



# ROHINI COLLEGE OF ENGINEERING AND TECHNOLOGY

## AUTONOMOUS INSTITUTION

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### DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

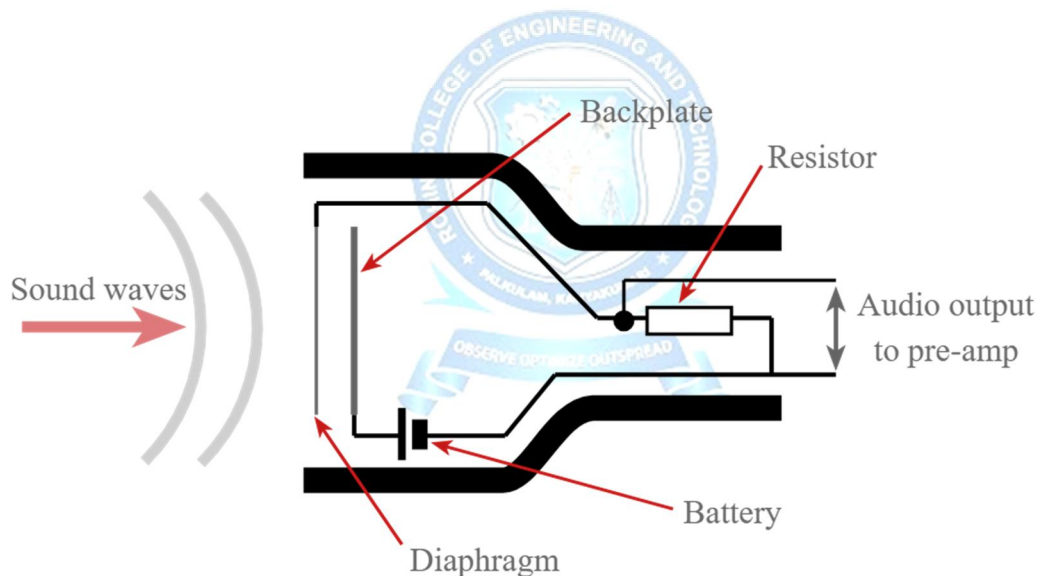
VII Semester

AU3008 Sensors and Actuators

### UNIT – 4 - AUTOMOTIVE ACTUATORS

#### 3.2 Capacitor Microphone

A **capacitor microphone** (also known as a condenser microphone) operates based on the principle of capacitance.



- As the name implies the condenser or capacitor microphone relies on changes in capacitance for its operation.
- The actual condenser microphone element consists of a thin membrane in close proximity to a solid metal plate. The membrane acts as the diaphragm and is electrically conductive. Older microphones used a thin metal foil but more modern types may use a plastic coated with gold or aluminium. One common type is gold-sputtered mylar.
- This construction creates a capacitor which may be in the region of 10 to 50pF. For the condenser microphone to operate it requires a DC voltage to be applied.

- ❑ This can be supplied by the battery shown, but for high end microphones it may also be supplied along the coaxial line to the microphone – this is known as phantom power. The most common voltage this is 48volts.
- ❑ **Phantom Power:** Phantom power is a method used to supply steady direct current (DC) electric power to the active electronic components of the microphone through the balanced audio signal cables. Generally, professional audio interfaces and preamplifiers provide this power.
- ❑ **Battery Power:** Some microphones also offer battery compartments for standalone power, allowing for portable use where an external power source might not be available.

This image illustrates the internal working principle of a capacitor (condenser) microphone. It shows key components such as:

1. **Diaphragm:** The thin, movable plate that responds to sound waves.
2. **Backplate:** A stationary plate forming a capacitor with the diaphragm.
3. **Battery:** Supplies the necessary bias voltage to charge the capacitor.
4. **Resistor:** Helps stabilize the circuit and enables signal output.
5. **Audio Output to Pre-Amp:** The output signal, which is weak, is sent to a preamplifier for amplification.

