STEREO RECORDING

with DPA Microphones

DPA MICROPHONES

STEREO RECORDING

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Contents

Stereo Boom for DPA Microphones

The UA0836 Stereo Boom (fig. 1) is a precision-crafted microphone boom for easy and secure mounting of microphone pairs for stereo recording. It can be precisely adjusted for both spacing and angling of the microphones.

The boom can be mounted on a stand or suspended from wires. It has centimeter graduations on the boom and angle graduations on the microphone holders for precise, quick and easy configuration of the recording setup.

The holders supplied with the UA0836 are the UA0961 Microphone Holders (fig. 2), but can also be supplied without microphone holders as UA0837. Apart from that, the UA0897 Shock Mount (fig. 3) can be used. For arrangement of a coincident XY stereo or near coincident (including ORTF or NOS) stereo configuration, the stereo boom can be fitted with two directional microphones and DUA0019 Spacer for Stereo Boom (fig. 15).

Mounting on a stand (fig. 4)
Simply use the centered standard microphone thread or connect using the 3/8" NS27 thread adapter supplied.

Suspension (fig. 5)
Suspension of the boom is easily made by using the fly eyelets at the ends of the bar. Position the holders up-side down to obtain balance.

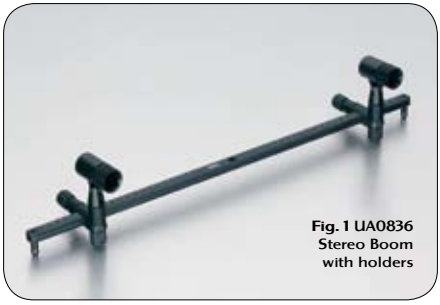

Fig. 1 UA0836 Stereo Boom with holders

Fig. 2 UA0961 Microphone holder

Fig. 3 UA0897 Shock Mount

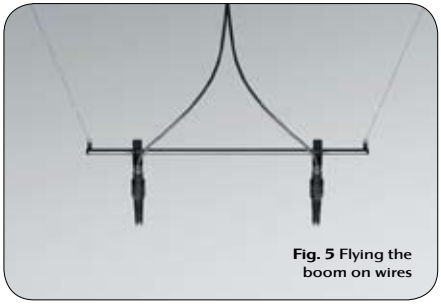

Fig. 5 Flying the boom on wires

Fig. 4 Mounting the boom on a microphone stand

Background on two-channel stereo

How to determine spacing and angling

The stereophonic recording techniques are based on the knowledge of how directional information is perceived by the human hearing system: When reproduced by loudspeakers in a two-channel system, the first arriving, and/or the strongest sound produces this directional information to the listener.

Psychoacoustic research [1] has quantified the time and level differences adequate for directional imaging to any position on the line between left and right loudspeaker in a standard loudspeaker setup (fig. 6).

The result can be seen from the curves in (fig. 7).
If no time or level differences between left and right are present, the sound source is reproduced at 0° (hard center). To make a sound source appear at 30°, the level difference between left and right channel should be 15 dB. Also the sound appears at 30° if the time difference between left and right channel is 1.12 ms (milliseconds).

Additionally, a combination of time difference and level difference can act together. For instance the sound will be reproduced at 30° if the signal in one channel is delayed by 0.5 ms and the level is approximately 6 dB below the other channel (see dotted lines in fig. 7).

As mentioned, stereo recording is not just a question of reproduction at hard left or right. Naturally the "in-between" distribution is important, otherwise angle distortion will occur (fig. 8).

In fig. 7 the inter channel differences adequate for 10° and 20° reproduction respectively are also found.

First quantified, this information can be combined with the directional characteristics of the units in a two-microphone setup. Then it is possible to determine the optimum positioning of the microphones for a stereo recording.

