



PRESS RELEASE

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Titel:

Mastering the Low Notes

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Theme:

Sound engineers often discuss the best way to pick up a double bass. What type of pickup should one use in what spot for what kind of sound? Or is there a simple solution, after all?

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Discography (producer and/or composer):

- **"New Aspects of Cutting Wood"**
- **"Electric Groove featuring Patricia Ferrara"**
- **"Peter Natterer Quartett feat. Wolfgang Puschnig" (to be released 01/2002)**

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Mastering the Low Notes

The double bass produces highly complex vibration patterns with numerous acoustic parameters. In addition, different playing situations require different miking techniques. A symphony orchestra is a totally different acoustic environment from a jazz group where the bass needs to be amplified with maximum channel separation to be heard within the ensemble. In any case, we should first take a look at what happens acoustically inside a double bass.

Understanding the basic physical principles at work in a double bass will be helpful in getting a good bass sound on stage.

Blame it on the strings!

The strings is where the sound of the instrument originates. This is why it is of paramount importance to use the right type of strings. With few exceptions, it is impossible to correct unwanted effects due to unsuitable strings by tweaking the various controls of the sound system.

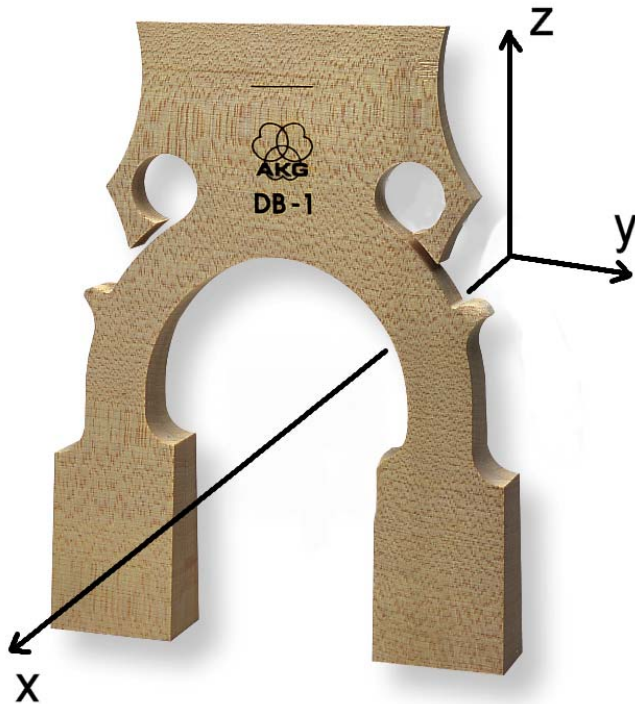
String diameter, tension, and material are obvious criteria, but less obvious parameters are very important, too. Torsional rigidity, for instance, determines to a high degree the attack of the sound. Supple strings that are easy to twist about their centroidal axis provide a round, full tone when plucked, whereas bass players prefer more rigid strings for bowing. Rigid strings when played pizzicato, however, produce an unpleasantly harsh plucking sound that is virtually impossible to mitigate later.

Another little-known criterion for the sound of a string is inharmonicity. The term "inharmonicity" refers to overtones whose frequencies are not integral multiples of the fundamental frequency. The further the actual harmonics deviate from integral multiples of the fundamental, the more "inharmonic" is the string. Observations have shown that many pizzicato players prefer strings with an exceptionally high degree of inharmonicity.

[R. Barnert & H. Frank, Observations on the Inharmonicity of Violin Strings, Proc. 4th International Conference in Music Perception and Cognition, McGill University, Montreal, Canada, Aug. 11-15, 1996].

The tuning of the instrument is another factor one should not forget. Some basses go down to B at 31 Hz. The flageolet note G5 has a fundamental frequency of 784 Hz. However, as mentioned above, it is the harmonics that determine the sound of an instrument. Therefore, it is advisable to capture the widest possible range of frequencies when amplifying a bass. Fortunately, the old myth that a double bass should be miked up with a special bass microphone whose frequency response ends at a few kHz, is quickly dying out.

