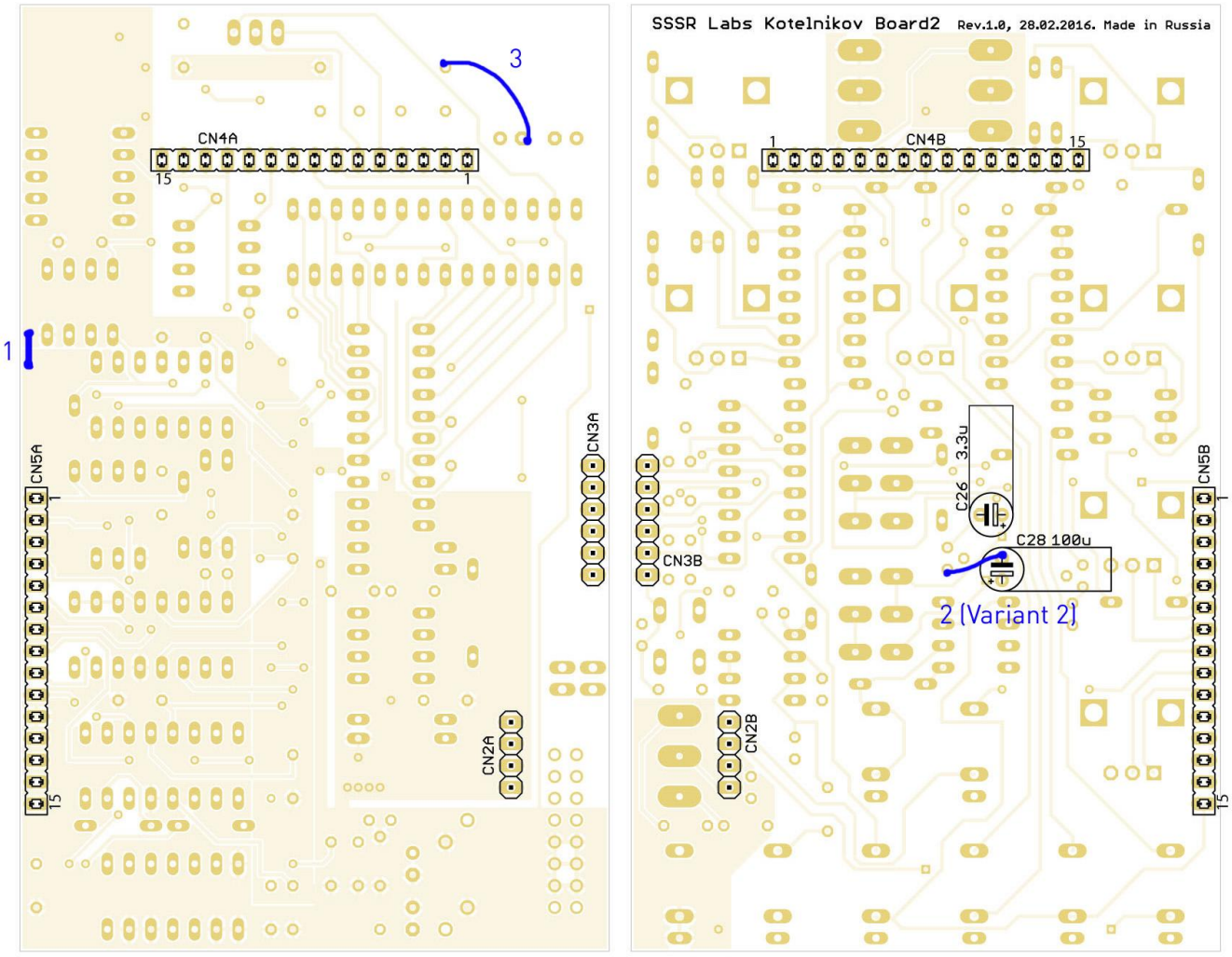
KOTELNIKOV. Assembly Manual (preliminary)

Warning!

PCB Version 1.0 (green silkscreen) has a few routing errors, which must be fixed:

1. Join the two Ground pads on the back side of Board 1 near the 4th terminal of IC1. You need to carefully remove the solder mask in those spots, tin them and solder a short jumper wire (stripped 1n4004 leg should fit perfectly)
2. Connect the two Ground pads on the back side of Board 2. To do this, connect the negative (upper) lead of the C20 to the emitter (bottom lead) of Q3 during assembly
3. Connect the top (−) leads of C30 and C31 together or connect C30 and C8 as shown on the picture.

PCB v. 1.1 (black silkscreen) does not need any changes.

