# Sound_Sensor_Module -- Overview

**Mukesh Soni**
Researcher / PhD Student
Mechanical Engineering Department
The University of Melbourne

THE UNIVERSITY OF MELBOURNE

## Understanding Sound Sensor Module

## Objectives:

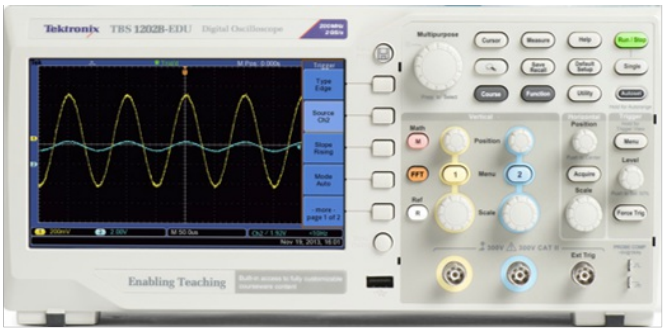
After performing this lab exercise, learner will be able to:

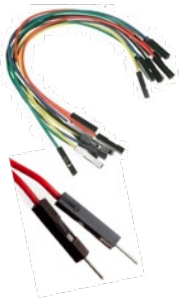
- Understand the working of sound sensor module (FC-04)
- Practice working with measuring equipment and laboratory tools like digital oscilloscope and DC Power Supply
- Use digital oscilloscope to debug/analyze the circuit

## Equipment:

To perform this lab experiment, learner will need:

- Digital Storage Oscilloscope (TBS1000B-Edu from Tektronix or any equivalent)
- Power Supply (2231A-30-3 Power Supply from Keithley or any equivalent power supply capable of supplying +/- 10V DC)
- Multimeter (for voltage measurement)
- Sound Sensor module FC-04
- Breadboard and connecting wires



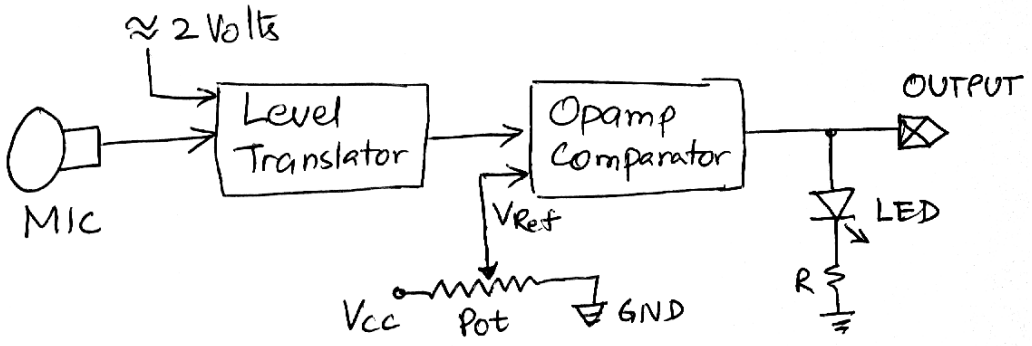





## Theory / Key Concepts:

Before performing this lab experiment, it is important to learn following concepts:

- Sound sensor module FC-04 uses a microphone that converts the accoustic signal (sound) to electrical signal.
- The functional block diagram for FC-04 module is shown below:




- Electrical signal from microphone (which is proportional to sound) is translated at about 2V using potential divider circuit.
- Signal is then amplified and compared (using LM393 Opamp) against a reference to product a digital output whenever sound signal is more than reference (threshold).
- The threshold can be adjusted using a potentiometer.

# Sound_Sensor_Module -- Procedures

## Step 1

### Check Your Understanding:

Before performing this lab experiment, learners can check their understanding of key concepts by answering these?

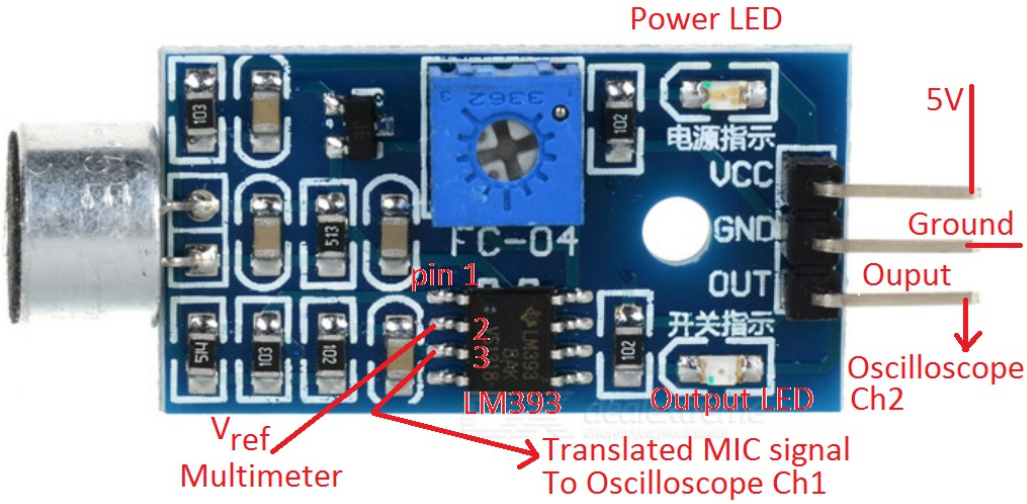
- Microphone is used to convert:
  - Sound to electrical signal
  - Light to electrical signal
  - Pressure to electrical signal
  - Distance to electrical signal
- A microphone, connected at non-inverting terminal of an opamp comparator, produces 2.7V. If the reference voltage at inverting pin is 2.2V, then what will be the comparator output ?
  - Voltage close to $V_{CC}$
  - Voltage close to ground
  - 2.2V
  - 2.7V
- What is the purpose of providing potentiometer on FC-04 sound sensor module?
  - To adjust brightness of output LED
  - To adjust DC power to LM393 comparator
  - To adjust threshold & sensitivity of the switching by sound