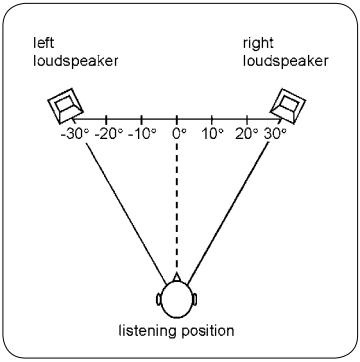

Fig. 6 Setup for stereo listening

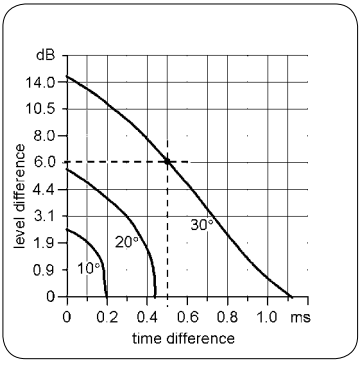

Fig. 7 Inter channel differences to provide a specific directional information

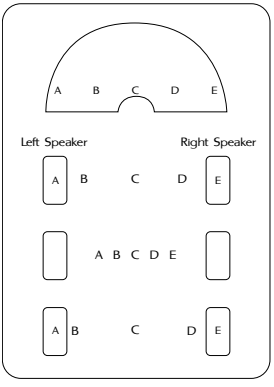

Fig. 8 Angle distortion. 3 different examples, showing irregularities between original sound source placement and perceived localization.

Setups for stereo: AB

AB stereo recording uses a spaced pair of omni microphones. On the boom, the microphones are normally mounted keeping the housings in parallel.

The distance from the centre of the thread to the centerline of the microphone can be read on the bar at the outer side of the two holders respectively, (fig 11).

The AB setup provides a nice reproduction of the reverberant sound field and provides useful spatial information. The directional information is slightly less distinctive compared to other setups.

AB is generally not suitable for mono as the summed signal may suffer from comb filtering. (For mono, just use one of the channels).

The spacing between two omni microphones can be chosen from the curves in (fig. 9).

The scale on the horizontal axis indicates the time difference between the microphones in milliseconds and the scale on the vertical axis indicates the position (width) of the sound source to be recorded in degrees (fig. 19).

Procedure
The first step is to select a distance between the sound source(-s) and the microphone setup. Please note that the ideal distance from the microphone pair to the sound source depends not only on the type and size of the sound source and on the surroundings in which the recording is to be made, but also on individual preference.

The mix of direct and diffuse sound in a recording is also of crucial importance. Therefore, considerable time should be used in establishing the optimum positioning of the microphones.
Be aware, that all directional information from the room will be reproduced in front of you in a 2-channel stereo playback system. Placement of the AB setup closer than expected, will consequently give a more appropriate direct to diffuse sound balance. It is also here the versatility of our AB Stereo Kits can be considered. Using the different acoustical modification devices for the microphones, the amount of ambience and the tonal colour of the recording can be adjusted without adding any noise. The choice of floor and ceiling mounting of the boom gives you added flexibility when positioning the microphones.

Omnidirectional microphones and AB Stereo are often the preferred choice when the distance between the microphone and the sound source is large. The reason is that omnidirectional microphones are able to capture the true low frequencies of the sound source regardless of the distance, while directional microphones are influenced by the proximity effect. Directional microphones will therefore typically exhibit loss of low frequencies at larger distances.

Now we turn to the diagram, (fig. 9): Measure the angle under which the sound source(s) can be observed, normally called the recording angle. If the total angle is say 140° this should be referred to as ±70°. Now, decide on the reproduction angle and find the related distance between the microphones.

Example: The recording angle is ±70°. This should be reproduced at ±30° (time difference approximately 1.1 ms). The crossing point is marked (•): Hence the spacing should be 40 cm (16 in).

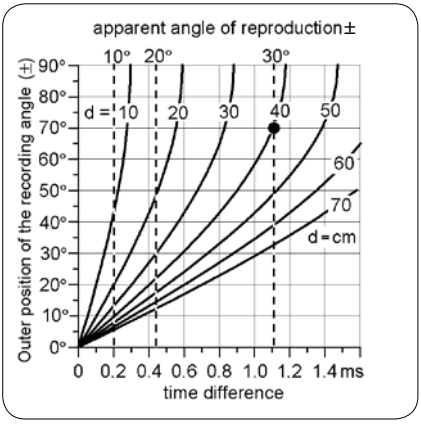

Fig. 9: Diagram to determine the distance between two omni microphones for the AB setup

DPA Microphones suited for this setup:
DPA 4003, DPA 4006, DPA 4006-TL, DPA 4004, DPA 4007 and DPA 4041*

* Since the 4041 Large Diaphragm Microphone is not completely omnidirectional at higher frequencies and has an on-axis upper midrange frequency lift, the perceived directionality will change compared to most other omni microphones. It calls for a little deviation from the graphs shown. For positioning circumstances, the 4041 can be considered as a wide cardioid microphone (fig. 21).

