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VS.

TEST

P 261-AMT

EVENT

P 261-AMT

CINE

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P 261-AMT | Cine vs. Event

New Pan Acoustics loudspeaker systems with air motion transformer

Dirk Wedell, Dieter Michel, Prosound

If Michael Hünteler from Pan Acoustics had not delivered the new loudspeakers of the AMT series for testing in person, we might have wondered why we received four loudspeakers that looked identical at first glance. The explanation is quite simple: Pan Acoustics' developers have designed two new loudspeaker systems for the AMT series, which have the same enclosure dimensions and "only" differ in some internal values – i.e. design details. For the new P 261-AMT loudspeakers in the two variants "Event" and "Cine", the team of developers has again made full use of high-quality components and put in a considerable development effort. And this is perhaps also the reason why there are two variants at all: if your quality standards for such a development are high, there is no point in making compromises later on to meet the different requirements of various application profiles. The following report will show how the elaborate design of the two new loudspeaker systems translates into audible characteristics.

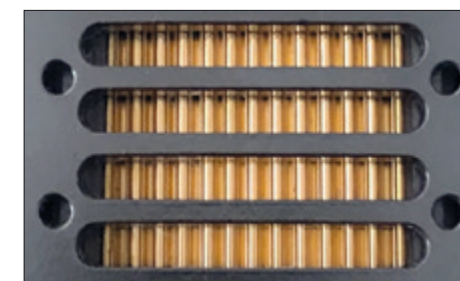
With the market launch of the P 04-AMT (see report in Prosound 2/2020), Pan Acoustics had already used the air motion transformer (AMT) technology for the tweeter system, which has interesting advantages over conventional tweeter driver technology. The two variants of the P 261-AMT add two new loudspeaker systems to the concept of this series, which have an extended low-frequency range compared to the P 04-AMT as well as a higher capacity and efficiency. The new systems can therefore also be used for applications with increased (sound) power requirements, where the P 04-AMT regularly reaches its limits or does not go low enough in full-range operation.

Enclosure/design

In order to achieve this, the developers have given the new P 261-AMT loudspeaker systems a larger enclosure, which now accommodates two 6.5" low mid-range drivers. The design of the enclosure remained based on an aluminium profile. Given the size of the enclosure, the profile used for the P 261-AMT has of course a larger cross-section. The ball impact resistant grille is held by slots in the aluminium profile and handmade aluminium covers close the profile at both ends. They contribute to the high-quality look of the P 261-AMT series, which is thus also suited for use in demanding architectural environments. To match the colour scheme of installations, the enclosure is available in a wide range of colours. Connection to an amplifier is made via a speakON connector at the back. The basic concept is that of a bass reflex box, equipped with two 6.5" low mid-range drivers and an air motion transformer for the high-frequency range. The latter works quite differently from a typical tweeter driver and therefore does not have some of its disadvantages. The AMT and the two low mid-range drivers are operated via a specially developed passive crossover.

Air motion transformer

Short recap: the working principle of an air motion transformer (AMT) is similar to that of a magnetostatic loudspeaker, but it boasts some special design characteristics that give the AMT high efficiency and high capacity.



Detailed view of the AMT with the folded diaphragm (not the AMT of the P 261-AMT)

The centrepiece is a Kapton film, onto which a thin strip conductor made of aluminium is laminated in a meandering shape. During installation, the film is laid in S-shaped folds, so that once installed, the conductors are located on the flanks of the folds. The magnetic structure of an AMT uses two pole plates, one in front of and one behind the diaphragm. At least the front pole plate has sound outlet openings. The magnetic flux causes the folded diaphragm to be vertically permeated by a virtually homogeneous magnetic field.

A current flow through the laminated strip conductor causes a force to act on the diaphragm which is lying vertically on the magnetic field lines and vertically on the current flow direction. As the magnetic field is oriented parallel to the main radiation axis and the current flows longitudinally to the folds, the force thus acts vertically on the flanks of the folds. The diaphragm therefore does not move back and forth, but the adjacent flanks of the folds are pushed towards each other or apart by the Lorentz force. The sound is created when the folded diaphragm of the AMT, following the electrical signal, presses the air out of the folds or draws it in. The principle of the AMT is similar to a magnetostatic loudspeaker, but it has the advantage that the effective sound-radiating diaphragm surface is larger than the front surface of the diaphragm design.

