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Active Compact Line Array

SE Audiotechnik M-F3A Pro / S12 Pro

With the M-F3A Pro, SE Audiotechnik presents a new version of the compact M-Line array with new drivers and integrated electronics. The matching S12 subwoofer is also available in a Pro version with a new 12" enclosure and active electronics.

Copy and measurements: Anselm Goertz | Images: Dieter Stork, Detlef Hoepfner (4), SE (2)

SE Audiotechnik, headquartered in Solingen, Germany, is a manufacturer of professional loudspeakers that is still relatively unknown under this name. But a glance at the company's history reveals that this manufacturer is by no means a newcomer to the industry: the basis was already formed in 1980 by Michael von Keitz with the company speaker trade and its brand MIVOC. In the early days, the main focus was on the development and production of HiFi loudspeakers. From the 1990s onwards, the pro audio business was added. The resulting increase in demand led to the establishment of the subsidiary Speaker Electronic (SE) near Shanghai, China. Today, SE operates in China with 700 employees in a rare constellation: the Chinese company is 100% German-owned and managed with a company structure and philosophy common in Germany. All loudspeaker enclosures and all electronics used in the products mentioned here are 100% manufactured in the company's own factory. In addition to MIVOC and SE, the brands VUE and Speaker Connection were also created in this environment. VUE has been active as a manufacturer of high-end sound reinforcement loudspeakers for several years and can boast a number of illustrious names such as Kenneth Berger and Michael Adams on the management board. Speaker Connection, on the other hand, operates more in the background with the development and manufacture of OEM products for various major brands. Controlled from the headquarters in Solingen, 40 international engineers work in development, 95% of whom are employed on a permanent basis or freelance for SE.

The experienced developer Michael Kapp from Solingen has been responsible for loudspeaker development since the 1990s. Additionally, the company relies on some purchased contract development work from specialised audio technology companies. In September 2018, a large demo showroom was inaugurated in the company building in Solingen, a former brewery on Neuenhofer Strasse, where SE products can now also be tested under good conditions at any time.

A glance at the SE product range reveals three series: the M-Line with active compact PA loudspeakers, from which the products presented here originate, the I-Line with installation loudspeakers, subwoofers and power amplifiers as well as the L-Line with two compact line array systems. The M-Line is based on the M-F3A Pro active line array top, which can be expanded with the flyable M-F3A FS subwoofer or supported by an M-F3A S12 Pro subwoofer when ground-stacked. All subwoofers are also active and equipped with their own DSP system.

SE Audiotechnik M-F3A Pro and S12 Pro

The second M-Line generation – with the suffix "Pro" in the type designation – was premiered at the Prolight+Sound 2019 in Frankfurt, Germany. The improvements can be found in more powerful amplifiers and improved drivers. The latter are of course also completely developed and manufactured in-house.

SE Audiotechnik M-F3A Pro *is designed as a line array element with eight low/midrange drivers and seven tweeters*

A simple selector switch *allows the selection of pre-sets for an array length of 1 to 8 units*

Subwoofer S12 Pro *with bass reflex cabinet and 12" driver*

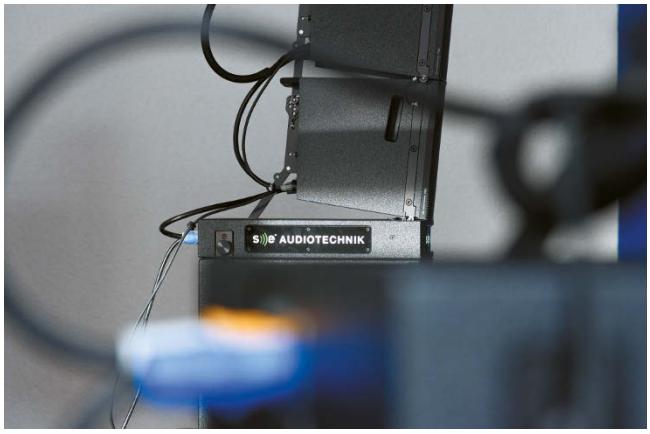
The top is constructed as a line array element with eight low-midrange drivers and seven tweeters. In the arrangement symmetrical to the central axis, the line consists of seven tweeters in the middle, flanked on both sides by four woofers each. Small 2.8" neodymium drivers are used as midrange woofers. The tweeters are 1" domes, also with neodymium drive. The somewhat unusual number of seven tweeters was caused by the desire to locate the woofers as closely to each other as possible – so that exactly seven tweeters fitted into the defined height of the speaker. Alternatively, the speaker could have been built a little higher to accompany eight tweeters, which however would have resulted in acoustic disadvantages due the form of the larger individual array elements and the artificially increased distance between the woofers. The version with seven tweeters, on the other hand, allows the individual sources to be as densely arranged as possible – both regarding the woofers and the tweeters. The corresponding subwoofer in the "Pro" version is the S12. Due to its construction with a bass reflex cabinet and a 12" driver, the S12 can be seen as the successor of the 112BR. It, too, features a more powerful amplifier and a new improved driver.