- To adjust the level translation of microphone output

## Step 2

### Circuit diagram / Connection Details

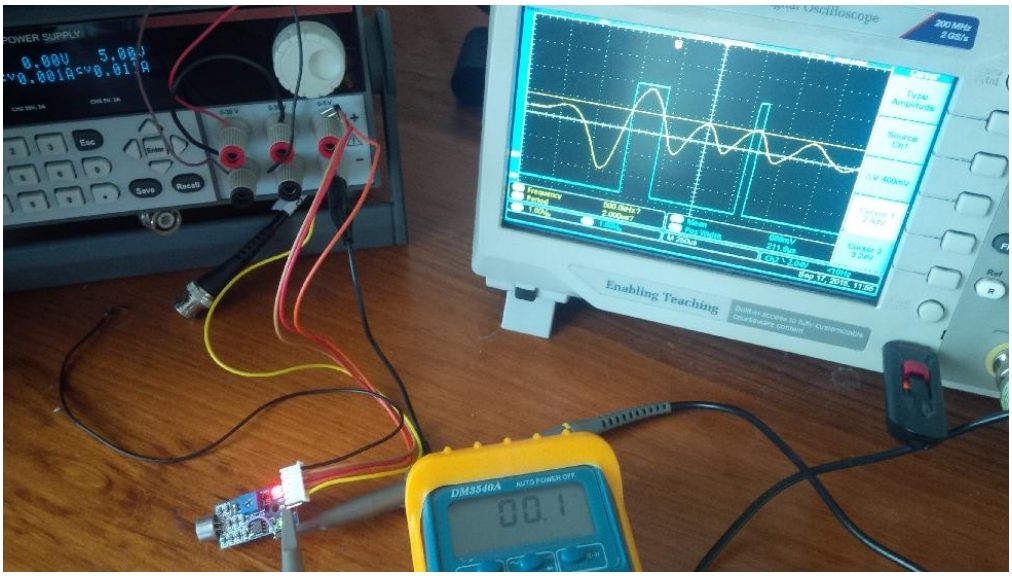
- Using the jumper / connecting wires prepare the circuit as shown below -
  - Pin 3 (MIC output after level translation) of LM393 goes to Ch1 of the oscilloscope
  - Pin 2 ($V_{ref}$) is measured by mutimeter
  - Output pin goes to Ch2 of the oscilloscope
  - 5V is applied between $V_{cc}$ and Ground using DC power supply




## Step 3

### Experiment Setup

- Make the arrangement as shown in figure below -

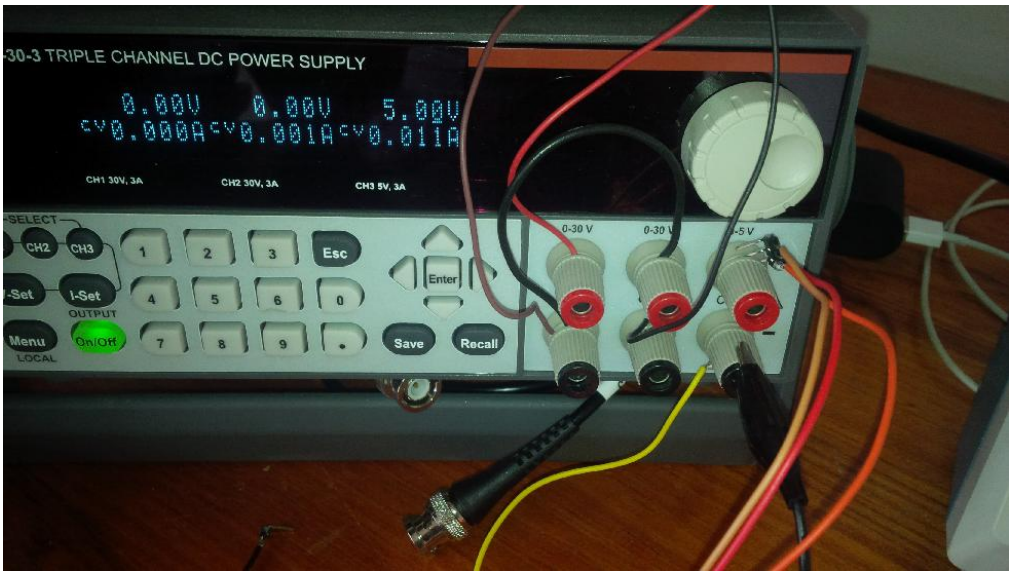


- 5V supply is provided using 2231A power supply to the sound sensor module
- From the sound sensor module, Pin 3 of LM393 IC is fed to channel 1 of the osciloscope
- Connect output pin of sensor module to channel 2
- Multimeter is used to measue the $V_{ref}$ (voltage at pin 2 of the LM393 IC on sensor module)

