

The objective

The many-faceted demands placed on a modern, future-proofed touring concept carved the foundation behind the development of the GAE-Director series. The motivation for development of the GAE Director systems was derived from the demands placed on a speaker system tailored especially to the needs of the German and European event markets. These demands have given rise to a full-range loudspeaker system for highest power requirements, combining maximum reliability with excellent economy.

The majority of European productions involving speech and music reproduction are staged in front of audiences which redefine the meaning of "arena-sound" when compared with US-American dimensions. The relatively few European productions of US-American proportions, where gigantic sound systems have to play to audiences in excess of 50,000 people, are generally catered for by only a small number of major US-American or British rental companies incorporated within the logistics of gigantic Tour productions and accompanied by the listing of superlatives in the "technical" press journals. These outstanding events however, have very little to do with the numerous tours in municipal-, sports- and ex-factory buildings which make up the majority of productions within the European concert landscape. With this in mind, it appears that there is, momentarily, a certain distortion present in the expert discussion as to the applicability of certain sound systems.



These arguments lead to a list of standard requirements and basic aspects which characterise the demands on a new sound-system concept:

- Uncompromising operational-compatibility allowing configurations to suit large, touring array-applications down to a minimum-configuration as a "Stand-alone-system".
- Fulfilment of all requirement-profiles and operation-areas within a tour-situation (F.O.H. / Side-fill-monitoring / F.O.H. side-wing-fill) by the employment of a universal concept.
- Flexible and practical functionality: through the employment of professional "lifting-points" (MAN) for flying, through moderate weight and enclosure size for stacking stability.
- Configuration and unexceptionable suitability for the employment in fixed installations.



From the sum of the construction details the **Director system** draws the following product features:

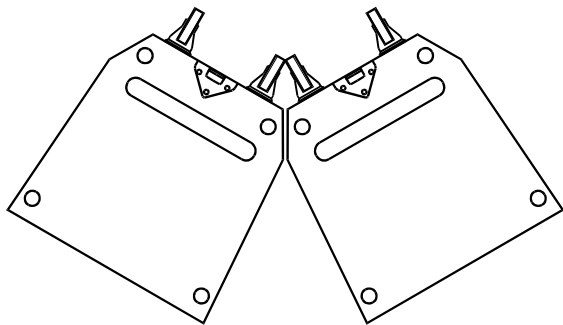
- compact enclosure-shaping and -dimensions with a reserved, smart design
- moderate weight
- highest possible efficiency with maximum possible functional safety
- exact dispersion-behaviour
- long-term, dependable parameter-consistency
- tough design, exact workmanship, clear construction for easy maintenance- and service-operations
- intelligent handle-construction for optimal handling with minimal manpower.
- safe and certified engineering for the "flying" of the system with few standard elements
- clearly arranged cabling to the highest mechanical standards
- identical enclosure shaping of top- and bass-system
- tonality

Electro-acoustical concept

The smallest possible number of system-components and a maximum of flexibility guarantee a future-proofed economical investment.

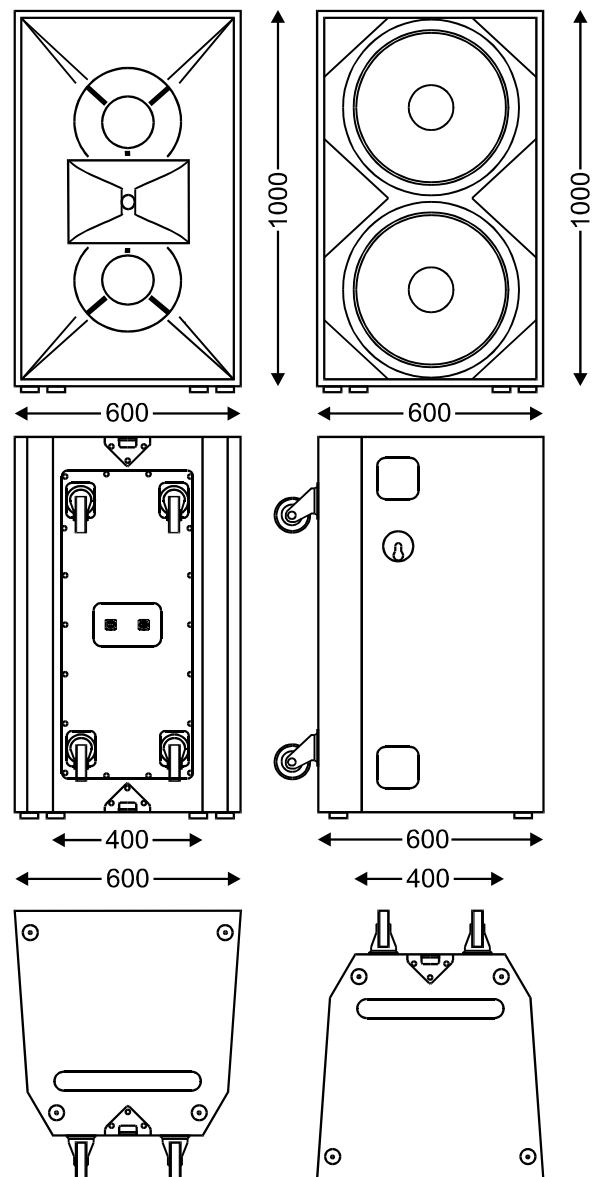
Less is more...

The completely new developed, twin-coaxial-principle enables a precise symmetrical dispersion characteristic - the basic requirement for perfect "stacking". A precise dispersion-angle of 60° horizontal and 40° vertical creates the possibility of carrying-out single-stack-operations as well as expansive array-productions.



The high efficiency reduces material requirements to a minimum.

The Director's ability to exactly focus sound on the desired audience-area overcomes the influence of "bad" room-acoustics which have a negative effect on the final sound. The uncompromising construction of the sound-guide is reflected in the balanced frequency-response and the high efficiency of the system's individual paths.

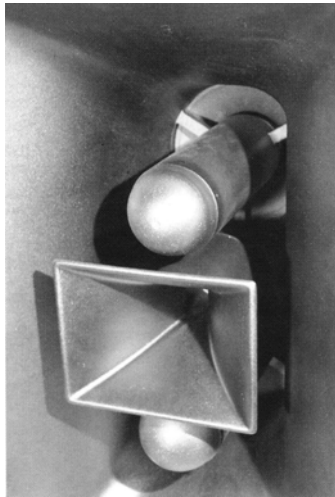


Director-Top

The cleverly constructed, twin-coaxial arrangement of the 1.5" N/Dym driver and the two 12" chassis allow an ideal and symmetrical dispersion characteristic in both horizontal and vertical planes from the **GAE Director Top** whilst adhering to the smallest possible enclosure dimensions. The two custom-developed 12" speakers with 4" voice coils are loaded with specially tuned phase plugs optimising the compression rate and providing an extended frequency range at the best possible reproduction linearity.

Due to the system construction allowing the acoustical centre of the components to be as close together as physically possible, the dispersion in the horizontal and (especially) in the vertical planes are absolutely symmetrical. Taking into consideration the chassis proximity and the wavelength at the cross-over frequency, a virtual single-point-source system is achieved. This acoustical advantage is also present in conventionally constructed coaxial systems, however, in the case of the Director Top, the double 12" horn-throat allows for reduced horn and enclosure depth whilst increasing the power handling capacity in the transition range to the bass system.