The objective when developing the M-F3A Pro was not only maximise acoustic performance but also to ensure easy handling, enabling even inexperienced users to set up and configure a line array correctly. This regards both the mechanical properties and also the loudspeaker's setup. The tops offer only one simple selector switch to set the array's length from 1 to 8 units. The subwoofer is operated via a multi-line display with an incremental encoder, where pre-sets for combination with the M-F3A Pro top are already

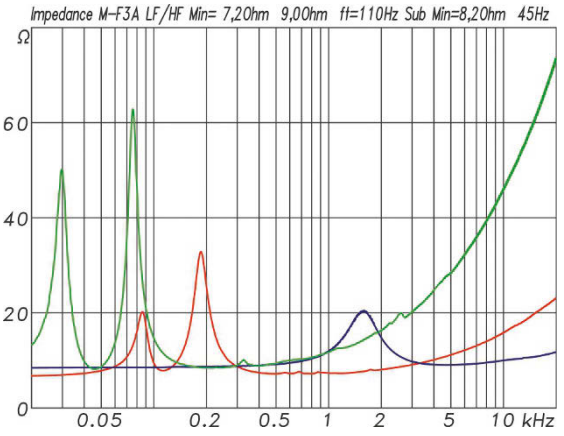
stored – as standard, cardioid or endfire versions. The latter two allow directional bass dispersion. In the cardioid arrangement, in the stack, two subwoofers with forward dispersion are combined with one subwoofer with rear dispersion. The endfire principle operates with subwoofers that are arranged one behind the other at a defined distance so that the sound radiated to the rear is extinguished. Both arrangements make it possible to achieve significant directivity at low frequencies, even with compact loudspeakers. The three settings (standard, cardioid and endfire) are also available for the S12's factory-set setups in a generic version allowing a combination with other tops. Regardless of the predefined setups, users can also create their own setups or modify the predefined ones and store these in new storage locations. In the free configuration, high and low pass functions, various parametric EQs, gain, delay and phase inverse can be set. However, for all standard M-F3A applications, this is not required. For the purpose of easy operation, users only have to select one of the three standard, cardioid or endfire pre-sets.

The M-F3A Pro's mechanics are as simple and safe to operate as the electronics. To combine them in a stack, the S12 Pro subwoofers can be connected quickly and securely to each other via a two-point mechanism. As the locks are arranged diagonally to each other at the front and rear, they can also be used in a cardioid stack. Irrespective of the locking mechanism, the upper unit's feet also snap into the corresponding cut-outs in the lower unit, so that the subs are always exactly aligned with each other. The mechanism then snaps into place with a single movement and the stack forms a solid entity. The tops can be installed or suspended using different approaches. Up to four M-F3As can be mounted on the ground stack using a groundstack frame. This is attached to the top subwoofer in the same way as another sub would be by using the two-point mechanism. This way, three cardioid subs and four tops can be combined to form a very effective and optically pleasing mini system. For smaller sets, one or two M-F3A Pros can be mounted on a subwoofer or tripod by using a U-bracket and a tripod rod. Larger arrays with up to twelve M-F3A Pros are flown with the help of a bumper frame or the multi purpose rigging frame. The M-F3A Pro relies on a three-point mechanism in which the rear splay angle is adjusted via the corresponding holes for the ball locking bolt. Angles from 0° to 8° can be set in steps of 1°. Thanks to the M-F3A's low weight of only 8.3 kg, an array can be easily assembled. For transport, SE offers a case for four M-F3As each.

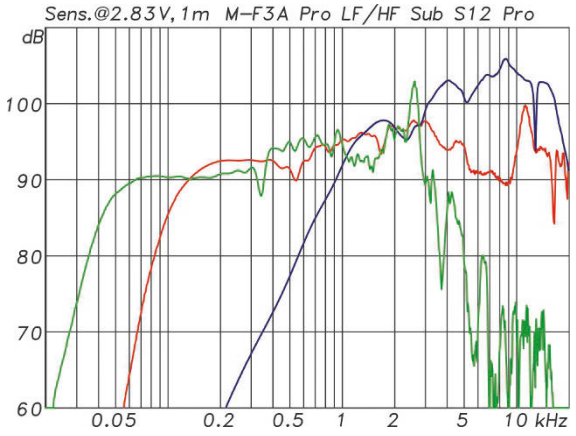
Subwoofer S12 Pro *multi-line display and incremental encoder call up complete setups for the combination with the M-F3A Pro top in standard, cardioid or endfire versions*



Flying frame with power connection? *An illuminated logo is loved in Asia; in Germany the connection will probably remain empty*



Impedance curves *of the M-F3A Pro with LF (red) and HF (blue) as well as the subwoofer S12 Pro (green). The bass reflex cabinets' tuning frequencies are 110 Hz for the M-F3A Pro and 45 Hz for the S12 Pro (Fig. 1)*



Frequency response and sensitivity *of the M-F3A Pro with LF (red) and HF (blue) as well as the subwoofer S12 Pro (green). All level values refer to 2.83 V/1 m corresponding to 1 W/1 m (Fig. 2)*

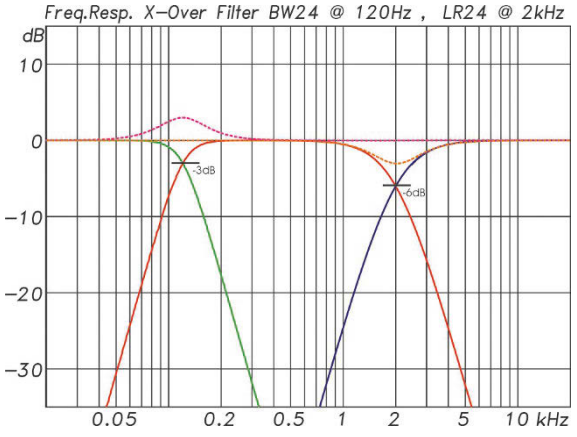
Not to be left unmentioned is a special feature of the ground stack frame, which – rather unusually – features a power connection. If this is powered, SE Audiotechnik's logo lights up on three sides. Solingen's employees explain that such small decorative details are very popular especially in Asia and this small marketing feature was therefore included.

