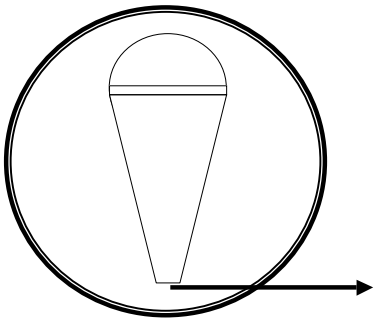
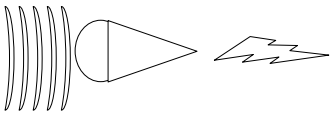
Microphones



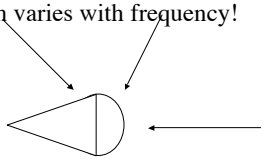
What does a microphone do?

- Transducer
- Changes sound into audio
- Converts vibrations in air (pressure variations) into electrical representation of that sound

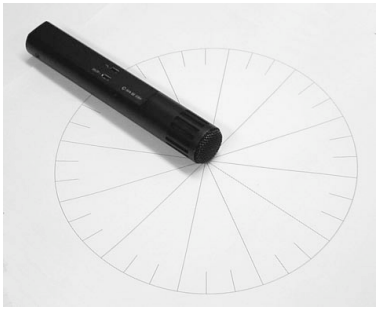


Microphone Pattern

- Determined by how well a microphone picks up signals (sensitivity) coming from different directions
- Pattern varies with frequency!

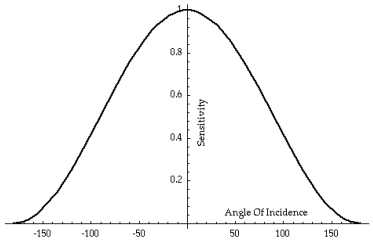


Polar Coordinate System

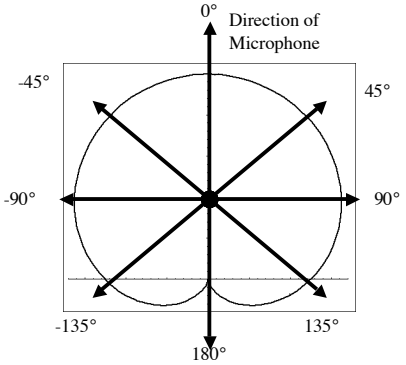


http://www.tonmeister.ca

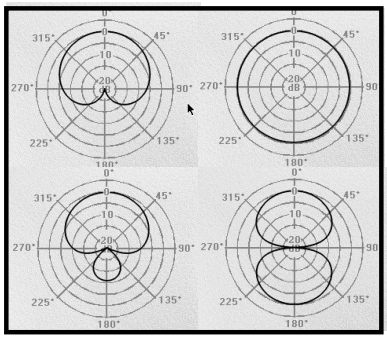
"Cardioid" Pattern as graphed on a Cartesian Display



