

About Microphones

September 2003

A microphone is an example of a Transducer, a device that changes information from one form to another form

All Electrically Transmitted or Recorded Sound starts with the Microphone

Sound produces changes in Air Pressure closely related to the loudness and frequencies of the sound

All common types of Microphones are provided with a Diaphragm arranged to respond or move in response to these Air Pressure Changes and converts these usually minute movements into Electric Current Changes, Electric Voltage Changes, Electric Current Generation or Electric Voltage Generation depending on the generic type of Microphone

Generic Microphone types, with a couple of exceptions are as follows

Current Changing; Carbon and Strain Gage Microphones

Voltage Changing; Polarised and Electret Condenser Microphones

Current Generating; Moving Iron, Dynamic Moving Coil and Ribbon Microphones

Voltage Generating; Crystal or Ceramic

Frequency Modulating; RF Condenser

Current Changing Microphones

Carbon Microphone

One of the earliest types of Microphone designed, and used till quite recently in ordinary Telephones

Works on the principle of Sound Induced resistance changes to Carbon Granules trapped under slight pressure between the Diaphragm and Electrodes inside the body of the Microphone

Basic Carbon Microphones are Cheap to Manufacture, Robust, Reliable and produce the High Output Levels required in Telephone Systems

Unfortunately Cheap Carbon Microphones have High Self Noise, High Distortion and Poor Frequency Response making them unsuitable for serious Broadcast and Sound Recording applications

They have now largely been replaced by Low Cost Electret Condenser Microphones

Elaborate Carbon Microphones having reasonably good performance were manufactured in the 1920's for use in Broadcast and Sound Recording applications

These are now of sentimental value only, and are sought after "Collectors Items"

Carbon Microphones require external power to operate

Strain Gage Microphone

Fairly recent concept, now believed to be abandoned in favour of Electret Condenser Microphones

Works on the principle of Resistance Changes of a Strain Gage Element mechanically coupled to the Diaphragm, not unlike the mechanism of the Human Ear

Strain Gage Microphones require external power to operate

Voltage Changing Microphones

Polarised Condenser Microphones

Polarised Condenser Microphones, Valve Condenser Microphones in particular, are considered by many, including the author, as the ultimate in Microphones

Invented simultaneously in Germany and the USA in the mid 1920's for Broadcast and Sound Recording

Works on the principle of Sound Induced changes to the Polarizing Voltage between a very thin and light Diaphragm and a Fixed Electrode

Electrical output levels from the Microphone Element are very low and have a very high impedance requiring elaborate, "Very Low Noise Amplification" inside the Microphone Body

Very Expensive, Recording Studio Quality Valve Condenser Microphones are manufactured by companies such as AKG in Austria, and Neumann and Schoeps in Germany

Lower cost Valve Condenser Microphones are manufactured by Rode in Australia and several European, Japanese and Chinese Manufacturers

Lower Cost Polarised Condenser Microphones, featuring Field Effect Transistor Amplification are made by many manufacturers including, AKG, Neumann, Schoeps etc

The Sound Quality obtained from the expensive, AKG, Neumann and Schoeps Polarised Condenser Microphones is impressive

They have a certain openness and clarity, combined with low "Self Noise" unequalled by other generic types of Microphones

The Sound Quality and Self-Noise from the lower cost alternatives is not known to the author

Polarised Condenser Microphones are delicate and can be affected by Humidity

They are generally used for serious Sound Recording, and are rarely used On-Air for Broadcasting

All Polarised Condenser Microphones have built in Pre-Amplification and require external power to operate

Electret Condenser Microphones

Electret Condenser Microphones are based on the same principle as Polarized Condenser Microphones with the important difference that the Polarizing Voltage instead of being supplied from an external voltage source, is permanently impressed on an internal Semiconductor Electrode, the "Electret"

Electret Microphones are the most common generic types of microphone in use today

It ranges in cost from a few cents for a basic Communications Grade Microphone Capsule, to expensive Large Diaphragm Studio Quality Microphones

Low Cost Electret Microphones have completely displaced the Carbon Microphone and other generic types in Telephones and other communications applications, but does have relatively High Self Noise, High Distortion and Poor Frequency Response making them unsuitable for Broadcast and Recording

Many reputable manufacturers, including AKG of Austria make Studio Quality Electret Microphones

These are relatively inexpensive and robust, compared to Polarised Condenser Microphones, and are very suitable and popular for use as Broadcast On-Air Microphones

All Electret Condenser Microphones have built in Pre-Amplification and require power to operate from either a Built In Battery or External Power

Current Generating or Dynamic Microphones

Moving Iron Microphones

Probably the earliest type of Microphone invented and dates back to the era of Alexander Graham Bell

Robust, Low Cost, relatively High Output, Communications Quality Only, Poor Frequency Response, High Distortion

Were used for Paging, Two Way Radios and Field Telephones, now probably extinct except for Toys

Not suitable for Recording or Broadcast

Does not require external power

Moving Coil Microphones

Probably the most common generic type of Microphone

Ranging from Low Cost, Low Quality types to High Quality Studio and Broadcast Microphones

Principle and construction is similar to a very small Moving Coil Loudspeaker

Became popular in the mid 1950's when durable Lightweight Plastic Materials suitable for the Diaphragm and Strong Magnets became available

