● 16HP Eurorack Module ● Built & designed in Belgium ● www.shakmat.com

Shakmat Four Bricks Rook Building Guide

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1. Preamble

Thank you for purchasing a Shakmat DIY kit !

We spare no effort in our kit packing process to prevent any mistakes or missing parts. In this document as well, we do our best to describe the assembly process in the most practical and comprehensive way. If by any chance there is a missing/damaged part in your kit or if you have any suggestion, feel free to contact us via shakmat.com.

The assembly process will be dramatically simplified if you follow the order defined by this building guide. We tested various orders of steps before finding the most convenient, and the one presented here is the best!

2. Component list & necessary tools

Pack 1

1x 1.5 kΩ 1% resistor
4x 33 kΩ 5% resistors
1x Red LED
4x Green LEDs
1x 2x5 pin power header
1x Mini potentiometer
3x Metal potentiometers
3x Metal potentiometer nuts
3x 33 μF electrolytic capacitors
2x 8 pin male header
2x 3 pin male header
10x Jack connectors
10x Jack connector nuts
1x 7 segment display

Pack 2

1x 5.6 kΩ 1% resistors
4x 1.2 kΩ 1% resistor
11x 1N4148 diodes
1x 78L05 regulator
1x WhiteLED
9x Amber LEDs
9x Push buttons
4x M3 screws
4x M3 nuts
5x Round push buttons caps
4x Square push buttons caps

Pack 3

1x Top PCB
1x Bottom PCB

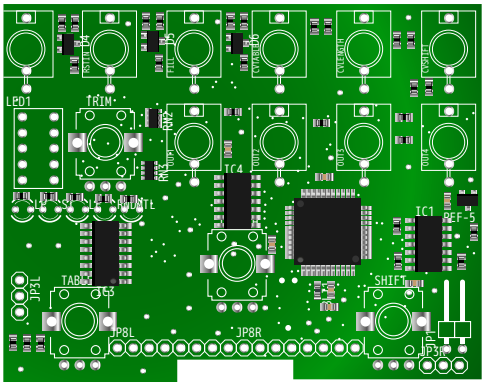
Loose parts

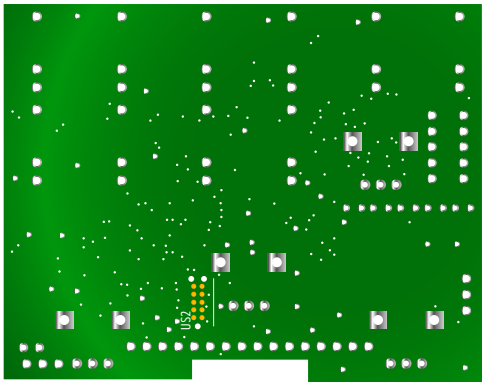
3x Black rubber knobs
1x Power cable
1x User manual

Necessay tools

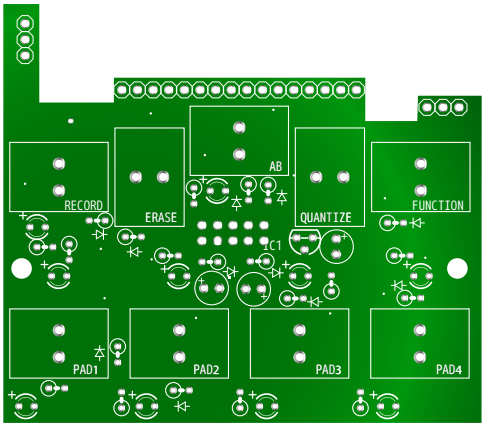
Soldering iron
Solder
Cutting pliers
Masking tape

