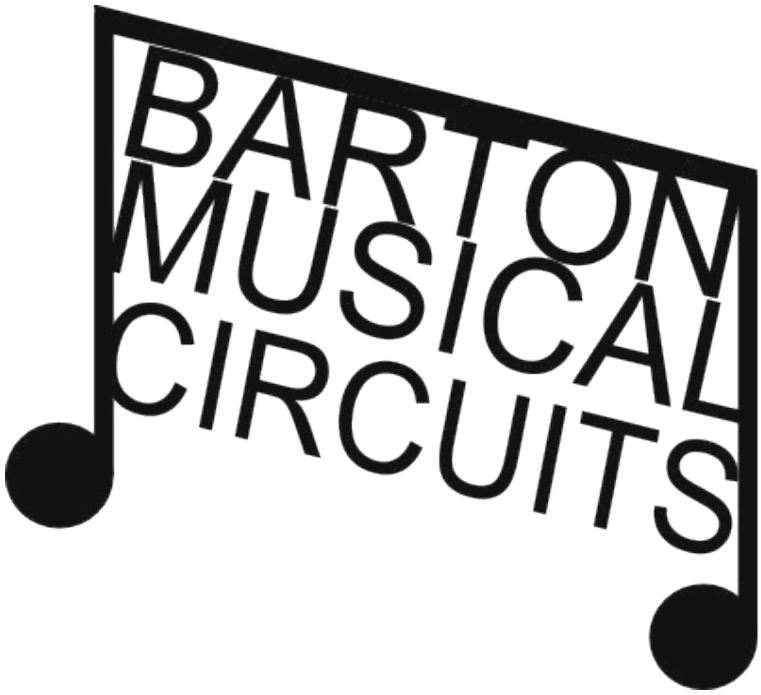

BMC039. Step Sequencer.
Last updated 2-2-2016

If you have any questions, or need help trouble shooting, please e-mail
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I. Overview/Features

This module is a rhythmic step sequencer. Sequences are programmed by using push buttons to turn the steps on or off. Two sequences are output simultaneously while only one at a time can be edited, a toggle switch selects which output is being edited. It features EEPROM storage of patterns, and sequences up to 32 steps long.

CONTROLS

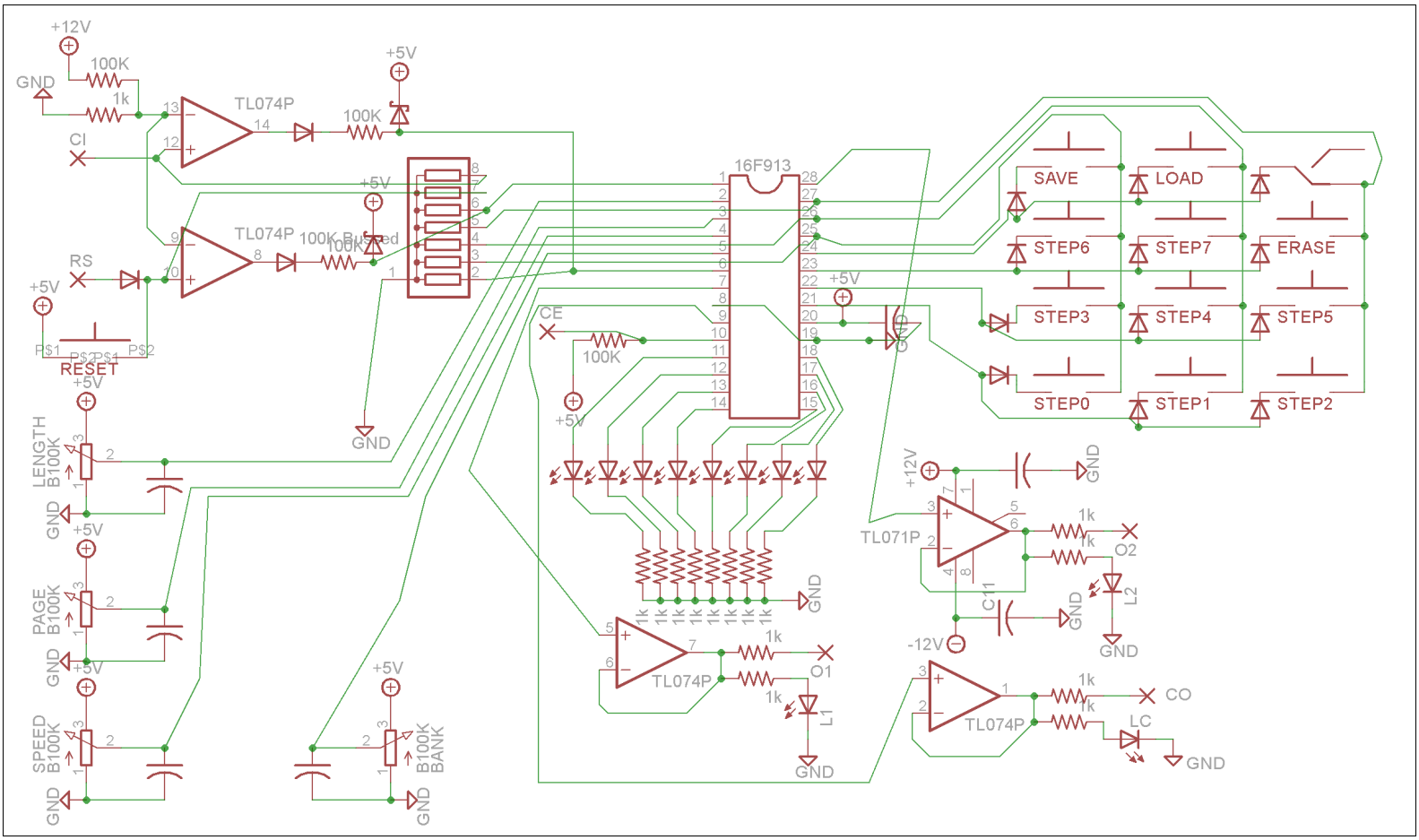
1.Step on/off buttons – These are the 8 buttons which turn individual steps of the pattern on or off. The LEDs next to the buttons indicate whether the step is on or off.
2.Speed Knob – This controls the speed of the internal clock. When an external clock is input, this knob controls a divider for the external clock, dividing by 1, 2, 4 or 8.
3.Page Knob – Because there are only 8 buttons used to control up to 32 steps, this knob selects which steps are being edited. When the sequence length is set to 8 or less, this control does nothing.
4.Length Knob – This sets the length of the sequence. Available lengths are 2, 4, 8, 16 and 32. This control and the Page knob affect both sequences simultaneously.
5.Bank Knob – This selects which bank is being used for the SAVE and LOAD functions. There are 5 available banks to save/load.
6.Edit Toggle – This selects which channel is being edited. When the switch is down Output 1's sequence is being edited, and when up, Output 2's sequence is edited.
7.Erase Button – This button erases the current sequences.
8.Reset Button – This button will return the sequences to the first step on the next clock input.
9.Save Button – This saves the current sequences to the selected bank.
10.Load Button – This loads the sequences selected by the bank knob. If the selected sequence's length is different from the length currently selected by the Length knob, it will override the length knob until the length knob is adjusted.

