Technical Description
Jamo R 909

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GENERAL DESCRIPTION

When we set out our design aims for the Jamo R 909 speaker we had just one goal in mind… to deliver an exceptionally memorable experience. We wanted listeners to forget about the speakers and the equipment and just enjoy what it's all about… entertainment.

Doing that wasn't going to be easy though. If you want to create full fidelity loudspeakers (and so forget that you are actually listening to the loudspeaker) your design needs to use a cabinet. If you don't use one, bass reproduction suffers because of acoustic 'short-circuiting'.

The total surface area of a cabinet's surfaces is typically 20 to 50 times the size of the cone area of the drive units. So, no matter how much the cabinet is damped it will always have resonance points at which it – due to its sheer size – will contribute substantially to the total sound generated by the speaker.

There are fixes of course. You can make the cabinet extremely rigid – e.g. by using lots of internal bracing - but doing so just shifts the points of resonance up into the midrange frequencies, an area where any sort of cabinet contribution is bad news.

So, it's fair to say that any cabinet involves compromises to some extent: It needs to be of a certain size in order to be able to deliver deep bass but it also needs to be rigid if it is to avoid a 'fat', wobbly bass… but not so rigid that it affects midrange clarity.

And then there's the 'suspension' effect to consider. The air inside the cabinet effectively works like a 'spring' attached to the cone and so actually holds back the driver unit when it starts to move. In summary, the cabinet actually drains energy from the drive units which naturally affects the dynamics, attack and precision.

Last but not least there are also the placement problems one routinely faces when locating a cabinet speaker (or, to give it its technical name, a pressure transducer) in a room.

It's extremely difficult to find a position that minimizes the influence of reflections and room modes. While you may be able to find a listening position that's great for imaging and transparency it could also be at a 'null' point where the bass reproduction is extremely poor. Or indeed, it might coincide with a peak point where bass frequencies are greatly boosted.

A multitude of considerations then. Our eventual conclusion was that we had to think 'out of the box - literally - if we were to come up with a solution which avoided the cabinet issues. And that's exactly what we have done… the result is the R 909, the first open baffle speaker to wear the Jamo badge.

In the following pages you will read about the innovative technical solutions we have had to develop in order to overcome the difficulties of using an open baffle.

DIPOLAR SPEAKER – AND THE ROOM

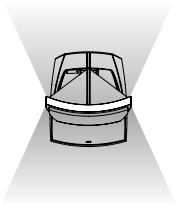
As we have discussed earlier, placing a cabinet speaker (pressure transducer) in a room creates its own unique challenges.
So exactly how does a dipolar speaker (or velocity transducer)"behave"?

Due the dipolar radiation pattern, sound is distributed from the front and rear of the speaker – in opposite phase. This is important because with a conventional loudspeaker, side wall (i.e. 1st order) reflections typically are in opposite phase with the direct transmitted sound from the drive units i.e. they sound annoying.

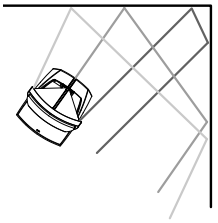
However, with a dipolar radiation pattern there is virtually no 'sideways' sound transmission and so the critical 1st order sound reflections are practically eliminated.

But, you might ask, what about the sound transmitted from the rear of the speaker… doesn't that destroy imaging and the soundstage?

Actually, when placed correctly the laws of psycho acoustics come into play.



The human ear uses the first sound received (the 1st wave-front) to determine the direction of the sound (i.e. where it's coming from). That means that even if reflected sound is slightly delayed it doesn't affect the brain's ability to determine direction.

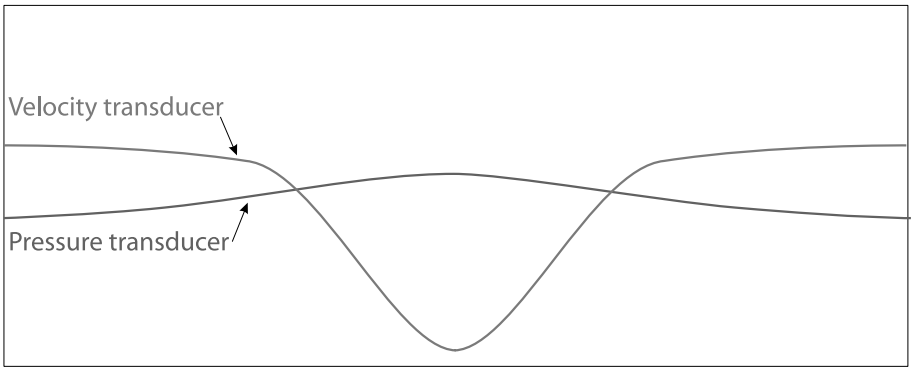


If a dipolar speaker is placed a minimum of 3ft/1 m away from the rear wall and angled in slightly (as a serious listener with cabinet speakers would probably do anyway), the reflected sound will be delayed (due to physical distance and the fact it will be bouncing off two boundaries before reaching the listener's ears) but it still gives directional cues.

Now the 2nd order reflections add ambience and give the listener the impression of a much larger room.

