







## Large Diaphragm

Large Diaphragm microphones are very sensitive, give a very high-quality sound and are the normal choice for recording vocals. They can get expensive and are normally kept for Recording Studio work. Great care is needed to use them Live, but if you can put them on the singers you will get excellent results. They will usually be Condenser or Ribbon. Ribbon microphones just connect and go. They are the best sound possible, especially for voices, but are the most delicate. Condenser microphones are a little more robust but need to be powered by 'Phantom Power' 48v from the mixer. If your mixer doesn't have a Phantom Power switch you can purchase a box that will apply 48v phantom power to the microphone cable as you pass through it.



## Valve Tubes

For the 'retro' kind of sound technicians they still make microphones that have a Valve Tube inside. Obviously, the valve is glass and it is all quite delicate, but it offers a warmth of sound that some search for. Once again, they can get expensive and tend to be used more in Recording Studios, but this high-quality microphone could be used Live, with care.

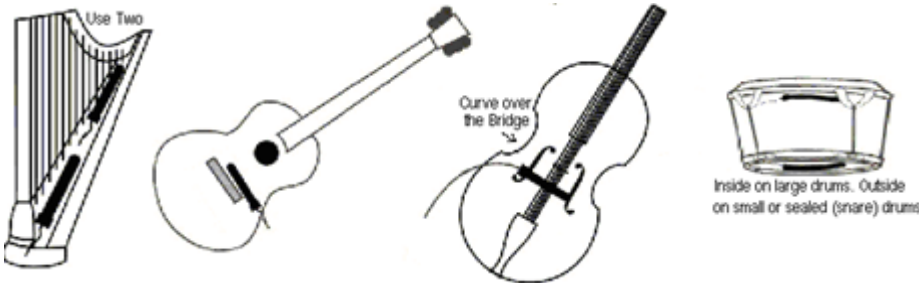
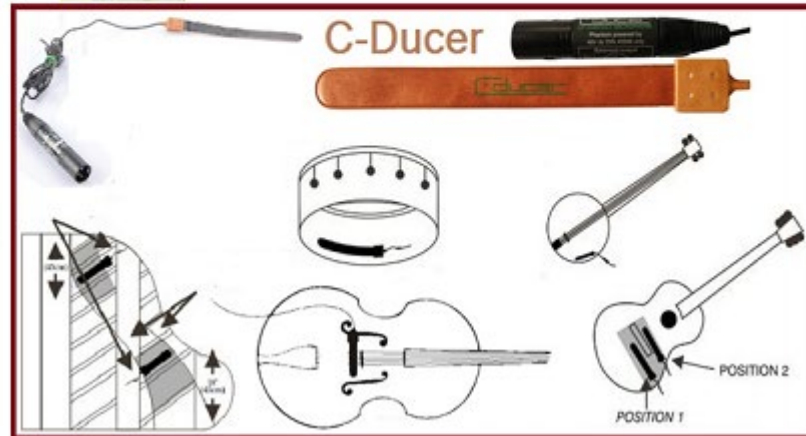


### **Miniature Microphone (Lavalier) Pick-ups**

With the invention of miniature condenser microphones (lavalieres) we are now able to clip on to musical instruments directly. These microphones are robust and leave the musician with complete freedom to move about (instead of having to park in front of a microphone sitting on a stand). Their sound is very good.

These are also the choice for attaching to a person's shirt or collar. It is excellent for speech, but it doesn't have the necessary frequency range for singers.





## Contact Pick-ups

With the advent of piezo-electrics we can now get attachable adhesive microphones that are in direct contact with the vibrations of the musical instrument. The sound quality varies. There are some excellent ones, and some terrible ones, listen before you buy.

Contact mics have the advantage of only hearing that specific instrument and not the nearby instruments as well (spillage). They come with non-staining, reusable, solvent-free adhesive compound. There are Piezo-electric Discs, and more recently we have Fluoro-polymer Piezo Film (PVDF). PVDF comes as tabs, strips, cables and even large sheets, and will bend around curves on musical instruments. You can use epoxy or silicone, or low-adhesive tape to attach them.

**Examples:** The **C-ducer** Tape Microphone is very popular. It is a capacitive transducer with a flat frequency response extending well beyond that of human hearing. Less than 1mm thick, the microphone is flexible, extremely light and will conform to curved surfaces such as a double bass or a drum shell. It has a very good response on all acoustic instruments, from pianos to drums. The **B-Band UKKO Kick-Drum** contact mic is designed for the low frequencies of a kick drum. The mic has an adhesive back and mounts easily on the inside of the drum shell near the batter head. It is connected to a preamp provided and uses phantom power.