The specially designed outer sheathing of the 1,5" horn together with the shaping and positioning of the 12" phase plugs are responsible for the reduction of horn-surface-reflection disturbances moving them out of the relevant frequency range. As such the use of damping material on the surface of the mid-range horn could be avoided.



The aperture area of the mid-range horn corresponds to the entire loudspeaker-front allowing radiation-resistance as well as radiation-consistency to be distinctly extended down to the lower frequencies.

The impedance of the two 12" transducers connected in parallel, along with that of the 1,5" driver allow the operation of two Director tops on one side of a power-amplifier for each of the ways. A specially constructed protective-high-pass for the 1.5" driver provides DC protection by utilising a high-pass filter of 1st order as well as performing special, often neglected, attenuation duties.

Director-Bass

The planning of the bass enclosure was preceded by the usual discussion as to whether a bass-reflex or a band-pass design should be employed. As well as the well-known advantages and disadvantages of the different types of enclosure, special attention was placed, from both the measurement as well as the tonal point of view, on the homogeneous transition to the mid-high system.

Whilst the bass-reflex construction covers the sub-low region with its resonator and works in the cross-over area to the low-mid horn as a direct radiator, the band-pass system, with its high and low tuned-resonators, is coupled to the low-mid horn by its high resonator. From a measurement point of view this coupling has no adverse effects on the frequency response. However, when additionally taking into account the decay response, it can be seen that this resonator has a long decay opposed to the short and exact decay of the horn-loudspeaker. It goes without saying that the transition from the long decaying response of the resonator in the band-pass system to that of the "fast" horn is not necessarily of tonal advantage and as such, underlined the decision for the direct radiating bass-reflex system. Furthermore there were no compromises incurred by taking this decision due to the extremely linear excursion of the 18" loudspeaker which shows no power-loss in comparison to the band-pass variation.



Two long-excursion 18" loudspeakers with unusual construction details can to be found in the GAE Director Bass. The voice-coil and pole-plate dimensioning of these driver's allow for an extreme linear- excursion of the membrane. A special cooling system as well as the innovative optimising of all moving parts allow high continuous power handling peaks of up to 6000 Watt whilst maintaining low power-compression.

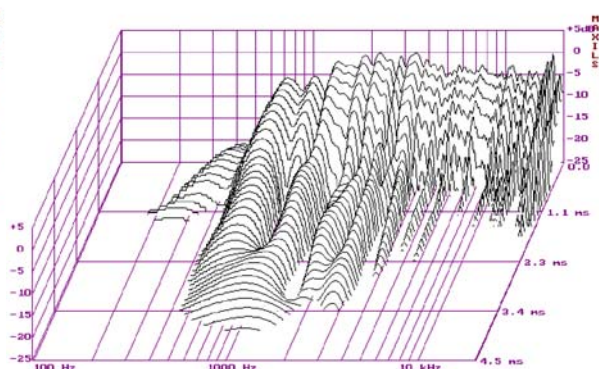
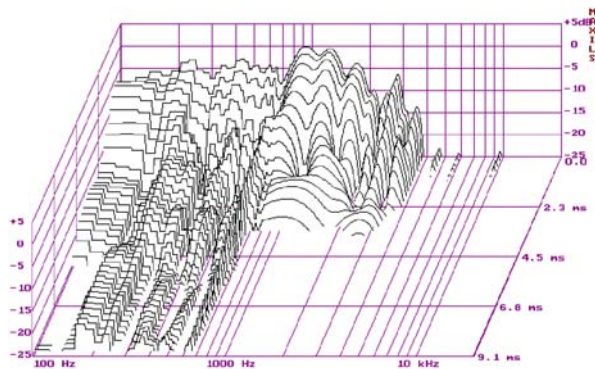
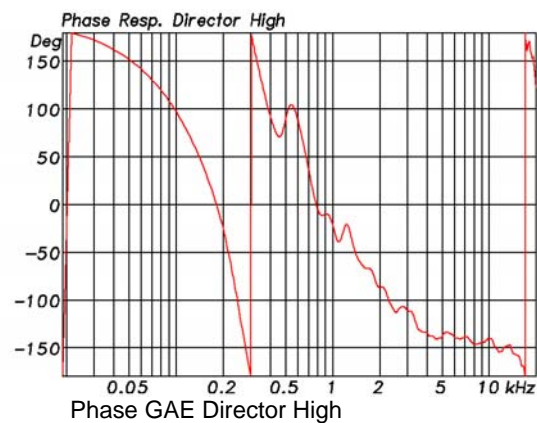
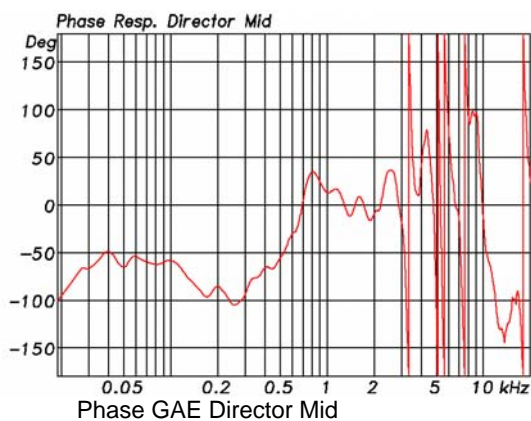
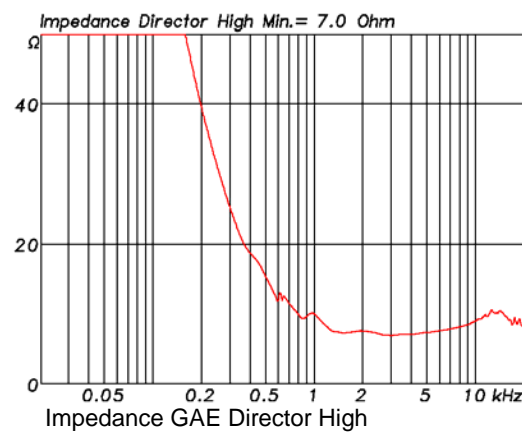
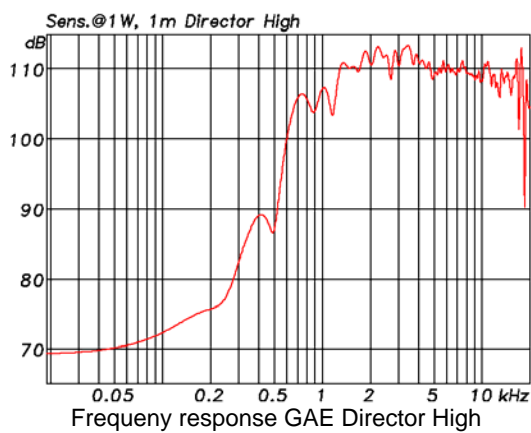
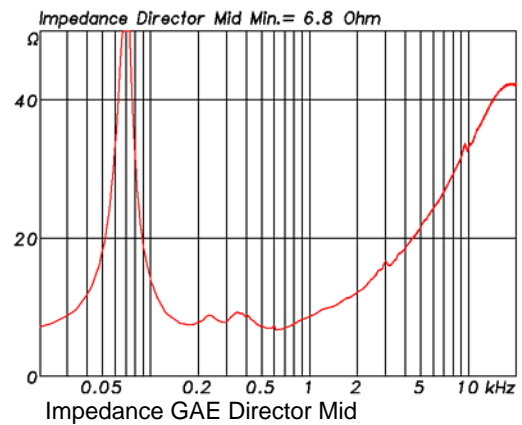
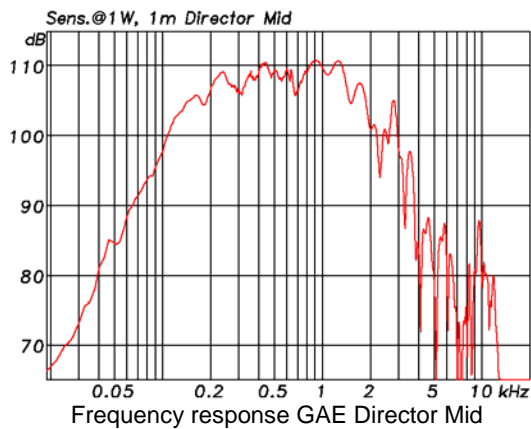
The extremely compact bass-system with only 330 litres volume called for special detail-solutions to achieve the development target: the single-chamber enclosure is optimally matched to the volume requirement by utilising broad-area resonator venting. The form and the positioning of the venting guarantees the best possible use of the baffle and ensure the symmetrical loading of the 18" loudspeakers. Furthermore the art of construction supports a maximum stiffening of the baffle and the enclosures outer walls. Additionally the magnets of the bass loudspeakers are evenly cooled by the resulting ventilation stream.

