

1. [10 points] Write code to implement a simple reaction timer that works as follows and uses interrupts.
 - i) Set the switch SW1 in Off position. The program starts with a message on LCD as “Toggle SW1” on the first line and “if LED glows” on the second line. After displaying this message for 2 seconds, turn on the LED P1.4.
 - ii) The user toggles SW1 because of the displayed message. The LED should be turned Off as soon as the switch is toggled.
 - iii) The program is expected to measure time between the instant the LED starts glowing and the instant the switch toggle is identified.
 - iv) Next, the display on the LCD shows “Reaction Time” on the first line and the “Count is XX XXXX” on the second line. Assuming T0 is used, display of count should be of 6 digits. First 2 digits show the number of times the timer has overflowed, next 2 digits show the TH0 value, next 2 digits show TL0 value, each value in hexadecimal. This message is displayed for 5 seconds. *Note:* Optionally, you can display the time in msec.
 - v) Go back to Step (i) and repeat the process continuously.
2. [10 points] Write code to generate two musical notes corresponding to the frequencies shown in Table 1. The musical notes can be generated as square waveform of specific frequencies. These can be generated and output using the speaker with appropriate interfacing.
 1. Use timer T0 to generate the note (waveform) of appropriate frequency. Use timer T1 to control the duration of the note. The output has to be written to port P0.0. Generate the two notes shown in Table 1 and let the duration of the notes be 2 s each. Do this continuously and verify the output using the debugger.
 2. Connect the speaker to the Pt-51 kit using the SL100 transistor and interfacing circuit shown in Figure 1. You should be able to hear the notes being played out on the speaker.

Table 1: Note frequencies.

| S. No. | Note | Frequency |
|--------|------|-----------|
| 1 | Re | 270 |
| 2 | Ga | 300 |

TA Checkpoints

1. For question 1, ask the students to show the working of the reaction timer. Do this with short and long reaction times.
2. For question 2, check the appropriate waveforms on the logic analyzer (Keil). Also ask them to play out the notes.

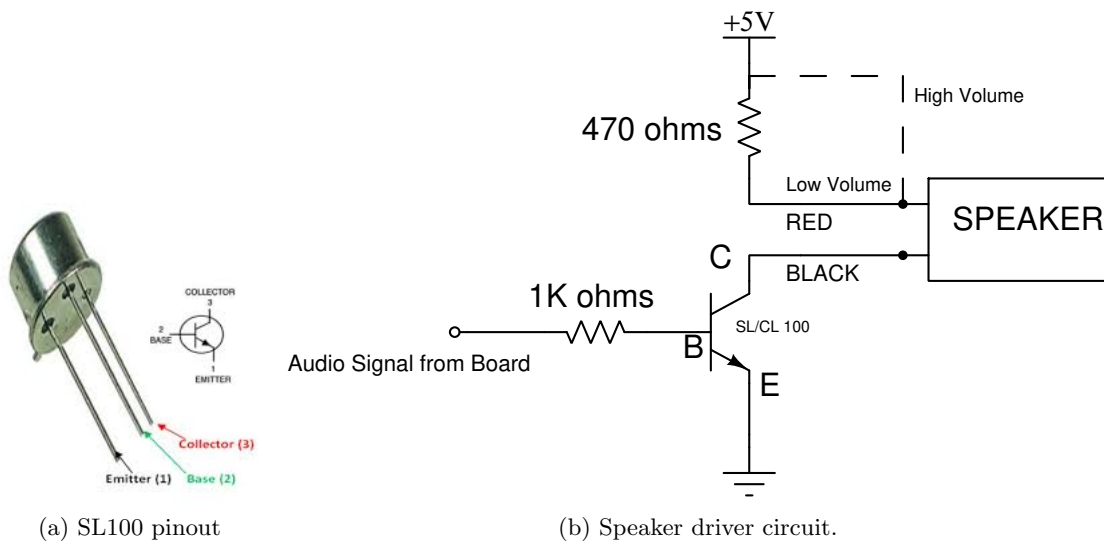


Figure 1: Circuit for interfacing Pt-51 with speaker.