BMC112. Divided Step Sequencer

If you have any questions, or need help trouble shooting, please e-mail
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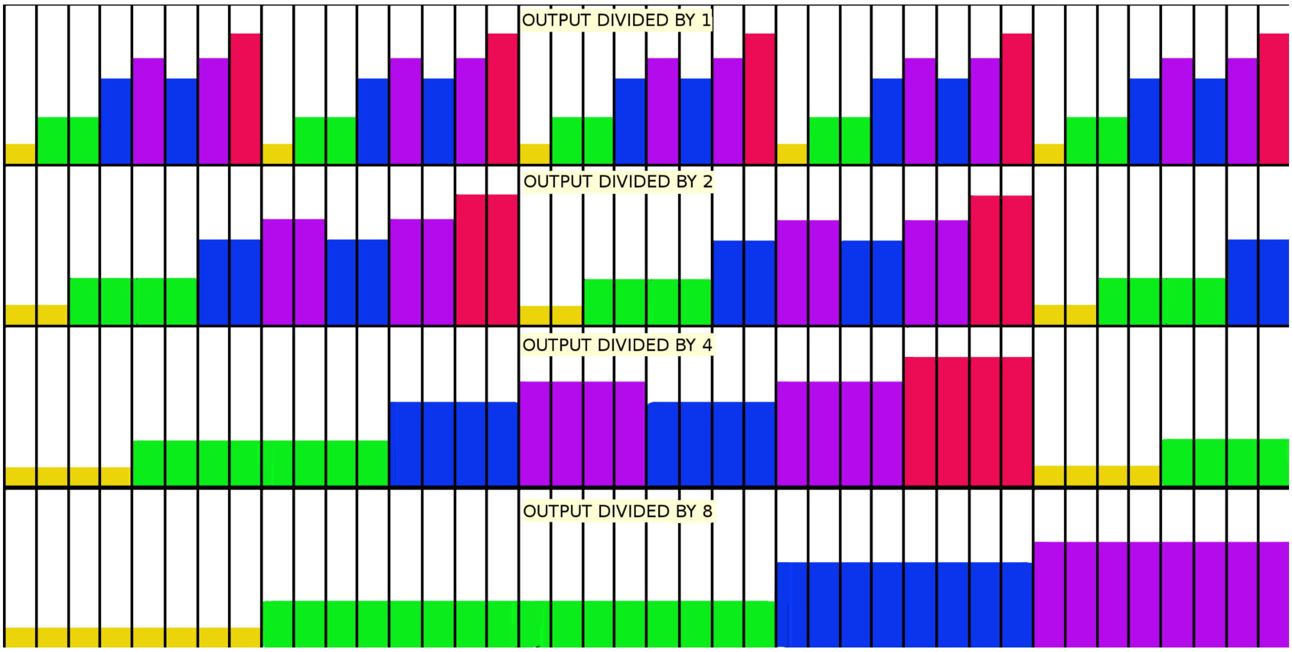
I. What it Does