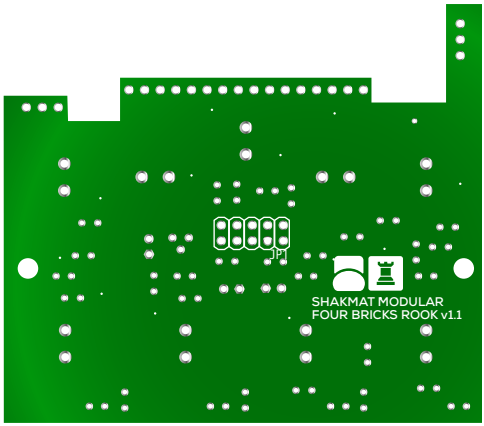
3. PCB details





Top PCB
Front & back



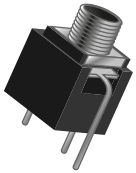


Bottom PCB
Front & back

4. Top PCB assembly

4.1 Front

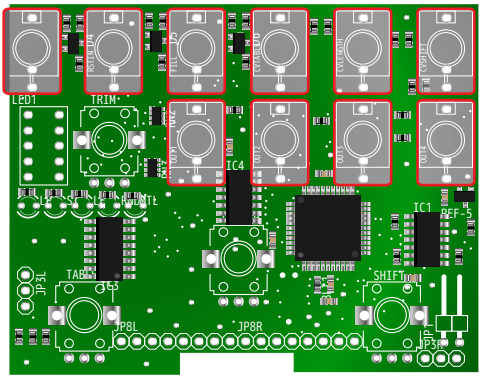
4.1.1 Jack connectors (x10)



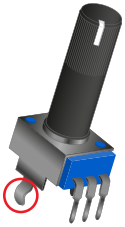
P1

Let's begin by soldering the ten jack connectors. Be sure to lay them completely flat on the PCB before soldering. If those jacks aren't perpendicular, the front panel will be very hard to mount.

If one of the jack is not perfectly perpendicular with the PCB, you can reheat the pads and push it until it is with your thumb.

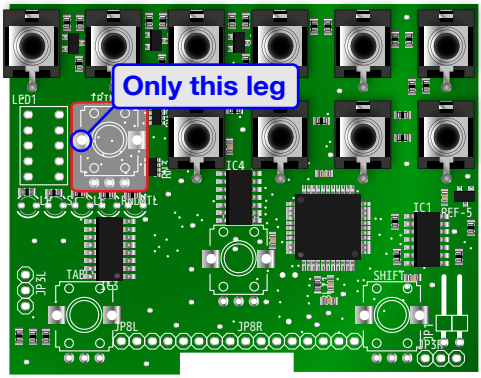


4.1.2 Mini potentiometer

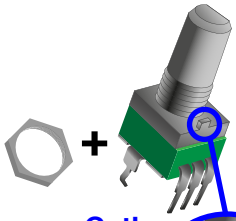


P1

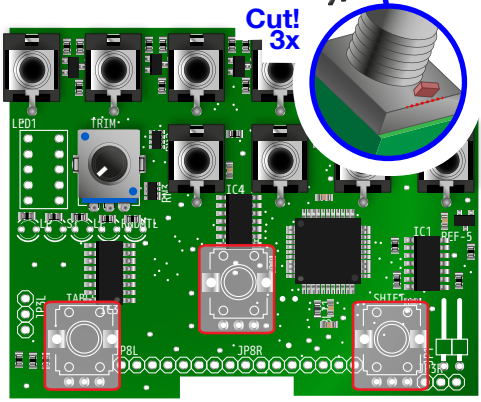
Place the mini potentiometer. To ensure a perfect alignment of the potentiometer with the front panel, solder only one of the mechanical pins and nothing else. You will solder the remaining pins once the potentiometer is well placed through its front panel hole.



4.1.3 Big potentiometers & nuts (x3)

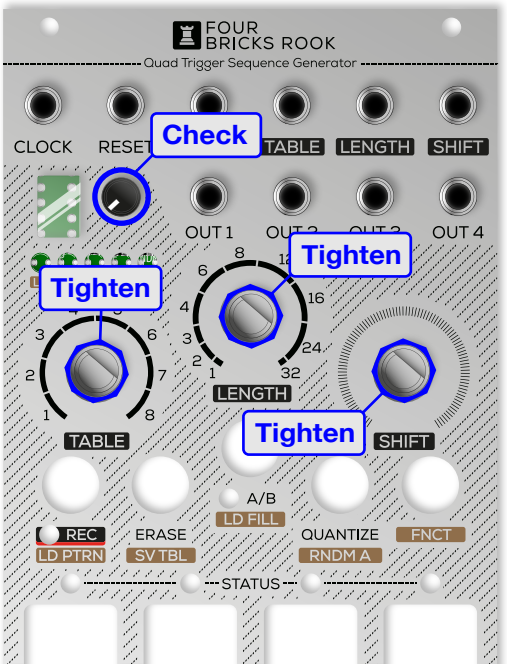


Before soldering, you will have to cut a little metal piece off the top of each potentiometer, as shown in the picture. This little stud prevents the front panel from sitting properly. Use some small & sharp cutting pliers for this task.