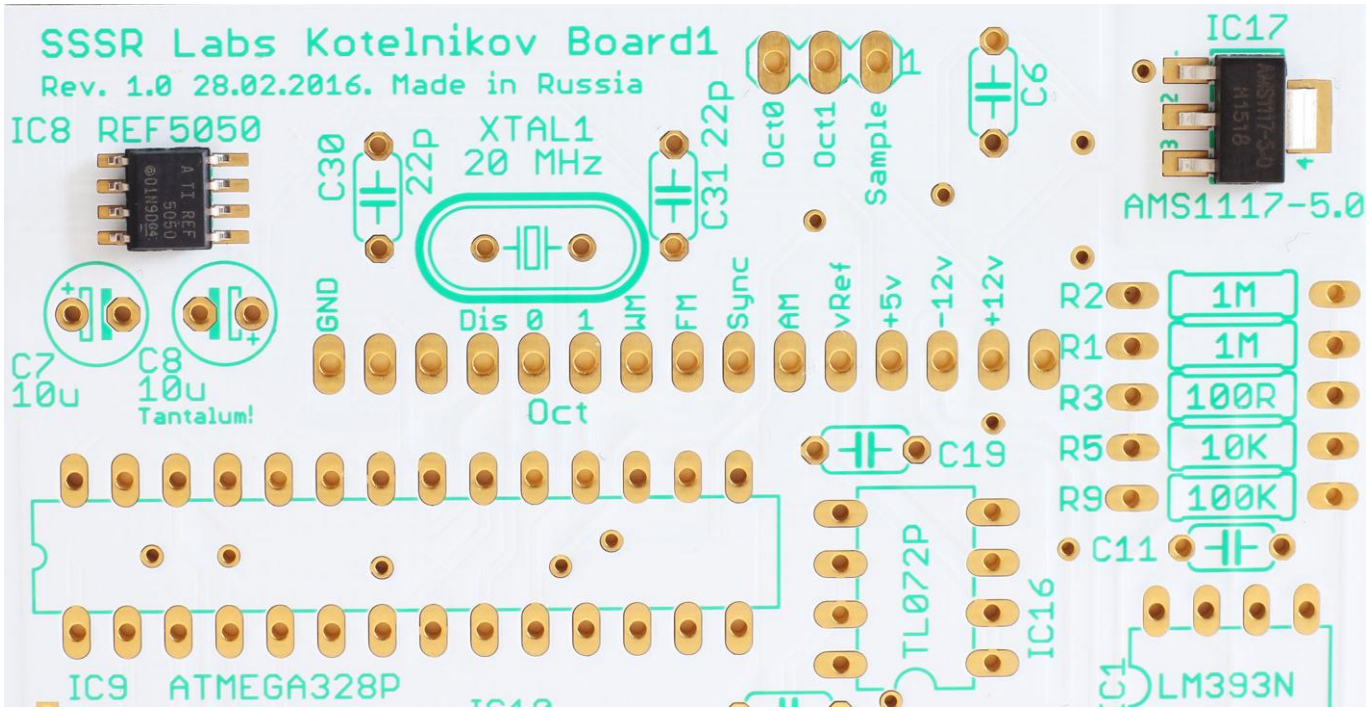


Assembly

The primary idea of effective assembly process is successive installation of components grouped by their physical height and accessibility for your soldering iron considering quite dense placement. The assembly process consists of several intentionally determined steps, which are described in the following manual. Average build time for single module using hand soldering tool is about 5 hours, so you don't need to rush. Follow the right order. Please don't remove the protective film off the front panel. The panel with the film on can be used as a plane to hold components in place while turning PCB around for further soldering. Cut legs off of soldered components after each step.

OPEN BAG 1.

1: SMT-COMPONENTS



Solder IC8 and IC17: REF5050AIDR and AMS1117-5.0. Those components are packed into tiny sqare-shaped boxes and easily distinguishable from each other. Carefully look at the marking on the REF5050 IC. You need to place it exactly as it is on the picture. Use a looking-glass if needed.

It's easiest to tin one pad at first (take pin 8 pad for example), then heat it up with a soldering iron; put IC in place with a tweezers, then remove the tip when it perfectly fits; Slightly push the IC down with any instrument and solder the first pad once more; Then solder one lead a time, starting with the opposite one, heating each lead with very small amount of the solder on the tip.

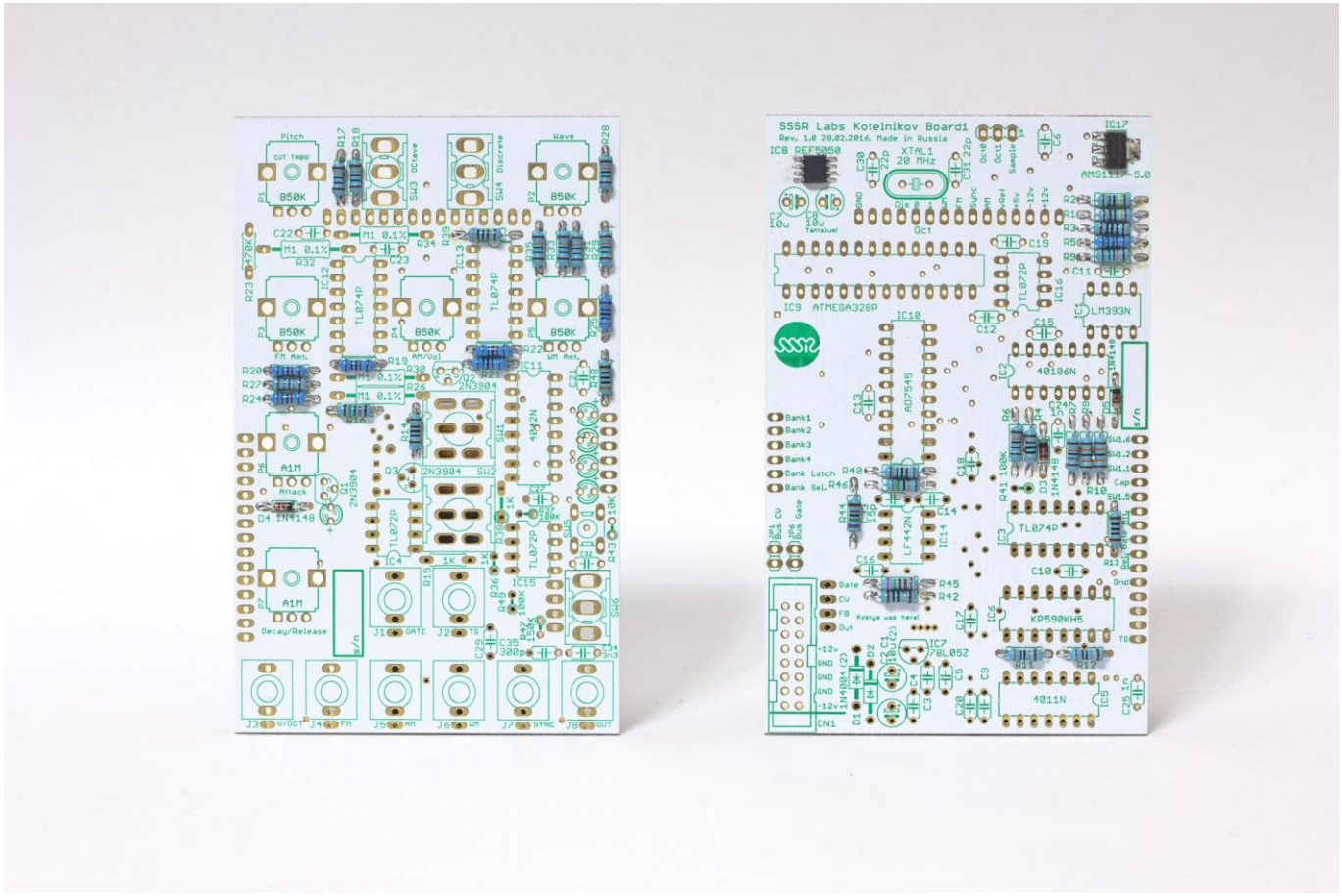
To install IC17, it's recommended to tin the heat-sink pin (4) first then put the IC in place, keeping the solder melted and wait until solder flows onto lead 4 of the IC. Then solder the other leads, watching the elevation of the IC.

2: 1N4148 DIODES

Install diodes to the corresponding places and solder. Watch out for the polarity of the diodes! The strip on a diode should follow the strip on the PCB.