As well as their primary function, extensive carrying recesses and enclosure angling also help to reduce enclosure wall resonance. The ideal positioning of high-quality damping material effectively reduces unwanted cavity resonance.

Technical Specification Director Top

<i>The design</i>	2-way mid-/high-system, twin-coaxial, horn-loaded (/P: passive Filter)
<i>The transmission range</i>	120Hz – 18kHz
<i>The input-power to IEC-Norm 268-5</i>	Low-/mid-horn: 2 x 12" cone driver 16Ω in parallel connection 700W IEC 8Ω
.....	HF-horn: 1 x 1,5"-driver 8Ω 120W IEC
<i>The impedance</i>	8Ω nominal
<i>The dispersion behaviour</i>	60°x40° Constant Directivity upwards of 500Hz
<i>The sensitivity at 1W/1m</i>	108dB
<i>The maximum sound-pressure SPL (1m)</i>	>138dB
<i>The components</i>	2x12" cone driver
.....	1.5" N/Dym hf-driver
<i>The fittings</i>	MAN flying system for accepting MAN HWSPB-studs, 100mm wheels
<i>The enclosure</i>	Cabinet made from multi-layered birch-plywood sealed with a 2-component, polyurethane, structure varnish; 6 ideally positioned carrying recesses for ergonomic handling; robust, framed front-grill backed with acoustic foam with high acoustical transparency
<i>The recommended amplifier power</i>	12" LS: 750W – 1200W / 8Ω
.....	1,5" LS: 250W - 350W / 8Ω
<i>The electrical connections</i>	ITT Cannon CA-COM 8pin (/P: CA-COM 4pin)
<i>Type legend:</i> CA-COM 8 pole CaxxCOM-E22-23-yB	
xx: 02 enclosure-plug/-socket	
xx: 06 cable-plug/-socket with bayonet-sheath	
xx: 01 cable-extension-plug/ -socket without bayonet-sheath	
y: P contact inset male	
y: S contact inset female	
<i>The wiring</i>	PIN A = LOW+ PIN B = LOW– PIN C = LOW+ PIN D = LOW– PIN E = MID+ PIN F = MID– PIN G = HIGH+ PIN H = HIGH–
	} (through connection for Director Bass)
	(12"-loudspeaker, 2 pieces in parallel connection) (12"-loudspeaker, 2 pieces in parallel connection) (1,5"-driver) (1,5"-driver)
<i>The weight</i>	90kgs
<i>The dimensions</i>	100cm high / 60cm wide / 60cm deep