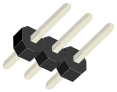
Then place the 3 big potentiometers on the PCB. Mount the front panel and tighten the 3 potentiometer nuts (this will ensure a proper placement of the pots) and then solder them.

Now verify that the mini potentiometer from the previous step is well placed thrugh its front panel hole. It must move freely without touching the panel. If necessary, you can reheat the only pin you have soldered to adjust the pot placement. Once the placement is OK, you can solder every remaining pin.

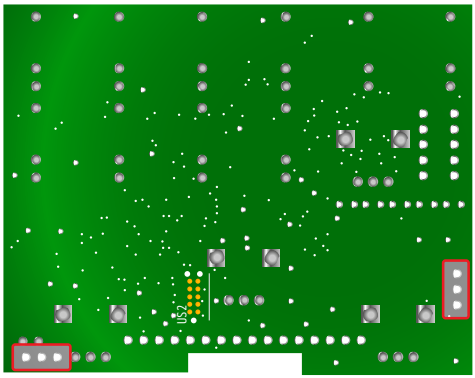


4.2 Back

4.2.1 Male headers (1x3 pin) (x2)



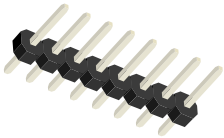
P1



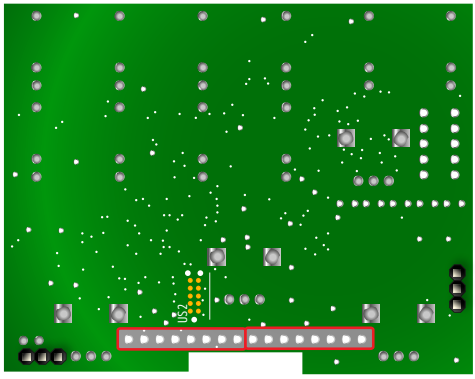
Flip the PCB and place the 3 pin male headers, with the short pin side through the hole. Be sure to lay them flat and upright. Those headers will later join the two PCBs together so they need to be perfectly perpendicular.

We recommend you to only solder one of the pin. Then reheat your soldered point and simultaneously press the plastic part of the header against the PCB to until its flat on the board. Release the soldering iron but keep pressing. Avoid touching the pins themselves because they will become hot very quickly and move out of alignment within their plastic bracket. Once you are satisfied with you placement, solder the remaining pin.

4.2.2 Male headers (1x8 pin) (x2)



P1

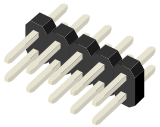


We will solder these two headers one by one. Place them, with the short pin side through the hole. Use the same procedure as for the smaller headers. It is even more important to have these two big headers upright than the smaller headers.

5. Bottom PCB assembly

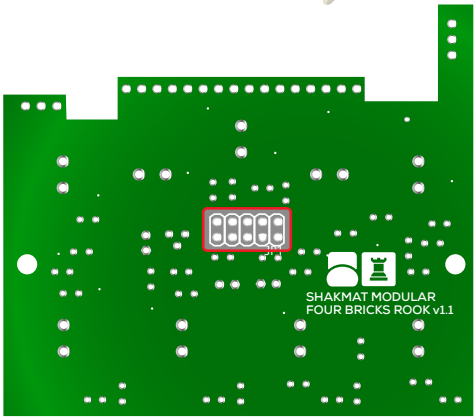
5.1 Back

5.1.1 Power header



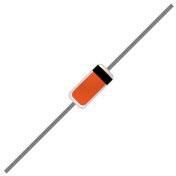
P1

Place the power header, short pin side in the hole and solder only one of the pins. Check the alignment and correct with the same method as for a single row header. Then, once your component is upright and flat with the PCB, solder the remaining pins.



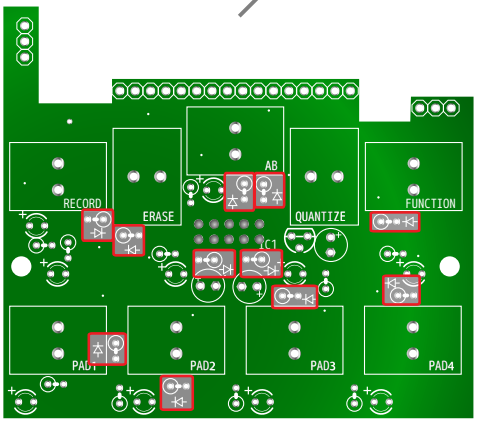
5.2 Front

5.2.1 1N4148 Diodes (x11)



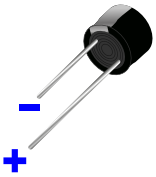
P2

Flip the PCB and place the eleven diodes. Be aware of their orientation, as the black line on the component goes into the circled hole on the silkcreen. Push the diodes all the way through their holes and be careful not to bend the leg too far from the diode's body, as this can lead to shorts with the aluminium front panel.

