Buzzer/Speaker

Core Concept Instructions

Materials:

myDAQ

Buzzer

Learn It!

An electric buzzer or speaker is a piezoelectric device, which uses electrical signals to create mechanical motion. Motion in these devices creates vibrations in the air. These vibrations, when created at the correct frequencies, are distinct pitches or tones of sound. Creating these pitches is accomplished most simply by using a digital signal and varying the frequency of "high" values written, thereby varying the emitted pitch.

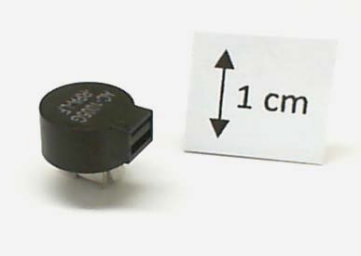
Simple buzzers like this one are commonly used in alarms or other notification devices, but can be used to play simple music and songs.

In this exercise, you will use a Pulse-Width-Modulated (or "PWM") signal to vary both the frequency and quality of sound generated by an electric buzzer; In doing so you will achieve some understanding of Pulse-Width Modulated signals and the characteristics of a simple piezo-electric speaker.

"…used in alarms or other notification devices, but can be used to play simple music and songs."

Build It!

Buzzers require well controlled PWM signals to function properly. For this reason a transistor and diode are required to ensure a suitable signal is delivered to the buzzer.



Creating a Buzzer Circuit

Step 1: Connect the Buzzer as indicated in the circuit diagram. The buzzer circuit requires three basic connections: power, ground, and a digital signal. The digital signal and ground are connected through a transistor to ensure clean changes from high to low in the digital signal.

Step 2: Download the LabVIEW files from the Resource tab, open the Buzzer Sensor Module, and open the VI titled "Buzzer Demo.vi". On the front panel should be a slider control for frequency (Figure 1). This will allow the user to vary the frequency of the digital signal sent to the buzzer, and therefore vary the frequency of the sound emitted by the buzzer.

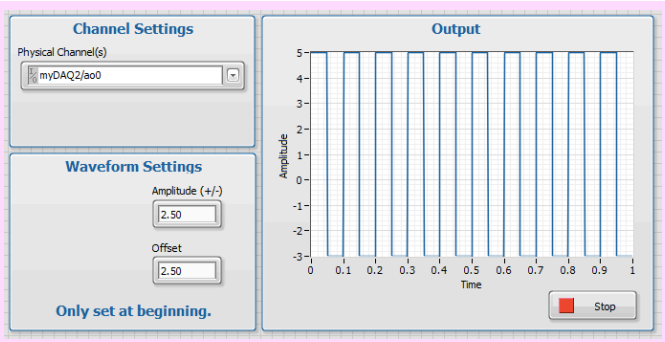


Figure 1: Buzzer Demo Front Panel

Step 3: Run the VI. Try varying the frequency of the control on the front panel. Make sure that the pitch emitted by the buzzer changes when you move the slider, and that its pitch increases as the frequency increases.

Guiding Questions:

- Can you think of a better control to use to set the frequency of the sound?
- The front panel control allows the user to vary the emitted sound frequency. Are certain frequencies inaudible? Why is this? Try researching the frequency limits of human hearing to learn more

