TRIPLE POWER SUPPLY

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This low-cost, multipurpose power supply fulfils the requirements of almost all laboratory experiments. Nonetheless, it can be easily fabricated by hobbyists.

A single transformer is used to build this triple power supply. Regulator IC LM317 generates variable power supply of 1.25 to 20V, 1A. The dual ±12V, 1A power supply is generated by regulators 7812 and 7912. Similarly, dual ±5V, 1A power supply is generated by regulators 7805 and 7905. 'On'/'off' switches (S2 through S4) select the required power supply. Variable power supply is used to study the characteristics of devices. Fixed +5V power supply is used for all digital, microprocessor and microcontroller experiments. Dual ±12V power supply is used for op-amp-based analogue circuit experiments.

Fig. 1 shows the circuit of the triple power supply, while Fig. 2 shows the pin configuration of the regulators used in the circuit. Transformer X1 steps down the mains power to deliver the secondary output of 18V-0-18V. The transformer output is rectified by full-wave bridge rectifier BR1, filtered by capacitors C1, C2, C3, C7 and C8, and regulated by IC1 through IC5. Regulator IC1 (LM317) provides variable voltages (1.25 to 20V), while IC2 and IC4 provide regulated +12V and –12V, respectively. The output of IC2 is fed to regulator IC3 (7805), which provides fixed +5V. Similarly, the output of IC4 is fed to regulator IC5 (7905), which provides fixed –5V. Capacitors C4 through C6, and C9 through C11, are used for further filtering of ripples in positive and negative regulated power supplies. LED1 glows to indicate that +5V is available, while LED2 indicates that –5V is available.

Switch S1 is used for mains 'on'/'off'. Using switches S2 through S4, any of the three supplies can be independently turned off when not required in a particular experiment. This reduces unnecessary power dissipation and increases the life and reliability of the power supply. Since the circuit uses three terminal regulators, only capacitors are required at the input and output. The use of few components makes the circuit very simple. The three terminal regulators have heat-sink provision to directly deliver 1A output current. To ensure the maximum output, do not forget to