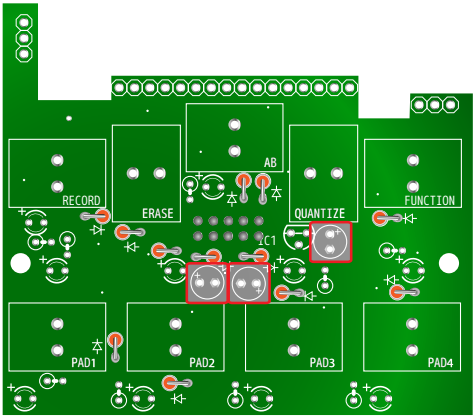


5.2.2 Electrolytic capacitors (x3)

P1

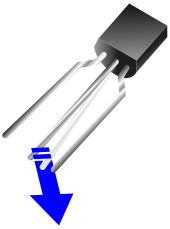


Solder the three 33μF capacitors. You must pay attention to the orientation of these components. The long leg is indicating the positive side, therefore it has to match the + sign on the PCB silkscreen.

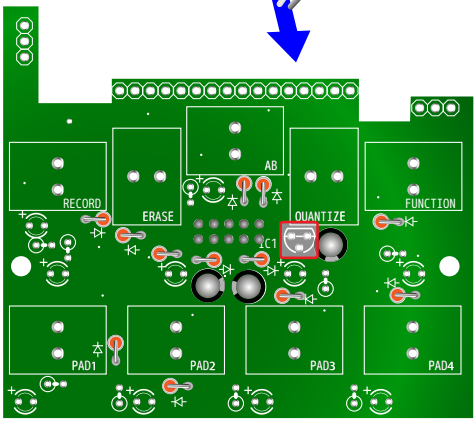


5.2.3 78L05

P2



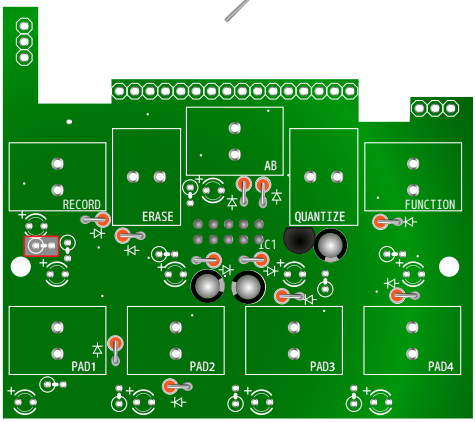
Before soldering the 78L05, bend the central leg a little to help it sit flush with the PCB. Also pay attention to the orientation, the flat & round contour of the component have to match the contour of the PCB silkscreen.



5.2.4 1.5 kΩ 1% resistor

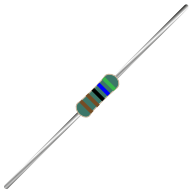
P1

Solder the 1k5Ω resistor.
There's no orientation to observe on resistors. Be careful not to bend the leg too far from the resistor's body, as this can lead to shorts with the aluminium front panel.

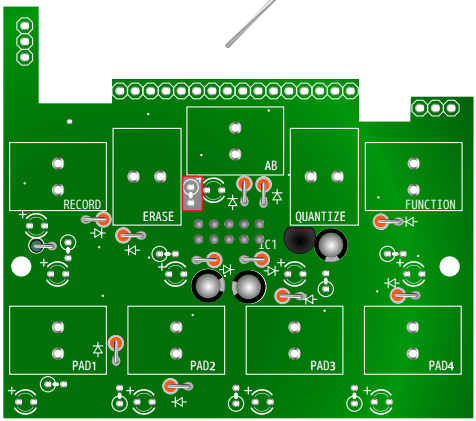


5.2.5 5.6 kΩ 1% resistor

P2

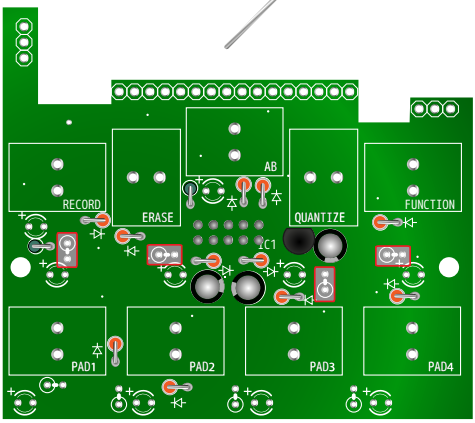


Solder the 5k6Ω resistor.
There's no orientation to observe on resistors.

