thc recursive machine manual

Introduction

Thank you for purchasing the **thc recursive machine** diy kit — Your portable drone focused noise box. This small booklet contains all the knowledge you need to complete the build. Before we dig in with the build instructions just a quick reminder —

No stress. Take it easy, have a nice beer, relax. It's fun to build so take your time.

Clean your tools and tidy your desk. I should too. This makes everything easier.

Sort and count everything. Make sure you have all the parts and everything you need.

So with that out of the way let's start!

I would suggest building and testing it like this —

First build the PSU + battery connnectors

Second build the oscllators

Third is the two low frequency oscillators

Fourth is the filter

Followed by the distortion

Sixth is the reverb

Seventh the delays

Eigth is the dual voltage controlled amplifer

Ninth the mixer and speaker

Finish up with the front panel and pin headers

You can of course rearange the order and build left to right, or right to left, or reverse the whole order. I mean it might be a good idea to build the speaker first so you can listen to the things. It's all individual. As for me I just populate the whole thing at once and power it up fingers crossed. It's worked so far!

The board is double sided, so components can be soldered from the topside. This works especially well for reistors and diodes. Suggested build order is small components to tall components. If you're using sockets for the ICs, install them first. Followed by reistors and diodes. Then capacitors and transistors. Hardware to be installed last. Wait with the pin headers until it's time to assemble both the boards together. Solder the female header to the backside of the front panel board. Install the male pin strips into the female and mount both boards. That way you get the correct height of the pin headers.

To ensure the topside for the front panel boards are clean (It serves as the front panel, so it's nice if it's nice). Mask everything but the topside solder points. This can be done with electrical tape and two sheets of paper. To ensure that no flux residue is splattered on the PCB.

Be creative and use any and all the tools you have available.

Good luck and happy building!

Jon, thc

building it

Power supply unit and battery connectors. The only thing you have to pay attention to is the correct hight of the LED. The best way to do that is to assemble the two boards. Push the LED through the hole and solder it. After installing all components apply 5V to the DC jack, note that the center pin should be negative. The LED should turn on when flipping the switch. Check the selected pads for +4.5-5V and -4.5-5V accordingly. Remove the external DC and test with batteries and check that the voltages are the same.

Pin headers reference
For testing purposes

Oscillators. Install all components. After powering up look/listen for a triangle at pin 4 of the pin header. The frequency will differ, since one osc is high and the other is low. Also test the square wave at pin 2.

Filter. The only thing here is that the switch is problematic. The distance to the front panel is a tad too long, so the switch has to be mounted almost floating above PCB. This can be done by tapeing the switch to something square and solid and then soldering it into position. Test by using a 68k resistor from pin 2 of one osc to pin 1 of the filter, and by connecting +5V to pin 2 of the filter. Output at pin 4 should match input.

Distortion. Install all componenets and check for operation. Connect pin 1 and 6 with a 100k resistor. Input signal to pin 3. Check for distorted signal at pin 6 in the header in the reverb section.

Reverb. Install all components. Take care of the reverb module, it can preferable be attached to the board with some double sided adhesive tape. Function check by inputing signal at pin 1 and output at pin 2.

Delays. After completing — Input signal to pin 1 and check output at pin 6. The output waveform will not be a perfect copy of the input. Check the delay rate by connecting +5V to pin 2 and the output should change when connecting/disconnecting the voltage.

Low frequency oscillators. By now you know the drill. Chuck everything in there, bridge pin 5 and 3 on the lower header with a 100k resistor. Then check the upper header for signal at pin 1, which will be a sawtooth, the square wave can be found at pin 5.

Mixer and speaker. Start with the mixer section. Install all components and take extra care of the speaker element. Check function by inputing signal to pin 1 of the top header and jumper pin 3 to 5. Adjust the trimmer for desired output volume. It distorts quite easily though.

The bottom side of the voice board is filled with small pads for surface mounted decoupling capacitors. Depending on your belives it might be a good idea to install them. It'll work without as well but the whole thing will be wobbly.

Front panel. Now with the voice board complete it's time to assemble the front panel board. Mask of as much of the board as you can when soldering on the topside of it. There are five surface mounted components on this board. All in the filter section. Put some solder on one pad, heat it up and attach the component. Add solder to the other pad. Then head on to the pin headers. As stated earlier in the manual, It's best to have the female headers on the backside of the front panel PCB. Solder in the jacks and pots last. The pots might take some patience, since the cut out in the boards look super nice — But they also cause the pots to push each other out of position. But keep pressure on the pots and take it easy and it'll be done in a jiffy.

With all separate modules complete it's time to assemble the machine. If you've bought the enclosure it's a good idea to get it out now. Attach the spacers to either board and place said board inside the frame. Mate the other board with the spacers from the other side. It's advisable not to run it on batteries when using the frame, as the construction makes battery changes a bit of a hassle.

When it's all done and ready. Bring your cat, get your succulents, take a pic and post it to instagram and give me a ping!

Operate it

So you're done and everything works. Congratulations on your newly built instrument! I would suggest you put these papers to the side and spend the next few hours exploring the sonic possibilites of your new recursive machine. Please return to read up on anything you're wondering about, as some of the configurations and functions are explained in the following paragraphs.

Pre-patch

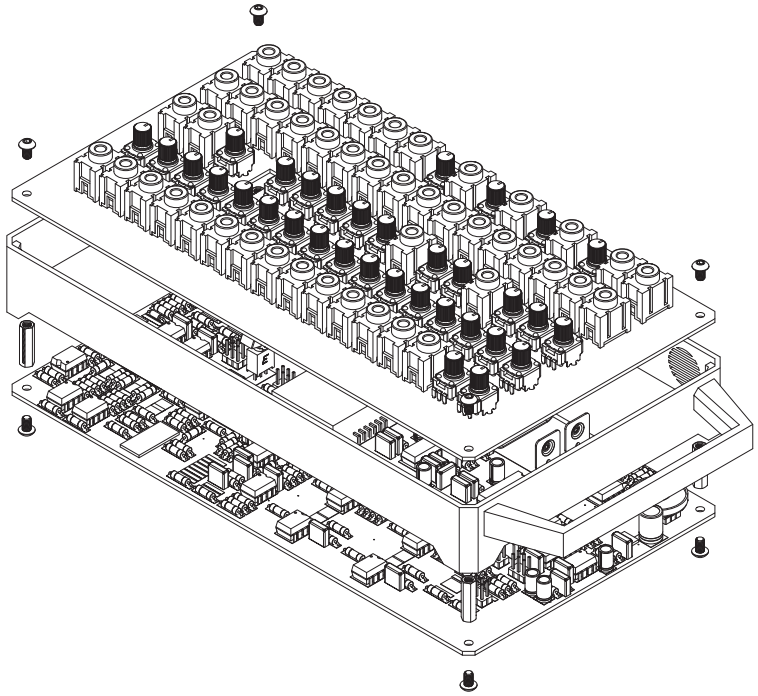
The recursive machine has a pre-configured routing. Input jacks are connected to selected output jacks. The diagram on the following page gives a clear overview of the patch. And in plain text the connections are as follows —

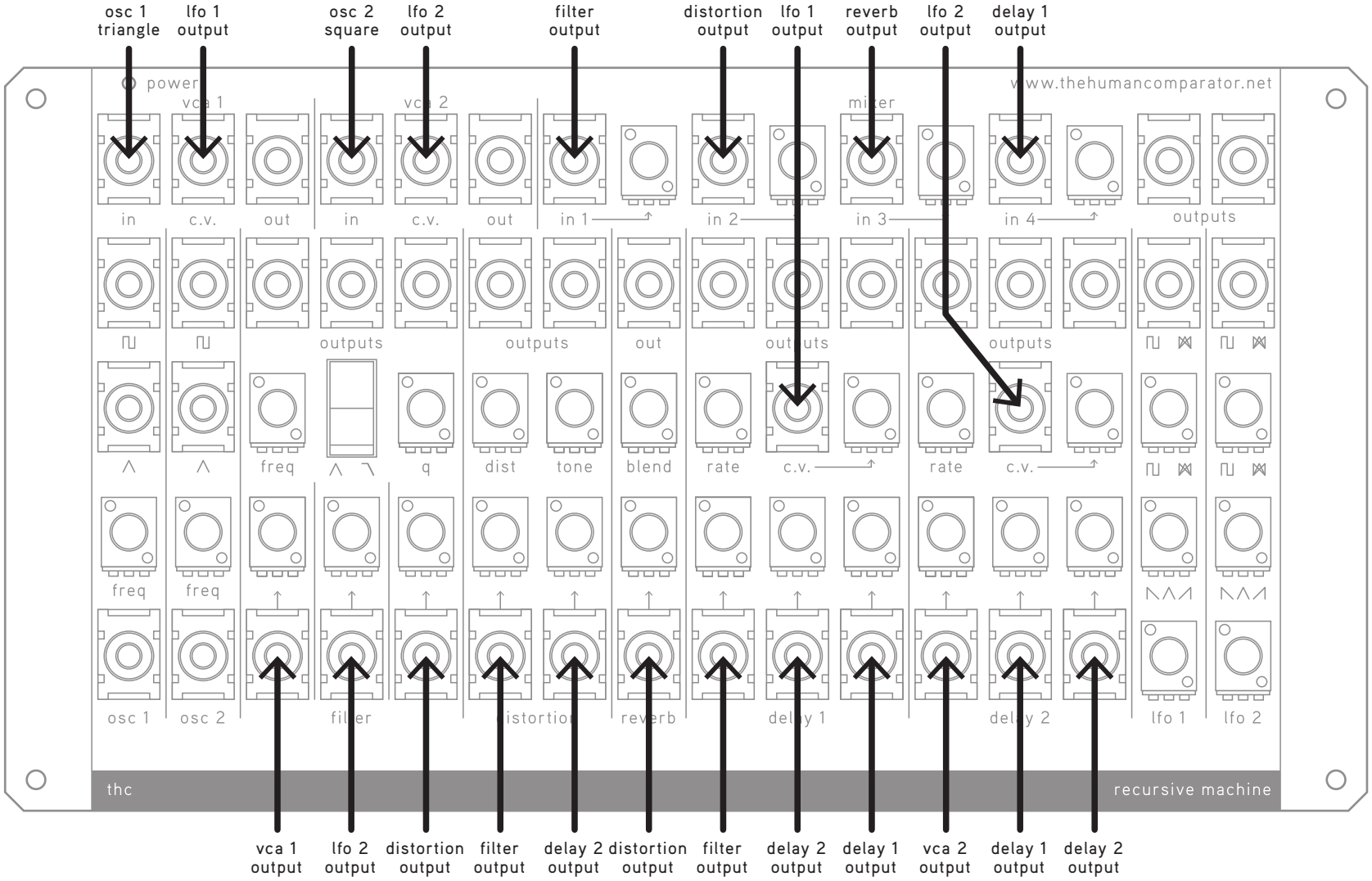
Module input	Connected to
vca 1 in	osc 1 triangle
vca 1 c.v.	lfo 1 output
vca 2 in	osc 2 square
vca 2 c.v.	lfo 2 output
mix in 1	filter output
mix in 2	distortion output
mix in 3	reverb output
mix in 4	delay 1 output
filter in 1	vca 1 output
filter in c.v.	lfo 2 output
filter in 2	distortion
distortion in 1	filter output
distortion in 2	delay 2
reverb in	distortion output
delay 1 in 1	filter output
delay 1 in 2	delay 2 output
delay 1 in 3	delay 1 output
delay 1 c.v.	lfo 1 output
delay 2 in 1	vca 2 output
delay 2 in 2	delay 1 output
delay 2 in 3	delay 2 output
delay 2 c.v.	lfo 2 output

