Turntable Strobe Generator by Les Carpenter G4CNH Dec 2020

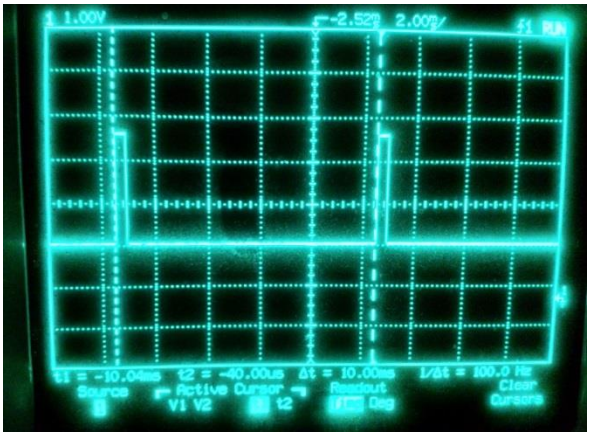
This was designed in response to a request for a strobe to assist in setting turntable speeds.
There were some designs available that utilised programmable devices such as the Arduino, but these required programming skills, so a simple traditional integrated circuit solution was decided upon.
A 2.4576MHz crystal is fitted to a CD4060 Oscillator/Divider chip which provides an output of 2400Hz on pin 15. This is fed to a CD40103 Programmable Divider to produce either 100Hz or 120Hz depending on the position of the 50/60 Hz selector switch. Although the CD40103 is described as programmable, this is done via its inputs so no software knowledge is required ☺.

A higher switching speed was tried, said to be better, but this resulted in making the strobe lines on a disc look very thin and compact, so the normal 100/120Hz was adopted as it looked the best.

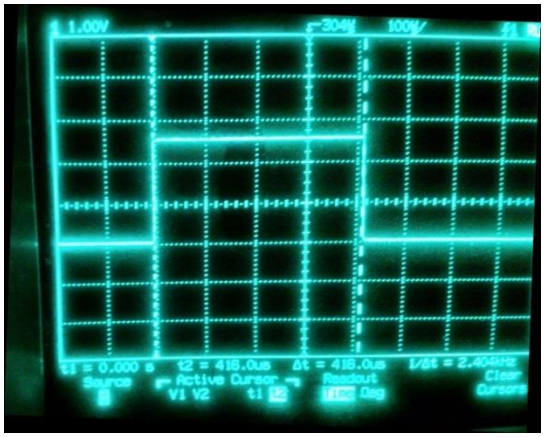
The required output from pins 14/15 is unfortunately logic High for much longer than it is Low. It is preferable, for good strobe action, to have the reverse and the simplest way is to drive the LED such that when the transistor is turned On, it shorts out the LED rather than illuminate it.
Thus the short logic Low produces the desirable quick flash from the LED.

LED Waveforms.