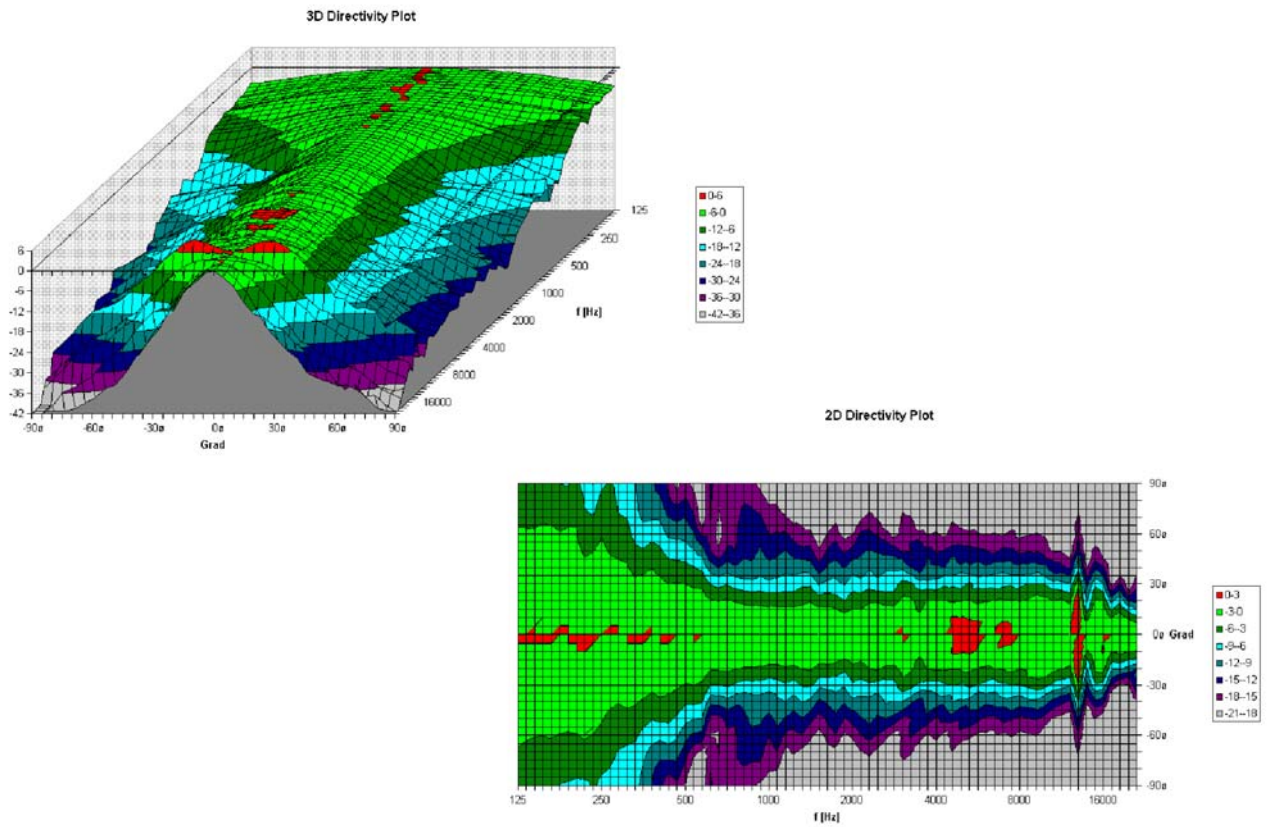
Measurements



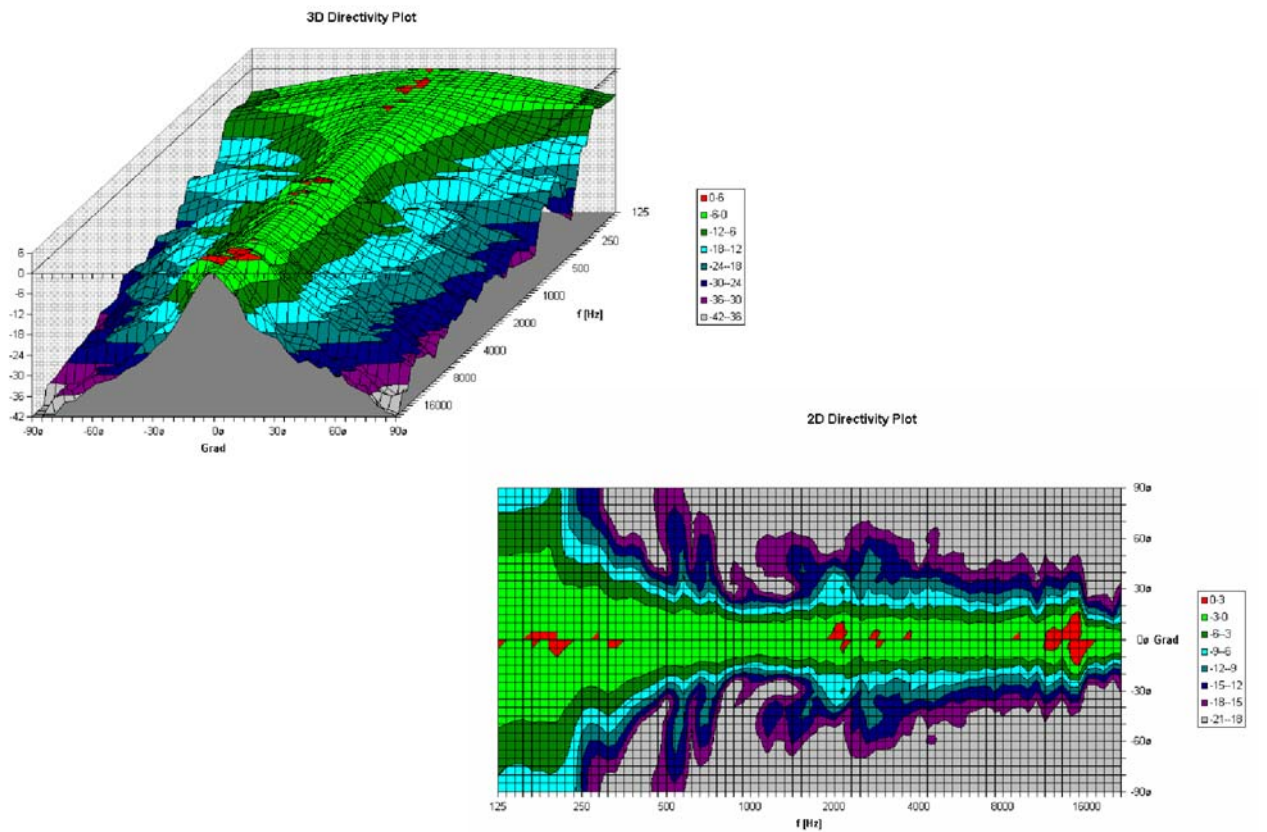
Spectral decay GAE Director Mid

Spectral decay GAE Director High

Directivity GAE Director Top horizontal



Directivity GAE Director Top vertical



Technical Specification Director Bass

<i>The design</i>	Vented, bass-reflex system for low-frequency reproduction (/P: wiring for passive Top)
<i>The transmission range</i>	45Hz – 150Hz
<i>The input-power IEC-Norm 268-5</i>	2 x 18" high-excursion cone-driver 8Ω in parallel connection 2000W IEC 4Ω
<i>The impedance</i>	4Ω nominal
<i>The dispersion behaviour</i>	Dependent on stacking-/cluster-variation
<i>The sensitivity at 1W/1m</i>	100dB
<i>The maximum sound-pressure SPL (1m)</i>	>135dB
<i>The components</i>	2x18" high-excursion cone loudspeaker
<i>The fittings</i>	MAN flying system for accepting MAN HWSPB-studs, 100mm wheels
<i>The enclosure</i>	Cabinet made from multi-layered birch-plywood sealed with a 2-component, polyurethane, structure varnish; 6 ideally positioned carrying recesses for ergonomic handling; robust, framed front-grill backed with acoustic foam allowing high acoustical transparency
<i>The recommended amplifier-power</i>	18" LS: 1500W – 2500W / 4Ω
<i>The electrical connections</i>	ITT Cannon CA-COM 8pin (/P: CA-COM 4pin)

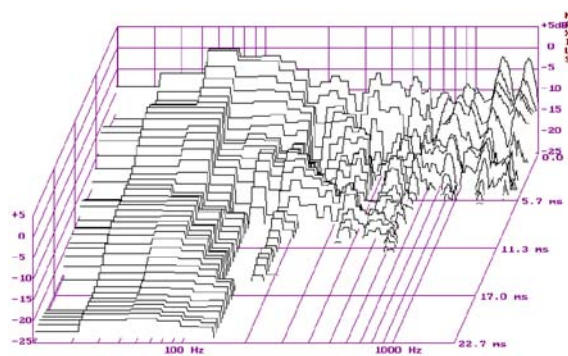
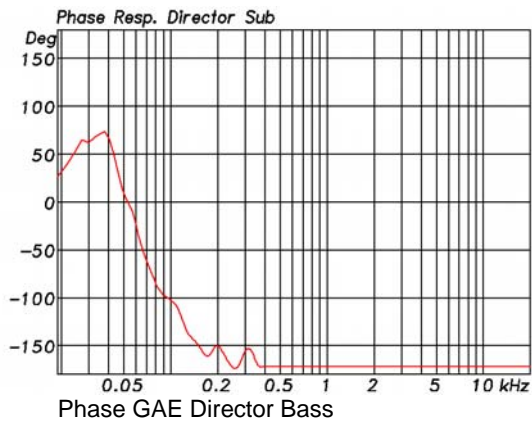
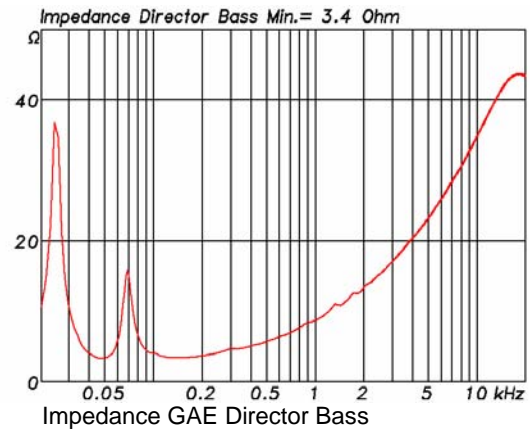
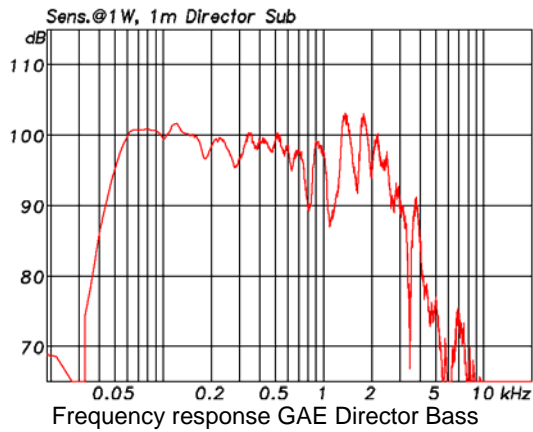
Type legend: CA-COM 8 pole CAxxCOM-E22-23-yB
 xx: 02 enclosure-plug/-socket
 xx: 06 cable-plug/-socket with bayonet-sheath
 xx: 01 cable-extension-plug/
 -socket without bayonet-sheath
 y: P contact-inset male
 y: S contact-inset female