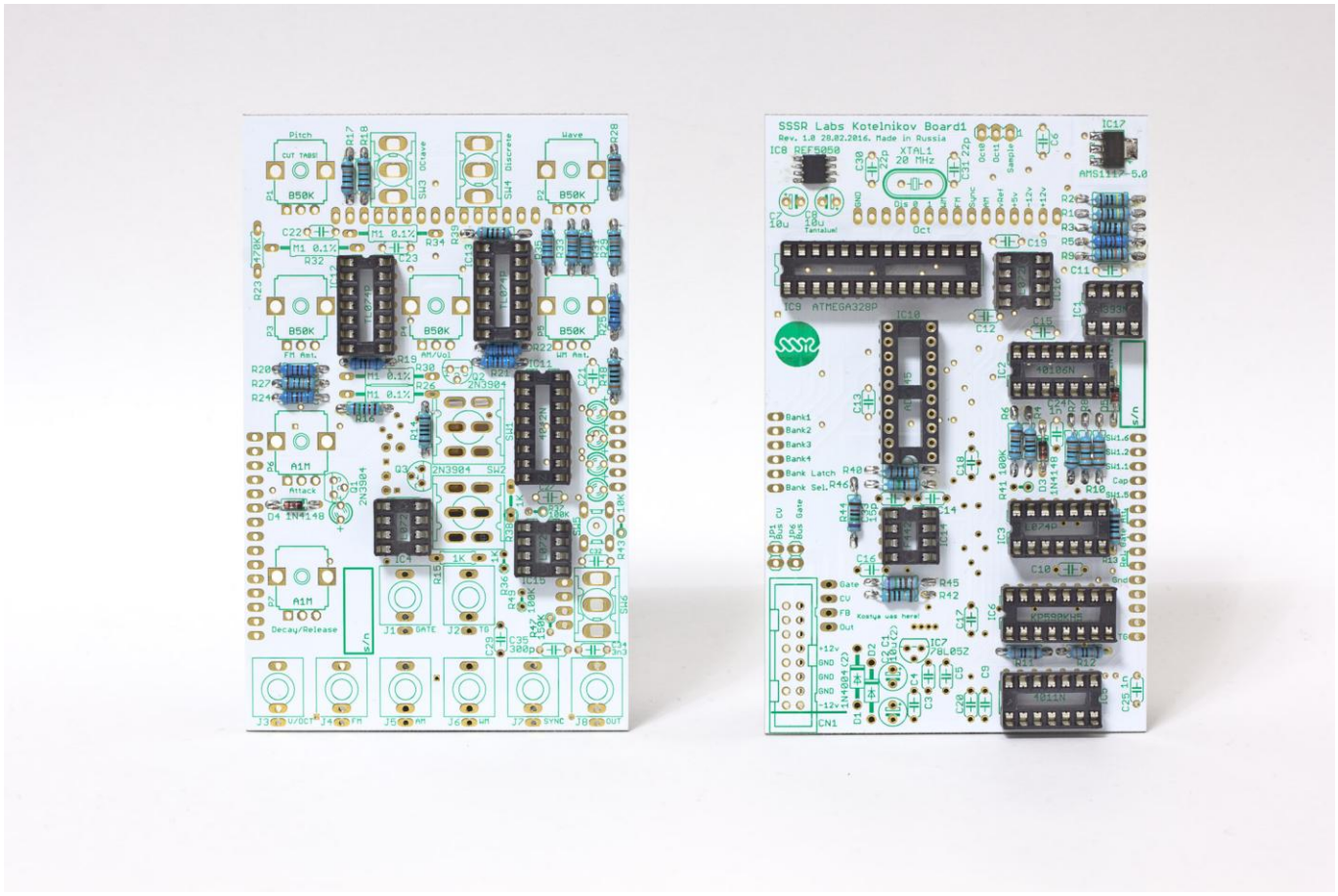
3: RESISTORS

Install all 1% resistors except for the vertically-mounted ones. It's useful to solder them from the component side then cut legs and solder one more time from the back side. This will ensure outstandingly strong contact and all resistors will be soldered just in two passes. **Some resistors in your package are marked with the letter M and digits after it. This means "order right below Megaohm" e.g. hundreds of Kiloohms. For example, M47 = 470K, M33 = 330K and M1 = 100K.** (And sometimes a famous vintage synth, but not in our case)



