VC-touch building guide
Version 1.0
By sixeight at vguitarforums.com

Introduction

Here is a quick guide for building the VC-touch, a dedicated MIDI controller for Boss GP-10 / Roland GR-55 / Roland VG-99 / Zoom G3 / Zoom MS70-CDR / Line6 M13 / Line6 Helix / Fractal AxeFX / Boss Katana and the Kemper Profiling Amp. Building this device should cost around 5 - 10 hours and $200 - 500 for parts, depending on the cost for the enclosure.

Features of the VC-touch:

Check out the VC-touch User Guide for features.

Main parts of the VC-touch:

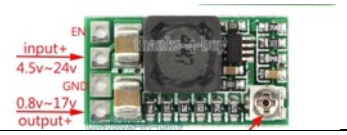
The VC-touch has the following main parts:

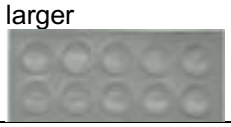
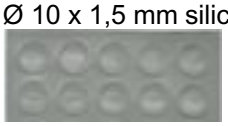
- Enclosure of sheet metal with 3D printed supports for the display
- Main PCB board with Teensy and all the connectors.
- 15 footswitches
- 1 colour TFT touch display

Additional documents – see https://github.com/sixeight7/VController_v3/tree/master/VC-touch%20hardware :

- PDF, DWG and step files for the enclosure:
- STL files for the 3D printed parts

BOM/Parts list: PCB main

Reference	Nr	Part	Where to get
U1	1	Teensy 4.1	https://www.pjrc.com/store/teensy41.html reichelt.de: **TEENSY 4.1**
U1	2	24-pin strips for connecting the Teensy	reichelt.de: **MPE 087-1-024 or 040**
U1, U8	4	Socket for Teensy. Cut off four pins of 2 headers to get 24 pins in total for U1. Remaining 15 pins are used for U8. See guide.	reichelt.de: **BL 1X20G 2,54** (socket) digikey.com: **S7053-ND**
U1	1	5-pin strip	reichelt.de: **MPE 087-1-005**
U1	1	Socket for Teensy. Cut off five pins for the USB host connection. See guide.	reichelt.de: **BL 1X10G 2,54** (socket) digikey.com:
U2, U3	2	VO2630/2631 dual optocoupler HCPL 2630 / 2631 alternative	reichelt.de: **VO 2630 VIS / HCPL 2631** **ebay**
U7	1	5V buck converter 	ebay: 5V buck convertor – check if pinout corresponds to the image on the left.
U7	1	Three pin header for buck convertor	
U4, U5	2	24LC512 I/P serial EEPROM Alternative: 24AA512	reichelt.de: **24LC512-I/P** reichelt.de: **24AA512-I/P**
U9	1	ESP32 WROOM devkit v1 (optional)	reichelt.de: **DEBO JT ESP32**
JK2, JK3, JK4	3	7 pin din socket (MIDI) Cliff FM6727 Pro Signal PSG03465	Farnell: 1791759 or 2679728 reichelt.de does not stock these. Could use 5 pin instead if power is not needed
J6, J7	2	Lumberg 1503-07 3,5mm stereo jack PCB	reichelt.de: **LUM 1503-07**
JK5, JK9, JK10	3	jack socket 6.35 mm stereo Neutrik NR-J6HF	reichelt.de: **NEUTRIK NR-J6HF**
JK5, JK9, JK10	3	jack mounting nut Neutrik NR-JNUTB	reichelt.de: **NEUTRIK NR-JNUTB**
JK1	1	Power barrel – centre pin 2 mm	reichelt.de: **LUM NEB 21R** Farnell: 1737246
JK11	1	USB male socket type B	reichelt.de: **USB BW**
JK6	1	USB male socket type A vertical	
Q1	1	IRF9530 P-channel MOSFET	reichelt.de: **IRF 9530**
Q2	1	BC547 transistor or similar	reichelt.de: **BC 547C**
D1, D2, D9, D10	4	1N5817 shottky diode	reichelt.de: **1N 5817**
D3, D4, D5, D6, D7, D8	6	1N4148 diode	reichelt.de: **1N 4148**
C1	1	100 uF capacitor, >=16V	reichelt.de: **RAD FR 100/35**
C2	1	4,7 uF >= 16V	reichelt.de: **SM 4,7/50RAD**
C3	1	10 uF capacitor, >=16V	reichelt.de: **SM 10/16RAD**
C4 C5,C6, C7, C8, C9 C10	7	100 nF capacitor	reichelt.de: **KERKO 100N**
R2, R10	2	10k resistor	reichelt.de: **1/4W 10K**
R9	1	100k resistor	reichelt.de: **1/4W 100K**
R16, 17, 18, 19 R20, 21, 24, 25 R26, 27, 28, 29 R31, 32, 33, 38	4	Resistor network 4 res./8 pin 4k7	reichelt.de: **SIL 8-4 4,7K**
R1, 3, 4, 13 R5, 6, 7, 12	2	Resistor network 47	reichelt.de: **SIL 8-4 47**
R35, 35, 36, 37	1	Resistor network 470k	reichelt.de: **SIL 8-4 470K**

R8, 11, 14, 15	1	Resistor network 220	reichelt.de: **SIL 8-4 220**
J2	1	Display Buydisplay ER-TFTM0748-1 Order with options: 4-wire SPI header + 5V + cap. touch panel	
J2	1	WINBOND IC Chip FLASH 128M BIT W25Q128JV SOP8 Package (optional)	
J2	1	Header or stacking header	reichelt.de: **RPI HEADER CG4** reichelt.de: **RPI HEADER 40** (needs cutting of pins)
J2	6	15mm spacer	reichelt.de: **DI 15mm**
Enclosure	1	Anodized aluminum enclosure with 3D printed sides, display bezel and middle support	SixEight sound Control or see building instructions.
Enclosure	1	Perspex display window	SixEight sound Control or see building instructions.
Enclosure	4	M3 x 20mm flat head (black)	Ebay
Enclosure	6	M3 x 10mm flat head(black)	Ebay
Enclosure	18	M3 x 10mm round head (black)	Ebay
Enclosure	18	DIN557 M3 square nuts	Ebay
Enclosure	4	Ø 10 x 3.0 mm silicon clear feet or larger 	Bol.com: https://www.bol.com/nl/nl/p/hofftech-siliconendruppels-stootdoppen-50-stuks/9200000088749154/?referrer=sociallshare_pdp_www
Enclosure	2	Ø 10 x 1,5 mm silicon clear feet 	Bol.com: https://www.bol.com/nl/nl/p/hofftech-siliconendruppels-stootdoppen-50-stuks/9200000088749150/?referrer=sociallshare_pdp_www
J8, J9	2	Dual pin header 6 pins	reichelt.de: **MPE 087-2-006**
J8, J9	5	jumper	reichelt.de: **JUMPER 2,54 SW**
J3	1	PCB connector angled, brown, 3-pin	reichelt.de: **PS 25/3W BR**
J4	1	PCB connector angled, brown, 5-pin	reichelt.de: **PS 25/5W BR**
SW1-15	15	Footswitch	digikey.com: **432-1287-ND** http://www.ebay.com/itm/271930278587
SW1	1	Angled pin header – need four pins	reichelt.de: **BKL 10120522**
SW1	1	2 pin dupon cable	reichelt.de: **DEBO DUPON 2PIN**
SW16	1	Power switch momentary (optional)	Anything you like – drill your own hole or use a regular footswitch…