## TRANSMITTERS



## RECEIVERS



## Radio (Wireless) Microphone

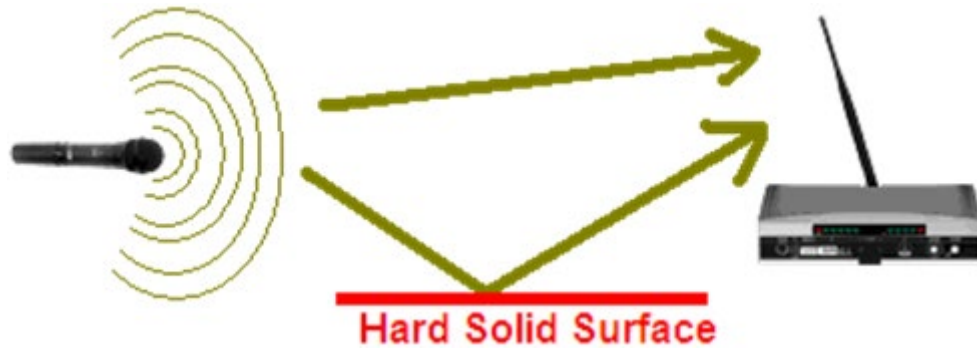
A radio microphone involves a microphone containing a miniature radio transmitter which transmits to a matching radio receiver connected to the mixer.

The microphone part may be handheld, lavalier (lapel microphone), head-worn, or instrument-mounted, depending on which suits your application best. The lapel mic and the head-set mic give you hands-free but because of the smaller capsule (and quality) of these two are more suited to speech rather than singing.

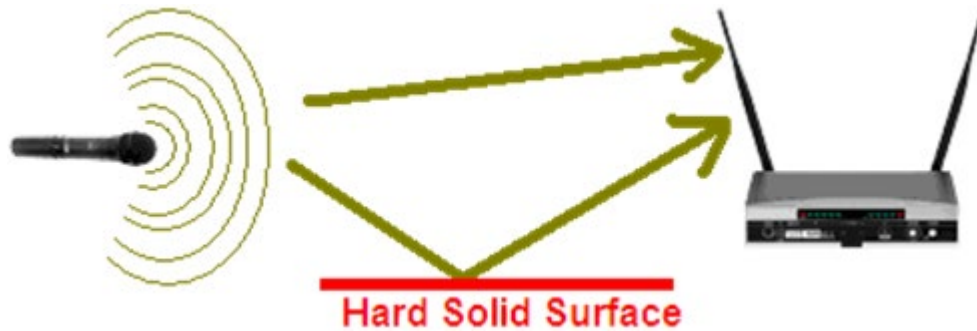
Some systems offer you multiple channels (frequencies) to choose from in case one of the transmission frequencies is being used by another radio microphone, or a trucking or taxi company, local radio station etc. Just listen for a noise-free channel.

On Receivers there is a '**Squelch**' control. This automatically mutes the audio output of the receiver in the absence of your microphone transmitting (no one is singing or playing). Otherwise, during these pauses you often hear background radio hiss, or local radio stations or a taxi passing by (which your receiver may pick up as well). A good way to set the Squelch level is to turn off the microphone and adjust the Squelch till it silences noise and hiss. Now turn on the microphone and check that your audio is clean in the silent moments.

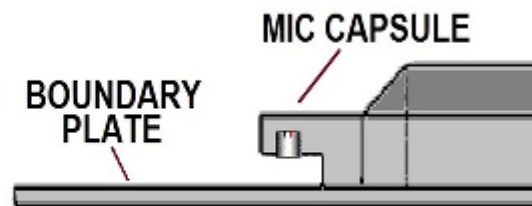
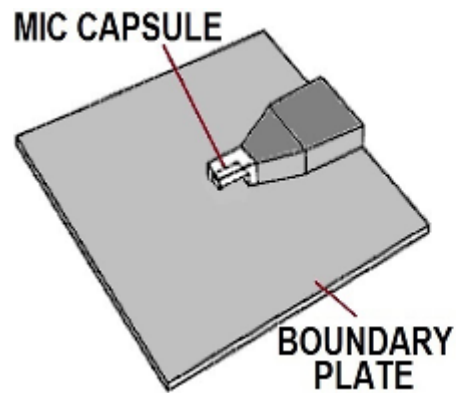
There are two basic radio microphone systems: **Non-Diversity (one antenna)** and **Diversity (two antennae)**.



