

Figure 3 shows a typical disk drive application circuit using the AD7669. The circuit implements a servo control loop using the ADC to monitor the head position while the DAC is used to control the position. Separate ground offset voltages are applied but these could be connected together if required.

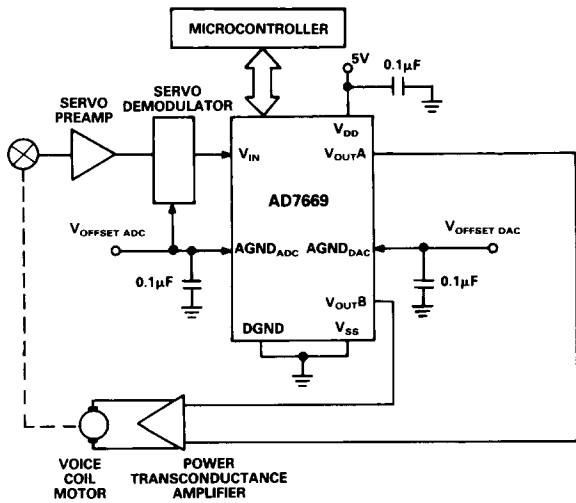


Figure 3. Servo Control Loop

The ADC input voltage range is shifted with respect to the system ground (DGND) by $V_{\text{OFFSET_ADC}}$. This results in an offset transfer function as shown in Figure 4. The first code transition occurs at an input voltage of $V_{\text{OFFSET_ADC}} + 0.5 \text{ LSB}$.

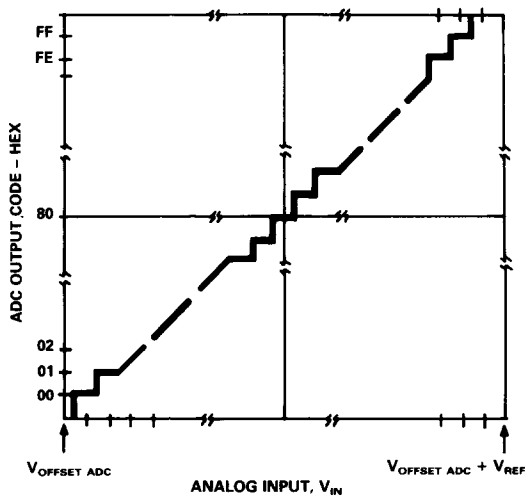


Figure 4. ADC Transfer Function with Offset Ground

Similarly, the AGND_{DAC} may be offset and the transfer function for the DAC is shown in Figure 5. The output voltage may be expressed as

$$V_{\text{OUT}} = V_{\text{OFFSET_DAC}} + V_{\text{REF}} \cdot D$$

where D is the fractional representation of the digital word. D may be set from 0 to 255/256.

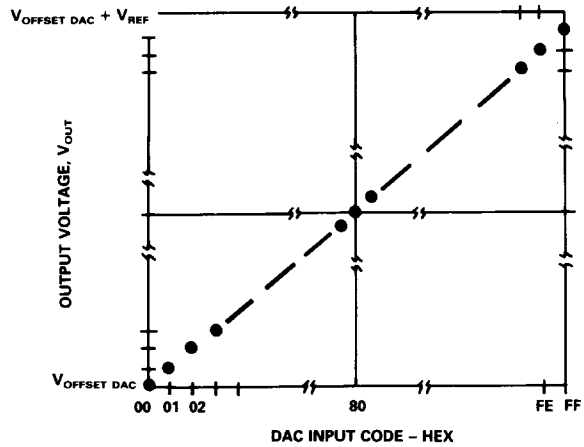


Figure 5. DAC Transfer Function with Offset Ground

For both analog grounds, a low impedance voltage source is required which can sink the currents flowing in the ground lines. With a 0.5 V bias, the AGND_{ADC} current is approximately 4 mA, and the AGND_{DAC} current is approximately 2 mA. In order to maintain a low dynamic impedance, the pseudo grounds should be decoupled to DGND using 0.1 μF capacitors. The capacitors will absorb the current transients which occur during conversion.

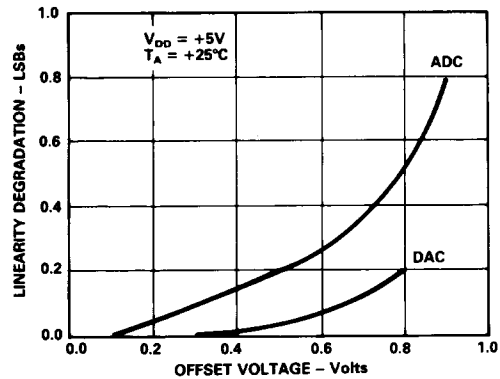


Figure 6. Accuracy vs. Offset Voltage

A plot of linearity error degradation for both the ADC and the DAC is shown in Figure 6. With a ground offset of 0.5 V, the ADC linearity error degradation is 0.2 LSBs while the DAC degrades by less than 0.1 LSB. The DNL error for both the ADC and the DAC remains well below 1 LSB thus ensuring no missed codes for the ADC and monotonic DAC operation.

Larger ground offsets than those shown in Figure 6 may be applied at the expense of accuracy. If significantly larger ground offsets are desired, then another I/O port manufactured by Analog Devices, the AD7769, should be used. This part allows user programmable offsets over a much wider range. Please consult the data sheet for further details on this part.

Information furnished in this application note is based on results taken from three fabrication lots and is believed to be accurate and reliable. However no responsibility is assumed by Analog Devices for its use.