INPUTS

1.Clock input – An external clock can be applied to this input.
2.Reset Input – This input works in parallel with the Reset Button, when the input goes high the next clock tick will go to the first step of the sequence.

OUTPUTS

1.Clock Output – This outputs triggers in time with the clock.
2.Output 1 – This outputs triggers for sequence 1.
3.Output 2 – This outputs triggers for sequence 2.



II. Schematic.

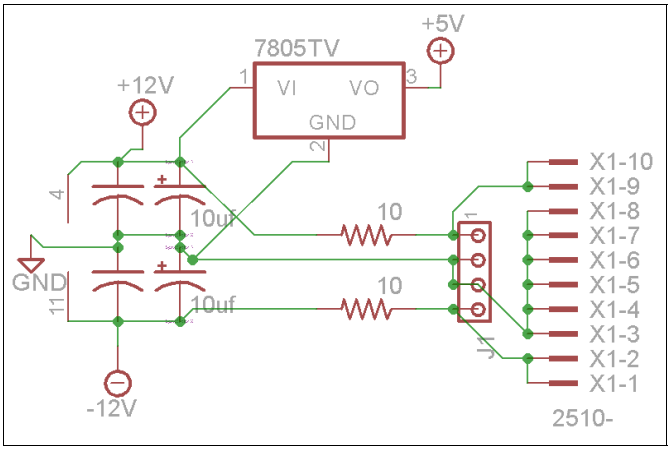
Above is the schematic for this module, minus the power supply connections. In the center is the 16F913 PIC which is the heart of the module. To the left of the PIC are the external inputs for the Clock and Reset. The Reset input goes through a switching diode to keep the pushbutton from affecting the output driving the Reset input. Each of these goes to a comparator with a threshold set to .12V, and the outputs go through a network of diodes and resistors to keep the voltage within a range which won't damage the PIC. An eight pin 100K resistor buss to ground acts as the pull-down resistors for all of the PICs digital inputs.

Below the external inputs are the potentiometers for the control knobs. Each of these is a linear 100K potentiometer wired as a variable voltage source. The wipers are filtered by .01uf capacitors to keep high frequency noise out.

Below the PIC are the LED outputs for the sequence display. Each is in series with a 1K current limiting resistor. Below and to the right of this are the outputs, each of which is composed of an op amp wired as a buffer with 1K resistors in series with the wirepad and the display LED.

