## RAQ's

## **Rarely Asked Questions**

Strange stories from the call logs of Analog Devices

## Rotary Potentiometers: There Must Be a Better Option

**Q:** I'm trying to use a potentiometer (pot) in the feedback loop of an op amp circuit, but the adjustment is too sensitive. Do you have any suggestions on how to improve the performance of this circuit?



A: The first thing I would tell you is to be careful when using pots in feedback loops, especially at higher frequencies. Wire wound pots have lots of inductance and can cause instability. Watch out for carbon pots as they are noisy.

Here are a few things you can try, however. Depending on your situation, you can add a series resistor and use the pot to "fine tune" the value you need. Sized appropriately, the pot sensitivity will be reduced greatly. You can also put the pot in parallel with the feedback resistor. Again, sizing the feedback resistor value is critical as to what contribution the pot will play. The advantage of this option is it allows you to go all the way to zero ohms.

A better option is to use a digitally controlled potentiometer or "digiPOT," which are extremely accurate and avoid typical pot issues such as wear out, vibration, drift, size, mechanical adjustment, and environmental issues, to name a few. Several options are available for the digital control (SPI, I<sup>2</sup>C, push button, and up/ down interface), and the adjustment is accurate and repeatable. A digiPOT can also be used as a rheostat, which is a pot with one of the end terminals tied to the wiper to form a variable resistor. digiPOTs work in both noninverting and inverting op amp configurations.

The bandwidth of these parts covers a wide range as a function of the resistor value. For example, a digiPOT set at 1K ohms has about 5 MHz of bandwidth, whereas a resistor setting of 10K ohms has a bandwidth of 500 kHz. These parts are extremely versatile and offer the designer a new tool for their "tool box." Low power, small footprint, and solid-state reliability make digiPOTs a very attractive alternative to the "old fashioned" option.

Even though they are simple building block devices (as most components are), there is a fair amount of detailed information to be considered. The datasheets for these devices (and all Analog Devices components) contain a wealth of comprehensive information, so a thorough read is recommended to optimize your design experience.

To Learn More About digiPOTs http://dn.hotims.com/34946-1000



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Have a question involving a perplexing or unusual analog problem? Submit your question to: www.analog.com/ askjohn

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