When it comes to the electrical connections actually required for operation, each unit features a Powercon with a link socket for the power supply and an XLR socket with a link output for the signal feed. Both can be linked through in the array. Since every loudspeaker also has a mains switch, users should still take a look at the switches before positioning an array to make sure that they are all switched on. The same applies to the level controls located on the tops. In principle, it is possible to operate four tops and two to three subwoofers on one phase. However, a problem can arise from the inrush current if all loudspeakers in an array are connected to the mains at the same time. This constellation even triggered a 16 A C machine during our test.

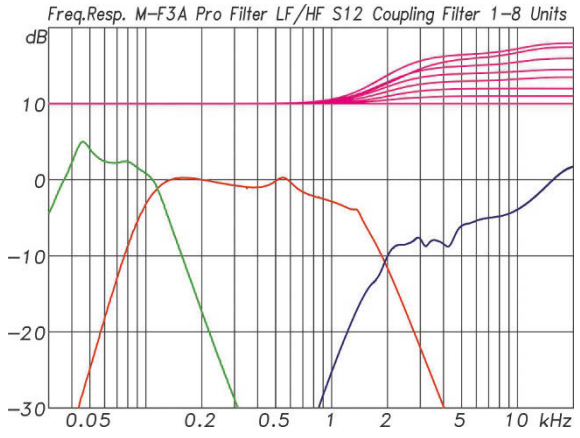
Measured values SE Audiotechnik M-F3A Pro and S12 Pro

In the laboratory measurements, we first examined the individual ways without using the integrated electronics. All ways including those of the 12" subwoofer are 8-Ω systems. The sensitivity values in Fig. 2 for 2.83 V/1 m therefore also correspond to the values 1 W/1 m. The subwoofer works flawlessly with a lower cut-off frequency of approximately 40 Hz. Towards the mid, the sensitivity curve increases slowly, also without any noticeable abnormalities. In the relevant frequency range, the sensitivity is 90 dB. With a tuning frequency (Fig. 1) of 45 Hz, the S12 Pro can thus be used well down to 40 Hz. The tops' small low-midrange drivers are significantly higher tuned at 110 Hz. If one has a look at their frequency response as a whole, one could definitely speak of a decent broadband chassis. The separation to the tweeters takes place at 2 kHz, which is completely problem-free. In combination, the eight drivers' sensitivity lies in the relevant frequency range between 92 and 95 dB, which – together with the available amplifier power of 300 W – already ensures a certain potential. When it comes to the subwoofer, the separation takes place at 120 Hz, where neither of the two ways involved has to compromise. The high-frequency line could already be deployed from approximately 1.5 kHz onwards and reaches a likewise remarkable sensitivity of 98 to 105 dB 1 W/1 m. All three ways in themselves thus already create a good basis for an equally good overall result.

The associated filter functions of all three ways are shown in Fig. 4. As expected, not a lot has to be filtered. The one or other small increase or decrease is already rather of the cosmetic kind. The separations take place at 120 Hz and at 2 kHz, considering the overall filter and loudspeaker result of Fig. 5. Within the tops, this results in a transition with

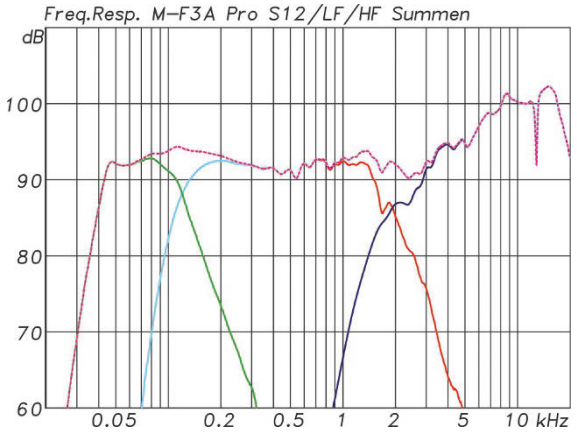


Frequency response *of high and low pass filters at 120 Hz with Butterworth characteristic and at 2 kHz with Linkwitz-Riley characteristic. In both cases, the slope steepness is 24 dB/Oct. The dashed magenta curve shows the complex addition of the individual curves; the dashed orange curve shows the energetic addition (Fig. 3)*

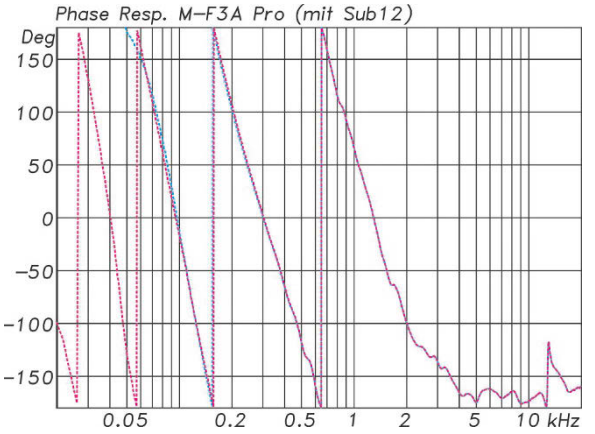


Filter functions *of the LF (red), the HF (blue) and for the subwoofer S12 Pro (green). Above, the coupling filters for arrays with a length of 1 to 8 units (Fig. 4)*

