BMC58. Yes No Maybe Sequencer

last updated August 28th, 2019

I.Using The Module

A. What does it do?

This sequencer outputs an 8 or 16 step pattern. Each step has a toggle that can set the output definitely on (YES), definitely off (NO) or maybe on or off (MAYBE). The probability of an output being on can be controlled with the MAYBE knob and MAYBE CV input.

It has three modes: 1 channel 16 steps long with gate and trigger outputs, 2 channels 8 steps long with trigger outputs or 2 channels 8 steps long with gate outputs.

B. Controls/IO

1.Toggles – There are 16 toggles, each corresponding to a single step of the sequence. When a toggle is pushed to the left (NO), there is no output on that step. When pushed to the right (YES) an output will always fire on that step. When the toggle is centered (MAYBE), the output will sometimes fire with the probability controleld by the MAYBE knob.

2.MAYBE knob – This knob controls the probability of the MAYBE steps firing. When fully counterclockwise no MAYBE steps will fire and when fully clockwise all MAYBE steps will fire.

3.MAYBE CV knob/input – The Maybe CV is attenuated by the CV knob and then mixed with the voltage from the MAYBE knob. A negative voltage inputted will act like turning the MAYBE knob counterclockwise and a positive will act like turning the knob clockwise.

4.Reset Button/input – The Reset button returns the sequence to step one on the next clock input. It is also used for selecting modes at power up, so it's a good idea to not leave something patched to the Reset input when first powering up as it could accidentally cause an accidental mode change.

5.Clock input – This is a clock for the sequencer.

6.Outputs – The two outputs will output a trigger or gate signal with a range of 0 to +5V. The type of output is controlled by what mode the sequencer is in.