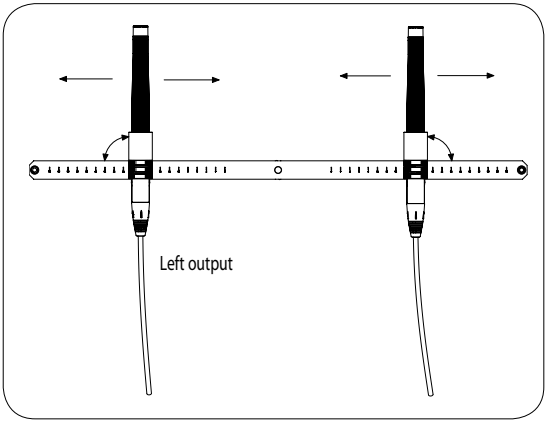

Fig. 10: AB setup

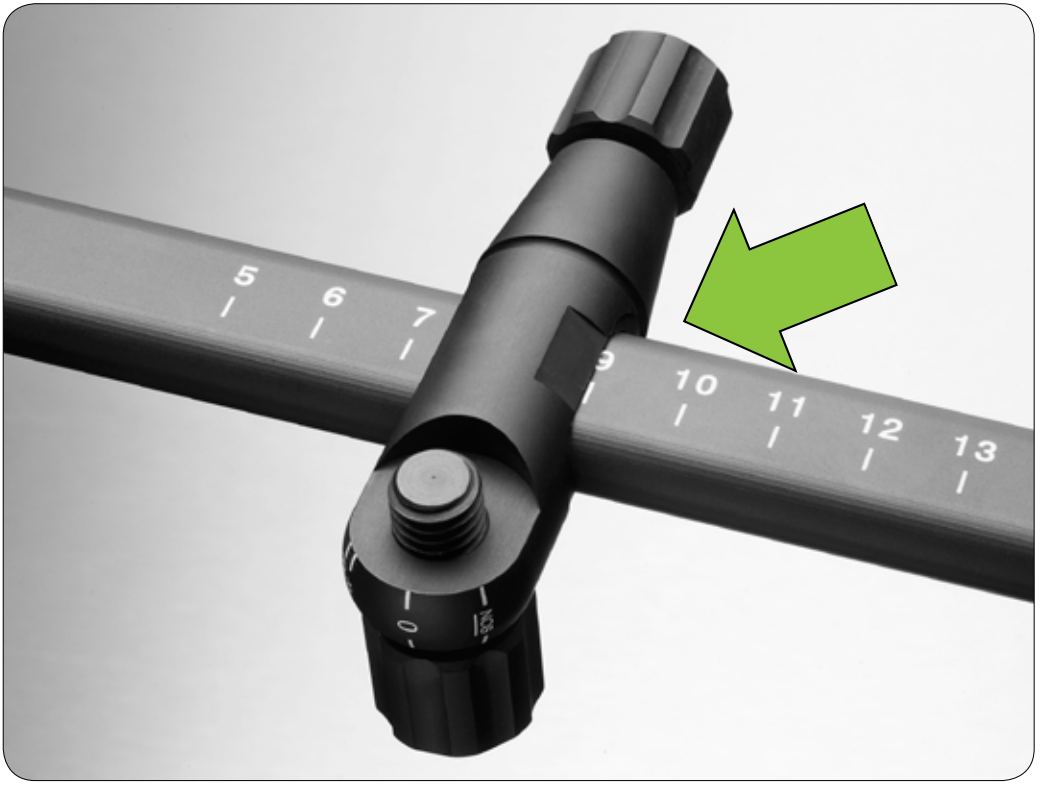

Fig. 11: The distance from the center is read on the outer side of the holder.