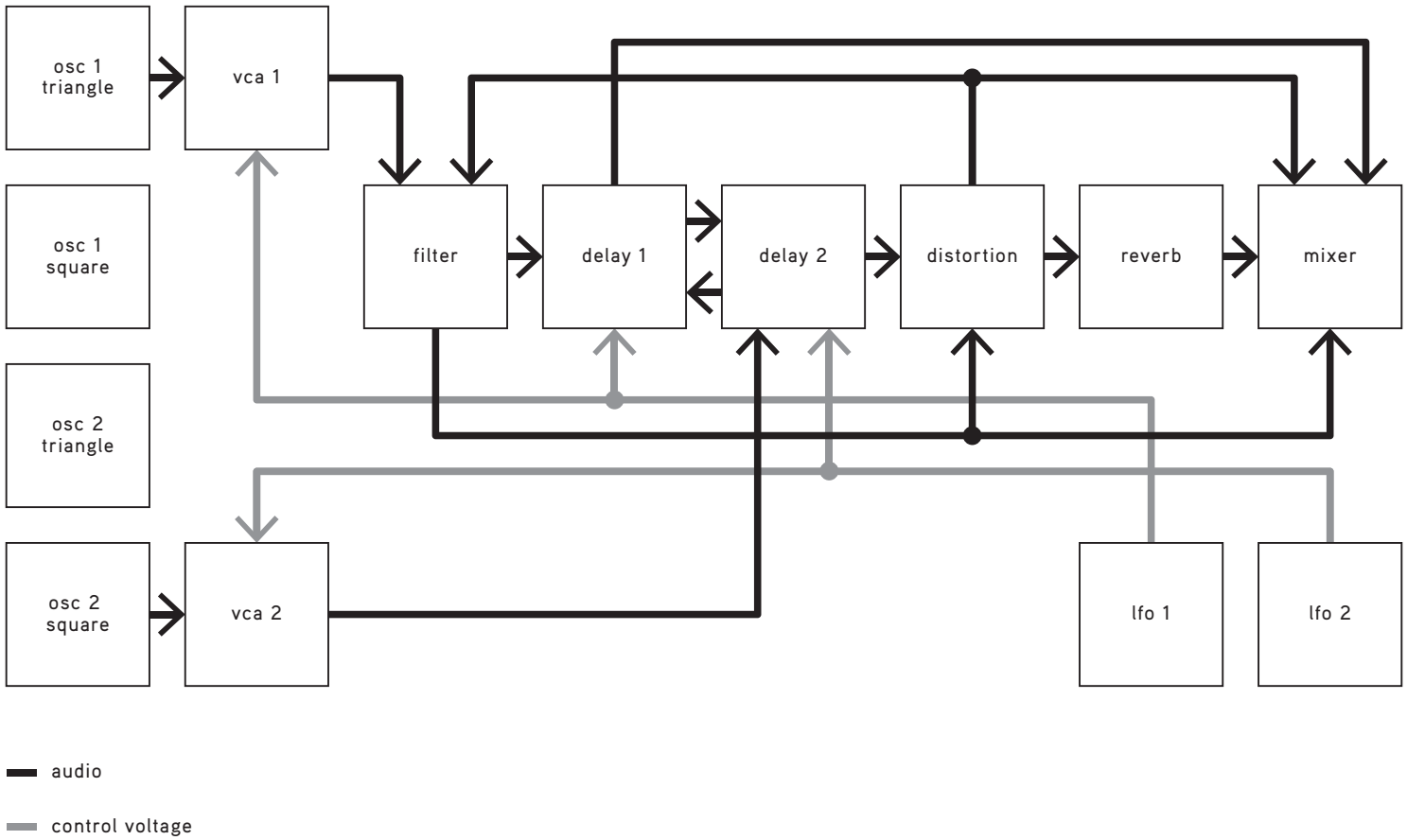
Technical information

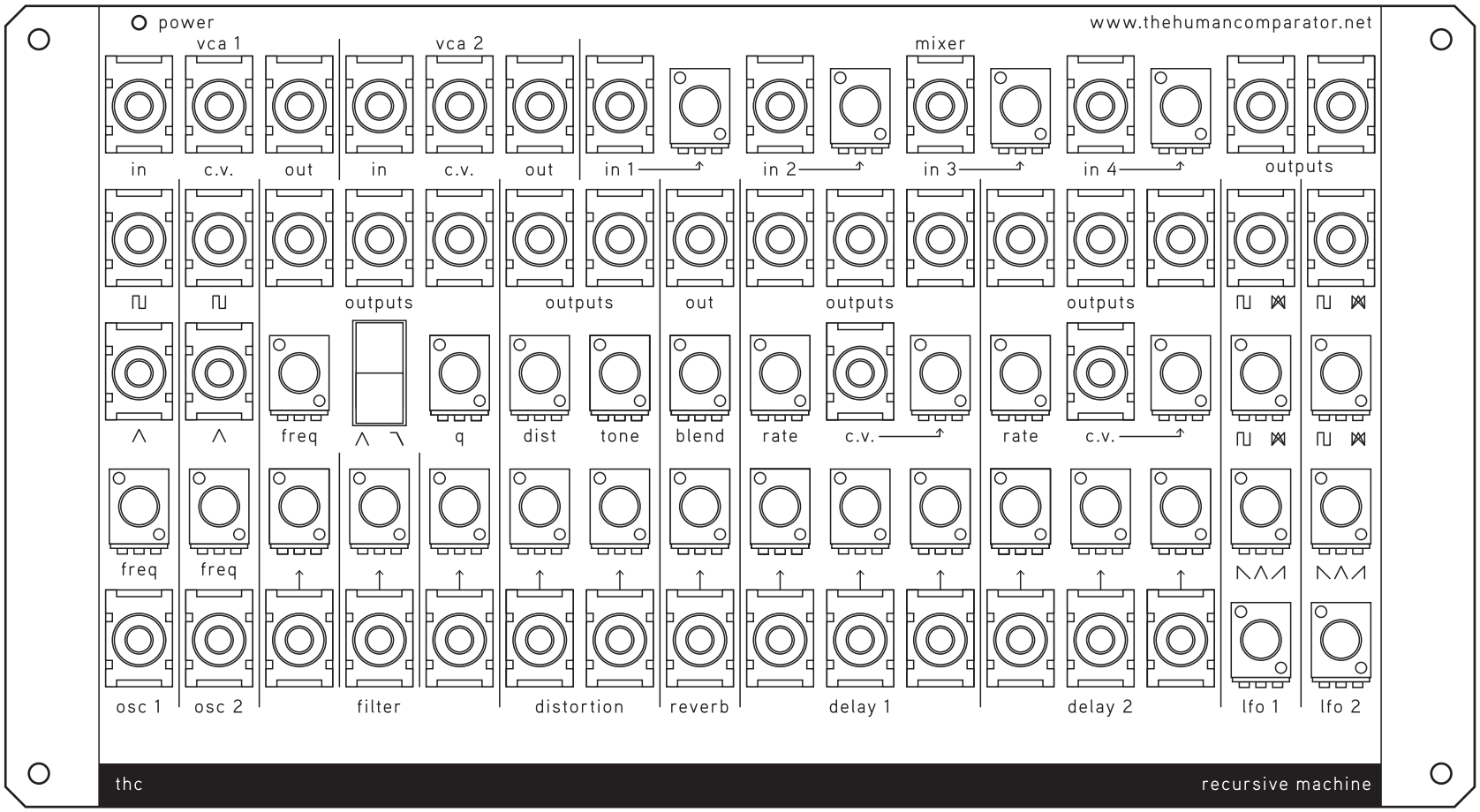
The expected control range is 0V to +5V, although most module will be OK with anything between -5V to +5V. External power can be supplied with a DC wall wart, 5V 500mA and center pin negative. The current draw of the whole system is about 130mA at the 5V wall wart input when not using the speaker. Powered with batteries the whole system has an expected operation time of about 5h.

Dimensions of the system is 220mm x 120mm. Suggested lenght of spacers are 18mm, to accomodate the batteries. If the batteries are not used you can probably squeeze it down to 10mm. The optional enclosure is 252mm x 124mm x 28mm and 3D printed of ABS plastic.



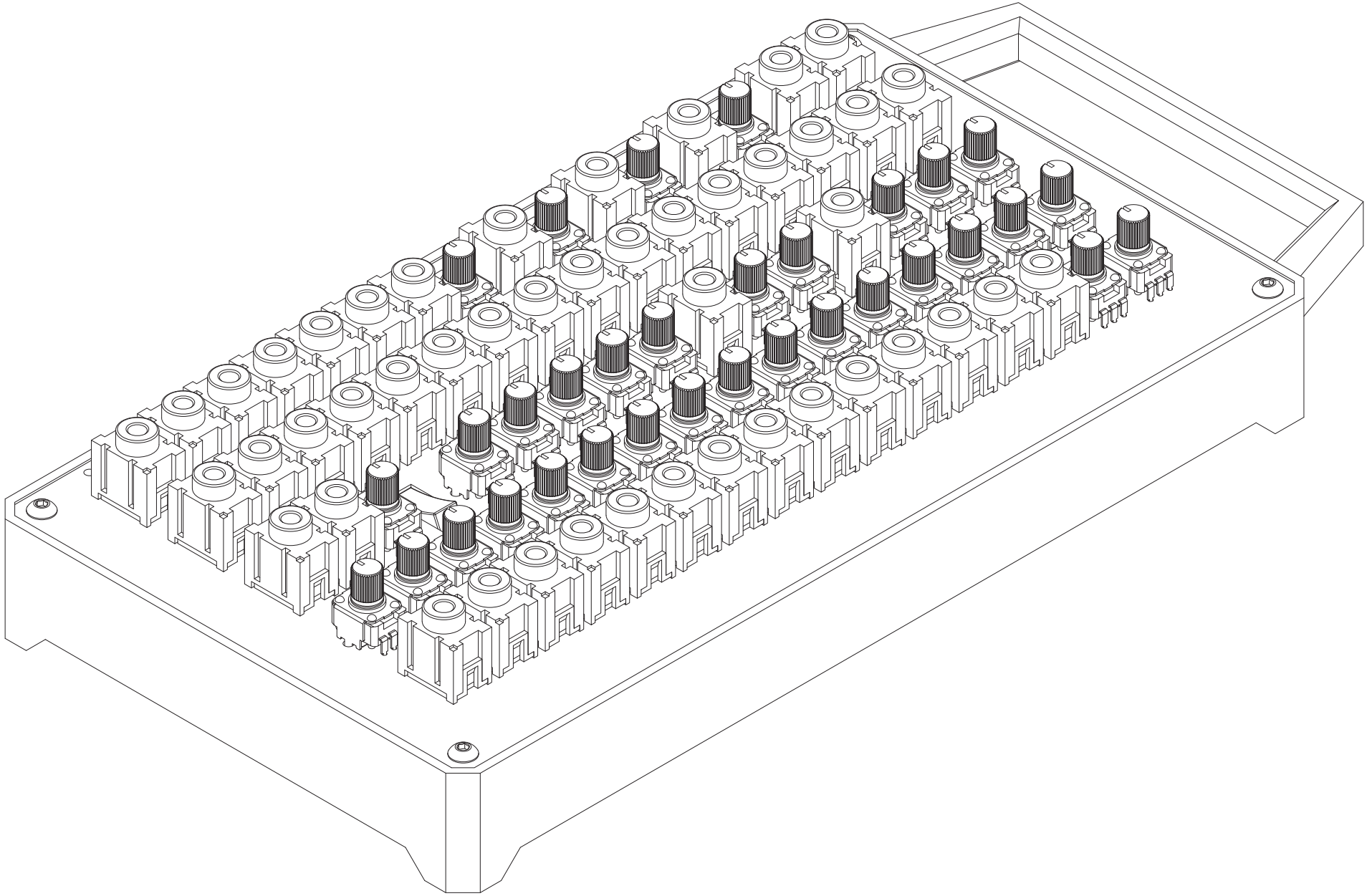

osc 1 triangle
lfo 1 output
osc 2 square
lfo 2 output
filter output
distortion output
lfo 1 output
reverb output
lfo 2 output
delay 1 output
power
vca 1
vca 2
mixer
www.thehumancomparator.net
in
c.v.
out
in
c.v.
out
in 1
in 2
in 3
in 4
outputs
outputs
outputs
out
outputs
outputs
freq
q
dist
tone
blend
rate
c.v.
rate
c.v.
freq
freq
osc 1
osc 2
filter
distortion
reverb
delay 1
delay 2
lfo 1
lfo 2
thc
recursive machine
vca 1 output
lfo 2 output
distortion output
filter output
delay 2 output
distortion output
filter output
delay 2 output
delay 1 output
vca 2 output
delay 1 output
delay 2 output


