller: Controller is the hardware/software combination for managing movement of your machine.

Conventional cut: The traditional way to move a router through material which is counter clockwise, opposite the rotation.

Downcut Bit: A bit that forces material downwards, leaves very clean lips and faces, but the bottom may not be as clean as the the upcut. (See also Upcut / Downcut / Straight bit)

Depth of Cut / DOC & Depth Per Pass: The amount of material that the cutter will remove vertically (along z axis) in a single pass.

When dealing with DOC, it is based on the bit diameter. 2x on a 1/4" endmill is 1/2", 3x on same 1/4" endmill is 3/4 in. ect and the feed should be reduced by about 25% per step. Refer to manufactures specifications for specifics.

DRO (Digital Read Out): A window on your controller which gives reference points for your cnc's current position as it understands it. Could be Absolute or Relative and in Inches or Millimeters.

Endmill: A 2 or 3 tooth bit with a flat or inversed v bottom. Best used for pockets and profiles

Feed/Feedrate: The speed at which the router/spindle moves amongst the XYZ axis

Example rates include in/min and mm/min

Gantry: The cross member that represents your X-Axis.

G/M-Code: G-Code is the machine code sequence of letters and numbers that allows for execution of the preprogrammed sequence of instructions to be output by your controller.

It is possible to decipher g-code in small pieces but no one can look at a million lines of code and see what will be created without the use of a visualizer.

You should never remove the header/footer in gcode, and if you must modify the raw code, modify between these points. Failure to do so may result in damages or errors.

T1

G17

G21

G90

G0Z20.320

G0X0.000Y0.000

S18000 M03

M8

G4 P4 (Header ends here)

G0X-2.540Y-2.540Z2.540 (G-Code starts on this line)

G1Z-3.493F1143.0

G1X2.540F2286.0

G1Y2.540

G1X-2.540

G1Y-2.540

...

G1Y25.400

G1X-25.400

G1Y-25.400

G0Z2.540 (Raise Z Up at completion)

M5 (footer starts here)

G0Z20.320

G53z-5f5000

G53X-415.0000Y-7.0000F6000.0

M2

G-Code can vary from a dozen or so lines to millions & theoretically billions of lines.

Incremental Coordinate(s) (System) (Positioning): A coordinate system that is related to your axis zero point. G-Code compiled after your post processor utilizes the incremental coordinate system. (G91 in gcode) See Absolute Coordinates for the obverse.

Inlay: The art of carving a piece of wood, then carving another piece of wood and gluing the plug into the pocket to create a seamless piece of wood. Great for cutting boards. Can be very basic or extremely elaborate. Tear out is your weakness on the plug.

Janka: The hardness of a wood according to the amount of pressure measured in pounds of force (kilograms-force, Newton's or kilo-Newton's) it takes to make a dimple in material with a 7/16" (11.28mm) diameter steel ball.

Regardless of the unit of measure, balsa wood is softer than pine, pine is softer than oak, and mesquite is harder than all listed.

MDI (Manual Data Input): A window on your controller allowing for the manual data input in the form of g-code.

O/O flute: A single tooth bit forming a semi circle. Best used for plastics such as HDPE and acrylic.

Offset: Can have several meanings based on context, but the alternative to Raster is it would start in the center and work either clockwise or counterclockwise out depending on programming. May also refer to growing or shrinking a vector by creating an offset of it.

“Paper Method”: The act of using a sheet of paper to zero z off a work surface. Goggle a piece of paper under your cutter until it is no longer moveable. Caution should be exercised with vbits and the like as their prone to tearing. See Touch Probe for the alternative.

Pocket: Hollowing out the outline of a shape

Pocket (Inlay): The female part of an inlay. This should be laid out as you wish it to be displayed. May also be called female, negative, pocket. See Plug for the obverse.

Post Processor: The compiler that converts the language of the CAD program to one that your controller / machine will be able to understand

Plug: The male part of an inlay, must be flipped horizontally and a start depth must be established to work properly. This has several different names, and it depends on who’s talking what it is. Male, positive, plug. See Pocket (inlay) for the obverse

Profile: Cutting the outline of a shape

Raster: A linear methodology of toolpath that is linear maybe offset with any degree. It would run left to right (or vice versa) then drop the level of stepover programmed, and proceed the opposite direction. See Offset for obverse.