As a result, the effective diaphragm surface is relatively high, but at the same time the diaphragm itself is very light and unlike a driver diaphragm, it is driven directly and in phase at all points of the moving surfaces by the magnetic field. This is why we can assume to a good approximation that a coherent sound wave is generated in the sound outlet plane.

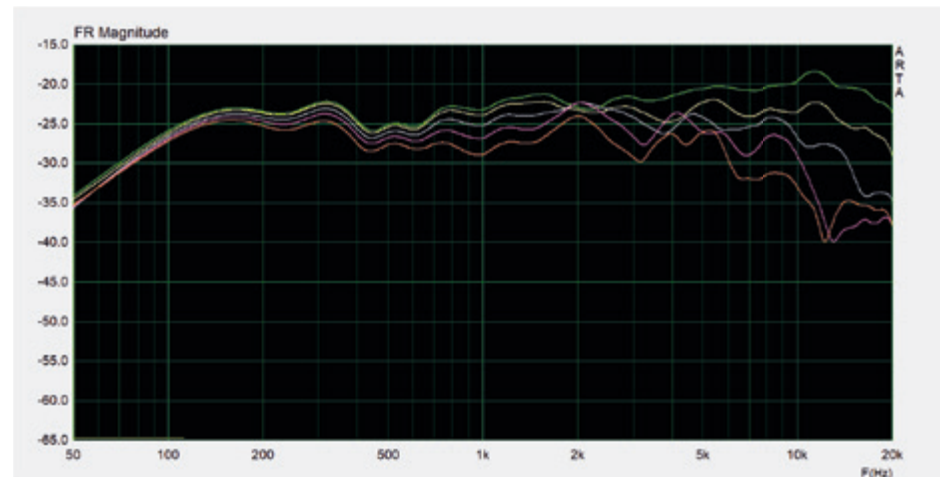
The AMT working principle also has the advantage that a relatively



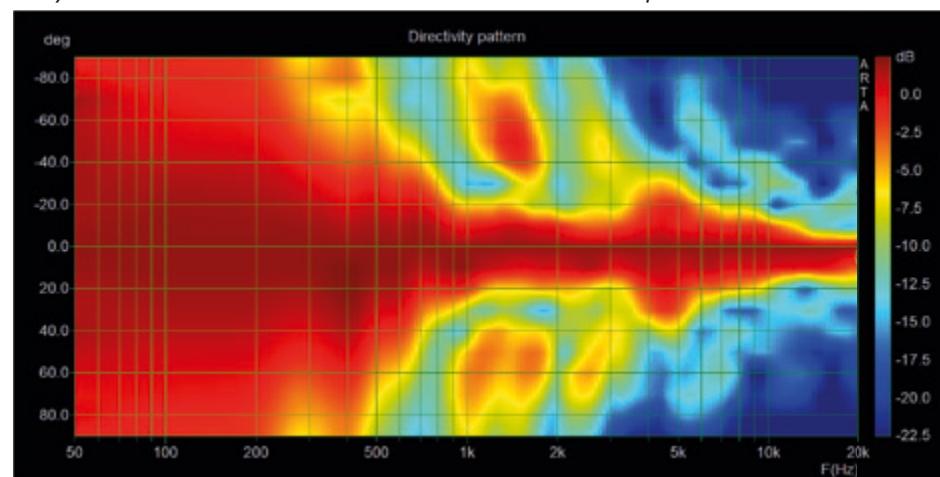
Rear view of the P 261-AMT

high upper cut-off frequency can be achieved (in this case 24 kHz) without having to use – as is typically the case with compression drivers – harmonics of the diaphragm, which in turn can lead to non-linearities. An AMT can therefore operate up to the limits of the audible frequency range (and beyond) and has very good impulse behaviour.

