AKG Microphones in the Home Studio

Introduction:

The home studio evolved during the seventies as an alternative to the standard studio for many smaller recording assignments. What defined it was primarily the use of so-called “narrow-gauge” analog tape recording equipment with 8 tracks on half-inch tape and 16 tracks on 1-inch tape. The rapid acceptance of dbx and Dolby-B noise reduction made this possible, but the most you could reliably expect from a home studio was a very good demo tape.

Two major forces in recent years have completely redefined the home studio: digital recording and the advent of “sampling” as essential elements in the creative process. Beginning with the first tape cartridge based digital multi-tracks (ADAT and DA-88 machines) and the newer generation of quiet, flexible low cost consoles, the home environment lost its stigma as a demo studio and became an environment in which professional recording and mastering could be carried out.

Sampling technology merges quickly with that of synthesizers, and quality standards have risen so rapidly that we now see the basic audio stems for film scores being generated in the home studio environment. Does all of this leave room for microphones? Yes, but on a more limited basis as more musical ingredients are synthesized, sampled or fed into the console from instrument direct outputs.

In a well equipped, broad-based home studio you should be able to do an excellent job of vocal overdubbing, adding three or four background vocals at once, recording the guitar or any other single instrument -- or possibly an instrument duo. Do not expect to record strings, winds, brass or large vocal groups, since these require big rooms in order to create sufficient stereo cues to sound natural and justify their hefty budgets. Good as they are, the best of today’s reverberation units can’t quite make that last quantum leap.

In this White Paper we will assume that you have already come up to speed in the area of direct-inputs from instruments and synthesizers and that you are familiar with the rudiments of sampling. We will also assume that you know the ins and outs of your recording setup so that you can add new track in sync with existing ones and move flexibly between one job and the next. Our concern here is with your console mike input capability, your choice of microphones, your choice of signal processing and your recording space.

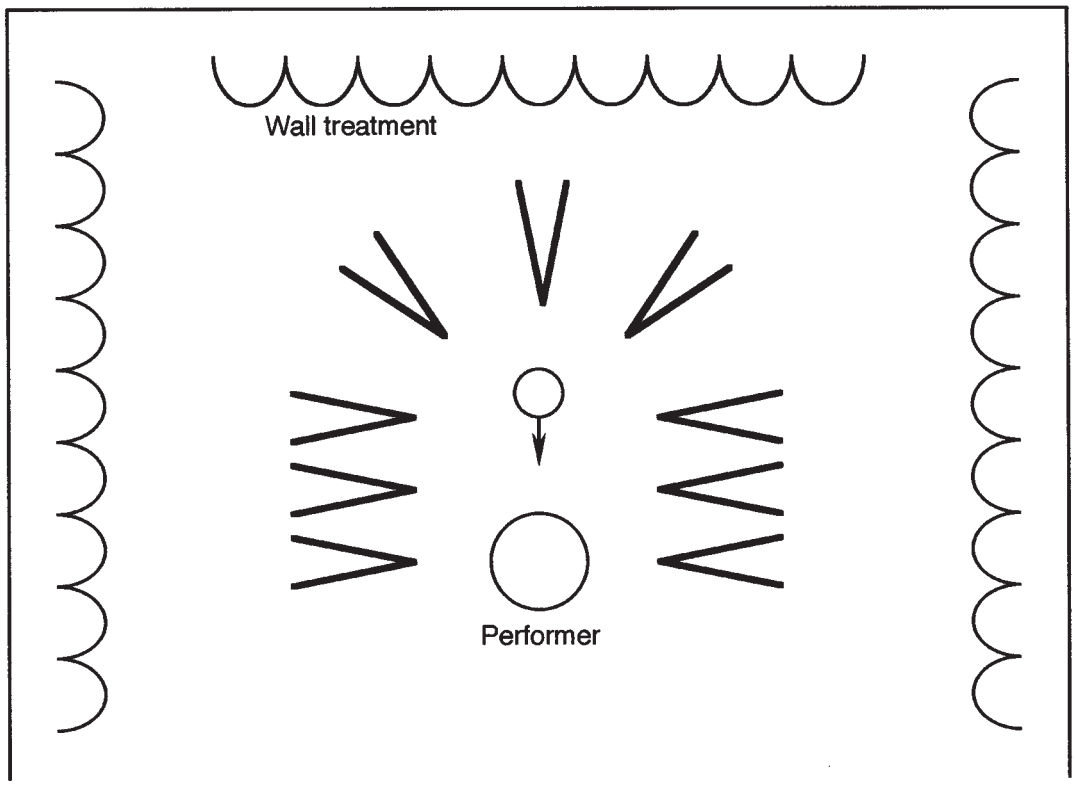
What Kind of Space do You Need?