osc 1
triangle
vca 1
osc 1
square
filter
delay 1
delay 2
distortion
reverb
mixer
osc 2
triangle
osc 2
square
vca 2
lfo 1
lfo 2
audio
control voltage



patch name —
date —

comments —



recursive machine isometric reference

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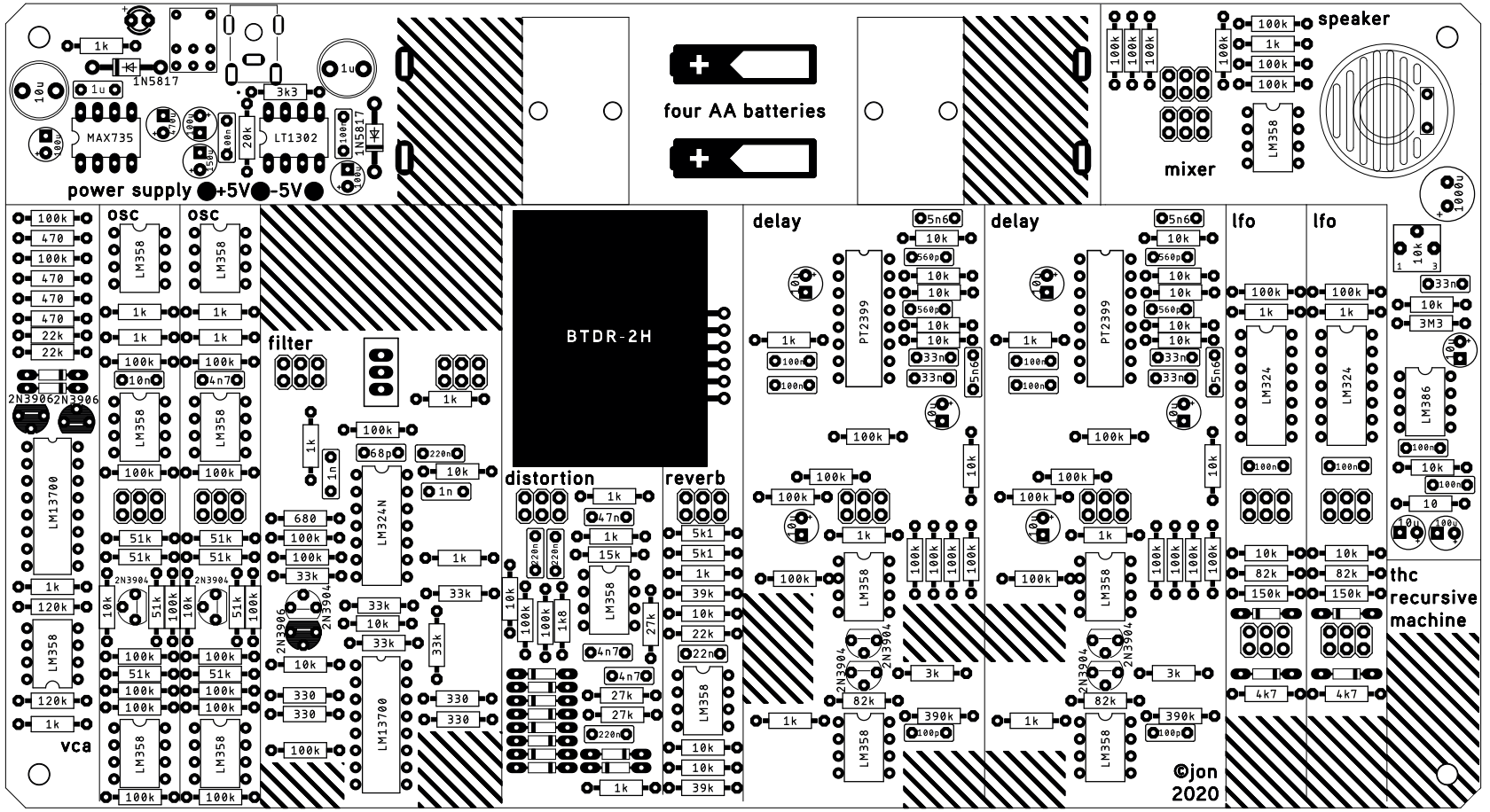
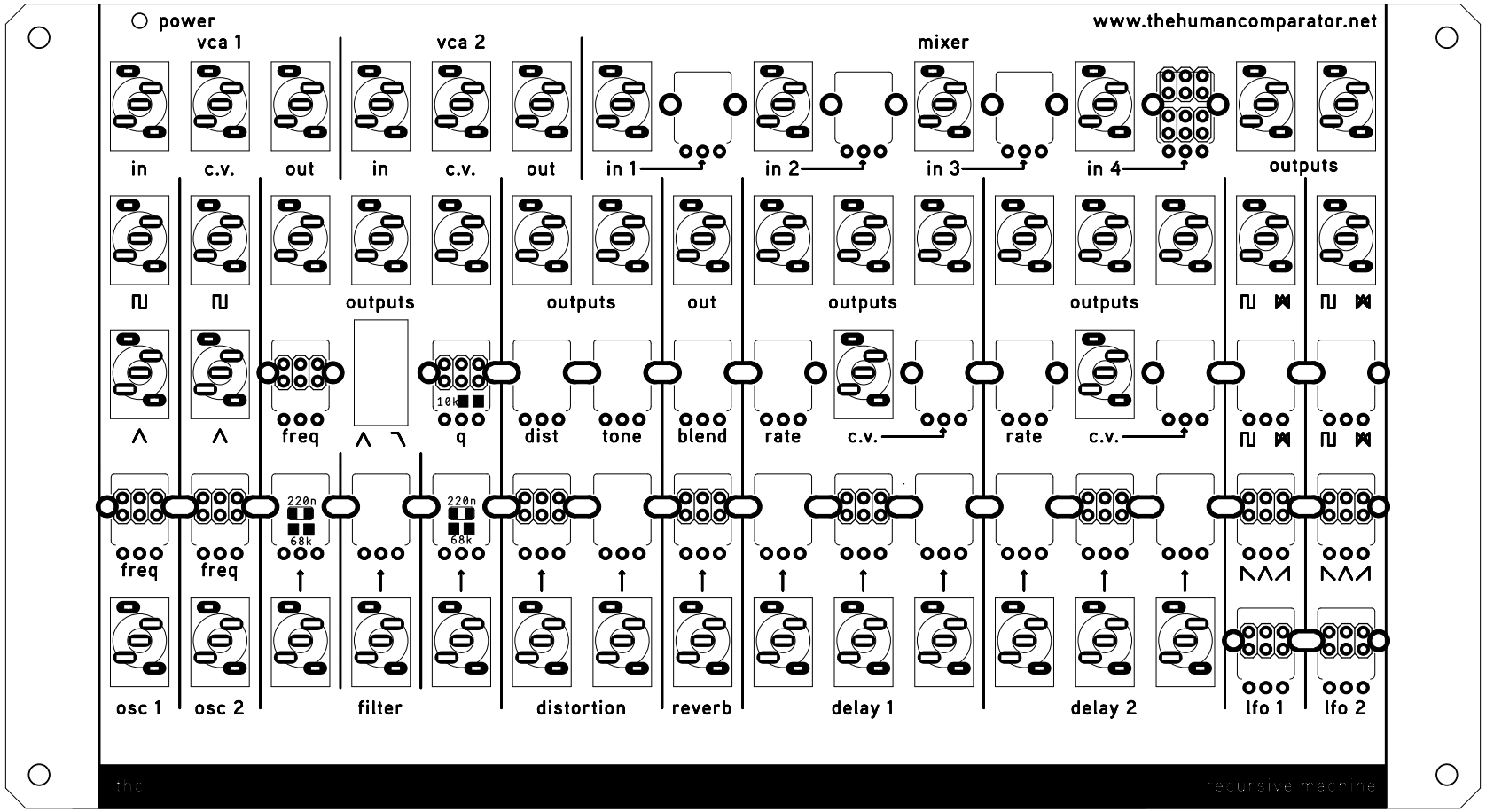

power supply
+5V
-5V
four AA batteries
mixer
speaker
vca
osc
osc
filter
BTDR-2H
distortion
reverb
delay
delay
lfo
lfo
thc
recursive
machine
©jon
2020


power
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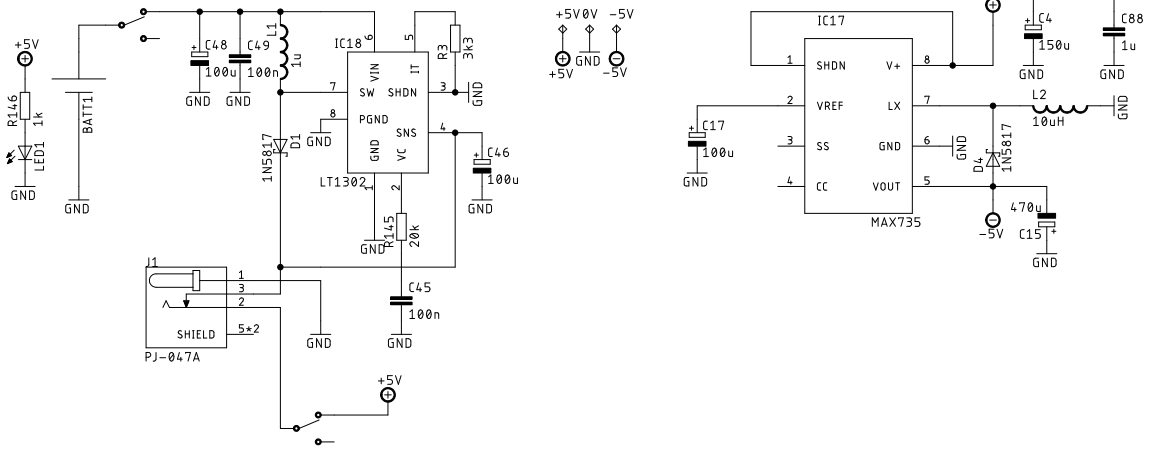
vca 1
vca 2
mixer
in
c.v.
out
in
c.v.
out
in 1
in 2
in 3
in 4
outputs
outputs
outputs
out
outputs
outputs
freq
q
dist
tone
blend
rate
c.v.
rate
c.v.
freq
freq
220n
68k
220n
68k
osc 1
osc 2
filter
distortion
reverb
delay 1
delay 2
lfo 1
lfo 2
thc
recursive machine

