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Review
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Self-Powered Compact Line Array

Meyer Sound LINA

Meyer Sound introduces the successor to the LEO family's MINA models: LINA. Equipped with new drivers, new power amplifiers and improved signal processing, the new line array promises less distortion, more headroom for signal peaks and an overall increase in performance.

Copy and measurements: Anselm Goertz | Images: Dieter Stork (2), Anselm Goertz, Detlef Hoepfner (3)

Line arrays consisting of two 6.5” speakers are very popular systems for both rental operation and fixed installations as its dimensions and weight allow the system to be used even in confined spaces where larger loudspeakers could not be deployed regardless of their design. A further advantage is this compact line array’s flexibility: Depending on the length of the array, it can also be used as a main PA in small and medium-sized venues. Additionally, users can also rely on these systems as a side fill for large stages, as a down fill located under large arrays or as a separate system at the side of the stage. Together with the corresponding subwoofers, these systems are also ideally suited as compact PAs for club gigs and the like.

Most of these compact line arrays have a nominal horizontal dispersion angle between 80° and 110° (as is the case for Meyer Sound’s LINA, which is discussed here and has a nominal dispersion angle of 100°). Compact line arrays are therefore already well suited for many of the applications mentioned above. By adjusting the number of elements and their respective curving, the array can then be adjusted vertically to meet the needs of the specific application. Compared to classic point source loudspeakers, a small line array with 3-5 elements also offers the possibility of vertically dispersing sound very narrowly and directly in the direction of the audience, without unnecessarily exciting the room or creating reflections from the ceiling. The same applies to the corresponding subwoofers, which also meet multiple application needs: They can be deployed as a simple ground stack bass, as a flying bass in an array or as a cardioid array – both on the ground or flown. The flexibility offered by this type of system provides a large advantage especially for rental businesses. Another very important aspect is operational safety. Failure safety plays an important role, as does the avoidance of incorrect operation or configuration. Especially with this in mind, Meyer Sound relies consistently on active self-powered systems, with loudspeakers, amplifiers and controllers always operating as a single unit that always interacts perfectly. Incorrect pre-sets, inappropriate amplifiers or even wiring errors cannot occur here – thereby excluding a large source of error from the outset. At Meyer Sound, active self-powered loudspeakers have a decades-long tradition, so that John Meyer can certainly be described as a pioneer of this loudspeaker concept. From a technical point of view, advantages include short cables and amplifiers that are always optimally adapted to the respective loudspeakers. For users who want to use electronic beam forming for line arrays in addition to mechanical curving, the self-powered concept offers yet another advantage as each loudspeaker can be filtered individually.

On the other had, one also has to consider the costs and the aspect of easy maintenance. A large amplifier that can supply a lot of line array elements and/or subwoofers is usually cheaper than the surcharge for a self-powered loudspeaker. When it comes to maintenance, especially of fixed installations, the concern is sometimes expressed that in the event of a defect in the loudspeaker electronics, a great deal of effort may be required to replace the respective speaker. Both concepts thus have their advantages and disadvantages. Depending on the type of application, one or the other argument will weigh more heavily.

The LINA in detail

For this review, we tested Meyer Sound’s new LINA line array together with the 750-LFC subwoofer. Tops and subwoofers are compatible in rigging and can be flown together or used as a ground stack. The net housing width is 471 mm; for the subwoofers one needs to add the width of the optional external handles, for the tops one needs to add the flyware’s pins. Let us begin by taking a look at LINA’s line array elements. As is typical for Meyer Sound, the loudspeakers make a very solid and robust impression. The front is protected by a sturdy grille with foam backing; the housing is made of multiplex with black textured paint and the flyware is attached to the side from the outside. The flyware is designed as a four-point system, which is rather unusual for a small line array. However, this is also cause by the fact that an electronic module occupies the entire rear surface. If one unscrews the front grille, the horn or waveguide dominates the picture. The two 6.5” woofers can be identified behind the waveguide’s side surfaces, located on the front’s diagonally inward parts. From an acoustic point of view, the construction for the two woofers represents a kind of band pass chamber. The 6.5” drivers as well as the 3” compression driver and its horn were developed and manufactured in-house by Meyer Sound. The cabinet’s bass reflex ports are located in the handles. If one removes the electronics on the back, the drivers become visible. The woofers and tweeters are equipped with neodymium magnets. For better heat dissipation, a cooling profile is attached to the high frequency driver. Interesting is the fan located in the middle of the enclosure on the left side, whose task is to provide air movement in the housing if necessary. Some air exchange can be achieved via the bass reflex ports. The waste heat in this case is caused by the drivers and the built-in electronics, which are only separated from the housing by a perforated plate. The electronics can dissipate heat to the outside via a large cooling profile that occupies approximately 2/3 of the rear.

A single LINA *prepared for a first measurement in an anechoic chamber (the microphone is located in the lower right corner)*

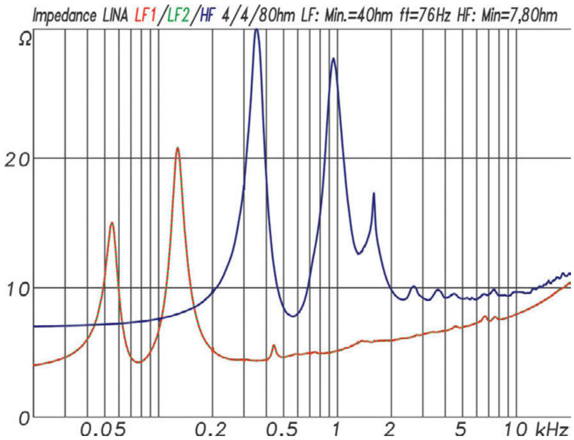
The LINA's electronics consist of three Class D amplifiers, a DSP system and various peripheral circuits for loudspeaker monitoring. The data sheet specifies the amplifier's total power as a peak power of 1950 W. Meyer Sound attaches particular importance to peak values, as particular emphasis is placed on the undistorted and uncompressed reproduction of individual signal peaks during music reproduction. This ultimately determines the reproduction's dynamics. In this context, the new M-Noise measurement method was recently developed (see our article on M-Noise).