Power supply (optional)

	1	Compact switching power supply, 18W, out 9V	Reichelt.de: **SNT 2250 9V**

Buydisplay order screen:

Serial SPI I2C 7.84 inch IPS TFT LCD Module RA8876

Share to:

Interface * *Required Fields

Pin Header Connection-4-Wire SPI +US$0.33

Power Supply (Typ.) *

VDD=5.0V

Touch Panel(Attached by default) *

7.84"Capacitive Touch Panel +US$10.33

MicroSD Card Interface

-- Please Select --

Font Chip (Refer to font chip datasheet for detail)

-- Please Select --

Qty

- 1 +

Enclosure

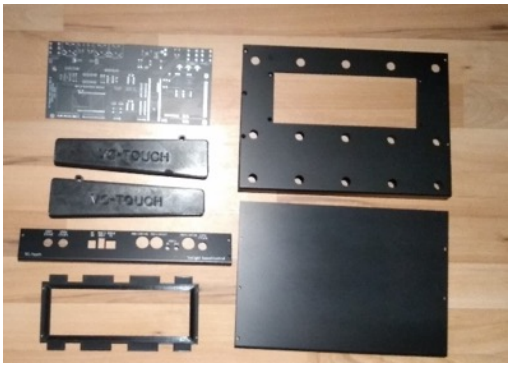
See https://github.com/sixeight7/VController_v3/tree/master/VC-touch%20hardware/Enclosure%20metal.

There are three metal parts to the enclosure:

- Top plate
- Back plate
- Bottom plate

The dwg files show flat versions of each metal plate. Extra space for bending has been taken into account, but different type of metal may give different results.

I found a metal company that does laser cutting, bending, anodizing and milling for me. I also sell ready made enclosures of anodised aluminum.



Perspex window:
To protect the display there is a perspex window that is on top of the VC-touch.
See https://github.com/sixeight7/VController_v3/tree/master/VC-touch%20hardware/Enclosure%20perspex

3D printing:
See https://github.com/sixeight7/VController_v3/tree/master/VC-touch%20hardware/Enclosure%20stl

There are four 3D printed parts:

- Left side
- Right side
- Display bezel
- Display support

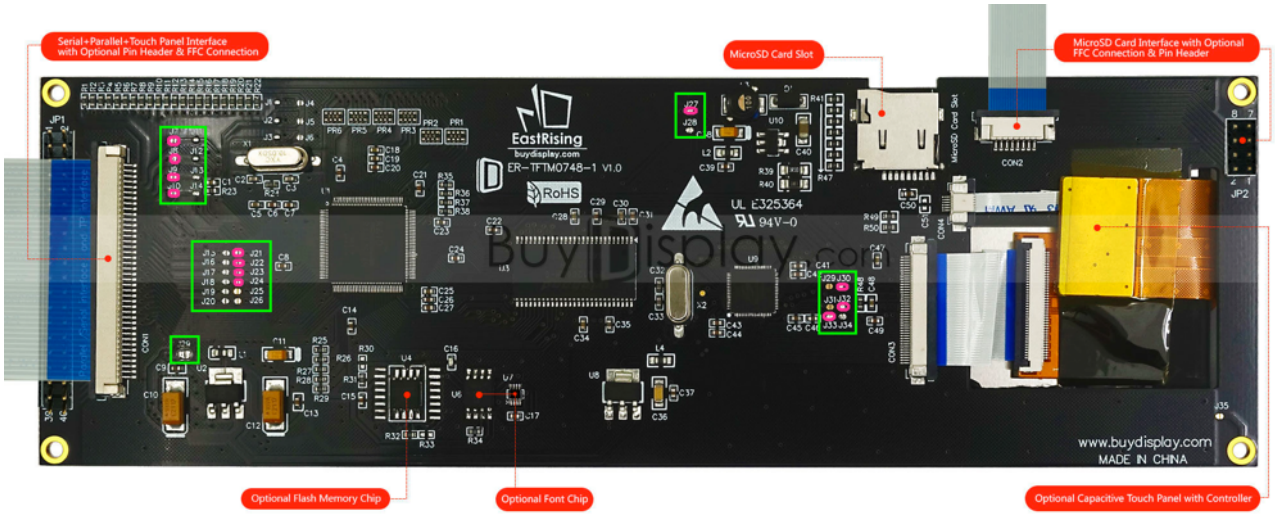
The preferred color for the filament is black. Check appendix 1 for the settings I use. It did take me some work to get the VC-TOUCH text on the sides to print nicely.

Main TFT display

Ordering information is in the BOM. Buydisplay will deliver the display with the proper pin header and the correct jumper settings. Make sure you select the proper interface (4-WIRE SPI) and voltage (Vcc = 5V) when you order the display. Also the capacitive touch panel is necessary to have touch capability.

We do not need the font chip. You may want to add the flash memory chip (W25Q128JV). So far I have not used it, but there may be extra functionality that could be added in the future that requires the flash memory chip to be present.

On the display there are a lot of jumpers that need to be set. Usually these are set right by Buydisplay, but if you have trouble getting the display to work, you can check the proper settings here. I highlighted the location of the jumpers with green boxes in the picture below. All the jumpers that need to be set are colored pink. All the jumpers that do not need to be set are not marked. A jumper is set by connecting the two halves with solder. If a jumper is set incorrectly the solder can be removed using desoldering wire.

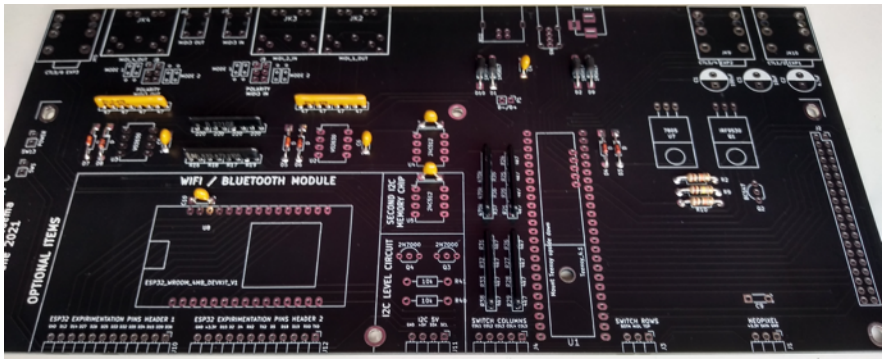


The MicroSD card slot and JP2 on the right are not used.