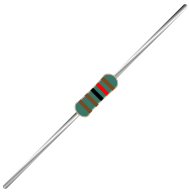


5.2.6 33 kΩ 5% resistor (x4) P1

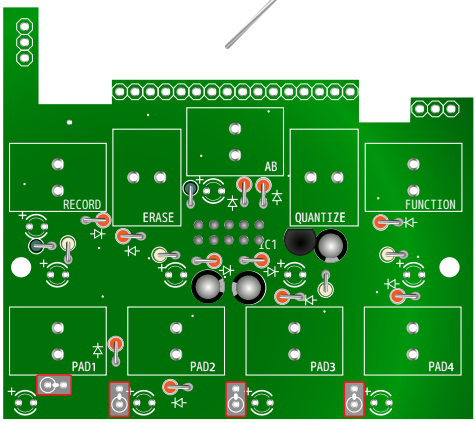
Solder the four 33kΩ resistors.
There's no orientation to observe on resistors.



5.2.7 1.2 kΩ 1% resistor (x4) P2



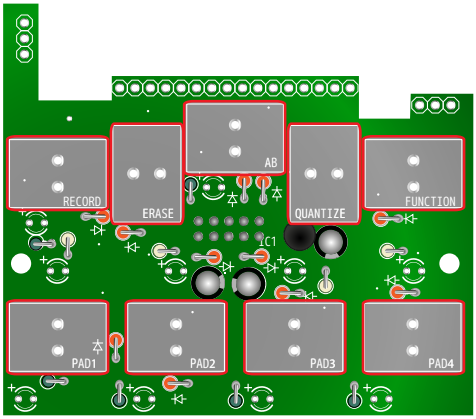
Solder the four 1k2Ω resistors.
There's no orientation to observe on resistors.



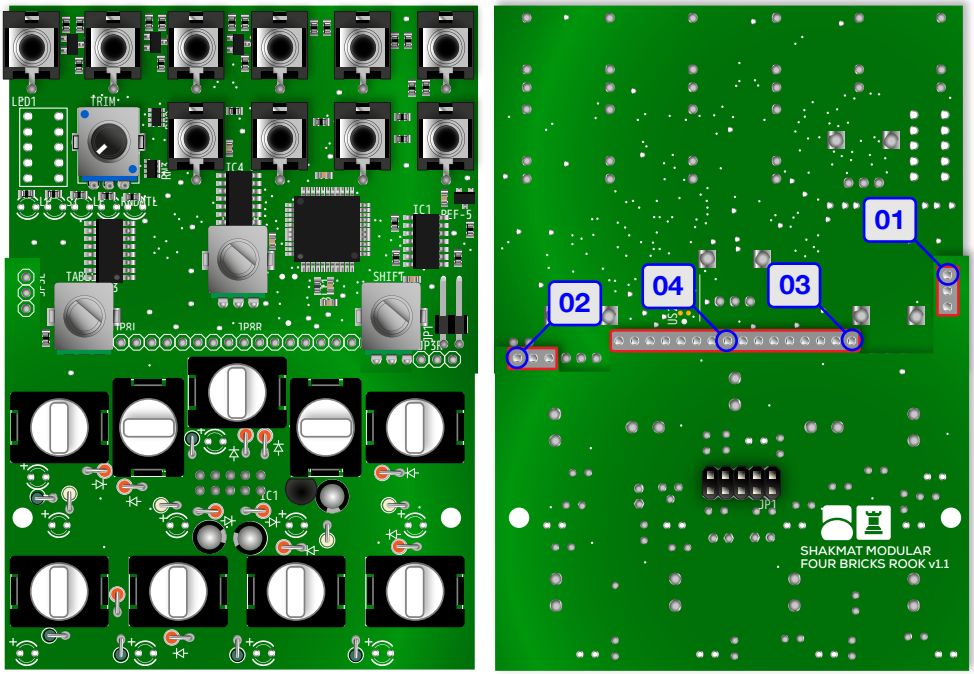
5.2.8 Push buttons (x9)

P2

The buttons need to be upright and pushed well against the PCB. An imprecise mounting will result in a cap scrapping against the front panel. We recommend you to place the buttons, then flip the PCB (holding the button in place with a piece of cardboard) and press it against a table.



