WASHING MACHINE MOTOR CONTROLLER

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Washing machines usually employ a single-phase motor. In semi-automatic washing machines, a purely mechanical switch controls the timing and direction of the motor. These switches are costly and wear out easily.

Here's a controller for single-phase motors of washing machines (Fig. 1) that efficiently replaces its mechanical equivalent. Basically, a single-phase motor requires a master timer, which decides the time for which the motor should keep rotating (washing time), and a spin direction controller, which stops the motor for 3 seconds after every 10 seconds and then resumes rotation in opposite direction.

The direction of rotation can be controlled as shown in Fig. 2. When switch S1 is in position A, coil L1 of the motor receives the current directly, whereas coil L2 receives the current with a phase shift due to capacitor C. So the rotor rotates in clockwise direction (see Fig. 2(a)). When switch S1 is in position B, the reverse happens and the rotor rotates in anti-clockwise direction (see Fig. 2(b)). Thus switch S1 can change the rotation direction.

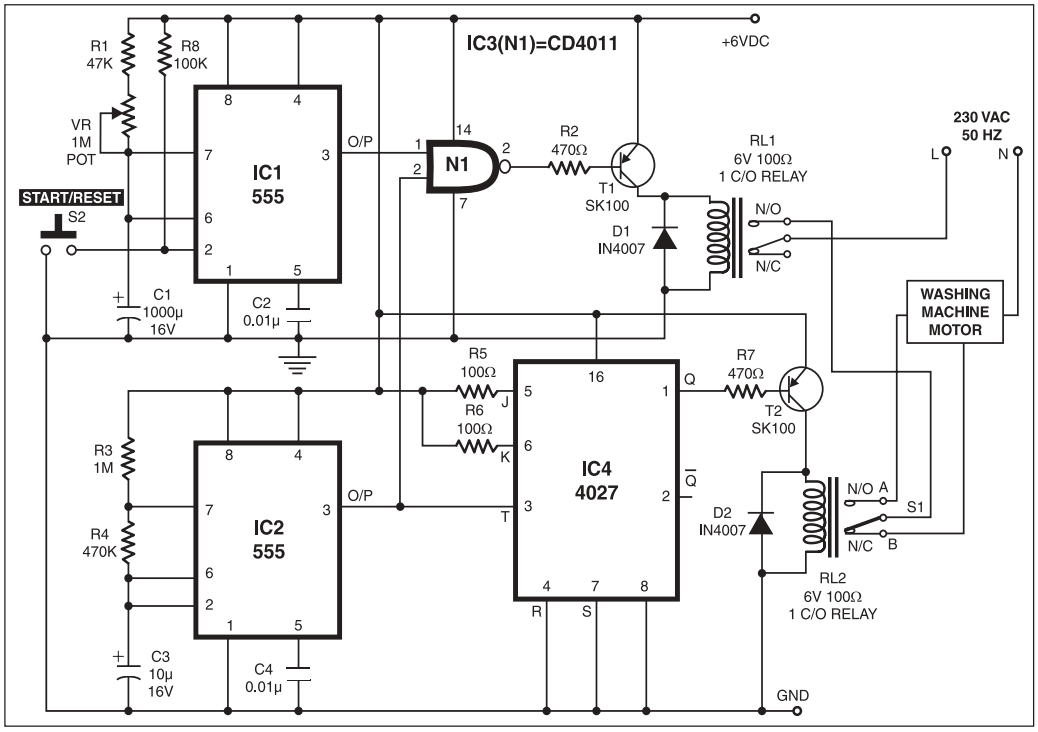

Fig. 1: Circuit diagram of washing machine motor controller

The motor cannot be reversed instantly. It needs a brief pause between switching directions, or else it may get damaged. For this purpose, another spin direction control timer (IC2) is employed. It is realised with an IC 555. This timer gives an alternate 'on' and 'off' time duration of 10 seconds and 3 seconds, respectively. So after every l0 seconds of running (either in clockwise or anticlockwise direction), the motor stops for a brief duration of 3 seconds. The values of R3 and R4 are calculated accordingly.

The master timer is realised with monostable IC 555 (IC1) and its 'on' time is decided by the resistance of 1-mega-ohm potmeter VR. A 47-kilo-ohm resistor is added in series so that even when the VR knob is in zero resistance position, the net series resistance is not zero.

The on-off cycle in the master timer should

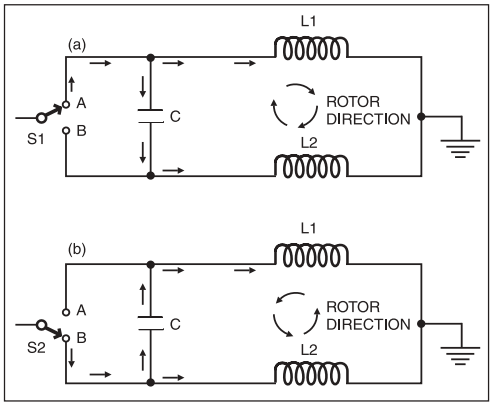

Fig. 2: Direction of motor

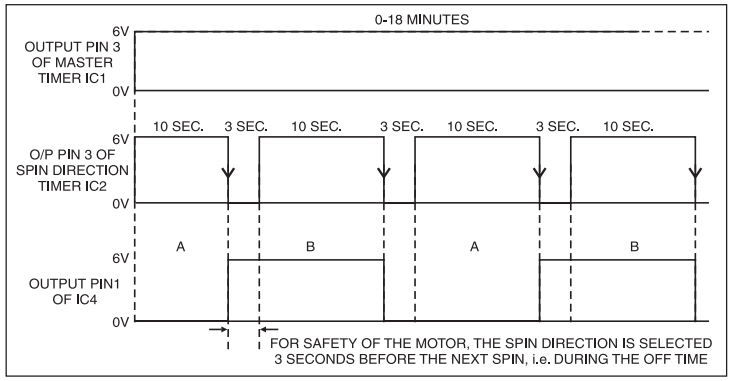

Fig. 3: Timing diagram for rotation of motor

go on only for the set time (here it is 18 minutes). Once the master timer goes off, the cycle should stop. To achieve this, the outputs of both the timers are connected to NAND gate N1 (IC3), which gives a low output only when both the timers are giving high outputs.The output pin 2 of N1 is connected to relay RL1 via pnp transistor T1, so the relay energises only when the output from NAND gate N1 is low. As the mains 220V line is taken through relay RL1, the motor turns off during the 3-second off period after the set time of 10 seconds is over. The graph is shown in Fig. 3.

During 'on' time of spin direction timer IC2, the output of negative-edge triggerd JK flip-flop at pin 2 goes low to energise relay RL2 and washing machine motor rotates in one direction. During the off time of IC2, the output of N1 goes high again to de-energise relay RL1, which cuts off the mains supply to RL2 and the motor stops rotating.

Floating point trouble may occur at trigger pin 2 of IC1. Resistor R8 overcomes this problem by holding pin 2 high.