The LINA's HF *The two 6.5" woofers can be identified behind the waveguide's sides*

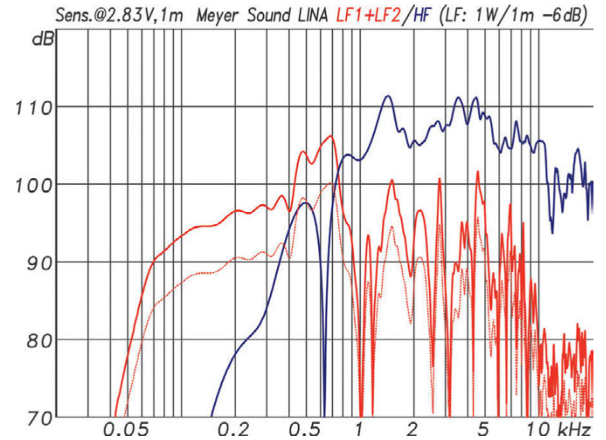
In order to also gain an insight into the properties of the individual ways, LINA's LF and HF ways were first measured separately – in other words directly with the drivers on the measuring amplifier, without using the internal electronics. Fig. 1 shows the resulting impedance curves. The two woofers are 4-Ohm systems; the tweeter is an 8-Ohm driver. Somewhat unusual are the 4-Ohm woofers. With the relatively low impedance, the two amplifiers can be optimally used with the woofers. The bass reflex system's resonators are tuned to 76 Hz.

The woofers' frequency response (Fig. 2) shows that – with this tuning – the LF way can be used well down to 70 Hz and that even 60 Hz is still acceptable. Relative to 1 W / 1 m, the average sensitivity is approximately 90 dB with a significant increase above 400 Hz up to 100 dB. This powerful gain is generated by the band pass chamber located in front of the membranes. Above 800 Hz, however, the curve then breaks steeply, as the band pass's low-pass section comes into effect. Correspondingly, the separation of the two ways takes place just below 800 Hz. Despite the deep separation, the combination of the powerful high-frequency driver and the large horn operates well. The corresponding curve in Fig. 2 demonstrates that the tweeter operates fully at 800 Hz and can take over from the woofer.

A glance at the LINA's connection panel displays a Powercon power connector with link output, two orange Weidmüller plugs and a five-pin XLR connector with link socket. In addition to the audio signal, the XLR socket on pins 4 and 5 also carries the RMS signal (Remote Monitoring System) for remote control and monitoring of the loudspeakers.



Impedance curves *of the two LF way (red and green) and the tweeter (blue). The two woofers are 4-Ω systems; the tweeter is an 8-Ω driver. The bass reflex cabinet's tuning frequency is 76 Hz (Fig. 1)*



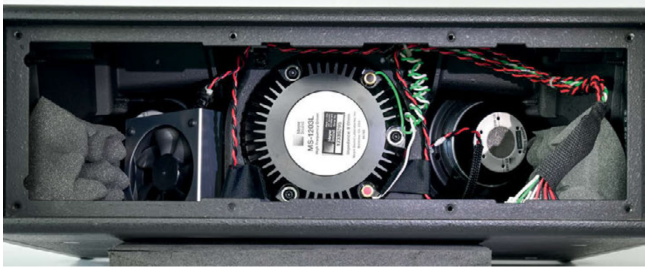
Frequency response *of the LF (red) and HF way (blue) with indication of sensitivity related to 2.83 V / 1 m. For the measurements, the two woofers were operated in parallel with 2-Ω nominal impedance. For conversion to the 1 W / 1 m value, 6 dB must therefore be subtracted from the LF way's sensitivity (red dotted curve) (Fig. 2)*

For LINA systems, the RMS module is an optional feature that can be ordered or retrofitted as an alternative to the standard module, which offers three-pole XLR connections. The connection panel is protected from rain and dirt by a cover. This cover was removed for some of our photos, as the connection panel would otherwise not have been completely visible.

Meyer Sound 750-LFC subwoofer

The 750-LFC, with LFC standing for "Low Frequency Control Element", can be used as a subwoofer for the LINA. While a normal 15" subwoofer is located in a bass reflex cabinet, the driver here has a special feature: a double voice coil chassis with two 2-Ohm coils is installed here, with one coil being located on the inside and the other being located on the outside of the carrier. The integrated electronics comprise of two Class D amplifiers, each of which supplies one coil. Similar to the LINA's woofers, the low impedance allows a very good use of the amplifiers. At 2 Ohm, the amplifiers can deliver high power even at a rather low output voltage. For the circuit, this means that semiconductors and capacitors with lower dielectric strength, which are more readily available (and also cheaper), can also be used. The otherwise unavoidable problems in 2-Ohm operation with high cable and

The LINA's rear *with cooling profile and connection panel (the protective cover was temporarily removed for the photo)*



The LINA's two 6.5" woofers with neodymium drive, *the HF driver with 3" cone in the middle, the left woofer is covered by a fan, which provides air movement in the cabinet if necessary*

Connection panel with RMS input module *The power supply is located in the upper part; two amplifiers with a total peak power of 3100 W are located in the lower part. The 750-LFC's 15" driver is a dual coil chassis with two voice coils, each with a nominal impedance of 2 Ohms*

contact losses do not occur here, as the amplifiers are located in the loudspeaker's immediate vicinity

The 750-LFC's electronics are similar to those of the LINA. However, the two amplifiers' total power is higher, namely 3100 W Peak. The power supply unit, which in this case also has its own fan, is also designed to be more powerful. The 750-LFC's input module is identical to that of the LINA and can again be equipped with or without RMS option. Slightly unusual for a subwoofer is the direct installation of the electronics in the woofer's active volume without their own cabinet chamber. Here, one could have doubts whether the electronics can withstand the violent vibrations in the long run. However, based on Meyer Sound's many years of experience in building active subwoofers, it can be assumed that this aspect has been sufficiently considered and tested.

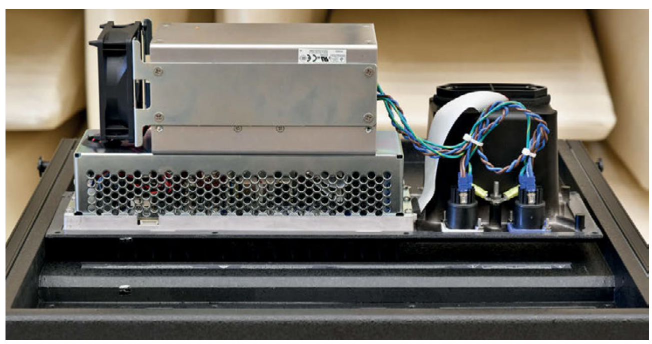
The impedance curves of the woofer's two driver coils in Fig. 3 show a tuning of the cabinet resonator to 44 Hz and an impedance minimum of 2.5 Ohm – the driver could almost formally be specified as a system with a nominal 2 × 3 Ohm. However, this formality does not play a relevant role in an active system anyway.

