

# Inexpensive power supply produces zero-ripple output

by Rod Spencer  
Chlorescope Systems, Linden, N.J.

Here is an easy way to build a low-cost power supply in which ripple voltage can be brought virtually to zero. Through a feedback arrangement, the ripple voltage is inverted and summed to cancel the normal ripple.

As indicated in the figure, an operational amplifier and a series-pass transistor are connected in the standard manner. However, a portion of the unregulated ripple voltage is fed into the op amp's inverting input.

When the wiper of the RIPPLE NULL potentiometer is set up toward the output voltage bus, the supply's ripple is normal. But when the pot wiper is set down toward its

unregulated-input end, a phase shift of  $180^\circ$  is introduced, and the ripple is reversed. If this RIPPLE NULL is adjusted properly, the supply's ripple voltage can be completely eliminated.

To adjust the circuit, first set the regulated output voltage to the desired level and then subject the output to the maximum load condition. Next, use an oscilloscope to monitor load voltage, and trim the output ripple voltage to zero. This supply's ripple will remain essentially zero for any load condition less than the maximum.

Representative component values are shown in the figure, and parts should be chosen to satisfy a particular application. The series-pass transistor, of course, is selected to meet load requirements. And, if an op amp cannot supply a sufficient base drive for the transistor chosen, a Darlington pair can be used instead. □

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**Canceling ripple.** Low-cost power supply employs inverting feedback loop to eliminate output ripple voltage almost entirely. Some of the circuit's unregulated ripple is applied to the op amp's inverting input, where it is reversed. This "negative" ripple cancels the supply's normal "positive" ripple. The technique can be made to satisfy a variety of application requirements by adjusting the component values.

