Single Phase Cycle Skipping Controller for AC Loads Simplified.

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Speed control of single phase AC motor or power control of resistor load bank is generally achieved by varying impressed voltage through phase control of Triac or Thyristor. Though such circuits are simple, voltage control is not smooth. As these devices are switched on at anywhere in the voltage cycle, unwanted harmonics are introduced and expensive filter circuits are used to kill them.

Circuit in Fig 1 obviates these problems. This is a cycle skipping controller. In this design, 10 full cycles are taken as base. Timer U2 (555) through R4 and C3 decides this by giving output pulses of width of 200 msec, which is the width of 10 full AC cycles of 50Hz AC mains. (For 60 Hz mains this will be 166.6 msec). These pulses trigger U3 (555) monostable to produce pulses with preset width within 200 msec, by adjusting potentiometer RV1. This pulse train controls optotriac U4 (MOC3021) to trigger Triac U5 (T410-600B). Triac conducts for the duration of pulse widths produced by U3. Thus, this conduction allows the selected number of cycles to pass through and impress on load. Suppose if 80 msec width is chosen by RV1, which corresponds to 4 full cycles of each 20 msec, Triac will allow 4 voltage cycles to the load and restart conducting after 120 msec , which corresponds to 6 off cycles. (Triac conducts for 4 cycles and skips 6 cycles). This operation repeats. Thus load power is controlled. As AC cycles passed to load are full cycles, unwanted harmonics are eliminated. D1, R1 and D2 portion generates 12 V DC for powering the circuit. Diodes D3, D4, D5, D6 are connected as bridge rectifier and opto coupler U1 (4N25) generates pulses at zero crossings . Load can be connected in neutral side as shown in Fig ! or Line side. Select R7 to meet gate current requirement of U5.

Normally such controllers are realized with micro controllers and software. Novelty of this circuit is not using microcontrollers and still realizing the same function, thus making it simple with low cost components.