Linkwitz-Riley characteristics. The separation to the subwoofer is achieved with Butterworth high pass and low pass filters. Linkwitz-Riley characteristics are preferably used when the loudspeaker already develops a certain directivity, in other words at medium and higher frequencies. Direct sound components measured on axis add up complexly to a constant frequency response. At the crossover frequency, high pass and low pass curves meet at -6 dB. At low frequencies – and thus for the separation between tops and subwoofers – it is not so much the direct sound component as it is the energy input in the room that determines the listening impression. If high and low pass components are to add energetically to a constant amount, the curves must intersect at the -3 dB crossover frequency, which corresponds to the



Frequency response *of a single M-F3A Pro without and with subwoofer S12 Pro; the high-frequency boost already compensates part of the array's coupling effect (Fig. 5)*



Phase response *of an M-F3A Pro without (light blue) and with subwoofer S12 Pro (magenta) (Fig. 6)*

Butterworth characteristic. Complexly added or measured as a loudspeaker in the anechoic environment, this results in an increase of 3 dB at the crossover frequency. Fig. 3 shows these connections using the example of simple high and low pass filters with Butterworth characteristics at 120 Hz and Linkwitz-Riley at 2 kHz. Together with the loudspeakers shown in Fig. 5, the effect is not quite so clear, as both curves start to fall off a little earlier.

Interaction in the array

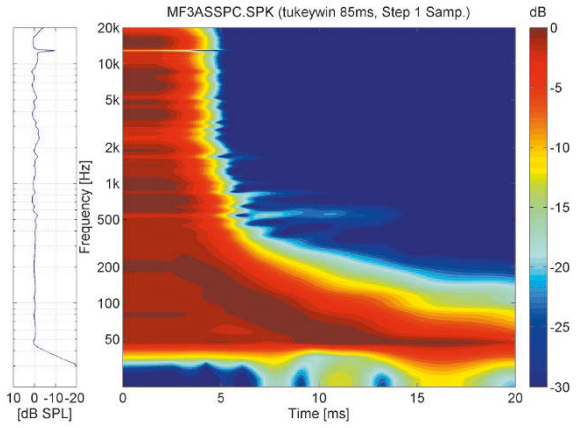
The other curves in the upper part of Fig. 4 show the set corrections for arrays with up to eight M-F3A Pros. The thought behind this seems a little unclear at first. There is a switch on the speaker, which allows for the filter adjustment of one to eight units in single steps. This could be interpreted in such a way that the speaker setting now also has a linear frequency response, for example allowing it to be used independently as a fill system. However, this is not the case as Fig. 5 clearly shows. The curve increases by 8 dB above 3 kHz. A certain advance compensation for an array is therefore already available. Developer Michael Kapp explains this setting with the fact that – due to the strong directivity in the highs – a single speaker would have far too few highs in the listening impression if it had a straight frequency response on axis outside the centre axis. A short hearing test confirms this impression. Only exactly on the middle axis, the highs seem a little overemphasized; however no more when they are slightly outside. Accordingly, the elevations in the highs caused by the filters for arrays with 2 to 8 units are also weaker. For example, the setting for a four M-F3A array raises the highs by 4 dB, giving a total boost of 12 dB, which is suitable for an array of four elements, as the lows and mids increase is 6 dB with each doubling of the array elements. What at first glance did not seem entirely plausible, is explained on closer inspection.

Together with the S12 Pro subwoofer, the combination reaches approximately 40 Hz and is therefore fully PA-compatible. Without a subwoofer, the M-F3A Pro's lower cut-off frequency is about 110 Hz, based on -6 dB. A dedicated full-range setup for the M-F3A Pro is not available.

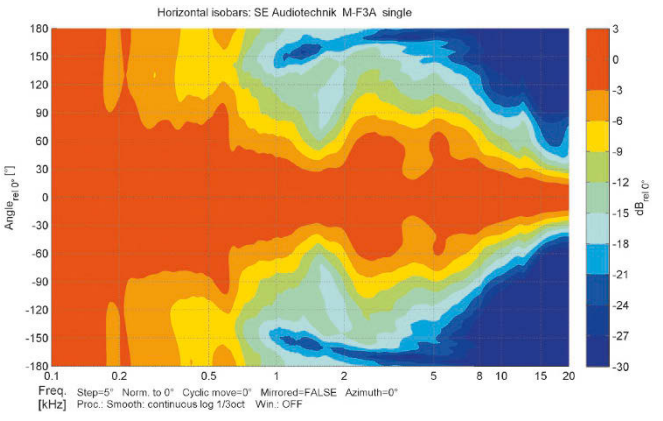
The corresponding phase responses with and without the S12 Pro subwoofer are shown in Fig. 6. Starting from the low frequencies, the combination with a subwoofer up to 300 Hz shows a phase rotation of 3 x 360°. These are made up of the 360° of the acoustic high pass (4th order) in the form of the subwoofer's bass reflex cabinet, the electric high pass

Through wiring of the tops *we could have unfolded the rain cover a little bit better for the picture*

Enclosure production *the electronic modules and loudspeaker components are also manufactured in the company's own factory near Shanghai*



Spectrogram *of the M-F3A Pro with subwoofer S12 Pro. The loudspeaker shows an almost flawless behaviour. Only a tiny resonance can be observed at 500 Hz (Fig. 7)*



Horizontal isobars *of the M-F3A Pro with a nominal radiation angle according to the data sheet of 120°, which is reached on average from 1 kHz upwards (Fig. 8)*