Most home studios do not have a separate control room looking into a performance space. Actually, most microphone applications here will be fairly close-in, and an ordinarily quiet living room or den may suffice with only minimal treatment. You will find that some noises, like over-flights, occasional heavy traffic or home appliances such as refrigerators or air conditioning may intrude -- but such is the nature of any living space today. It would cost more than you think to isolate these problems, so be prepared to live with them -- or to turn certain items off when you are working.

Your biggest problem may be what we call small room ambience. A living room with lots of glass and bare portions of wood flooring may look warm and appear very inviting. As you talk with people in such a space, you may be virtually unaware that there are considerable room reflections. You may not be aware of them until you put up a microphone, record speech, and play it back. Most of the problematic reflections and room standing waves will be at mid and lower frequencies, in the range below about 500 Hz.

You probably won’t be able to isolate your room from the outside world, but you should do everything you can to damp it internally. Start by picking the “driest, deadest” room available to you, one with lots of carpeting, upholstering, bookcases and curtains. It may even be advisable to build a set of absorptive separators, such as shown in Figure 1, since these will kill reflections from room boundaries back to the microphone. There are a number of portable tube traps marketed today that will work as well. You can further isolate your recording activities by using a cardioid microphone rather than an omnidirectional.

Room acoustical treatment and details:



Detail of hinged panels:

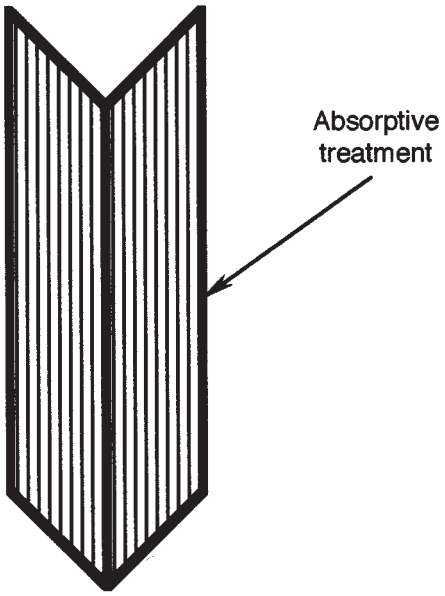


Figure 1

Can the Control Room and Recording Space be Combined?

Yes, and this is often the best way to go since it keeps you and the artist in direct visual and speech contact. Just be sure that there is very little in the way of machine noise and that you are, yourself, conscious of every small noise that you may make. It may be necessary to locate noisy tape transports and hard drives in another room. It goes without saying that when recording you must monitor over headphones.

Many engineers want to set up a studio in the basement, since it is likely to be well isolated from outside noises. However, watch out for noise utility functions, such as air conditioning, heating, and plumbing related noises.

Another problem in the basement are very hard walls and flooring, usually made of cinder blocks and concrete. These can set up very hard to manage low or low-mid standing waves in the space. These are deleterious and must be reduced before you go much further. We recommend that you refer to the following books for ways to treat these spaces:

A. Everest, Acoustic Techniques for Home & Studio, TAB Books (1980).

J. Cooper, Building a Recording Studio, Synergy Group, Los Angeles (1996).

Some Things Not to Do:

Don't bite off complex recording jobs. Remember that your studio will work best when you are laying down single tracks, or at most a pair of tracks.

Don't try to do a regulation union gig at home where the clock will be ticking. There are far too many variables here, and you'll probably run out of scheduled time before you've finished what you set out to do. Do your work in the home studio only when you can agree with the musician(s) that the project is the important thing and that you will both work until the project is done. You must know the limits of what you can do at home and when you must hire a full-service studio.

Choosing the Right Microphones:

You won't need very many microphones, so make sure you choose them wisely. You will need:

1. A good large diaphragm multi-pattern condenser model. You can't go wrong here with a C414/TLII.

2. A pair of small format condensers (Blue Lines or 480-Series) with cardioid and omni capsules.

3. A pair of smooth vocal-type dynamics, such as the D440, 550 or 660's.

Recording Operations:

We'll now describe some of the tasks that you can easily handle at home:

Recording a vocalist:

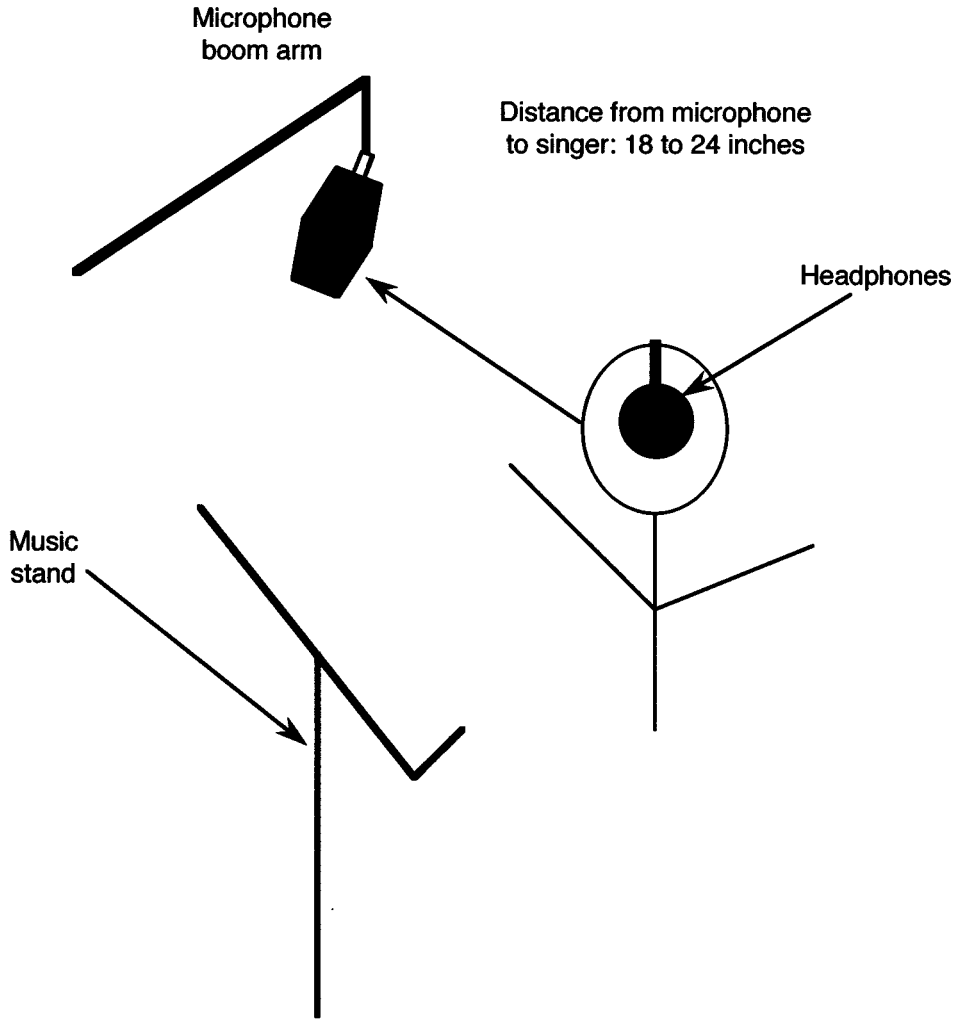


Figure 2

Adding a Vocal Track:

This is one of the most common tasks you'll be asked to carry out. Figure 2 shows the basic setup for the artist. Comfort is essential, and do everything you can to make the setup work the first time around. Headphone monitoring by the artist should be done with background tracks in stereo, and there should be plenty of the new vocal track in the mix -- with reverberation, even though you are recording the new track without sweetening. In other words, set up the monitor mix in the best, most flattering manner you can.

Use a windscreen on the C414 if the artist is on the breathy side. If the artist has a tendency to move around, you may want to use a compressor in order to keep a consistent level on the track.

Adding background vocals in stereo:
This is an easy task if you approach it as shown in Figure 3. This requires spacing the artists a bit, so watch out for excessive room sound in the pickup. As before, use stereo monitoring for the artists, with reverberation. If you feel that compression is necessary, make sure that the two channels of the compressor are operating in their linked mode, so that the two compressors will track in both channels.

Since you are recording more than one artist on each track, make sure that the singers are spaced at mike distances that produce the exact balance that you want. You won't be able to fix this later.