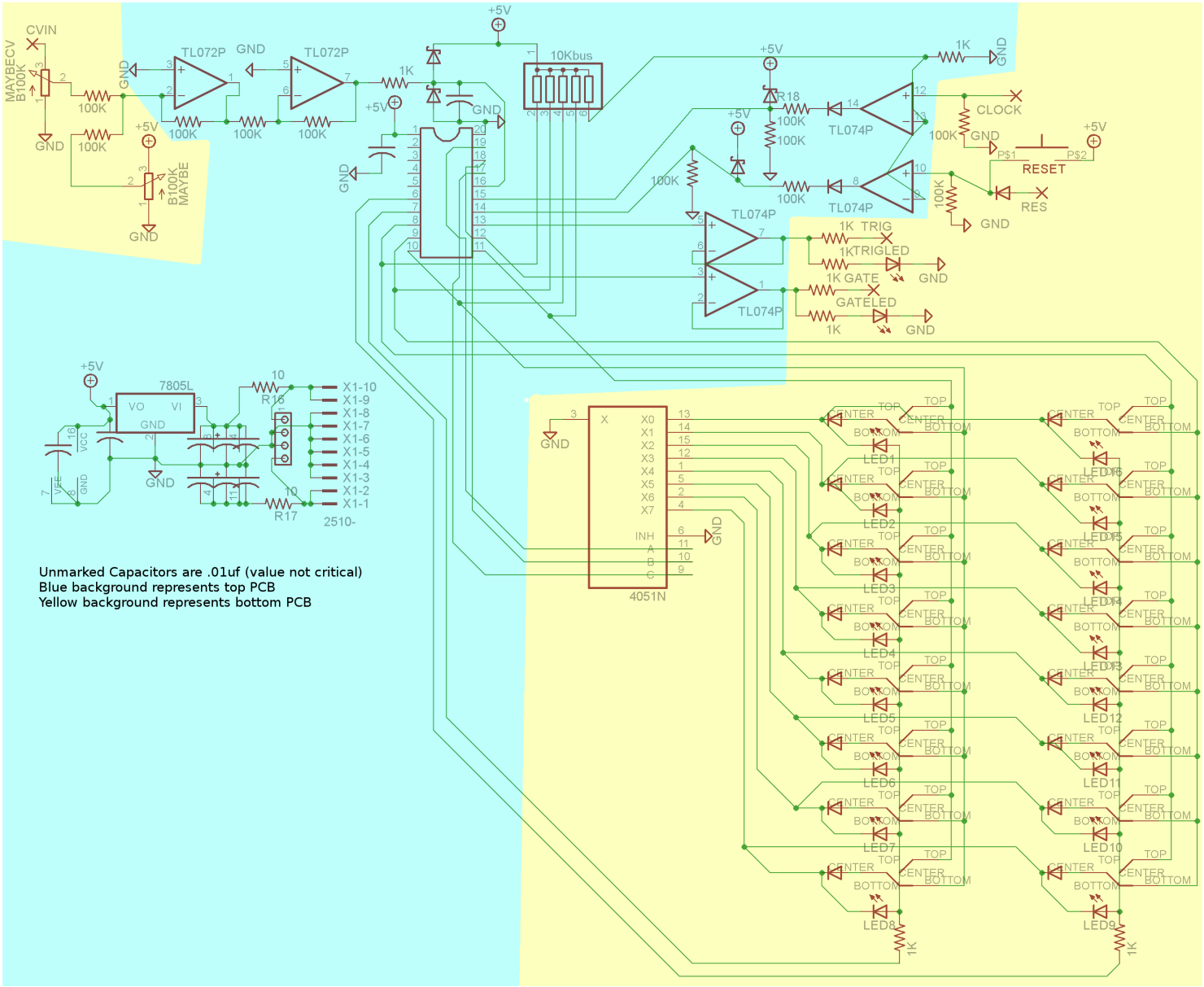
C.Changing Modes

1. With the module powered down, set the knob's position to the selected mode.
2. Hold down the reset button.
3. Power up the module without releasing the reset button.

MODE	# of channels	Outputs	Knob position
16 Step	1	1x Gate, 1x Trigger	Fully Clockwise
8 Step G	2	2x Gate	Centered (up)
8 Step T	2	2x Trigger	Fully Counterclockwise