Setups for stereo: XY

XY stereo recording uses a coincident pair of directional or bidirectional microphones, hence the directional information is obtained solely from the level difference between signals.

In practice, "coincident" means that the microphone capsules must be placed close and slightly above each other. In order to keep identical vertical aiming of the microphones, the DUA0019 Spacer for Stereo Boom (fig. 15) should be used.

Please note: Avoid the microphones touching each other as this might cause mechanical noise.

The XY setup provides a stable directional image but produces a slightly weaker impression of space and reverb compared to the AB setup.

Be aware, that directional microphones exhibit low frequency loss at larger distances and will result in a lack of richness and energy in sound colour. Contrary to AB there are no comb filtering effects summing XY signals to mono.

In the most commonly used XY setup, a pair of first order cardioid microphones (e.g. DPA 4011-TL) are arranged in a 90° angle (±45°). This angular position is marked on the holders (fig. 13).

The sliders are marked XY for a 90° angular position.

Other angles than 90° can be used for a XY setup, causing a change in the recording angle.

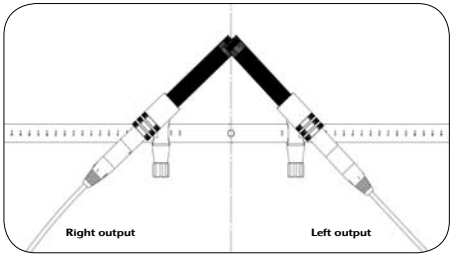

Fig. 12: XY setup

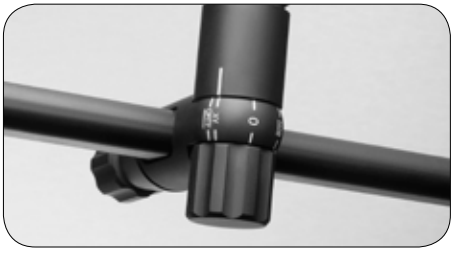

Fig. 13: Marking for XY

Procedure
At first, decide on the microphone position. Define the angle under which the sound source can be seen from the microphone position. This is the recording angle (fig. 19). Then use the set of curves in fig. 14.

The scale on the horizontal axis indicates the recording angle and the scale on the vertical axis indicates the level difference.

The curves in the diagram express the angle between the microphones.

Example: The recording angle is ±70° and this should be reproduced at ±30°. These two values meet the curve at the • mark. This shows that the angle between the microphones should be 120°.

When recording an acoustic guitar for example, the width of the image might be reduced in the mix, so the desired microphone technique should not produce any artifact like comb filtering. The XY setup provides these qualities. Place the microphones at a distance of approximately 40 cm (16 in) from the sound hole of the guitar and in front of 12th fret.

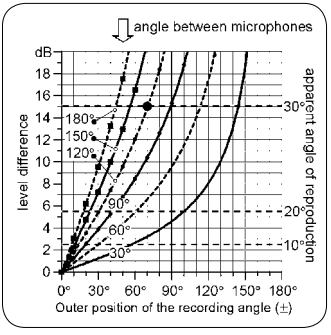

Fig. 14: Set of curves to determine the angle between two cardioid microphones for the XY setup.

Fig. 15: DUA0019 Spacer for Stereo Boom, 19 mm (0.75 in)

Fig. 16: Mounting microphones closely, but without any physical contact.

DPA Microphones suited for this setup:
DPA 4011, DPA 4011-TL, DPA 4012

Setups for stereo: Near coincident

It is possible to combine the principles of AB and XY in setups normally referred to as "near coincident". Some successful configurations are named after the institutions that used them first, like ORTF (Office de la Radio et de la Télévision Française), NOS (Nederlandse Omroep Stichting), DIN (Deutsche Industrie Norm), etc.

The advantage of near coincident techniques is the combination of good ambient reproduction with precise image positioning.

The microphone capsules must point away from each other since the left microphone must reproduce left information earlier and louder than the right microphone and vice versa. The 19 mm spacer (DUA0019) must be used whenever the microphones cross each other (fig. 17).

When using the UA0897 Shock Mounts it may be necessary to use the female XLR connector on the cable in one of the rubber mounts, since the shock mounts take up more space than the normal holders (fig. 18).

