

Workbee CNC Router

I recently bought a 1500×1500 [Workbee CNC router Kit from Bulkman 3d](#) and i bought both the leadscrew and belt versions (technically i bought the leadscrew version and a belt kit)

i think i'm going to be happier with the belt because it can supposedly go faster.

leadscrew wobble really is an issue on this size of the machine. except for Bulkman nobody sells the 1500 kits with leadscrews.. there is a video out there suggesting to put tension on the leadscrews rather than pressure to eliminate wobble.. i might try that but i don't want to shorten my extrusions, so i'll need to figure out another way to put tension on the leadscrews.

i've got the grbl controller and am running grbl v1.1 these are my settings for the leadscrew so far.. limit switches haven't been configured yet.

```
$0 = 10      (Step pulse time, microseconds)
$1 = 25      (Step idle delay, milliseconds)
$2 = 0       (Step pulse invert, mask)
$3 = 0       (Step direction invert, mask)
$4 = 0       (Invert step enable pin, boolean)
$5 = 1       (Invert limit pins, boolean)
$6 = 0       (Invert probe pin, boolean)
$10 = 1      (Status report options, mask)
$11 = 0.010  (Junction deviation, millimeters)
$12 = 0.002  (Arc tolerance, millimeters)
$13 = 0      (Report in inches, boolean)
$20 = 0      (Soft limits enable, boolean)
$21 = 1      (Hard limits enable, boolean)
$22 = 0      (Homing cycle enable, boolean)
$23 = 0      (Homing direction invert, mask)
$24 = 25.000 (Homing locate feed rate, mm/min)
$25 = 500.000 (Homing search seek rate, mm/min)
$26 = 250    (Homing switch debounce delay, milliseconds)
$27 = 1.000  (Homing switch pull-off distance, millimeters)
$30 = 1000   (Maximum spindle speed, RPM)
$31 = 0      (Minimum spindle speed, RPM)
$32 = 0      (Laser-mode enable, boolean)
$100 = 100.000 (X-axis travel resolution, step/mm)
$101 = 100.000 (Y-axis travel resolution, step/mm)
$102 = 100.000 (Z-axis travel resolution, step/mm)
$110 = 4000.000 (X-axis maximum rate, mm/min)
$111 = 4000.000 (Y-axis maximum rate, mm/min)
$112 = 500.000 (Z-axis maximum rate, mm/min)
$120 = 300.000 (X-axis acceleration, mm/sec^2)
$121 = 300.000 (Y-axis acceleration, mm/sec^2)
$122 = 200.000 (Z-axis acceleration, mm/sec^2)
$130 = 200.000 (X-axis maximum travel, millimeters)
$131 = 200.000 (Y-axis maximum travel, millimeters)
$132 = 200.000 (Z-axis maximum travel, millimeters)
```

the above maximum speeds where reached doing aircuts only!

Here are some configurations that worked so far:

material	bit	depth	spindle RPM	feed rate (mm/min)	result
OSB	1/4 upcut	6mm	19200	1700 mm/min	very rough cut, a little smoke every now and then
OSB	1/4 upcut	3mm	19200	3000 mm/min	much smoother, no smoke
MDF	1/8 upcut 2-flute	spiral ?? bore	3000	500	no smoke but vibrations
MDF	1/8 upcut 2-flute	spiralpocket	7000	500	no smoke
Valchromat (Colored MDF, slightly harder than regular MDF)	6mm straight 2-flute	7mm	10'000	2000 mm/min	some vibrations but acceptable quality that only needs slight sanding on visible edges
Aluminum (unknown type)	1/8 2-flute straight	0.1mm	6000	1000mm/min	dry with air cooling, slow but decent :)
0.5mm Aluminium 50xx	1/8 2-flute straight	0.5mm	16000	700mm/min (200mm/min plunge)	cutting fluid in pan, looks professional :)
Brass	1/8 upcut	0.5	14000	500 mm/min	with minimum quantity lubrication

