

line array

**BEYMA LINE ARRAY SYSTEM PROJECT
LA10-3V AND SUB218**

Beyond making sound

beyma //

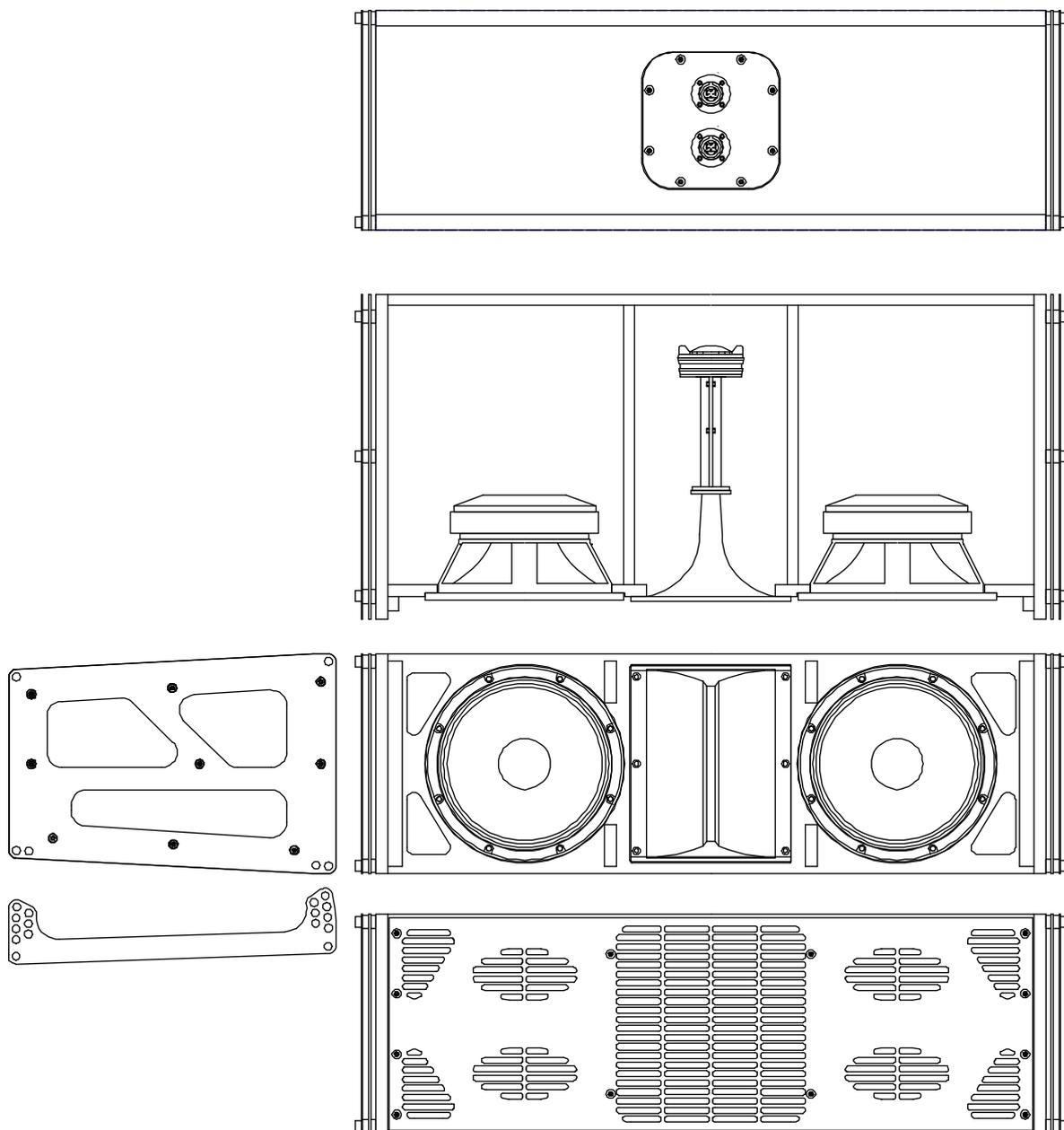
PROFESSIONAL LOUDSPEAKERS



1° PRESENTATION OF THE SYSTEM. LA3V210

The system that we are going to describe is a three-way Line Array system. It is made up of:

- A LF via that mounts the Beyma model 10G40.
- A MF via that mounts the model Beyma 10MI100.
- And a HF via composed by two WL4 waveguides and a diffuser specially designed for its specific use in this application, the TDWL4. The profile of the horn has been calculated thru numerical methods to optimize the dispersion and transient response of the WL4 units.



BEYMA LINE ARRAY SYSTEM PROJECT LA10-3V AND SUB218

2° LF VIA: 10G40

This low frequency transducer is specially intended for the most demanding applications. Its design concept arises from the need of achieve a more resistant loudspeaker that matches the more and more power given by ultimate amplification systems.

In order to accomplish that, almost every component of the speaker has been reconsidered: its voice coil has the benefits of an improved manufacturing process, made with the highest quality materials and the diaphragm has been carefully developed to give an extremely flat, smooth response. These characteristics make its integration in compact systems covering the low frequency range a straight-forward task. Moreover, its parameters has been optimized to obtain an excellent bass response when used in small bass-reflex cabinets.

