Earthworks®
HIGH DEFINITION MICROPHONES™

Made in U.S.A.

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C30/C & C30/HC

Hanging High Definition Microphone™ for Choir

User's Guide

Guidelines for Positioning ChoirMics

Earthworks near-perfect polar response may require some elements of your mike placement to be done differently. Please read the manual to gain a full understanding of the pick-up characteristics of Earthworks cardioid microphones.

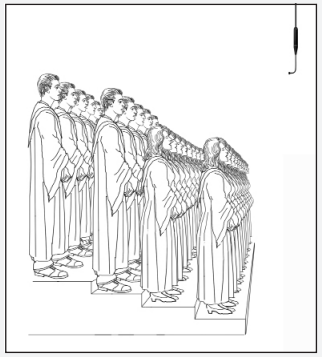

Figure 1 Microphone head positioned perpendicular to the floor

Microphone Placement Distance and Height

Place microphones as close as 3 feet in front of choir and no lower than the heads of the highest singers.

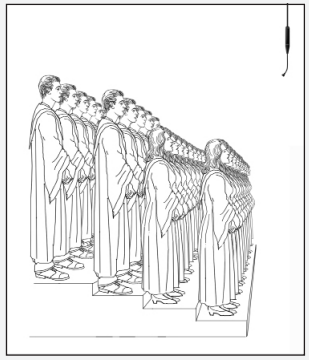

Figure 2 Microphone head positioned at an angle to the floor

Near-perfect polar response will allow placing the microphones closer to the choir (as close as 3 feet). The height of the microphone should be in line with the head of the highest singer in the choir.

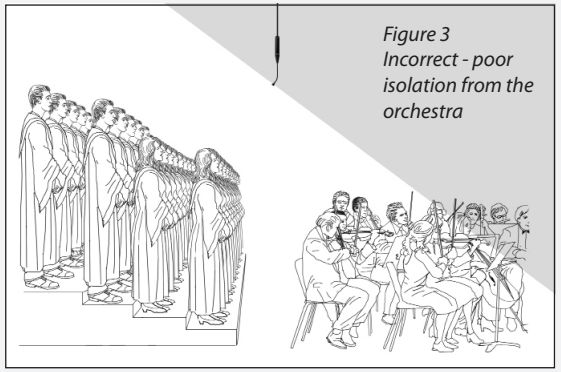

Figure 3 Incorrect - poor isolation from the orchestra

When miking choirs with an orchestra or band in front of the choir, the microphone head should be perpendicular to the floor to provide the greatest amount of isolation from the orchestra or band.

Figure 3 shows the way "not to" position the microphones.

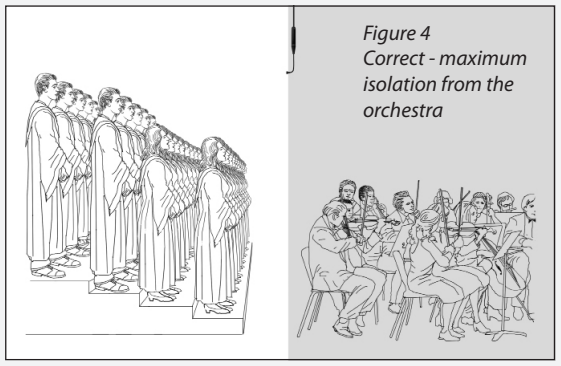

Figure 4 Correct - maximum isolation from the orchestra

Figure 4 shows the correct way to position the microphones.

If you do not have an orchestra or band, positioning the microphones as shown in Figure 4 will also provide greater isolation from loudspeakers located behind the microphone as well as reduce pick-up of unwanted sounds from the audience.

Guidelines for Positioning ChoirMics

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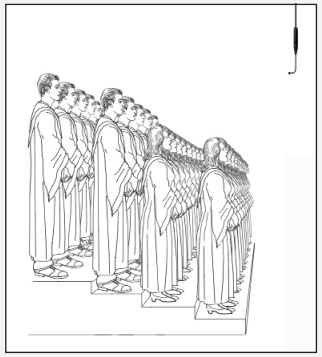

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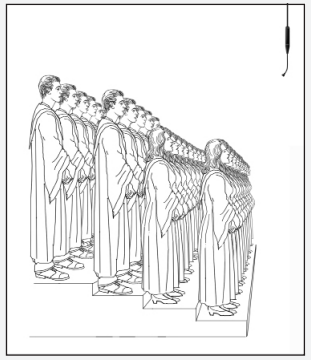