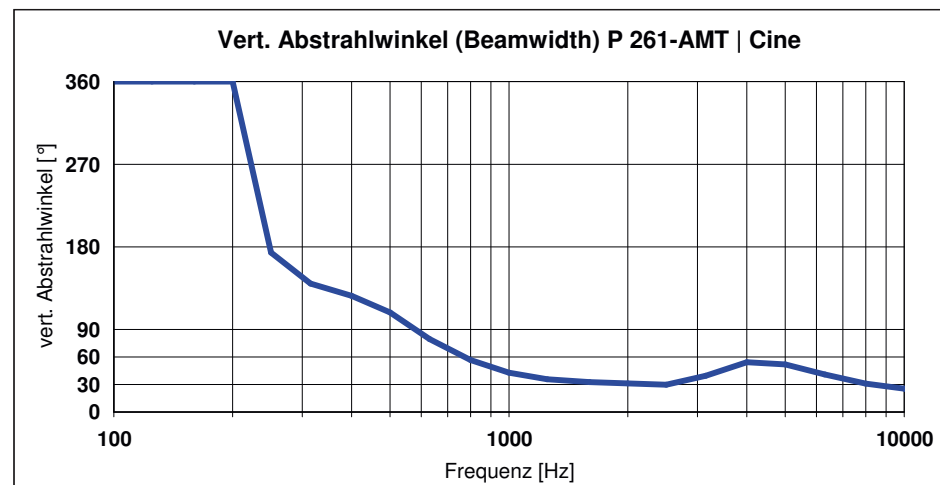
A generally clean high-frequency behaviour, especially one without the typical side effects of a compression driver, for example with respect to non-linear distortion, is of course highly desirable in all applications. This applies in particular when it comes to unadulterated reproduction



Frequency response of the P261 | Cine for different horizontal radiation directions (0° to 60°) with DSP system equalisation. As expected, one can see here essentially the directional characteristic of the individual components.



Isobar plot/heat map of the vertical radiation pattern of the P261 | Cine. Also thanks to the MTM configuration, there is a well-defined radiation pattern already from about 800 Hz. The off-axis structures between 1 and 2 kHz are due to the fact that an ideal MTM configuration cannot be achieved with normal tweeter dimensions and crossover frequencies.



Vertical radiation angle of the P261 | Cine as a function of frequency. As expected, one sees increasing bundling until, from approx. 800 Hz, the radiation angle remains more or less constant within a certain tolerance range.

with optimum sound quality, where ideally you should not hear that a loudspeaker is involved at all for electroacoustic support.

This includes various (music) theatre applications, but also monitor systems and feed systems for immersive audio and cinema sound formats.

Of course, this cannot be achieved by the tweeter system alone. The transmission characteristics of Mundorf's AMT components can be relatively finely adapted by the manufacturer to meet the requirements of the task at hand, but the rest of the loudspeaker system must also be able to maintain this high level.

As a developer, it is important to bear in mind that features such as linearity of the frequency response, low distortion, efficiency and maximum sound pressure level may be weighted differently by users depending on the application. One application needs, for example, a very good PA loudspeaker with undistorted voice reproduction, that should, however, also be powerful and assertive. Another application may focus more on the best possible linearity and low distortion and therefore needs a loudspeaker that plays itself into the foreground as little as possible, but rather permits very neutral electroacoustic support or feed of acoustic instruments and voices, i.e. rather something like a neutral studio monitor loudspeaker, but capable of a somewhat higher sound pressure level.

Pan Acoustics' developers have in fact implemented these two priorities in the two variants "Cine" and "Event". In line with these different emphases, the two loudspeaker versions are very similar, but differ in some details. While both P 261-AMT are equipped with two 6.5" low mid-range drivers, the driver types differ in some details. The arrangement of the bass reflex ports and possibly the tuning are also slightly different. While the P 261-AMT | Cine has a rectangular

bass reflex port at one end of the baffle, the P261-AMT | Event has two smaller, round ones each at opposite ends of the baffle.

In case of the Event variant, the idea may be to extend the underlying MTM configuration to the bass reflex ports to achieve a defined vertical radiation pattern down to the lowest possible frequencies. However, this is rather a speculation on the part of the authors and cannot be found in the product documentation.

