

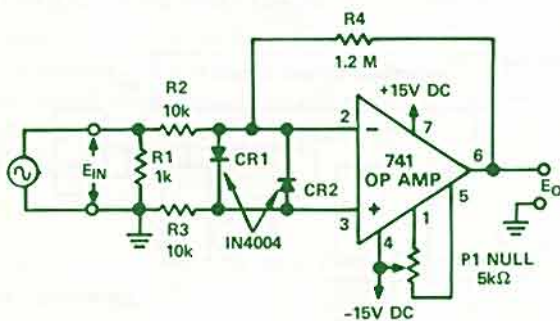
Application Brief

THE STRANGE CASE OF THE LARGE OFFSET or, Treat Your Diodes Like Mushrooms

by Richard P. Johnson*

The use of back-to-back protective diodes, a time-worn, tried-and-true arrangement used to prevent damage to op-amp input stages, in a garden-variety application with a 741-type amplifier, led to the manifestation of an interesting phenomenon. If you have had similar symptoms, without being aware of the cause, the following words may be helpful.

While checking out the circuit shown, on the test bench, an attempt was made to adjust the offset-null pot for zero dc output under no-signal conditions. Every time the operator's hand was brought near the circuit board, the dc output level shifted randomly over a +1V to +5V range. There was no evidence of instability, oscillation, or stray signal pickup, yet the movement of an opaque (aha!) object over the circuit board caused a definite level shift.



The op-amp output level shift was found to bear a direct relationship to the amount of light incident upon the circuit board. For example, when the small 50-watt bench-type reflector floodlamp was turned off, the level-shift disappeared almost entirely and null action was controllable and consistent. The overhead flush-mounted fluorescent lamps had a less-important effect but introduced an ac signal superimposed on the dc level shift. When the ambient light was removed, the op-amp output level was entirely normal.

The cause was (you guessed it!) photovoltaic action of the 1N4004 silicon glass-encapsulated diodes, which produced a net photocurrent of up to several microamperes through the feedback resistor, causing the output level-shift. This was checked out by a measurement involving only the diodes, a dummy load, and a digital voltmeter. The diode having the larger value of photocurrent determined the polarity of the voltage.

Conclusion: Use diodes having opaque encapsulation, or keep glass-encapsulated diodes in the dark during test and use. (Ed. note: Or use amplifiers with built-in protection, e.g., AD517, if the application isn't quite "garden variety".) ►►►

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