thc recursive machine schematics



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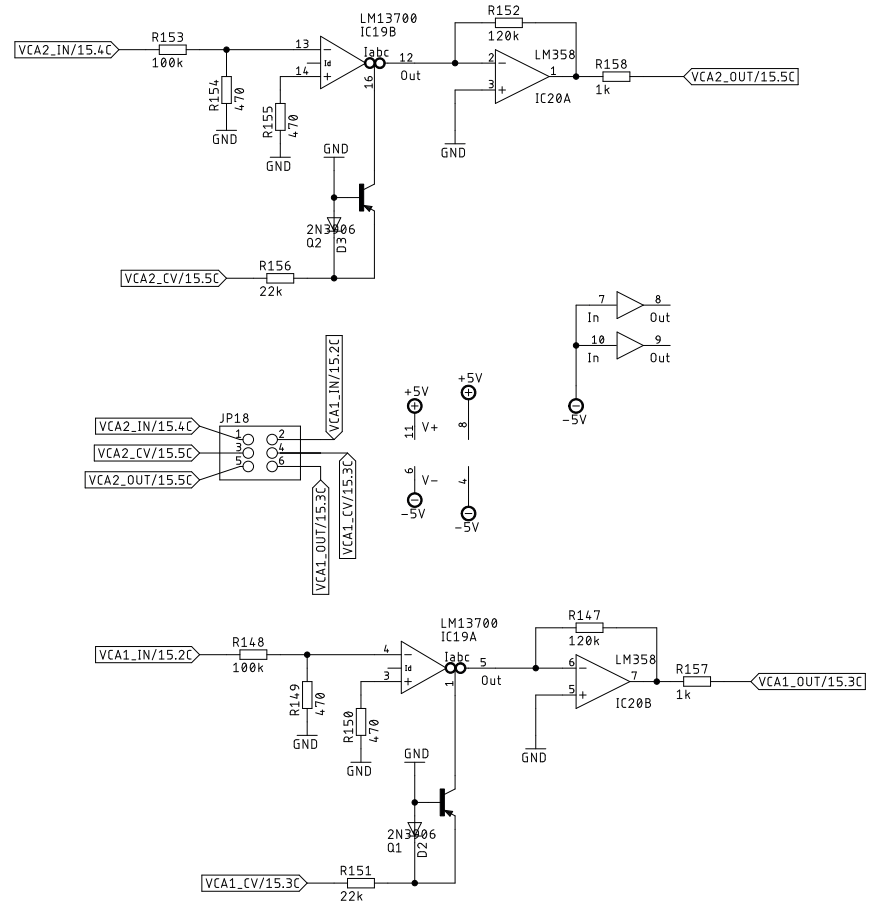

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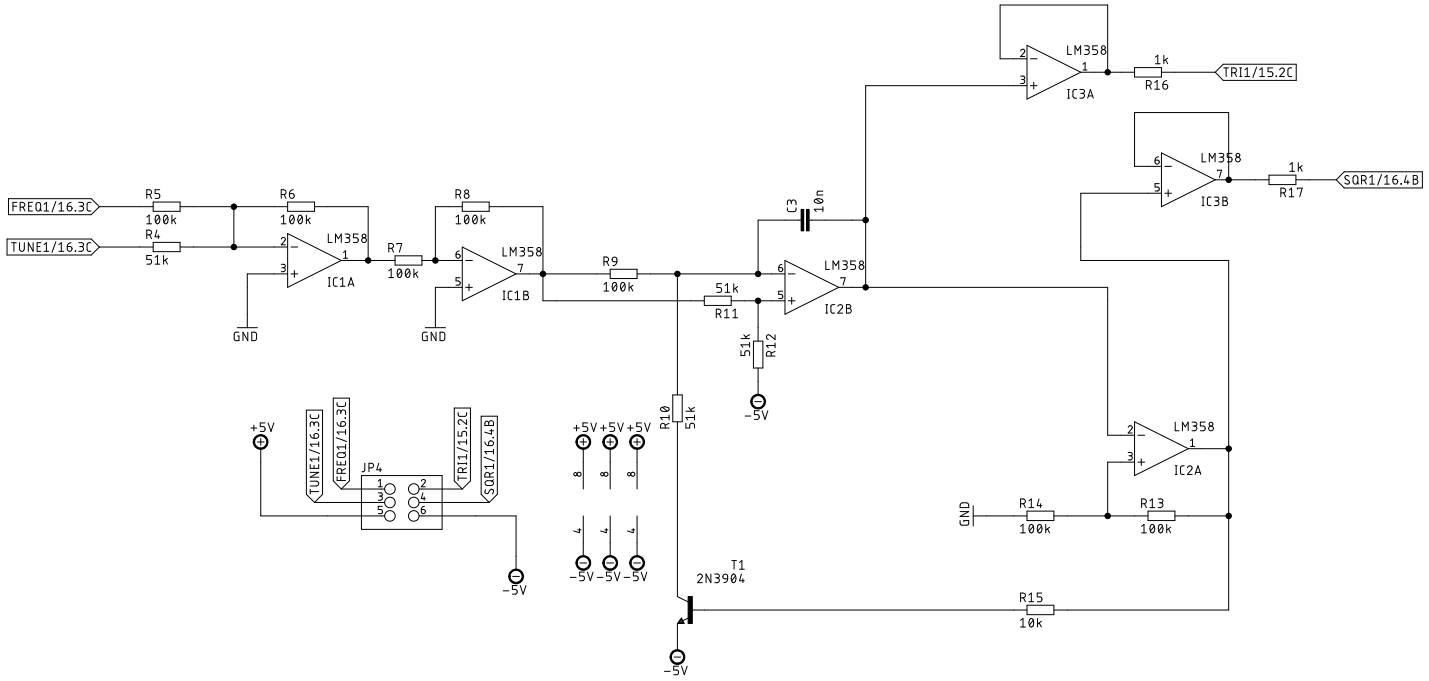

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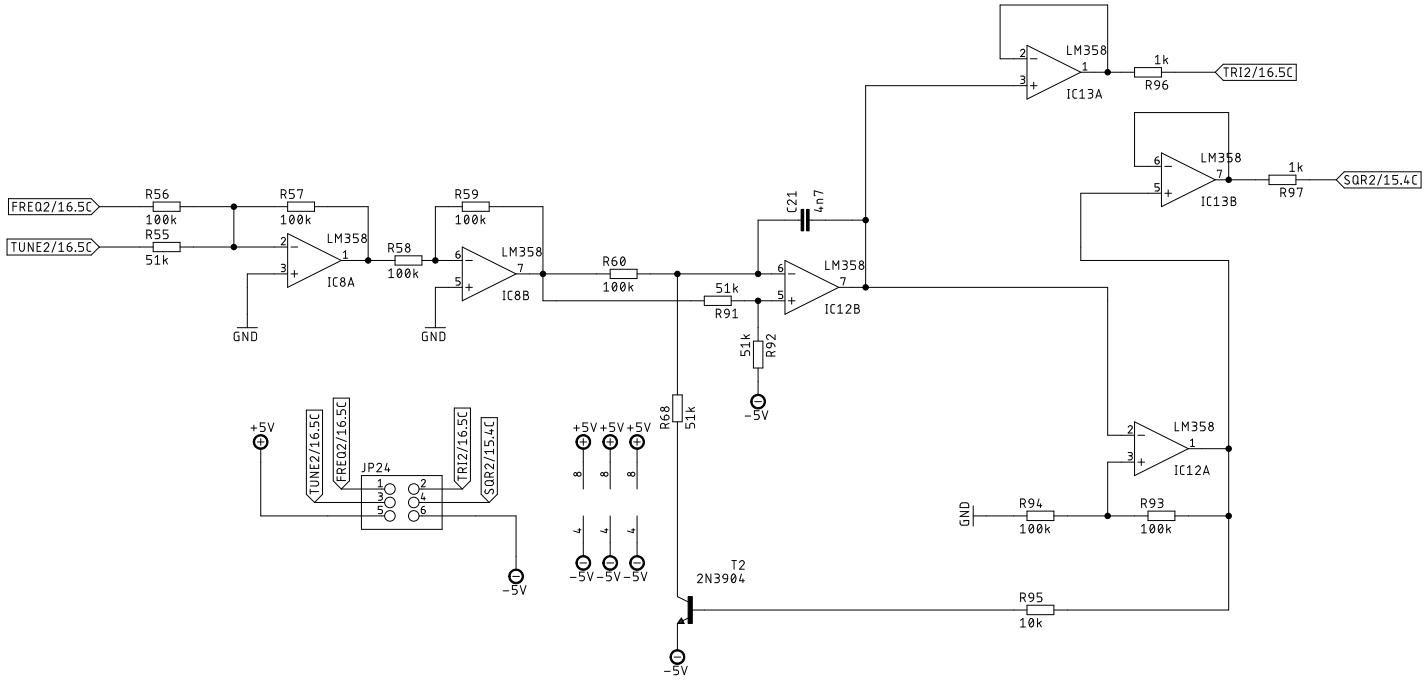

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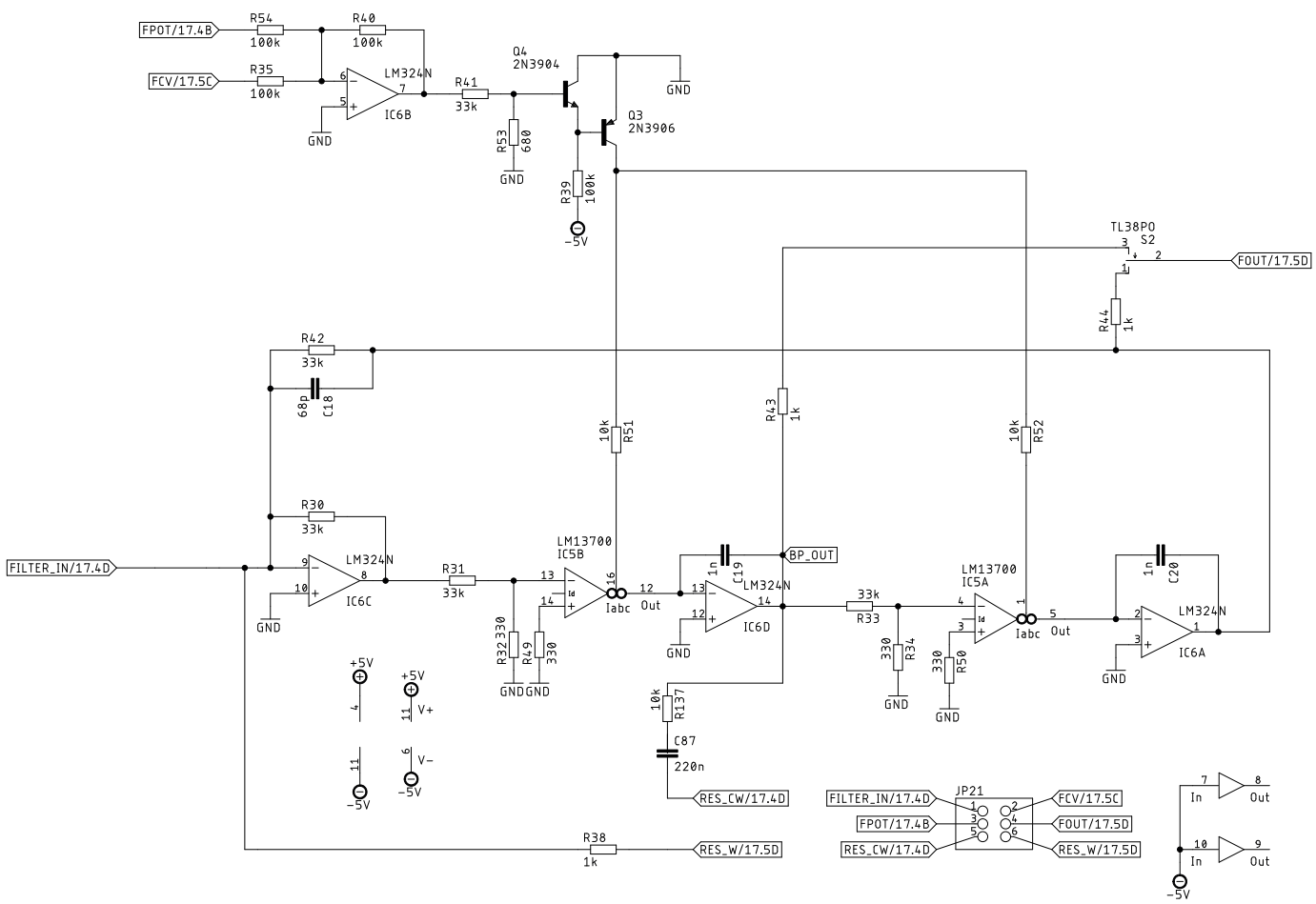