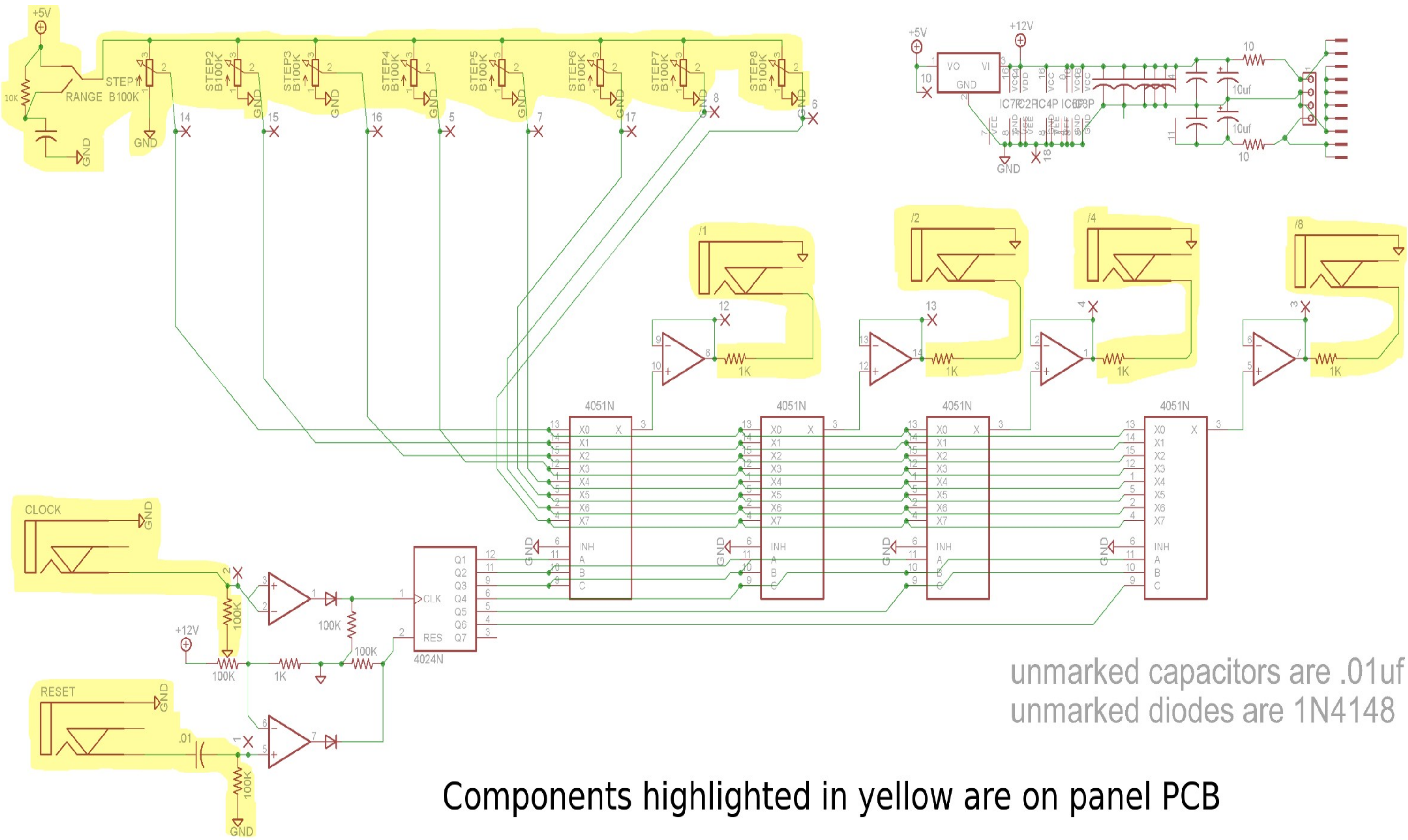
This module is an eight step CV sequencer with it's 4 different outputs which change the outputted step at different rates with each output changing at half the speed of the previous output. The graphic below illustrates the voltage changes, each vertical black line representing one clock tick.



The PCB is set up only for Eurorack, with attached jacks and no footprint for MOTM style power jack.

CONTROLS/INPUTS/OUTPUTS

VOLTAGE KNOBS – These 8 knobs set the voltages sent to the outputs.
RANGE TOGGLE – **T**his controls the voltage range of the module, choosing between a wide range or fine control over just a couple of octaves. In full range the voltage can go from 0V to +5V and in fine mode it goes from 0V to +2.6V
CLOCK INPUT – When voltage goes high on this input the sequencer will move onto the next tick of the clock.
RESET INPUT – When a pulse is input to this jack, all outputs will return to step 1 and the count of clock ticks goes back to zero.
OUTPUT JACKS – These output the CV voltages set by the knobs.



Components highlighted in yellow are on panel PCB

II. Schematic

Above is the full schematic for this module. In the bottom left we see the clock and reset input jacks. The clock signal goes directly to an inverting comparator with just a 100K pull down resistor, the CD4024 wants an inverted clock, so we use an inverting comparator. The reset jack goes through a .01 capacitor before going to a non-inverting comparator, the capacitor shortens the pulse to make sure a reset doesn't go so long that a clock input is missed.

The comparators both have their thresholds set at 0.12V by the 100K/1K voltage divider. Their outputs go through diodes to only pass positive voltage onto the clock and reset input pins of the CD4024.

The CD4024 is a binary counter, every time a clock is input the number goes up and is represented by the output pins turning on. The output pins are connected to the control pins of four CD4051 analog switch chips. The control pins look for a 3-bit binary number to tell it which pot's voltage it should send to it's output. The outputs are all just op-amps wired as buffers with 1K current limiting resistors going to the jacks.