#### Working Principle:

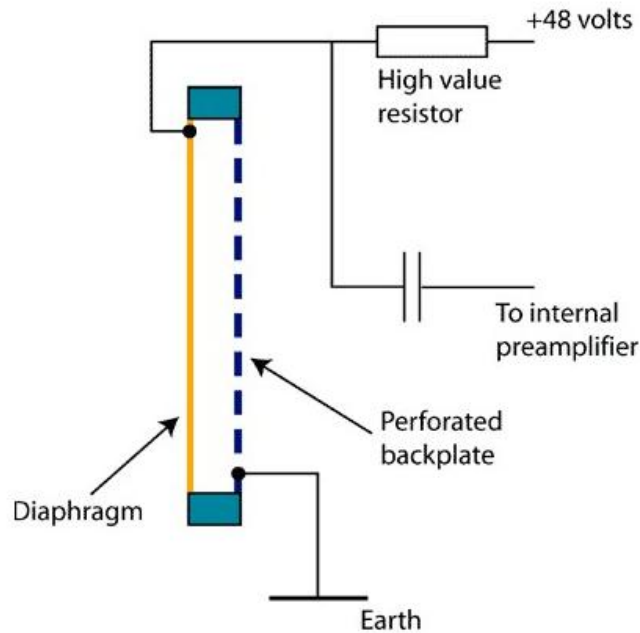
- ❑ **Sound Waves:** Sound waves enter the microphone and strike the diaphragm.
- ❑ **Diaphragm Vibration:** The diaphragm vibrates in response to the sound waves.
- ❑ **Coil Movement:** The vibration of the diaphragm causes the coil to move back and forth within the magnetic field.
- ❑ **Electromagnetic Induction:** The movement of the coil within the magnetic field generates a small electrical current.
- ❑ **Electrical Signal:** This electrical signal is a representation of the original sound wave.
- ❑ **Resistor and Battery:** The resistor and battery provide a small voltage to the coil, which helps to generate the electrical signal.
- ❑ **Audio Output:** The electrical signal is then sent to the preamplifier for further amplification and processing.

❑ **Differences Between Condenser and Dynamic Microphones:**

The primary difference between condenser microphones and dynamic microphones lies in their transducer principles:

- ❑ **Condenser Microphones:** These microphones convert sound into audio signals using electrostatic principles. They are active transducers, requiring power for operation, although some ribbon mics are exceptions due to internal amplification circuitry. Condenser mics generally offer higher sensitivity and superior accuracy in both transient and frequency response.
- ❑ **Dynamic Microphones:** Dynamic microphones, on the other hand, convert sound into audio via electromagnetic induction. They are passive transducers, except for some ribbon microphones with built-in amplification circuitry. Dynamic microphones are renowned for their durability and affordability compared to condenser microphones.

	<b>Dynamic Microphones</b>	<b>Condenser Microphones</b>
<b>Transducer Principle</b>	Electromagnetic induction	Electrostatic principles
<b>Active/Passive</b>	Passive	Active
<b>Frequency Response</b>	Coloured	Flat/extended
<b>Transient Response</b>	Slow	Fast
<b>Polar Patterns</b>	All but bidirectional	All (especially with dual-diaphragm capsule)
<b>Sensitivity</b>	Low	High
<b>Self-Noise</b>	No	Yes
<b>Maximum Sound Pressure Level</b>	Often too high to measure	Often within practical limits
<b>Durability</b>	Very durable	Somewhat durable
<b>Price</b>	Inexpensive to moderate	Cheap to very expensive



This diagram provides a detailed circuit representation of a capacitor (condenser) microphone's functioning. Here's what it illustrates:

1. **Diaphragm:**

- The movable component that vibrates in response to sound waves.
- Acts as one plate of the capacitor.

2. **Perforated Backplate:**

- A rigid, stationary plate with small holes to allow sound waves to interact with the diaphragm.
- Forms the second plate of the capacitor.

3. **High-Value Resistor:**

- Connected in the circuit to stabilize and control the charge on the capacitor.

4. **+48 Volts Power Supply:**

- Represents **phantom power**, which is a common method to supply the necessary voltage to operate the microphone.

5. **Capacitor:**

- The changing capacitance between the diaphragm and backplate is translated into a corresponding electrical signal.

6. **Internal Preamplifier:**

- Boosts the weak electrical signal produced by the microphone for further processing or recording.

#### 7. **Earth (Ground):**

- Ensures the circuit is grounded, which is essential for stability and noise reduction.

This setup illustrates how capacitance variations are translated into an audio signal.

### **Applications of Capacitive Microphones:**

Capacitive microphones find usage in a wide variety of applications owing to their superior sound quality and sensitivity. Here are a few notable ones:

- ❑ **Studio Recording:** Their wide frequency response and high sensitivity make them ideal for studio recording.
- ❑ **Broadcasting:** In the broadcasting industry, these microphones are used due to their excellent clarity and voice detail.
- ❑ **Live Sound:** Certain capacitive microphones are used for live performances due to their ability to handle high sound pressure levels.



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