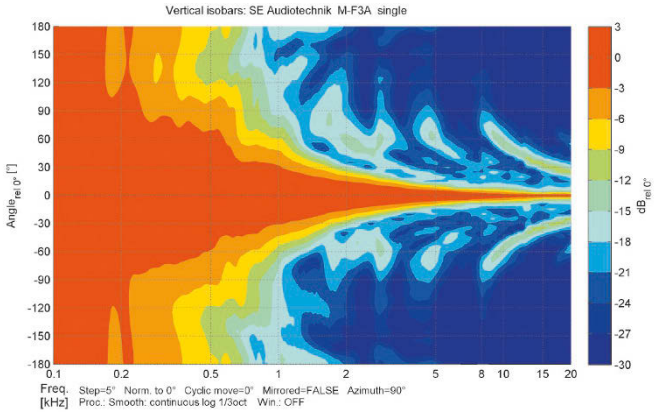
filter (4th order) for the subwoofer with a corner frequency of approximately 35 Hz and the crossover function (also 4th order) between subwoofer and top at 120 Hz. In the following, 540° are added, which result from the transition from the low-midrange to the tweeter and the tweeter's acoustic high-pass behaviour.

Deviations in the frequency response can have various reasons. Housing resonances and partial vibrations of the diaphragms are the most frequent causes. The latter occur primarily when large membranes are to radiate high frequencies and the membranes are thus excited to create partial oscillations. Of course, the M-F3A's low-midrange drivers with their 2.8" large (or rather: small) diaphragms process their intended frequency range up to 2 kHz without any problems. The adjacent tweeter unit with its 1" fabric domes is superior to a compression driver from this point of view, as the diaphragms are much smaller and there is no compression chamber and no waveguide to produce a flat wavefront. The spectrogram in Fig. 7 is therefore good. Apart from a tiny resonance at 500 Hz, the reverberation behaviour of the M-F3A Pro – including that of the S12 Pro subwoofer – can be described as exemplary. The long resonance at low frequencies is caused by the increase of the group delay, which – due to the various filters' phase rotations – rises to 40 ms at 40 Hz. If one wants to protect a subwoofer with a bass reflex cabinet with an additional electric high-pass filter, then the strong phase rotation is unavoidable.

Horizontal and vertical directivity

When it comes to directivity, there are several important aspects to consider when examining a line array speaker. As is the case for a point source system, the horizontal dispersion for a defined angle should be as even as possible. Regarding vertical angulation, the rules known for discrete line sources apply: the individual sources in their frequency range should not be more than half a wavelength apart. And the splay angle between the units should not be greater than 3° divided by the height of the element (in metres). Both are well met when it comes to the M-F3A Pro: the housing height is 0.317 m and the flight mechanics' maximum splay is 8°. According to the calculation, a maximum of 9.5° would be permissible. Regarding the distance between the individual sources, this is 8 cm for the low/midrange drivers and 4.5 cm for the tweeters. At a crossover frequency of 2 kHz, the low/midrange drivers meet the criterion completely and the tweeters meet it until just below 4 kHz.

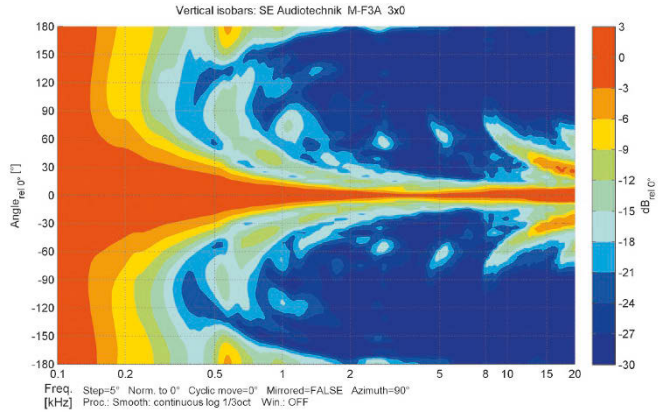
If one has a look at the vertical isobaric diagram in Fig. 9, the secondary maxima caused by the source distance with levels of -10 dB and less are moderate in relation to the centre axis. The reason for this can be seen just below 8 kHz, where the wavelength corresponds exactly to the distance between the tweeters. Here, the proportions of all tweeters add up perfectly at an angle of ±90°. If the tweeters were ideal spherical sources, two new maxima would be generated at ±90°, which would correspond in level to the 0° main maximum.