MTM configuration

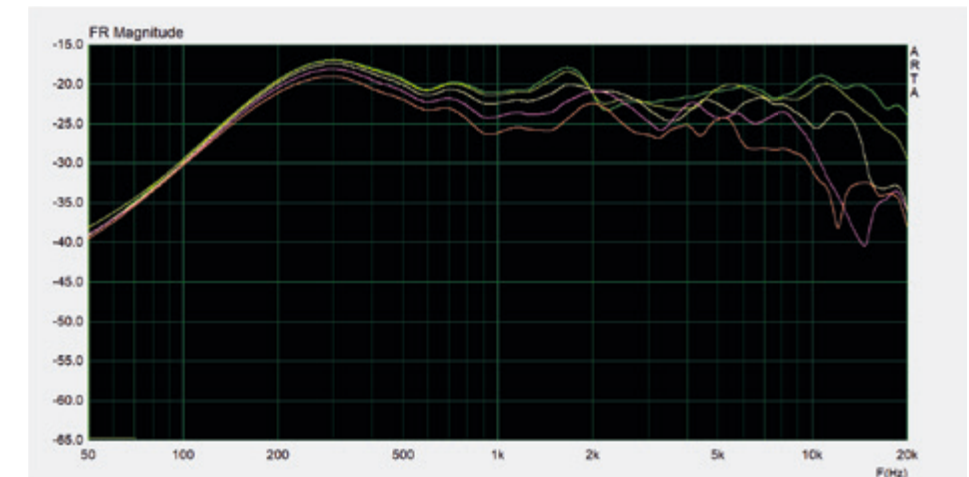
Speaking of the midwoofer-tweeter-midwoofer (MTM) configuration: this is a design principle for two-way loudspeaker systems that is to ensure that no side lobes form in the crossover range between the low mid-range and tweeter system in the – in this case vertical – radiation pattern. Two low mid-range drivers and one tweeter are arranged symmetrically, with the maximum crossover frequency resulting from the distance d between the two low mid-range drivers according to the following formula:

$$f < 2c / 3d$$

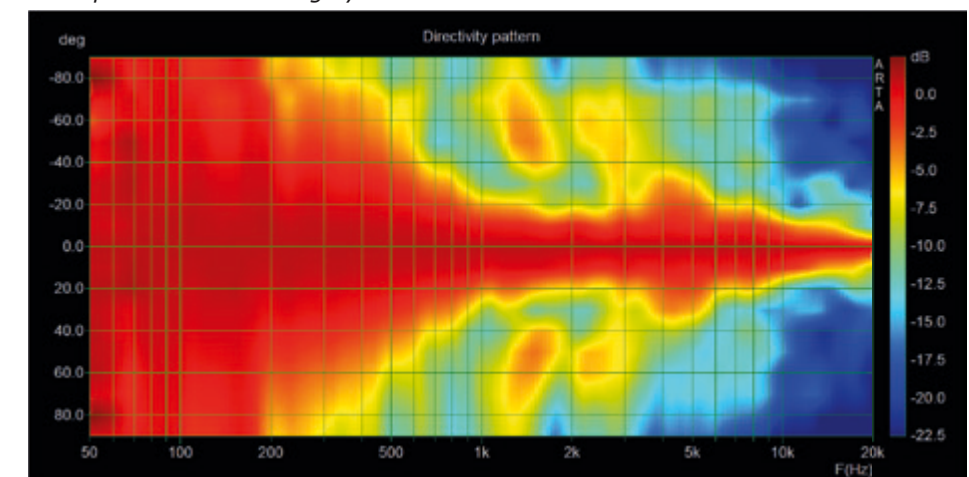
For the dimensions of the vast majority of real tweeter and low mid-range systems, this formula typically results in very low crossover frequencies (for the tweeter), so that developers can hardly implement the pure doctrine. However, the concept nevertheless permits to achieve a compliant radiation pattern if the crossover is suitably designed.

Sound

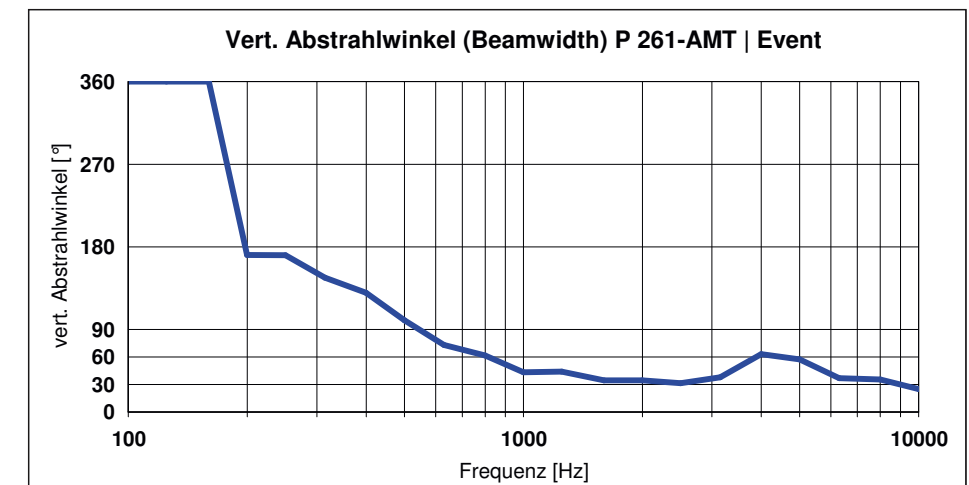
Let's start with a short anecdote before we continue with the sound: I have experienced the age of beam steering systems from its beginning. There was a demonstration at EAW, for which a number of press people were flown in to the USA to present a new vertically steerable line array to them. This was a system with the most sophisticated controller/amplifier