If one measures the woofer's sensitivity (Fig. 4) at the usual 2.83 V / 1 m, the result is an unusually high value for a single 15" driver, namely 98 dB from 50 Hz upwards. The reason is that together both chassis coils have a nominal impedance of approximately 1.5 Ohm – 7.25 dB have to be subtracted for the value 1 W / 1 m related to this impedance. The shifted curve then shows values of 90-92 dB in the relevant frequency range.

Similar to the LINA elements, the 750-LFCs are equipped with externally attached flyware. Unlike the line array tops, however, the flyware is optional, as not all users want to fly the subwoofers and the equipment is not only heavy, but also expensive.

The two external metal frames for rigging can also be fitted with grip rails, which allow safe and easy handling but also increase the woofer's width by 76 mm. With the rigging kit, the 750-LFC weighs a not inconsiderable 47.6 kg, without it, it weighs 40.3 kg. A solid grille with foam backing is located

Meyer Sound's 750-LFC subwoofer *for LINA systems in a low-reflection room*

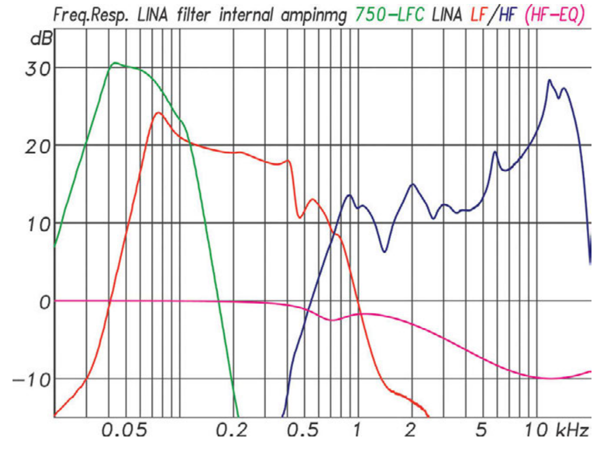


The 750-LFC's electronic module *The power supply is located in the upper part; two amplifiers with a total peak power of 3100 W are located in the lower part. The 750-LFC's 15" driver is a dual coil chassis with two voice coils, each with a nominal impedance of 2 Ohms* on the front side. If one takes a look inside the 750-LFC, one will also find two freely mounted fans, which start to swirl the air inside the housing and distribute the amplifier's waste heat when needed.

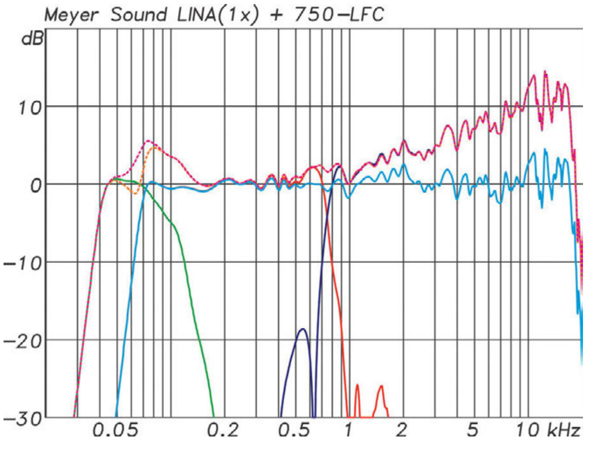
Discussion of the system foundations *Merlijn van Veen (r.) and Anselm Goertz*

Interaction: Meyer Sound LINA/750-LFC

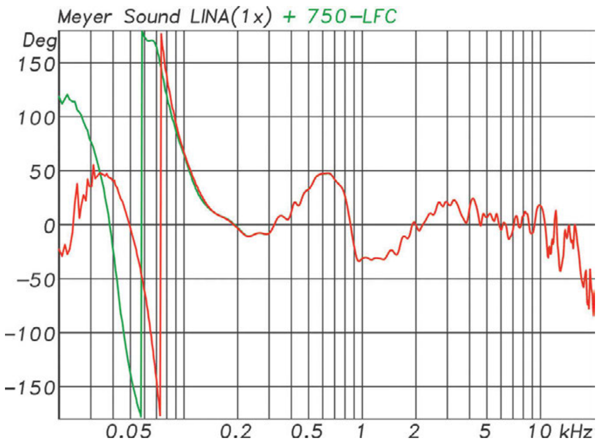
How the individual ways of the LINA and the 750-LFC interact is something users do not have to worry about. The integrated controllers are already configured and provide all necessary filter and limiter functions. The basic setting for the LINA already causes a treble boost of approximately 10 dB as coupling compensation for arrays with 3-6 elements. Fig. 5 shows the corresponding filter curves as well as the HF EQ if the treble boost for the LINA as a single system is to be cancelled. If required, such a filter would be set in the Galileo Galaxy controller, which is available in various sizes and equipment versions. In addition to LINA's filter functions, Fig. 5 also shows the 750-LFC's filter function, while Fig. 6 depicts the result the filters deliver together with the loudspeakers. A high pass filtering of the LINA systems together with the subwoofers is normally not provided. Due to the overlapping, there is a certain elevation in the bass range, which is also intended. The two dashed curves show the course of the sum function of the LINA system together with the 750-LFC – in the default setting (orange) and with a small delay adjustment (red).



