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Synchronous System Measures μΩs

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The circuit in **Fig 1** uses a synchronous-detection scheme to measure low-level resistances. Other low-resistance-measuring circuits sometimes inject unacceptably large currents into the system under test. This circuit synchronously demodulates the voltage drop across the system under test and can hence use extremely low currents while measuring resistance.

The 10V-pk, 1-kHz carrier generator injects a 1-mA reference current into unknown resistor, R_{TEST}. Instrument amplifier IC_1 and precision op amp IC_{2A} amplify the voltage across R_{TEST} by a gain of 100,000. Synchronous detector IC_3 demodulates this voltage, then op amp IC_{2B} acts as a lowpass filter on the demodulated voltage. The lowpass filtering will attenuate all uncorrelated disturbances, such as noise, drift, or offsets, while passing a dc voltage proportional to the unknown resistance.

The relationship between the output voltage and the unknown resistance is

$$V_{OUT} = 10 \times (2V/\pi) \times R_{TEST} \times 10^5/10\ k\Omega, \text{ or}$$
$$R = 0.0157 \times V_{OUT},$$

which is 15.7 mΩ/V at the circuit's output.

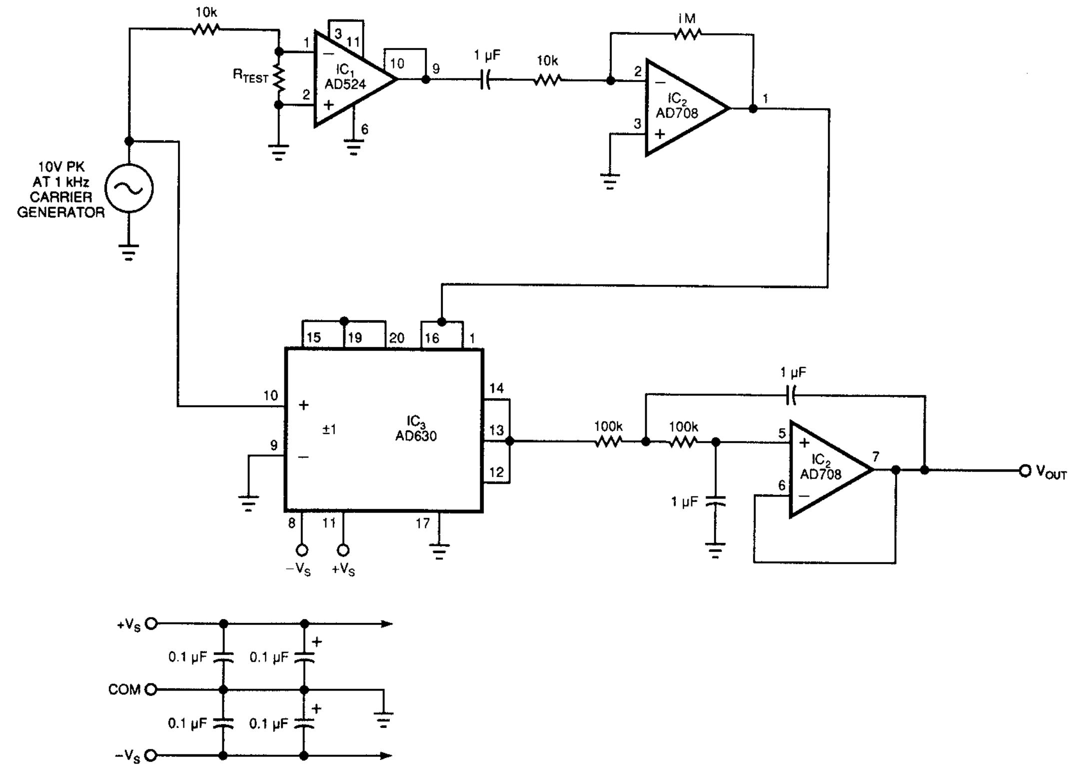

Fig 1—A synchronous demodulator helps this circuit *measure low-level resistances while rejecting uncorrelated disturbances, such as noise, drift, and offsets.*

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