To the right of the PIC is the switch reading network. Pins 21-24 are the outputs, these are each connected to three switches through switching diodes, the outputs of these switches are then sent to Pins 25-27 which are the inputs. When a button is pressed, there is only one input that can send a 5V signal through it and only one output that can receive that 5V signal. This allows us to read 12 switches using only 7 pins of the microcontroller.

To the right is the schematic for the power connections. The two power connector footprints are in parallel with each other. The positive and negative power rails are filtered by a 10 ohm/ 10uf passive low pass filter. The op-amps then have .01uf capacitors at their power pins for further filtering. The 5V buss is provided by an onboard 7805 voltage regulator.



III. Construction

A.Parts List

Semiconductors

Name	Quantity	Notes
16F913	1	Should be provided with your PCB
TL074	1	14 pin DIP package
TL071	1	8 pin DIP package
Switching diode	15	1N4148 or other small signal switching diode
Schottky diode	2	1N60P or other schottky
7805 Regulator	1	TO 220
LED	11	3mm Red

Resistors

Name/Value	Quantity	Notes
10 ohm	2	1/4w metal Film for all resistors unless otherwise noted
1K ohm	14	
100K ohm	4	
100K ohm buss	1	8pin SIP package. Or can be made with 7 resistors
B100K Pots	4	Parallel PC mounted. Like This.

Capacitors

Name/Value	Quantity	Notes
.01uf	9	Ceramic disc. Value not critical
10uf	2	Electrolytic, at least 16V rating.

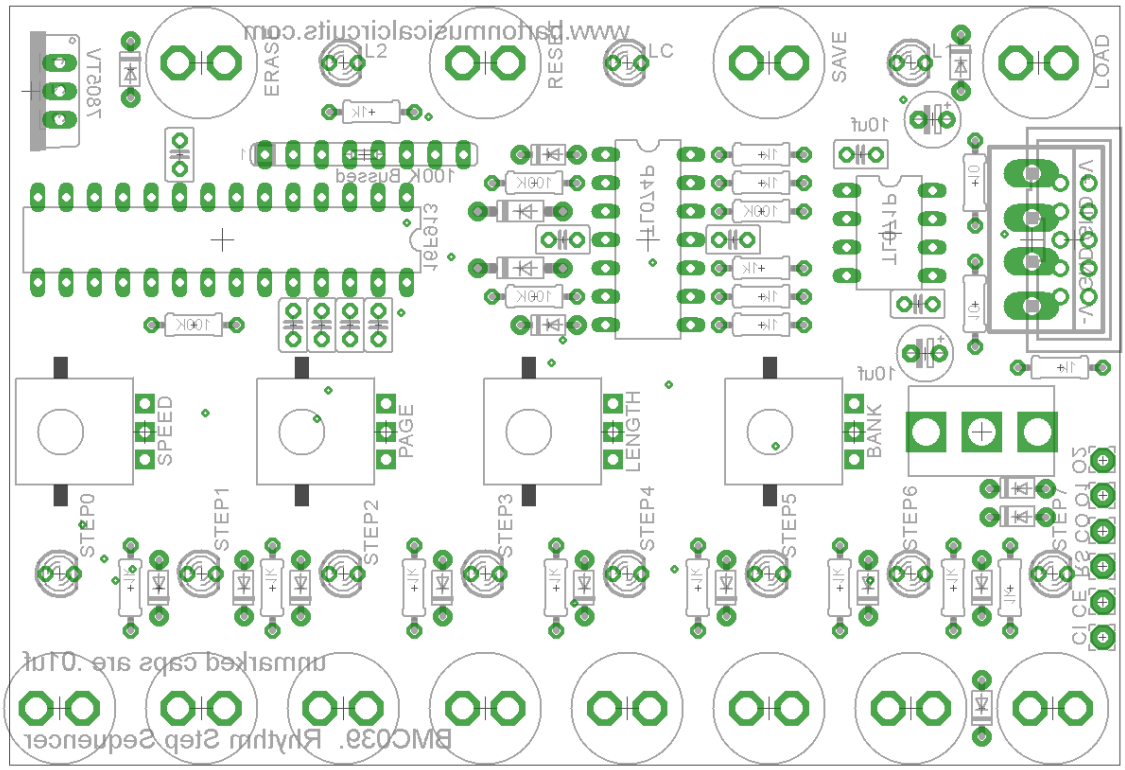
Other

Name/Value	Quantity	Notes
Power connecter	1	Eurorack or MOTM
Pushbutton	12	OFF-(ON). Like this.
Toggle switch	1	SPDT. Like this.
Stereo jack	1	For clock input.
Mono or Switching Jack	4	
Knobs	4	
28 pin DIP socket	1	
14 pin DIP socket	1	
8 pin DIP socket	1	