II. Schematic

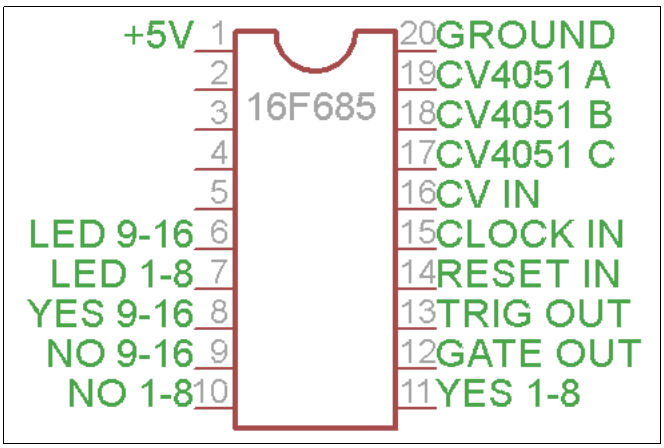
A. Master Schematic

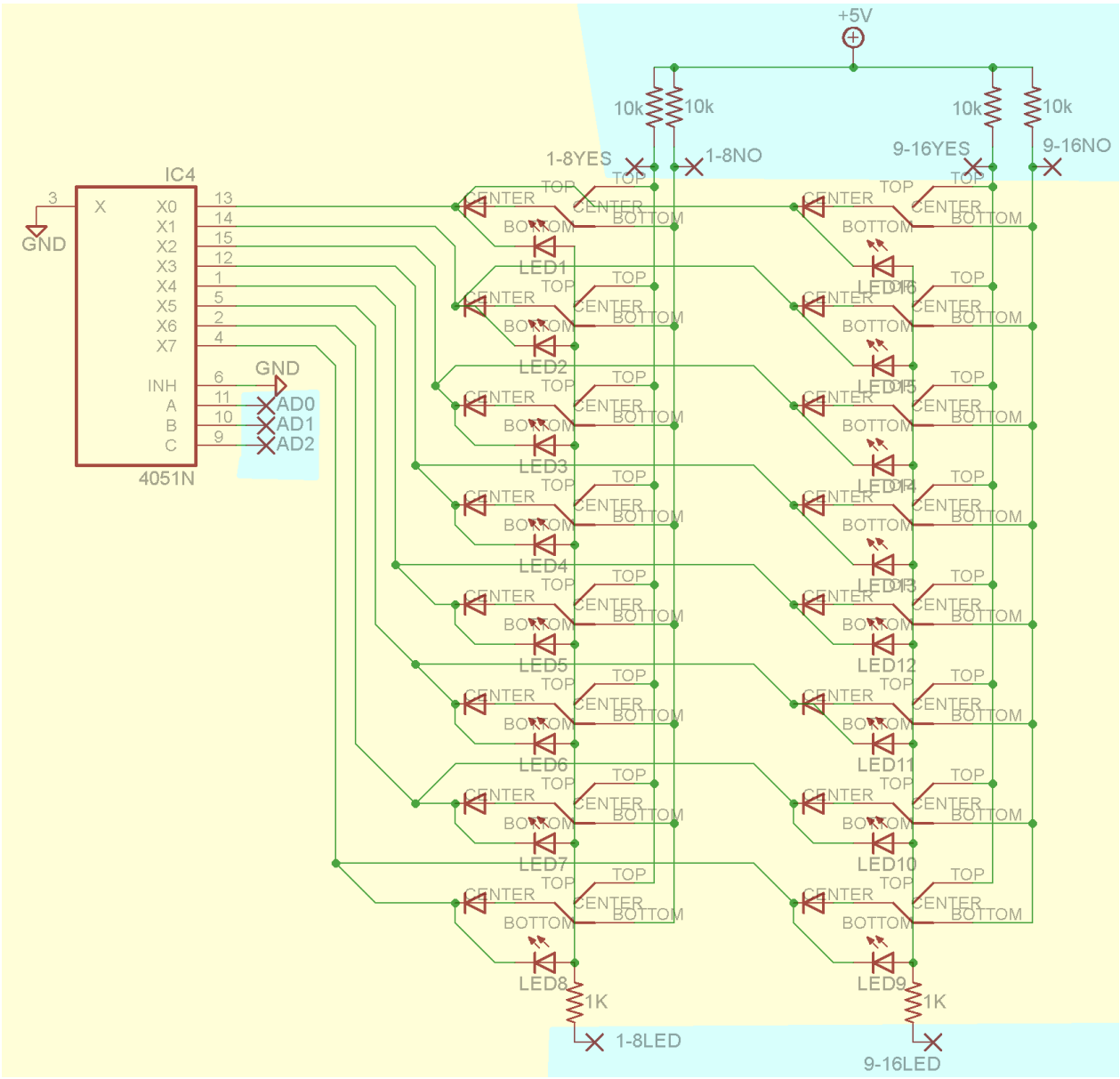


Above is the master schematic. It comprises both PCBs. The components on the Top PCB have a blue background and the components on the bottom PCB have a yellow background.

On the next pages, I'll show different sections of the project in easier to follow bits. You may notice that the master schematic shows a 10K resistor bus, in the following schematics, these will be shown as 10K resistors.

On the right is an image of the pinout of the PIC.





B. Switches

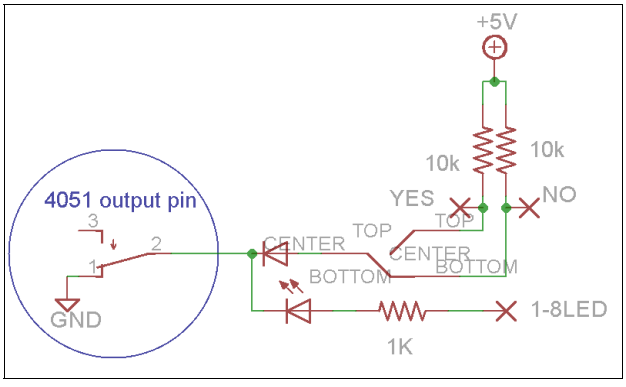
Above are the toggles, LEDs and the circuitry that controls it. On the far left of the image is the CD4051 CMOS switch. Pins 9, 10 and 11 of this are connected to the PIC, which controls which of the output pins connects to ground.

Each output pin is connected to two LEDs and two switching diodes connected to the center of an ON/OFF/ON SPDT toggle. Steps 1 and 9 are both connected to the same output pin of the 4051 as are 2 and 10, etc.