6. PCB stacking



It's now time to join and solder the two PCBs together. Be **very careful** during this step. If you solder every pin and the PCBs arn't well alligned, you will likely not be able to correct it and will encounter all sorts of problems on your way to the end of this build.

The first step is to assemble the two PCBs as shown above, and only solder the first pin of the small vertical header. It is vey important that you firmly hold the two PCBs against each other while soldering this point. There must be no gap between the PCBs and the header's black plastic part between them.

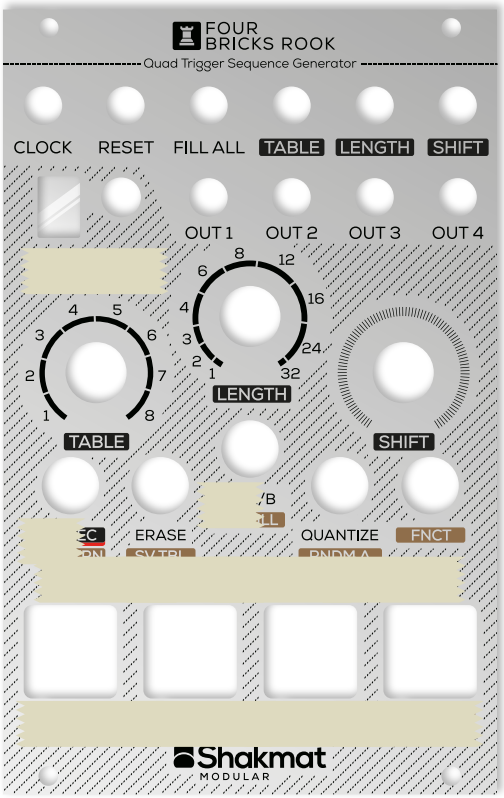
Once you've soldered the first point and it's perfect, you can move on to the second one listed above. Repeat the same procedure as for the first point for all of the four points listed. Once they're are all perfect, without any gap between the PCBs and headers, you can solder every remaining point.

7. Front panel preparation

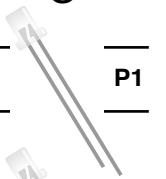
M3 nut (x2)	P2

Place some masking tape over every LED hole on the front panel. Be aware of not blocking any other component's hole with the tape. The LEDs are special flat top models intended to be mounted flush with the front panel. The masking tape will help you to do this neatly.

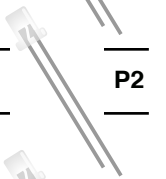
You also need to screw a small M3 nut on each of the two studs of the back of the front panel. You can screw them almost until the end of the thread. In addition to these, two other nuts added later will assure the stability & alignment of the PCB's bottom half.



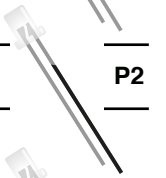
8. LED mounting



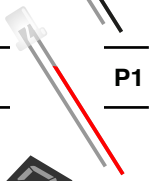
Green LEDs (A x4) **P1**



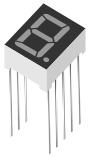
Amber LEDs (B x9) **P2**



White LED (C) **P2**



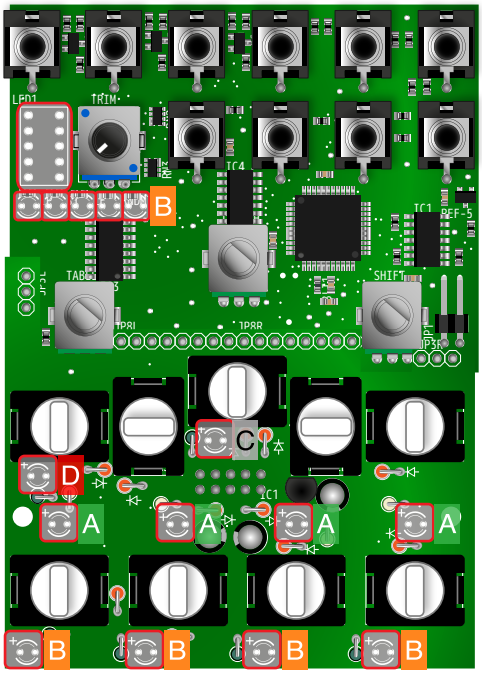
Red LED (D) **P1**



7 segments display **P1**

Potentiometer nuts (x1) P1

Jack nuts (x2) P1



LED POLARITY!

