PREPARATION

You will need a LaunchPad, a 1kΩ resistor, the headphone jack, and headphones. Look up a data sheet for your audio jack. This is a data sheet for one of the possible jacks that can be used with Labs 12-15: **SJ1-3553NG.pdf** (/c4x/UTAustinX/UT.6.01x/asset/SJ1-3553NG.pdf)

STARTER PROJECT

Lab12_TuningFork

PURPOSE

This lab has these major objectives: 1) the understanding and implementing of interrupt software; 2) interfacing an output pin to the speaker, so that the software can generate a quiet buzzing sound at 440 Hz; and 3) the study the accuracy of the pitch created with interrupts. Please read the entire lab before starting.

SYSTEM REQUIREMENTS

In this lab you will make a square wave sound at 440 Hz, which is a standard frequency created by a tuning fork. You will interface a positive logic switch as the input, and you will interface the headphones as an output. The choices for input/output pins supported by the graders is listed in Tables 12.1 and 12.2. A resistor placed in series with the headphones will control the loudness of the sound, see Figure 12.1. Any value between 680 Ω and 2 kΩ will be OK. Selecting a larger the resistor will make the sound quieter. Please do not leave this resistor off entirely.

WORKING LAB 12

Help

0:00 / 0:51 1.0x

DR. JONATHAN VALVANO: Hi.

Let's begin Lab 12 by showing you what the final product will look like.

Here's our LaunchPad, and I have a square wave coming out of a pin,

which comes to this 1k resistor, and then goes to the speaker.

That'll be your headphones.

I also have a regular switch, and when you press this switch,

your program is supposed to generate a 440 Hertz wave.

And that wave will generate a tone that you can hear.

[440 Hz tone]

Over on my oscilloscope, you can see I've captured that wave form,

and so the voltage across the speaker in this case

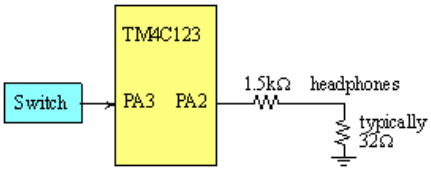

Figure 12.1. Possible hardware interface for Lab 12.

The lab describes using PA3 for input and PA2 for output, but Tables 12.1 and 12.2 show other options that the automatic graders can handle.

Output	PA2	PB2	PE2

Table 12.1. Possible ports to interface the output (PA2 is default).

Input	PA3	PB3	PE3

Table 12.2. Possible ports to interface the input (PA3 is default).

Figure 12.2 illustrates the operation of the system. You will push the switch to start a quiet 440 Hz tone on the headphones. The sound should continue to be generated until you push the switch a second time. Each time you press the switch the sound should either start or stop.

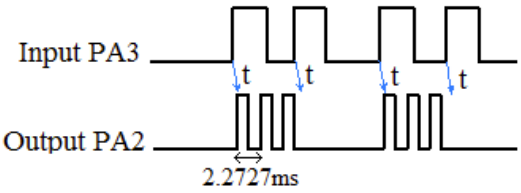

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Figure 12.2. Desired input/output behavior. Notice the first time the switch is pressed the 440 Hz tone starts, the second time it is pressed the tone stops, the third time the switch is pressed, the tone starts again, and the fourth time stops the tone again.

This on/off pattern should repeat each time the switch is pressed. When the output is oscillating it has a period of 1/440 sec = 2.2727ms (interrupt at 1/880 Hz = 1.13636ms.) The time, *t*, between touching a switch and the change in output need not be immediate. As long as the toggling starts or stops on the next SysTick interrupt.

We do not expect you to use edge-triggered interrupts to detect changes in the input. In fact, the TExaS simulator do not yet support edge-triggered, and the real-board grader uses edge-triggered interrupts on your output pins, so you will not be able to use edge-triggered interrupts on Lab 12.