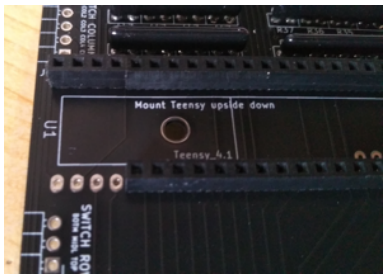
Building the Main PCB

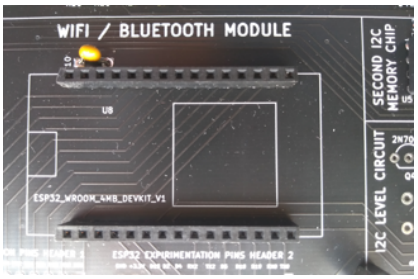
PCB manufacturing:
PCB boards can be ordered from me. The schematic is here:
https://github.com/sixeight7/VController_v3/blob/master/VC-touch%20hardware/VC-touch%20schematic.pdf

Soldering:
I always solder starting with the parts with the least height. Then I work my way up to the parts with more height.



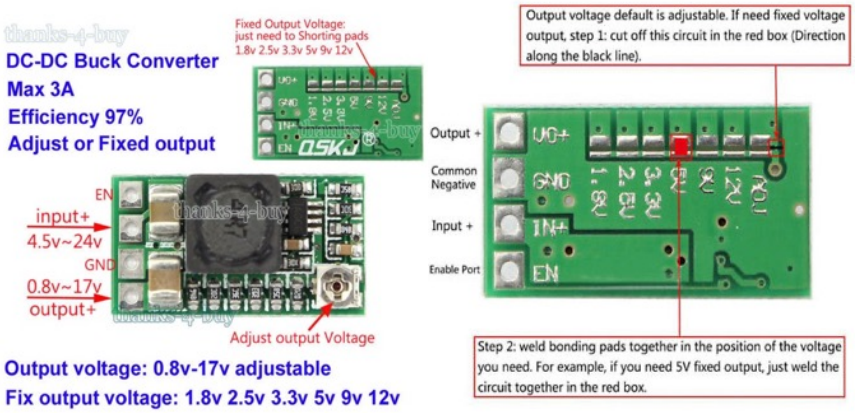
Two 20-pin headers need to be cut. I take of four pins and use them together with a full pin header for the Teensy. The remaining 15 pins are used for the WIFI/BT module (ESP32).





Before soldering all the pins of the connectors, check if they fit the enclosure. I found everything fitted fine without any filing.

Power conversion
The board uses a buck convertor. I buy these from ebay/aliexpress:

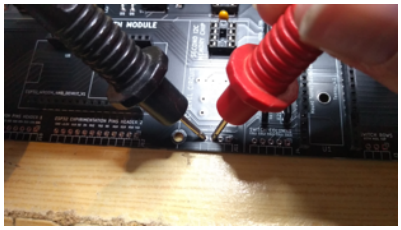


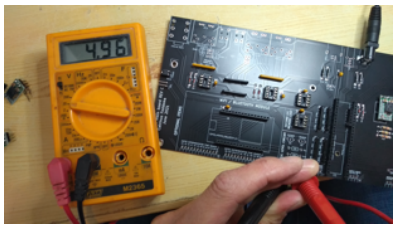
I used a small knife to cut the trace next to the ADJ pad and added a blob of solder to connect the 5V. That way the voltage level is stable at around 4.95 Volts. I do not trust the small potmeter on

the front. Touching it changes the voltage. The display, Teensy and attached USB devices may break when voltage exceeds 5.5 Volts.

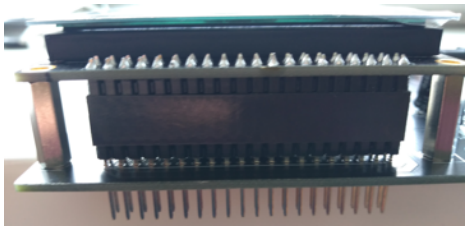
The buck convertor is attached to the board with a three pin header. The EN pin of the buck convertor is not connected.

After attaching the buck convertor to the board, I always check the voltage.

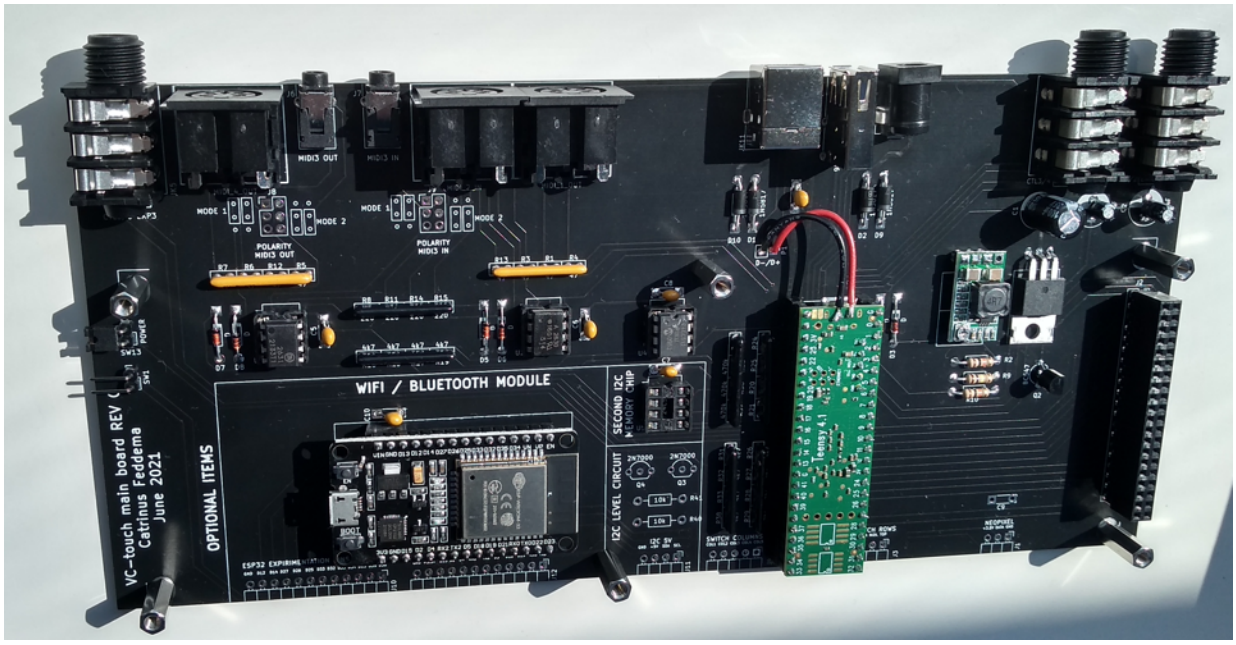




When doing the header for the display, make sure you first added the 15mm spacers so the connector is at the right height:

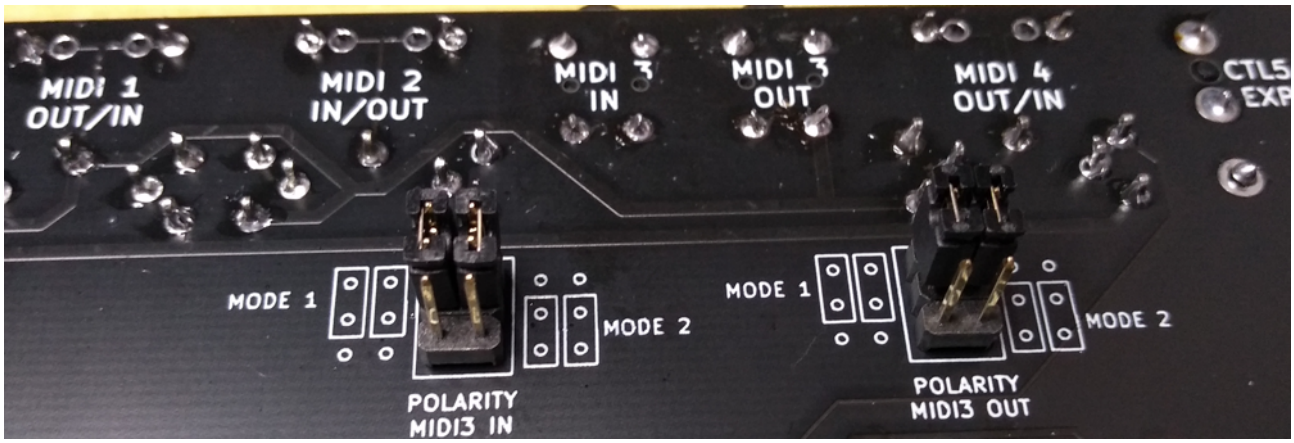


Here is the (almost) finished PCB:



The neopixel header and capacitor, the i2c level circuit and the experimental pins for the ESP32 can be skipped.

The polarity headers for MIDI3 should be soldered to the bottom side of the board, so they can easily be accessed by removing the bottom plate of the VC-touch. Once the VC-touch is fully assembled it is not easy to get to the top of the board.



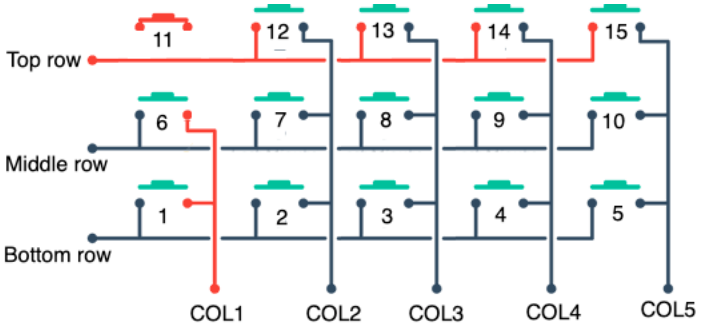
The jumpers set the polarity of the 3,5 mm MIDI jacks (MIDI 3). They are usually in MODE 1, but certain devices have the polarity reversed and should be set to MODE 2.

Putting it all together

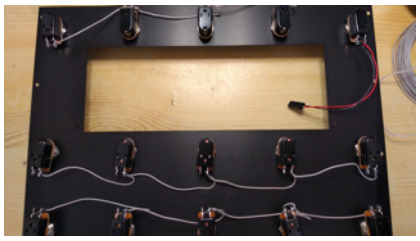
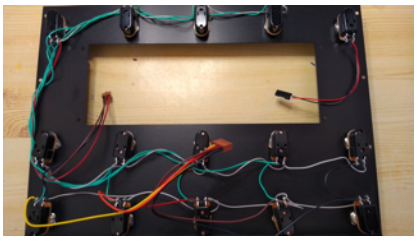
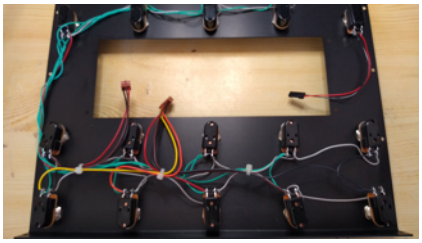
Once the enclosure is ready and all the main board has passed the test, it is time to put everything together.

First we add the switches to the top plate. The bottom row is set lower than the middle and top row. This makes it easier to operate with your feet.

Now we solder the wires in keypad style. Do note that switch 11 is not added to the keypad. This switch is attached directly to the main PCB.



Here is how I solder these wires:

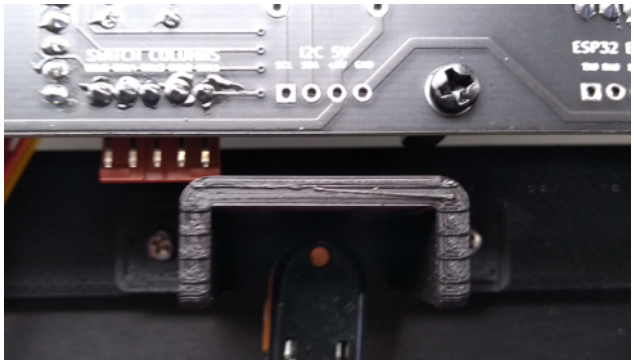




Switch 11 can be connected to either power connector on the PCB. When it is not connected to SW16 POWER, a jumper should be added to SW16 POWER. Now power will always be on.

Add the M3 square nuts to 3D printed sides. Be careful not to break the nut holders.

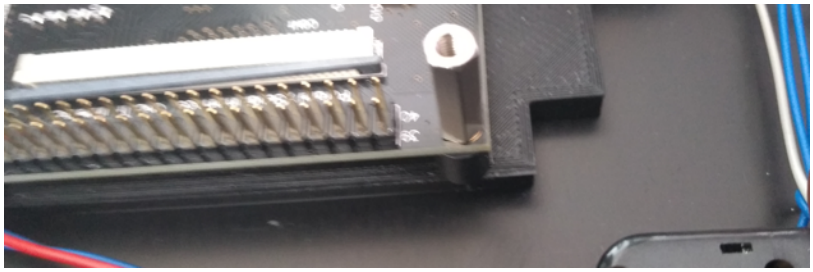
To add the bottom nuts, push out the nut holder as indicated by the red arrows with two fingers and push in the nut with your other hand or plyers.

Screw the display bezel and display holder together. Do check that the bezel is not in the way of the connector for the switches. Ask me how I know? See picture below. The design of the display holder has been changed, but you still need to check.

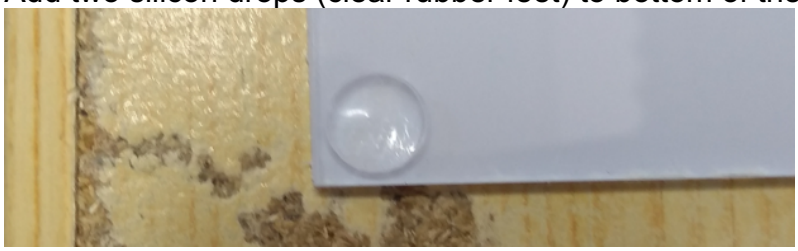


There are two types of screws: flat head screws for the top of the VC-touch and round head screws for all the other sides.