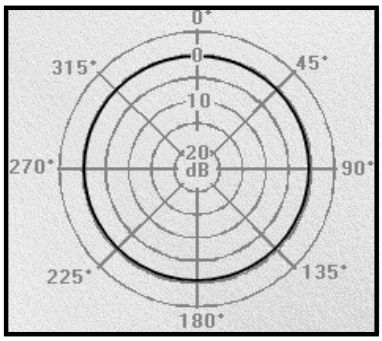
Cardioid Pattern on a Polar Chart



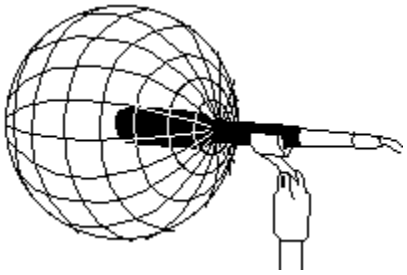
The 4 Basic Mic Patterns



Omnidirectional Pattern



Omnidirectional Pattern in 3D

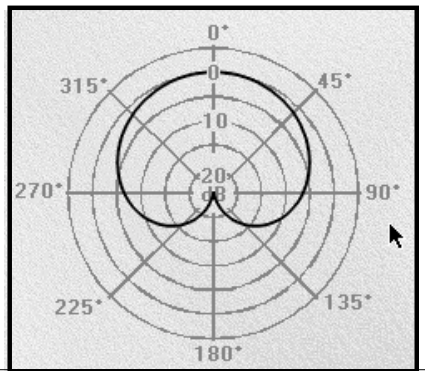


From Audio-Technica Web Site

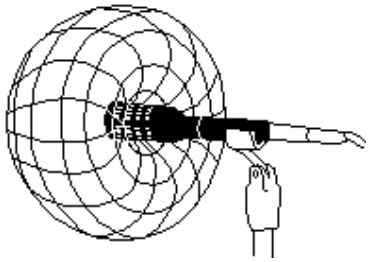
Omni Mic Characteristics

- Very accurate
- Non-directional, so no frequency-dependent "coloration"
- No "proximity effect"
- Non-directional, so challenging to use in live situations due to feedback.

Cardioid Pattern



Cardioid Pattern in 3D

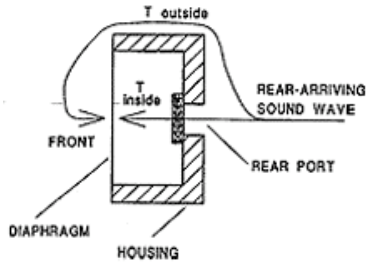


From Audio-Technica Web Site

Cardioid Mic Characteristics

- Directional, which is helpful with feedback and isolation

Directionality of Cardioid Mic



From http://www.prosoundweb.com/install/spotlight/cardioid/cardioidmics.shtml

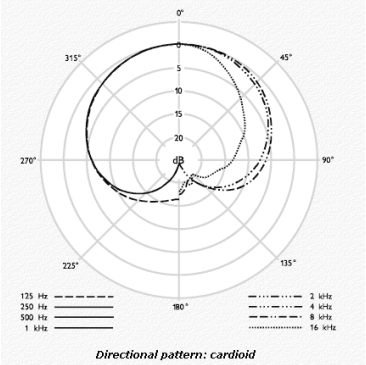
Directionality of Cardioid Mic

- Directionality caused by "vents" on the back of the mic, which allow rear-arriving waves to "Cancel out" due to phase shift
- Direct, front-arriving sound is either physically blocked by mic construction (HF especially) or has substantial phase shift to vents so it is not cancelled.

Proximity Effect

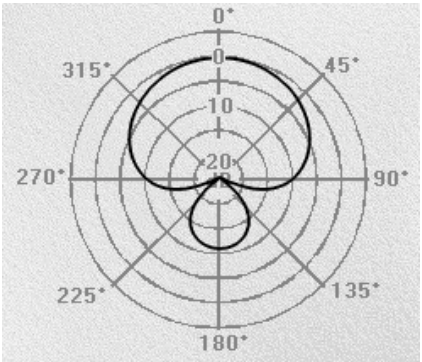
- Cardioid mics have "proximity effect"
- The closer to microphone, the greater the bass response.
- Proximity effect can be useful if you want the effect (Radio DJ's)
- If you want accuracy, proximity effect is not helpful

Polar Pattern varies with Frequency



Directional pattern: cardioid

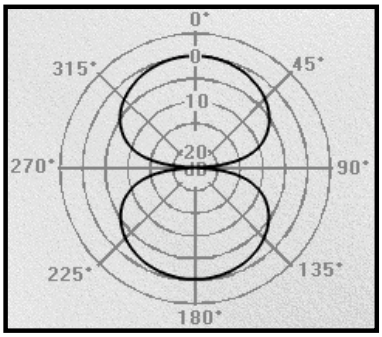
Hypercardioid Pattern



Hypercardiod Mic Characteristics

- Like Cardioid, but more directional

Bidirectional Pattern

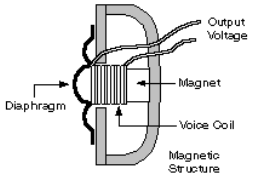


Transduction Methods

Dynamic—Magnet/Coil

- Coil of wire moving past magnet causes voltage to flow
- Mic is a generator, and needs no external power besides air vibrations

Dynamic mic workings



From Audio-Technica Web Site

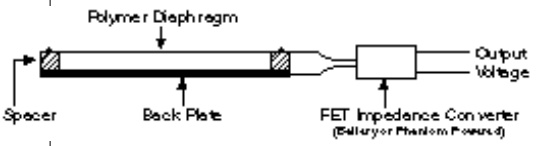
Dynamic mic characteristics

- Workhorse—takes abuse well, simple construction
- Very common
- Inexpensive construction