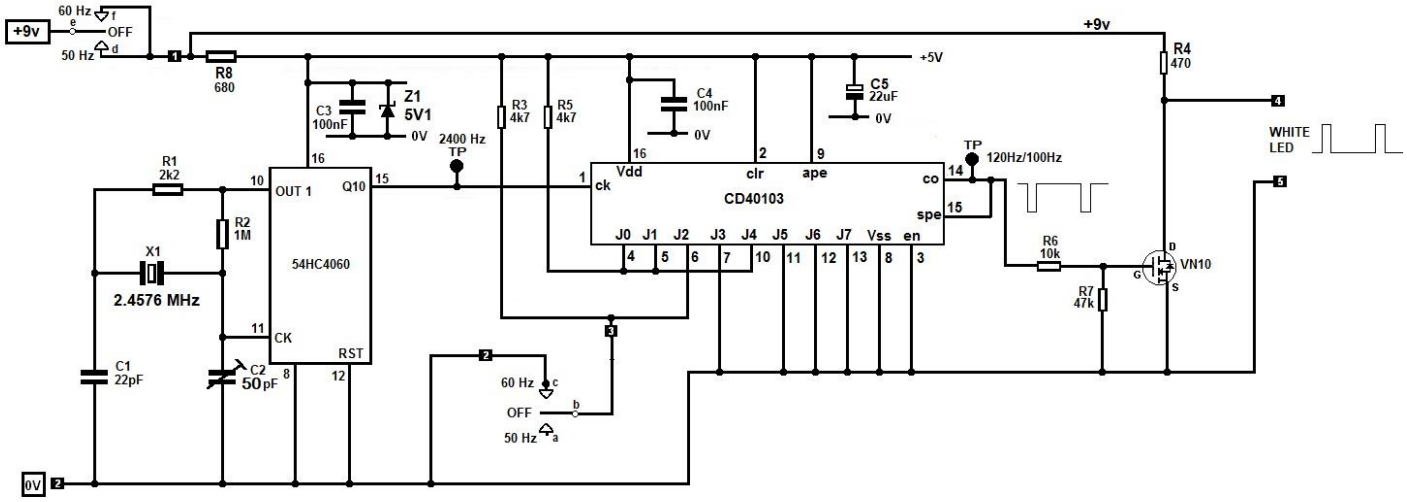
100Hz with 50/60 Hz selector switch open.



LED On time approximately 400µ secs.



The Circuit:-



The circuit can be driven from a PP3 battery, this powers a high brightness White LED and a 5V Zener provides a regulated supply to the integrated circuits. The trimmer allows the oscillator to be set to give the exact frequency if required but you will need an accurate frequency counter to do this.

Why use a divide by 256 one may ask, well we could actually dispense with the CD40103 completely by using the oscillator output at pin 2 which is 300Hz. But this would be OK for countries on a 50Hz supply but no good for those on 60 Hz. The ability to select a division ratio of 24 (50Hz) or 20 (60Hz) is very easy to do by switching just one bit of the programmable divider and here is how.
The only thing you have to remember about these counters is that there is an extra count to what you have programmed on the Jam inputs and this has to be taken into account.
For example, you would expect a division of 24 would require the input pins to be:-

J7	J6	J5	J4	J3	J2	J1	J0	
128	64	32	16	8	4	2	1	
0	0	0	1	1	0	0	0	i.e. 16 + 8 = 24

However it has to be 23 so the Jam inputs are wired as:-

0	**0**	**0**	**1**	**0**	**1**	**1**	**1**	i.e. 16 + 4 + 2 +1 = 23 + extra count of 1 = 24