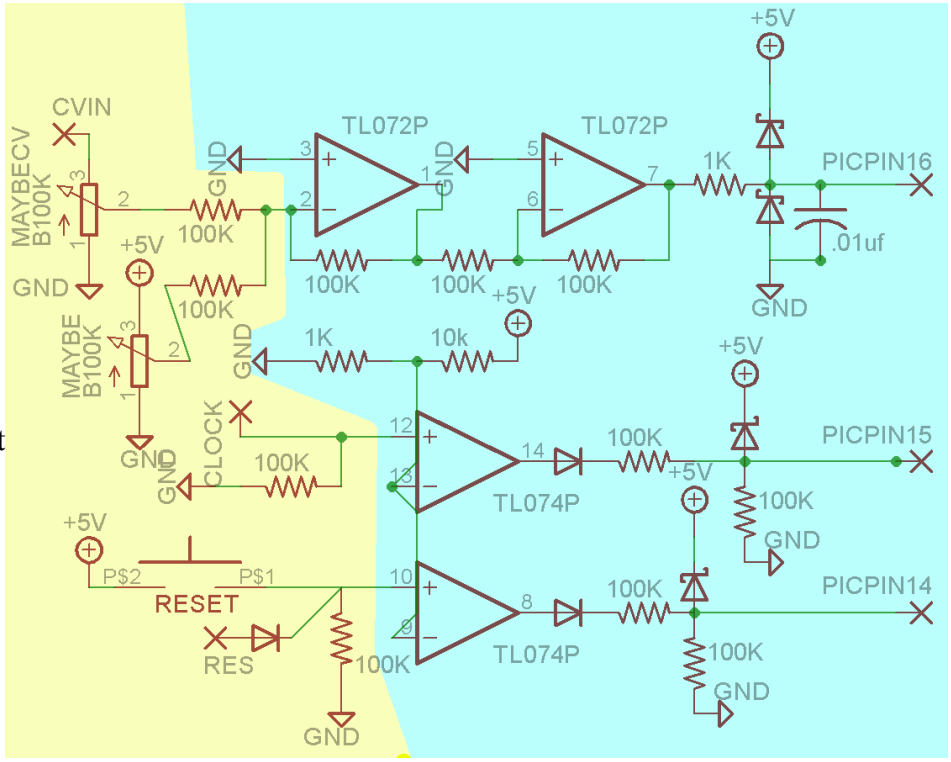
The two outside lugs of each toggle are connected to the PIC with a 10K pull-up resistor set to +5V. When the CD4051 connects to ground for that switch, if the toggle connects the PIC to ground through the switch and diode, it tells the PIC whether or not to fire the output for that step.

The anodes of the LEDs are connected to a pin on the PIC through a 1K current limiting resistor. When the LED controlling pin goes to +5V, the LED will light up for the current step.

To the right is a simplified version of a single toggle/LED set for clarity. The 4051 output pin is represented as a switch.

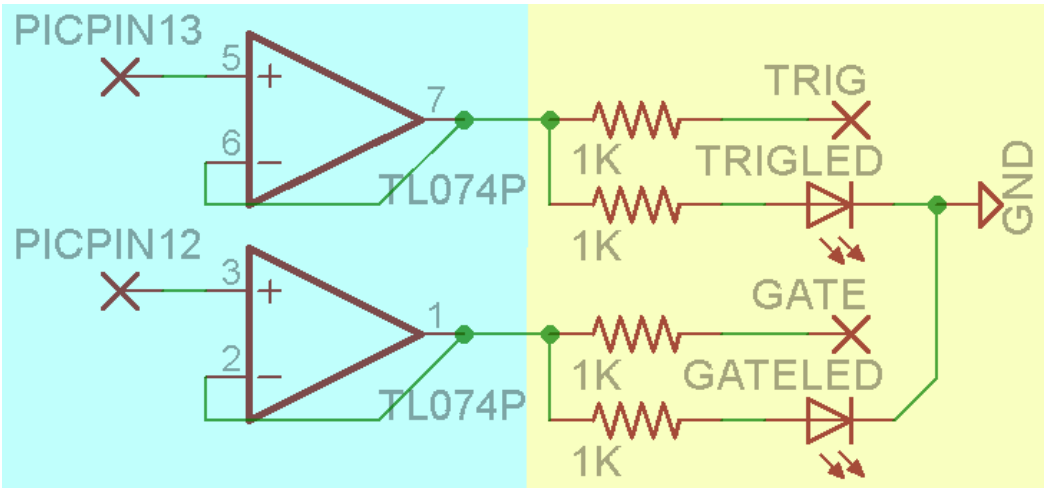


C.Inputs



To the right are the inputs for the module. On the top left, we see the Maybe and Maybe CV pots. The voltage on the wipers of these pots is mixed together by the TL072 op amps and 100K resistor network. Before connecting to the CV input pin of the PIC, a 1K resistor and a pair of schottky diodes form a voltage limiting circuit, and a .01uf capacitor filters noise.