Frequency response of the P261 | Event for different horizontal radiation directions (0° to 60°). Here, too, the radiation pattern of the individual components dominates. The box was operated without DSP equalisation and has a slightly different focus for event sound reinforcement than the Cine.



Isobar plot/heat map of the vertical radiation pattern of the P261 | Event. Here, too, a well-defined radiation pattern already from about 800 Hz. The off-axis structures between 1 and 2 kHz cannot be completely avoided due to the fact that an ideal MTM configuration cannot be achieved with normal tweeter dimensions.



Due to its almost identical geometry, the vertical radiation angle of the P261-AMT | Event as a function of frequency is very similar to the Cine variant. Here, too, increasing bundling, above approx. 800 Hz a more or less constant radiation angle.

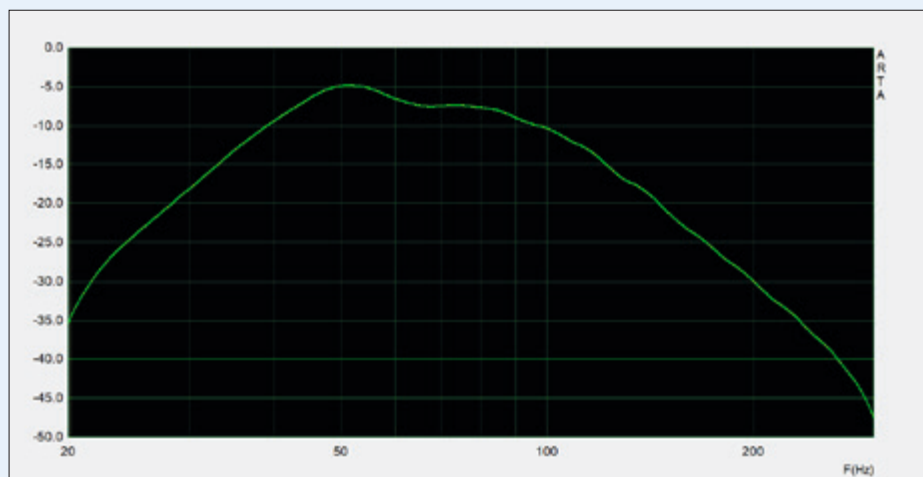


P SW-112 | SP

Shortly before the end of the test period, Michael Hünteler brought us the P SW-112, a new subwoofer that is available in a passive and an active variant (P SW-112 | SP). The birch multiplex enclosure is equipped with a specially developed 12" woofer driver. The subwoofer is designed as a direct radiator. Thanks to the dimensions of the 12" driver, the subwoofer is quite compact (38.6 cm x 51 cm x 60 cm) and can therefore also be easily integrated into fixed installations. For operation, e.g. on a scene surface together with a high-mounted top, a distance bar can be attached to the top by means of a screw thread insert. In order to meet the design requirements of, for example, fixed installations, the enclosure with textured coating is available in all RAL colours. The standard colour is black.

The active variant has a built-in PWM amplifier with an output power of 3500 W (peak), 2500 W (programme) and 1100 W (AES). An additional passive P SW-112 can be connected and operated via the NL4 output at the back.

The integrated DSP operates at 24-bit resolution and a sampling rate of 96 kHz and enables Pan Audio DSP and network functionalities such as Pan Net, AES/EBU and Dante. It is operated via a Windows software, which permits, for example, to adjust the equalisation and delay. The P SW-112 | SP can be operated individually or in various cardioid configurations. Our test sample was equipped with Dante and Pan Net, and we fed the audio signal via an external Pan Net interface.