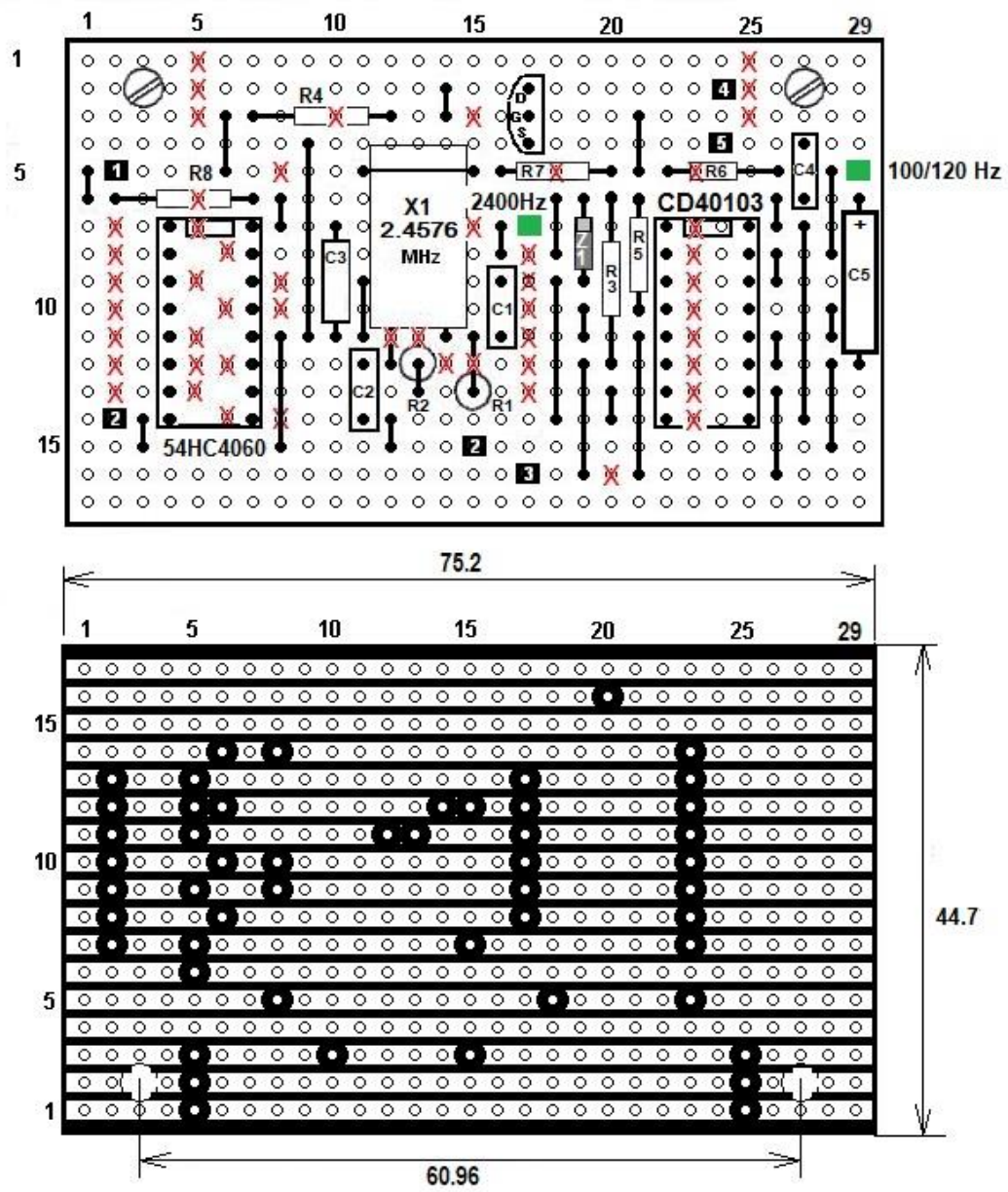
This will occur when the switch is in the 50Hz position as 2400Hz divided by 24 = 100Hz which is the required illumination that would be seen from a light source driven by a 50Hz power supply.

To get 120Hz (divide by 20) we just have to set the input J2 to 0 to make the actual division to 19.

J7	J6	J5	J4	J3	J2	J1	J0	
128	64	32	16	8	4	2	1	
0	**0**	**0**	**1**	**0**	**0**	**1**	**1**	i.e. 16 + 2 + 1 = 19 + extra count of 1 = 20

This will occur when the switch is in the 60Hz position as 2400Hz divided by 20 = 120Hz which is the required illumination that would be seen from a light source driven by a 60Hz power supply.