A velocity transducer/dipole speaker couples with a room in a totally different way, and actually, where you would normally experience a 'bass null' with a cabinet speaker, you will actually experience a slight peak with a dipolar.

While there has been little research into the pros and cons of dipolar speakers in rooms Jamo has conducted extensive research of its own. Our measurements of different speakers in different sized rooms show that with speakers this size, the room's influence on the resulting sound is substantially less when using dipolar speakers than when using traditional cabinet speakers.



DRIVER PRINCIPLES

Most dipolar speakers on the market today are either electrostatic or magnestatic in nature, engineering arrangements that are known for their excellent transparency and smooth flowing midrange/treble reproduction. Equally, however, they are also known for their inability to play deep bass with true authority, extremely poor voltage sensitivity and - last but not least - for typically being very difficult loads for an amplifier to handle (because of their low impedance).

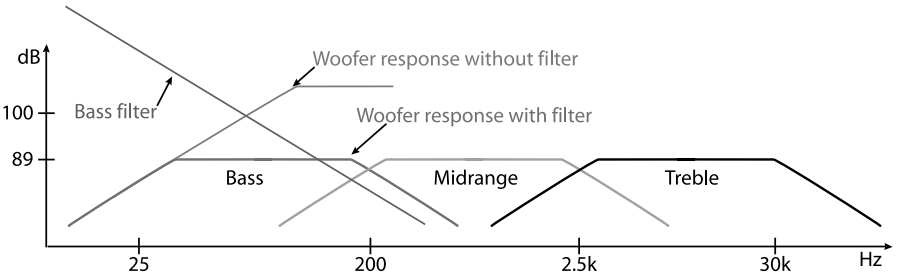
That's why Jamo decided, quite early on in the development of the R 909, to opt for an arrangement that used dynamic drivers.

A DIPOLAR SPEAKER THAT GENERATES SERIOUS BASS?
The major problem to overcome in dipolar designs, regardless of whether they are designed to use dynamic or electrostatic principles, is the acoustic 'short-circuiting' effect which invariably occurs from approx 200Hz downwards.

For those unfamiliar with this bugbear here's a brief explanation. When the bass driver's cone moves forward, part of the compressed air created in front of the cone, will be counteracted by the under-pressure that's created behind the cone. As a consequence the resulting sound pressure level that's generated is "phased out" or acoustically short-circuited. And unfortunately it's an effect that's significantly more pronounced at lower frequencies.

That was another excellent justification for using dynamic drivers in the R 909 - they are the only sort that are endowed with enough physical cone area/excursion to move the amount of air you need to shift, in order to compensate for acoustic short circuiting. The woofers in R 909 actually deliver more than 100dB at 200Hz, an output that then rolls off at 6dB/oct (caused by the acoustic short circuiting...) all the way down to 25Hz.

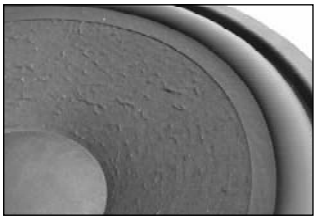
A 'low pass' bass filter is applied to match the higher bass output to that of the mid and treble levels, so that they integrate smoothly. However, at the lowest frequencies the bass is not filtered at all, a tactic which allows the woofers to reach down to an amazing 25Hz with unmatched precision and attack.
It may be hard to believe it's possible but a quick demonstration is all it takes to be convinced - sit down, take a listen to the R 909 and you'll hear the proof!!



THE DRIVERS

WOOFERS
In order to obtain a full frequency response the woofer basically needs to fulfil two criteria: it has to be of high efficiency and have sufficiently low resonance frequency.

As most woofers are developed to work in a cabinet (which necessitates heavy cones in order to reach the desired resonance frequency – typically around 45Hz) we had to develop a special woofer for this open-baffle application. A woofer constructed for a dipole application is utterly different to a traditional boxed driver.



The cones used, for instance, are lightweight air dried paper cones with P.U. (polyurethane) suspension which allows both fast acceleration and deceleration. To optimize air flow the sturdy magnesium basket is of a very open construction. In order to minimize mechanical losses (created by over/under pressure behind the cone and the huge 2in/50mm voice coil), the magnet also features a vented polepiece as well as a ventilated basket behind the spider.

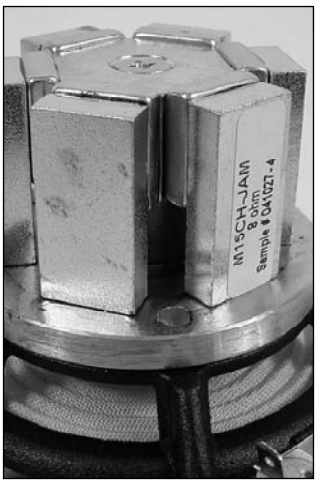
We actually managed to reach a resonance frequency of 27Hz!
The overall result is a driver capable of delivering an extremely fast and firm bass.

MIDRANGE
Designing a loudspeaker cone involves striking an optimum balance between stiffness and low weight. Magnesium meets both criteria, resulting in highly effective and dynamic sounding reproduction.