The CD4024's first three output bits are sent to the CD4051 that outputs the divide by 1 voltage. This output should change every clock tick and return to 1 every 8 ticks. The CD4024's second through fourth output bits are sent to CD4051 that outputs the divide by 2 voltage, this will only change every other clock tick and take 16 ticks to return to 1. The third through fifth output bits go to the divide by 4 CD4051 making for an output that takes 4 ticks to change and requires 32 ticks to reset. The final CD4051 uses outputs four through six of the CD4024 and takes 8 ticks to change and 64 to reset.

The pots are all simple voltage dividers, each has it's wiper wired to the same pin of all four CD4051s and divide down either +5V or +2.7V. The 2.7V supply is made by adding a 10K resistor in series with the +5V supply and a .01uf capacitor filtering out any switching noise from the supply.

The op-amp is powered off of the +/-12V supply and the CMOS chips are all powered by +12V/0V. The power rails are filtered by 10ohm/10uf low pass filter with .01uf caps next to power pins to provide extra filtering.

III Construction
A.PARTS LIST

SEMICONDUCTORS

Name/Value	QTY	Notes
CD4051	4	
CD4024	1	
TL064	1	Or other quad op amp
TL062	1	Or other dual op amp
1N4148	2	
78L05	1	TO-92 +5V regulator

RESISTORS

Name/Value	QTY	Notes
10 ohms	2	1/4W metal film
1K	5	1/4W metal film
10K	1	1/4W metal film
100K	5	1/4W metal film
B100K 9mm PC Mount	8	Like these.

CAPACITORS

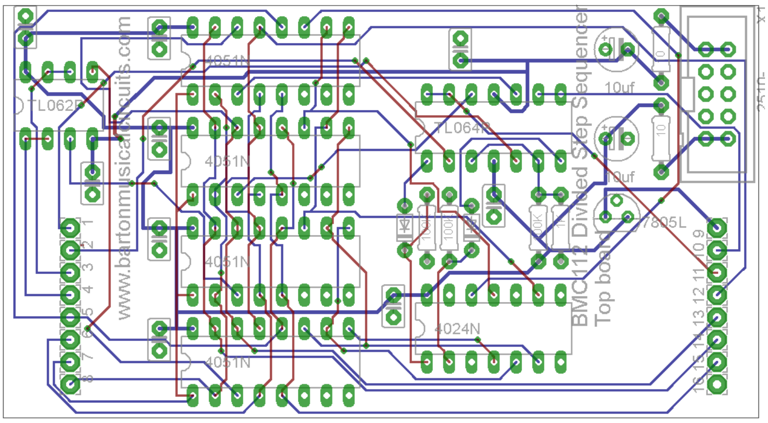
Name/Value	QTY	Notes
.01uf	11	Ceramic disc
10uf	2	Electrolytic

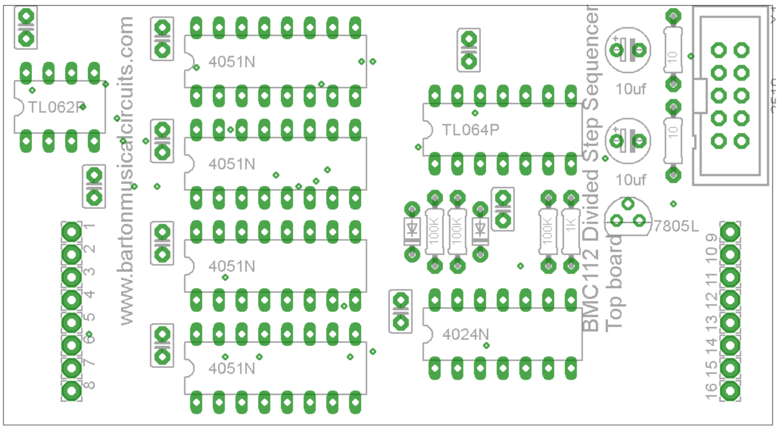
OTHER

Name/Value	QTY	Notes
SPDT Toggle	1	Mini On-On like this
3.5mm Jack	6	Like these.
Power connector	1	
8 pin DIP socket	1	
14 pin DIP socket	2	
16 pin DIP socket	4	
Single Pin Header Male	16	2.54mm spacing, at least 24 pins
Single Pin Header Female	16	2.54mm spacing, at least 24 pins