Recording a backup vocal quartet in stereo:

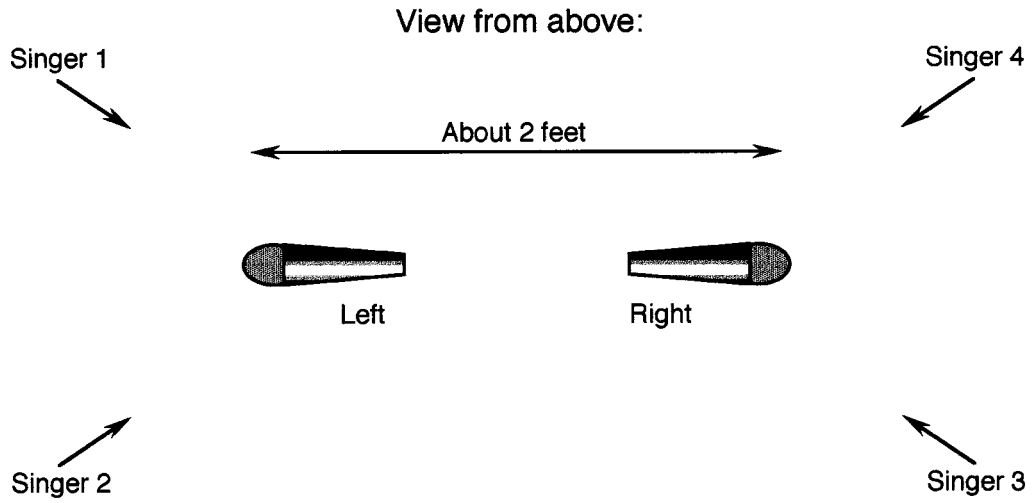


Figure 3

Adding a voice-over track:
Good narration pickup depends on a skilled reader who can enunciate clearly and consistently while not shuffling his papers! The setup shown in Figure 4 is the way to do this. Note that the mike is slightly higher than the talker's mouth and it tilted down to aim directly at the mouth. This will avoid pops at the mike that can be so troublesome later. The top surface of the desk should be cloth covered to cut down on noises of shuffling paper

Always take stock of the tabletop-to-mike reflection of the voice. Here, the approximate distance of the reflected path is about twice the direct-to-mike distance, and this will result in a 6 dB reduction in level of the reflection relative to the direct sound. Now, consider the off-axis response of the mike to the reflected sound. It is about 80° or so off-axis, and this will add another 6 dB of loss, resulting in response which is a total of 12 dB down for the reflected signal. This is low enough in level to be safely ignored.

Recording a narrator:

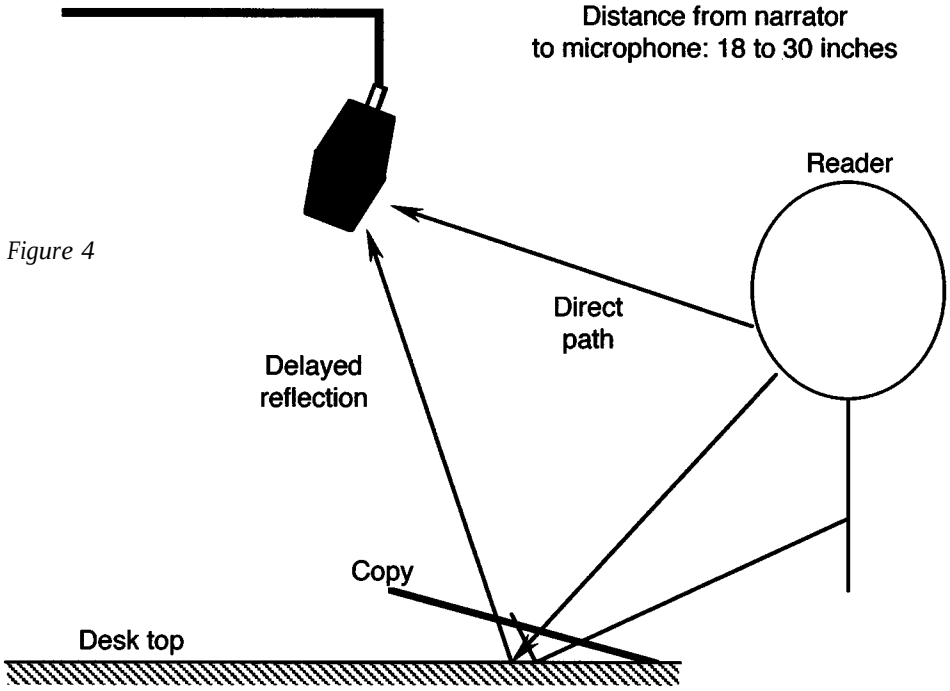


Figure 4

Many voice-over artists prefer to record while standing. The reason is that it gives them more breathing room and better diaphragm control. Their script will normally rest on a music stand, which should be cloth padded to minimize noise. Check also the reflection pattern of sound reflected from the stand.

An experienced voice-over reader will make few mistakes and will deliver the lines in a very consistent manner. A good reader will also avoid shuffling the script as well. Monitor carefully for extraneous room noises. The spoken voice is not always loud and it has a lot of open spaces; little noises that might be masked by music may come through here.