Under the CV inputs are the clock and reset inputs. Each of these is connected to an opamp on the TL074. The opamps are wired as comparators with their thresholds set at .5V by the 10K/1K voltage divider. Each comparator has a 100K resistor to ground on it's input, and it's output goes through a switching diode to prevent negative voltage passing from the comparator's output to the PIC's inputs. A 100K/100K voltage divider and a schottky diode connected to +5V prevent overvoltage from damaging the PIC's input pins.



D.Outputs

Above are the outputs. The opamps are wired as non-inverting buffers. They connect to LEDs through a 1K current limiting resistor, to the output wirepads through a 1K output impedance setting resistor.

III. Construction

A.Parts List

Semiconductors

Value	Qty	Notes
PIC16f685	1	Came with your PCB
TL072	1	8 pin DIP package
TL074	1	14 pin DIP package
CD4051	1	16 pin DIP package
78L05	1	+5V voltage regulator, TO92 package
Schottky Diode	4	Any schottky diode should work, 1N5819, 1N60, BAT46, etc
Switching Diode	19	1N4148, 1N914 or any small signal switching diode
LED	18	3mm package

Resistors

Value	Qty	Notes
10 ohm	2	7.5mm lead spacing. 1/4w Metal Film unless otherwise noted on all resistors
1K ohm	8	
100K ohm	11	
10K 6 pin bussed array	1	SIP package, or make your own.
B100K Pot	2	PC mounted 9mm, parallel mount. Like this.

Capacitors

Value	Qty	Notes
.01uf	6	Ceramic type. Value not critical.
10uf	2	2.5mm lead spacing Electrolytic 16V or higher

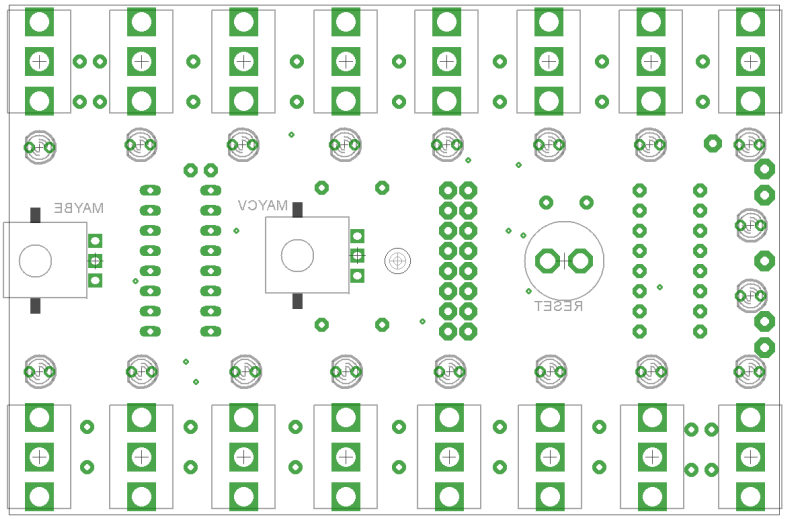
Other

Value	Qty	Notes
8 pin DIP socket	1	
14 pin Dip socket	1	
16 pin DIP socket	1	
20 pin DIP socket	1	
Power Connecter	1	either Eurorack or MOTM style, depending on your synth format
SPDT ON-OFF-ON	16	I use these. They will fit the PCB
Jack	5	Whatever type your synth format uses
Pushbutton	1	I use these. They will fit the PCB
2x8 Female Pin	1	I uses these.

Header		
2x8 Male Pin Header	1	I buy 40 pin two row male header like this, and then cut it down.

