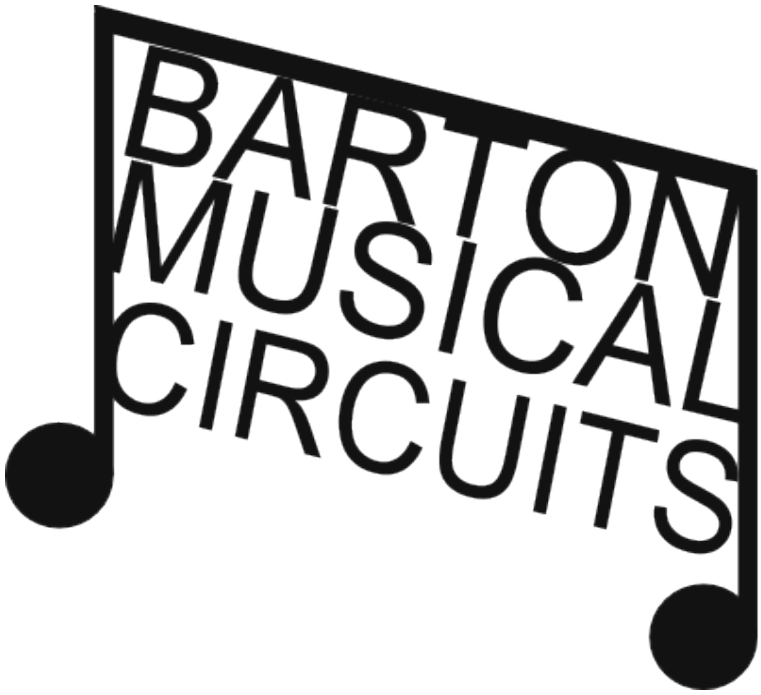


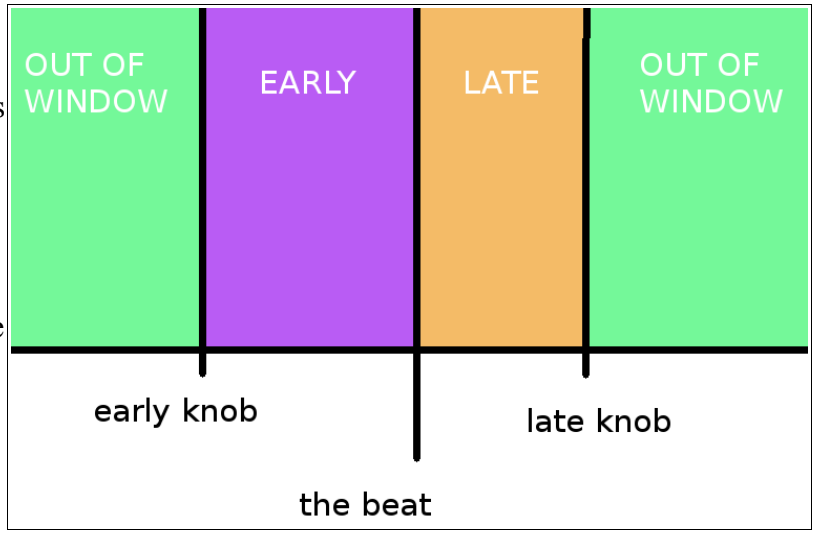
BMC028. Live Rhythm Quantizer [LRQ]

Last updated 1-7-2015

I. Features

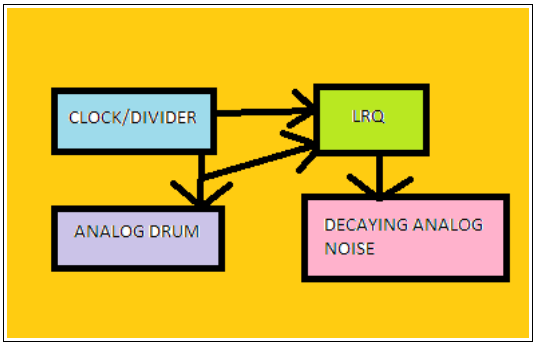
The purpose of the Live Rhythm Quantizer (or "LRQ") is to help a rhythmic performance stay in time with an inputted clock. It can also be used to process clock signals as a way to create interesting rhythmic sequences. The LRQ is designed to work with trigger signals, if using a gate, it will treat it as a trigger.