Adding Instrumental Tracks:

Sometimes the master plan for an otherwise well though out recording goes awry, and the producer or artist may feel that an additional new acoustical track can add something important to the mix. This will usually be a fill line involving no more than one or two performers.

Also, a performer may at a later date feel that a musical line can be played better than recorded originally and may want to come back into the studio to do it over. At first blush, the artist will want to go back into the same studio where the original tracks were laid down, but this may not be possible due to budget considerations, previous booking of the studio or a production schedule that demands that it be done immediately.

Miking two instruments in stereo:

Whatever the occasion or circumstance, the best recording conditions must be offered to the artist. Here's how we would recommend adding some exotic percussion fills using two players -- just the kind of thing that's likely to crop up as an afterthought.

You will want to lay down a new pair of tracks, possibly in stereo, if the producer feels that will offer more flexibility in the mix. Figure 5 shows how this would be done. Set your matched pair of small cardioids in one of the stereo patterns shown in Figure 5. The X-Y pattern offers excellent stereo pickup, with very accurate phantom imaging.

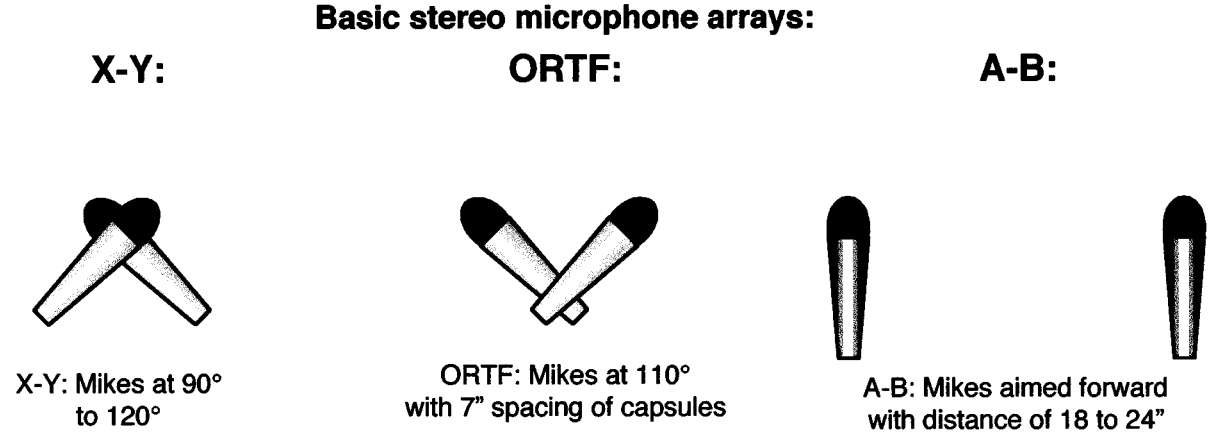


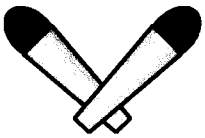
Figure 5

If you want a little more feeling of spaciousness, use the ORTF array. This setup adds subtle timing differences between stereo channels that will sacrifice a little in image precision while adding a increased sense of ambience. Finally, if you want still more feeling of space and don't mind sacrificing more imaging precision, use the A-B approach. By all means, experiment with these three approaches to see which one best satisfies the musical needs. Set up the players and microphones as shown in Figure 6.

Recording two instrumentalists in stereo:

Player 1 Player 2

Figure 6



Miking the acoustical guitar:
You may find yourself doing this quite often. Many of the previous mike comments apply, and you should proceed as shown in Figure 7. A pair of cardioids will usually work best, since the proximity effect will flesh out the low end of the instrument. While you're at it, you should record the direct output from the instrument as well. It's simply another ingredient for the remix engineer to work with. Use either condensers or dynamics, which ever gives you the best sound.

Recording the acoustical guitar in stereo:

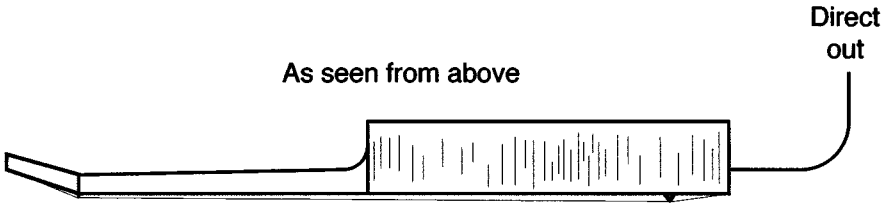


Figure 7

Spaced microphones about 15 to
30 inches from guitar body

The guitar usually fares best with spaced (A-B) microphone placement than with X-Y or ORTF, because of the more spacious sound it gives.

