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# Simplified 16-Bit, 4 mA-to-20 mA Output Solution Using the AD5420

## CIRCUIT FUNCTION AND BENEFITS

This circuit provides a 4 mA-to-20 mA output using the AD5420, a single channel, 16-bit, serial input, 4 mA-to-20 mA current source DAC. This circuit utilizes only the AD5420 product. The only external components needed are decoupling capacitors on the supply pins and reference input and a pull-up resistor for the open-drain $\overline{\text{FAULT}}$ output, which alerts to a loss of compliance voltage on the output or an over-temperature of the AD5420 device. This offers a level of integration that leads to savings in both cost and board space. This circuit is well suited for both programmable logic controllers (PLCs) and distributed control systems (DCSes) in industrial control applications.

## CIRCUIT DESCRIPTION

The AD5420 is a low cost, precision, highly integrated 16-bit digital-to-analog converter offering a programmable current source output designed to meet the requirements of industrial process control applications. The current output can be programmed with the ranges of 4 mA to 20 mA, 0 mA to 20 mA, or 0 mA to 24 mA. The AD5420 contains an internal 5 V, 10 ppm/°C maximum voltage reference. This leads to further savings in both cost and board space. Operation is specified with an $AV_{DD}$ supply up to 24 V. However, the AD5420 is capable of operating with an $AV_{DD}$ supply of up to 40 V. The AD5420 contains an on-chip regulated 4.5 V output ($DV_{CC}$ pin) capable of sourcing up to 5 mA. This can be used as a termination for pull-up resistors or to power digital circuitry, eliminating the need to generate a logic power supply.

Figure 2 shows that the typical accuracy of this circuit at 25°C ambient temperature is better than 0.016%.

The circuit must be constructed on a multilayer PC board with a large area ground plane. Proper layout, grounding, and decoupling techniques must be used to achieve optimum performance (see Tutorial MT-031, *Grounding Data Converters and Solving the Mystery of "AGND" and "DGND,"* and Tutorial MT-101, *Decoupling Techniques*).

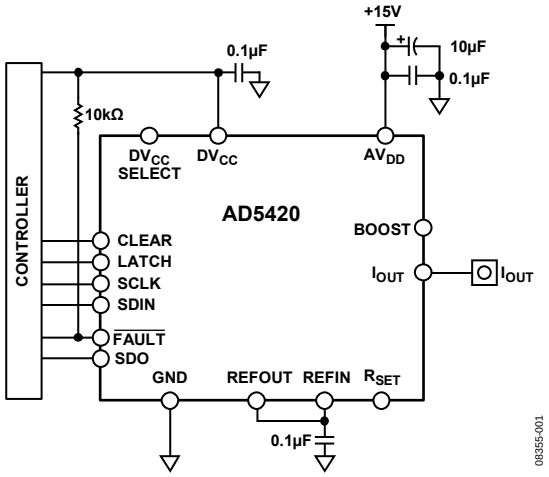


*Figure 1. Configuration of the AD5420 (Simplified Schematic)*

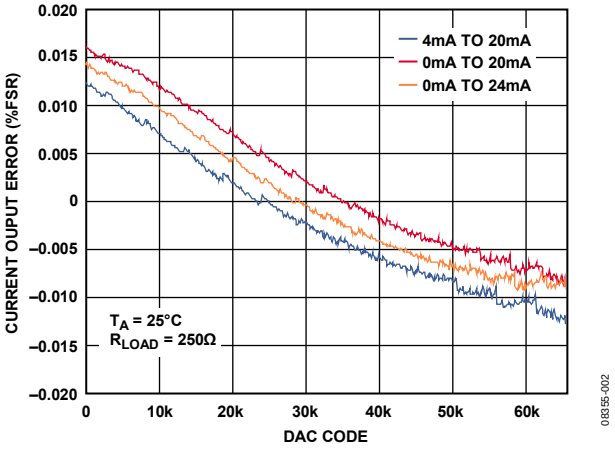


*Figure 2. Current Output Accuracy*

## LEARN MORE

Kester, Walt. 2005. *The Data Conversion Handbook*. Analog Devices. Chapters 3 and 7.

MT-015 Tutorial, *Basic DAC Architectures II: Binary DACs*. Analog Devices.

MT-031 Tutorial, *Grounding Data Converters and Solving the Mystery of "AGND" and "DGND."* Analog Devices.

MT-101 Tutorial, *Decoupling Techniques*. Analog Devices.

Voltage Reference Wizard Design Tool.

### *Data Sheets and Evaluation Boards*

AD5420 Data Sheet.

AD5420 Evaluation Board.

## REVISION HISTORY

**4/13—Rev. 0 to Rev. A**

Changed Document Title from CN-0098 to AN-1203 ..... Universal

**7/09—Revision 0: Initial Version**


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