Use four 20mm flat head screws to screw the display and the 3D printed display bezel to the top plate of the VC-touch. Add four 7mm spacers between the bezel and the display. Do not forget the spacers. I already destroyed a display board by putting too much pressure on the PCB board of the display. Use four 15mm spacers as nuts for the screws.



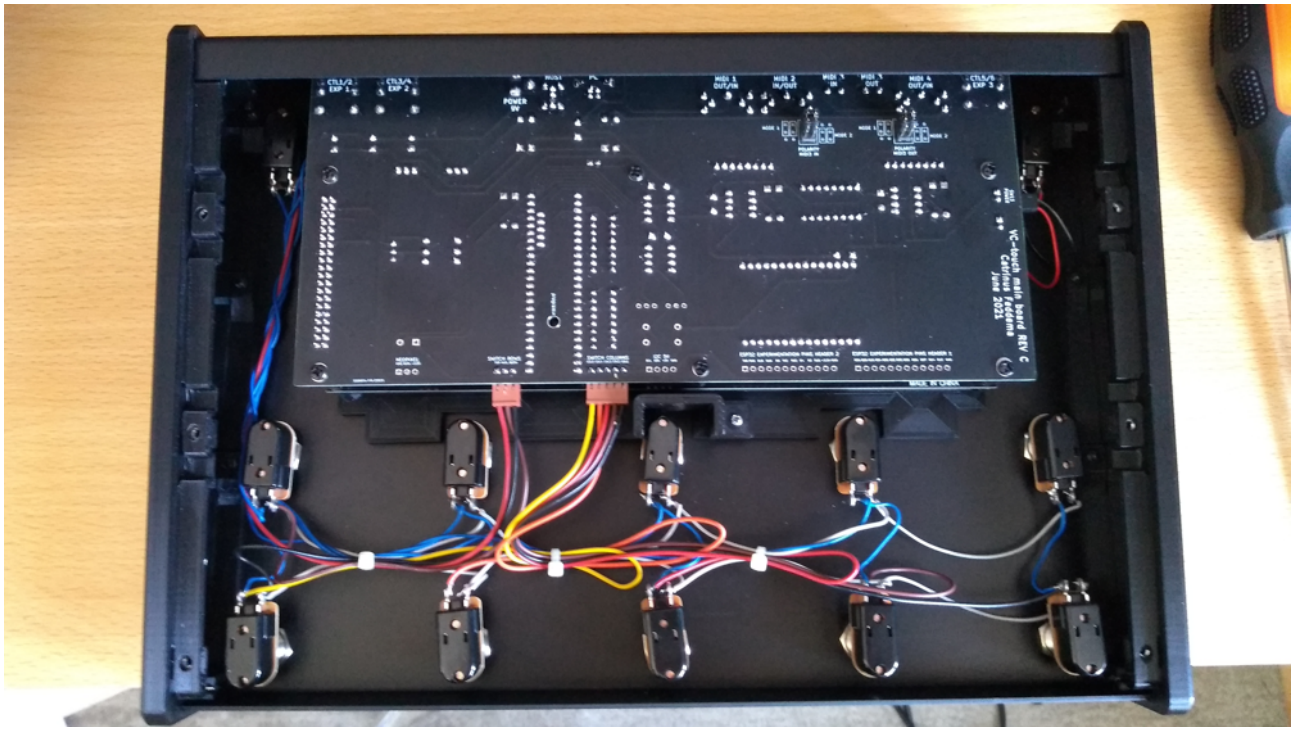
Add two silicon drops (clear rubber feet) to bottom of the perspex window on either end.



Use six 10mm flat head screw to attach the top plate to the 3D printed sides. Use two round head screws to connect the front side. Add the perspex window before attaching the second side.

Attach two DI 15mm spacers to the middle holes of the PCB. These provide extra support for the display.

Place the PCB to the 40 pin header of the display. Now add the back side of the VC-touch. Add the three plastic nuts of the jack sockets. Add the screws to the top of the PCB. Attach the switch connectors to the main PCB.



Finally add the bottom plate of the enclosure and add the silicone “rubber” feet to the bottom in the four corners.

Firmware for the Teensy 4.1
There are two ways to install firmware. One is to use a pre-compiled hex file. The other way is to compile the data yourself, using the Arduino IDE.

Loading precompiled hex files to the Arduino:

On Github you can download the hex files for the test sketch and the VC-touch firmware itself. Right click on the hex file and select Save as… You can find the hex files here:
https://github.com/sixeight7/VController_v3/tree/master/Firmware/VController_v3%20compiled

To install the firmware on the VC-touch you need the following tool:
https://www.pjrc.com/teensy/loader.html

Follow the instructions on the PJRC website to install the tool for you operating system.

To install the firmware, take the following steps:

1. Connect the VC-touch or just the Teensy to your computer using a USB cable
2. Press the small button on the Teensy. It is now ready to receive firmware.
3. Start the Teensy loader. You should see the following three buttons:

4. Press the first button to open the hex file.
5. Press the second button to upload it to the Teensy.
6. Press the third button to reboot the Teensy. This should reboot the VC-touch with the hardware test sketch or the VC-touch firmware.

Compile the Teensy sketches yourself:

You will need to install Arduino IDE with the additional Teensyduino add-on:
https://www.arduino.cc/en/main/software
https://www.pjrc.com/teensy/teensyduino.html

You will need the correct libraries, which can be found here:
https://github.com/sixeight7/ER-TFTM0784-1
https://github.com/sixeight7/arduino-goodix
https://github.com/sixeight7/extEEPROM
https://github.com/sixeight7/MIDI4.3

Firmware can be downloaded and installed from github:
https://github.com/sixeight7/VController_v3/tree/master/Firmware/VController_v3

The first page of the sketch gives instructions on how to compile the code for the different versions of the VController. Enable the hardware_VCtouch.h file and make the right settings in the Arduino IDE.

```
// **** Choose the correct hardware below and update the Arduino compiler settings ****
// Current version of Arduino: 1.8.9 and TeensyDuino: 1.46

// Hardware of production model
#include "hardware.h"
// Arduino IDE settings: Board: Teensy 3.1/3.2, USB Type: MIDI, CPU speed: 96 MHz, Optimize: Faster, Programmer: AVRISP mkII

// Hardware of VC-mini rev. B
//#include "hardware_VCmini_b.h"
// Arduino IDE settings: Board: Teensy 3.6, USB Type: MIDI, CPU speed: 180 MHz, Optimize: Fast(!), Programmer: AVRISP mkII
```

Firmware for the optional wireless module
The optional wireless module is an ESP32 dev kit. There are three ways to upload the firmware.

First time: upload the firmware using a precompiled hex file
You can find a precompiled hex-file here:
https://github.com/sixeight7/VController_v3/tree/master/Firmware/VCtouch_wireless%20compiled

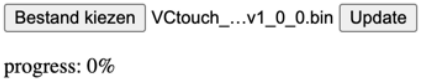
The following article explains how to upload this to an ESP32:
https://www.aranacorp.com/en/generating-and-uploading-bin-files-for-esp32/

Updating firmware wirelessly
You can make a WIFI connection from the VC-touch, either by connecting to your home network, or by setting your VC-touch as an access point. Check out the user manual for more details. Make sure your computer or laptop is on the same network.

