UNDER-/OVER-VOLTAGE BEEP FOR MANUAL STABILISER

K. UDHAYA KUMARAN

Manual stabilisers are still popular because of their simple construction, low cost, and high reliability due to the absence of any relays while covering a wide range of mains AC voltages compared to that handled by automatic voltage stabilisers. These are used mostly in homes and in business centres for loads such as lighting, TV, and fridge, and in certain areas where the mains AC voltage fluctuates between very low (during peak hours) and abnormally high (during non-peak hours).

Some manual stabilisers available in the market incorporate the high-voltage auto-cut-off facility to turn off the load when the output voltage of manual stabiliser exceeds a certain preset high voltage limit. The output voltage may become high due to the rise in AC mains voltage or due to improper selection by the rotary switch on manual stabiliser.

One of the major disadvantage of using a manual stabiliser in areas with a wide range of voltage fluctuations is that one has to keep a watch on the manual stabiliser's output voltage that is displayed on a voltmeter and keep changing the same using its rotary switch. Or else, the output voltage may reach the preset auto-cut-off limit to switch off the load without the user's knowledge. To turn on the load again, one has to readjust the stabiliser voltage using its rotary switch. Such operation is very irritating and inconvenient for the user.

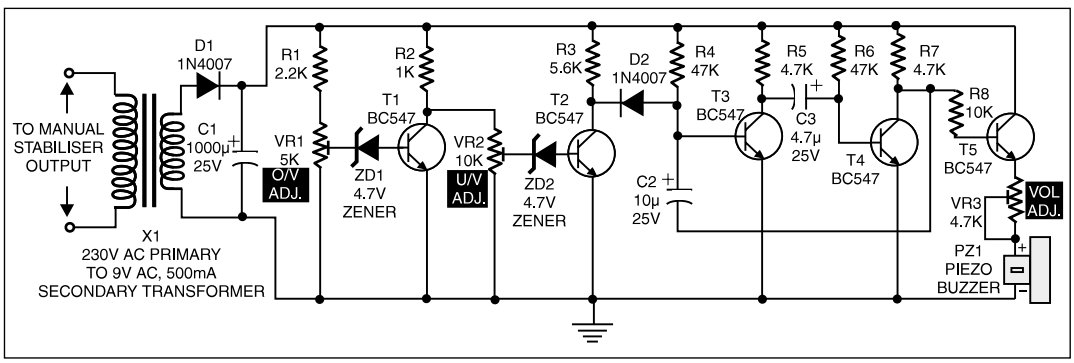
This under-/over-voltage audio alarm circuit designed as an add-on circuit for the existing manual stabilisers overcomes the above problem. Whenever the stabiliser's output voltage falls below a preset low-level voltage or rises above a preset high-level voltage, it produces different beep sounds for 'high' and 'low' voltage levels-short-duration beeps with short intervals between successive beeps for 'high' voltage level and slightly longer-duration beeps with longer interval between successive beeps for 'low' voltage level. By using these two different types of beep sounds one can readily readjust the stabiliser's AC voltage output with the help of the rotary switch. There is no need of frequently checking voltmeter reading.

It is advisable to preset the high-level voltage 10V to 20V less than the required high-voltage limit for auto-cut-off operation. Similarly, for low level one may preset low-level AC voltage 20V to 30V above minimum operating voltage for a given load.

The primary winding terminals of step-down transformer X1 are connected to the output terminals of the manual stabiliser. Thus, 9V DC available across capacitor C1 will vary in accordance with the voltage available at the output terminals of the manual stabiliser, which is used to sense high or low voltage in this circuit.

Transistor T1 in conjunction with zener diode ZD1 and preset VR1 is used to sense and adjust the high-voltage level for beep indication. Similarly, transistor T2 along with zener ZD2 and preset VR2 is used to sense and adjust low voltage level for beep indication.

When the DC voltage across capacitor C1 rises above the preset high-level voltage or falls below the preset low-level voltage, the collector of transistor T2 becomes high due to non-conduction of transistor T2, in either case. However, if the DC voltage sampled across C1 is within the preset high- and low-level voltage, transistor T2 conducts and its collector voltage gets pulled to the ground level. These changes in the collector voltage of transistor T2 are used to start or stop oscillations in the astable multivibrator circuit that is built around transistors T3 and T4. The collector of transistor T4 is connected to the base of buzzer driver transistor T5 through resistor R8. Thus when the collector voltage of transistor T4 goes high, the buzzer sounds. Preset VR3 is used to control the volume of buzzer sound.



In normal condition, the DC voltage sampled across capacitor C1 is within the permissible window voltage zone. The base of transistor T3 is pulled low due to conduction of diode D2 and transistor T2. As a result, capacitor C2 is discharged. The astable multivibrator stops oscillating and transistor T4 starts conducting because transistor T3 is in cut-off state. No beep sound is heard in the buzzer due to conduction of transistor T4 and non-conduction of transistor T5.

When the DC voltage across capacitor C1 goes above or below the window voltage level, transistor T2 is cut off. Its collector voltage goes high and diode D2 stops conducting. Thus there is no discharge path for capacitor C2 through diode D2. The astable multivibrator starts

oscillating. The time period for which the beep is heard and the time interval between two successive beeps are achieved with the help of the DC supply voltage, which is low during low-level voltage sampling and high during high-level voltage sampling. The time taken for charging capacitors C2 and C3 is less when the DC voltage is high and slightly greater when the DC voltage is low for astable multivibrator operation. Thus during low-level voltage sensing the buzzer beeps for longer duration with longer interval between successive beeps compared to that during high-voltage level sensing.

This circuit can be added to any existing stabiliser (automatic or manual) or UPS to monitor its performance. ❑