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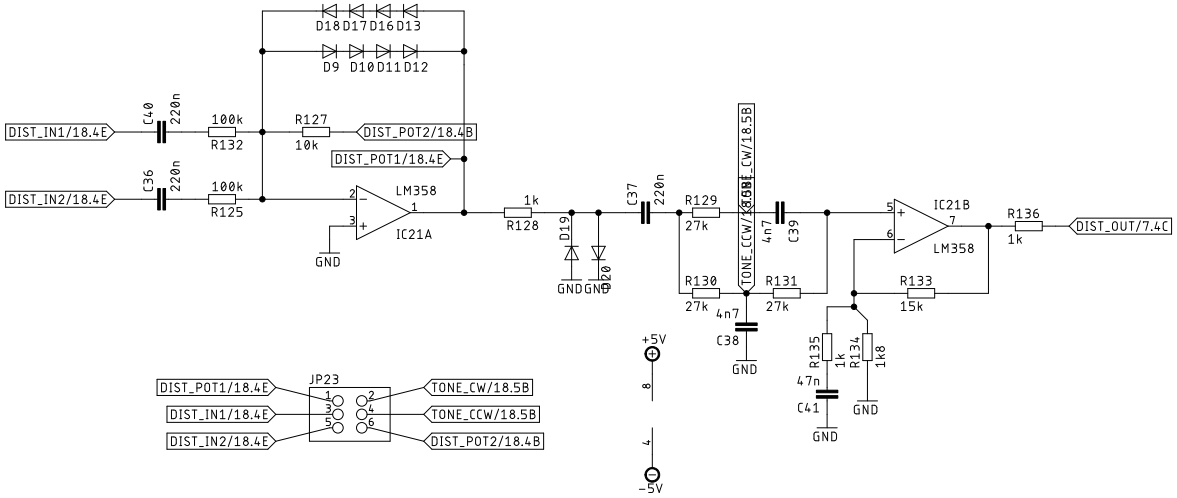

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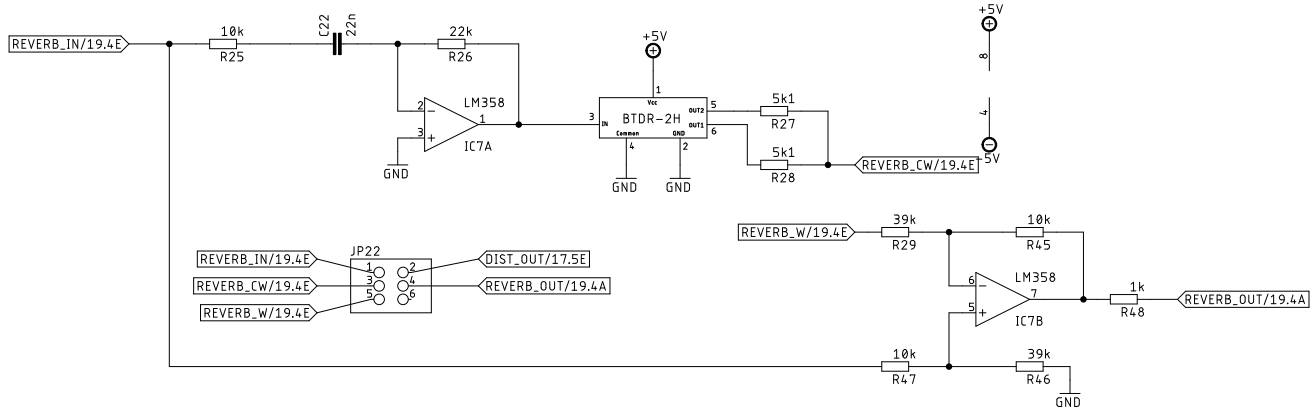

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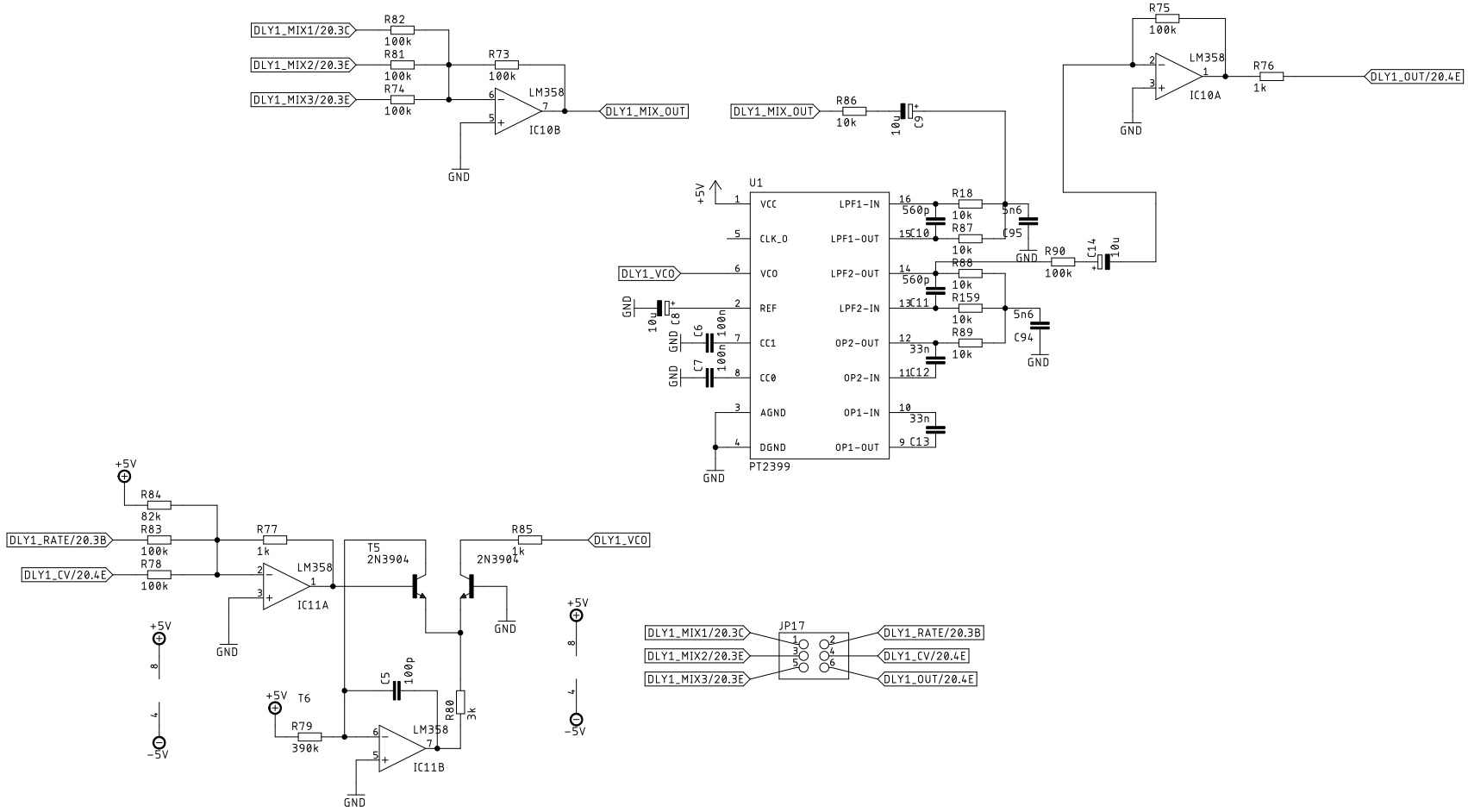

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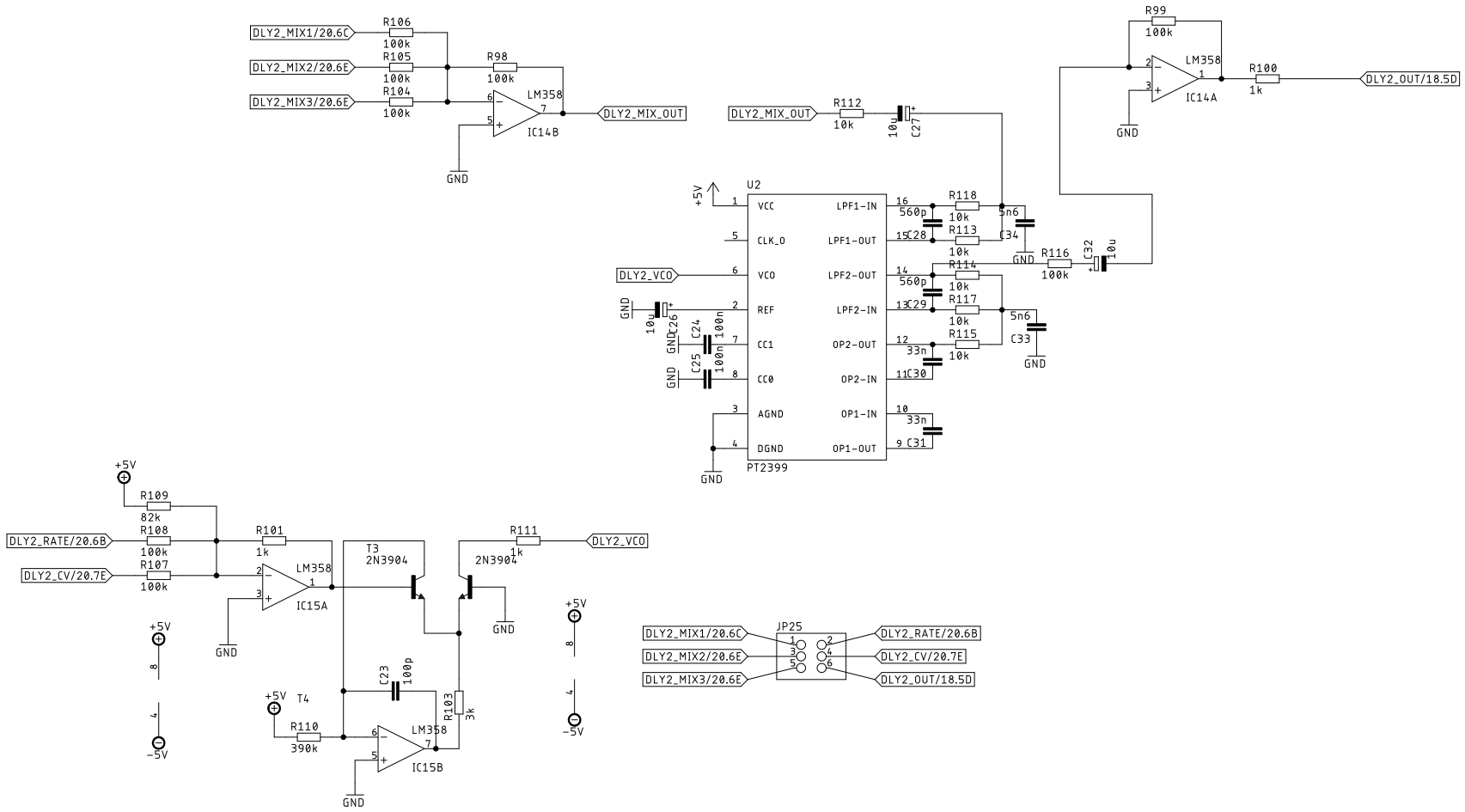