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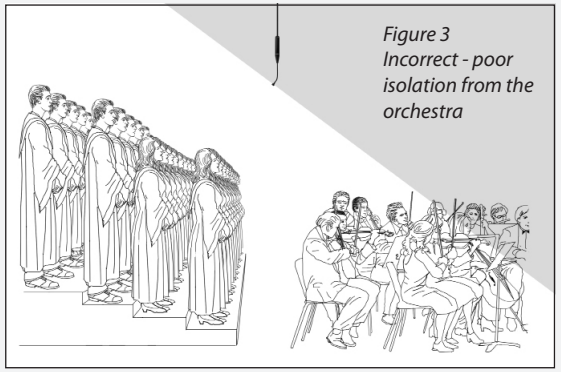

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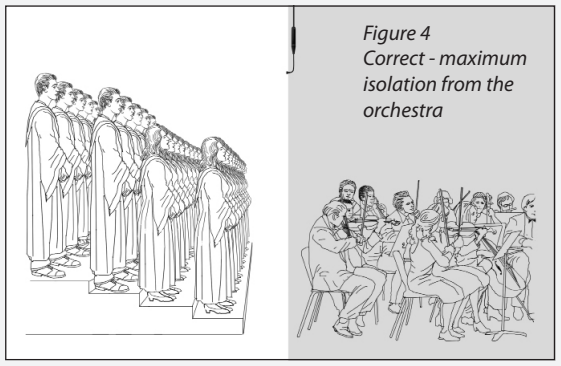

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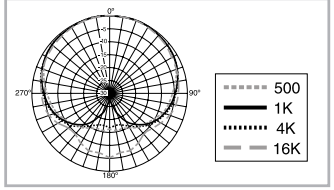
SPECIFICATIONS

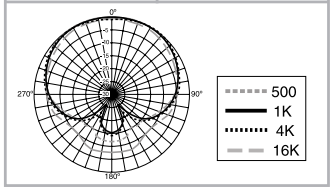
C30/C

Frequency response	20Hz to 30kHz
Polar Pattern	Cardioid
Sensitivity	20mV/Pa (-34 dBV/Pa)
Power requirements	24-48V Phantom,10mA
Peak acoustic input	145dB SPL
Output	XLR (PIN 2+)
Minimum output load	600Ω, balanced between pins 2&3
Noise	20dB SPL (A weighted)
Dimensions L x D	12.75 x .860 inches (324mm x 22mm)
Attached Cable	30' (9.14m) Canare Star Quad™
Weight	(microphone only) .22lb (100g) (mic with 30' cable) 1.2lb (544.3g)



C30/HC

Frequency response	20Hz to 30kHz
Polar Pattern	Hypercardioid
Sensitivity	20mV/Pa (-34dBV/Pa)
Power requirements	24-48V Phantom,10mA
Peak acoustic input	139dB SPL
Output	XLR (PIN 2+)
Minimum output load	600Ω, balanced between pins 2&3
Noise	16dB SPL (A weighted)
Dimensions L x D	12.75 x .860 inches (324mm x 22mm)
Attached Cable	30' (9.14m) Canare StarQuad™
Weight	(microphone only) .22lb (100g) (mic with 30' cable) 1.2lb (544.3g)



Pin Connection Information for Installing the XLR

The ChoirMics™ use Canare™ Star Quad™ microphone cable which has two twisted pairs and a shield. Solder the shield to pin 1, the white twisted pair (i.e. both white wires) to pin 2. and the blue twisted pair (i.e. both blue wires) to pin 3.

Congratulations on your purchase of Earthworks Hanging ChoirMic™ C30/C (cardioid) or C30/HC (hypercardioid) microphones. You will be thrilled with the results that will be obtained using these microphones on your choir. You will hear far more detail with no spotlighting or hot spots, a more uniform pick-up, more gain before feedback and a high rejection of sounds from the rear of the microphone. After reading this manual, if you have any questions, please contact Earthworks using the contact information on the back cover of this manual.

Items Enclosed with the Earthworks ChoirMic™ Microphone:

1 - ChoirMic™ Microphone (C30/C or C30/HC in black or white)
(microphone comes with a 30 foot Star Quad™ microphone cable attached). The ChoirMic cable comes standard with no XLR-3M connector, unless the C30-XLR accessory was purchased (which includes an installed XLR-3 male connector).
1 - PW1 Foam Windscreen (in black or white)
1 - ChoirMic™ Users Manual

IMPORTANT NOTICE - Please Read This:

Earthworks microphones do not pick up sound in the same way conventional microphones do. This is because Earthworks microphones have near-perfect polar response and high rejection of sounds from the rear of the microphone. Therefore, Earthworks microphones may need to be installed and positioned differently than conventional microphones to achieve optimum results.