Fig. 17:
When the mics are crossed, the 19 mm spacer must be used

Fig. 18:
XLR connector suspension

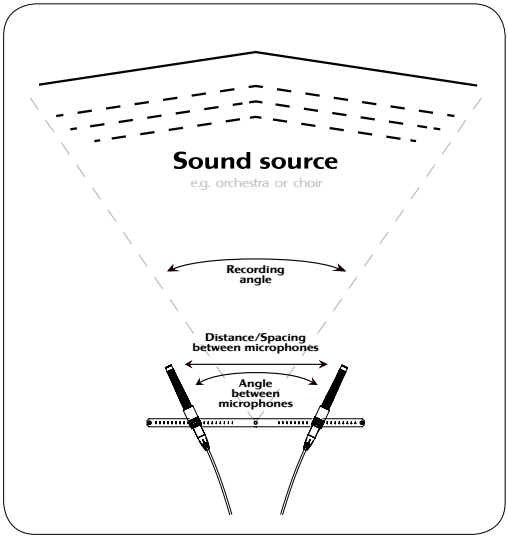

Fig. 19:
Difference between recording angle, spacing between microphones and angle between microphones

Near coincident setup in general
When defining the position of the stereo image it is easy to place the outer limits - the "edge" of the image - and it is easy to place the center. However, in between the center and the outer edge there may occur a small misplacement, typically 4-10 degrees. This is called angular distortion. One of the advantages of the near coincident setup is the possibility of minimizing the angular distortion. Figures 20 and 21 show how microphone spacing and angling can be selected individually. The scale on the horizontal axis is related to spacing, and the vertical scale is related to angling. On each curve a number of circled figures are shown indicating the theoretical angular distortion of the different combinations of distance and angle.

Example, cardioid microphones: A recording angle of ±70° can be achieved by spacing the cardioid microphones 20 cm (7.87 in) and by a 50° angling.

Example, wide cardioid microphones: A recording of ±70° can be achieved by spacing the cardioid microphones 20 cm and by a 90° angling.

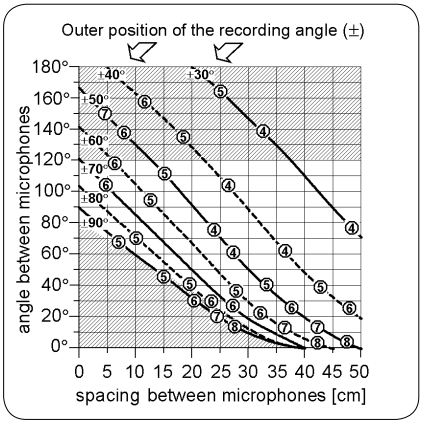

Fig. 20
Near coincident setup using first order cardioid microphones.

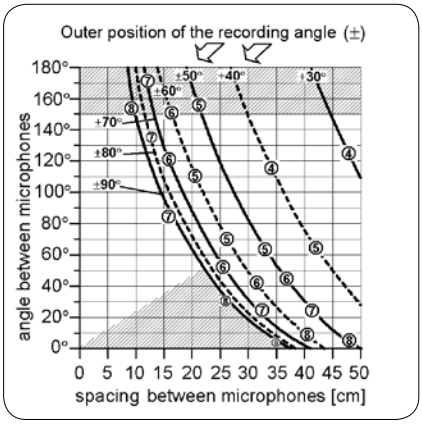

Fig. 21
Near coincident setup using wide cardioid microphones.

DPA Microphones suited for this setup:
DPA 4003, DPA 4006, DPA 4006-TL, DPA 4004, DPA 4007 and DPA 4041*

* Since the 4041 Large Diaphragm Microphone is not completely omnidirectional at higher frequencies and has an on-axis upper midrange frequency lift, the perceived directiona-lity will change compared to most other omni microphones. It calls for a little deviation from the graphs shown. For positioning circumstances, the 4041 can be considered as a wide cardioid microphone (fig. 21).

ORTF

This setup uses two first order cardioid microphones spaced 17 cm (7 in) and angled ±110°. (Fig. 22)
(The DUA0019 spacer must be applied).

