EGR 262

Fundamental Circuits Lab

Presentation for Lab #6

Analog-to-Digital Conversion - Hardware

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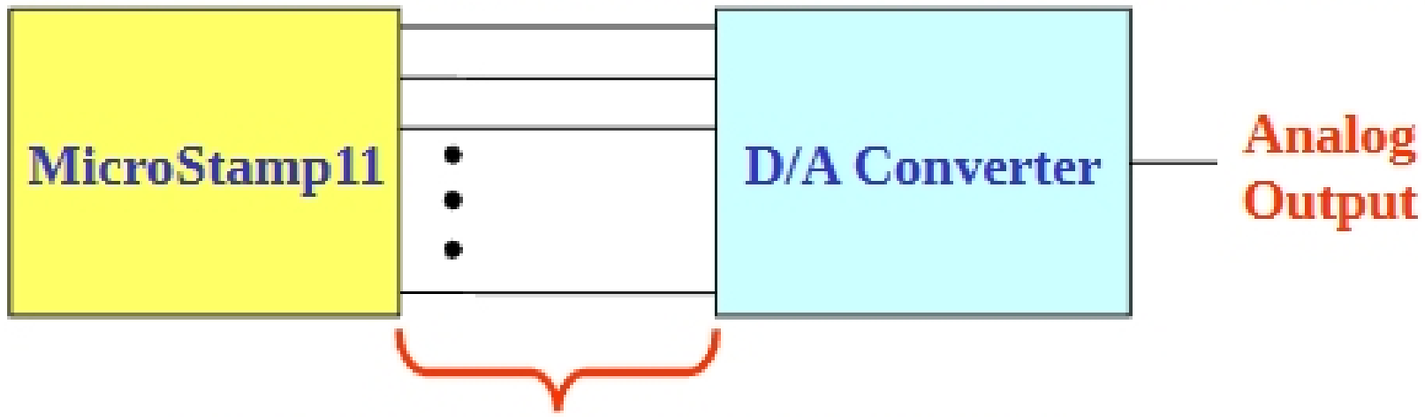
Digital-to-Analog Conversion

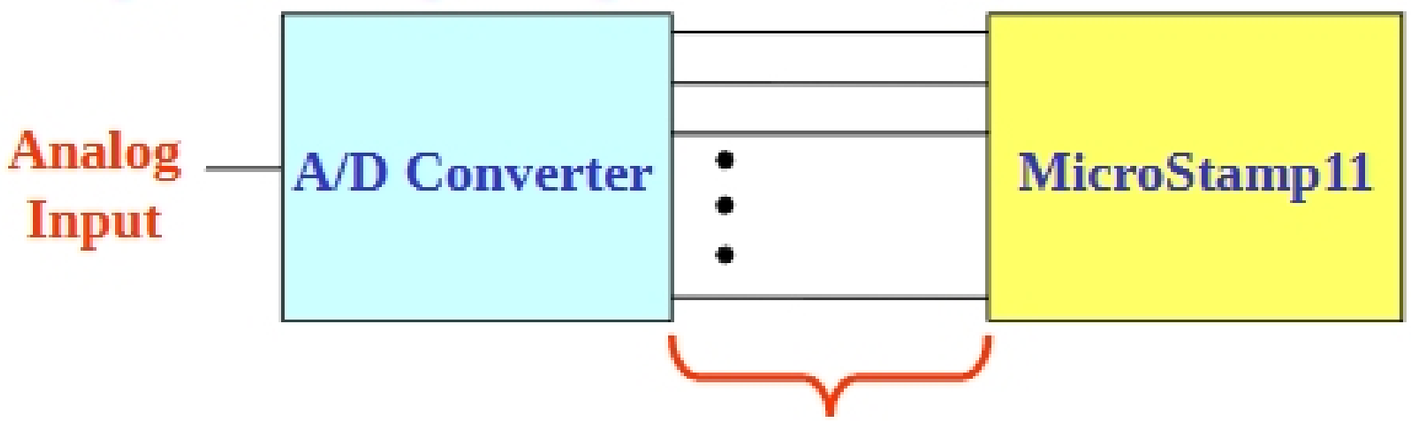
In order to control analog outputs, digital outputs must first be converted to analog form using a digital-to-analog converter (also referred to as a DAC or D/A converter).



Note: Labs 5 & 9 deal with digital-to-analog conversion.

Analog-to-Digital Conversion

In order to read analog inputs, the analog inputs must first be converted to digital form using a an analog-to-digital converter (also referred to as a ADC or A/D converter).



Note: Labs 6 & 7 deal with analog-to-digital conversion.

Analog-to-Digital Conversion

There are several methods of performing analog-to-digital conversion, including:

- Simultaneous A/D converter – this method uses 2^N comparators and an N-bit priority encoder to produce an N-bit output.
- Stairstep-ramp A/D converter – this method uses a D/A converter and a counter. As the binary count advances, it is converted to an analog signal and compared to the analog input.
- Tracking A/D converter – similar to the stairstep-ramp A/D converter, but uses an UP/DOWN counter so that each successive conversion starts with the last digital value and counts up or down until the new analog input value is detected.
- Single-slope A/D converter – instead of using D/A converter like the previous two methods, this method uses a linear ramp generator to produce a constant-slope reference voltage. A counter is synchronized with the slope of the ramp.
- Dual-slope A/D converter – similar to the single-slope A/D converter, but the input charges a capacitor linearly, producing a negative, variable-slope ramp. The capacitor then discharges linearly with a positive slope. A counter runs as the capacitor discharges, yielding a count proportional to the voltage. This method is commonly used with voltmeters and other test equipment.
- **Successive-approximation A/D converter** – this is perhaps the most widely used method and is used in Labs 6-7. It has a much shorter conversion time than most other methods and the conversion time is the same for any analog input.