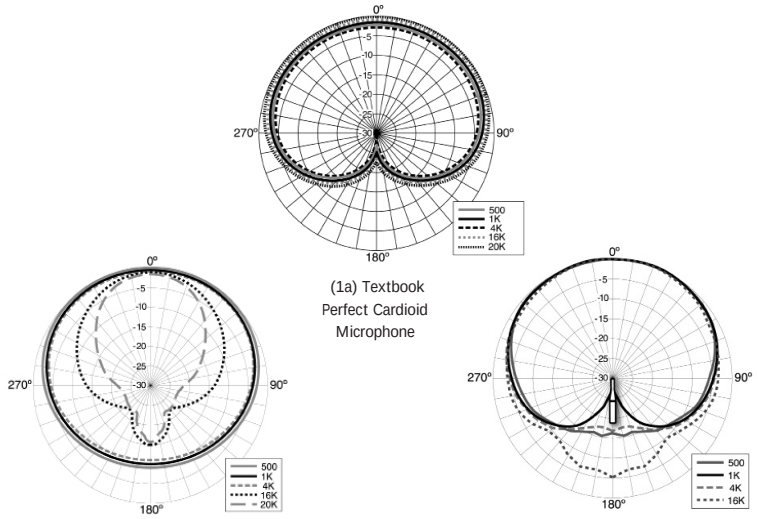
Please take the time to fully read the information regarding installation and positioning starting on the next page. Doing so, could save you time and the possibility of having to re-install or re-position the microphones. Again, Earthworks microphones do not pick up sound like conventional microphones, so understanding the pick-up characteristics of Earthworks microphones prior to installation and positioning will provide you with optimum results the first time.

See page 12 for XLR connector pin information prior to soldering an XLR connector on the ChoirMic microphone cable.

Utilizing Earthworks Near-perfect Polar Response

Near-perfect Polar Response

Conventional cardioid microphones typically have poor polar response. They will have a relatively uniform (i.e. flat) frequency response at the front of the microphone (on-axis or 0 degrees), meaning they will uniformly reproduce high frequencies, mid frequencies and low frequencies with a uniform level. However, if you move to either side of the microphone (90 or 270 degrees) there will be a dramatic loss in high frequency response. Perhaps the most telling demonstration of this is attempting to place three singers on a single conventional cardioid microphone (one at the front and the other two singers on the sides). The singers on the sides of the microphone will sound muddled and undefined due to the loss of high frequencies at the sides of the microphone (off-axis). In figure 1a you will see a perfect cardioid polar pattern which will pick up all frequencies uniformly at the front and the sides of the microphone. Figure 1b shows the polar response of a typical conventional cardioid microphone. Notice the severe loss of high frequencies at the sides of the microphone. Figure 1c is the near-perfect polar response of an Earthworks microphone. The Earthworks microphone has a uniform frequency response at the sides of the microphone that is within 3db of the on-axis response at any frequency.



(1a) Textbook Perfect Cardioid Microphone

(1b) Conventional Cardioid Microphone

(1c) Earthworks Cardioid Microphone

Figure 1. Differences Between a Perfect, Conventional and an Earthworks Cardioid Microphone

The Earthworks cardioid microphone will pick up sounds with nearly the same fidelity at the front and the sides of the microphone. This is a remarkable technical achievement and one that will provide incredible results for you.

WARRANTY & REPAIR

Online Warranty Registration

You can perform the warranty registration for your Earthworks microphones online by visiting the Earthworks website at www.earthworksaudio.com/register. Simply complete this form with the required information. You can also register multiple microphones on the same online registration form.

Warranty Repair

Each Earthworks High Definition Microphone™ is expertly designed and hand made by members of our highly trained staff. We make every effort to design out any potential problems we can foresee when our microphones are used in the field. In addition only the very best of components are utilized in making these outstanding premium quality microphones. Earthworks microphones have been utilized by audio professionals for over a decade. Our very low number of repairs indicates that you will have years of dependable and trouble free use of your Earthworks microphone or microphones.