B. PCB Information

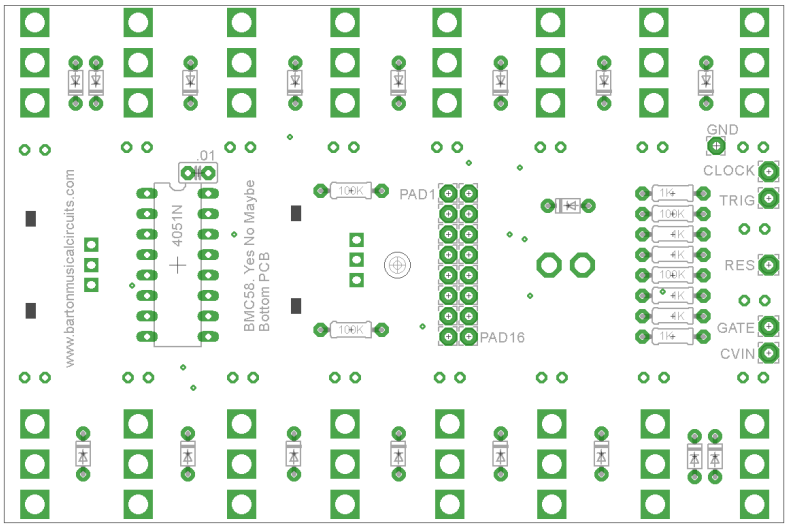
To the right are images of the bottom and top of the bottom PCB and the top of the top PCB.