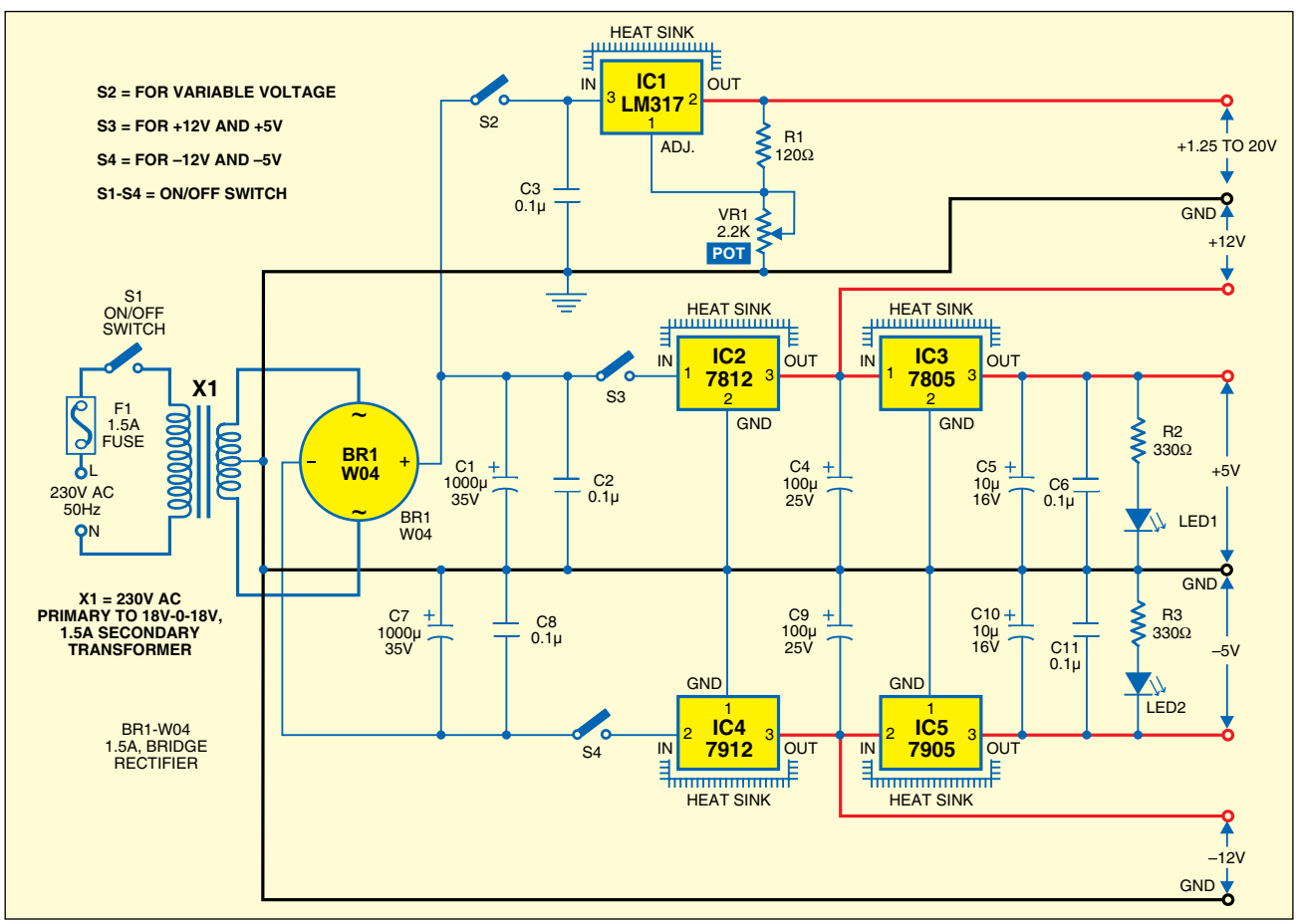

Fig. 1: Tripple power supply

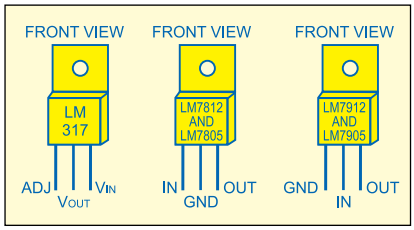

Fig. 2: Pin configurations of regulators

use heat-sinks for the regulators.

The three-terminal regulators are almost non-destructible. These have inbuilt protection circuits including the thermal shutdown protection. Even if there is overload or shorting of the output, the inbuilt overload protection circuit will limit the current and slowly reduce the output voltage to zero. Similarly, if the temperature increases beyond a certain value due to excessive load and heat dissipation, the in-built thermal shutdown circuit will reduce the output current and the output voltage (gradually) to zero. Thus complete protection is provided to the circuitry.

Assemble the circuit on a general-purpose PCB and enclose in a box as shown in Fig. 3.

The step-by-step procedure to build the triple power supply for the laboratory follows:

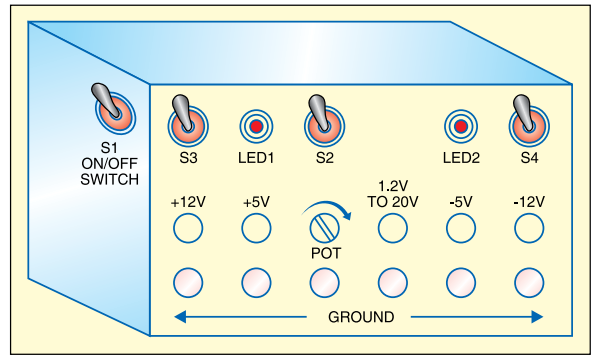

Fig. 3: Proposed cabinet for power supply

1. Collect all the components shown in the circuit diagram.

2. Connect switch S1, fuse, transformer and mains cord to the assembled PCB as well as the box.

3. Keep the multimeter in DC voltage range (more than 25V DC) and measure the DC voltage across capacitors C1 and C7 (1000 µF, 35V). This voltage should be around 18V×1.41=25 to 26V DC. Check both positive and negative voltages with respect to ground.

4. It is advisable to use three-wire mains cable and plug. If you are using any metallic box, earthing wire/pin of the mains plug should be soldered to the body of the metallic box using an earthing tag.

5. If the 18V-0-18V transformer is replaced with 15V-0-15V transformer, the output voltage of the variable supply using LM317 will be correspondingly lower.

6. If proper voltages are available, go to step 7. Otherwise, check the connections.

7. Connect variable regulator LM317 to the circuit and check 1.25V to 20V output by varying the 2.2-kilo-ohm linear potentiometers.

8. Now connect ICs 7812, 7912, 7805 and 7905 to the circuit and check their output voltage.

9. Connect terminals, potmeter, switches and indicator LED on the front panel of the box and complete the connections. Close the box by using screws.

Precaution. At the primary side of the transformer, 230V AC could give lethal shocks. So be careful not to touch this part. EFY will not be responsible for any resulting loss or harm to the user. ●