G-Code Sender

my Workbee is using the GRBL firmware on a arduino together with a CNCshield on top of it. In order to send gcode to the arduino, a gcode-sender is used on a PC that is connected via USB.

currently i am using UGS (Univseral Gcode Sender) Platform edition. The reason why i chose this software is simple: i used it on my shapeoko and already kenw it. It seems though, that UGS crashes every now and then, leaving the machine stuck. i then need stop the job, disconnect from the arduino, reconnect and start over again. since the ardino still knows the machine position etc. I have a feeling this crash might happen on the UGS side. I therefore want to try different gcode senders in the near future. the two most interesting ones seem to be:

- [CNC.js](#) - nice web gui, touch probe support, “pendants” which are small ui's for small devices like phones etc. server can be run on a raspberry pi
- [bCNC](#) - basic CAM built in, accepts not only gcode but also svg and dxf. curretly i do the CAM work on fusion 360 which is nice, but it might be simpler to have it integrated into the gcode sender, so it can be modified easily while standing at the machine.. the Fusion 360 interface needs quite a big screen to work with it smoothly and simple changes like changing the cutting speed means saving re-opening files etc. all the time.

CNC.js

i've decided to try CNC.js. I am installing it on a Raspberry PI 3 (because i had one laying around). the idea is, to get the raspberry as close as possible to the grbl to keep the USB cable as short as possible. I've read that communications issues on the USB link cause by interference could cause the hang-ups i saw with UGS. in any case, the size of the raspberry makes it a practical choice anyway :)

so first i installed raspberry OS, there is pre-built raspberry image from CNC.js but it has not been updated in the last two years, so I decided to go with a manual install.

here are the steps i went through:

[install_raspbian_on_f2fs_root](#) with my script, set wifi and hostname and enable ssh so we don't need to connect a screen to it ever :)

install git

```
sudo apt update
sudo apt install git
```

install cncjs with npm which is installed via nvm. basically, just follow the instructions on the [CNC.js github page](#)

create a systemd service that will start cncjs automatically:

```
sudo nano /etc/systemd/system/cncjs.service
```

here are the contents of the startup script:

```
[Unit]
Description=CNCjs

[Service]
ExecStart=/bin/bash -c -l cncjs
Restart=always
RestartSec=10
# Output to syslog
StandardOutput=syslog
StandardError=syslog
SyslogIdentifier=cncjs
User=pi
Group=pi

[Install]
WantedBy=multi-user.target
```

nwo start it:

```
sudo systemctl daemon-reload
sudo systemctl --now enable cncjs
```

systemctl status cncjs

this should show that it's running now and you should be able to access it on port 8000 of your raspberry

i'm lazy, so i don't want to type that port 8000 all the time, let's add a redirect using lighttpd:

```
sudo apt install lighttpd
cd /etc/lighttpd
sudo nano conf-available/10-redirect.conf
```

put this in there:

```
$HTTP["scheme"] == "http" {
    # capture vhost name with regex conditiona -> %0 in redirect pattern
    # must be the most inner block to the redirect rule
    $HTTP["host"] =~ ".*" {
        url.redirect = (".*" => "http://%0:8000$0")
    }
}
```

activate the config and restart the service

```
cd conf-enabled
sudo ln -s ../conf-available/10-redirect.conf
sudo systemctl restart lighttpd.service
```

now you should be able to simply access the cncjs gui by entering the hostname of your raspberry in your browser

it prettymuch runs out of the box now. simply connect to it, choose the usb serial interface and hit connect and you are good to go!

in the future i will add an [ESCAM Q6](#) ip camera. those things are genius.. they come with everything you need and cost only \$26 on banggood or aliexpress. the field of view is also perfect for such applications.

so far i can't get the stream to display, although i can access it with vlc or my webbrower directy. i have two urls for the sub stream:

- <http://192.168.169.111/Streams/1/4/ReceiveData>
- *rtsp:192.168.169.111/live/0/sub neither show up on screen, got to debug that.. i hope it's not trying to re-encode it on the raspberry using ffmpeg which might be missing.. but we will see..*

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