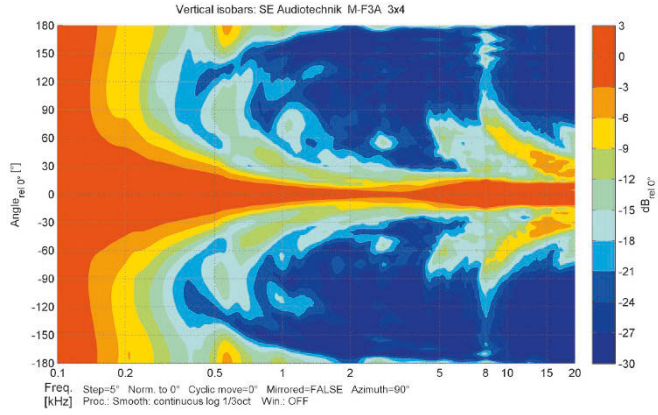


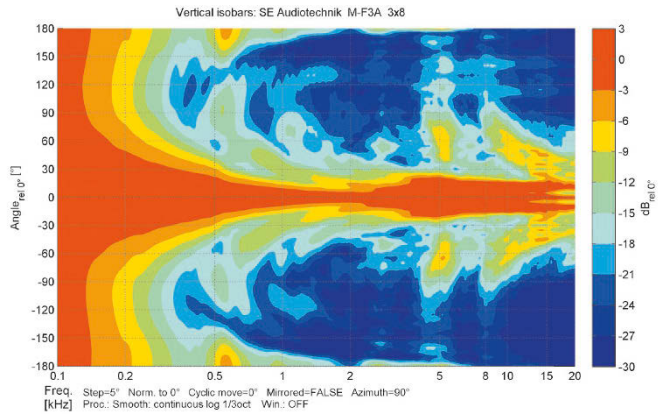
Vertical isobars *of a single M-F3A Pro. Due to the distance between the tweeters of approximately 45 mm from each other, secondary maxima approaching the main maximum are generated from 4 kHz upwards (starting at ±90°). Overlaid by the directivity of the individual sources, however, these are moderated in level (Fig. 9)*

In reality, however, the radiation behaviour of the arrangement as a whole is overlaid by the radiation behaviour of the individual sources. However, as the tweeters, which are equipped with a small waveguide, already have a pronounced directivity at 8 kHz, the ±90° secondary maxima are significantly reduced. The horizontal isobar diagram at 8 kHz shows how a single tweeter behaves at 8 kHz. Below ±90°, the level is already reduced by 15 dB compared to the centre axis. Above 8 kHz, these maxima move towards the centre axis and then also increase slightly in level, as the individual source's directional effect decreases at smaller angles.

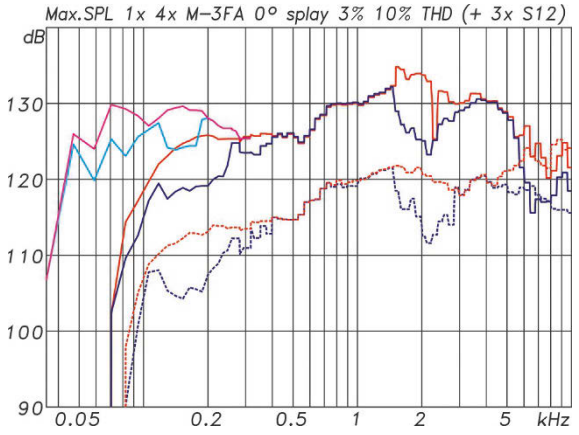
When we take a look at the horizontal isobars in Fig. 8, there is a small disadvantage compared to the usual compression drivers with a waveguide and a horizontal horn approach: the M-F3A's horizontal dispersion corresponds to that of a classic 2-way system with a cone woofer and a dome tweeter. The arrangement with two woofers, which is quite extensive in the horizontal, already causes a certain constriction of the isobaric curves up to approximately 80° until it reaches the crossover frequency. At 2 kHz, where the domes take over, the -6 dB isobars then expand again to 160° to constrict again thereafter. On average, this results in the horizontal dispersion angle of 120° specified in the data sheet. In terms of uniformity, however, it does not achieve the behaviour known from line arrays with waveguides and horizontal horn approaches. The extent to



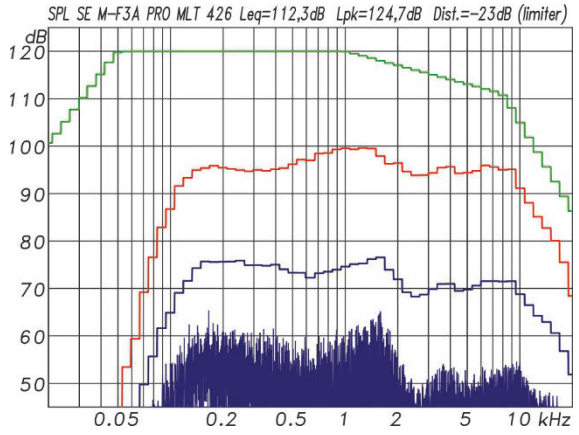




Vertical isobars *of three M-F3A Pros with splay angles of 0°, 4° and 8°. The secondary maxima are now slightly more pronounced. The main maximum expands according to the splay angle and remains coherent at 8° up to 15 kHz (Fig. 10)*



Maximum level *determined with a sine burst measurement for a maximum of 3% (blue) or 10% (red) distortion. For a single M-F3A Pro (dashed lines), for four M-F3A Pros (solid lines) and with three subwoofers S12 Pro (<300 Hz) (Fig. 11)*



Multitone measurement *with EIA-426B spectrum and 12 dB crest factor. A single M-F3A Pro achieves an average level of 112.3 dB and a peak level of 124.7 dB at -23 dB total distortions (TD) (Fig. 12)*

which this is a disadvantage, if any at all, will probably have to be decided on a case-by-case basis.