Miking the piano in stereo:

It is a rare home environment that will have a grand piano good enough for tracking, but it you have one, here's how to proceed. We will assume that you are recording pop or rock material and need a close-in piano sound. With the piano's cover full-up, place two cardioid microphones as shown in the overhead view of Figure 8A. The microphones should be aimed downward, about 4 to 5 inches above the strings. Experiment with the cover full-up and also on "half-stick," the short extension that props the cover up only part way, as shown in Figure 8B.

Avoid proximity to the very high strings and the very low ones, and keep the microphones within about 2 or 2.5 feet of each other. If this approach gives you a sound that is too close-in, move the mikes upward in small steps. An alternate approach is to use a pair of boundary layer mikes, as shown at Figure 8C. These can be fastened to the underside of the cover with small pieces of double-sided tape. (Use the kind that will leave no residue on the cover's surface.) If you need more damping or isolation, drape one or more blankets over the cover of the piano as shown in the figure.

Recording the grand piano:

Figure 8A

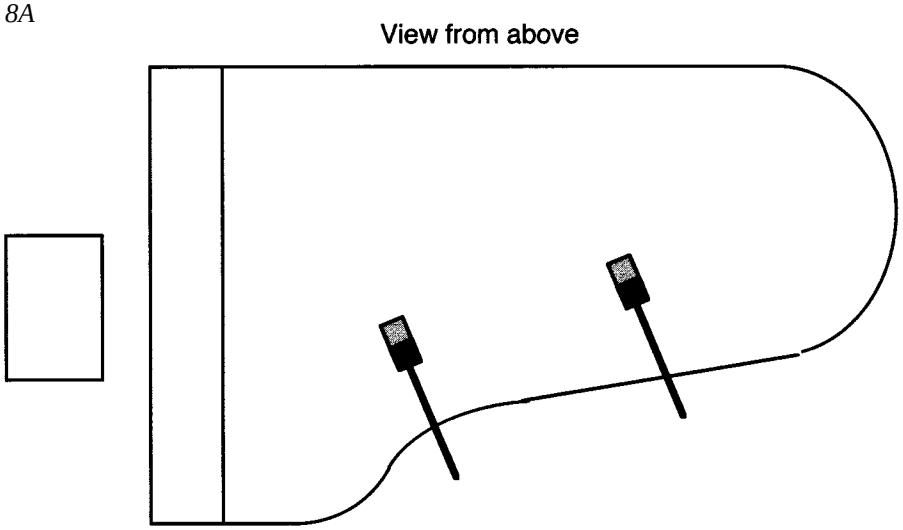


Figure 8B

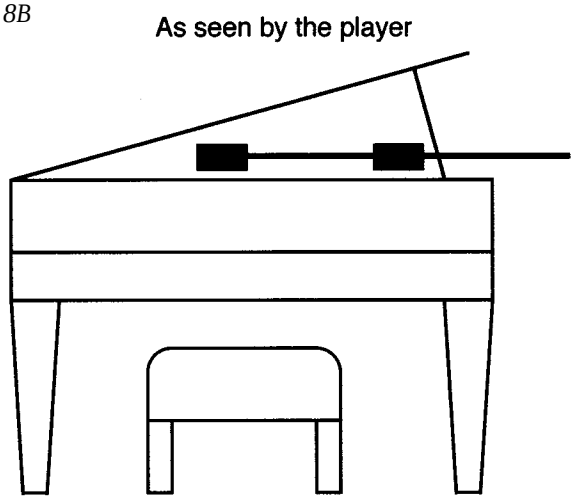
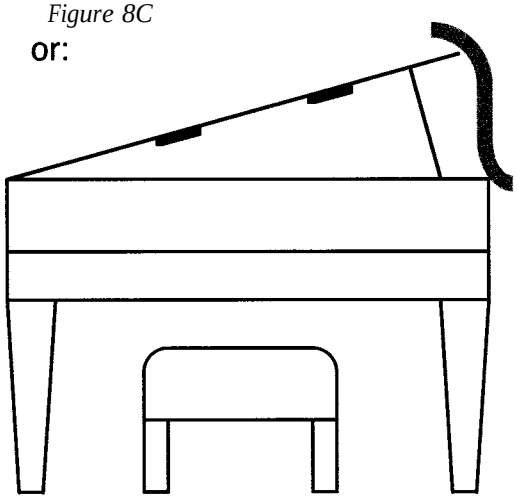


Figure 8C



Be prepared to do a good bit of experimenting in order to get just the right sound. At first, the instrument may sound too bright -- but remember that the piano may need to be on the bright side in order to fit properly into a complex mix. If necessary, you can always move the mikes outside the piano, putting them about a foot in front of the rim and an inch or two above the rim. If you do this, be careful about room sound. Also, try omnis for a rounder, more mellow sound.