One problem with using radio transmission for indoor microphone work comes from what we call the “multi-path” effect. Radio signals are very high frequencies and reflect easily off hard surfaces. These reflected signals all arrive at the antenna, all at different times (depending on the distance they travelled) interfering with the original signal transmitted by the microphone. A Non-diversity Receiver (only one antenna) is quite susceptible to this type of interference, resulting in drop-outs in the sound, and dead spots in the room.



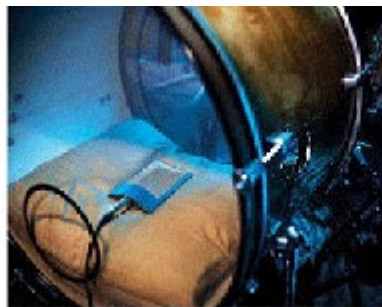
Diversity Receivers have twin antennae. When this type of receiver gets the same signal from several locations, it can easily minimise any interference (it calculates the time differences between the antennae).



### Pressure Zone Microphone (PZM)

A PZM, also called a **Boundary** Microphone, has a flat plate with a microphone transducer. All sounds that arrive have to bounce off the plate. This is called the 'boundary' effect. Because all sound is reflected it has less trouble with phasing.

PZM's perform extremely well on a podium or pulpit, and the sound quality is usually better than any normal microphone in the same situation. Even if a person is speaking and moving back and forth, the sound never changes, and the output volume remains high. You may find it better to place a thin rubber mat underneath the mic if there is chance of people banging the surface, or inside a Piano.







## Polarity (The directionality of Microphones)

Some microphones can hear equally in all directions (**omni-directional**). While this might seem a great choice, it is generally the worst choice.

**Omni** microphones hear the neighbouring instruments and singers (spillage) that you don't want in this microphone, and they pick up a lot of room reverberation and noise from the congregation. Worst of all they hear the floor monitors and so they squeal very easily. Many make the mistake of thinking an omni mic will be well-suited for a choir. You may have placed it in front of the choir pointing at their mouths, but you will be surprised at all the extra unwanted sound sources it manages to pick up!

Also, with any choir, the microphone will necessarily be back some distance, and an omni-directional mic will absolutely hear too much room reverberation and background noise.

For 99.99% of jobs we use **directional** microphones. This means they can be pointed at the subject and the microphone will reject neighbouring musicians, and the room echoes, and floor monitors.

The normal directional microphone we use has quite a wide span (basically you just need to be in front of it, and you can move around somewhat). This is called a **Cardioid** (it looks heart-shaped).

There are microphones that are even more directional (**Hyper-cardioid** and **Super-cardioid**) which are very selective and require the subject to be perfectly still and directly in front.



Knowing the polarity (directionality) of a microphone lets us aim each microphone on an angle that will capture the sound we want, while rejecting any neighbouring sounds we don't want.

The maximum rejection is always going to be at the rear of a directional microphone, so point the rear of the microphone towards any neighbouring sound that you definitely don't want.

If the Drummer is also a Singer, then a hyper-cardioid or super-cardioid polarity is best choice as it will keep the surrounding drum sounds to a minimum.



## Best of both worlds

With an electric musical instrument there will be a connector containing the electrical output sound.

You either plug in your cable here, and connect it directly to the Mixer (line in), or you connect the instrument to an Amplifier Cabinet, and use a Microphone instead (mic in).

A better sound comes from connecting both the 'line' sound and the 'microphone' sound to the Mixer on different channels. Now you have two sound sources for the same instrument, one electronic and one acoustic.

The electronic sound will be very clean sounding, and it actually arrives a little bit faster than the microphone sound.

The acoustic sound from the microphone will have more body, and more ambient (room reverberation). It will also have background noises.

If you mix the two sounds (not necessarily 50/50) you will create one very full strong sound.



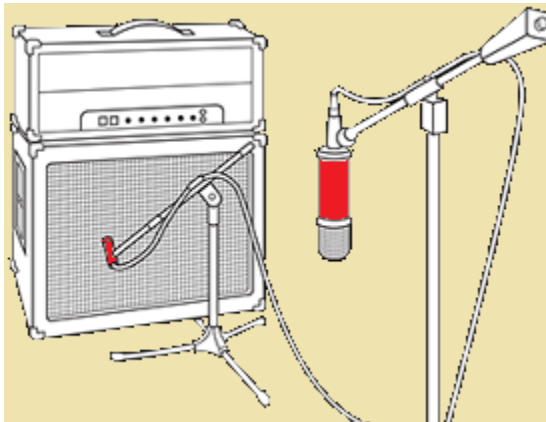
If you have a microphone on something, and you want a bigger sound, you could place a second microphone at the source and then connect that to a Loudspeaker Cabinet where you place a microphone. Now you have two sound sources for the same instrument, but with very different sound material.