If your microphone develops a problem, please contact the Earthworks warranty repair department by phone at (603) 654-2433, Ext 119 or by email at: returns@earthworksaudio.com.

wire spring type element on the cable to position the microphone. Not much fun for an installer on top of a tall step ladder. These types of microphones usually require many trips up and down the ladder to position each microphone. Installers will quickly appreciate the simplicity and ease of positioning of the Earthworks ChoirMic which hangs straight and stable, and can be easily positioned with the mini-flex gooseneck.

Earthworks ChoirMics with a mini-flex gooseneck can be positioned quite easily

Conventional Choir microphones with wire clips are extremely difficult to position

Other important design features of the ChoirMics is their high SPL handling up to 145dB SPL. Their extended high frequency response to 30kHz will improve intelligibility and sound quality. The very short diaphragm settling time of the ChoirMic will allow the listeners to hear detail never before possible (which is masked by conventional microphones). The use of high current, Class A, low distortion electronics maintain the quality and integrity of the sound and allow high frequency information to be sent easily through long lengths of cable without loss of high frequency content.

Microphone Cable is Field Replaceable

The ChoirMic™ microphone cable is field replaceable in the event that a microphone cable becomes damaged, or the use of a longer cable becomes necessary. To replace the cable, loosen the set screw on the cap at the cable end of the microphone with an Allen wrench. With the set screw loosened, hold the microphone body in one hand and rotate the top cap with the other hand to remove the top cap. With the top cap removed, pull on the microphone cable and the connector will come out. This connector is a Neutrik model NC3FX-SPEC with gold contacts. You can solder it like a standard XLR-3 microphone connector.

To replace the top cap, first replace the locking push-button under the rubber grommet then push the reassembled connector back into the microphone body, mating the connectors. Then hold down the locking push-button and slide the top cap over it and screw the top cap back on. Once the top cap is screwed on, the locking push-button will lock the connector into place. If you have any difficulty in replacing the microphone cable, please contact the Earthworks factory for assistance.

Conventional Polar Response vs. Near-perfect Polar Response

Before reading this information, if you were asked to spread your arms to indicate the width of the pick-up pattern of a conventional cardioid microphone, you would probably indicate something like shown in Figure 2a. The actual polar response of a typical conventional microphone is illustrated in Figure 2b. Notice that the shaded area in Figures 2a and 2b is virtually the same. Outside of the shaded area there will be a substantial loss of high frequency information.

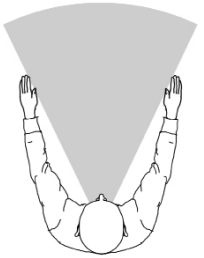


Figure 2a. Typical pick up area (with full frequency response) of a conventional cardioid microphone indicated by extending arms

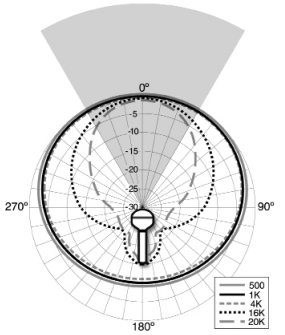


Figure 2b. Typical polar pattern (with full frequency response) of a conventional cardioid microphone

In contrast, if one were asked to spread their arms to indicate the width of the pick-up pattern of an Earthworks cardioid microphone, they would indicate something like shown in Figure 3a. The actual polar response of an Earthworks cardioid microphone is illustrated in Figure 3b. Again, notice that the shaded areas in Figures 3a and 3b are virtually the same. Notice on the Earthworks microphone (Figure 3b) that even outside the shaded area there is a very minimal change or loss in the level of high frequency information.

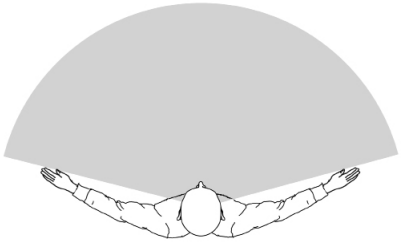


Figure 3a. Typical pick-up area (with full frequency response) of an Earthworks cardioid microphone indicated by extending arms

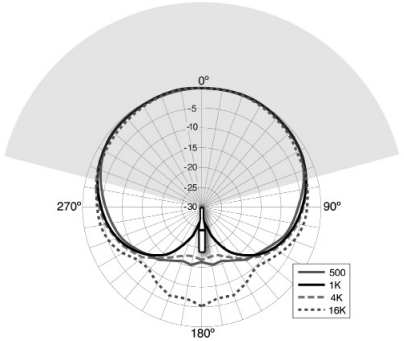


Figure 3b. Typical polar pattern (with full frequency response) of an Earthworks cardioid microphone

How Earthworks Near-perfect Polar Response Can Benefit You

There are several ways near-perfect polar response can benefit you.

