ELECTRONIC METRONOME

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A metronome is used by musicians for practice in maintaining a consistent tempo, or rubato, around a fixed beat. This circuit produces a regular beat at the rate of 40 to 200 beats per minute. It accentuates every second, third, fourth, fifth, sixth or eighth beat, which is adjustable as per your liking and requirement. Every beat is indicated by the glowing of an LED. The accented beat is indicated by another LED.

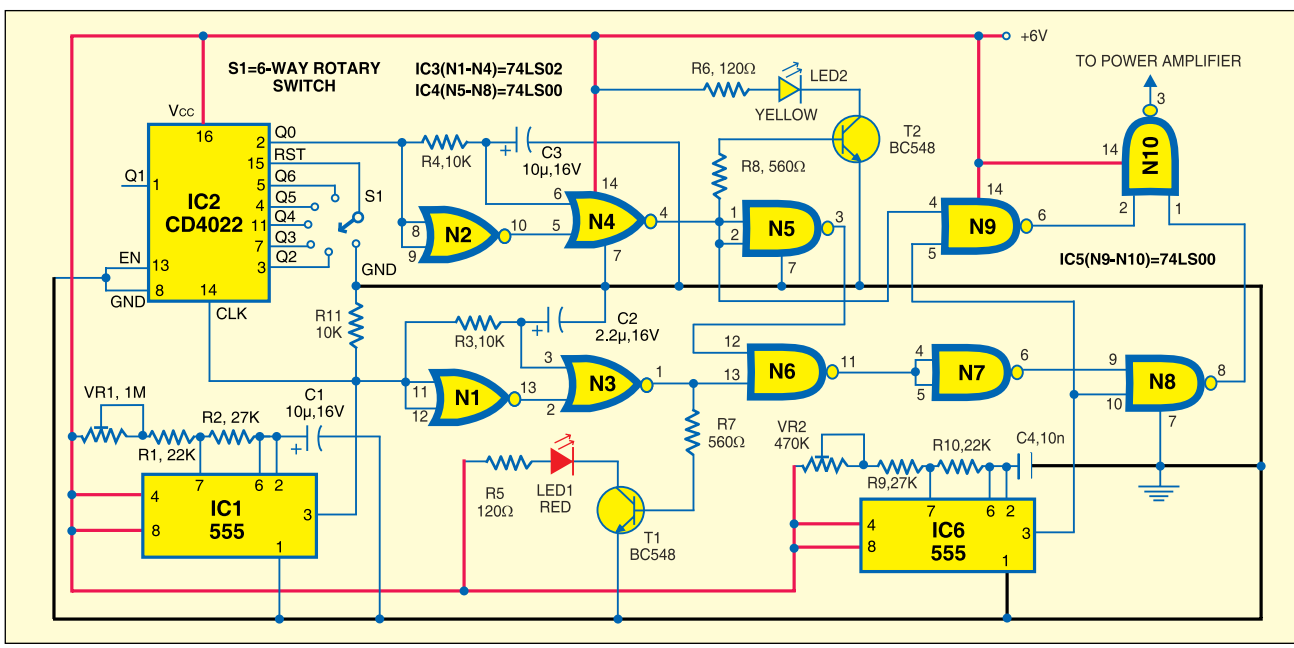
IC1 drives the pulse generator. The length of the pulse is about 10 ms, and it appears at pin 1 of IC3 (NOR gate N3). At each pulse, the red LED (LED1) flashes to indicate occurrence of the beat. The pulse passes through NAND gates N6 and N7 of IC4. The pulse output from pin 6 of N7 is fed to NAND gate N8. The audio signal output generated by another multivibrator (IC6) is also fed to gate N8. The audio signal can be adjusted to obtain a note of suitable pitch.

The output from IC1 also goes to IC2 (CD4022), which is a divide-by-eight counter/divider with eight decoded outputs. Rotary switch S1 allows the counter to be reset every two, three, four, five or six counts, or cycle through eight counts without resetting.

Output Q0 of IC2 drives the second pulse generator built around NOR gates N2 and N4, resistor R4 and capacitor C3. The output is an accented beat pulse, which is fed to NAND gates N5 and N9 and the base of transistor T2. Since C3 has a higher capacitance than C2, this pulse is longer (about 40ms) and is used to mark the accented beat. The result is a 'tick' sound lasting about 40 ms, which sounds every second, third, fourth, fifth, sixth or eighth beat, depending on the setting of S1. The accent pulse makes the yellow LED (LED2) flash.

It is important that the base 'tick' note or beat is not heard on the accented beat. This is achieved by gates N5 through N7 of IC4.

The final audio signal appears at pin 3 of IC5 (NAND gate N10). This signal can be fed to the audio power amplifier stage. When you supply 6V DC to the circuit, you can hear the base or tempo beats and accented beats from the speaker of your power amplifier. The red LED (LED1) flashes with the beat and the yellow LED (LED2) flashes on the accented beat.



Construction and testing is simple. Assemble the circuit on a breadboard or general-purpose PCB. Mount all the components, except S1, and temporarily connect pin 15 of IC2 to ground rail. IC1 produces an audible tick sound

(tempo beat) at a fixed rate that varies as VR1 is adjusted. IC6 produces a tone that varies in pitch from about 250 Hz (about an octave below middle C) to about 2 kHz (about two octaves above middle C) as VR2 is adjusted. The counter goes through its normal eight-stage cycle and the yellow LED (LED2) flashes once for every eight flashes of the red LED (LED1).

Now connect a loudspeaker to pin 3 of NAND gate N10 through a 10µF capacitor. The circuit should produce a series of tick sound with a double-tick sound at every eighth tick sound. If this works well, remove pin 15 of IC2 from the ground rail and connect to six-way rotary switch S1. Remove the speaker and 10µF capacitor from pin 3 of N10 and connect pin 3 to an audio power amplifier. Use presets VR1 and VR2 such that turning their knobs clockwise increases the tempo and the pitch, respectively. ●