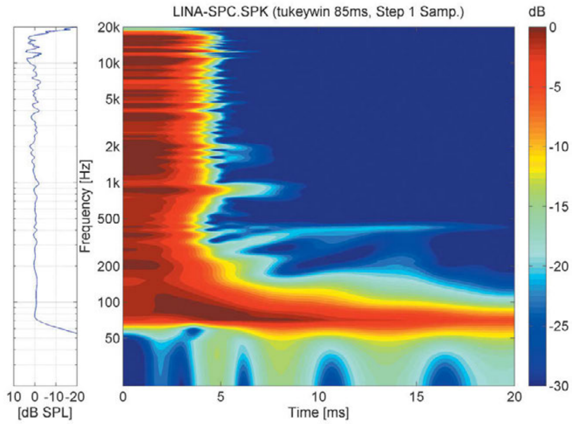
Filter functions *of the integrated electronics for the 750-LFC subwoofer (green) and for the LINA's LF and HF ways; below the HF compensation set for the measurement of a single speaker (Fig. 5)*



Frequency response *of a single LINA with LF and HF way (red and blue) and in combination with a 750-LFC subwoofer, which is usually operated with overlapping with the tops. The LINA tops are already pre-filtered for small arrays with 3-6 elements. The light blue curve shows a single LINA with HF compensation (Fig. 6)*



Phasengang *der LINA solo (rot) und in Kombination mit dem Subwoofer 750-LFC (grün), Abb. 7*

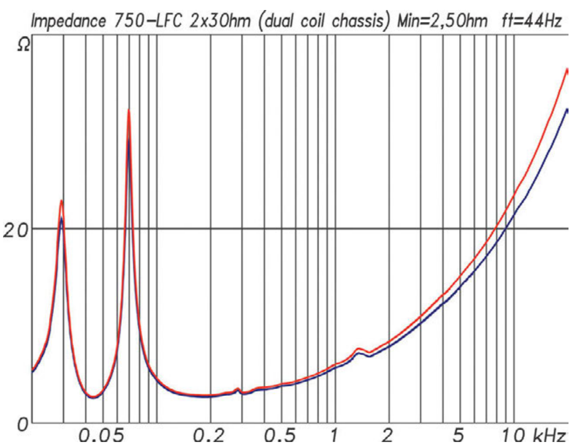


Spektrogramm *der LINA mit HF-EQ für den Betrieb als einzelne Box (Abb. 8)*

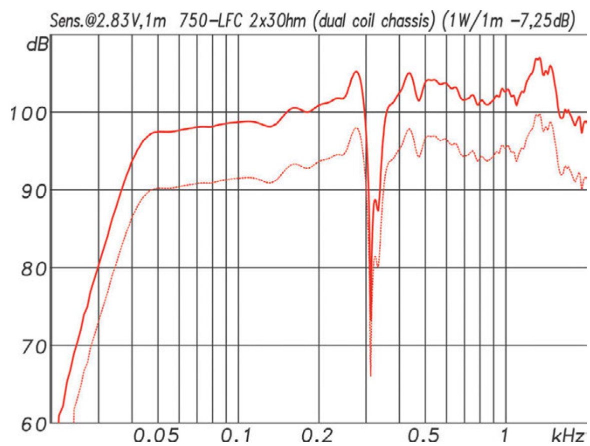
A glance at the LINA's data sheet shows a phase response value of ±45° for the frequency range from 100 Hz to 18 kHz. The phase responses shown in Fig. 7 confirm the values.

The largely linear-phase course is achieved with the aid of simple minimal-phase filters and delays. FIR filters are not used here.

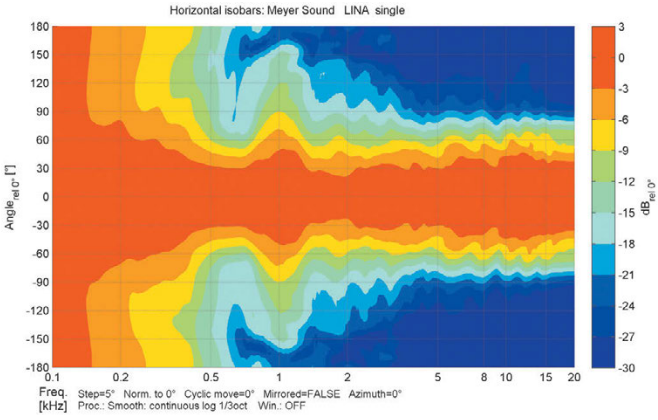
The LINA's spectrogram from Fig. 8 was generated from the measurement of a single speaker with tweeter compensation for a straight frequency response. There are no particularly noticeable resonances. Only at 900 Hz, a slightly longer resonance can be observed. A few additional small and narrow resonances, which can be recognized, are not relevant. The long post-oscillation at 70 Hz is caused by the phase



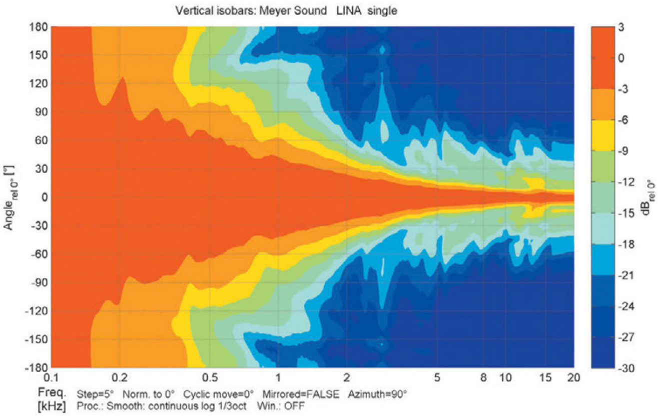
Impedance curves *of the woofer's two voice coils with 2-Ohm nominal impedance each; the cabinet is tuned to 44 Hz (Fig. 3)*



Frequency response *of the 750-LFC with specification of the sensitivity related to 2.83 V / 1 m. For the measurements, the subwoofer's two voice coils were operated in parallel. For conversion to the 1 W / 1 m value, 7.25 dB must therefore be subtracted from the sensitivity (red dotted curve) (Fig. 4)*



Horizontal isobars *of the LINA. The nominal opening angle of 100° is well maintained with small deviations starting at approximately 400 Hz (Fig. 9)*



Vertical isobars *of the LINA with an evenly tapering course of isobaric lines (Fig. 10)*

reversal of the bass reflex cabinet' high-pass functions and the additional electrical high-pass filtering.

LINA's directivity

The directivity of a line array is defined in the horizontal plane by the radiation behaviour of the respective elements and in the vertical plane by the array as a whole, in other words, by its length and curving. Line array loudspeakers are therefore constructed with special horns or waveguides for the horizontal plane. In the vertical plane, one tries to radiate a wavefront that is either as flat as possible or pre-curved in a controlled manner, which makes interaction in the array possible. Meyer Sound calls this type of horn "CD Horn with REM manifold". REM stands for the "Ribbon Emulation Manifold" waveguide, patented by Meyer Sound in 2003. A white paper published by Perrin Meyer in 2005 explains the details.