1. Use of fewer microphones
2. Ability to place microphones closer to the sound source for more gain before feedback.
3. No spotlighting or highlighting
4. More rejection of sounds from the rear of the microphone
5. Singers on the sides of the microphone enjoy the same quality as those in front of the microphone.

Fewer Microphones Required

Referring to Figure 2b, notice how narrow the pick-up pattern is on a conventional cardioid microphone. In comparison, notice how much wider the pickup pattern is on the Earthworks cardioid microphone (Figure 3b). Keep in mind that the shaded areas in these figures indicate the area where you can obtain the full frequency response of the microphone without a significant loss of high frequencies.

Conventional microphones (Figure 2b) only provide a narrow window (or area) in which they can pick up sounds with full frequency response. Figure 4 below, shows an 80-voice choir miked with conventional microphones. It takes 6 conventional microphones, placed 6 feet in front of the choir, to adequately cover the choir with the full frequency response of the microphones.

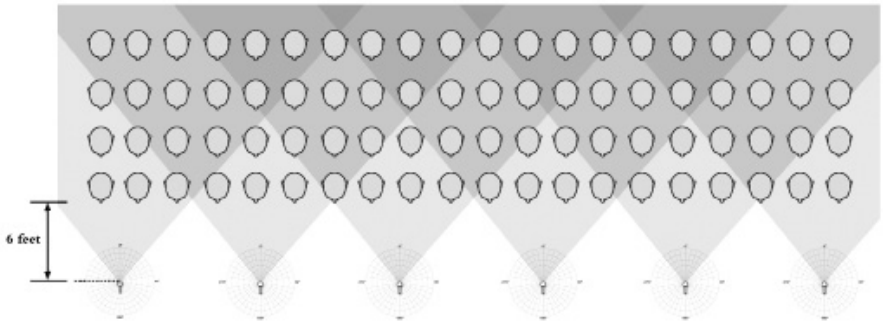
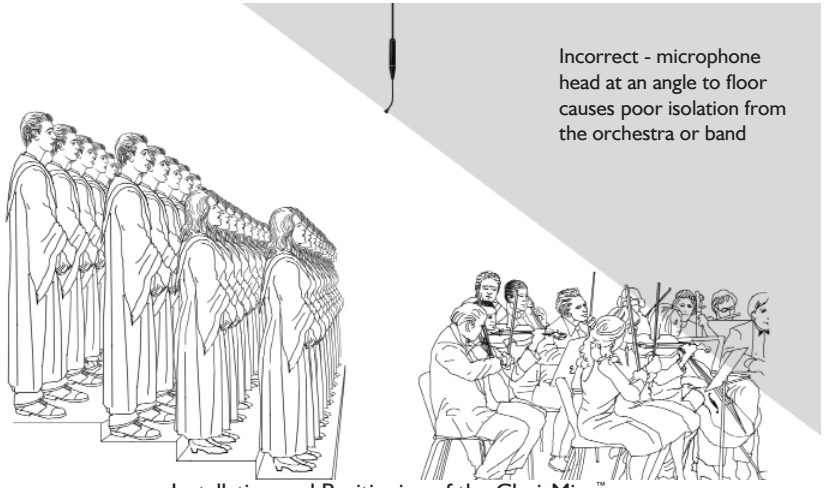


Figure 4. An 80-voice choir miked with 6 conventional microphones at 6 feet

In contrast, the near-perfect polar response of Earthworks cardioid microphones provide a wider pickup pattern (or area) where you can obtain the full frequency response of the microphones. Figure 5 on the following page, is the same 80-voice choir is covered using only 3 Earthworks cardioid microphones.



Installation and Positioning of the ChoirMics™

Figure 12. Improper Positioning of an Earthworks Cardioid Microphone with an Orchestra or Band behind the Microphone

Notice in Figure 12 what happens if the rear of the Earthworks cardioid microphone is not positioned toward the orchestra or band.

ChoirMic™ Design Philosophy

The majority of conventional hanging choir microphones suffer from several similar design flaws. Some have the microphone electronics installed in the ceiling with unbalanced microphone cable going to the microphone. Such designs are often susceptible to radio frequency interference (RFI) or picking up hum from nearby electrical lines. Another common flaw is the use of small, lightweight microphone housings that do not have enough weight to pull the cable straight when suspended from the ceiling. These lightweight microphone housings sometimes move due to the air blowing on them from the air conditioning system. Another problem is the use of cables that will move or rotate due to temperature or humidity changes. These microphones may be perfectly positioned, then a few days later may be pointed a different direction as the cable has rotated due to temperature or humidity changes.