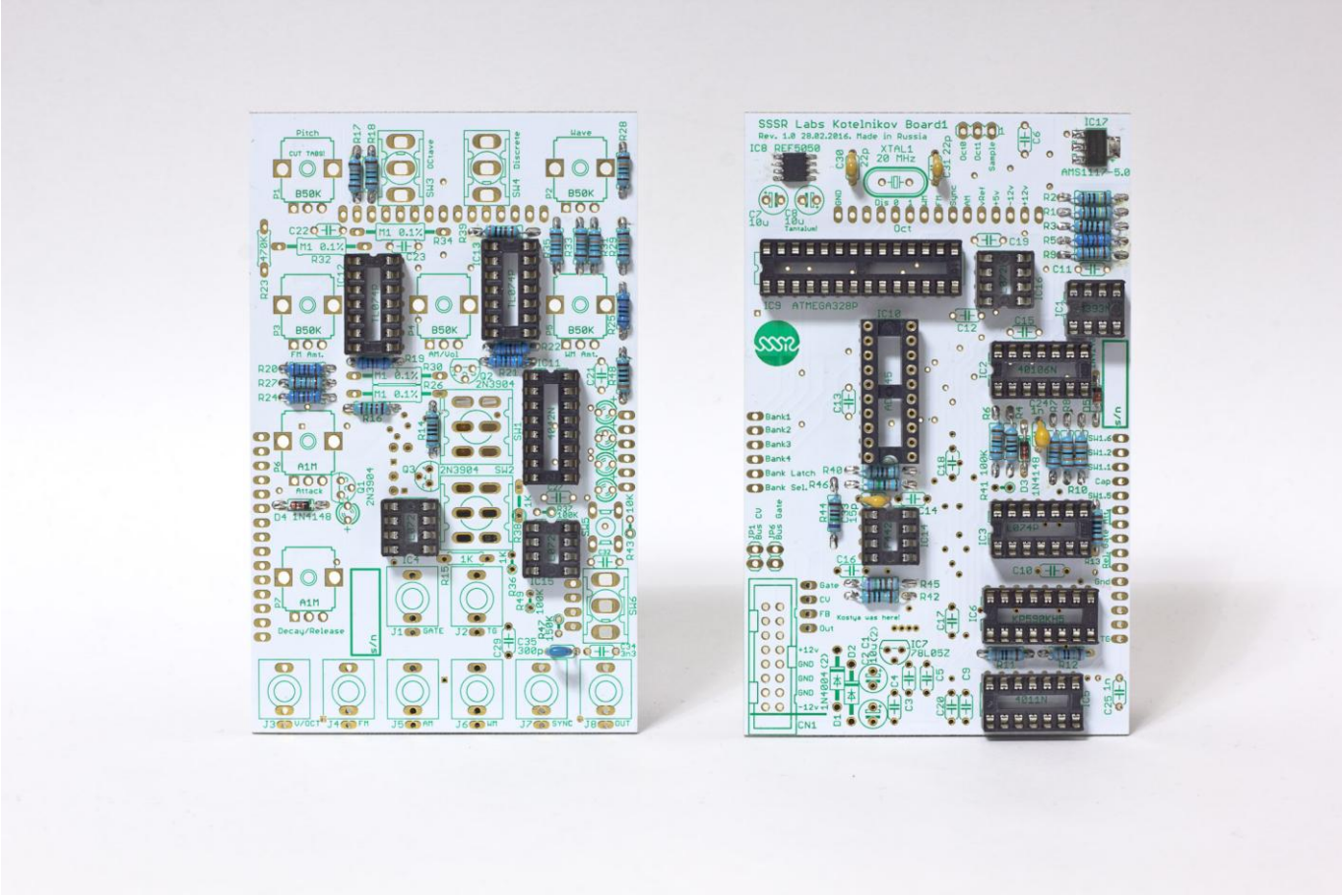
4: IC SOCKETS

Install all IC sockets. Watch for the right orientation! The notch on the socket should follow the notch on the PCB. It's almost impossible to desolder IC sockets undamaged.



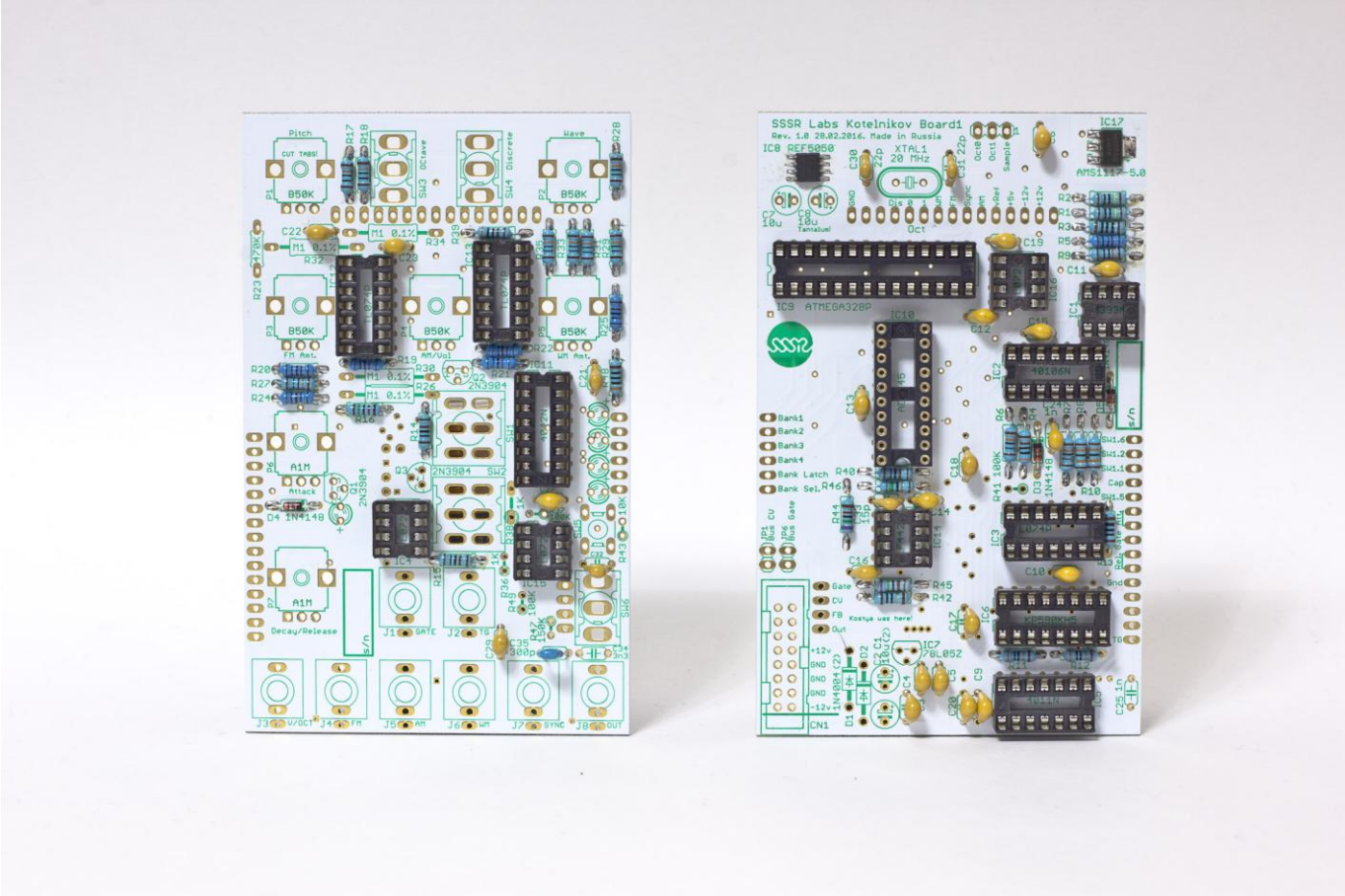
5: CERAMIC CAPACITORS, 22PF AND 1NF

Install capacitor C24 (1nF) and C30, C31 and C33 (22pF) into their corresponding places. All of those are on Board 1. Note: The indicated value of C33 is 15pF, but 22pF is allowed. There is a place for 1nF capacitor C25. This capacitor is deprecated and you do not need to install it.