Do as much miking experimenting as you can before the pianist arrives.

Do you Dare Record a Drum Set at Home?

You can certainly record some polite fills, but a full-blown drum session really belongs in a big studio. The sheer volume level of a full drum set in a den or living room is apt to be oppressive, and neighbors may complain. See the AKG Acoustics White Paper on Miking Drums if you intend to work in this area.

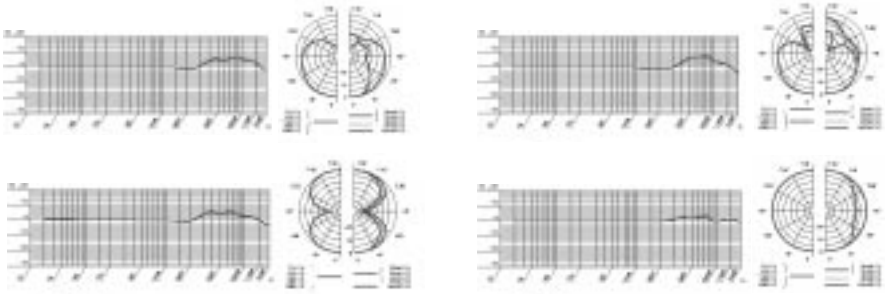
A Final Note:

The general guidelines provided here will get you started, and you will ultimately be limited only by your own imagination as you move onward. Keep moving upward technically; who knows, some day you may move out of that den into your own studio.

The AKG Microphones we Recommend:

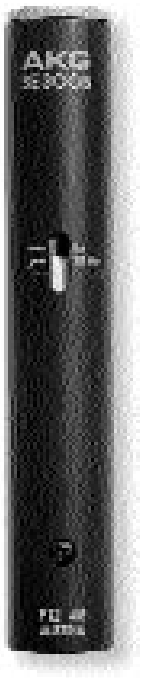
C414B-TLII "Vintage TL"

Frequency Range: 10Hz to 20kHz
Polar Patterns: cardioid, hypercardioid, omnidirectional, and figure-8
Preattenuation: –10dB, –20dB switchable
Bass Cut Filter: 12dB/octave roll-off at 75Hz or 150Hz
Sensitivity: 12.5 mV/Pa (–38dBV) (all patterns)
Impedance: 180Ω
Equivalent Noise Level: 14dB-A
Maximum SPL for 0.5% THD: 140dB (160dB@ –20dB) at 1kHz
134dB (154dB@ –20dB) 30Hz–20kHz
Power Requirement: 9–52V phantom power to DIN 45596
Current Consumption: approx. 2mA
Size: 5.6x1.8x1.4 in. (141x45x35mm)
Net/Shipping Weight: 11.3 oz./2.1 lbs. (320/920g)



C480B

Frequency Range: 10Hz to 30kHz
Response of bass cut filter:
12dB/octave at 70Hz and 150Hz
Sensitivity: switchable +6, 0, –10dB
Electrical Impedance: ≤150Ω
Recommended load impedance:
2,000Ω/11,000pF
Power requirements:
48V phantom power to DIN 45596
Size: 0.8Δx5.9 in. (21Δx150mm)
Net/Shipping Weight: 3.5/18 oz.
(100/800g)

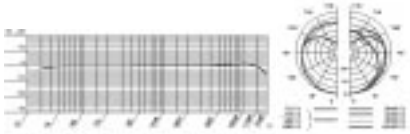


SE300B

Powering Output Module Frequency Range: 20Hz to 20kHz
Sensitivity: 10mV/Pa (–40dBV)
Impedance: 200Ω
Equivalent Noise Level: 17dB-A
Maximum SPL for 1% THD: 132dB (142dB with 10dB preattenuation)
Power Requirement: 9–52V phantom power to DIN 45596
Size: 0.7Δx4.3 in. (19Δx110mm)
Net Weight: 2.8 oz. (80g)

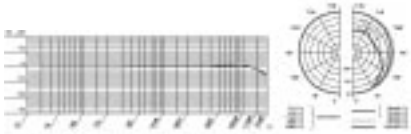
CK91 (with SE300B)