The idea behind this technique is that it is well suited for reproducing stereo cues that are similar to those that are used by the human ear to perceive directional information in the horizontal plane. The spacing of the microphones emulates the distance between the human ears, and the angle between the two directional microphones emulates the shadow effect of the human head.

The ORTF stereo technique provides the recording with a wider stereo image than XY stereo while still preserving a reasonable amount of mono information. Be aware, that directional microphones exhibit low frequency loss at larger distances and will result in a lack of richness and energy in sound colour.

If using the UA0897 Shock Mount, additional XLR extension units must be applied as well, see fig. 18. The sliders are marked for the ORTF angular position.

In recording a grand piano for example, placing the ORTF setup in the curve of the pianos with the lid on "full stick" will usually produce a very direct sound and a good balance between the low key and the high key sound of the instrument.

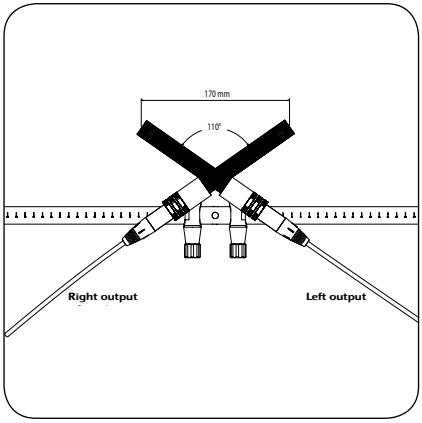

Fig 22:
ORTF setup

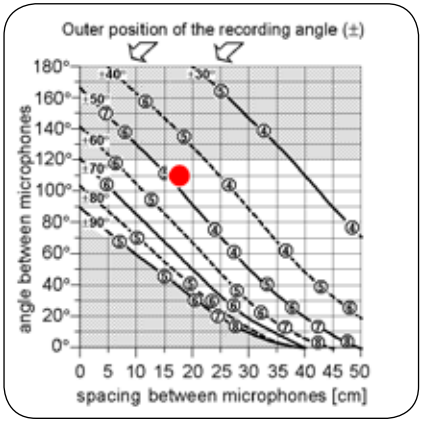

Fig. 23:
The ORTF setup marked in a general diagram for cardioid microphones

DPA Microphones suited for these setups:
DPA 4011, DPA 4011-TL, DPA 4012

DIN stereo

DIN stereo uses two first-order cardioid microphones spaced 20 cm (7.8 in) apart and angled at 90° to create a stereo image. (fig. 24)

The DIN stereo produces a blend of intensity stereo signals and time delay stereo signals, due to the off-axis attenuation of the cardioid microphones together with the 20 cm spacing. Be aware, that directional microphones exhibit low frequency loss at larger distances and will result in a lack of richness and energy in sound colour.

The DIN stereo technique is more useful at shorter distances, for example on piano, small ensembles or used for creating stereo on an instrument section in a classical orchestra.

When recording a choir for example, the perfect balance between the direct and the diffuse sound field, using cardioid microphones, can be accomplished at a distance that leaves you with a recording angle of approximately 100°. The reproduced image of the choir should be evenly distributed between the left and the right loudspeaker.