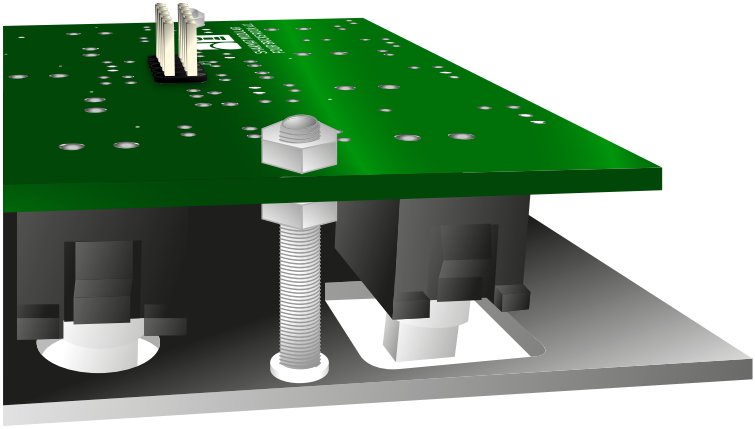
M3 nut (x2)

P2

Placing the LEDs requires a specific orientation due to their polarity. The long legs are the positive side and they all go into the left holes of the PCBs.

Place all the LEDs and the 7 segment display through the PCB. Be aware of LED colors, the white LED has a black leg & the red LED has a red leg. Also pay attention to the orientation of the display (the dot is on the bottom line). Assemble the PCBs & front panel with some nuts: one on the Clock input, one on Out 4 and one on the Length potentiometer.(...)

(...) Once everything is well secured, it's time to adjust the two small M3 nuts you've screwed on the previous step. These nuts have to rest against the PCB and can be used to correct the bottom half PCB horizontality. Screw them until the PCB is parrallel to the front panel from every angle (when the module is held horizontally, the front panel toward the ceilling, check from the left, right and bottom sides). When the PCB is well aligned with the front panel, tighten the two last M3 nuts on the stud to secure the bottom PCB in place.



▲ View of the left stud securing the bottom PCB to the front panel, with the two nuts correctly mounted in place

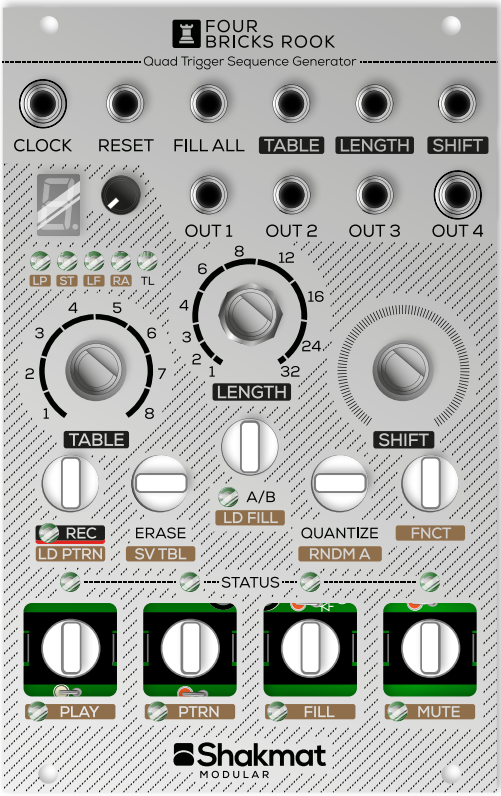
Now, push every LED through their holes until they sit flush with the panel and stick to the tape. Once they are all in place, you can solder them and trim their legs. Finally, solder only one leg of the 7 segments display and check that it sits well against the front panel window. Triple check the display alignment through the front panel window. When all of its legs are soldered, it is imposible to correct its placement. Once it's nicely placed, you can solder the remaining legs of the display and trim them all.