The Earthworks ChoirMic is larger in size than most conventional choir microphones, however, all of the electronics are housed inside the microphone body and the output is low impedance and balanced. This greatly reduces the likelihood of RFI problems. In addition, high quality Canare™ Star Quad™ microphone cable is used which provides greater insurance against RFI. This premium microphone cable is also guaranteed not to rotate or move due to temperature or humidity changes. The heavy microphone body also provides enough weight to pull the microphone cable straight down for a good cosmetic appearance.

Installers will love the mini-gooseneck on the ChoirMic, as it allows easy positioning of the microphone head. Many conventional choir microphones require a

What we have reviewed so far is technical information shown on charts and graphs. Now let's look at what happens in the actual use and application of these two types of cardioid microphones. If you were to take the typical conventional cardioid microphone in your hand and talk into the front of the mic and while you are talking, rotate the microphone 180 degrees and talk into the rear of the microphone, you would notice some reduction in the audible level of your voice. In contrast, if you were to do the same exercise with an Earthworks cardioid microphone, when you started talking into the rear of the microphone your voice would be nearly inaudible. This practical demonstration shows how dead the Earthworks cardioid microphones are at the rear. As a general guideline, you can consider the coverage area from 90°, 180° to 270° the dead zone of an Earthworks cardioid microphone as illustrated in Figure 10.

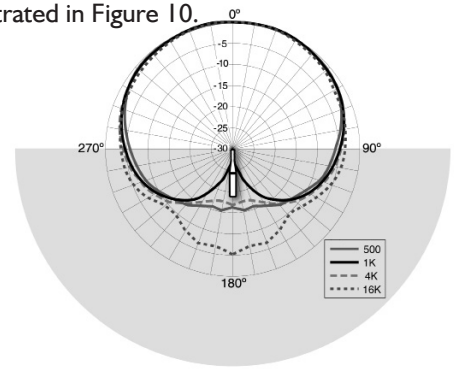


Figure 10. Rear Polar Response of an Earthworks Cardioid Microphone

When miking choirs with an orchestra or band in front of the choir, the rear rejection of sounds from an Earthworks cardioid can be a real benefit. When positioning the Earthworks microphone, make sure that the rear of the capsule is facing the direction of the orchestra or band as shown in Figure 11.

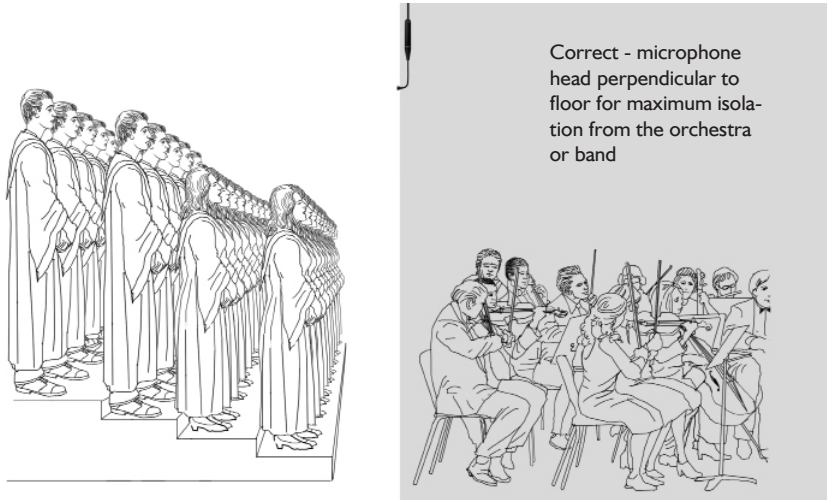


Figure 11. Proper Positioning of an Earthworks Cardioid Microphone with an Orchestra or Band behind the Microphone