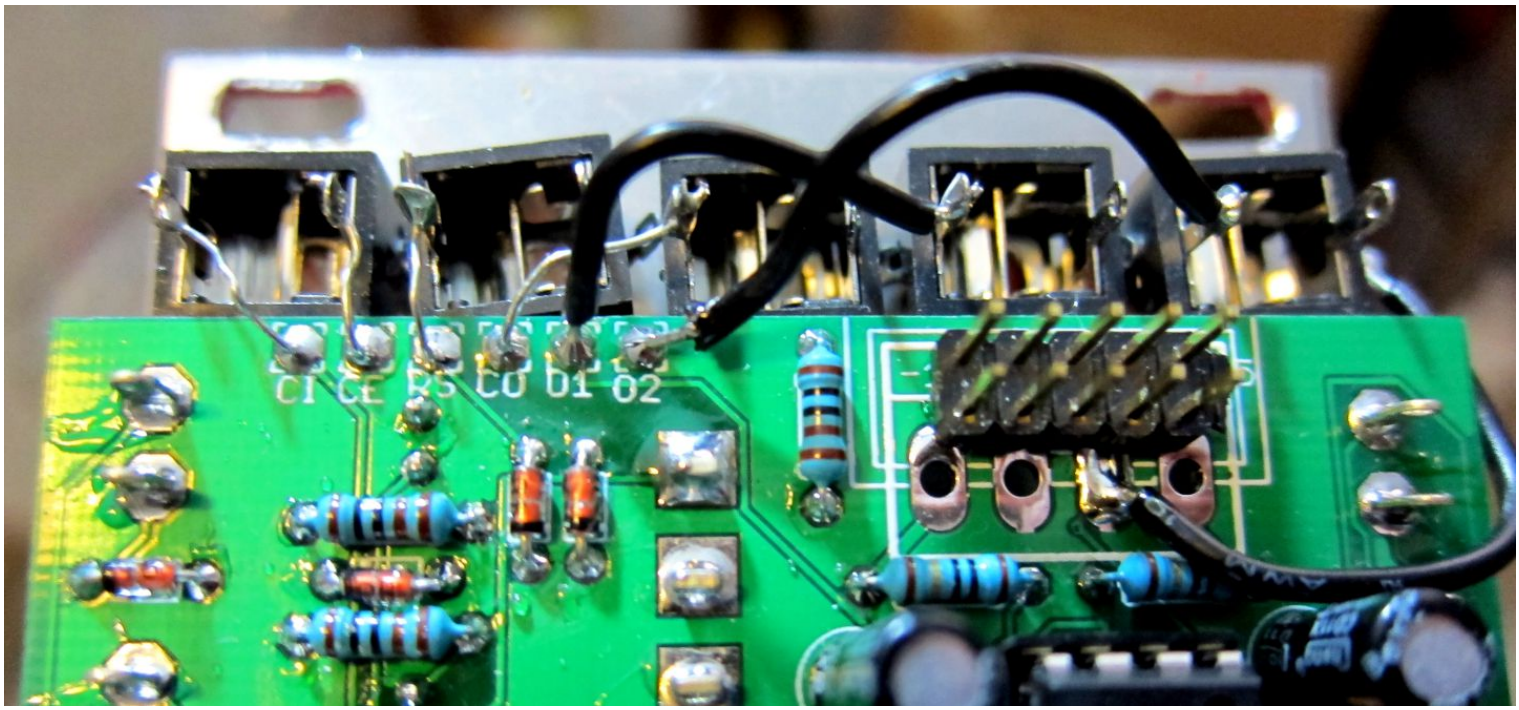
B. The PCB

The PCB is two sided. All of the components which attach to the panel are on the bottom, and all of the other components are on the top. I recommend stuffing and soldering all components on the top first. When stuffing and soldering components on the bottom, I recommend only soldering one pad for each component before attaching it to the panel, this will make fitting everything in the holes easier and put less strain on the PCB. After everything is secured to the panel, then resolder these connections and finish soldering these components.

The current PCB has three errors. The screenprinting for the diode next to the Step 1 led should be on the top of the PCB, not the bottom. If you attach the diode on the bottom, it won't negatively affect the circuit, it's just annoying. Secondly, the Schottky diodes aren't marked with an “S” like they are in other designs I've done. Thirdly, there is not a wirepad marked for Ground. The easiest place to get a ground connection is to use one of the center wirepads for whichever power connecter is unused.



Above is an image of the PCB.



C. Wiring/Photos

Above is a photo of the wiring.

“CI” is connected to the tip of the Clock input jack
“CE” is connected to the ring of the Clock input jack.
“RS” is connected to the tip of the Reset jack.
“CO” is connected to the tip of the Clock Output jack.
“O1” is connected to the tip of the Output 1 jack.
“O2” is connected to the tip of the Output 2 jack.