Frequency Range: 20Hz to 20kHz
Polar Pattern: cardioid
Sensitivity: 10mV/Pa (–40dBV)
Impedance: 200Ω
Equivalent Noise Level: 17dB-A
Maximum SPL for 1% THD: 132dB
(142dB with 10dB preattenuation)
Power Requirement: 9–52V phantom power to DIN 45596
Size: 0.7Δx2.0 in. (19Δx52mm)
Net Weight: 1.2 oz. (35g)



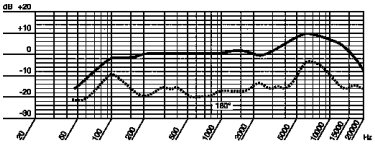
CK92 (with SE300B)

Frequency Range: 20Hz to 20kHz
Polar Pattern: omnidirectional
Sensitivity: 10mV/Pa (–40dBV)
Impedance: 200Ω
Equivalent Noise Level: 17dB-A
Maximum SPL for 1% THD: 132dB
(142dB with 10dB preattenuation)
Power Requirement: 9–52V phantom power to DIN 45596
Size: 0.7Δx2.0 in. (19Δx52mm)
Net Weight: 1.2 oz. (35g)



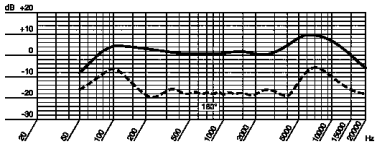
D440

Frequency Range: 60Hz to 20kHz
Polar Pattern: Cardioid
Sensitivity: 2.5mV/Pa (–52dBV)
Equivalent Noise Level: 18dB-A
Electrical impedance: ≤600Ω
Recommended load impedance: ≥
Maximum SPL for 1% THD: 147dB SPL (
Power Requirement: 9–52V phantom power to DIN 45596
Size: 3.35x7.09 in. (85x104mm)
Net Weight: 5.2 oz. (148g)



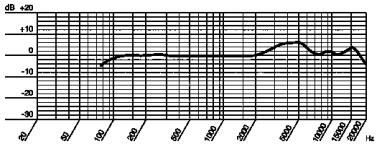
D550

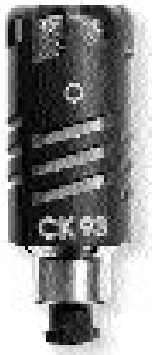
Frequency Range: 20Hz to 20kHz
Polar Pattern: Cardioid
Sensitivity: 2.5mV/Pa (–52dBV)
Equivalent Noise Level: 18dB-A
Electrical impedance: ≤600Ω
Recommended load impedance: ≥2,00
Maximum SPL for 1% THD: 147dB SPL (
Power Requirement: 9–52V phantom power to DIN 45596
Size: 4.76x7.09 in. (121x104mm)
Net Weight: 7.2 oz. (203g)



D660S

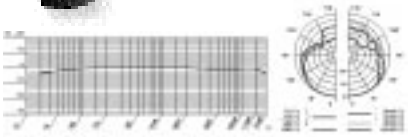
Frequency Range: 70Hz to 20kHz
Polar Pattern: Hypercardioid
Sensitivity: 2.0mV/Pa (–54dBV)
Equivalent Noise Level: 20dB-A
Electrical impedance: ≤500Ω
Recommended load impedance: ≥1,200Ω
Maximum SPL for 1% THD: 140dB SPL (
Power Requirement: 9–52V phantom power to DIN 45596
Size: 7.13x1.97 in. (181x50mm)
Net Weight: 8.5 oz. (240g)





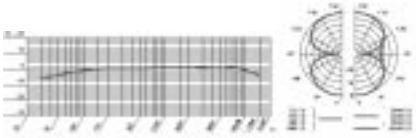
CK93 (with SE300B)

Frequency Range: 20Hz to 20kHz
Polar Pattern: hypercardioid
Sensitivity: 10mV/Pa (–40dBV)
Impedance: 200Ω
Equivalent Noise Level: 17dB-A
Maximum SPL for 1% THD: 132dB
(142dB with 10dB preattenuation)
Power Requirement: 9–52V phantom power to DIN 45596
Size: 0.7Δx2.0 in. (19Δx52mm)
Net Weight: 1.2 oz. (35g)



CK94 (with SE300B)

Frequency Range: 20Hz to 20kHz
Polar Pattern: figure-8
Sensitivity: 10mV/Pa (–40dBV)
Impedance: 200Ω
Equivalent Noise Level: 22dB-A
Maximum SPL for 1% THD: 132dB (142dB with
10dB preattenuation)
Power Requirement: 9–52V phantom power to DIN 45596
Size: 0.7Δx2.3 in. (19Δx58mm)
Net Weight: 1.6 oz. (45g)



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