ANALOG DEVICES

AN-683
APPLICATION NOTE

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Strain Gage Measurement Using an AC Excitation

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INTRODUCTION

Strain gage measurements are often plagued by offset drift, 1/f noise, and line noise. One solution is to use an ac signal to excite the bridge, as shown in Figure 1. The AD8221 gains the signal and an AD630AR synchronously demodulates the waveform. What results is a dc output proportional to the strain on the bridge. The output signal is devoid of all dc errors associated with the in-amp and the detector including offset and offset drift.

In Figure 1, a 400 Hz signal excites the bridge. The signal at the AD8221's input is an ac voltage. Similarly, the signal at the input of the AD630 is ac; the signal is dc at the end of the low-pass filter following the AD630.

The 400 Hz ac signal is rectified and then averaged; dc errors are converted to an ac signal and removed by the AD630. Ultimately, a precision dc signal is obtained.

The AD8221 is well suited for this application because its high CMRR over frequency ensures that the signal of interest, which appears as a small difference voltage riding on a large sinusoidal common-mode voltage, is gained and the common-mode signal is rejected. In typical instrumentation amplifiers, CMRR falls off at about 200 Hz. In contrast, the AD8221 continues to reject common-mode signals beyond 10 kHz.

If an ac source is not available, a commutating voltage may be constructed using switches. The AD8221's high CMRR over frequency rejects high frequency harmonics from a commutating voltage source.

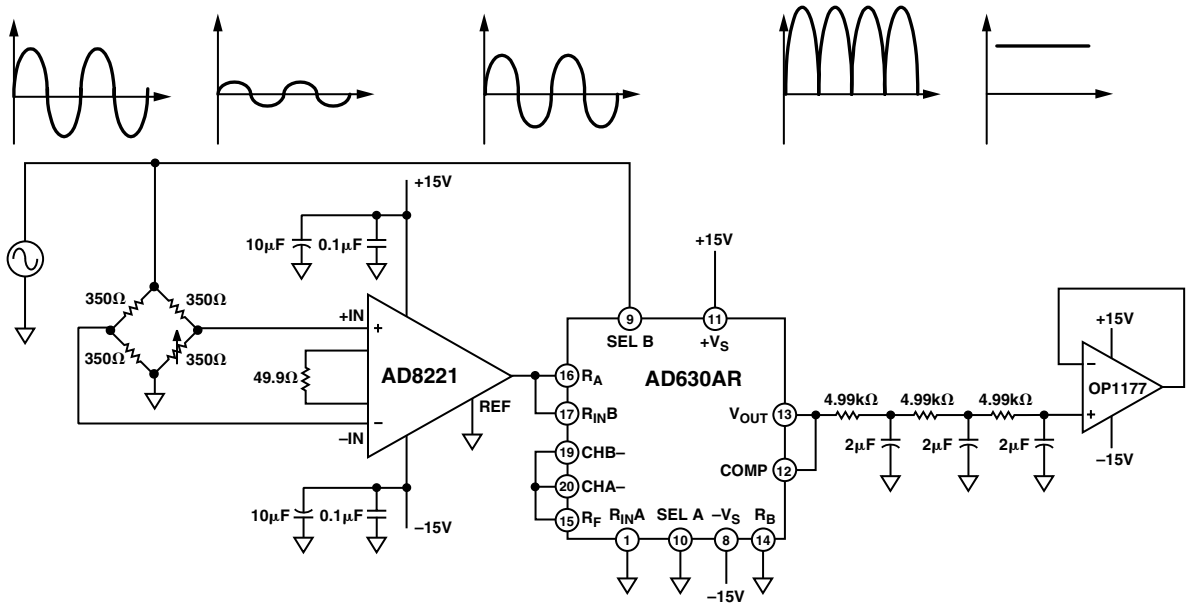

Figure 1. Using an AC Signal to Excite the Bridge