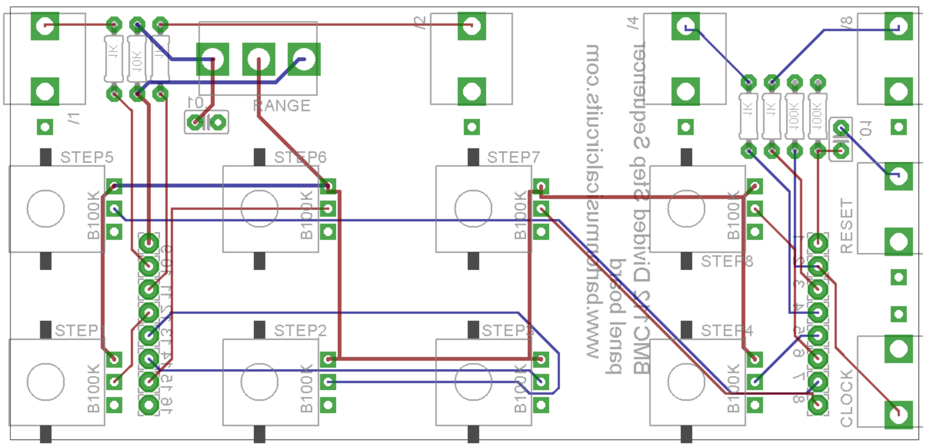
B. THE BOARDs

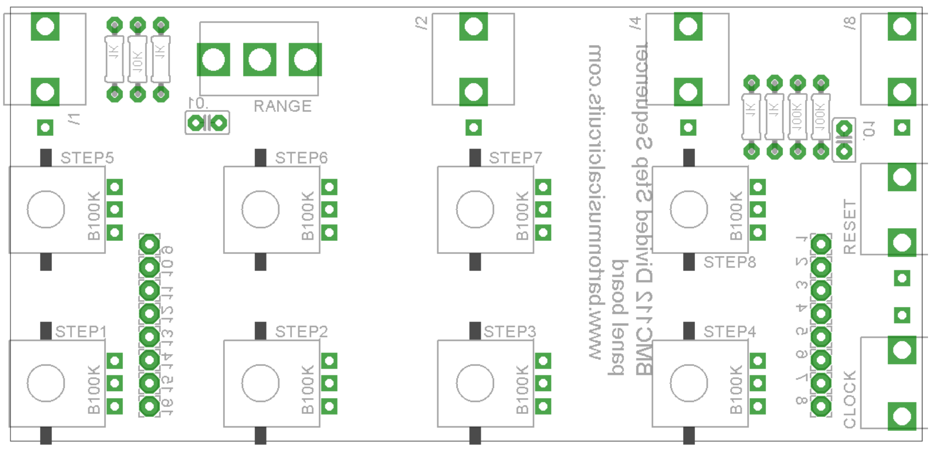
Below are renderings of the top PCB, both with and without traces present.





Below are renderings of the panel PCB with and without traces:





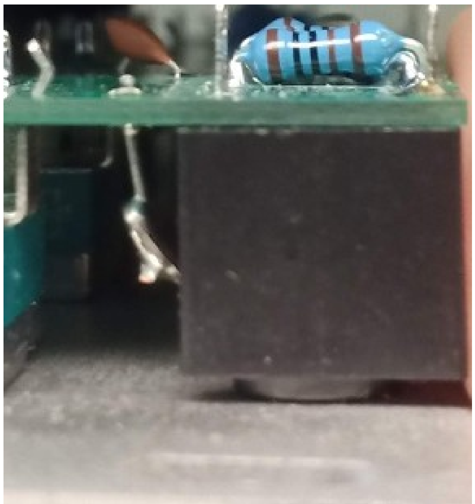
Because the PCBs have components on both sides, I suggest building in the following order.

1. Stuffing the top PCB

A. Resistors and diodes
B. DIP sockets
C. Ceramic capacitors
D. Voltage regulator
E. Power Header
F. Electrolytic capacitors
G. Male Pin Headers

2. Stuffing the Panel PCB

A. Resistors and Diodes
B. Ceramic capacitors
C. Female Pin Header
D. 3.5mm jacks.
E. Solder a snipped resistor lead from the sleeve connector of a jack to the grounding wirepad (see photo to the right)
F. Toggle Switches



3. Putting it together

A. Remove all nuts from jacks and switches.
B. Carefully attach the panel to the jacks and switches of the panel PCB and then secure with mounting nuts.
C. Connect the headers of the top PCB and panel PCB.
D. Insert ICs to their sockets.

Below are photos of a fully built module to use as a reference.