The way the LRQ works is by dividing the time between clock ticks (AKA "the beat") into three separate windows of time. There are two knobs which are used to adjust the size of these windows, the **EARLY KNOB** which adjusts how much time before the beat is considered the "Early Window" and a **LATE KNOB** which does the same for the "Late Window." Everything outside of the early and late windows are the "Out Of Window."



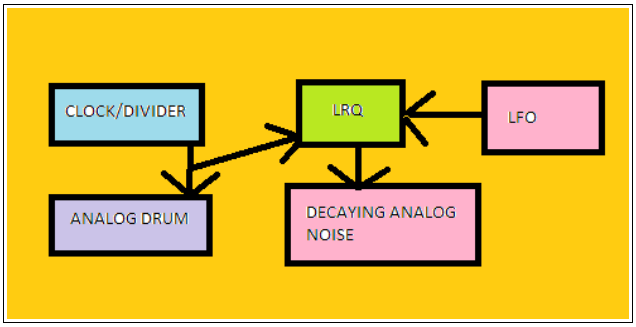
Each of these windows has a three way toggle switch associated with it which tells the module how inputs in this window should be processed. If the toggle is pushed up it's in the **ON** position, any inputs during this window of time will be sent to the output. If the toggle is pushed down it is in the **DELAY** position, an input during this time window will result in a delayed output when the next clock input is received, this lets an early hit sound like it was on time. In the center, the toggle is in it's **OFF** position, inputs during this window of time will be ignored.

MP3 DEMO #1



In this demo the BMC004 Clock/Divider is being used as base source for rhythms. The clock output is going to the main input of the LRQ and an output divided by 8 is going to the clock input of the LRQ, another /8 output is being sent to an Analog Drum module. The LRQ's output is connected to a Decaying Analog Noise. The LRQ is set so that the early and late windows are in the off position and the Out of Window is set to the on.The only controls being adjusted are the Early and Late knobs. As you can hear, the amount of hits on the Decaying Analog Noise changes with these adjustments.