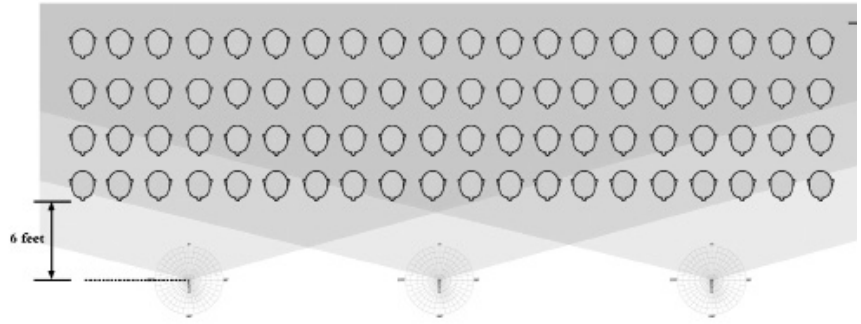


Figure 5. An 80-voice choir miked with 3 Earthworks microphones at 6 feet

Closer Miking Provides Additional Gain Before Feedback

Seasoned sound engineers know that placing a microphone closer to the sound source will result in additional gain before feedback. Figure 6 below, shows the same 80-voice choir miked with 3 Earthworks cardioid microphones, however, notice that the microphones are placed 3 feet in front of the choir rather than at 6 feet as indicated in Figures 4 and 5.

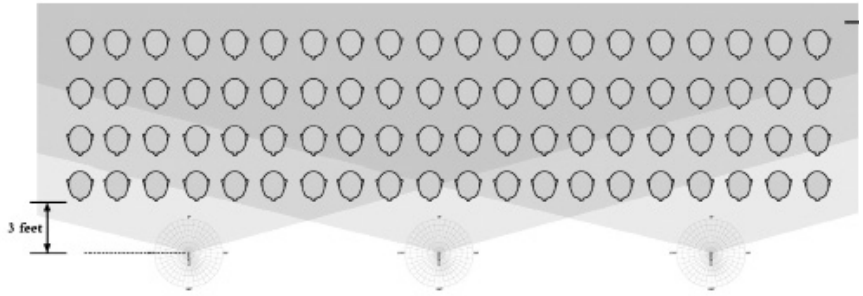


Figure 6. An 80-voice choir miked with 3 Earthworks microphones at 3 feet

In contrast, Figure 7 shows the same choir miked with 6 conventional cardioid microphones placed 3 feet in front of the choir. Notice the blank coverage spots in the pick-up area. This illustrates that placing conventional microphones 3 feet in front of the choir would require even more microphones to adequately cover the choir.

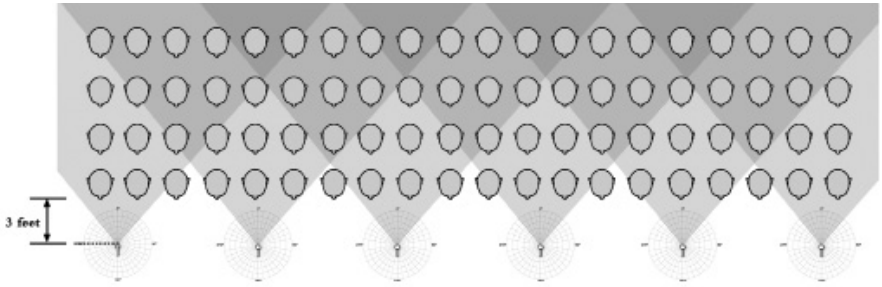


Figure 7. An 80-voice choir miked with 6 conventional microphones at 3 feet

Figure 8 below, shows that it would actually take 12 conventional cardioid microphones to provide the same coverage as 3 Earthworks cardioid microphones, when placed 3 feet in front of the choir.

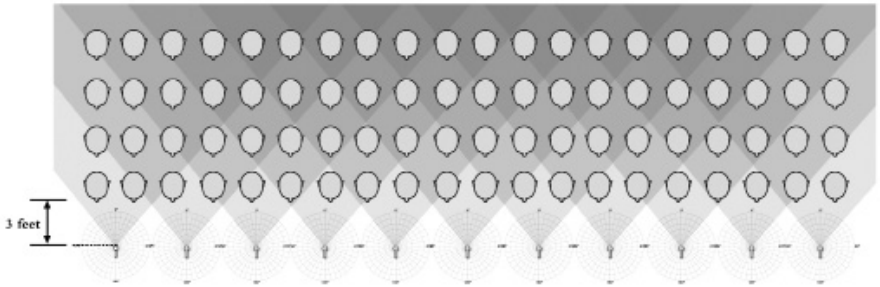


Figure 8. An 80-voice choir miked with 12 conventional microphones at 3 feet

Three characteristics of Earthworks microphones will provide more gain before feedback: (1) Smooth off-axis response, (2) picking up far less sound from the rear of the microphone and (3) wider usable polar-response that allows microphones to be placed closer to the source. Each of these characteristics will provide more gain before feedback, however, when you have all 3 it is somewhat remarkable.