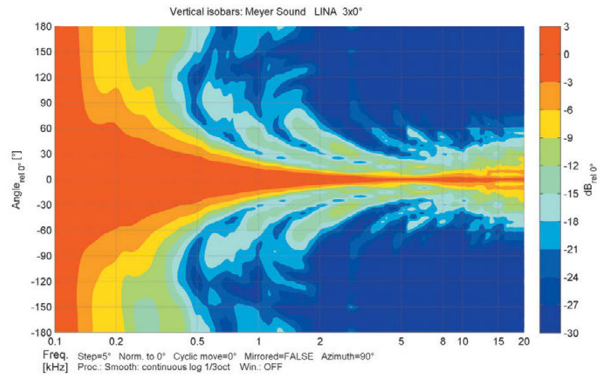
The measurement of a line array element's horizontal dispersion behaviour is no different from that of a normal loudspeaker. For this purpose, the loudspeaker is mounted on a rotating device in the anechoic chamber and is turned in a full circular path from -180° to +180° in the plane to be measured. The measurement is typically carried out in 5° steps, so that one plane is recorded with 73 individual measurements. In former times, when polar measurements were carried out with level recorders on circular paper, the results were presented as polar diagrams. The diagrams thus represented the measured level values as a function of the angle. However, this type of display is limited to one frequency or one frequency range per curve. If several curves are included in a single diagram, this diagram quickly becomes unclear. With the introduction of modern computer measurement technology, the isobaric diagram has therefore established itself. The x-axis shows the frequency, the y-axis shows the angle and the level is plotted over the area spanned by the x- and

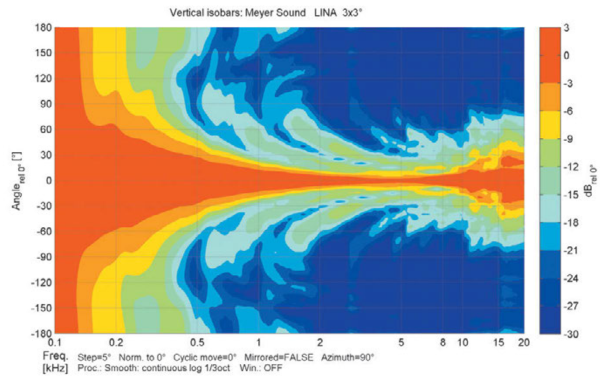
LINA-Laserpositionierung *Merlijn van Veen (Support Meyer Sound), Measurement Engineer Oliver Strauch and Anselm Goertz* y-axes either as mountains or differentiated by colour. The display is relative to the main beam direction. The isobar diagram in Fig. 9 depicts the corresponding measurement for LINA. Apart from small deviations, the nominal opening angle of 100° is well maintained already from approximately 400 Hz upwards. A slight expansion in the radiation behaviour can be found only in the crossover frequency range.

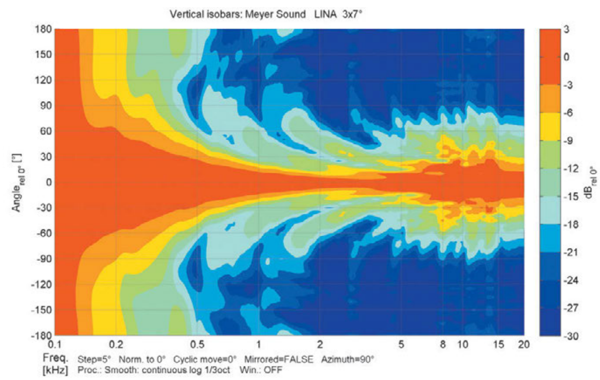
For the vertical plane, several isobaric measurements are required when it comes to line arrays. On the one hand, it is again necessary to consider a single element; on the other, further measurements are carried out for several elements in an array with different angles to each other. In the individual measurement, the isobars ideally present themselves as increasingly pointed curves, which should preferably have no lateral secondary maxima. Fig. 10 shows this measurement for a single LINA. The formation of the flat wavefront works well. There are no secondary maxima and the curves are mostly constricting themselves in a continuous way.

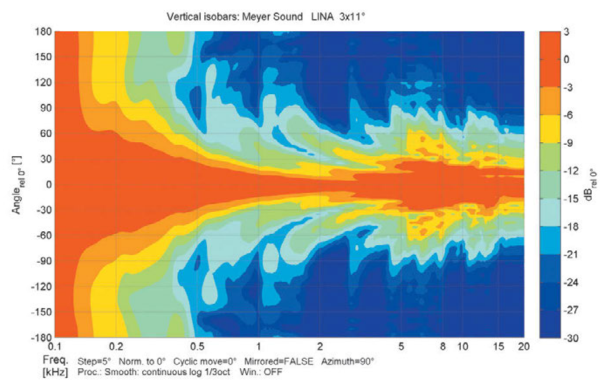
For the array measurements, an array of three LINAs was then assembled and measured with different angles between the elements. These angles can be set from 0° to 11° in 1° degree increments. The adjustment is carried out on the rear mechanism by positioning the ball locking bolts.

The LINA was measured with exemplary angles of 0°, 3°, 7° and 11°. The 0° setting is expected to behave in a similar way to a single speaker with a more pronounced directional behaviour corresponding to the length. This effect can also be seen in Fig. 11. The lateral secondary maxima are caused by the spatial rectangular windowing and are unavoidable, but are also located at a level that is more than 12 dB below the main maximum. The widening of the main maximum with increasing angles between the individual LINA elements is clearly visible, but with a certain fraying out at the edges. On the other hand, the space between the isobars remains even and does not tear out even for the maximum element-to-element angle of 11°. The low-mid beam, which can already be recognized here, increases noticeably with the increasing length of the array. Such behaviour is principle-based and occurs with all line arrays. Meyer Sound (like some other manufacturers) offers the possibility to superimpose an electronic beam forming for a frequency range of up to approximately 800 Hz. With this, the beam can be expanded and, if necessary, readjusted in the tilt angle. The filters for this are set in the Galileo Galaxy processor. The only requirement is that the Galaxy processor has to supply each array speaker with its own signal.