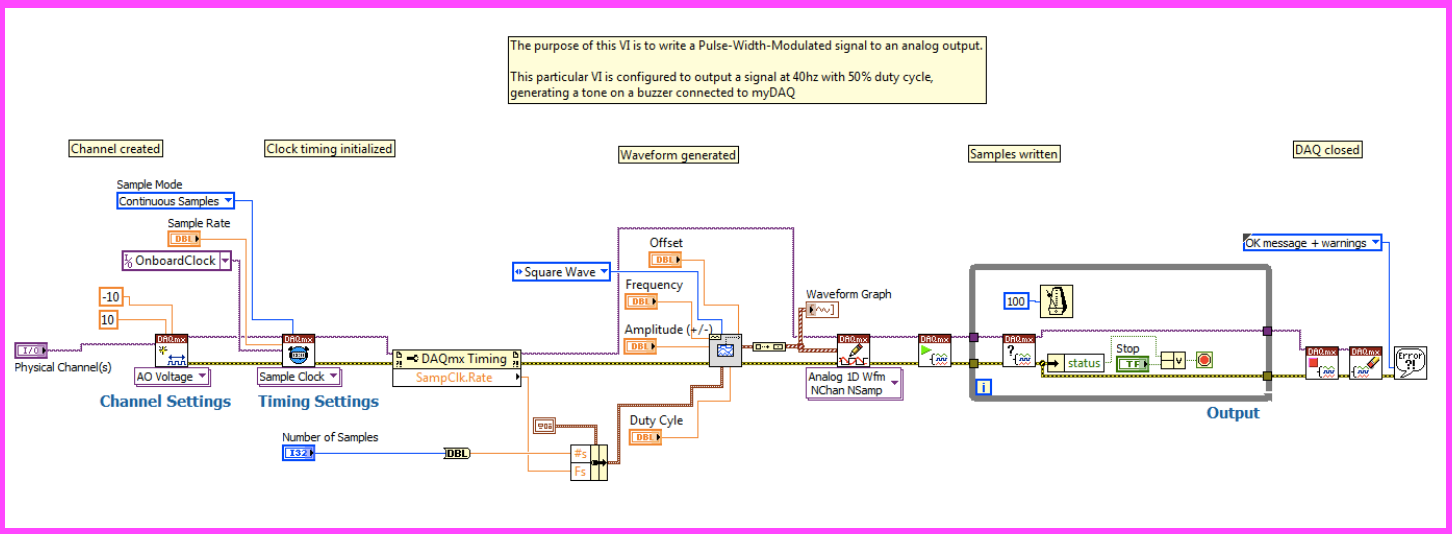


Figure 2: Writing the Buzzer's PWM signal

Step 4: Examine the Block Diagram of the Main VI (Figure 2).

The code writes a digital PWM signal to a selected Digital output. In this case, the duty cycle is fixed to 50%, and we are adjusting the frequency with the slider control on the front panel. This signal is then written to the digital output, which drives the emission of sound from the buzzer.

Guiding Questions:

- The duty cycle is set to a constant of 0.5 or 50%. What affect would using a 100% duty cycle have? Why?
- The front panel control allows the user to vary the emitted sound frequency. Could you use an array to store and deliver these values? What benefits might this have?