Condenser Microphone

- Uses two plates (one is diaphragm) held apart by a spacer
- Variance in capacitance is used with pre-amp which must be powered
- Generally more sensitive/accurate than dynamic mics
- Requires Phantom Power
- More fragile than dynamic mics

Condensor mic workings



From Audio-Technica Web Site

Electret Condenser

- Diaphragm permanently charged
- Power still needed for pre-amplifier in microphone

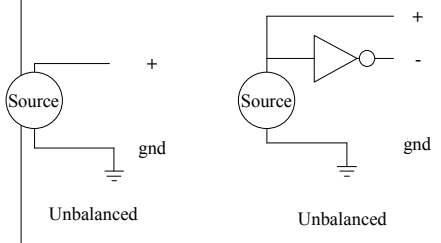
Ribbon

- Ribbon suspended around permanent magnet
- "Warm" sound
- Fragile

Balanced Signal

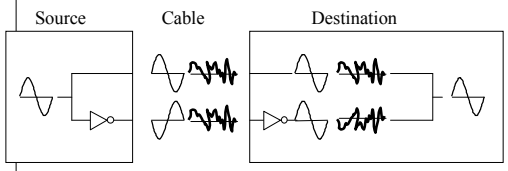
- Technique to run signal a long distance without inducting noise.
- Requires an additional channel of conduction

Difference in makeup

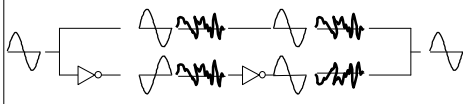


An unbalanced signal relies on shielding to eliminate hum

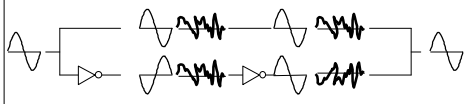
A balanced signal relies on signal inversion



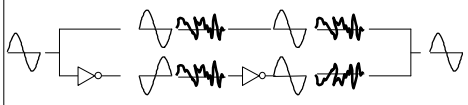
Signal is created at the source location



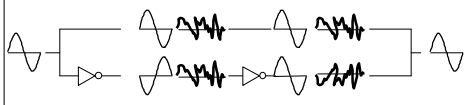
Signal is split, and one path is inverted.



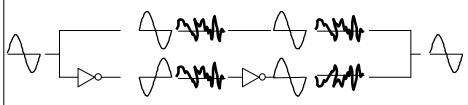
Audio travels along cable, and noise is inducted onto signal



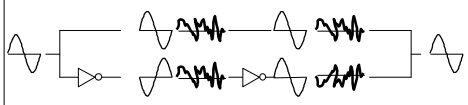
Audio Audio arrives at destination, and the signal is reinverted.



Note that now the signal is in phase, and the noise is out of phase.



The signals are now combined, and the inverted noise is cancelled out.



Phantom Power

- Sound is AC
- Phantom power is DC
- Two don't interact
- Typically +48V DC on XLR pins 2 and 3 relative to pin 1 (shield)
- Typically provided by mixer
- Condensor mics won't work without phantom power (or batteries)!

Why are XLR connector sexes in audio "backwards"?

- Phantom Power
- Mixers supply phantom power so mixers have "female" connectors

Mic Functional Types

- Handheld
- Stand Mounting
- "Lavalier"
- PZM
- Contact
- Shotgun

Wireless

- Non-Diversity
- Diversity
- UHF/VHF

Windscreens

- Block excessive air movement from distorting sound
- Direct wind onto mic element causes it to physically hit its limits and make popping sounds

Mic Frequency Response

- Different mics have different frequency response characteristics, depending on:
- Quality
- Cost
- Pattern
- Construction

Other Mic Characteristics

- Sensitivity: How much voltage produced for a given sound pressure level. Varies with each microphone model.
- Transient Response: How well the mic deals with quick changes in audio level

Mic Impedance

- Low—Professional (generally < 150 ohms
- High—Consumer (> 25k ohms)

Important Rules

- Treat ALL microphones gently!
- NEVER blow into a microphone
- NEVER hit the front of a microphone
- Condensor mics are fragile when active (phantom power on)
- Never connect microphones into a system if volume is up on that channel.
- Never turn on/off phantom power if the volume is up on that channel

Garbage in-Garbage Out!

- Spend money on Mics (and speakers)