MP3 DEMO #2

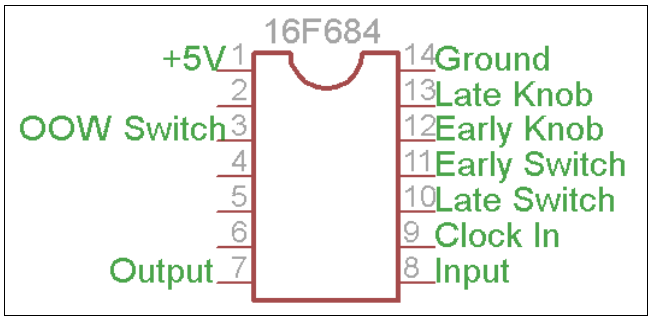


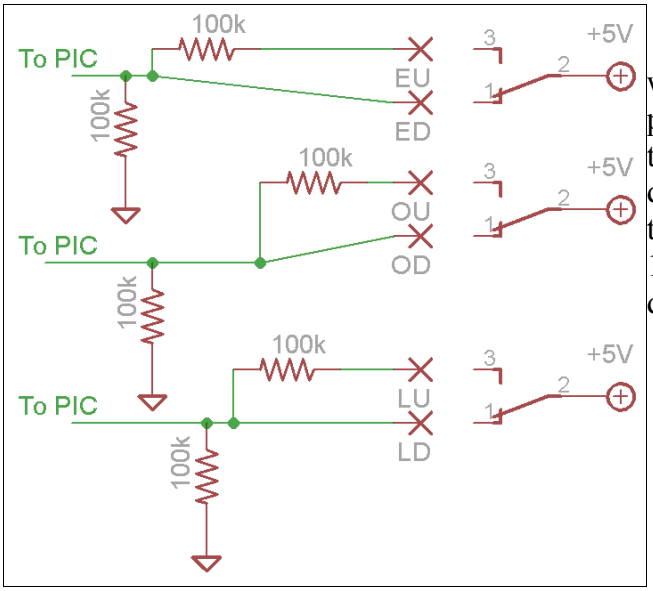
In this demo the LRQ's clock is connected to the clock out of a BMC004, and it's main input is connected to an LFO, the frequency of which is not synchronized with BMC004. The same Analog drum patch is used as in the last demo. The Early and Late switches are both set to "ON" and the Out of Window Switch is set to "Delay."

At the beginning, the Late and Early Knobs are set for very small windows (though not at minimum) which results in a tight rhythm. As the demo progresses, I adjust these knobs to allow extra off-time hits in around the beat.

II Schematics

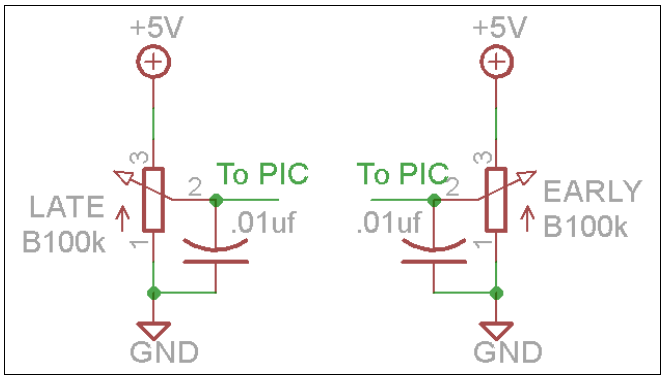
To the right is the pinout for the 16F684 micro controller used in this project. All of the other schematics intersect with this chip.

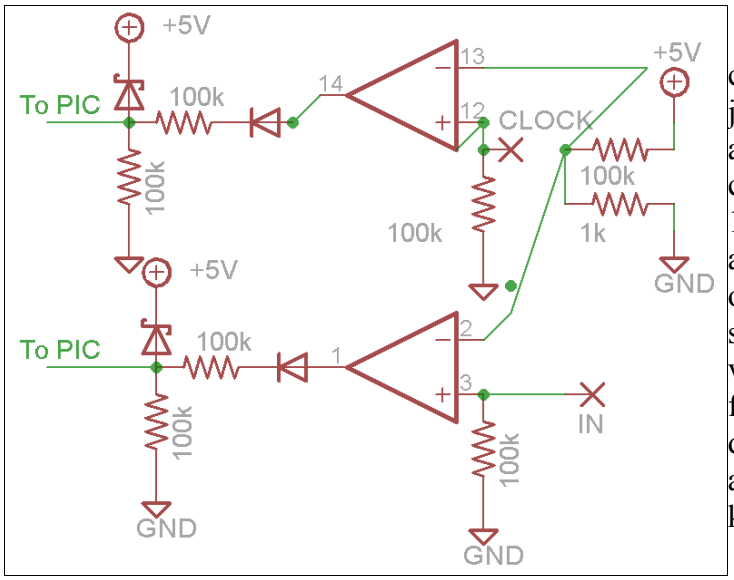




To the left are the window switches, each of which uses an identical circuit. In the down position, 5V is connected directly to the PIC. In the up position, the 5V goes through a voltage divider consisting of two 100K resistors and so the PIC receives 2.5V. In the center position, the 100K resistor to ground will pull the PIC's pin down to 0V.