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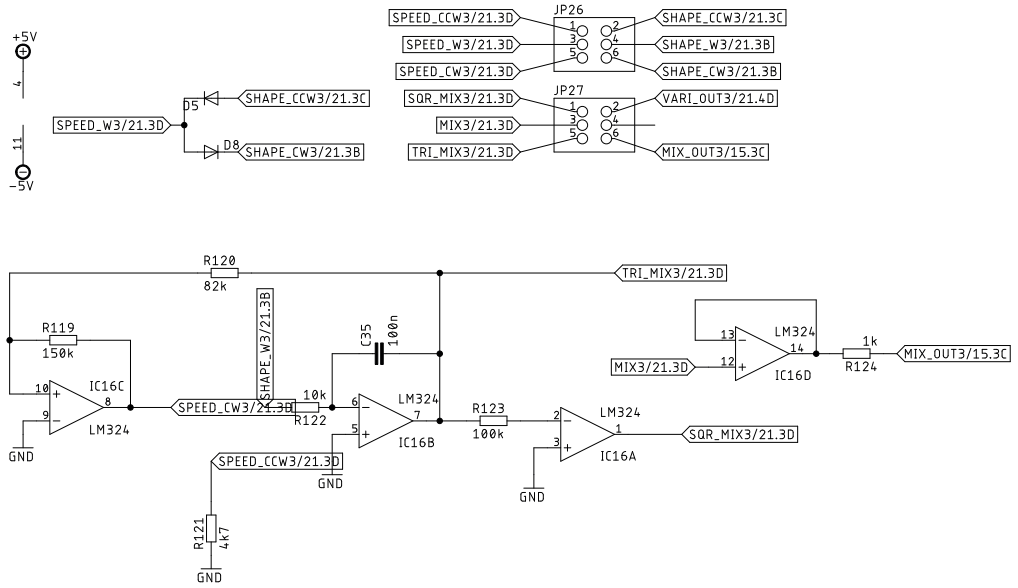

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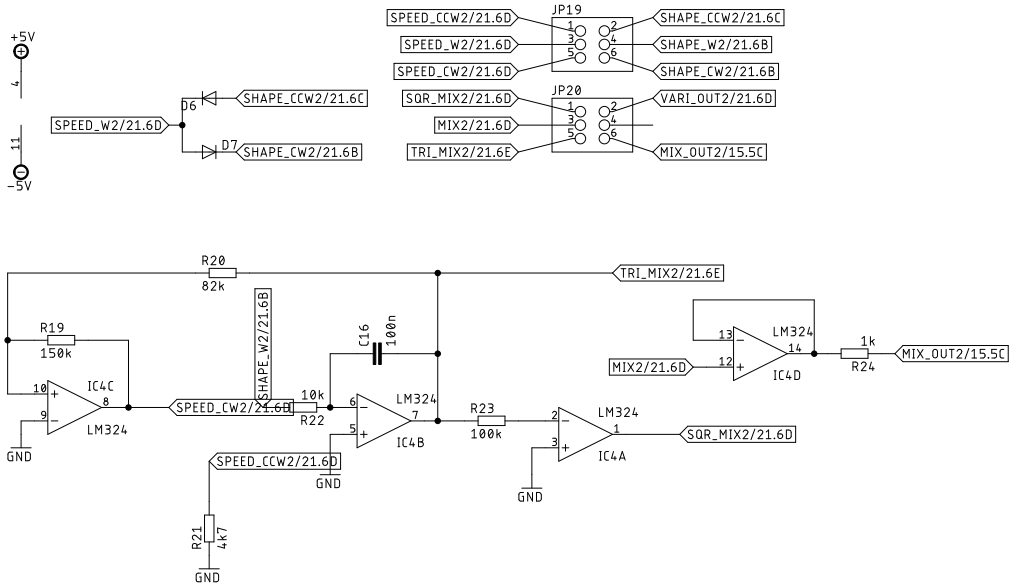

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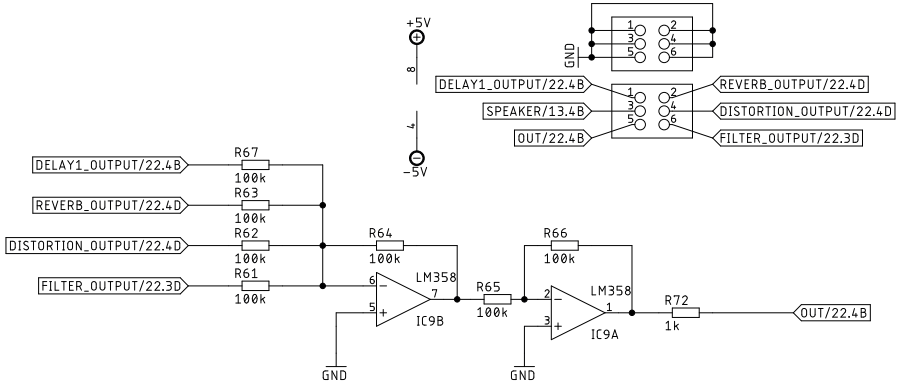

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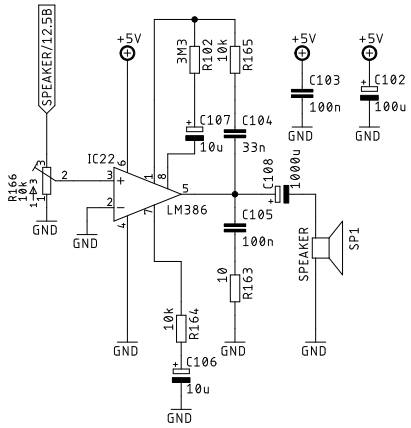

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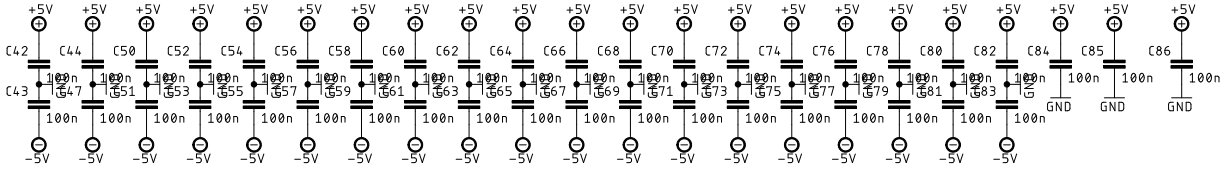

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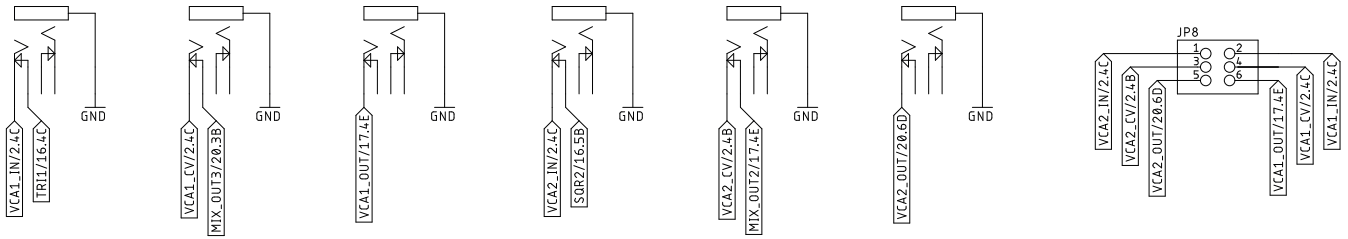

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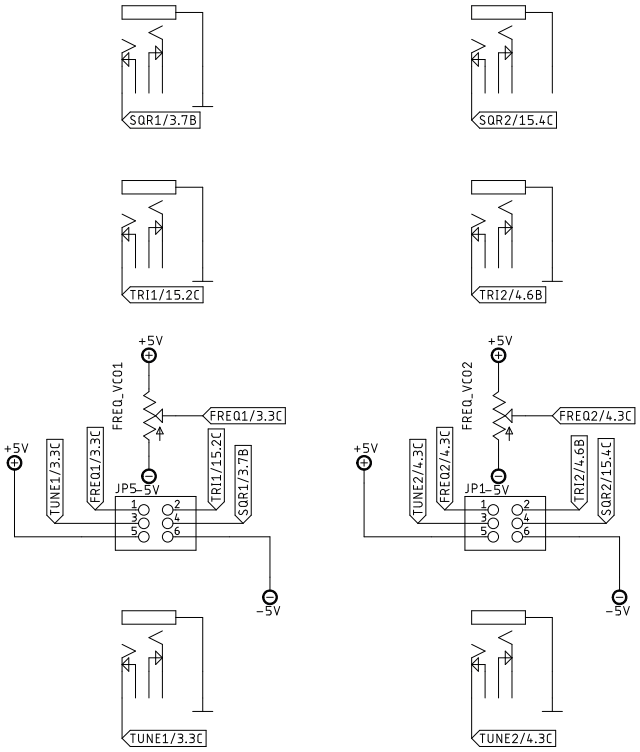

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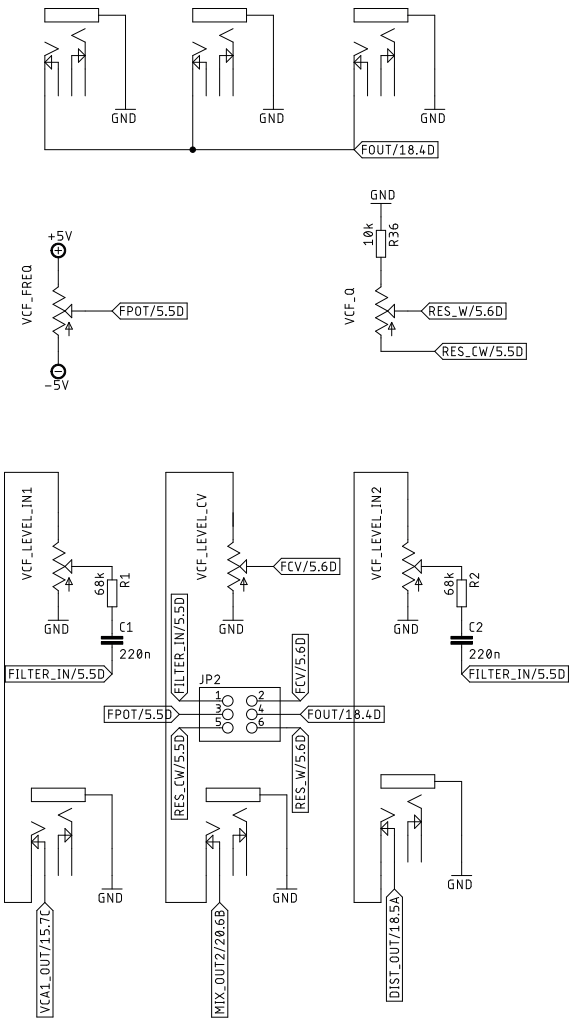