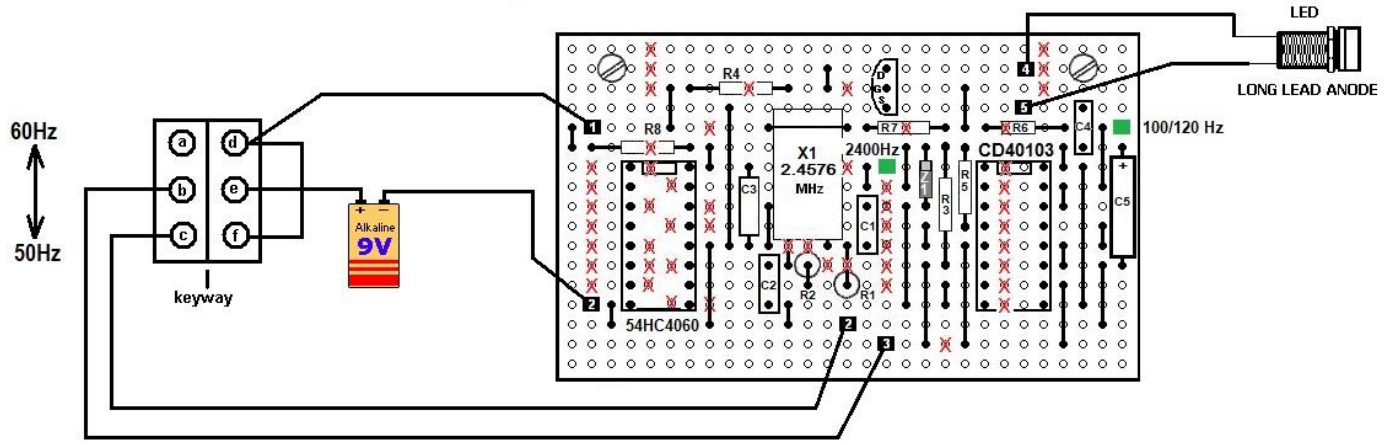
Typical Board Layout:-



Parts Used

Ref	Description	UK Supplier	Part No.
1	ABS Box 117 x 70 x 38 with Battery Compartment.	RS Components	239-7277
2	Stripboard cut to 17 Tracks x 30 Holes (44.7 x 77.7)	CRICKLEWOOD	CQ127
3	LED Holder for 5mm LED	CRICKLEWOOD	5CC
4	Miniature Toggle Switch DPDT Centre Off	CRICKLEWOOD ALT. RS	TM22C1 734-7038
5	Battery Clip for PP3 Battery	CRICKLEWOOD	PP3H
6	Quartz Crystal, HC49U, 2.4576MHz	FARNELL	1666946
7	0.1 Board Pin (9 off)	CRICKLEWOOD	CQP1
C1	22pF 63V	CRICKLEWOOD	CER22P
C2	3-50pF Variable (For trimming Crystal) ALPS GREEN	eBAY	LOUDARTRONICS
C3	100nF	CRICKLEWOOD	CER100N
C4	100nF	CRICKLEWOOD	CER100N
C5	22uF	CRICKLEWOOD	22A63
FET	VN10KLS	CRICKLEWOOD	VN10KLS
IC1	74HC4060 Oscillator/Divider	CRICKLEWOOD	74HC4060
IC2	CD40103 Programmable Divider	CRICKLEWOOD	CD40103
LED	Hyper Bright 5mm	CRICKLEWOOD	W5A
R1	2k2	CRICKLEWOOD	M2K2
R2	1M	CRICKLEWOOD	M1M0
R3	4k7	CRICKLEWOOD	M4K7
R4	470	CRICKLEWOOD	M470R
R5	4k7	CRICKLEWOOD	M4K7
R6	10k	CRICKLEWOOD	M10K
R7	47k	CRICKLEWOOD	M47K
R8	680	CRICKLEWOOD	M680R
Z1	5V1 Zener Diode 400mW	CRICKLEWOOD	Z5V1

Physical wiring



Connect suitable wires to board pins 2 & 3 to terminate at switch contacts b and c.
Connect suitable wires to board pins 4 & 5 to terminate at LED Anode and Cathode respectively.
Connect suitable wire to board pins 1 to terminate at switch contacts d and f.
Drill suitable holes in case to ones preferences, the Author fitted the LED centrally in front panel and the switch onto the top half roughly in the centre. He is certain the more mechanically skilled amongst the readership will make a better job than he did, but at least leave room for a label.
He just dropped the board into the case compartment for it, drilled two holes for it and counter-sunk the holes on the outside of the case half. He mounted the board using two M3 counter-sunk screws plus two plastic spacers of the type used to mount power transistors. These act as spacers between the case and board, the board being secured on top by two M3 crinkle washers and two M3 nuts.

Finished Views