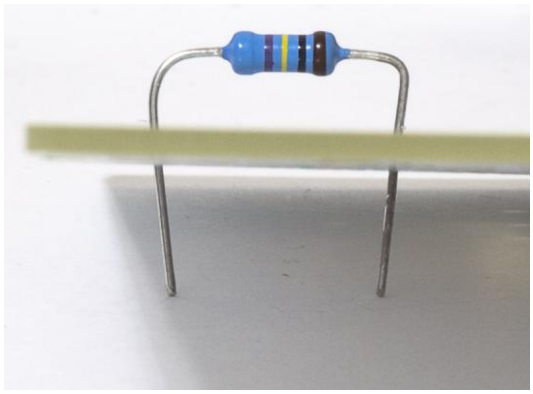


6: CERAMIC CAPACITORS, 100NF AND 300PF

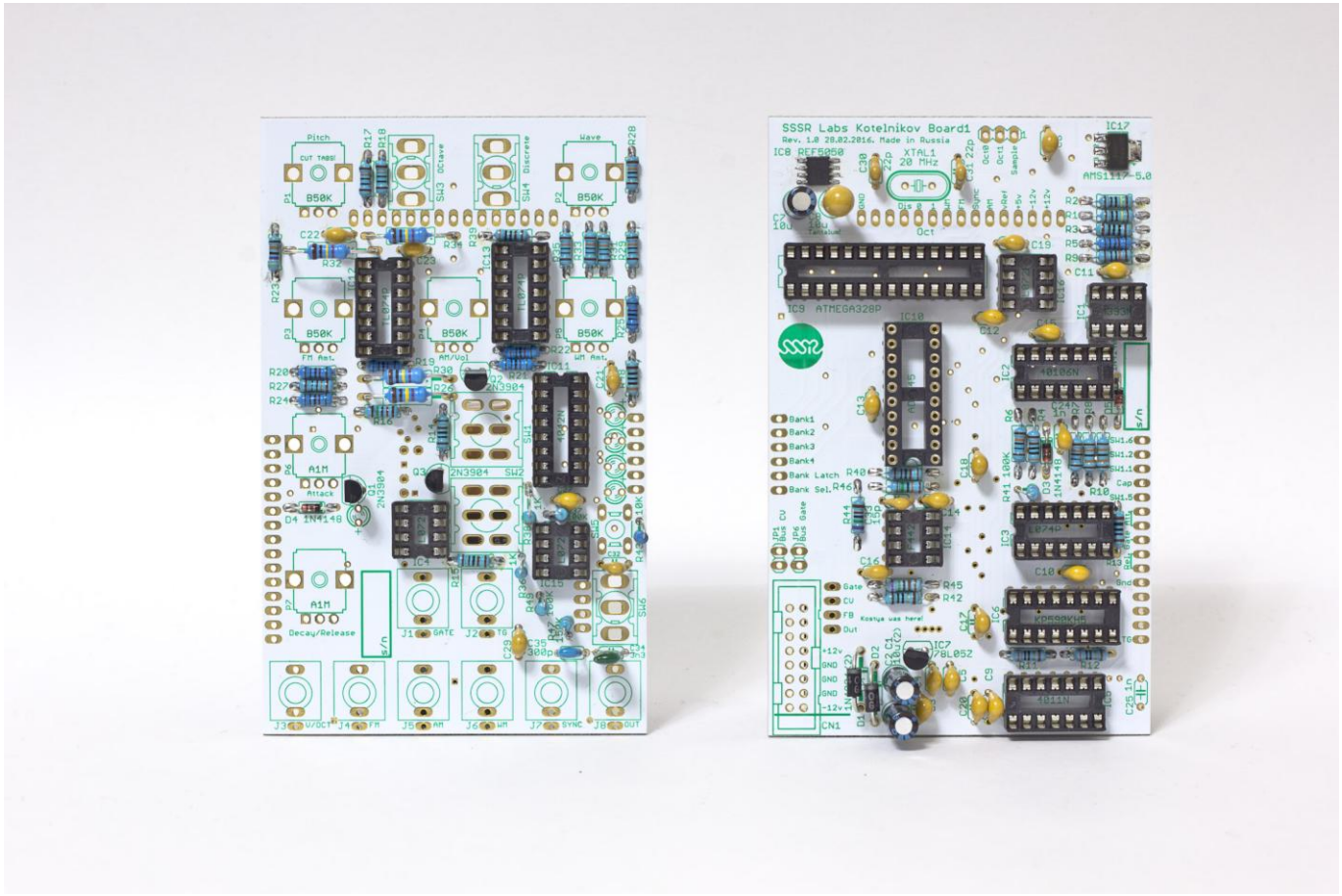
Install blue 300pF capacitor C35 and 100nF capacitors to all remaining places (except 3n3 C34). Values for the 100nF capacitors are not indicated. Now you can solder all the capacitors at once.



7: REMAINING ELECTRONIC COMPONENTS FROM BAG 1

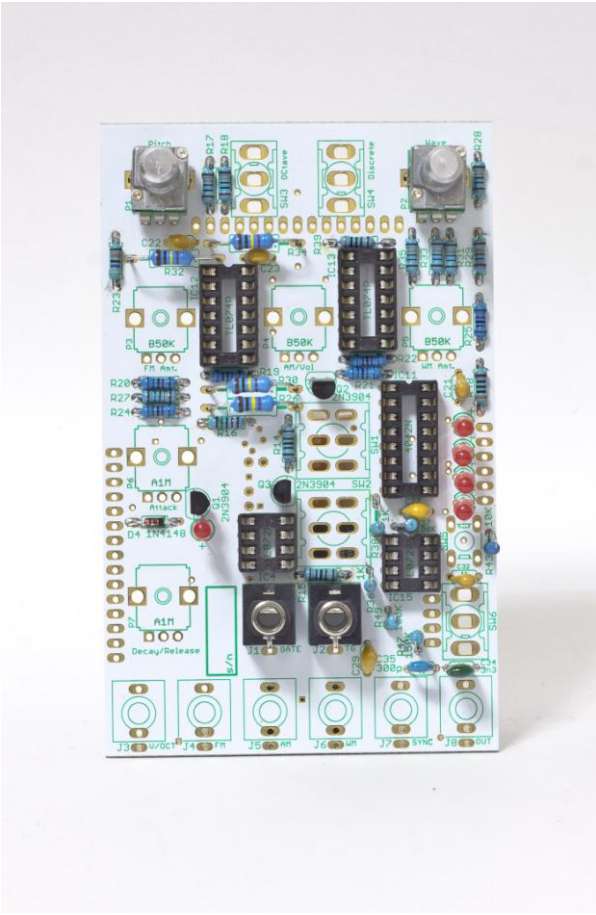


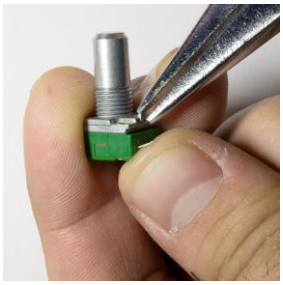
Install precision 100K resistors into their places as shown on the picture. They must float over the PCB! Values are indicated as M1 0.1%. This method of installation is required by the resistors' design and it helps to keep values within tolerance. Then install all remaining components from Bag 1. When installing mylar capacitor C34 (3n3) you must keep it as low as possible. To do this you must bend leads apart near the very base of the capacitor and bend them down with 5mm (1/5") pitch. All positive leads of electrolytic capacitors are marked with the "+" sign on the boards. All positive leads are longer than negative.