<i>The wiring</i>	PIN A = LOW+ (18"-loudspeaker, 2 pieces in parallel connection)
	PIN B = LOW– (18"-loudspeaker, 2 pieces in parallel connection)
	PIN C = LOW+ (18"-loudspeaker, 2 pieces in parallel connection)
	PIN D = LOW– (18"-loudspeaker, 2 pieces in parallel connection)
	(PIN A/C and B/D jumpered within the loudspeaker-enclosure)

PIN E = MID+	} (through connection for Director Top)
PIN F = MID–	
PIN G = HIGH+	
PIN H = HIGH–	

<i>The weight</i>	80kgs
<i>The dimensions</i>	100cm high / 60cm wide / 60cm deep

Measurements



Spectral decay GAE Director Bass

Controller

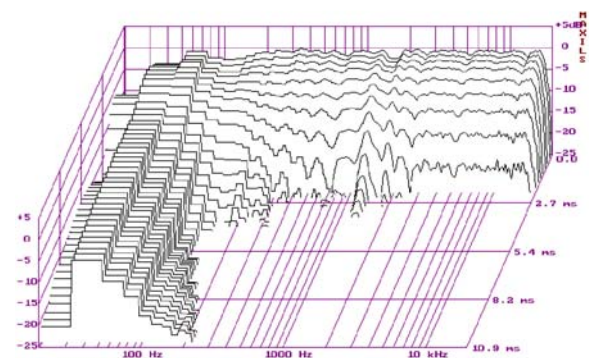
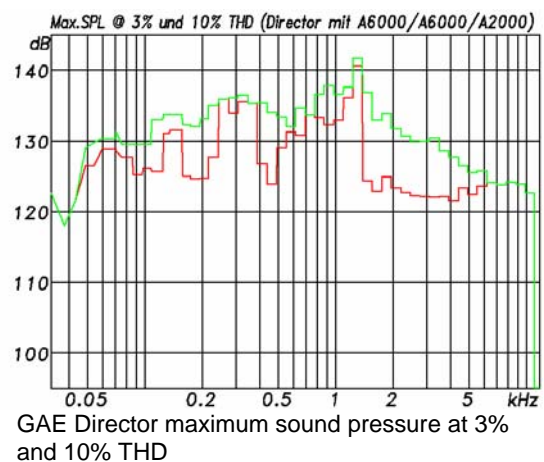
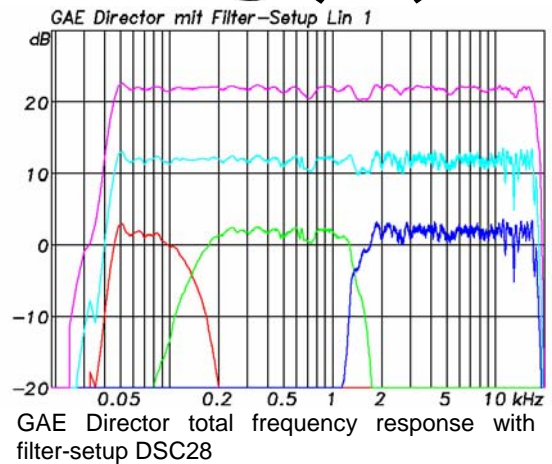
The driving of the system is performed by the digital signal controller Digital PA Master DSC28 incorporating FIR-filter-technology.



The 2-channel-system-controller DSC28 harmonically blends the three frequency-bands of the Director-system together and performs the equalisation of the whole system by exploiting modern digital-technology. An additional 4th channel configured as a standard SUB-bass-output can be used to drive additional bass systems. The high-precision limiters provide exact level-control at maximum power-efficiency without negative sound influences. By combining the utilised loudspeaker-components with this system-controller an extraordinary operational safety is achieved. The balanced, neutral sound-characteristic of the Director-system forms the basis for clear, distortion-free sound-reproduction from fixed-installations to huge outdoor festival applications.

Upon request GAE can supply recommended set-ups for controllers from other manufactures. Because controllers produced by different manufacturers show divergent intrinsic delay-times, system-combination in a "mega-event" situation only makes sense when using identical controllers.

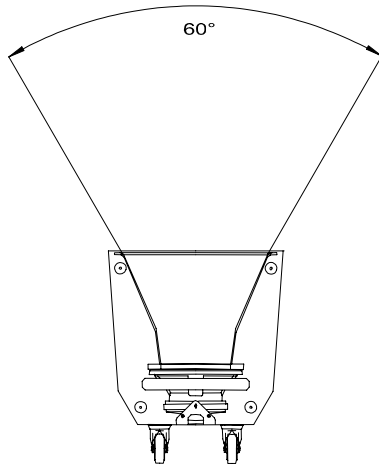
For further information regarding the Digital Signal Controller DSC28 please see the respective booklet.



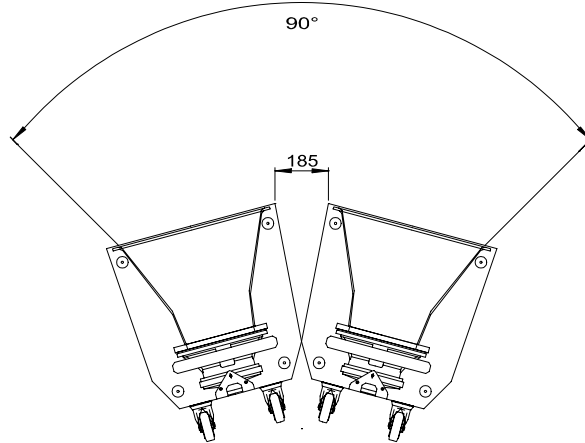
Spectral decay GAE Director full system

Horizontal dispersion, range of application

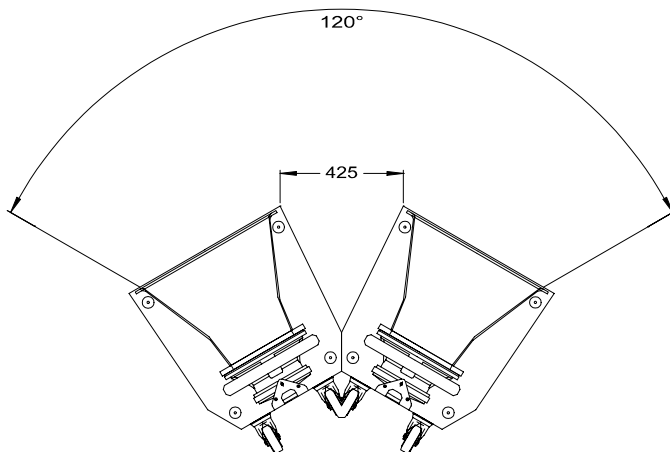
The enclosure shaping of the GAE Director system allows various grouping possibilities with pre-determined dispersion angles. The following horizontal dispersion characteristics apply to the Director Top:



60°-dispersion

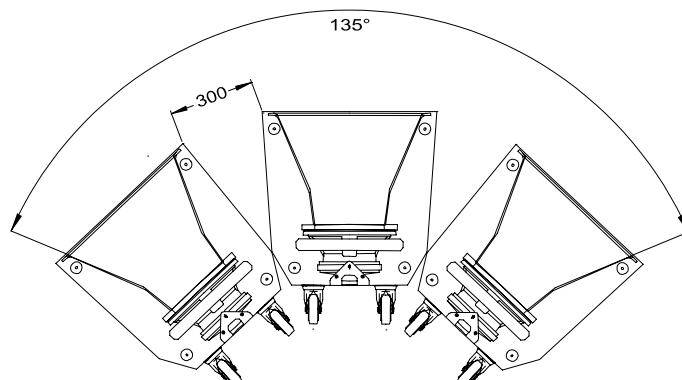


90°-dispersion, 185mm opening at front edge

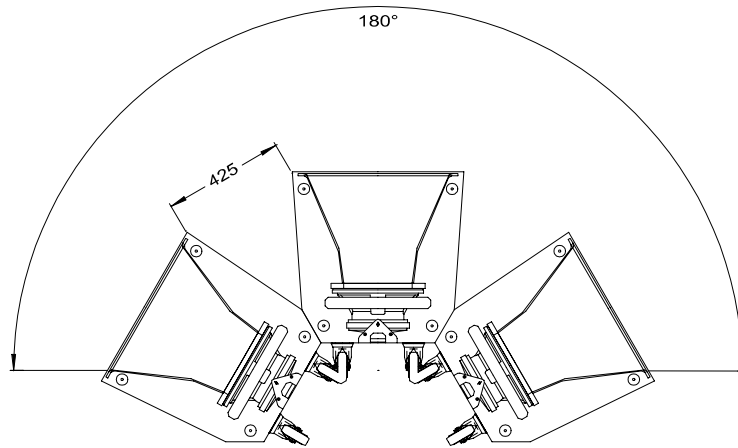


120°-dispersion,
rear shaping coupled
425mm opening at front edge

For high power requirements 120°-dispersion can be arranged with 3 systems. (2x 185mm opening at front edge)

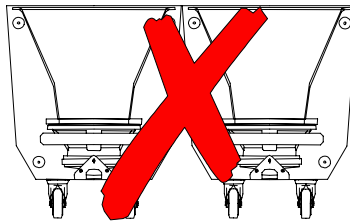


135°-dispersion, 300mm opening at front edge

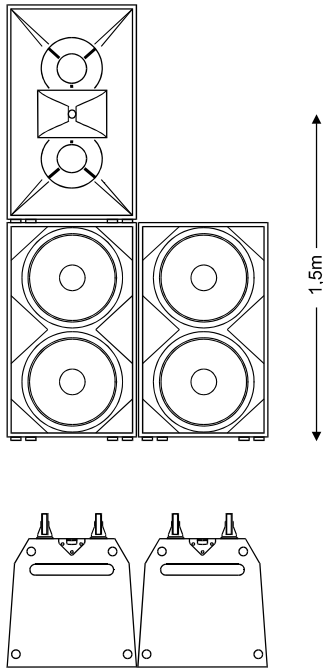


180°-dispersion, rear shaping coupled, 425mm opening at front edge

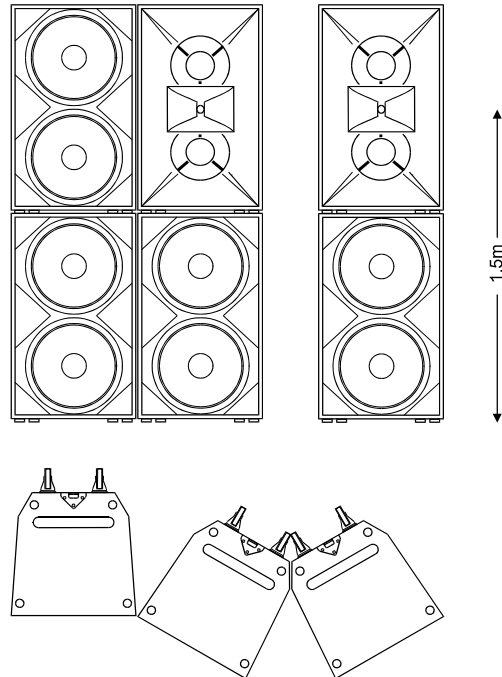
DO NOT operate tops in a linear formation!



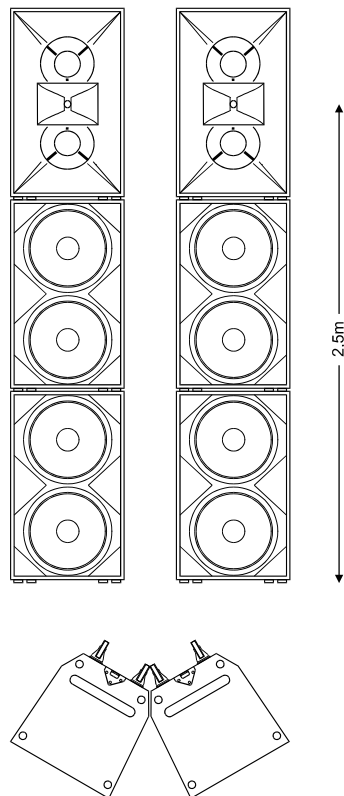
Stacking



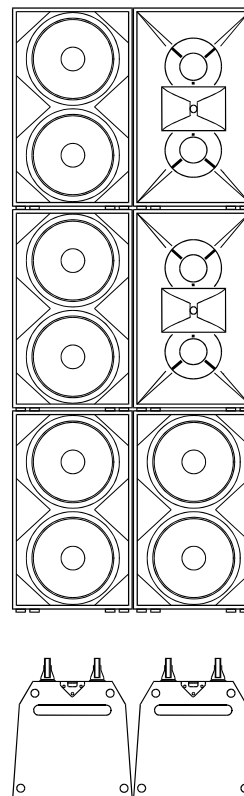
Example 1: 60° medium-throw operation. Stacked on stage. Height of hf-driver above stage level 1.5 meters, height of hf-driver above ground level 1.5m+stage height.



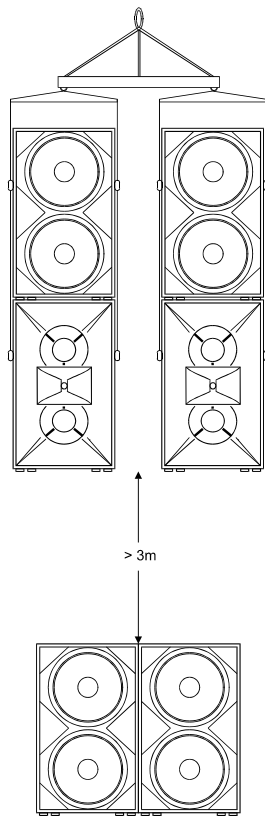
Example 2: 90°-120° medium-throw operation. Stacked on stage. Height of hf-driver above stage level 1.5 meters, height of hf-driver above ground level 1.5m+stage height.