The frequency response of the P SW-112 | SP looks like something out of a textbook. The slight rise at about 52 Hz was part of the factory setting of our test sample.

er equipment at the time and corresponding cabling. It all worked, but at the time seemed to me to be quite impractical and academic.

The second experience I had was with a company called Pan Acoustics at an in-house exhibition of the former company EAS in Emsdetten. There I saw a loudspeaker column without noticeable cabling, and one could clearly hear the change in directivity when switching presets. It sounded good too. When I later talked to the developer and company boss Udo Borgmann, he said the decisive words: "All the complicated technology should never take centre stage. What matters in the end is that the system sounds good."

At that time, Pan Acoustics was perhaps ten years ahead of mainstream development, and so it took a not always easy period of about ten years for these new ideas to catch on. Today, Pan Acoustics is one of the technology and market leaders in beam steering loudspeakers.

With the variants P261-AMT | Cine and P261-AMT | Event, we hence have a basic design which is offered in two differently optimised variants. The Cine variant has the absolute high-class sound and has been designed for sound enthusiasts. The Event variant is just as good. Due to its optimisation for event conditions with slightly differently adapted frequency response and its higher efficiency, it differs a little from the Cine variant.

Sound/operation P 261-AMT | Event

The P261-AMT | Event is a normal passive loudspeaker, so just plug in the speakON connector and off you go. This is almost all you have to do to take care of the second word of the heading "Sound/operation". Having got to know the P 04-AMT (see PROSOUND 2/2020), I now come to the conclusion that Pan Acoustics is

building a new second leg. No matter what the installation looks like, there are always sub-areas that can easily be served by a normal loudspeaker box. You do not have to use beam steering systems everywhere. The innovation in the new series is, however, the already mentioned air motion transformer. In the AMT, the actuator and the diaphragm are one. There is no separate voice coil moving the diaphragm. It is obvious that this technique has a considerable influence on the sound.

A loudspeaker box with a flat diaphragm tweeter driver always makes me sceptical. I can say that I know these tweeters really well because I have been using my magnetostatic loudspeakers from Stage Accompany to listen to music at home since the 1990s. At home, the efficiency does not matter and you just have to get used to the radiation pattern. For this tweeter radiates in a very flat disc, and as soon as you sit up in the listening position on the sofa, the high frequencies are gone. When I got to know the P 04-AMT and now the new P 261-AMT systems, I therefore first walked around the loudspeakers and listened to them from all directions. It radiates broadly in both directions – vertically and horizontally – and is not "suddenly gone" when you leave the nominal radiation area. This is due to the relatively small tweeter. This is a decisive criterion for me because otherwise there would be no point in following up with something like this.

At first listen, the P 261-AMT | Event sounds clear and transparent, but has a powerful bass transmission. Now, do not think of it as the thundering, rolling big PA bass, but the bass sound goes beyond what one would call "well rounded at the low end". The loudspeaker can provide a pleasant music transmission as a stand-alone solution and does not necessarily need a subwoofer. From everyday experience, we know nevertheless

that this is still a small loudspeaker box. As a result, a subwoofer makes perfect sense, and it is meanwhile also available (see box on the left). But I am now just talking about the loudspeaker itself. The bass blends very well and pleasantly into the lower mid-range.

The hall I listen in has a fairly normal reverberation time, no flutter echoes and not much else one is not used to. However, there is one thing you always have to pay attention to: the reverberation time rises sharply below 100 Hz. This makes every loudspeaker box sound as if there were a subwoofer involved. There is a simple experiment to explore this. I play music where the basses run through quite continuously. The Event is on channel 1 and my floor monitor loudspeaker, which has no bass, is on the second channel. Now I run channel 1 and pull the fader down quickly. I can clearly hear the low-frequency reverberation in the hall. With my floor monitor loudspeaker, I hear next to nothing in the same experiment. To be sure, I carry the loudspeaker box to the balcony of the hall and there the sound is as intended by the manufacturer.

As already mentioned, the good, seamless connection of the bass to the lower mid-range makes a voice sound full and round and also convincing. However, the P 04-AMT can do this almost as well, which shows once again that real bass does not have that much to do with the voice. But it is really favourable for music transmission. Does the bass, which also runs through the small cone loudspeakers, impair the "clarity" and "speech intelligibility" in the mid-range in any way?