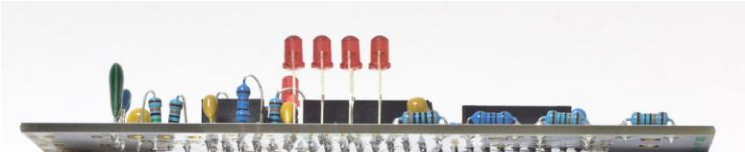
NOW OPEN BAG 2

8: LEDS



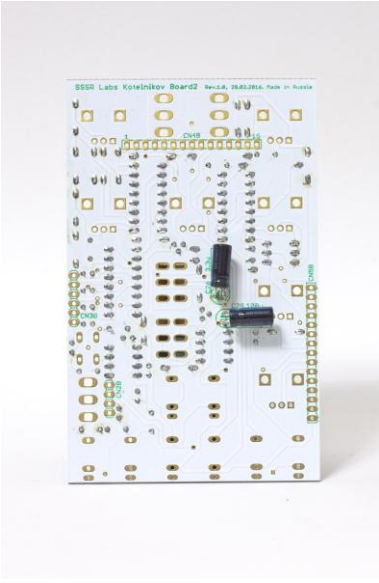


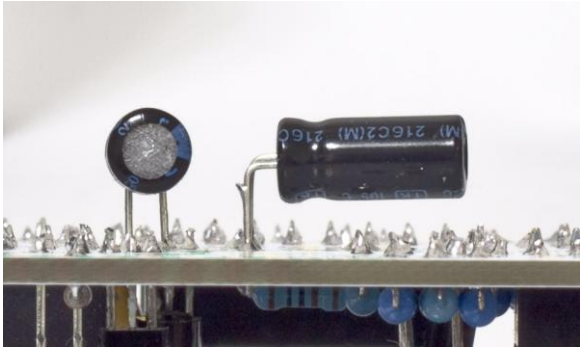
Pick any two potentiometers and break the tabs on the pots' top. Install those two pots and two jack sockets into P1, P2, J1 and J2 places but do not solder them. Then insert 5 LEDs keeping the right polarity. Anodes are indicated by the "+" sign on the board and the LED's anode lead is longer. Remove the film from the front panel and install it onto the board through the pots and sockets. Holding the panel, turn the board upside down and let all diodes slip into their holes. Then solder them one by one keeping the right clamping of the panel and LEDs' height. Finally the board must look like the picture below.



9: ELECTROLYTIC CAPACITORS, 3.3UF AND 100UF

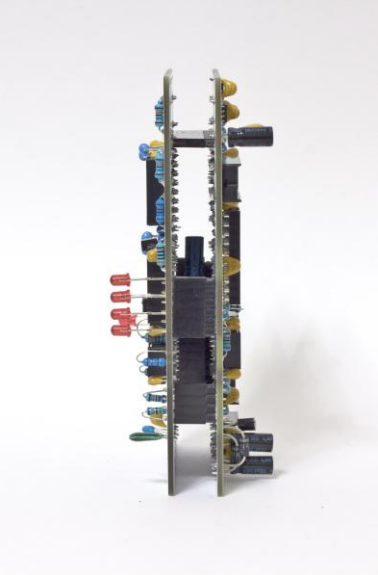
Insert electrolytic caps on the back side of Board 2 as shown on the picture and solder. Positive leads are indicated on the board with white stripes and negative as black.