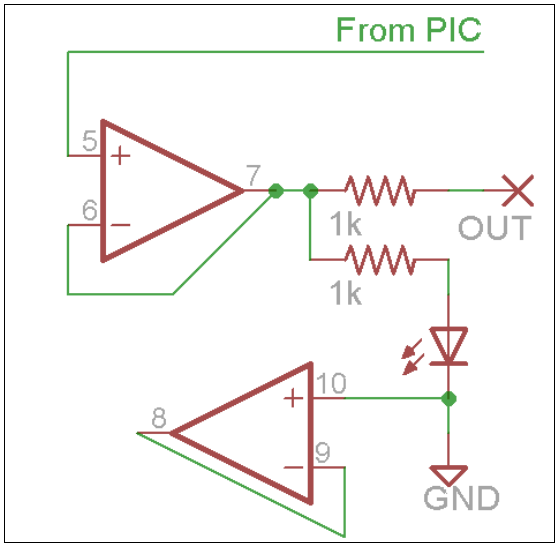
To the right are the Early and Late knobs. Each is a 100K linear pot wired as a voltage divider to provide variable voltage between 0V and 5V. The wiper of each pot is connected to the appropriate pin on the microcontroller as well as to a .01uf capacitor which filters out any high frequency noise.

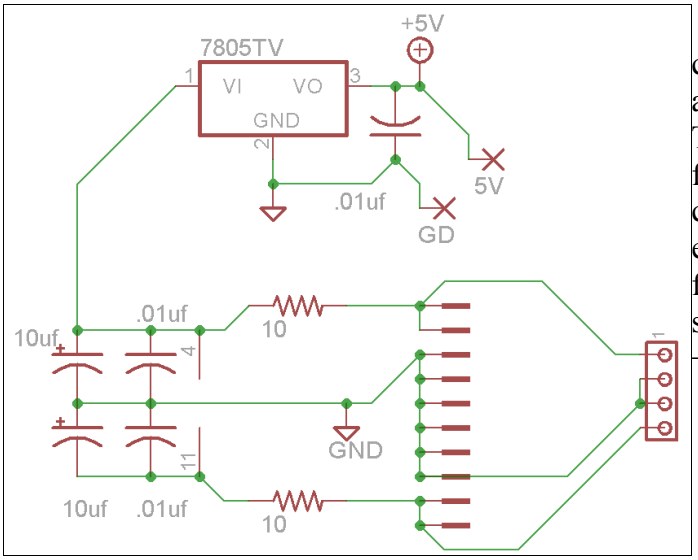




To the left are the Clock and Input circuits. These circuits are identical. The jacks are wired to inputs of op-amps wired as comparators, with the input of each comparator tied down to ground through a 100K resistor. The threshold voltage is set at .05V by the 100K and 1K resistor. The output of the comprators go through a switching diode to only pass the positive voltage, then through a 100K resistor which forms a voltage divider with the 100K pull down resistor. Then a Schottky diode attached to +5V limits all voltage to +5V to keep from damaging the PIC.

To the right is the output circuit and the extra op-amp. One op-amp is wired as a buffer, with it's output going through a 1K resistor to the output jack and through another 1K resistor to an LED. The unused op-amp is wired as a buffer with it's input tied to ground.





To the left is the power supply for the circuit. On the bottom right of the diagram are the two footprints for power connecters. The positive and negative rails are both filtered by a 10 ohm resistor and a 10 uf capacitor. A .01uf capacitor is then placed at each of the power connections for the TL074 for further filtering. The positive rail is then sent to a 7805 voltage regulator to create the +5V supply for the PIC and control circuitry.