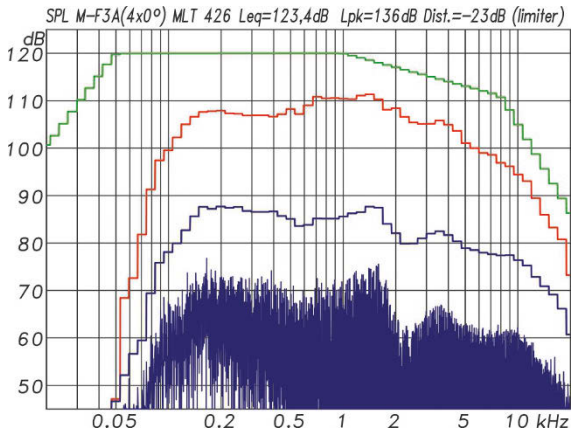
The interaction of several elements in the array is of substantial importance for a line array. How the M-F3A Pro behaves was measured with three elements for splay angles of 0°, 4° and 8° on the turntable. In an array consisting of three elements, the secondary maxima appear somewhat stronger at first glance, but this only appears in the relative representation to the main maximum at 0°. With large arrays, the level on the centre axis is weakened depending on the measurement distance by differences in duration and angle dependence of the individual sources at high frequencies. This does not apply to the secondary maxima ±90° in this form, so that they now stand out more strongly in relation to the 0° axis. The main maximum itself widens in an exemplary way according to the set splay angle. The isobaric area around the 0° axis remains very even and coherent, even at a maximum splay angle of 8°. With three M-F3A Pros, an angle of up to approximately 35° in the vertical can therefore be covered.

In summary, it could be said that the use of dome arrays in a line array is by all means an alternative to the use of compression drivers with waveguides. The slightly more uneven dispersion behaviour in the horizontal plane is countered by a very well scalable and uniform vertical dispersion behaviour. How does the dome array behave when it comes to maximum levels and distortions?

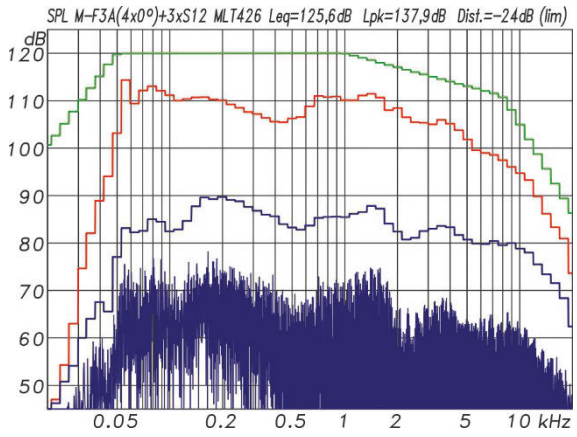
Maximum level of the dome array

In general, the opinion exists that: “Dome tweeters sound nice, but they aren’t loud and don’t tolerate a lot of power. Compression drivers with a horn, on the other hand, are loud and can tolerate a lot of power.” In a 1:1 comparison, this is also largely true. In the M-F3A Pro or other line arrays constructed with dome arrays, however, seven or eight calottes are usually opposed by one large or two small compression drivers. If one first only takes a look at the load capacity and then sets 10 W per dome, then this sums up to 70 W in the M-F3A Pro – a number, which corresponds pretty much exactly to what is known from two small or one large compression drivers. To increase the M-F3A domes’ long-term thermal load capacity, the domes’ neodymium magnets are equipped with cooling profiles. The same applies to the mid-low drivers. In terms of sensitivity, the dome array with a mean 103 dB 1 W/1 m does not quite reach the values of a compression driver, but remains at this level up to over 15 kHz with a more even overall frequency response, as neither a compression chamber nor a waveformer are involved. That leaves the question: what maximum level can I achieve in practical use with a line array that uses a dome array in the high frequency range instead of the usual compression drivers?

Our measurements, for which we have been using two methods to measure the maximum level of loudspeakers for



Multitone measurement *with EIA-426B spectrum and 12 dB crest factor. An array with four M-F3A Pros achieves an average level of 123.4 dB and a peak level of 136 dB at -23 dB total distortions (TD) (Fig. 13)*



Multitone measurement *with EIA-426B spectrum and 12 dB crest factor. An array with four M-F3A Pros and a S12 Pro achieves an average level of 125.6 dB and a peak level of 137.9 dB at -24 dB total distortions (TD) (Fig. 14)*

quite some time, provide an objective statement in this respect: on the one hand, the measurement with 185 ms long sinusoidal burst signals. Here, the level is increased with a sinusoidal signal for one frequency until a certain amount of distortion, typically 3% or 10%, is reached. The sound pressure measured as the average level for the duration of the measurement is recorded as the measured value. This measurement is performed over a frequency range to be defined in frequency steps of 1/12 octaves. Fig. 11 shows three series of measurements. The maximum level values for a single M-F3A Pro, for an array with four M-F3A Pros and for the array in combination with three S12 Pro subwoofers are shown for a maximum of 3% and 10% distortion respectively. SE recommends this combination of four M-F3A Pro and three S12 Pro as a mini system for clubs and small concert stages. The measured values for this combination show level values around 130 dB. Where the 3% and 10% coincide, an internal limiter prevented the achievement of 10% distortions. There are no weaknesses in the high frequencies. Only in the low-mids between 200 and 600 Hz does the curve drop by a few dB, as the drivers reach their limits here. Without a subwoofer, this tendency also continues towards the lower frequencies. The curves of the individual M-F3A Pros show even more clearly that the tweeter unit can keep up very well with the low/midrange drivers and that it also has reserves in the array for cases in which the low/midrange drivers can benefit more from the acoustic coupling.

A second maximum level measurement that is even more meaningful in practice is the multitone measurement. The basis of the multitone signal consists of 60 sinusoidal signals with random phase, whose spectral weighting can be set at will. For the measurements shown in Figures 12 to 14, a weighting corresponding to an average music signal (green curve) was selected. The crest factor of the measurement signal synthesised in this way – which describes the ratio of the peak value to the effective value – is at a practical value of 4 corresponding to 12 dB.