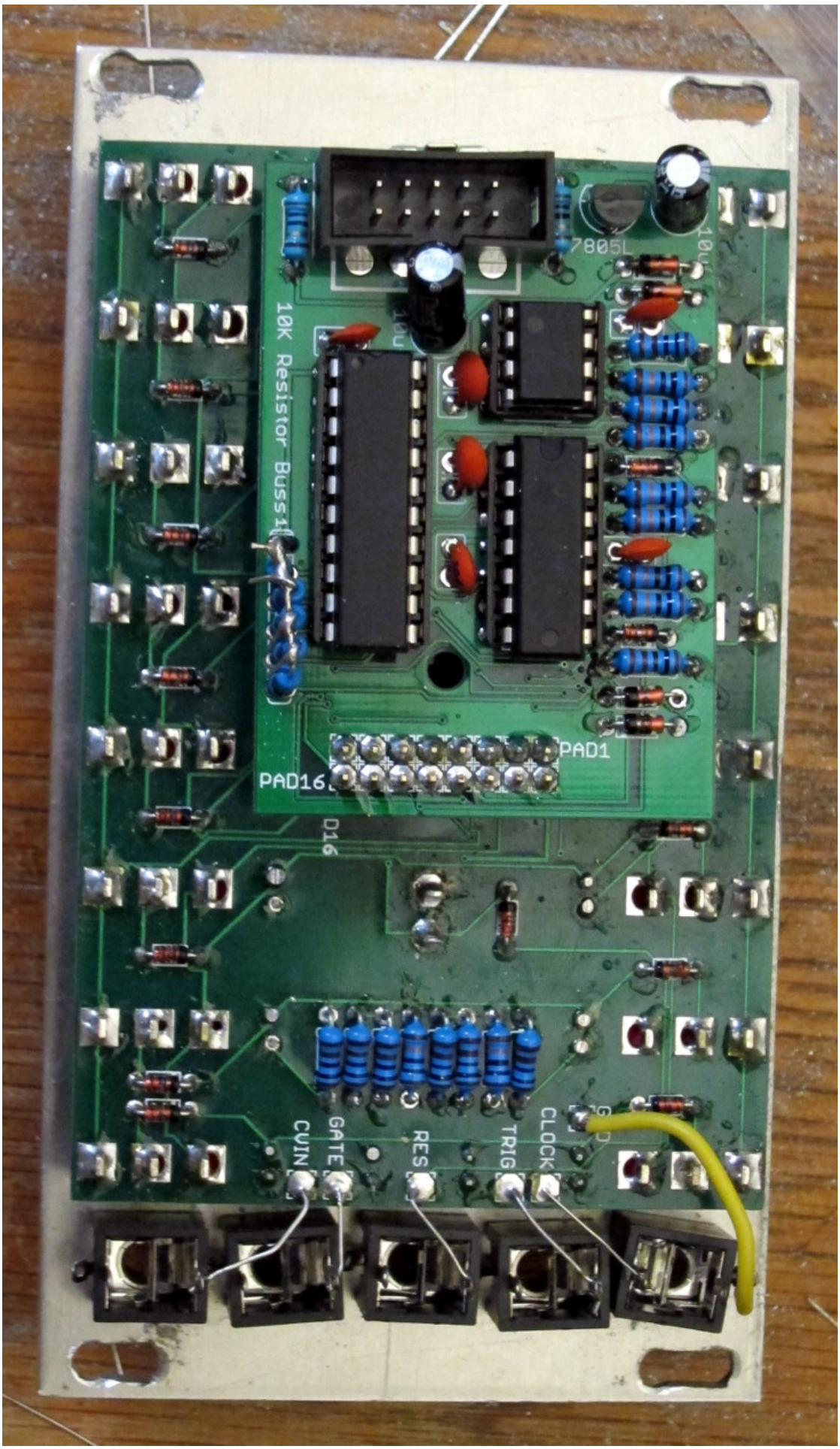
C.Wiring

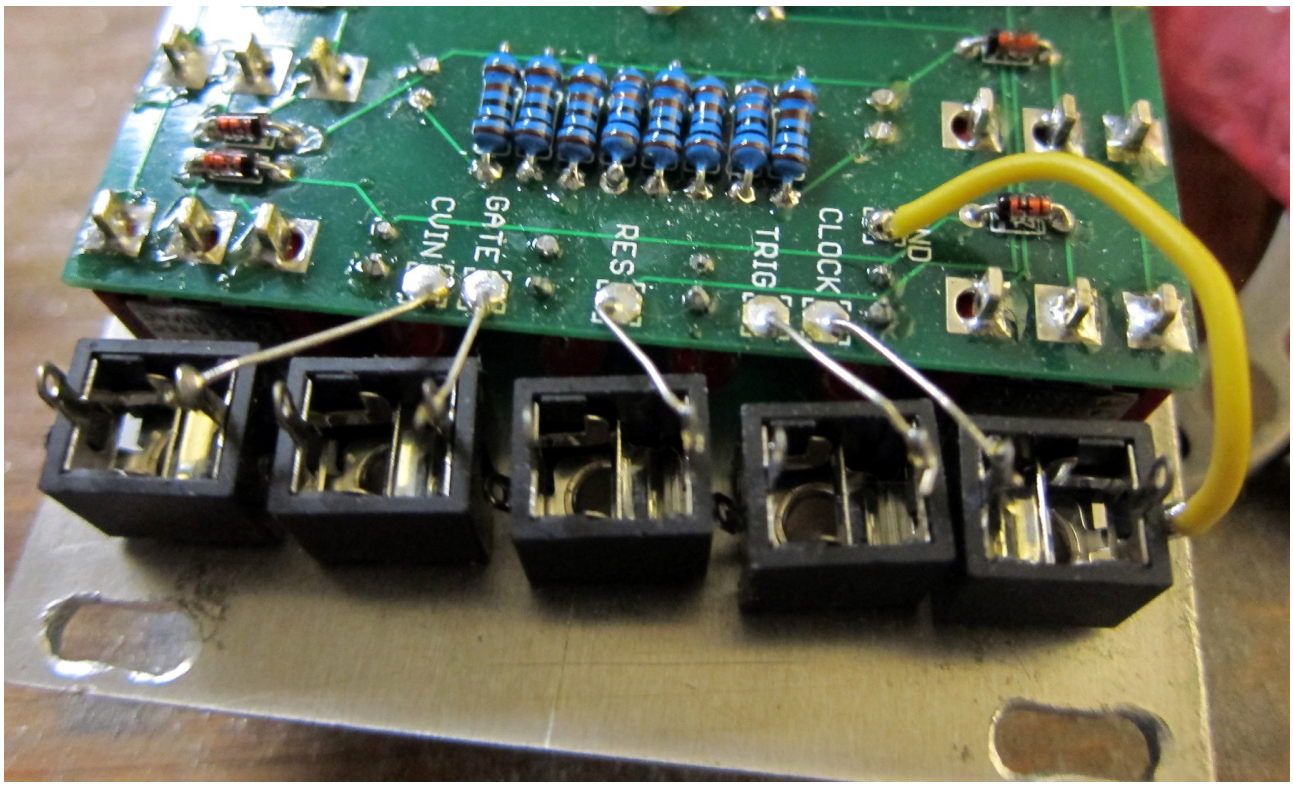
Wiring is very simple. The CLOCK, TRIG, RES, GATE and CVIN wirepads all connect to the tip of the appropriate jack. GND connects to the sleeve of a single jack if using a metal panel. If using a nonconductive panel, connect it to the sleeve of each jack.