Ramp: The act of angling the cutter as it gets to its depth per pass. There are several options when picking how it will measure that distance or angle.

Safe Z Height: The preprogrammed height that you tell the computer what it will take to miss obstructions above the work surface like clamps or other elevated work holding obstructions.

Scallop: Can be done intentionally with a ball nose in a pocket or unintentional with bad tram. Intentionally it would showcase the toolpath, looks better with offset than raster.

Speed: the rate at which the router or spindle rotates the cutter head. Spindles offer greater availability than routers which are "fixed" according to numbers on dial.

Example rate = RPM (revolution per minute)

Start depth: Where the toolpath will start below your zero depth. Useful if carving, painting then sanding. Necessary for plug on inlay work.

Step over: A percentage that represents the amount of previously cut material will be traveled by a cutter head. Used in 3d work ($x < \sim 10\%$), and pockets ($\sim 40\%$). The less your step over the more time it will take to traverse an area. Not used in profiles.

Straight (cutter) Bit: A common bit you will find at home stores that can be used in a pinch as long as there is no bearing or the bearing is above height of the surface based on your DOC. (See also Upcut, Compression / Downcut)

Tear out: unintentional removal of material. Could happen for numerous reasons from unstable wood type/characteristics (see janka), too fast of material removal (piece of material hit it) to unstable cut for grain direction.

Tool Setter: A switch mechanism used for measuring and adjusting the tool length between changes on the same project. Especially useful when the original top surface has been eliminated. Only available on the Masso controller in the elite series of the Onefinity line of products. Buildbotics work around would be to zero z on the waste board.

Touch Probe: A dimensional conductor (commonly aluminum) of known shape and size that hooks up to your controller and lets the machine probe the axis's to establish where your zero is. A touch probe will look for a completed circuit and will have a cable for attaching (example gator clip or magnet) to you router and may or may not be necessary when using a spindle. Capable of doing XYZ or just Z. Do not do another XYZ probe sequence between bit changes on the same project, instead do Z only & flip Touch probe over. See also Paper method and Tool Setter.

Tram: the alignment of the cutter head to the cutting surface. You want it to be as parallel as possible Effective/inexpensive way to measure is a stick affixed to the router, and spin it around. the longer the stick, the more noticeable the variation will be. avoid touching the stick and spin it by the collet

Upcut bit: a bit that draws material up. Known to damage edges and sides due to tearout but leave smoother bottoms. (See also Downcut, Compression & Straight Bits)

V-Bit: a bit that when looking at it forms a V. Measured as an angle from one outside cutter to the other outside cutter. Sizes range from 15 degrees to 120 degrees. The depth of the bit will travel depends on the widest side of the v-carve and the bit angle.

V-Carve (Not to be confused with software with the same name): Best used for words, shapes with sharp corners (stars).

Visualizer: a software platform that allows you to see what the resulting gcode is programmed to do. This is external of viewing the simulation in your CAD program and only shows travel, not resulting tool paths. It's great if you've modified the code to remove a previously completed section, and want to see what your modification did

Waste board: The sacrificial piece of material that is installed in the bed of your CNC. Without one, you would utilize your tabletop and if you cut through your material you will marr it up. When performing through cuts aim for no more than .05" when performing through cuts.

MDF is a common material as it soft, flat, and straight. Avoid getting wet. Will deform. Replace as needed, but if you find yourself replacing it more than once a year, you should reevaluate how deem your cutting into it, and potentially reduce that.

Work holding: The method utilized to keep the material stationary.

There are many options to include but not limited to, tape and CA Glue, T-Track and hold downs, cam (not to be confused with the software) clamps, screws/nails, & vacuum table.

X Axis: The cross member that connects the Y-Axis's. Allows the Z Carriage to have left/right movement

Y Axis: Every CNC has 2x Y Axis's. They are the parallel mechanism for movement. Maybe called Y1/Y2. It allows for forward and backward movement in relation to the front of the CNC

Z Axis: The mechanism that moves up and down on the z-carriage.

Zed/Z Carriage: The mechanism that travels along the X-Axis and is the vehicle that holds your router/spindle.