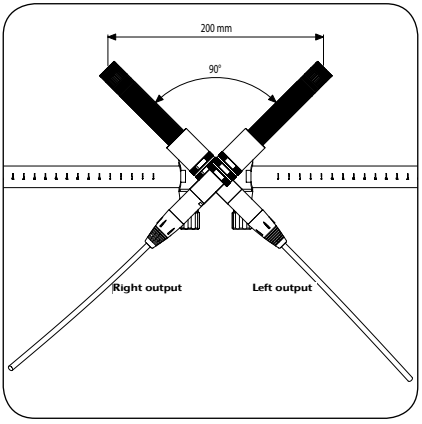

Fig. 24:
DIN setup

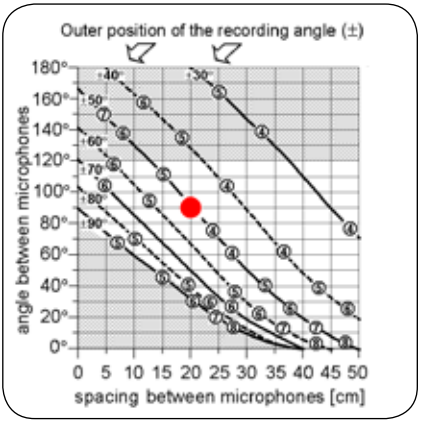

Fig. 25:
The DIN setup marked in a general diagram for cardioid microphones

DPA Microphones suited for these setups:
DPA 4011, DPA 4011-TL, DPA 4012

NOS

The NOS Stereo Technique uses two first order cardioid microphones spaced 30 cm (11.8 in) apart and angled at 90° to create a stereo image, which means a combination of difference-in-level stereo and difference-in-time stereo.

Be aware, that directional microphones exhibit low frequency loss at larger distances and will result in a lack of richness and energy in sound colour.

When making an overhead recording of a drum kit, you might want to create a widespread image. In this case the NOS setup is a good solution and can be achieved by simply placing the microphones approximately 50 cm (20 in) above the cymbals.

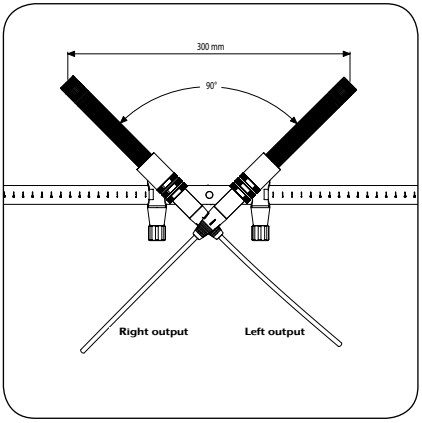

Fig. 26:
NOS setup

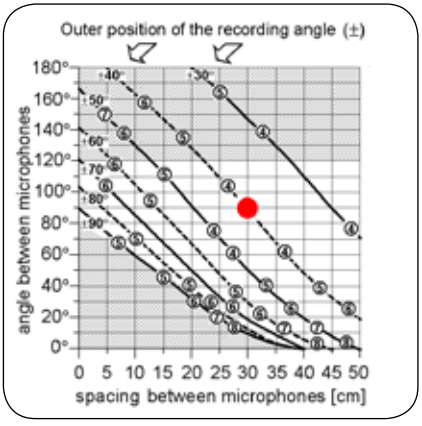

Fig. 27:
The DIN setup marked in a general diagram for cardioid microphones

DPA Microphones suited for these setups:
DPA 4011, DPA 4011-TL, DPA 4012

Specifications

Stereo Boom Specifications
Length: 54 cm (21 in)
Weight: 376 grams (13 oz) (w/o holders)
Colour: Black
Thread: 3/8" - NS27 (standard microphone thread)

Accessories:

Holders:
UA0961

Shock mount:
UA0897

19 mm spacer:
DUA0019

References

1. Simonsen, Gert. Doctoral thesis.
Technical University of Denmark

2. Williams, Michael: The Stereophonic Zoom.
1991. Published by author.

Service & Repair

Products from DPA Microphones are extremely stable and there should not be any significant change in the specifications with time and use. If, however, you are not totally satisfied with the characteristics exhibited by these products, contact your nearest DPA Microphones representative for further details of service and the repair facilities that are available. Please contact DPA Microphones for your nearest representative on:

TEL: + 45 48 14 28 28
FAX: + 45 48 14 27 00

You can also get in touch with DPA Microphones at:
info@dpamicrophones.com
or visit our website at:
www.dpamicrophones.com

Environmental Policy

This product is comprised by the Waste (WEEE) directive and should not be thrown in the garbage bin when obsolete. Instead, return it to your local DPA representative (or DPA Microphones A/S directly) who will dispose of the product in accordance with the current environmental standards.

WEEE directive: 2002/96/EC
RoHS directive: 2002/95/EC

CE-Marking

The CE-mark guarantees that the product conforms with relevant Directives approved by the European Commission.
EMC Directive: 89/336/EC, amended by 92/31/EC and 93/68/EC
Low voltage Directive: 73/23/EC, amended by 93/68/EC

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