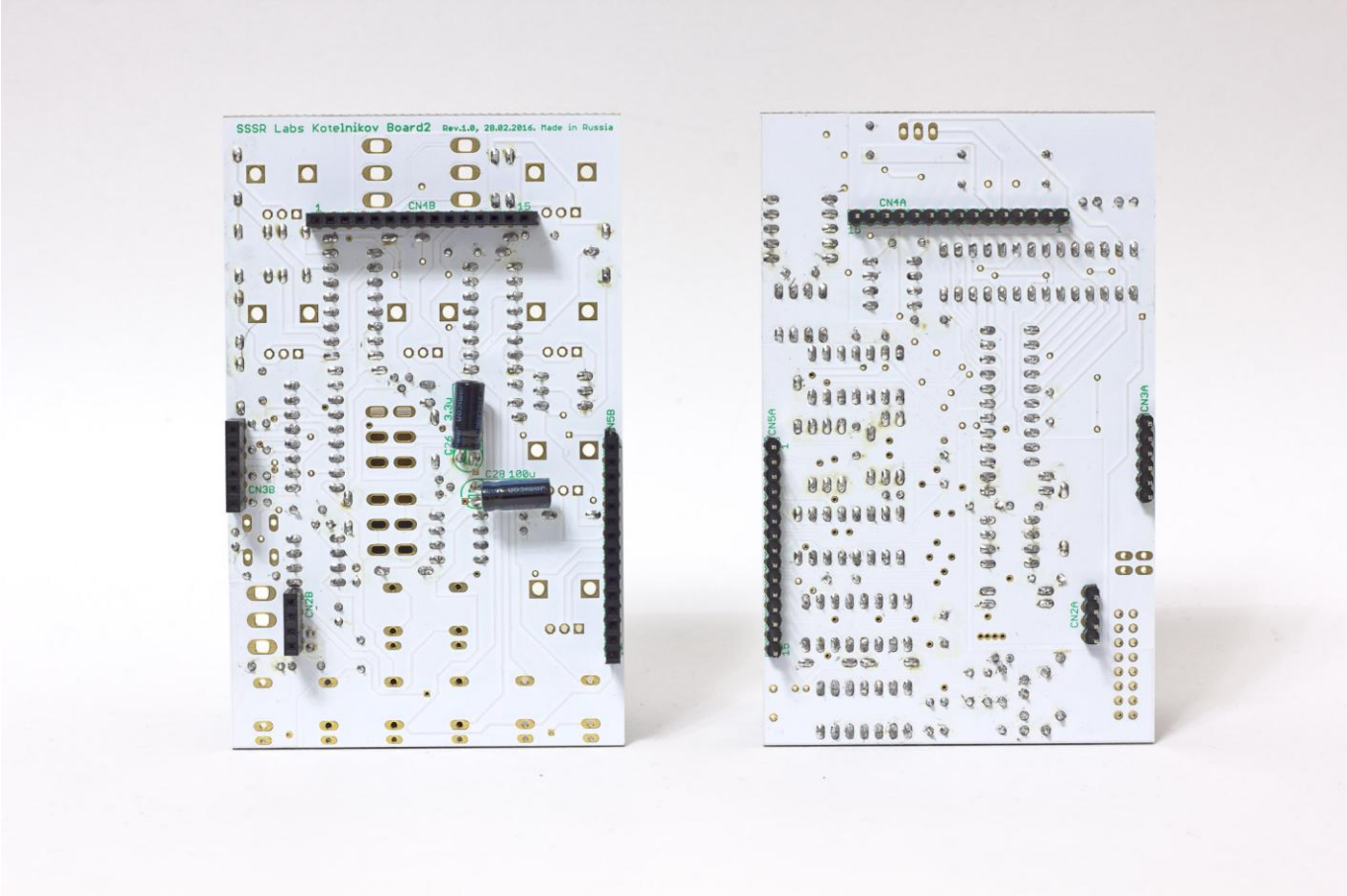




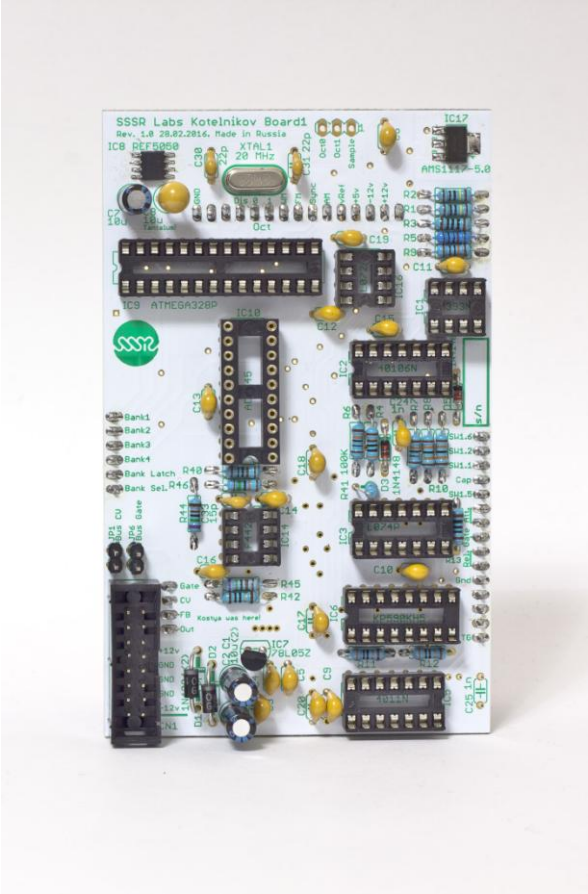
10: ONE-ROW HEADERS

You will find 4 pairs of pre-connected one-row headers: 2x15-pin, 1x4-pin and 1x6-pin. Traditionally, the female part must be installed on Board 2, and the male part — on the Board 1. Install connectors on the back side of Board 1, then construct a sandwich of both boards as shown on the picture. Solder all headers ensuring that all construction is clamped tight and secure.





11: REMAINING ELECTRONIC COMPONENTS

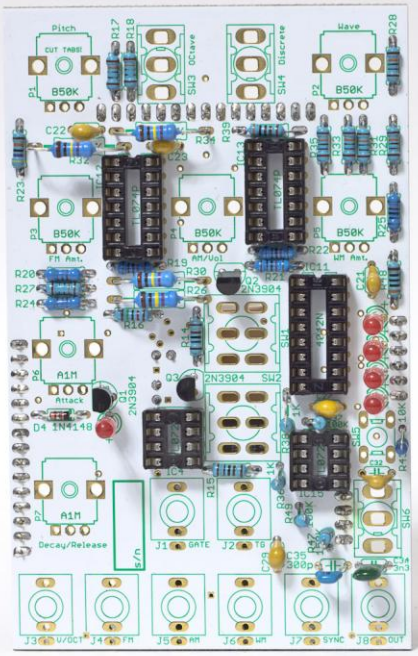


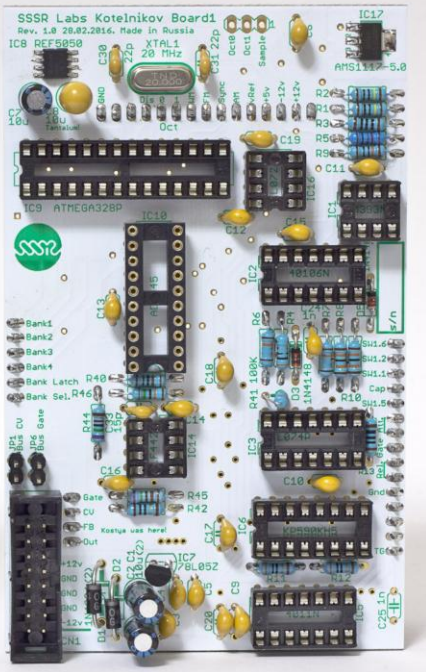
Solder remaining components: power header, jumper headers and 20 MHz quartz.

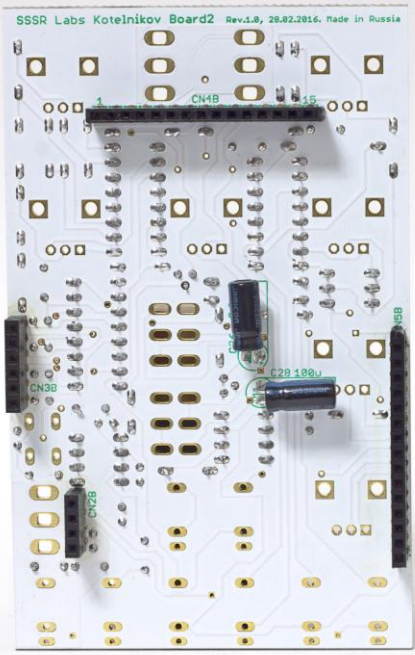
Now you can clean flux from both boards since the electro-mechanical components are not yet installed. The way of cleaning is up to you, but we use alcohol/resin based flux, which can be successfully removed with an old toothbrush, wetted with medical or rubbing alcohol, benzene, or benzene-ethylene blend. If you have enough cleaning solution you can drown boards entirely. Gurus can use ultra-sonic cleaning tubes.