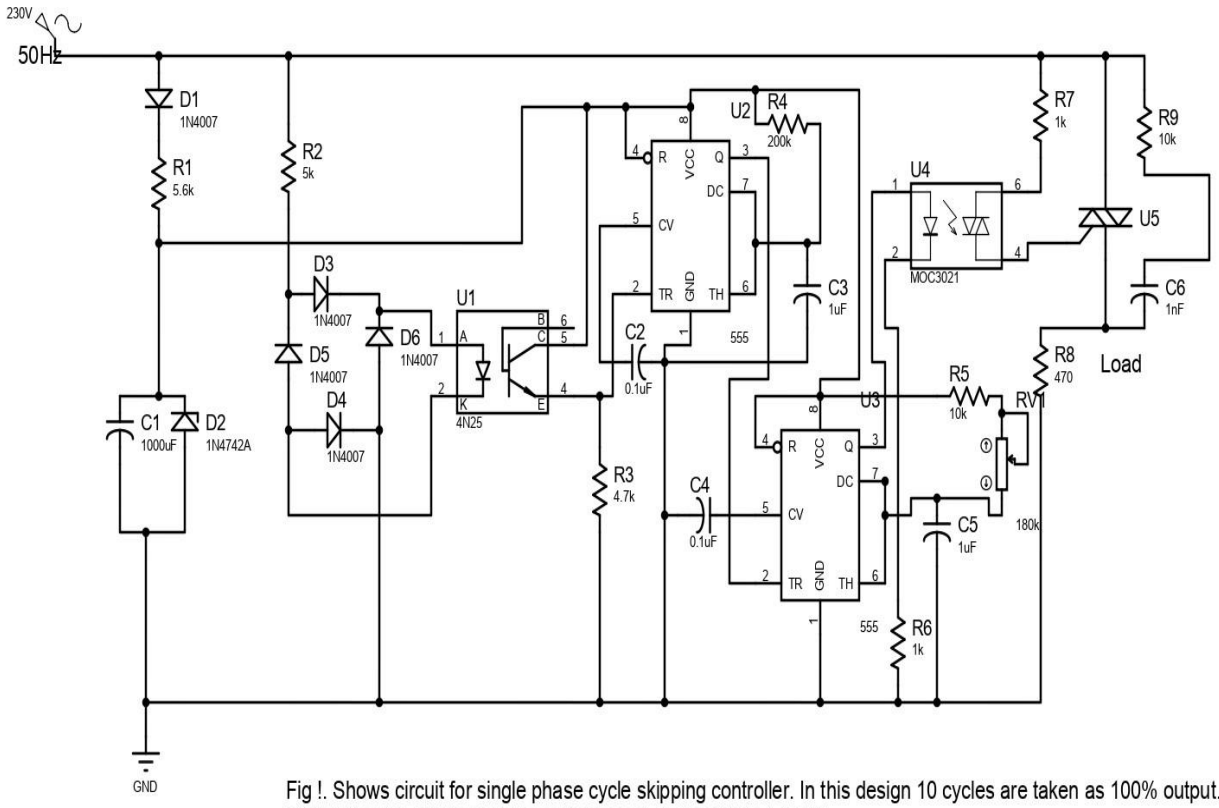
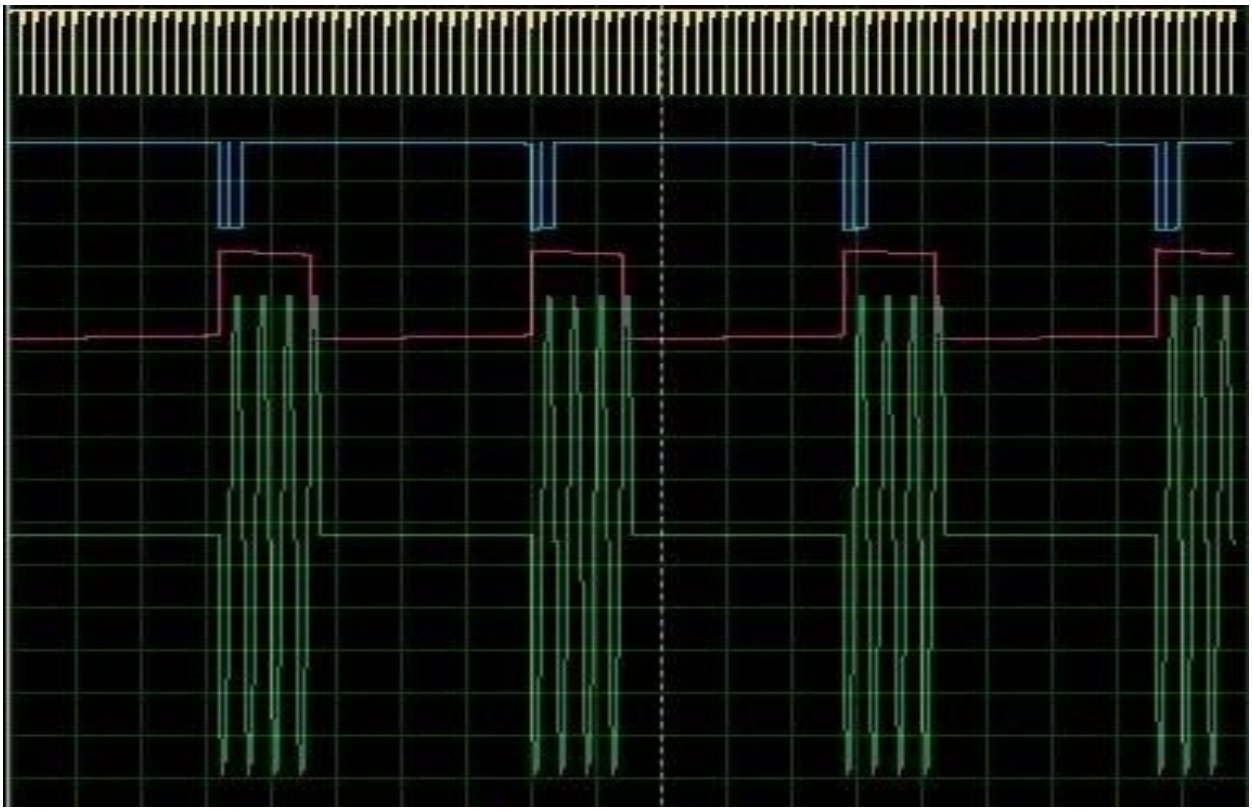


Fig !. Shows circuit for single phase cycle skipping controller. In this design 10 cycles are taken as 100% output. Potentiometer RV1 varies the number of cycles impressed on load from 1 to 10.



Simulation waveforms:

1. Zero cross pulse at U1
2. Full cycle duration pulses at U2
3. Selected cycles duration pulses at U3
4. Load voltage wave form