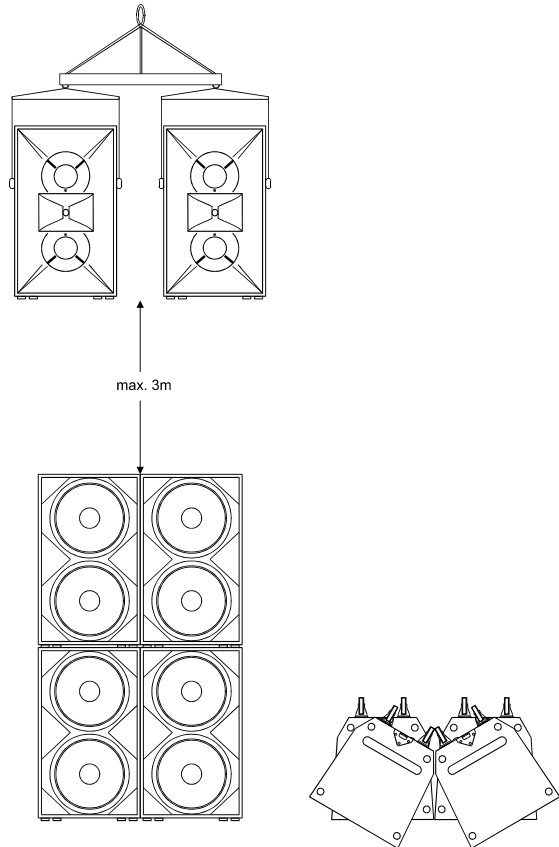
Example 3: 90°-120° medium-throw operation. Stacked at ground level. Height of hf-driver above ground 2.5 meters.



Example 4: 60° long-throw operation. L-form stacking of bass-systems supports a long distance response.

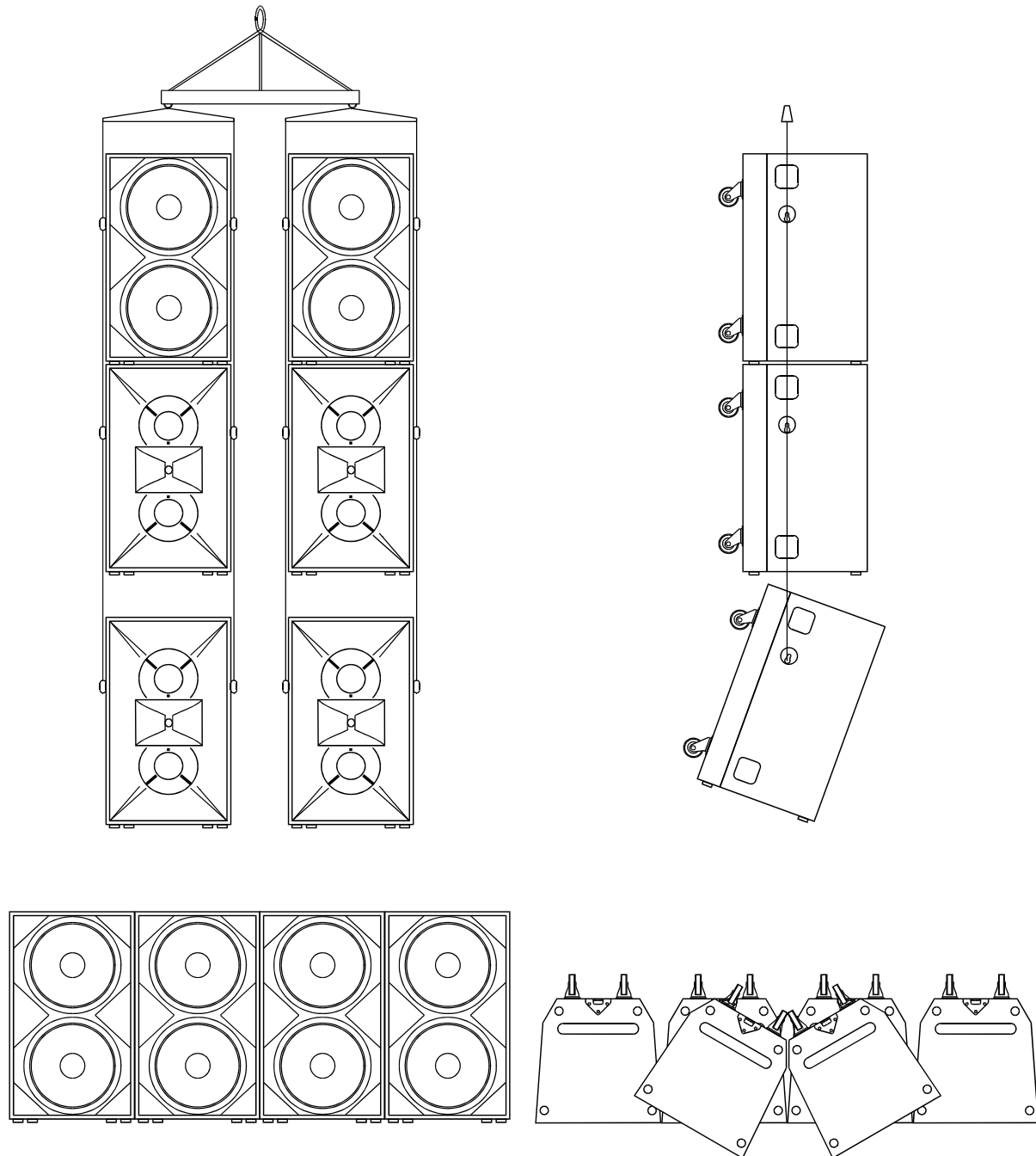


Example 5: 90°-120° medium-throw operation with 2 flown tops. Without flown basses the distance between tops and ground-stacked basses should not be more than 3 meters.