Start your browser and go to:
http://vc-touch.local/

You can login with admin/12345. The password an also be changed on the VC-touch wireless menu. Or you can switch off the WIFI server all together.

Now you can select the bin file and press upload.



Compile the ESP32 sketch yourself
You can find the sketch file here:
https://github.com/sixeight7/VController_v3/tree/master/Firmware/VCtouch_wireless

You will also need the following libraries:
MIDI library 5.0.2
NIM-BLE Arduino 1.2.0
https://github.com/sixeight7/Arduino-AppleMIDI-Library
https://github.com/sixeight7/Arduino-BLE-MIDI

Raspberry Pi option board:
An external Raspberry Pi can be added to the VC-touch to have an additional four USB host ports, supporting all the devices the VC-touch supports so far.

Raspberry Pi firmware:
The Raspberry Pi runs with special firmware called VCbridge. You can find the source code and installation instructions here:
https://github.com/sixeight7/VCbridge

You can also download a ready-made image from here for the RPi model B+:
https://www.dropbox.com/s/cgy4ypnyhkf0ucw/2017-10-24%20VCbridge.rar?dl=0

To install the ready made image:
1) Download and unrar the 2017-10-24 VCbridge.rar image.
2) Download Win32DiskImager from https://sourceforge.net/projects/win32diskimager/
3) Connect the microSD card to your PC.
4) Upload the image.

External Raspberry Pi board:
For the external board we need a 3D printed enclosure and a PCB.

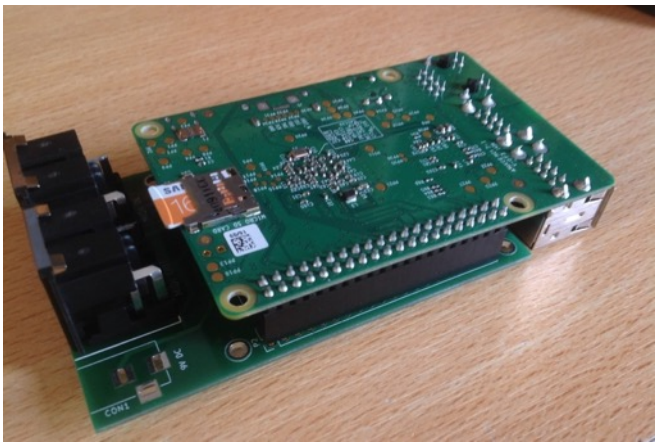
The design of the enclosure is found here:
Https://github.com/sixeight7/VController_v3/tree/master/Enclosure/RPi%20case

It consists of two parts. In total the enclosure requires 87 gram of PLA.

Building the PCB. You can find the gerbers here:
Https://github.com/sixeight7/VController_v3/tree/master/RPi%20Expansion%20Board

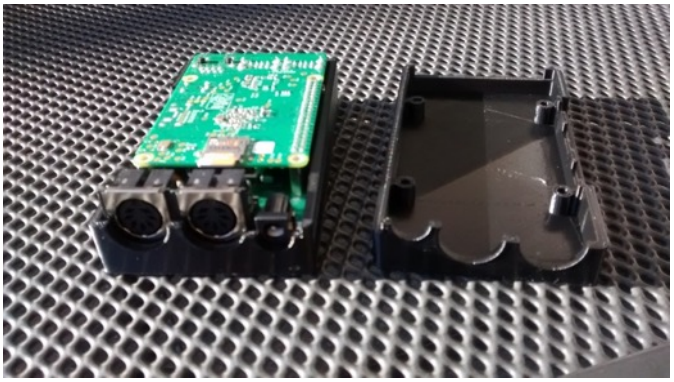
Here is the data you need to get the board made:
Dimensions: 89 x 57 mm
Layers: 2
Thickness: 1.6 mm
Hole count: 118 plated pads + 1 via = 119 total

The raspberry Pi board fits upside down on the Rpi board:



12 mm spacers go in between the boards. The two halves of the enclosure fit around the boards and are screwed tight in the spacers. Always start with the top side of the

enclosure, add the PCB board and attach the spacers. Then add the Raspberry Pi and the bottom side of the enclosure.



Check out the video: **Building the RPI expansion board**

https://youtu.be/kFdNmJK0trg

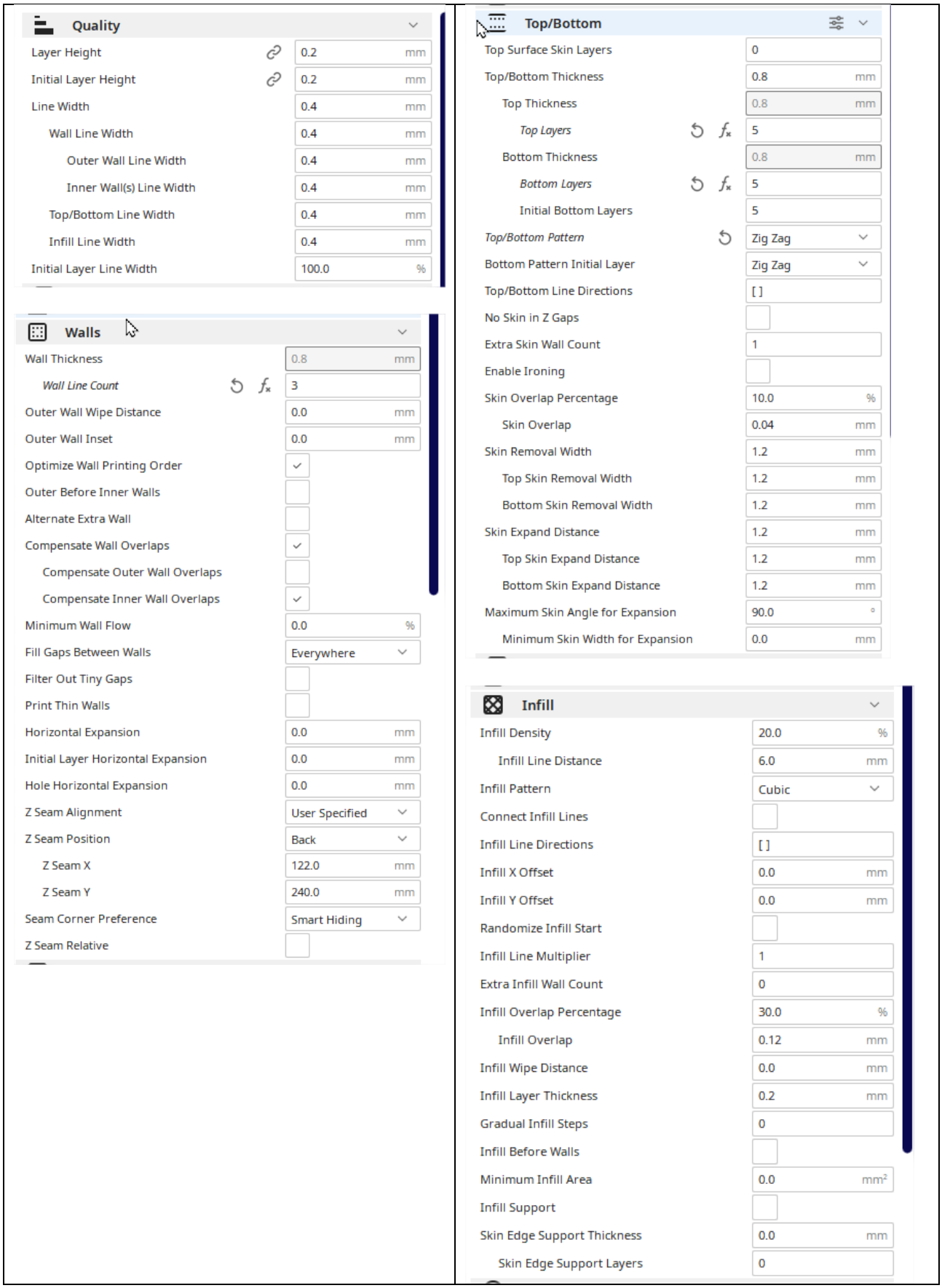
How much time does it cost to build a VC-touch:

Ordering of parts	1 hour
Having enclosure and 3D printing done	1 hour
Building main board	2 hours
Soldering wires to switches	30 mins
Putting it all together	1 hour
Testing and debugging	30 mins
Total time:	**6 hours**

Additional information:
Check out my blog at vguitarforums.com:
http://www.vguitarforums.com/smf/index.php?topic=15154.0

I have spent countless hours since May 2015 developing the VController, VC-mini and VC-touch. I would really appreciate a small donation:
https://www.paypal.me/sixeight

Appendix 1: Cura settings for 3D-printing sides of VC-touch



Quality

Layer Height	0.2 mm
Initial Layer Height	0.2 mm
Line Width	0.4 mm
Wall Line Width	0.4 mm
Outer Wall Line Width	0.4 mm
Inner Wall(s) Line Width	0.4 mm
Top/Bottom Line Width	0.4 mm
Infill Line Width	0.4 mm
Initial Layer Line Width	100.0 %

Walls

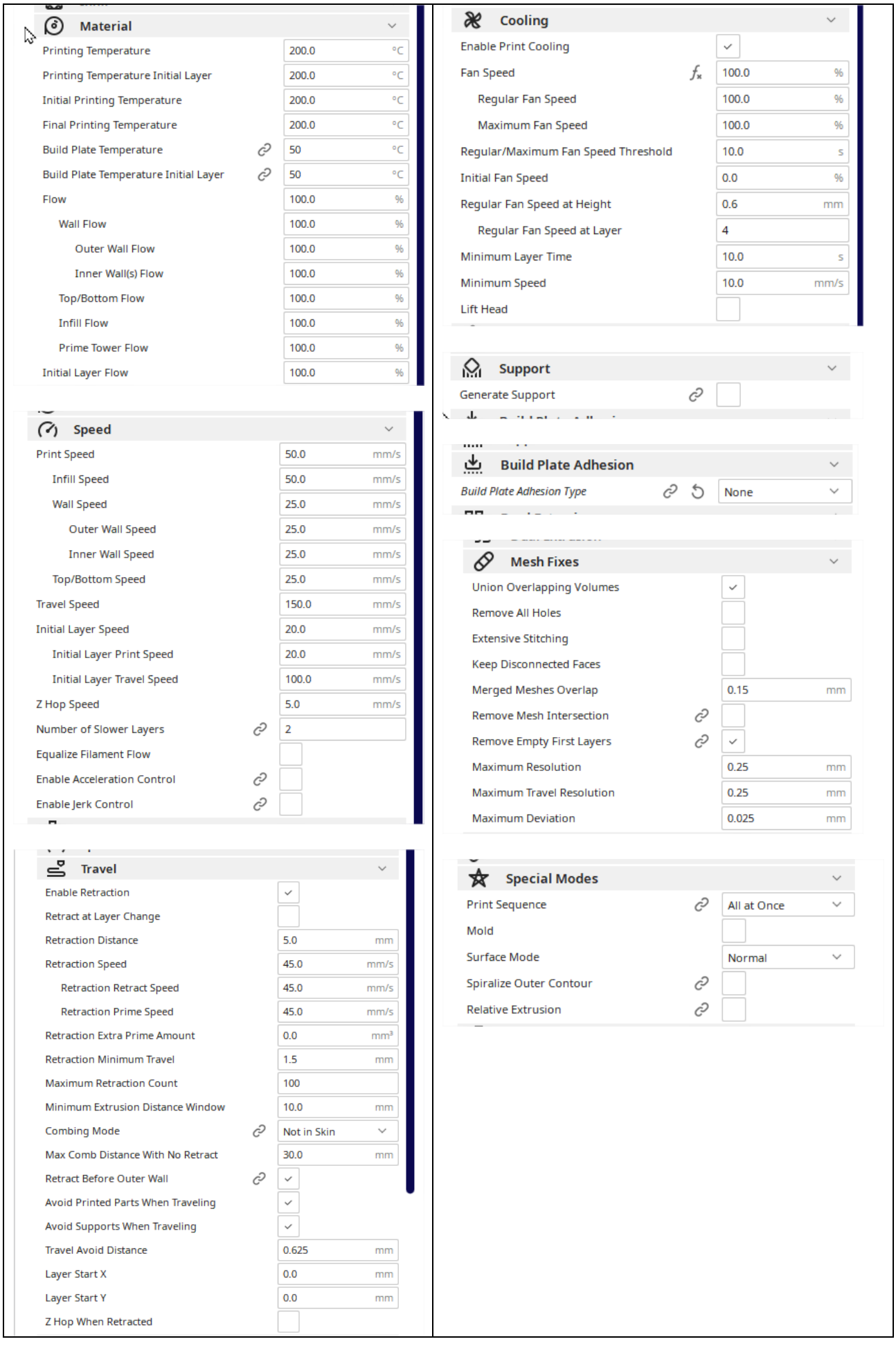
Wall Thickness	0.8 mm
Wall Line Count	3
Outer Wall Wipe Distance	0.0 mm
Outer Wall Inset	0.0 mm
Optimize Wall Printing Order	✓
Outer Before Inner Walls	
Alternate Extra Wall	
Compensate Wall Overlaps	✓
Compensate Outer Wall Overlaps	
Compensate Inner Wall Overlaps	✓
Minimum Wall Flow	0.0 %
Fill Gaps Between Walls	Everywhere
Filter Out Tiny Gaps	
Print Thin Walls	
Horizontal Expansion	0.0 mm
Initial Layer Horizontal Expansion	0.0 mm
Hole Horizontal Expansion	0.0 mm
Z Seam Alignment	User Specified
Z Seam Position	Back
Z Seam X	122.0 mm
Z Seam Y	240.0 mm
Seam Corner Preference	Smart Hiding
Z Seam Relative	