The end product is a cone that can reach up to 9k Hz before any significant cone break-ups occur. This makes for extremely low distortion throughout the range plus a very open and detailed midrange for optimum voice reproduction.

The basket is also made of magnesium, for several very good reasons: Firstly it makes it possible to create a very open basket – even behind the spider – thus ensuring high airflow at low frequencies, lessens reflections at high frequencies and prevents under/over-pressure causing mechanical losses.

Secondly, as magnesium is a non-magnetic material, the magnetic force from the magnet does not spread out in the basket but stays concentrated where it is needed… around the voice coil.



The ingenious magnet system is one that's been patented by Seas. Unlike conventional ferrite ring-type magnets this arrangement employs several compact neodymium magnets (10x stronger than ferrite magnets) strategically placed around the voice coil.

Thanks to this arrangement, the voice coil is completely ventilated which means there's no compression and so excellent heat dissipation.

The magnet system also features an integral copper ring which guarantees a significant reduction in distortion as it short-circuits the eddy currents that are inevitably sent into the magnet system when a signal current runs through the voice coil.

However, the most conspicuous feature of this drive unit has to be the mattchromated, solid brass centre-plug.

It replaces the traditional dust cap in the centre of the loudspeaker cone thereby making the cone lighter and subjectively faster sounding.

This also eliminates the potential break-up points that would result as a consequence of the dust cap being glued to the cone.

There's more. It also prevents over and under pressure developing behind the dust cap when the cone moves back and forth. The advantage here is a more dynamic and precise sound quality.

Turned from solid metal the centre plug also has a cooling effect on the voice coil, providing greater power handling capability and most importantly, extra sonic stability when playing at high volume levels.

When a voice coil heats up, the impedance increases (it can actually double) which means that the output will decrease and the cross-over points to the other drivers will move. That's why maintaining a stable temperature in the voice coil is essential for optimum sound reproduction.

TWEETER

There was only one choice when it came to choosing a tweeter to reproduce the delicate treble frequencies… the legendary Revelator from Scan Speak. However, since this model features a relatively large face-plate, it would have needed to have been placed further away from the midrange than would be ideal. So, in order to obtain a seamless transition with the midrange driver, we chose to fit a smaller cast-alloy face plate.

The tweeter features a 1in textile dome which is coated several times to obtain a unique combination of dynamic linearity and resonance damping, the result being an incredibly smooth, linear, dynamic and incredibly transparent sound.

The driver's Symmetric Drive Technology - a copper ring on the pole that extends past the voice coil, curving into the dome chamber - practically eliminates electrical phase shift. And, just as it does with the midrange, it also lowers distortion significantly.

To eliminate turbulence the double-damped, optimized chamber behind the magnet system is also equipped with an anti-resonator-plug.

And the specially designed chamber under the cloth surround minimizes air noise and compression. Actually this tweeter is so carefully manufactured that damping unwanted resonances using ferro-fluid - the usual way - is rendered unnecessary!

X-OVER

As should be apparent from the drive unit descriptions above, we wanted to start out with drivers of immense fundamental quality, precisely so that we would only need minimal assistance from the cross-over!

Consequently, the cross-over in the Jamo R 909 is of a relatively simple – in the most positive sense of the word – low-order configuration.

The advantages of using the 2nd order filters that are in the R 909 is that both electrical and phase angles are kept at very small values, something that's of great importance both in terms of sound quality and the eventual load on the amplifier.

The use of quality Solen foil-capacitors and air-coils in the crossover further ensures sound quality.

FRONT BAFFLE

The 1.7in/43mm thick front baffle is made from no less than seven layers of MDF board, glued together and shaped under high pressure.

The rounded shape provides optimum working conditions for the drivers as it prevents diffraction and improves rigidity even further.

The baffle itself is attached to a 60lb/26kg cast-iron base housing the cross-over network and the bi-wiring XL binding posts.

A solid double 5x60mm stainless steel brace with a special damper ensures a rock solid connection between the baffle and the base.

This is equipped with spikes which ensure a good mechanical contact to the floor, irrespective of the floor material underneath.

TO SUM UP…

The Jamo R 909 is a true high-end speaker but one that, thanks to its unique engineering, doesn't need a small nuclear power station to drive it.

It is a speaker that produces a sound quality which can be described as being firm, accurate but with sublime attack, precision and dynamics.

Significantly, it also benefits from the absolute absence of unwanted colouration and reverberation.

**We believe that it is truly a statement audiophile product,
worthy of bearing the Jamo name.**

SPECIFICATIONS

Type	R 909
System	3-way dipole
Woofer (In / mm)	2 x 15 / 2 x 380
Midrange (In / mm)	5½ / 150
Tweeter (In / mm)	1 / 25
Short term power (W)	Min 800
Sensitivity (dB/2.8v@1 m)	89
Frequency range (Hz)	25 - 30.000
Impedance (Ohm)	4
Crossover frequencies (Hz)	250 and 2.500
Weight (Kg / lbs)	63,1 / 139.1
Dimensions (HxWxD mm / in)	1276 x 488 x 541 50.2 x 19.2 x 21.3