On the next pages are photos of a completed build.

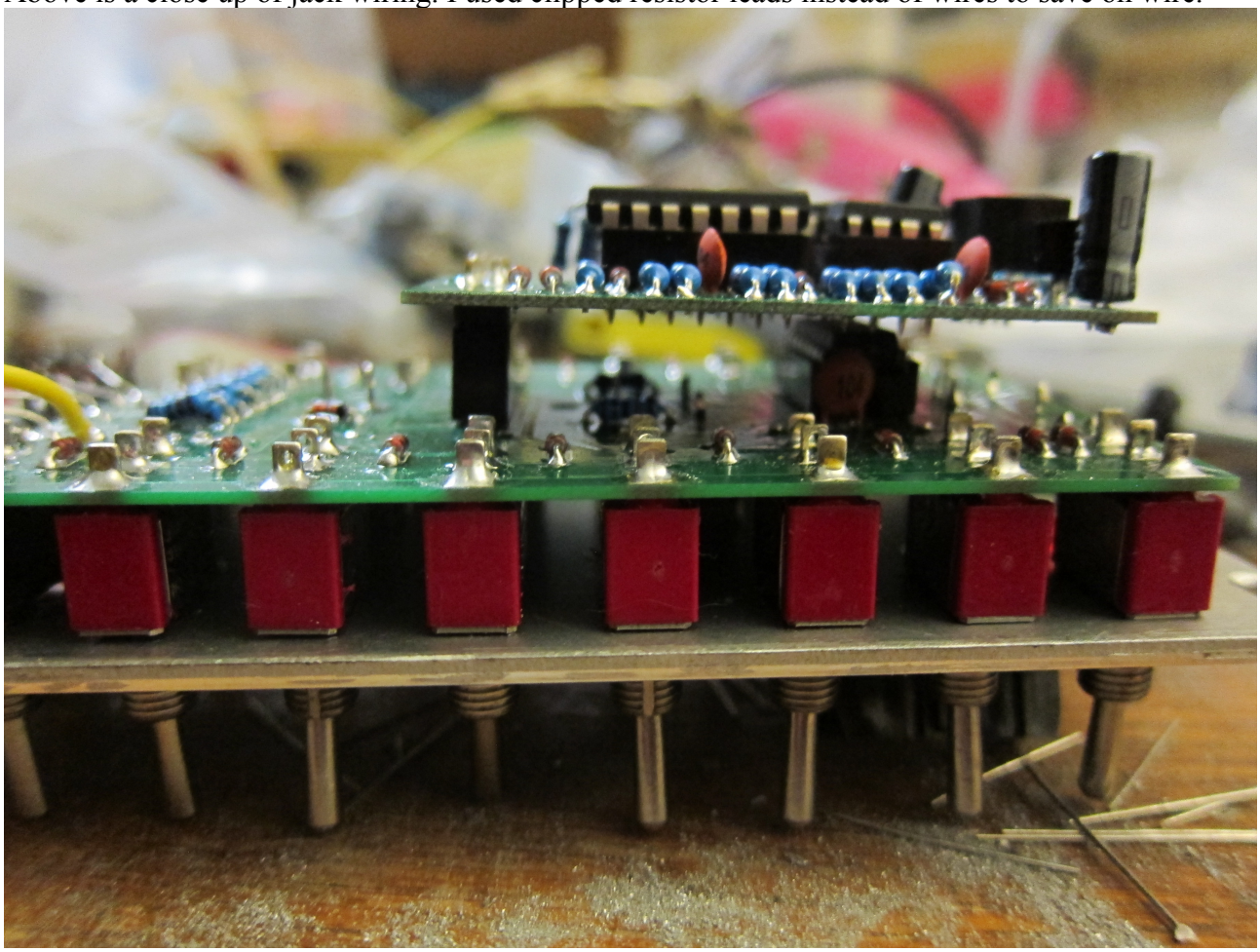


Here is a complete build using a home made resistor array.





Above is a close up of jack wiring. I used clipped resistor leads instead of wires to save on wire.



Above is a close up of the connection between the two PCBs. Make sure you clip leads on the bottom side of the top PCB so they don't short against the 4051 that sits below the PCB. There are holes in the PCB to use an optional spacer to keep PCBs seperated.