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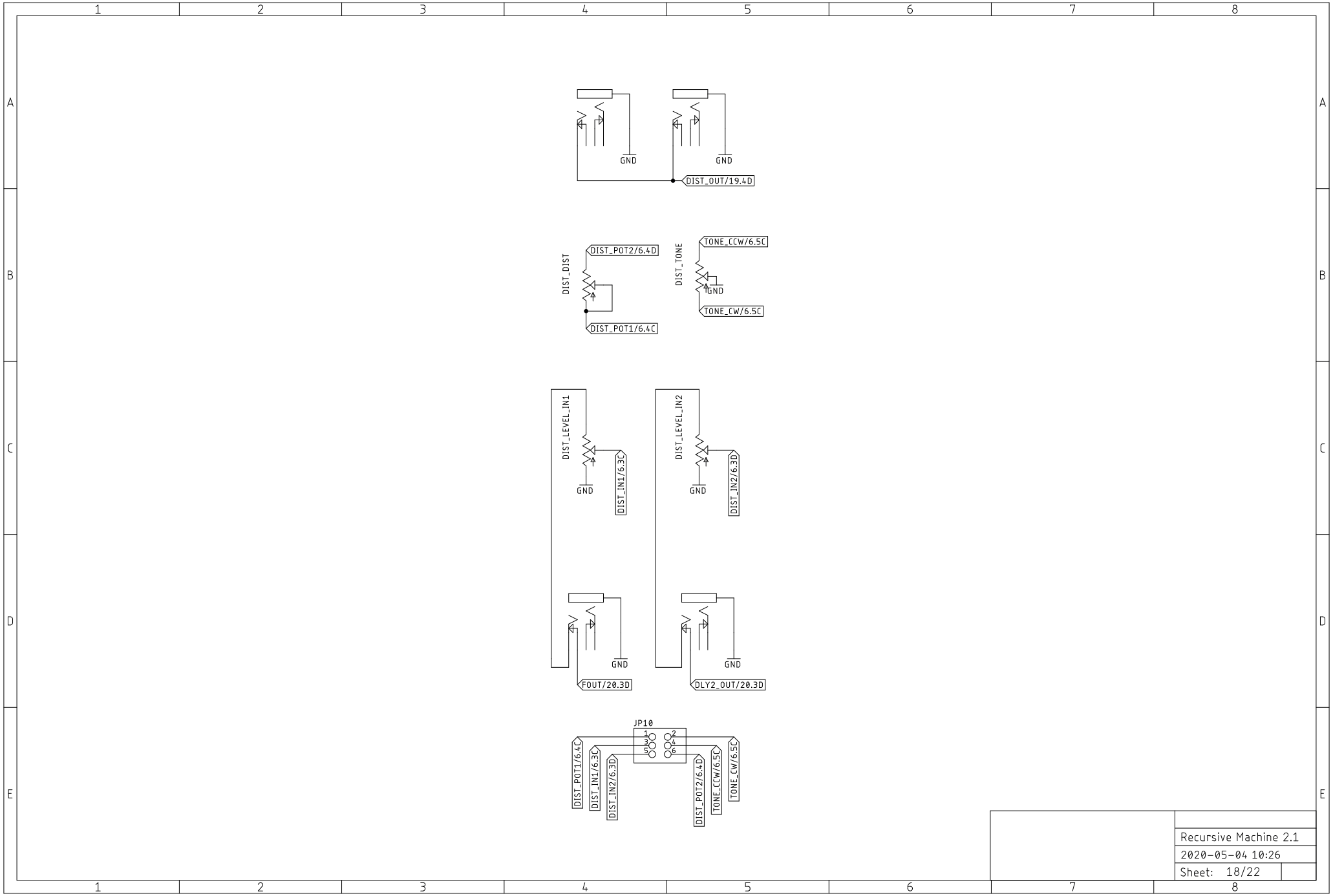
1
2
3
4
5
6
7
8
A
B
C
D
E
GND
GND
DIST_OUT/19.4D
DIST_DIST
DIST_POT2/6.4D
DIST_POT1/6.4C
DIST_TONE
TONE_CCW/6.5C
GND
TONE_CW/6.5C
DIST_LEVEL_IN1
GND
DIST_IN1/6.3C
DIST_LEVEL_IN2
GND
DIST_IN2/6.3D
GND
FOUT/20.3D
GND
DLY2_OUT/20.3D
JP10
1
2
3
4
5
6
DIST_POT1/6.4C
DIST_IN1/6.3C
DIST_IN2/6.3D
DIST_POT2/6.4D
TONE_CCW/6.5C
TONE_CW/6.5C
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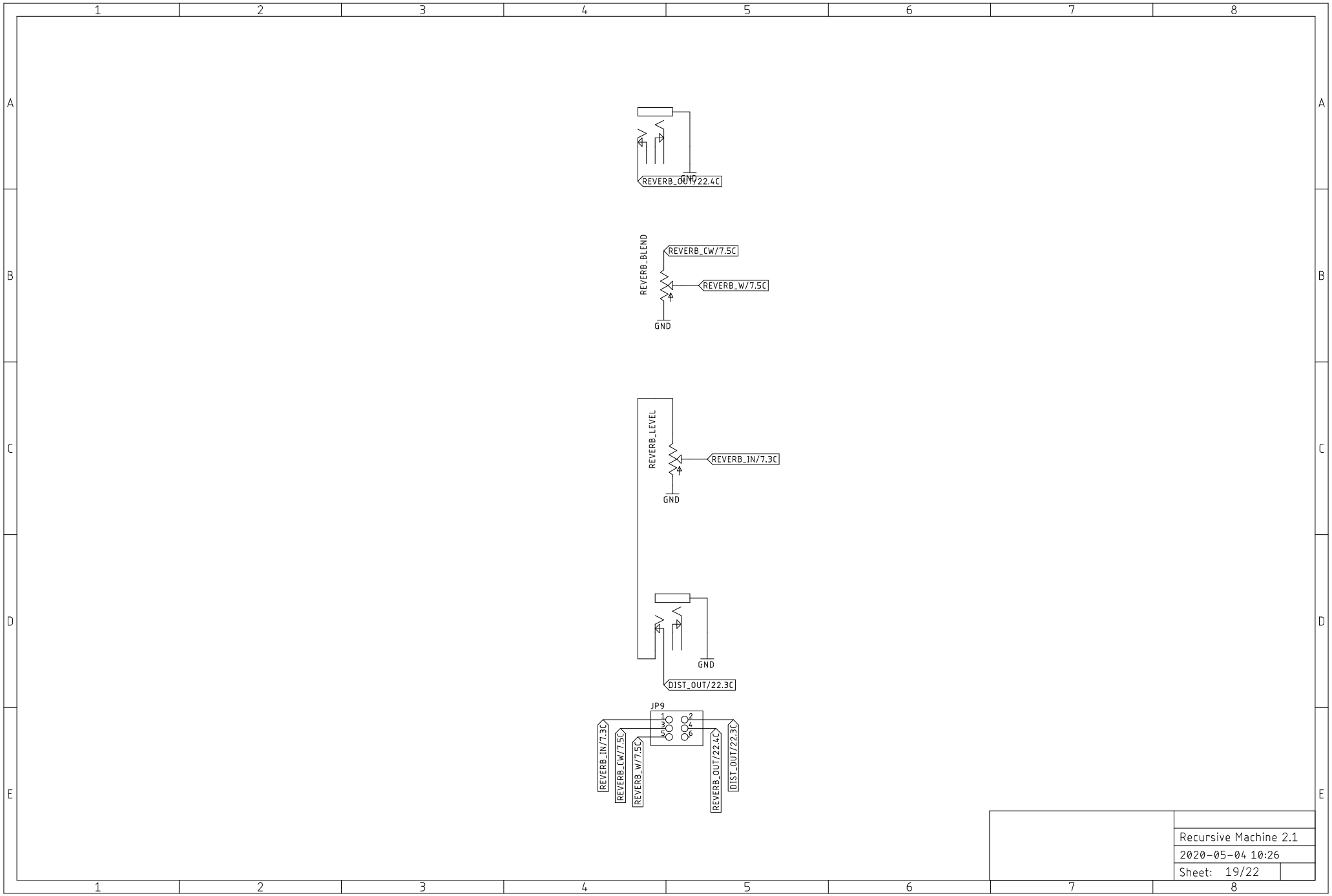
REVERB_OUT/22.4C
GND
REVERB_BLEND
REVERB_CW/7.5C
REVERB_W/7.5C
GND
REVERB_LEVEL
REVERB_IN/7.3C
GND
GND
DIST_OUT/22.3C
JP9
1
2
3
4
5
6
REVERB_IN/7.3C
REVERB_CW/7.5C
REVERB_W/7.5C
REVERB_OUT/22.4C
DIST_OUT/22.3C
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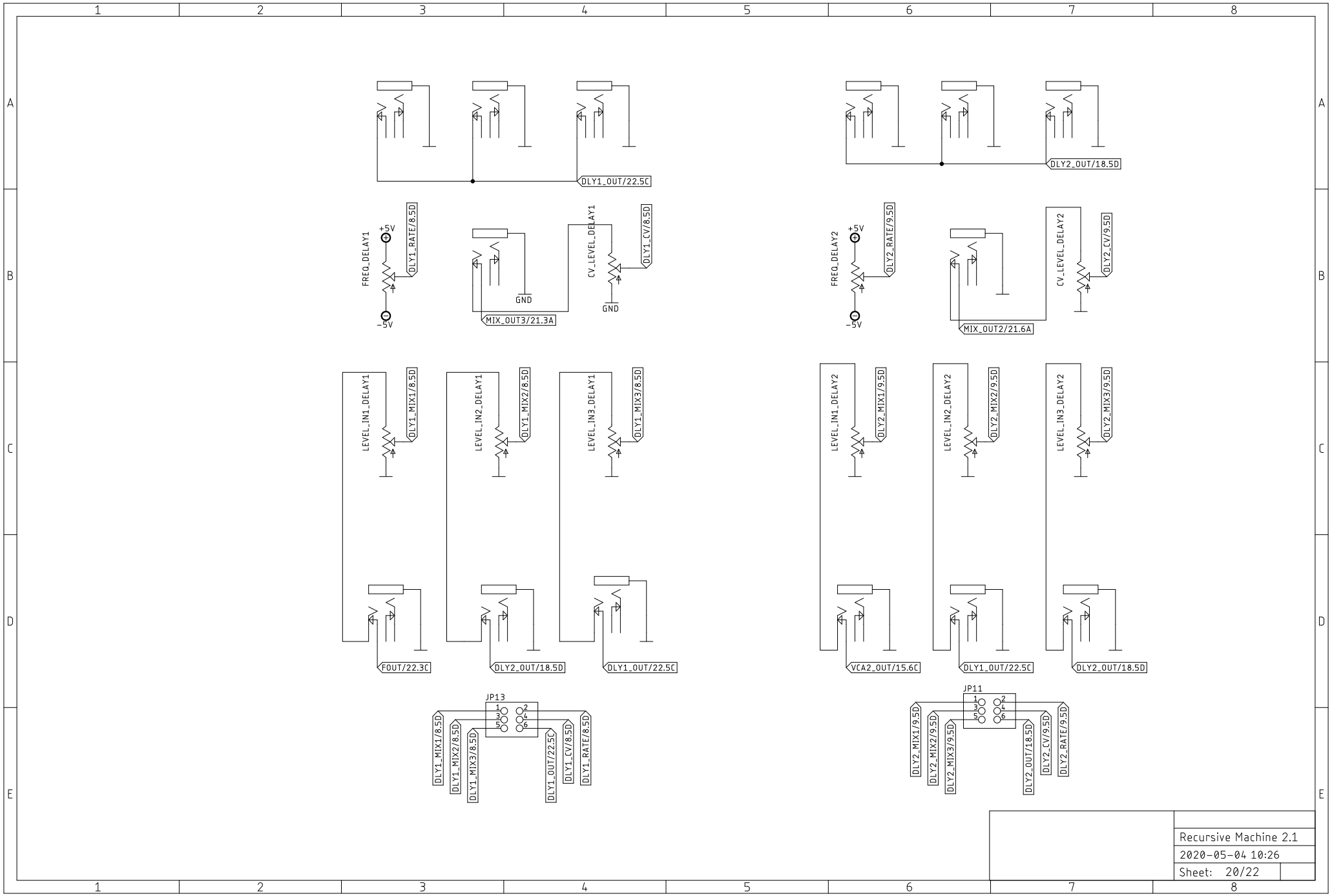
DLY1_OUT/22.5C
DLY2_OUT/18.5D
FREQ_DELAY1
+5V
-5V
DLY1_RATE/8.5D
GND
MIX_OUT3/21.3A
CV_LEVEL_DELAY1
DLY1_CV/8.5D
FREQ_DELAY2
DLY2_RATE/9.5D
MIX_OUT2/21.6A
CV_LEVEL_DELAY2
DLY2_CV/9.5D
LEVEL_IN1_DELAY1
DLY1_MIX1/8.5D
LEVEL_IN2_DELAY1
DLY1_MIX2/8.5D
LEVEL_IN3_DELAY1
DLY1_MIX3/8.5D
LEVEL_IN1_DELAY2
DLY2_MIX1/9.5D
LEVEL_IN2_DELAY2
DLY2_MIX2/9.5D
LEVEL_IN3_DELAY2
DLY2_MIX3/9.5D
FOUT/22.3C
DLY2_OUT/18.5D
DLY1_OUT/22.5C
VCA2_OUT/15.6C
DLY1_OUT/22.5C
DLY2_OUT/18.5D
JP13
DLY1_MIX1/8.5D
DLY1_MIX2/8.5D
DLY1_MIX3/8.5D
DLY1_OUT/22.5C
DLY1_CV/8.5D
DLY1_RATE/8.5D
JP11
DLY2_MIX1/9.5D
DLY2_MIX2/9.5D