Quality Dynamic Microphones have Low Distortion and Good Frequency Response suitable for Broadcast On-Air use

Relatively Robust, Output Level Reasonably High making external amplification easy, tendency to pick up "Buzz from Video Monitors" possibly making Electret Condenser Microphones more suitable for On-Air use

Made by many manufacturers including AKG of Austria

Does not require external power

Ribbon Microphones

Invented in the early 1930's

Once a very popular Recording, Stage and Broadcast On-Air Microphone

Still used in Recording Studios for Special Applications, has Strong Proximity Effect (Bass Boost) and tendency to "Popping" making it difficult to use by unskilled performers

Very Fragile and easily damaged by a Slight Drop or Blowing into it

Delightful and Unmatched Sound Quality for certain Recording Applications, Output Fairly Low making Amplification Critical

Not often used now in Broadcast On-Air Applications

Early Ribbon Microphones, particularly RCA types sought after Collectors items

Very few manufacturers now make Ribbon Microphones

Does not require external power

Voltage Generating Microphones

Crystal Microphones

Once a popular Stage and PA type Microphone based on Twisting of Rochelle Salt Element

Relatively Low Cost, Can be easily destroyed by High Heat or High Humidity

Quality ranges from Low to Fairly High

Output Voltage Level, Relatively High, unfortunately of High Impedance requiring High Impedance Microphone Pre Amplifier Input, and Short Microphone Cable to minimize capacitance

Not used for Broadcast and probably no longer manufactured

Does not require external power

Ceramic Microphones

A variation on Crystal Microphones using a Ceramic Crystal, more tolerant of Temperature and Humidity

Not used for Broadcast and probably no longer manufactured

Does not require external power

Frequency Modulating Microphones

RF Condenser Microphones

This type of Microphone is a distinct and very useful variation of the Condenser Microphone

It is based on a Radio Frequency Oscillator where the Diaphragm serves as one part of the Capacitor determining the Frequency of Oscillation

Movements of the Diaphragm by Sound Pressure Variations will Change its distance relative to the fixed Electrode and hence it's relative Capacitance and cause Frequency Modulation of the Oscillator

The Frequency Changes are detected in an FM Detector or Discriminator, and changed to Audio Signals being fed to the output of the Microphone

Self Noise of the RF Condenser Microphone is very low, and generally not affected by Humidity to the same extent as Polarised Condenser Microphones

It is not generally used as a Broadcast On-Air Microphone, but rather for special applications such as an Ultra Directional "Shotgun" or "Parabolic Mirror" Microphone for picking up Bird Calls, Clandestine, or Film Work involving very low level sound

It is an expensive type of Microphone, probably only made by Sennheiser of Germany

RF Condenser Microphones have built in Electronics and require external power to operate

Professional Recording and Broadcast Applications

Carbon; Historic Interest Only and Collectors

Strain Gage; Historic and General Interest Only

Polarised Valve Condenser; Recording, Film Studios and Collectors

Polarised FET Condenser; General Recording, Film and Broadcast On-Air

Electret Condenser;	General Recording, Film and Broadcast On-Air
Dynamic Moving Iron,	Historic Interest Only
Dynamic Moving Coil;	General Recording, Film and Broadcast On-Air
Dynamic Ribbon;	Recording, Film Studios and Collectors
Crystal;	Historic Interest Only
Ceramic;	Historic Interest Only
RF Condenser;	Special Recording, Film and Clandestine

Elan Audio are Distributors for AKG Microphones, and able to obtain and supply any Microphone including Radio Microphone Systems in the AKG Range of Products

The following are recommended for general Broadcast On-Air and Voice Production

- AKG C-1000 General Purpose Versatile Electret Condenser Microphone, Economically Priced, Built In Battery or Phantom Powered, Pattern and Response Modification Inserts, for On-Air, Recording and PA Work
- AKG C-2000B Entry Level, Mid Priced Electret Condenser Microphone, Cardioid Pattern, Exceptionally Smooth Frequency Response, Phantom Powered, for Recording Work, Complete with H-100 Spider Mount
- AKG C-3000B Affordable, Large Diaphragm Technology Electret Condenser, Cardioid Pattern, - 10 dB Gain Switch, LF Cut Switch, Phantom Powered, for On-Air and Recording Work, Complete with H-100 Spider Mount
- AKG C-4000B Large Dual Diaphragm Technology Electret Condenser, Selectable Pattern, - 10 dB Gain Switch, LF Cut Switch, Phantom Powered, for Recording Work, Complete with H-100 Spider Mount and W 4000 Windssock
- AKG C-4500 High Quality, General Purpose Microphone, Electret Condenser, Cardioid Pattern, - 20 dB Gain Switch, LF Cut Switch, Phantom Powered, for On-Air and Recording Work, Complete with H-100 Spider Mount and W 4000 Windssock
- AKG D-770 Rugged Dynamic Instrument/Vocal Microphone, Highly Efficient Windscreen, Cardioid Pattern, Ideal Guest On-Air Microphone
- AKG D 880 Rugged Dynamic Vocal Microphone, Highly Efficient Windscreen, Transducer Shockmount, Hypercardioid Pattern, Ideal Guest On-Air Microphone