Hardly at all. The individual instruments can be followed very vividly and they always stand out clearly from each other. However, the mid-range cannot be separated from the

high-frequency range; one simply never knows whether it is the mid-range in particular that brings this precision and clarity or whether the tweeter already has a powerful effect here. Well, the tester and thus the listener should not care.

The good interaction of the lower mid-range driver and tweeter driver no longer surprises me because I already know it from the P 04-AMT. I was already very impressed back then and I still am now for it is precisely this transition that requires certain acrobatics in terms of development technology. This is where the cone loudspeaker and the AMT meet, whose modes of operation could not be more different. The fact alone that the cone loudspeaker already starts to operate in the range of partial oscillations, while the AMT does not know such a thing at all, shows the huge difference between them.

Many people believe that partial oscillations only occur with quite large cone loudspeakers and there only in the upper range where the horn has already been operating for a long time (e.g. with a 12-2). But this is not true. Even small loudspeakers start to do this between 400 and 500 Hz, although the partial oscillations at these lower frequencies are fortunately still harmless. However, I also believe that we all have heard more loudspeaker sound in level and duration than natural sound from baby age onwards. So loudspeaker sound is our "natural" sound. It would be strange if we perceived a good music reproduction as natural just because we have gone through a lifelong habituation process. But if the reproduction here seems homogeneous and very natural, it does not matter to us why this is so.

Overall, I cannot say much about the sound, except that I like it very much. In terms of sound, the P 261-AMT | Event is simply exactly

what you want, and you get what you ask for. What else can I say?

In smaller rooms, the loudspeaker box can transmit music and speech well as a stand-alone solution. The speech reproduction is so clean that a non-native speaker can, for example, be understood by listeners also coming from different other countries. An example for this would be an announcement in English at a German airport. In the age of globalisation, this situation is almost commonplace and should play a central role in all PA considerations.

Sound/operation P 261-AMT | Cine

For the P261-AMT | Cine, Pan Acoustics provides DSP settings, e.g. for amplifiers with DSP. I first listened to the Cine in an acoustically very favourable room and then went into the hall. In both rooms, it worked very well, although in the hall I had the small problem of having to ignore the room acoustics. In both cases, I am sure it is the best sound I can remember for a long time. I have only had this experience a few times in my professional life and all I really know afterwards is that it was once again a unique sound experience. I have gone into more detail with the P 261-AMT | Event, e.g. with respect to the radiation pattern, because as a reporter in the field of PA technology it is somewhat closer to me. But I would like to emphasise the wonderful openness, full of power and energy, coupled with transparency and attention to detail. I did not say anything about high frequencies here, I mean the whole loudspeaker box.

Outdoors at higher volumes, it remains true to itself. So no one can say the P261-AMT | Cine is a somewhat modified studio monitor loudspeaker. It can also deliver volume. But they do exist – loudspeaker boxes that you cannot really write much about. Whenever I start to play one

of the pieces we use for our tests, the music suddenly takes centre stage. And this is exactly what I would like to avoid in my job. I want to listen to a loudspeaker box and use music to do it. But well, the P261-AMT | Cine succeeds in putting the music centre stage and practically not appearing itself. If this is the case, there is nothing wrong with the transmission quality. This will especially please those who have applications in mind where ideally one should not even hear that something is supported by loudspeakers at all.

Another special feature of the P261-AMT | Cine is that there is also a version for horizontal installation, in which the AMT is rotated by 90°. This variant would be interesting, for example, as a centre system in cinema applications or similar applications with surround feed. Horizontal installation could, however, also be interesting for a conference room in which the loudspeakers are to be hung/installed as flat as possible under the ceiling.

Summary

The new loudspeakers of the AMT series – P261-AMT | Cine und P261-AMT | Event – are an interesting addition to Pan Acoustics' product range. The manufacturer remains true to the series' concept of offering highest sound quality, among other things with the AMT tweeter system, without compromise.

As a result, there are two variants of the loudspeaker that are precisely optimised for event sound reinforcement and cinema/theatre/immersive sound reinforcement. Anyone interested in the current state of the art in the world of sound should listen to the P 261-AMT – no matter which variant. It is a benchmark, it is the current state of music transmission.

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