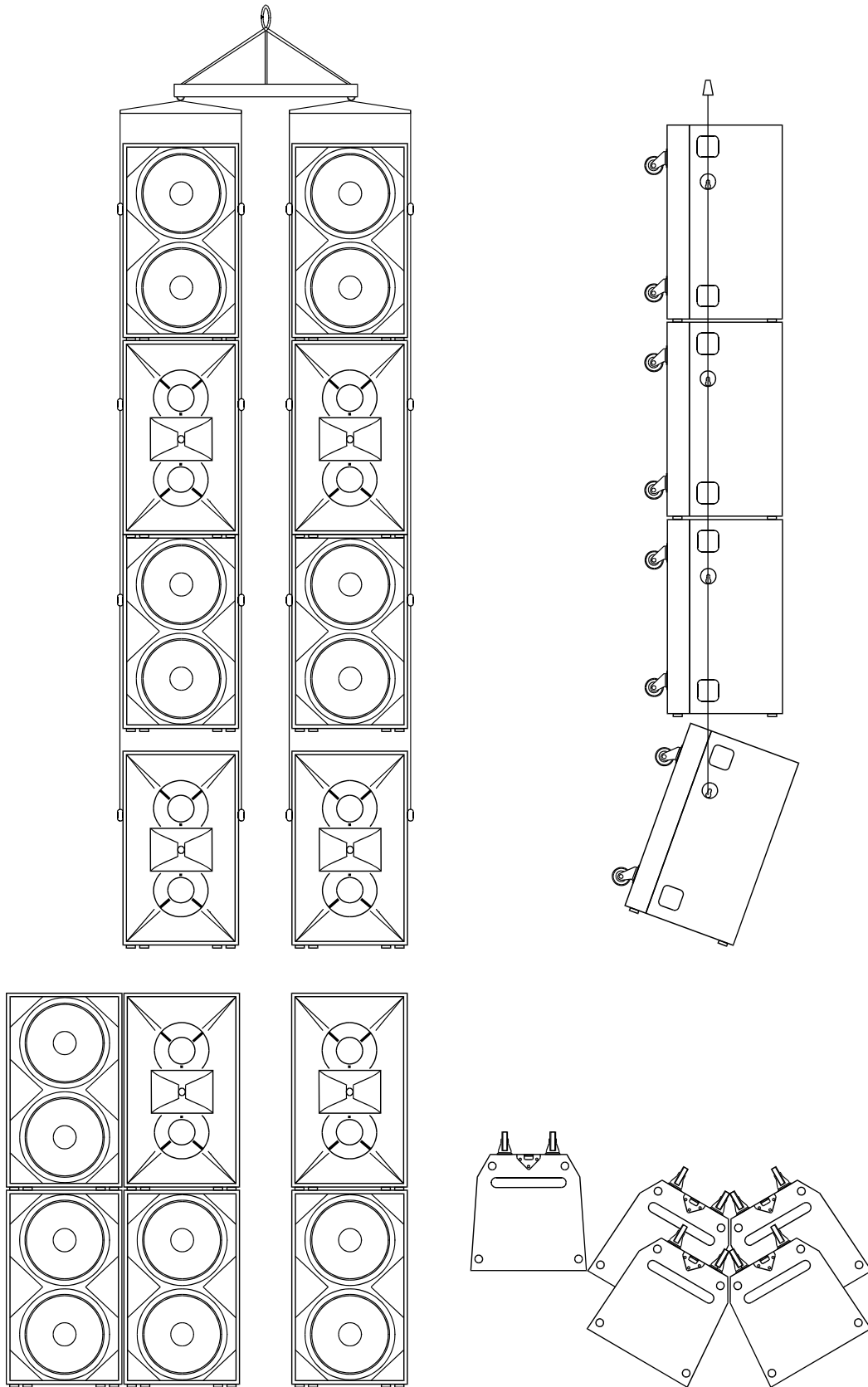
Example 6: 90°-120° medium-throw operation with 2 flown tops and basses. Flying bass systems allows the distance between flown systems and the ground-stacked basses to be greater than 3 meters.

Example 7:



90°-120° medium-/long-throw operation with 4 flown tops and 2 flown basses. Depending on performance power-level requirements the ground-stacked bass fundament can be configured up to earthquake level. For a wider spread sound-response the lower top-combination may be curved. A level decrease of up to 6 dB (respective of the tilting angle) may be useful in acquiring a homogenous sound dispersion in the vertical plane.

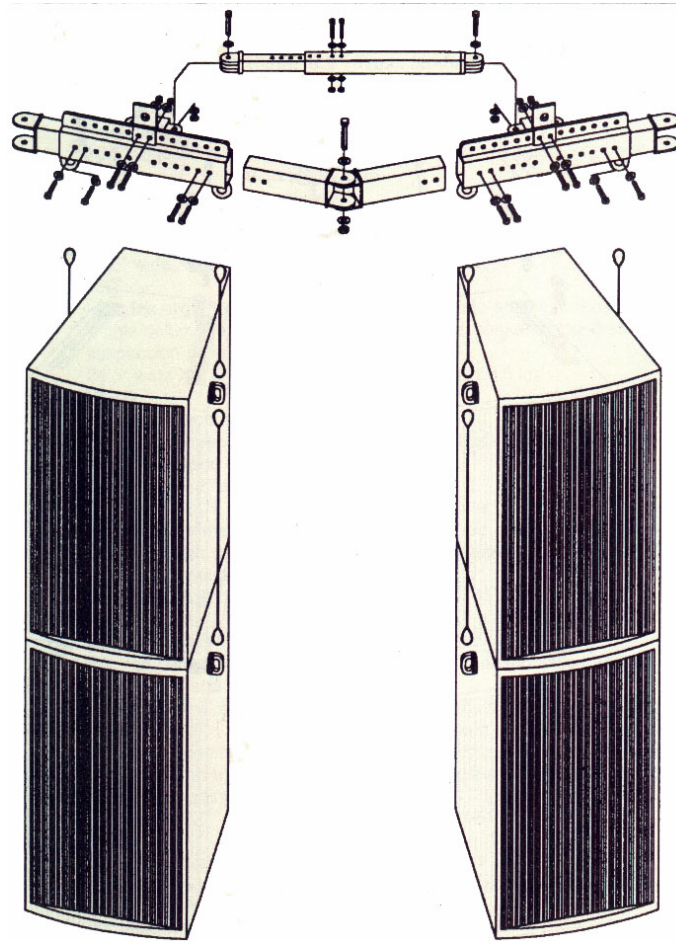
Example 8:



Arena-sound application. For a wider spread sound-response the lower top-combination may be curved. A level decrease of up to 6 dB (respective of the tilting angle) may be useful in acquiring a homogeneous sound dispersion in the vertical plane.

Rigging:

The favourite system for flying Director loudspeakers is manufactured by ATM. Most of our customers use components of the ATM MEGS3x4-series.



The picture above shows the usage of the following parts: (2 columns beneath)

- 2 pcs. ATM MEGS-575-T Truss Module
- 1 pcs. ATM MEGS-520-TB Truss Splay Bar

The so called „Truss Module“ is the upper cradle, the „Splay-Bar“ consists of an adjustable pole to fix the angle between two Truss Modules. The length of the Splay-Bar MEGS-520-TB is chosen to enable a correct horizontal angle between two Director tops.

The vertical angle for curving can be fixed by straining belts. For a placement of such belts you will find two fittings on the back of each Director system.

All information regarding ATM products can be downloaded at www.atmflyware.com. Experienced riggers may choose another system or modifications.

To align Director-Systeme beneath each other, our customers are using the following chain lengths:

Length of chain between Fly-Bar and first box

Application length 0,402m

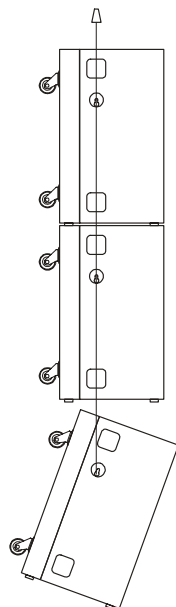
Length of chain between two close boxes

Application length 0,960m

Length of chain between two curved boxes

Application length 0,996m

These chains are assembled with a hook on one side and a shackle on the other. The length is measured between the points of touching the following Studs.



It is also possible to use steel ropes. The length must be adjusted to the application length listed above.



is a product of

opal audio vertrieb GmbH

Esch 13b, D-33824 Werther, Fon ++49-(0)5203-236/-7, Fax -238

Internet: <http://www.gae.de> / E-Mail: info@gae.de

All GAE-products undergo continuous scrutiny with regards to optimal functionality and as such are constantly being improved. Product refinements serving the purpose of technical advancement, increased operational safety or extended functionality may be carried out and be introduced to standard production by GAE without previous notice.

We are always pleased to receive comments, hints and suggestions for improvement with regards to all of our GAE-products.

All GAE-products are manufactured in Germany.