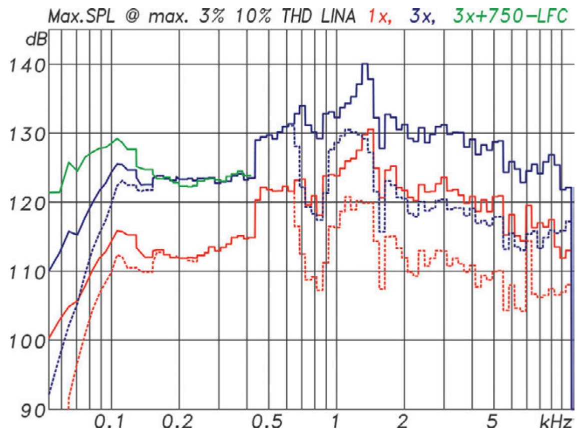




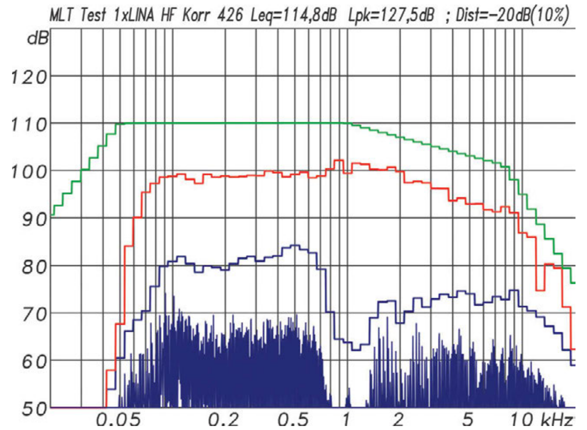




Isobars *for a small array consisting of three LINA elements with element-to-element angles of 0°, 3°, 7° and 11° (Figs. 11-14)*



Sinus burst maximum level measurement *for maximum THD of 3% and 10%. In red for a single LINA, in blue for three elements and in green with 750-LFC (only for 10% limit value) (Fig. 15)*

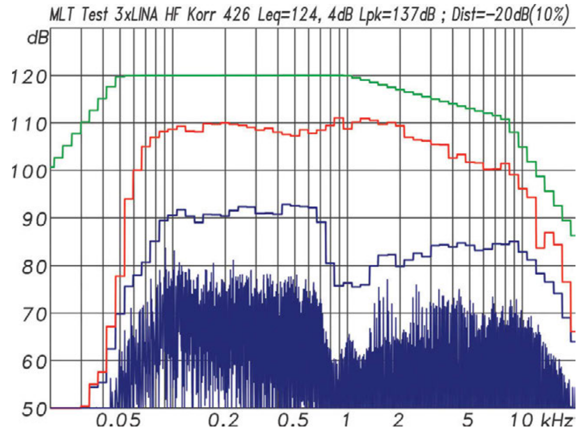


Multi-tone measurement *of a single LINA with HF compensation. With a maximum of 10% distortion (THD+IMD), a signal with an EIA-426B spectrum (green) and a 12 dB crest factor achieves 114.8 dB as Leq and 127.5 dB Lpk. Total signal spectrum in red and distortion components in blue (Fig. 16)*

Meyer Sound LINA: maximum level

In our test reports, Production Partner has been using two methods to measure the maximum loudspeaker level for some time now: on the one hand, the measurement with 185 ms long sinusoidal burst signals. Here, the level for a frequency is increased with a sinusoidal signal 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.

We first used the sinus burst method to measure a single LINA. The two red curves in Fig. 15 show the values for a maximum distortion of 3% and 10%. Where both curves coincide, the 10% limit was not reached before a limiter stepped in and prevented a further level increase. This is the case for the frequency range from 150 Hz to 700 Hz, where the two 6.5” drivers operate with little excursion and only the limiter protects against thermal overload by preventing a further level increase. Below 150 Hz, the increasing diaphragm excursion here causes the distortions of the driver to come into play, which then also determine the 10% limit value. The same applies to the tweeter’s working range, where the 3% and 10% curves differ by 10 dB. The 10 dB difference is typical for compression drivers and indicates k2 dominated distortions. The blue curves were measured using the same procedure for an array of three LINA units with 0° element-to-element angles. Accordingly, the achievable values for the 3% and 10% measurements increase by almost 10 dB. Up to 400 Hz, approximately 123 dB are reached, beyond that it was 130 dB and more. However, it should be remembered that the array was angled at 0°. If the opening angle is increased and/or the array lengthened, the high and low frequencies approximate. For a single line array element, the tweeter therefore appears to be completely oversized in the maximum level measurement. In the array, the woofers connect and support each other, while – due to the



Multi-tone measurement *of an array consisting of three LINAs with HF compensation. With a maximum of 10% distortion (THD+IMD), a signal with an EIA-426B spectrum (green) and a 12 dB crest factor achieves 124.4 dB as Leq and 137 dB Lpk. Total signal spectrum in red and distortion components in blue (Fig. 17)* curving – the tweeters share the total space angle and are "on their own". If a 750-LFC subwoofer is added to the 3 element array, a full 126 dB is possible at 60 Hz – with an increase to 129 dB at 100 Hz. Three LINAs as tops and a 750-LFC as subwoofer thus result in a good compact PA.

A second maximum level measurement, that is even more meaningful in practice, is the multi-tone measurement. The foundation of the multi-tone signal consists of 60 sinusoidal signals with random phase, whose spectral weighting can be set at will. For the measurements shown in Figs. 16 and 17 for a single LINA and the 3-element array, a weighting corresponding to an average music signal (green curve) was selected. The crest factor of the measurement signal synthesized in this way – which describes the ratio of the peak value to the effective value – is a practical value of 4 (corresponding to 12 dB). For the distortion value derived from this type of measurement, all spectral lines that 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, the level is also increased until the total distortion (TD) reaches a limit of 10%. The total distortion includes total harmonic distortion components (THD) and intermodulation distortions (IMD).

Under these conditions, the small triple array with a typical music spectrum according to EIA-426B reached a peak level of 137 dB and an average level of 124.4 dB at a distance of 1 m in open space under full room conditions. For a single LINA, the values were 127.5 dB peak and 114.8 dB Leq. The Leq value is well comparable with the value from the sinus burst measurement. The peak value, which is approximately 12 dB higher, proves that the system is still able to transmit undistorted signals with a relatively high crest factor of 12 dB even at full load.

