

Simplified 12-Bit, 4 mA-to-20 mA Output Solution Using the **AD5410** Current Source DAC

CIRCUIT FUNCTION AND BENEFITS

This circuit provides a 4 mA-to-20 mA output using the **AD5410**, a single channel, 12-bit, serial input, 4 mA-to-20 mA current source DAC. This circuit uses only the **AD5410** 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 **FAULT** output, which alerts to a loss of compliance voltage on the output or an overtemperature condition of the **AD5410**. This implementation offers a level of integration that leads to savings in both cost and board space. This circuit is well suited for both the programmable logic controllers (PLCs) and the distributed control systems (DCS) in industrial control applications.

CIRCUIT DESCRIPTION

The **AD5410** is a low-cost, highly integrated 12-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 ranges of 4 mA to 20 mA, 0 mA to 20 mA, or 0 mA to 24 mA. The **AD5410** 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 **AD5410** is capable of operating with an **AV_{DD}** supply of up to 40 V. The **AD5410** contains an on-chip regulated 4.5 V output (**DV_{CC}** pin) capable of sourcing up to 5 mA, which can be used as a termination for pull-up resistors or to power digital circuitry, eliminating the need to generate a logic power supply voltage. Figure 2 shows that the typical accuracy of this circuit at 25°C ambient temperature is 0.011%.

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 [MT-015 Tutorial](#) and [MT-101 Tutorial](#)).

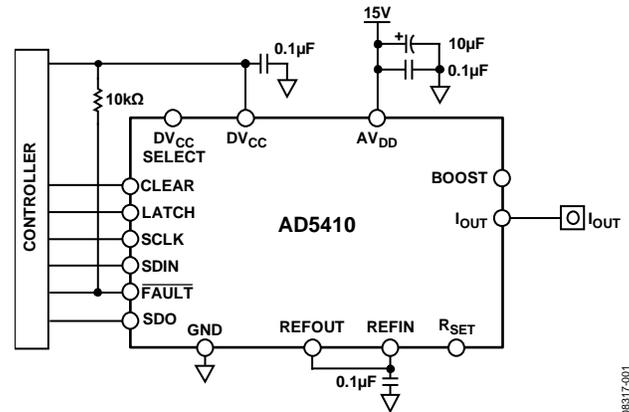


Figure 1. Connection Circuit for the **AD5410**

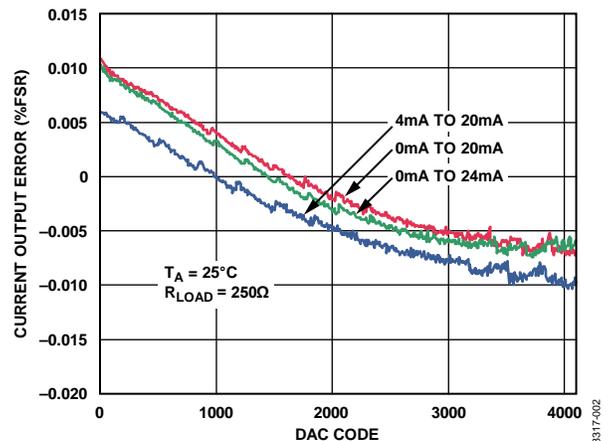


Figure 2. Current Output Accuracy

LEARN MORE

[Kester, Walt. 2005. *The Data Conversion Handbook*, Chapter 3 and Chapter 7. Analog Devices.](#)

[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

[AD5410 Data Sheet.](#)

[AD5420 Evaluation Board \(Compatible with AD5410\).](#)

REVISION HISTORY

04/13—Rev. 0 to Rev. A

Changed Document Title from CN-0081 to AN-1242 Universal

07/09—Revision 0: Initial Version