For the distortion value derived from this type of measurement, all spectral lines, which are not present in the excitation signal, in other words, which have been added as harmonic distortions or intermodulation distortions, are added together. In the graphic, these are the blue lines and their sum curve in 1/6-octave wide frequency bands. It is important to generate the excitation signal's frequencies in such a way that they do not coincide with the harmonic distortion components, as they could otherwise no longer be evaluated. With this type of measurement too, the level is also increased until the total distortions (TD) reach a limit value of 10% or a limiter no longer permits a further level increase. All total harmonic distortions (THD) and intermodulation distortions (IMD) are summed up in the total distortions. Under these conditions, a single M-F3A achieved a peak level of 124.7 dB and an average level of 112.3 dB for a typical music spectrum according to EIA-426B at a distance of 1 m in open space

under full room conditions. The data sheet specifies a peak level of 129 dB, however this was measured with a pink noise signal and without a distortion limit, thereby explaining the 4 dB higher value compared to a spectrum measurement according to EIA426B. A measurement according to the M-Noise method with a maximum of 2 dB broadband compression resulted in a value of 126 dB for an M-F3A Pro.

Further multitone measurements were carried out for an array consisting of four M-F3A Pros and for the mini system combination with three additional S12 Pro subwoofers. The peak level achievable with four M-F3A Pros was 136 dB and, together with the subwoofers, 138 dB. The gain from the three subwoofers is not as great as the listening impression suggests, as the additional 1.5 octaves at the lower end of the frequency band are not as influential in relation to the entire frequency range. In this case, there is also no gain by relieving the tops, as the M-F3A Pro with or without subwoofer is always operated with the same setting and high pass filtering.

Listening test in Solingen

In the summer of 2019, a listening test of the M-F3A Pro with two mini system combinations took place in SE Audiotechnik's demo room in Solingen, Germany. The acoustically well-conditioned room, which also features a stage, allows a neutral evaluation of the system under realistic conditions. The expectations derived from the measured values were fulfilled well. The system played all kinds of music powerfully, loudly, always pleasantly and never intrusively. The subwoofers, arranged in a cardioid setup, delivered a dry and precise bass without unnecessarily stimulating the room. The listening test could thus be described as an all-out success. In addition, there was also a lively

Hearing test *with developer Michael Kapp, Audio Application Engineer Ugis Vilcans and Anselm Goertz*

Part of the audio team in Solingen *Andreas Matten (Sales Manager), Ugis Vilcans (Audio Applications Engineer), Esteban Andres Gacome (Junior Audio Engineer), Sebastian Thiel (Logistics Manager), Harold Corneau (Audio Engineer), Michael Kapp (Senior Audio Engineer), Markus Schmittinger (Division Manager SE Audiotechnik), Jose Miguel Cadavid (Junior Audio Engineer)*

exchange with the developers and sales staff present. Audio Application Engineer Ugis Vilcans, for example, advises and assists customers, while Markus Schmittinger has been SE Audiotechnik's Division Manager since summer 2019.

In addition to the mini system demonstrated and measured in Solingen, SE's M-F3A brochure also proposes the micro system (consisting of a S12 subwoofer each with tripod, U-bracket and two M-F3A tops) as well as the large introduction system. The latter could be heard on the open-air grounds at this year's PLS in Frankfurt. The setup was equipped with two line arrays consisting of eight M-F3As each and received bass support from twelve S12 subwoofers per side in a 6+6 endfire setup. Although visually very unobtrusive, the M-F3A was able to stand its ground in an environment with partially much larger systems. Anyone familiar with the situation on the open-air grounds of the PLS in Frankfurt knows about the often-exaggerated setups with far too much bass and the recurring same pieces of music. SE's demo also attracted positive attention in this regard. The M-F3A system offered a well-balanced sound on the large terrain without exaggerations, with long range and with pleasant sound. At this point, one could also speak of HiFi sound, which would be quite true, but is also often misunderstood.

Summary

With the second-generation M-F3A models – entitled "Pro" – the Solingen-based manufacturer SE Audiotechnik has launched a compact line array that is suitable for a wide range of applications from small stages and clubs to smaller open-air events. Construction and handling are quick and easy thanks to the fully active concept with simple settings and well thought-out mechanics. The tops, which weigh only 8.3 kg, can also be assembled swiftly into an array. The same applies to the S12 Pro subwoofers, which operate in a groundstack and can be set up quickly and safely with the fully integrated mechanics. The measured values are almost always flawless – as is the listening impression, where the M-F3A Pro is fully convincing. The dome array impresses with a particularly pleasant and clean sound, even at high levels.

When it comes to planning installations with the M-F3A Pro, EASE Focus 3 offers data for the simple simulation of direct sound conditions, which can of course also be used in EASE for more complex planning in connection with room acoustics. The EASE-GLL's M-F3A Pro file delivered exactly those mean level Leq values at 12 dB crest factor that were measured in the laboratory for the maximum level determination. Finally, one should talk about prices. The price list specifies a RRP without VAT of 1,750 € for the M-F3A Pro top and 1,320 € for the subwoofer S12 Pro. The prices are valid for the black version. In the white version, the top costs € 1,800, while the subwoofer has a price of € 1,380. The illuminated stacking frame is available for 594 € and 637 € respectively; the bumper frame costs 495 €.

After the foundation in Solingen, *Michael von Keitz soon decided to set up the company's own production in China*