Flyware *on the LINA with angle adjustment from 0° to 11° in 1° steps; the connection panels are protected against water and dust with cover*

LINA accessories and flyware

As is customary for and expected of a professional loudspeaker system, the LINA offers a wide range of accessories for everyday use with constantly changing requirements. For rigging, MINA/LINA Multipurpose Grid is available for up to 16 LINA units with a safety of 5:1 and German BGV C1 (DGUV regulation 17) conformity when set with the specified angle ranges. The actual load distribution of the array can be calculated using Meyer Sound's MAPP software. LINA systems can be flown without additional intermediate frames located underneath the 750-LFC subs. The Multipurpose Grid can also be used as a basis for ground stacks. The U bracket can be deployed for a maximuof

Sample rack *with Galaxy processor and SIM analyser*

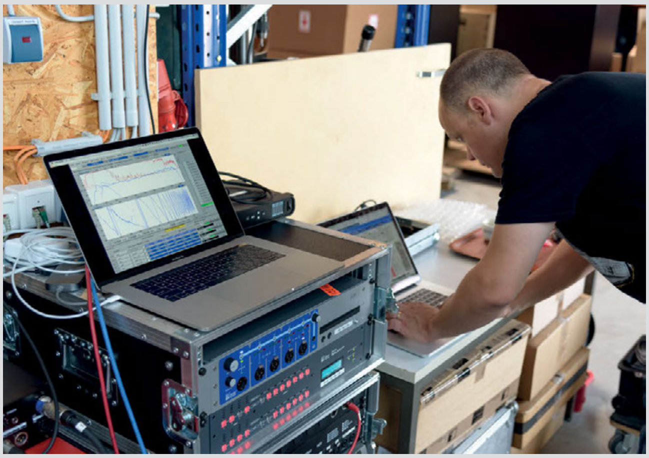
Comparative measurements with M-Noise

In Production Partner's 3/2019 issue (and online at www.production-partner.de), M-Noise has already been covered in detail. Here, we will now briefly take up the topic again with reference to the LINA measurements.

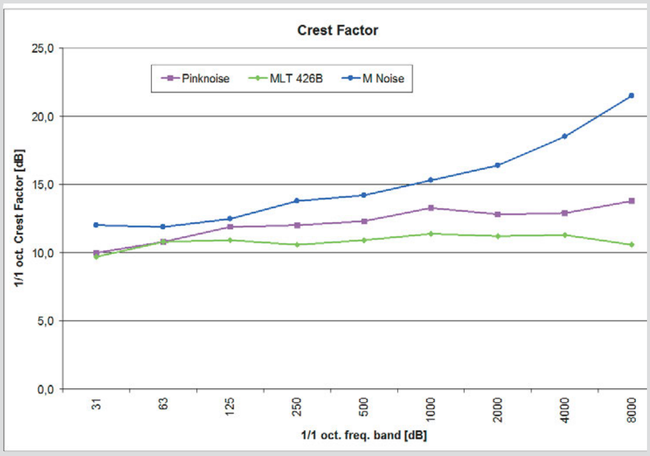
Meyer Sound had analysed and statistically evaluated various music signals. In addition to the spectral composition, the crest factor was also determined, but not only as broadband, as is usually the case, but also dependent on the frequency band. The result showed that the crest factor increases in the higher frequency bands, which is not surprising, especially when it comes to percussive music.

As an obvious consequence of this finding, a new noise signal was synthesized which shows a comparable behaviour to the analysed music signals. The result is the M-Noise (where the "M" does not stand for "Meyer", but instead for "music"). For an M-Noise measurement, the M-Noise signal is first used to measure a reference frequency response in the loudspeaker's linear working range. One can easily check if one is operating in the linear working range: If one increases the level by a few dB, the frequency response is not allowed to change. During our LINA test, Merlijn van Veen carried out a parallel M-Noise measurement using the SIM-3 system, in which the entire measurement process is integrated as a function. Two measuring microphones were used. One was located at the actual measuring position approximately 4 m away from the loudspeaker, while the other was positioned relatively close to the loudspeaker. The second microphone was used exclusively to test the signal coherence between the measurement signal and the signal emitted by the loudspeaker. The coherence of the two signals describes their linear dependence or similarity and is a good indicator for possible nonlinear distortions. In order to determine the coherence as free as possible from possible disturbances caused by the room or the environment, a second microphone is used which is located close to the loudspeaker. For the measurement carried out here under laboratory conditions in an anechoic room, the second microphone would not have been absolutely necessary, but we would like to demonstrate the basic procedure.

The SIM3 measurement from Fig. 19 shows the frequency responses in the upper half and the phase responses in the lower half. The green curve is the reference frequency response, the blue curve is its progression shifted downwards by 2 dB. The actual measurement now looks like this: the level is continuously increased until the current measurement (red curve) deviates from the reference by a maximum of 2 dB in a frequency range of two or more octaves. The deviations are caused by power compression,

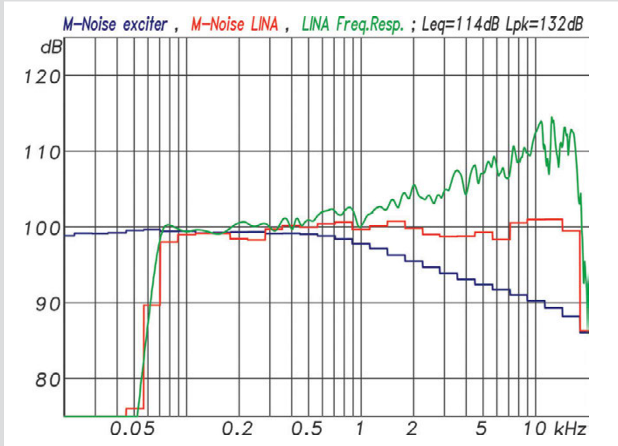


Double measuring *Merlijn van Veen supported us with a parallel M-Noise measurement*



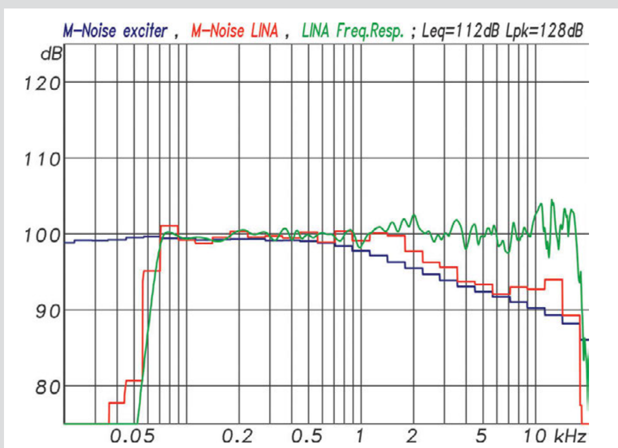
Crest factors *after third octave bands of a pink noise (pink), of a multi-tone signal with EIA-426B spectrum (green) and of M-Noise (blue)* limiter use and the like. In order to keep an eye on the distortions during the measurements, the signal coherence, which should not fall below 91% on the SIM scale, is also monitored at the same time. For a coherence of less than 91%, strong signal distortions can be assumed.