The legendary bridge



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The bridge is one of the most powerful factors in shaping the instrument's sound. In addition, since the bridge connects the strings that generate the sound to the body that radiates the sound, all sound information will necessarily pass through the bridge. [R. Barnert, Akustische Messungen am Kontrabass, M.A. thesis at the Hochschule für Musik und darstellende Kunst in Graz, January 1996].

Therefore, the bridge is obviously the ideal place for a pickup. For a closer examination, the bridge can be divided into three main planes (the xy , xz , and yz planes) as shown above. The force vectors through these three planes can be used specifically for picking up the sound. The bridge, when excited by a vibrating string, acts similarly to a rotor. At the point of contact, the string will excite the bridge mainly along the y -axis, i.e., orthogonally to the orientation of the string. The bridge will convert this motion into a z -oriented motion at the feet of the bridge. One of the implications of this for a bridge mounted pickup is that the closer the pickup is mounted to the feet, the more dominant the force vectors along the z -axis will be.

The top of the bridge, however, will vibrate in different ways in different places and a pickup will give a better sound in some places than in others. The art of the sound engineer is to find the best place for the pickup.

Pickup vs. microphone

Although many different devices are available on the market, most users prefer piezo pickups or condenser microphones. A piezo pickup consists of a crystal that converts force vectors acting orthogonally to its surface into an electrical signal. Piezo pickups are used as vibration pickups so they need to be mounted on a vibrating surface which often requires mechanical modifications to the bridge. Depending on which of the force vectors are captured by the pickup, the resulting sound will differ widely.

Condenser microphones respond to air-borne sound, so they normally give a very authentic sound, if at the expense of poor separation. Many engineers try to circumvent this problem by mounting a hypercardioid directly on the instrument but often end up with unwanted proximity effect. On stage, some bass players use both a condenser microphone and a pickup and either mix the two signals down or feed them separately to the monitor and FOH desks.

Live concert situations calling for a good sound and good separation are a special challenge to both sound engineers and bassists. It is worth noting that an "authentic" bass sound, particularly at high volume levels, will refuse to blend in with the rest of the instruments. The reason is simple. The sensitivity of the human ear to low frequencies changes rapidly with increasing sound levels. If the miked-up double bass signal sounds authentic at "normal" volume levels, the same signal will sound much too bass-heavy at higher levels. The inability of most equalizers to automatically adjust dynamically to the input level can cause sound engineering disasters with certain kinds of music.

When searching for the right sound, one should also remember that most commercial piezo pickups have inherent, substantial resonance peaks between 500 Hz and 1500 Hz that do not only color the sound but may cause feedback in a live setup. Users seeking a "flat" vibration pickup with no resonance peaks should consider the C 411 from AKG. Although it mounts on the instrument in the same way as a piezo pickup, its transducer element is a condenser capsule of much higher quality.



(Photo C411.jpg attached)

Placement determines the sound

When miking up air-borne sound, every experienced sound engineer knows where to place their microphone(s) to capture specific frequency bands. The way the sound of a pickup depends on its position on the instrument is less obvious. Here are some basic considerations:

The first question is how to balance the string and body signals. Placed on the bridge near the strings, the pickup will capture fingering, smacking, scratching, and fingerboard noises. The sound spectrum contains mostly high frequencies. Further down the bridge and in the body, these signals are much lower in level and the sound will be rounder. The acoustic sound of a double bass, however, is not radiated by the body alone. Fingerboard noises that are hardly radiated by the body contribute to the overall sound, too and should not be neglected when miking up a bass.

The best sound should contain both string and body frequencies. The body signal alone usually sounds too muddy and it is the string signal that adds definition. Using the bow produces a sawtooth vibration on the string whose harmonics are attenuated by the body. When bowing the bass, it is better to go for the body signal because otherwise the sound would be too scratchy.

For pizzicato playing, it pays to capture more of the string signal because the left hand and the fingerboard noise make a large contribution to the overall sound. As it turned out, the best compromise for both playing techniques is to pick up the signal in the central area of the yz plane of the bridge. The AKG DB-1 double bass bridge does exactly that. It is one of the few complete systems currently available with a pickup integrated in the bridge.

In conclusion, picking up a double bass should be regarded as part of a larger system. Perfect sound is the result of carefully matching the strings to the instrument and finding the optimum transducer type and position. Mastering the low notes is still a challenge for every ambitious sound engineer and musician.