Top/Bottom

Top Surface Skin Layers	0
Top/Bottom Thickness	0.8 mm
Top Thickness	0.8 mm
Top Layers	5
Bottom Thickness	0.8 mm
Bottom Layers	5
Initial Bottom Layers	5
Top/Bottom Pattern	Zig Zag
Bottom Pattern Initial Layer	Zig Zag
Top/Bottom Line Directions	[ ]
No Skin in Z Gaps	
Extra Skin Wall Count	1
Enable Ironing	
Skin Overlap Percentage	10.0 %
Skin Overlap	0.04 mm
Skin Removal Width	1.2 mm
Top Skin Removal Width	1.2 mm
Bottom Skin Removal Width	1.2 mm
Skin Expand Distance	1.2 mm
Top Skin Expand Distance	1.2 mm
Bottom Skin Expand Distance	1.2 mm
Maximum Skin Angle for Expansion	90.0 °
Minimum Skin Width for Expansion	0.0 mm

Infill

Infill Density	20.0 %
Infill Line Distance	6.0 mm
Infill Pattern	Cubic
Connect Infill Lines	
Infill Line Directions	[ ]
Infill X Offset	0.0 mm
Infill Y Offset	0.0 mm
Randomize Infill Start	
Infill Line Multiplier	1
Extra Infill Wall Count	0
Infill Overlap Percentage	30.0 %
Infill Overlap	0.12 mm
Infill Wipe Distance	0.0 mm
Infill Layer Thickness	0.2 mm
Gradual Infill Steps	0
Infill Before Walls	
Minimum Infill Area	0.0 mm²
Infill Support	
Skin Edge Support Thickness	0.0 mm
Skin Edge Support Layers	0



Material

Printing Temperature	200.0	°C
Printing Temperature Initial Layer	200.0	°C
Initial Printing Temperature	200.0	°C
Final Printing Temperature	200.0	°C
Build Plate Temperature	50	°C
Build Plate Temperature Initial Layer	50	°C
Flow	100.0	%
Wall Flow	100.0	%
Outer Wall Flow	100.0	%
Inner Wall(s) Flow	100.0	%
Top/Bottom Flow	100.0	%
Infill Flow	100.0	%
Prime Tower Flow	100.0	%
Initial Layer Flow	100.0	%

Speed

Print Speed	50.0	mm/s
Infill Speed	50.0	mm/s
Wall Speed	25.0	mm/s
Outer Wall Speed	25.0	mm/s
Inner Wall Speed	25.0	mm/s
Top/Bottom Speed	25.0	mm/s
Travel Speed	150.0	mm/s
Initial Layer Speed	20.0	mm/s
Initial Layer Print Speed	20.0	mm/s
Initial Layer Travel Speed	100.0	mm/s
Z Hop Speed	5.0	mm/s
Number of Slower Layers	2	
Equalize Filament Flow	☐	
Enable Acceleration Control	☐	
Enable Jerk Control	☐	

Travel

Enable Retraction	☑	
Retract at Layer Change	☐	
Retraction Distance	5.0	mm
Retraction Speed	45.0	mm/s
Retraction Retract Speed	45.0	mm/s
Retraction Prime Speed	45.0	mm/s
Retraction Extra Prime Amount	0.0	mm³
Retraction Minimum Travel	1.5	mm
Maximum Retraction Count	100	
Minimum Extrusion Distance Window	10.0	mm
Combing Mode	Not in Skin	
Max Comb Distance With No Retract	30.0	mm
Retract Before Outer Wall	☑	
Avoid Printed Parts When Traveling	☑	
Avoid Supports When Traveling	☑	
Travel Avoid Distance	0.625	mm
Layer Start X	0.0	mm
Layer Start Y	0.0	mm
Z Hop When Retracted	☐	

Cooling

Enable Print Cooling	☑	
Fan Speed	100.0	%
Regular Fan Speed	100.0	%
Maximum Fan Speed	100.0	%
Regular/Maximum Fan Speed Threshold	10.0	s
Initial Fan Speed	0.0	%
Regular Fan Speed at Height	0.6	mm
Regular Fan Speed at Layer	4	
Minimum Layer Time	10.0	s
Minimum Speed	10.0	mm/s
Lift Head	☐	

Support

Generate Support	☐	

Build Plate Adhesion

Build Plate Adhesion Type	None	

Mesh Fixes

Union Overlapping Volumes	☑	
Remove All Holes	☐	
Extensive Stitching	☐	
Keep Disconnected Faces	☐	
Merged Meshes Overlap	0.15	mm
Remove Mesh Intersection	☐	
Remove Empty First Layers	☑	
Maximum Resolution	0.25	mm
Maximum Travel Resolution	0.25	mm
Maximum Deviation	0.025	mm

Special Modes

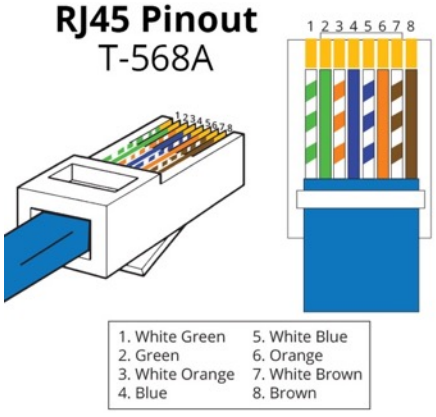
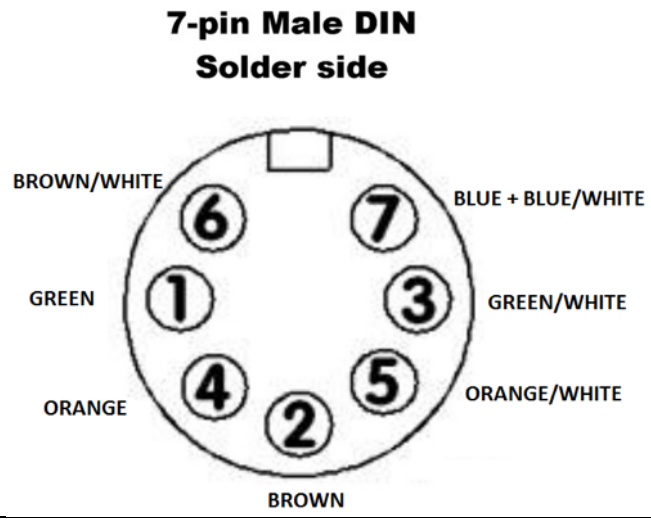
Print Sequence	All at Once	
Mold	☐	
Surface Mode	Normal	
Spiralize Outer Contour	☐	
Relative Extrusion	☐	

Appendix 2: RRC2 cable

To make an RRC2 to DIN-7 cable, I use an existing CAT 5 or CAT6 cable and replace one of the RJ45 connectors with a DIN-7 plug.

First check if the existing cable has been wired according to T-568A or T-568B standard, by checking if the colours match the correct diagram below. Then use the correct diagram for the DIN-7 side.

The view of the DIN-7 pin is the solder side of the plug.

RJ45 side – T-568A	DIN-7 side
	

RJ45 side – T568B	DIN-7 side