The M-Noise measurement was performed with a single LINA loudspeaker with and without tweeter compensation. Parallel to the SIM, our MF laboratory measurement system also recorded the levels. When the 2 dB limit from Fig. 19's red curve was reached, the measured sound pressure level was 132 dB peak and 114 dB mean level Leq. If the HF EQ for a single speaker is included in the signal way, the level values drop to 128 dB peak and 112 dB Leq. The correlation quickly becomes clear, since a single LINA causes a powerful treble boost without EQ, where the more powerful tweeter can fully exploit its level reserves and drive the level up. With EQ, this HF surcharge is eliminated and the level is correspondingly lower. The 132 dB peak measured without EQ corresponds exactly to the data given in LINA's data sheet.



M-Noise measurement *of a single LINA in the array setting without HF compensation. The blue curve shows the M-Noise's spectrum, the green curve depicts LINA's frequency response and the red curve shows the measured signal's spectrum. The SIM3 used for the measurement demonstrated a maximum power compression of 2 dB and only minor deviations in signal coherence. The mean level Leq determined in this way was 114 dB and the peak level Lpk was 132 dB. Both values refer to 1 m distance in an open field (Fig. 20).*

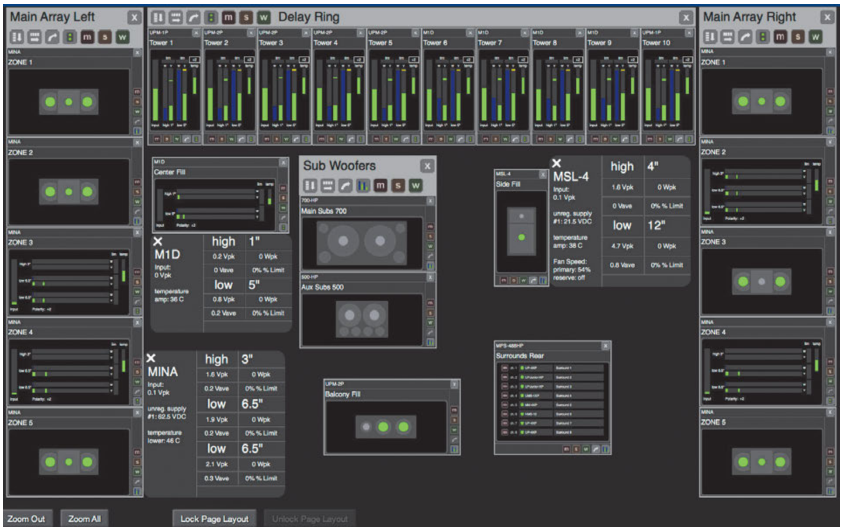
M-Noise measurement *with the Meyer Sound SIM3. In the upper half the frequency response and coherence measurement; below the corresponding phase responses (Fig. 19).*



M-Noise measurement *of a single LINA in the setting for a single speaker with HF compensation. The measured mean level Leq was now 112 dB and the peak level Lpk was 128 dB (Fig. 21).*

two LINA systems on a tripod, with a tripod rod on a subwoofer or for a maximum of four flown LINA systems. The same applies to a large U bracket with which up to four LINAs can also be operated in a flown or standing mode. For transport, Meyer Sound offers trolleys with nylon protective covers for a maximum of five LINAs can also be used for rigging.

In addition to the mechanical accessories, the Galaxy Galileo processor and the distribution module should also be mentioned. The Galaxy processor is available as 408 or 816 with four or eight inputs and eight or 16 outputs respectively and can be deployed as a central distributor for multi-zone operation or for electronic beam forming within an array. The processor is operated via the Compass software. An MDM-832 distribution module for up to eight lines can be used to distribute power, audio signals and RMS bus. It has eight audio inputs that can be flexibly routed to the outputs via switches. Power is supplied via a 32 A Powercon connector, which is divided into four Powercon 20 output sockets each via two 15 A circuit breakers.



Compass software *to monitor the speakers using the LINA's optionally available remote monitoring system (Fig. 18)*

Compass software and RMS

A lot of Meyer Sound loudspeakers already come with an RMS module (Remote Monitoring System) or, as is the case with the LINA, can be optionally equipped or retrofitted with it. The RMS can be used to completely monitor the loudspeakers using the Compass software and allows the remote control of some functions. The transmission takes place via a simple and robust twisted-pair cabling with a data rate of 78 Kbps. The connection can be made via Weidmüller plugs or – even easier – together with the audio signal via the five-pin XLR. A maximum of 50 loudspeakers can be connected to one RMS bus.

The connection to the PC or MAC is established using the RM-Server, a small 1 RU device with an Ethernet and a RMS connection as well as two contact inputs and two contact outputs each for external mute access and error messages. The external mute connection can, for example, be used by the central fire alarm system to mute the system if an alarm occurs. For systems with more than 50 RMS loudspeakers, several RMS servers are simply connected to the PC via a network.

Compass is Meyer Sound's software for controlling Galaxy controllers, CAL beam forming speakers and RMS functions. From here, all loudspeakers can be completely monitored both individually or in groups. The control of all system ways, temperatures and possible errors are displayed. Using the software, the loudspeakers can be muted individually or in groups or switched to solo mode for testing.

Meyer Sound LINA: test summary

In a conclusion about Meyer Sound's LINA one could write, as has been done often, that it is a highly professional line array, that it meets all of the usual requirements, that the measured values are good and that the housings are extremely solid. All of this is true. But what sets LINA highly apart from other highly professional systems is the complete package around the loudspeaker. This package includes various accessories, the RMS system, the Compass software, the Galaxy processors, the distribution modules and, of course, the SIM system for measuring and testing the systems. Meyer Sound's MAPP XT, a planning tool for acoustic and mechanical properties, should also not go unmentioned. All together, these ensure a fast, simple and safe installation – be it mobile or permanently installed. Finally, the price comes into play, which may sound like a lot at first. However, one has to consider what is already integrated, from amplifiers and controllers to remote monitoring – and that a lot of manufacturers do not even publish such a single price in the first place: systems of this type are not sold as individual pieces, but rather the modules fit into a system solution with a wide range of accessories.