# Step 4

## Make the Circuit Work

- Make sure 5V DC is supplied to the sensor module and its power LED is on - Use Channel 3 of 2231A power supply




- Turn the 'potentiometer' on the sensor module such that the output LED on the module glows without any sound.
- Then turn it in opposite direction so that LED is off for no sound input
- Make a sound by clapping or speaking -- output LED should glow

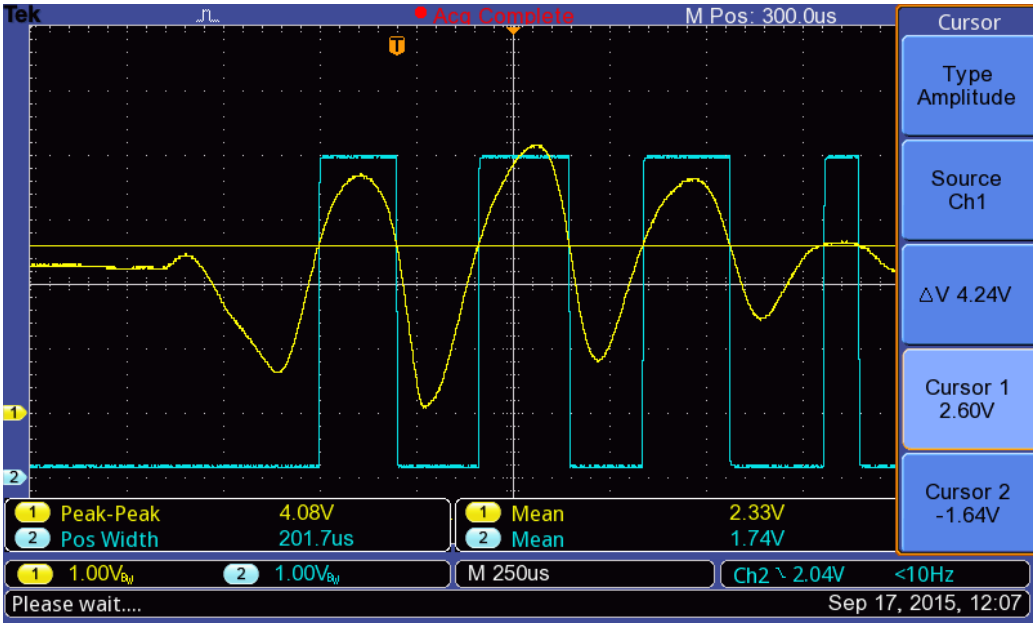
# Step 5

## Taking the Measurements

- Tune the potentiometer so that output LED is always off.
  - Measure the voltage at pin 2 of the LM393 IC on sensor module using multimeter - This will be the ref voltage


- Set up following measurements:
  - Mean voltage on Ch1 and Ch2
  - Cursor on Ch1 (MIC output)
- Without making any sound, acquire signal and measure mean value of Ch1 and Ch2.
- When Ch1 amplitude (MIC signal) is less than $V_{ref}$, the output (Ch2) will be low (0V).


- Tabulate the measurements.
- Now make a sound - clap! Capture the transition of output from low to high. User cursor to measure the voltage of Ch1 at which transition happens.




- Repeat the exercise by changing the $V_{ref}$ to a lower value (say 1.7V) and verify the output transition.

# Step 6

## Analyzing the Result

- The observation can be summarized as below:

| Sound input | Ch1 (MIC -Pin 3 of LM393) Voltage | V_ref (Pin 2 of LM393) voltage | Ch2 (Output of sensor module) Voltage | Output Transition Level (oscilloscope cursor) | Remarks |
|---|---|---|---|---|---|
| No | Mean = 2.27, Pk-Pk = 120mV | 2.594 | 0.000 | Not Applicable | Output is normally low without sound input |
| Yes | Mean = 2.33, Pk-Pk = 4.08V | | 5.000 | 2.600 | When sound makes transition beyond Vref, output is high |
| No | Mean = 2.27, Pk-Pk = 80mV | 1.760 | 5.000 | Not Applicable | Output is normally high without sound input |
| Yes | Mean = 2.23, Pk-Pk = 3.04V | | 0.000 | 1.750 | When sound makes transition below Vref, output is low |

# Step 7

## Conclusion

The analysis of the observed results confirm that (As expected):

- Microphone on the sound sensor module picks up sound and compares it against a set threshold or $V_{ref}$
- If the $V_{ref}$ is lower than MIC signal, the output is high and vice versa.
- Using potentiometer, we can change $V_{ref}$ and hence the sensitivity or the output switching