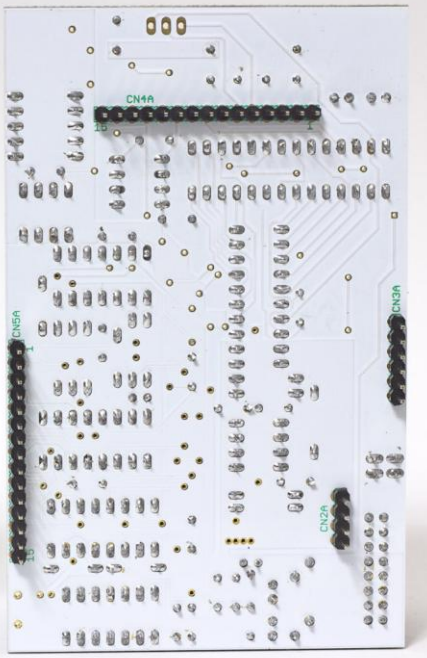
After cleaning, your PCBs will obtain shiny and professional look.

It is necessary to dry boards very well using any instrument: fan, hair-dryer, etc. PCB must be completely dry. Give special attention to IC sockets and female headers. Liquid may stay there for several days without proper drying and module may work improperly for all that time.


Pitch
Wave
Octave
Discrete
FM Ampl.
AM/Vol
WM Ampl.
Attack
Decay/Release
J1 GATE
J2 TG
J3 V/Oct
J4 FM
J5 AM
J6 WM
J7 SYNC
J8 OUT


SSSR Labs Kotelnikov Board1
Rev. 1.0 20.02.2016. Made in Russia
IC8 REF5050
XTAL1
20 MHz
IC9 ATMEGA328P
Bank1
Bank2
Bank3
Bank4
Bank Latch
Bank Sel.
Kostya was here!


SSSR Labs Kotelnikov Board2 Rev.1.0, 20.02.2016. Made in Russia
CN4B
CN3B
CN2B


CN4A
CN5A
CN3A
CN2A

12: HARDWARE

You can preliminarily insert all Board 2 chips into their sockets to avoid extra work with driver. Ensure proper orientation one more time!

All you have left is to solder are potentiometers, switches, pushbutton and jack sockets. Remove all nuts and washers from all hardware, remove tabs from pots. Set all switches to the middle position (except for two-position switch of course). Place all the hardware into corresponding places. Please note: two of seven pots has value of A1M and must be placed into P6 and P7: Attack and Decay/Release. Only two-position switch is SW4: Discrete.

DO NOT SOLDER ANYTHING YET!

Insert all construction into the front panel. Unfortunately, SW1 and SW2 switches in this run are a bit higher than rest of the hardware and you need to clamp all components to the back side of the panel before. Install all nuts on the front side. Use washers only for potentiometers. Start with central switches, then screw on right-side hardware, and then the rest. The board will be held firmly due to the mounting leads of the pots. Now take the whole thing and slightly align the board in parallel with the panel. Then take something like a tweezers and push the leads of the SW5 pushbutton up to the panel to make the black part stick above the panel about 1 mm.

Now you can solder it!

Please take into account that certain terminals of switches need significant heating time because ground planes have large area and take heat away from pads. If you have an adjustable soldering iron, heat it up a bit.

YAY! SOLDERING IS COMPLETE!

It is advisable to clean the Board 2 a second time, from the rear side, but you must do it carefully, avoiding moistening of the hardware. Any liquid inside the pots, switches or jacks can cause serious performance degradation.

13. FIRST POWER-ON

The KOTELNIKOV module does not need any adjustment, but for correct centering of certain knobs it is advisable to power on the module and monitor the output signal somehow.

Look over the module one more time and check all you can.

Set the Transient Generator section controls to the following settings:

Attack — min., Decay/Release — max., mode — LFO, speed — Normal.

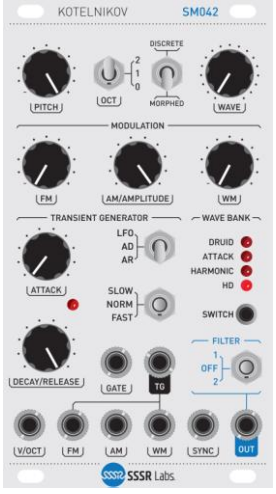
Connect the power, power-on your system and make sure that DRUID indicator is on and TG LED is blinking. If it does not happen within two seconds after power-on, turn it off immediately and check for build errors again.

If module is working as intended, you can proceed to knobs calibration.

14: KNOBS CALIBRATION

Prepare a thin permanent marker or a soft pencil. You need to find an accurate mid-point for three polarized potentiometers then draw a straight-to-the-top line on the shafts. After that you will be allowed to turn pots and get access for screwdriver to install knobs.

14.1: PITCH KNOB CALIBRATION



Set up the module as shown on the picture.

Observe the output frequency with an oscilloscope, frequency meter, tuner or your ears and turn the Pitch shaft counterclockwise until the frequency stops changing. This is the mid-point.

14.2: FM KNOB CALIBRATION

Set the module as shown on the picture.

Module will sound like a kind of siren. Find the position of the FM shaft where modulation is negligible or disappears completely. This is the mid-point.

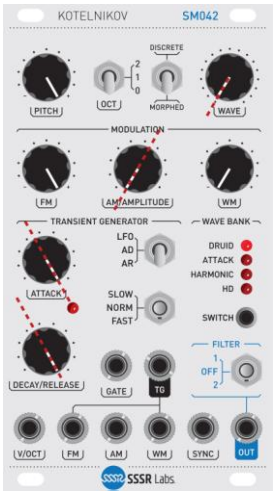
14.3: WM KNOB CALIBRATION

Change the settings to be as on this picture.

Find an exact WM shaft position where the waveform does not change or changes negligibly.

15: INSTALLATION OF KNOBS

Turn shafts like this:



PITCH, FM, ATTACK, DECAY/RELEASE — fully CW; WAVE, AM, WM — fully CCW.

Unscrew the set-screws to stick about 1mm outside the knob.

Put on and secure the knobs one by one being guided by your own marks and the picture. Please pull knobs a bit above the surface of the panel to avoid scraping the bottom of the knob by a potentiometer's nut.

Well done! You just have built a brand-new KOTELNIKOV!