9. Nut mounting

Potentiometer nuts (x3)		P1
Jack nuts (x10)		P1

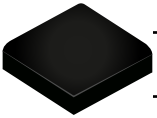
Screw all the nuts on the big metal potentiometers and mini-jacks. To firmly secure the bottom half of the PCB, tighten the two last M3 nuts over the front panel studs. Those nuts and the previous ones, installed behind the PCBs and have to be firmly tightened in place so that the PCBs are well held.

To ensure that these M3 nuts don't become loose over time and fall inside your case (potentially causing electrical damages), we recommand you to put a little dab of loctite or nail varnish over them.



10. Potentiometers & buttons Caps

Small button caps (x5) **P2**

Big button caps (x4)  **P2**

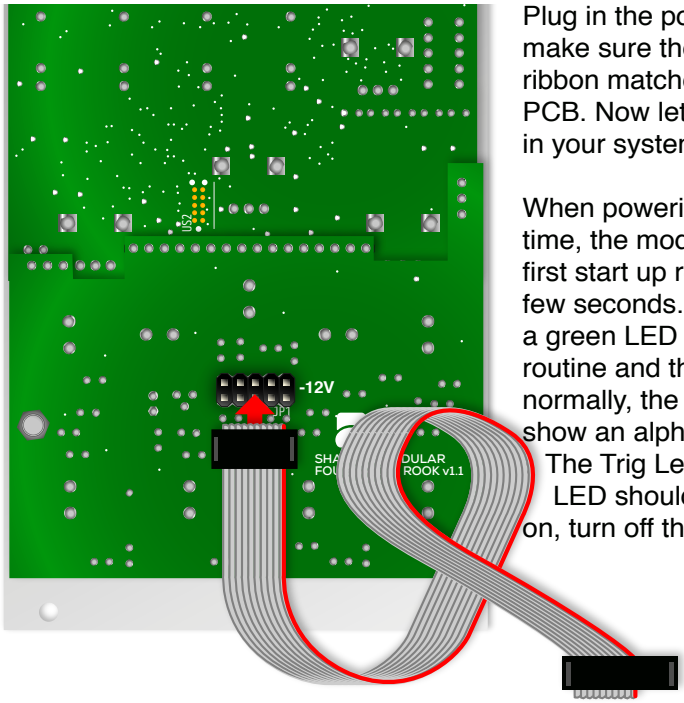
Pot knobs (x3) **LP**

Mount the five small button caps and the 4 big ones. If they somehow feel a bit loose, you can glue them on the component with some gel glue. Just be careful not to let the glue drain down the button and destroy it!

At this step if a button is not sitting properly on the front panel, you can reheat its two solder points at the same time and adjust it.

Finally, push the three knobs onto the potentiometers.

11. Powering & basic testing



Plug in the power cable and make sure the red side of the ribbon matches the -12V on the PCB. Now let's plug the module in your system and test it.

When powering up for the first time, the module will launch a first start up routine that lasts a few seconds. During this routine a green LED flashes. After the routine and the module starts up normally, the display should show an alphanumeric character. The Trig Length & Play mode LED should be on. If nothing is on, turn off the rack immediately.

Check the power cable connection, the orientation of all the diodes of step 5.2.1. The power header (5.1.1), the 78L05 (5.2.3) and all the headers joining the two PCBs. You can also measure the voltage between a potentiometer's external pins, which should be around 5 volts.

If the module starts (even with one of the two LEDs off or a buggy display), you can still test it. First, test the square buttons and mode LEDs by swapping between the three different modes (FNCT + one of the four pads). This step will show you if the pads & mode LEDs are working. Then, try the different menu options (random, save and load table / fills). Don't forget to press the FNCT button to exit menu.

If some LEDs or buttons don't respond correctly, check the polarity of the LEDs and diodes. You can also check all the buttons, resistors and LEDs solder points.

Go to PTRN mode, play with the four pads and make sure that all the green Status LEDs are working. Send a clock signal to the Clock input and the LEDs should start blinking. Turn the table potentiometer fully clockwise (position 8), all the LEDs should blink. Play with the Length and Shift potentiometer; the green Status LEDs should blink differently. Send bipolar CV signals to the Table CV input and the pattern should change.

Now test the four outputs and reset input.

Finally, remove the clock input, press on the four pads, and send a high gate signal (or any 5V signal) into the fill input. All the green Status LEDs should turn on. If at any moment you feel lost in a menu or stucked with something you don't understand, turn the module off and on again. After testing, take time to read the manual before playing - enjoy !

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