The near-perfect polar response provides a smooth off-axis response in addition to a much wider pick-up pattern with the full frequency response of the microphone. With a wider pick-up pattern, the microphone can be moved closer to the source (in this case singers) and obtain even more gain before feedback.

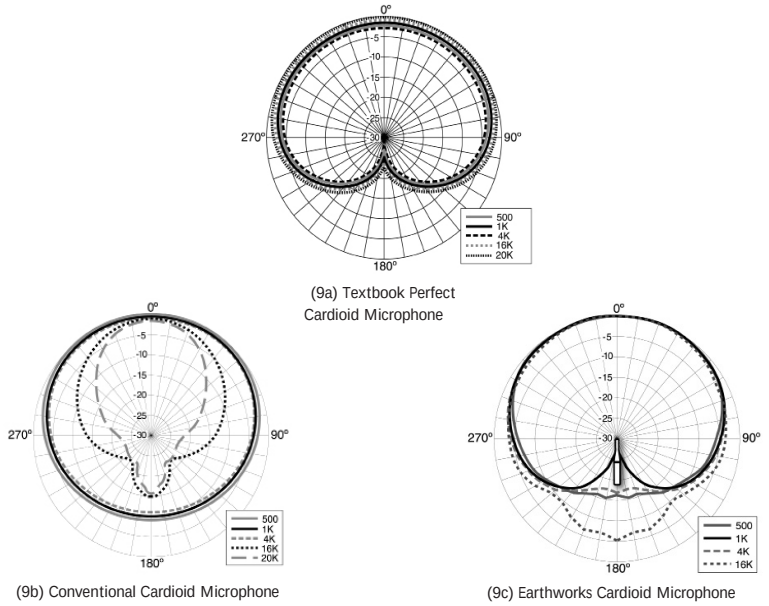
Spotlighting

Conventional microphones typically have problems with highlighting or spotlighting when used on choirs. This is caused by the significant changes in frequency response of sounds that are picked up off-axis. This phenomenon will cause singers in a given frequency range to sound louder than others not in that frequency range. This causes certain singers to stick out above the rest making it difficult to achieve a good balance between all of the voices in the choir. In contrast, the uniform off-axis response of Earthworks microphones greatly reduces this phenomenon allowing a uniform balance of choir voices to be achieved much easier.

Rejection of Sounds Behind the Microphone

A textbook perfect cardioid microphone will pick up sounds uniformly at the front and sides of the microphone. However, the level (in dB) on the sides of the microphone will be slightly less (as much as 6dB). Even though the level at the sides of the microphone may be lower, the frequency response should remain uniform (i.e. no loss of high frequencies). The textbook perfect cardioid microphone is very dead at the rear of the microphone. The polar response of a perfect cardioid microphone is shown in Figure 9a. Notice that at 180 degrees the level is down 30 dB or more.

This is what provides the directional characteristics of a cardioid microphone, in that it will pick up at the front and the sides and picks up far less at the rear, therefore making the microphone directional. However, this is textbook theory. This is much different in practice with real (imperfect) microphones used in the real world.



(9a) Textbook Perfect Cardioid Microphone

(9b) Conventional Cardioid Microphone

(9c) Earthworks Cardioid Microphone

Figure 9. Differences in the Rear Polar Response Between a Perfect, Conventional and an Earthworks Cardioid Microphone

Figure 9b shows the polar response of a typical conventional cardioid microphone. Notice at 500Hz, 1kHz and 4kHz the pick-up pattern is almost an omni pattern, however, these three frequencies are down 10dB in level in reference to their level at the front of the microphone (0 degrees). In contrast 16kHz and 20kHz are down 15dB at the rear of the microphone. We need to look at one important fact. Which frequencies are most audible, 500Hz to 4kHz, or 16kHz to 20kHz? Without question the frequencies between 500Hz and 4kHz are vastly more audible or predominant than those between 16kHz and 20kHz. This shows that the typical conventional microphone in Figure 9b will be somewhat less sensitive at the rear of the microphone, but by only about 10dB in the frequency range between 500Hz and 4kHz.

Looking at the Earthworks cardioid polar response in Figure 9c shows that it has far more rejection in 500Hz to 4kHz frequency range at the rear, than the conventional microphone shown in Figure 9b. In Figure 9c, see that 1kHz is down by 30dB or more, while 500Hz and 4kHz are down 15dB. Also notice that 16kHz and 20kHz are only down 5dB to 10dB. But remember that these high frequencies are far less audible than those between 500Hz and 4kHz.