Once again, connect both to the Mixer on different channels and mix the two sounds (not necessarily 50/50) to create one fuller sound with much more substance.



## A Microphone left in the cupboard? Then why not Multi-mic?

Have you still got spare microphones? They're no good in the cupboard! Even if the quality of the spare microphone isn't the greatest, blending additional versions of the same sound always creates one bigger sound (adding poor quality microphones at a lower level will still make the sound stronger).



## Close versus Distant Microphone Placement

**Close Micing:** Placing a microphone up-close will always give you a very fresh dry sound because it will pick up more high frequency detail. Up-close guarantees that there will be minimal spillage (neighbouring musicians and room reverberation won't be picked up).

Up-close using a Dynamic microphone will give you the 'proximity' effect, meaning the bass frequencies will increase, which you may like. Up-close to loud volumes will damage a Condenser microphone.

**Distant Micing:** This will give a warmer and more natural sound because it is far enough back to hear the full instrument or voice, and some room reverberation. Classical music and Jazz prefer this natural (ambient) sound. Micing at a distance gives you more coverage (the microphone will pick up a wider arc) which is necessary for a choir or large group, unfortunately that means increased spillage as the microphone picks up all neighbouring instruments. As you distance yourself with a microphone the dynamic volume (electrical level between the loud and quiet volumes) will be reduced, this is because air acts like a natural compressor.

If you have the possibility, place one microphone close to a source, and one microphone further back. The close one gets the freshness (presence), and the distant microphone has the fuller sound. The fact that there will be a time difference in the arrival at each microphone (delay) helps fatten the sound even more.



### **Separation for cleaner sound**

Even working 'Live' we are able to place separation panels between neighbouring musical instruments, like we do in Recording Studios. This stops neighbouring instruments spilling into each other's microphones.

A panel only needs to be in the area where the microphone is placed and doesn't need to encircle the entire instrument or cabinet, so it can be done quite discretely.

They are immensely helpful in getting a clean sound, especially when there are multiple 'loud' musicians blasting into everyone else's microphones.

## Microphone Accessories





## Microphone Holders / Clamps



There are two basic types of Microphone Clamp.

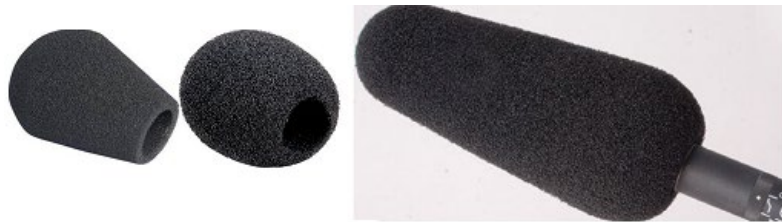
The first clamp is rigid, and only fits 'some' microphones. It holds on tightly to the microphone type it was designed for, and holds tight even if the microphone is angled upwards or downwards to the point where there is a risk of slipping.

The second type is a spring-clamp, much like a bulldog clip. This is convenient when you use multiple microphones of unknown sizes, but spring-clamps don't hold tightly and they need to be kept relatively horizontal or the microphone will slip out, guaranteed!



More advanced Microphone Clamps involve rubber-band type suspensions.

These reduce vibrations from stage noise, singers tapping their feet, and dancers on the stage. In Recording Studios, they are the standard to ensure vibration-less recordings.



## Wind Socks are only for outdoor wind

A foam cover (sock) can be placed on a microphone for outdoor use where the wind is blowing over the grill and causing a roaring sound. Foam covers have no place indoors as there is NO wind blowing. Dynamic microphones all come with a foam sock already under the grill. The manufacturer compensated for this during construction, so the built-in foam doesn't filter the sound at all.

When you add a thick foam sock because you think it will stop loud 'P' sounds from a singer, or you think it looks more professional, all that really happens is a filtering effect, diminishing your sound quality, and making your microphone less directional.

If you like the fact that you can have different coloured socks which are easily identifiable from the Mixer, then resist the temptation. Consider using coloured elastic sleeves on the body of the microphone, or coloured electrical tape, or use coloured cables.