III. Construction

Parts List

Semiconductors

Value	Qty	Notes
16F684	1	Should have come with your PCB
TL074	1	14 pin DIP package
7805 Voltage Regulator	1	TO-220 Package
1N4148	2	Or other small switching diode
1N60P	2	Or other schottky
LED	1	3mm

Resistors for +/-12v

Value	Qty	Notes
10 ohm	2	1/4W Metal Film
1K	3	1/4W Metal Film
100K	6	1/4W Metal Film
100K Bussed Array	1	8 Pin, or make your own with 7 more 100K resistors *
B100K Pot	2	16mm PCB mounted

Capacitors

Value	Qty	Notes
10uf	2	Electorlytic 5mm
.01uf	5	Ceramic disc. 2.5mm lead spacing

Other

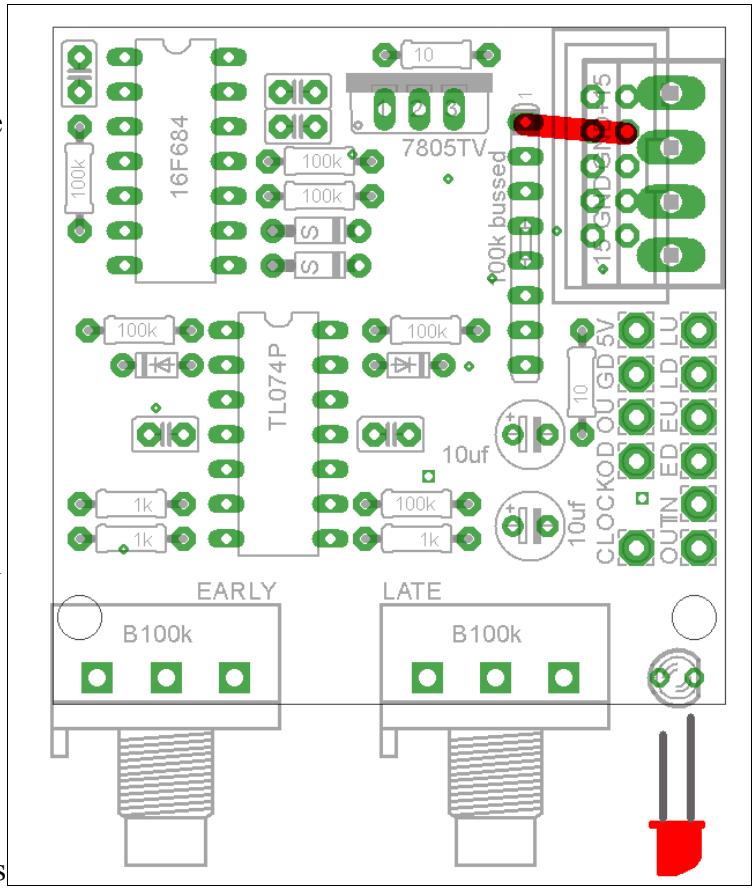
Value	Qty	Notes
Power Connecter	1	Eurorack or MOTM style
Toggle Switch	3	On-Off-On type
Jack	3	1/4" or 3.5mm depending on build
Knob	2	
14 Pin DIP socket	2	

***To learn how to make an array, visit this poorly drawn page.**

The Board

To the right is a diagram of the PCB. The PCB is 49mmx49mm. The pots are spaced 15/16" apart. The mounting holes are 45mm apart.

This is the first revision of the PCB and there are two very simple issues that will be adressed in the next revision. First, a jumper needs to be placed from pin 1 of the bussed array to ground. This is easily done with a spare resistor lead over to the Eurorack power connecter next to it. Second, the LED footprint is printed backwards, so install your LED with the long lead towards the right, as shown in the diagram.



Installing LEDs Sideways

The PCB indicates that the LEDs should be mounted parallel to the board, do not do this. Leds should be pointing in the same direction as the pots. The leads of the LED should be bent at a 90 degree angle, the easiest way to install them is in four steps:

1. Place the LED on the edge of the board facing out with it's leads going over it's pads on the PCB. Make sure the bottom lip of the LED is flush with the board.
2. Clip the leads 2 or 3 mm past the pads on the PCB.
3. Bend the LED leads 90 degrees 2 or 3mm from the edge.
4. The LED should pop into place easily.

Below is a simple wiring diagram for the offboard components. The color connects the wiring pad from the PCB to the solder lug on the component.