DLY2_MIX3/9.5D
DLY2_OUT/18.5D
DLY2_CV/9.5D
DLY2_RATE/9.5D
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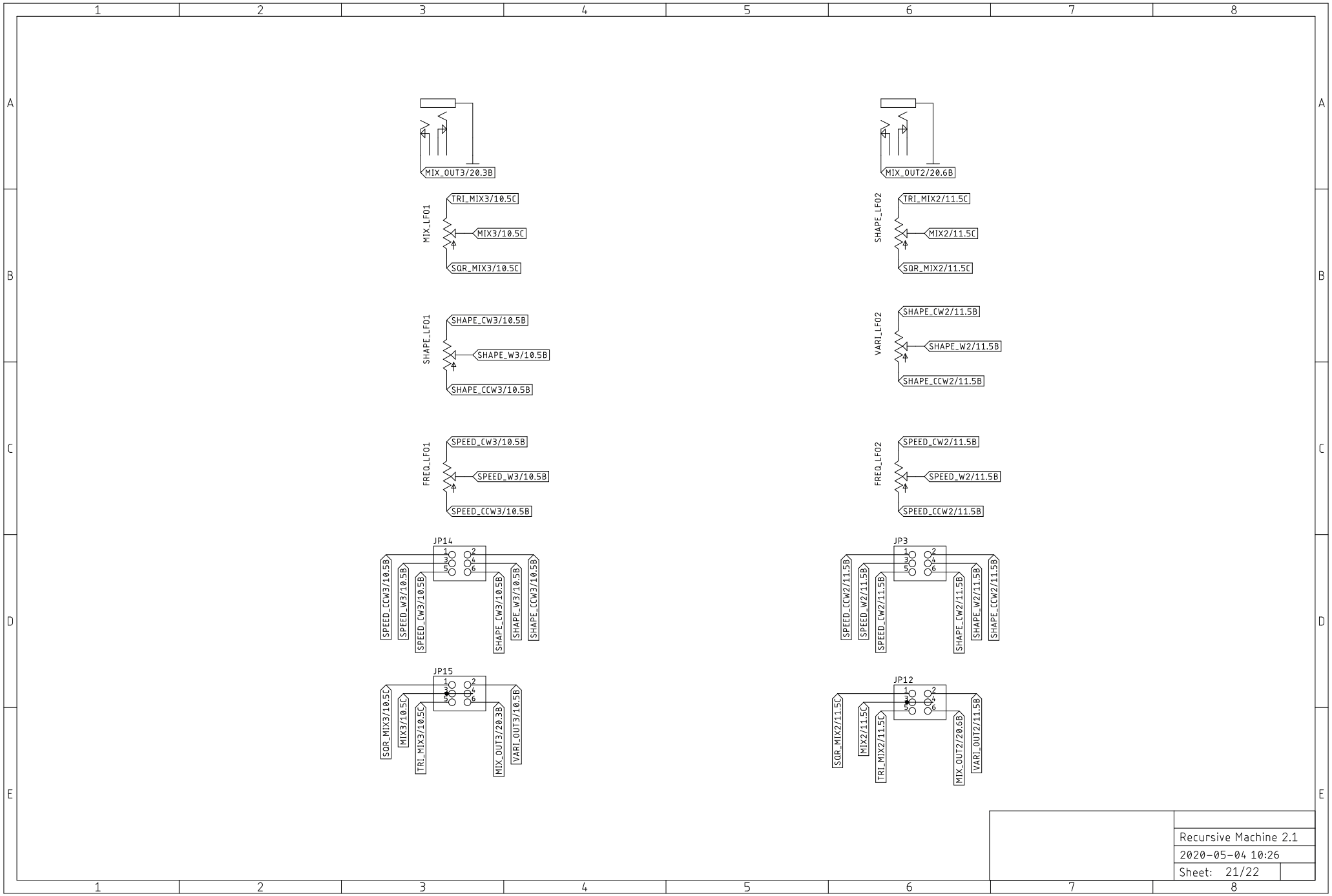
MIX_OUT3/20.3B
MIX_LFO1
TRI_MIX3/10.5C
MIX3/10.5C
SQR_MIX3/10.5C
SHAPE_LFO1
SHAPE_CW3/10.5B
SHAPE_W3/10.5B
SHAPE_CCW3/10.5B
FREQ_LFO1
SPEED_CW3/10.5B
SPEED_W3/10.5B
SPEED_CCW3/10.5B
JP14
SPEED_CCW3/10.5B
SPEED_W3/10.5B
SPEED_CW3/10.5B
SHAPE_CW3/10.5B
SHAPE_W3/10.5B
SHAPE_CCW3/10.5B
JP15
SQR_MIX3/10.5C
MIX3/10.5C
TRI_MIX3/10.5C
MIX_OUT3/20.3B
VARI_OUT3/10.5B
MIX_OUT2/20.6B
SHAPE_LFO2
TRI_MIX2/11.5C
MIX2/11.5C
SQR_MIX2/11.5C
VARI_LFO2
SHAPE_CW2/11.5B
SHAPE_W2/11.5B
SHAPE_CCW2/11.5B
FREQ_LFO2
SPEED_CW2/11.5B
SPEED_W2/11.5B
SPEED_CCW2/11.5B
JP3
SPEED_CCW2/11.5B
SPEED_W2/11.5B
SPEED_CW2/11.5B
SHAPE_CW2/11.5B
SHAPE_W2/11.5B
SHAPE_CCW2/11.5B
JP12
SQR_MIX2/11.5C
MIX2/11.5C
TRI_MIX2/11.5C
MIX_OUT2/20.6B
VARI_OUT2/11.5B
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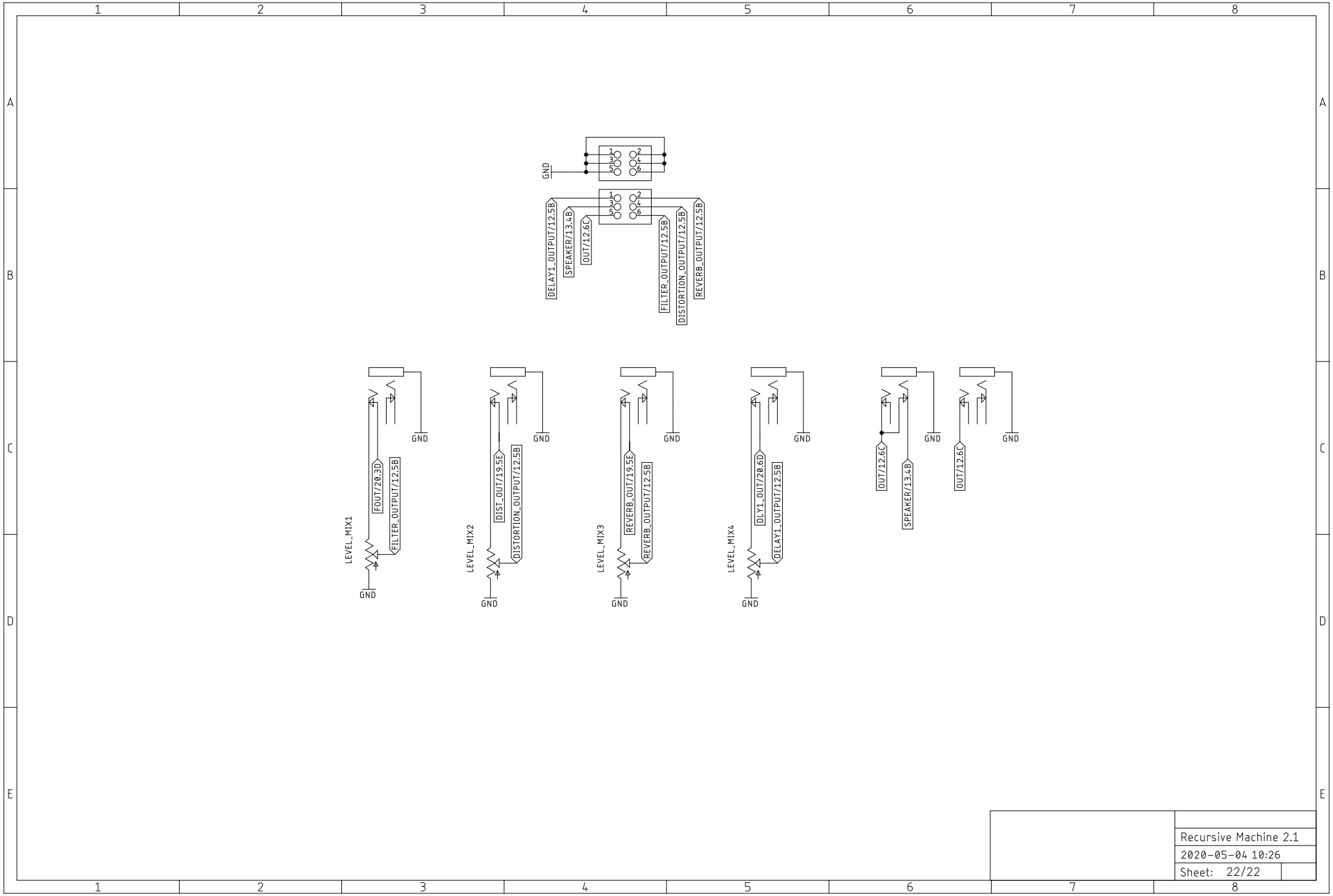
1
2
3
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5
6
7
8
A
B
C
D
E
GND
DELAY1_OUTPUT/12.5B
SPEAKER/13.4B
OUT/12.6C
FILTER_OUTPUT/12.5B
DISTORTION_OUTPUT/12.5B
REVERB_OUTPUT/12.5B
LEVEL_MIX1
FOUT/20.3D
FILTER_OUTPUT/12.5B
LEVEL_MIX2
DIST_OUT/19.5E
DISTORTION_OUTPUT/12.5B
LEVEL_MIX3
REVERB_OUT/19.5E
REVERB_OUTPUT/12.5B
LEVEL_MIX4
DLY1_OUT/20.6D
DELAY1_OUTPUT/12.5B
OUT/12.6C
SPEAKER/13.4B
OUT/12.6C
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