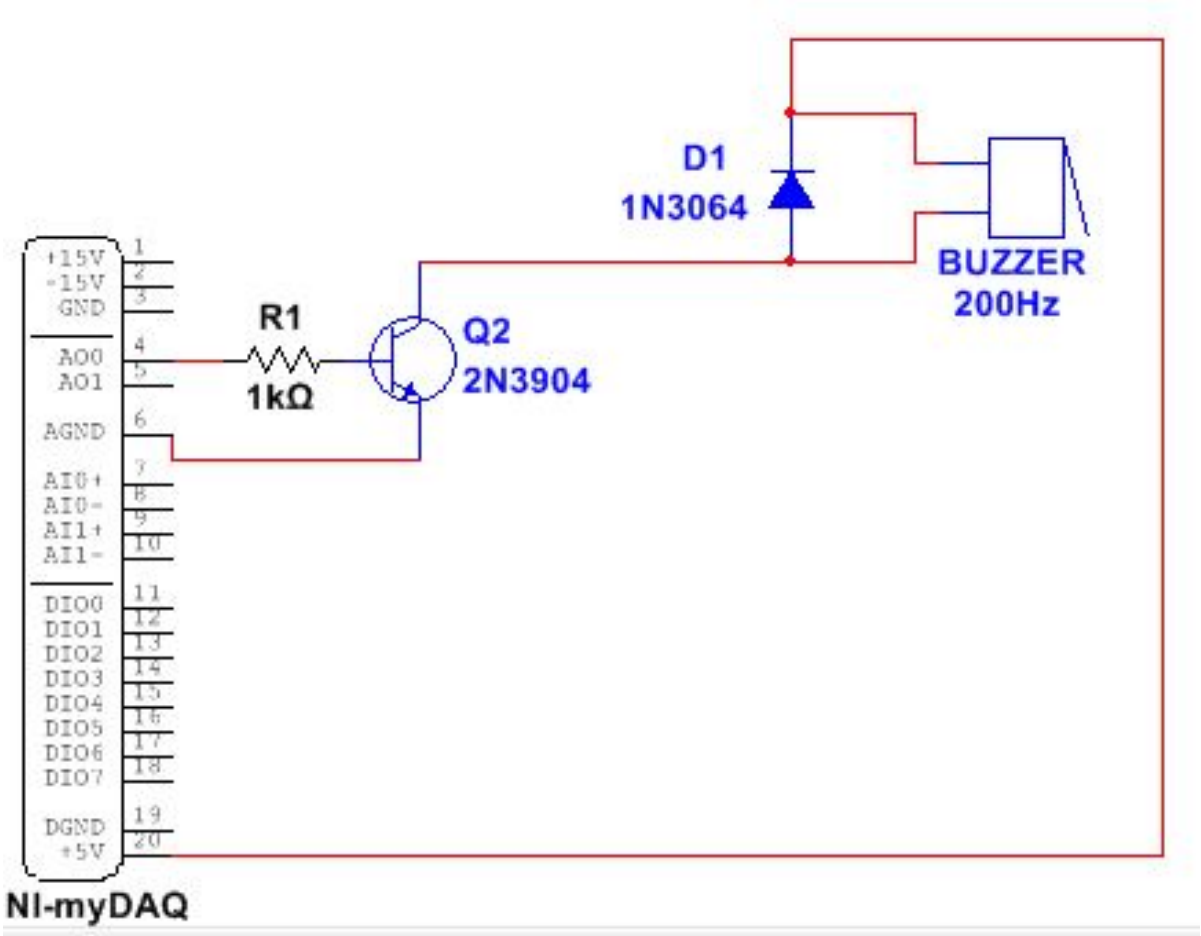


Figure 3: Buzzer Demo Multisim Circuit

Expand it!

- Add a front-panel control to adjust the waveform pulse width (called duty cycle) between 0% and 100%. How does a narrow pulse (low duty cycle) affect the tone quality at various frequencies?
- Create a two-tone alarm signal with a Boolean front panel control as an enable. Review "Discrete LED demo.lvproj" from section 2.3 on page 7 to learn how to make a two-state oscillator.

Research it!

Study the video Buzzer/speaker Characteristics (youtu.be/8IbTWH9MpV0, 5:14) to learn more about the buzzer/speaker characteristics and interface circuit design principles including: sizing the transistor for relay coil current, importance of the diode to deal with back-emf voltage spiking, and circuit topologies for DIOs with internal pull-up resistors (MXP connector) and internal pull-down resistors (MSP connector).

Study the video PWM Express VI (youtu.be/mVN9jfwXIeI, 2:41) to learn how to use the PWM Express VI (PWM=pulse-width modulation) to create a square wave output on B/PWM0 (pin 27) in the frequency range 40 Hz to 40 kHz with adjustable pulse width.

Study the video Buzzer/speaker Demo Walk-Through (youtu.be/kW4v16GuAFE, 2:06) to learn the design principles of Buzzer-Speaker demo,

Buzzer/speaker Specs ~ Soberton GT-0950RP3
http://www.soberton.com/product/gt-0950rp3

1N3064 small-signal diode Specs:
http://www.fairchildsemi.com/ds/1N/1N3064.pdf

2N3904 npn transistorSpecs:
http://www.fairchildsemi.com/ds/MM/MMBT3904.pdf