In the case of very strong winds outdoors you can use a more advanced wind sock similar to a fluffy cat ☺. These really do affect the sound and should only be used when wind is physically blowing over the grill causing a real roaring sound. They are not for use indoors, though journalists and camera operators love to leave them on because they look cool (unfortunately their sound just fell far short of being professional), and their shotgun microphone just became less directional.



### Pop Screens / Pop Filters

In the audio industry the blast from the letter 'P' is called a 'Pop' (though usually sounds more like a boom). There are other 'plosive' consonants but this one is the most pronounced. Firstly, let's be clear, a foam sock will not alleviate this.

The pop is caused by the microphone capsule being at mouth level and receiving the full wind blast from the mouth. A microphone capsule must always be lower than the mouth, pointing up, so it only gets the sound and not the wind.

Apart from positioning the microphone better, an alternative method (if it is appropriate) is to have a very light fabric in front of the microphone to act as a shock absorber. This is an anti-pop screen. A thin tightly stretched fabric suspended in front of the microphone doesn't deteriorate the sound and stops air-blasts.



### Microphone Stands

Microphone Stands with a tripod-type base do not easily pick up floor vibrations and are a great choice for this reason. Be sure the central shaft doesn't touch the ground, or it ruins the advantage. Always line up the boom with one of the legs to keep it stable as these tripods can be tipped over easily if you don't. Don't extend the arm out any more than you really need, as it makes it absolutely unstable and guaranteed to fall down (onto your mic).

Microphone Stands with a flat round base will act like a large diaphragm and tend to pick up all stage floor vibrations.

Whenever there will be a lot of performer movement and/or choreography use shock-mounts on all of your microphone stands, and rubber mats under the stands, to reduce the banging. Place rugs or mats around the stage to help dampen the stage rumble.

A rubber mat under the kick drum itself, and the Bass Amplifier, should also be considered.

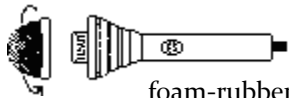




### Microphone Storage

Microphones are best stored in boxes or trays lined with foam rubber which act as a shock absorber. They lose a tiny bit of their quality each time you bang them, and worse... drop them (they look fairly bullet-proof because they have a metal housing, but microphones deteriorate in sound and sensitivity according to the bad treatment you give them).

Microphone cables should always be coiled up 'loosely' so that the fine wires inside never get strained. For long storage cables should be coiled under / over before being stacked in a box.



### Microphone Maintenance

The metal grill on many dynamic microphones will unscrew. The grill can be carefully cleaned with a toothbrush etc. Inside there is a foam-rubber lining attached under the grill which does a great job of harbouring saliva (and bacterial colonies). Periodically unscrew the grill and soak it in detergent (preferably something anti-bacterial), rinse and leave to dry.



## So... what are you actually trying to do with a Microphone?

You're trying to get the best 'capture' possible:

- *a clean sound- no background hiss or hum, minimal spillage from other instruments.*
- *'natural' sounding- not thin and weak, not boomy or nasal, not muffled, not screechy.*
- *good electrical level- signal visible on the level meter, no Peak LED lighting up, no distortion.*

## CREDITS

*This material is offered freely to the Christian Churches; downloadable at [Pietango.com](http://Pietango.com)*

**Text:** *Original, by the Author, a Christian Recording Engineer.*

**Images:** *Designed by the Author. Some photographs were sourced from the Internet, then re-worked.*

Ever since the creation of the world, God's invisible attributes and divine nature have been evident. They are clearly understood through his workmanship, and all the wonderful things that he has made. Therefore, those who fail to believe and trust in him are without excuse, or defence. **Romans 1:20**

All of us have sinned and fallen short of God's glory, but God treats us much better than we deserve.

Because of Christ Jesus, he freely accepts us and sets us free from our sins. God sent Christ to be our sacrifice. Christ offered his life's blood, so that by faith in him we could come to God. **Romans 3:23**

If you declare with your mouth, "Jesus is lord," and believe in your heart that God raised him from the dead, you will be saved. For it is with your heart that you believe and are justified, and it is with your mouth that you profess your faith and are saved. **Romans 10:9**

For the Scripture (*Isaiah 28:16*) says, "Whoever believes in Him will not be disappointed." **Romans 10:11**

These things have been written so that you may believe that Jesus is the Christ, the son of God; and that by believing, and relying on him, you may have new life in his name. **John 20:31**