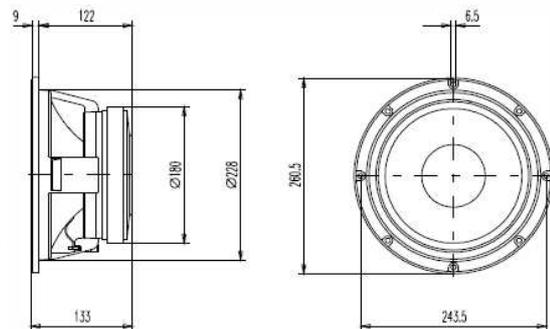
TECHNICAL SPECIFICATIONS

Nominal diameter	250 mm. 10 in.
Rated impedance	8 ohms
Minimum impedance	7.2 ohms
Power capacity	400 w AES
Program power	800 w
Sensitivity	96 dB 2.83v @ 1m @ 2π
Frequency range	45 - 4000 Hz
Recom. enclosure vol.	20 / 70 l 0.7 / 2.6 ft. ³
Voice coil diameter	77 mm. 3 in.
Magnetic assembly weight	5 kg. 11 lb.
BL factor	17.9 N/A
Moving mass	0.051 kg.
Voice coil length	20 mm
Air gap height	8 mm
X damage (peak to peak)	28 mm



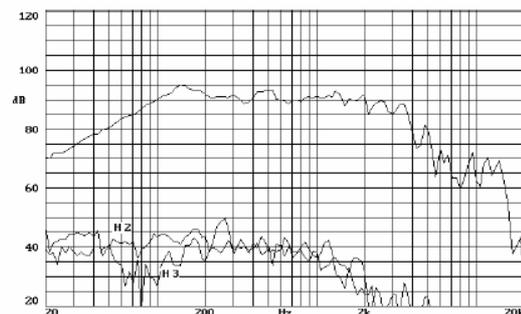
MOUNTING INFORMATION

Overall diameter	260.5 mm. 10.26 in.
Bolt circle diameter	243.5 mm. 9.59 in.
Baffle cutout diameter:	
- Front mount	228 mm. 8.98 in.
- Rear mount	230 mm. 9 in.
Depth	133 mm. 5.24 in.
Volume displaced by driver	3 l 0.1 ft. ³
Net weight	5.7 kg. 12.5 lb.
Shipping weight	6 kg. 13.2 lb.



THIELE-SMALL PARAMETERS

Resonant frequency, fs	55 Hz
D.C. Voice coil resistance, Re	6 ohms.
Mechanical Quality Factor, Qms	6.47
Electrical Quality Factor, Qes	0.33
Total Quality Factor, Qts	0.31
Equivalent Air Volume to Cms, Vas	33 l
Mechanical Compliance, Cms	164 μm / N
Mechanical Resistance, Rms	2.75 kg / s
Efficiency, ηo (%)	1.6
Effective Surface Area, Sd (m ²)	0.0380 m ²
Maximum Displacement, Xmax	6 mm
Displacement Volume, Vd	227 cm ³
Voice Coil Inductance, Le @ 1 kHz	1 mH



BEYMA LINE ARRAY SYSTEM PROJECT LA10-3V AND SUB218

3° MF VIA: 10MI100

This low-mid frequency transducer offers three main points of interest: a high efficiency (5.2 %), an extremely linear frequency response and a low harmonic distortion. These characteristics make it suitable for high quality sound reinforcement systems, especially for live applications.

Beyond its frequency response advantages, this loudspeaker offers more: it takes profit of the improvements achieved in our low frequency-high power transducers. Thus, it incorporates a high quality voice coil and a large magnetic assembly to provide efficient heat dissipation. Thanks to this design concept of strongness, the 10 MI100 reaches a considerable power handling (350 WAES).

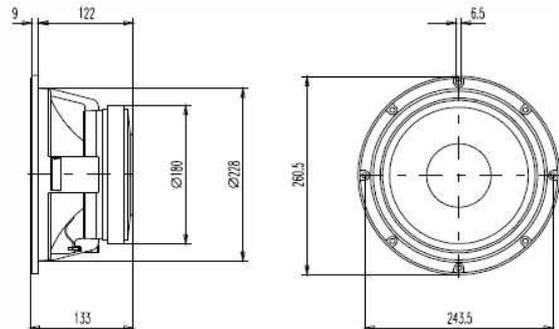
TECHNICAL SPECIFICATIONS

Nominal diameter	250 mm.	10 in.
Rated impedance		8 ohms.
Minimum impedance		8 ohms.
Power capacity*		350 w AES
Program power		700 w
Sensitivity	101 dB	2.83v @ 1m @ 2π
Frequency range		70 - 4000 Hz
Recom. enclosure vol.	20 / 50 l	0.7 / 1.75 ft. ³
Voice coil diameter		77 mm. 3 in.
Magnetic assembly weight		6.5 kg. 14.2 lb.
BL factor		21.6 N / A
Moving mass		0.034 kg.
Voice coil length		13.5 mm.
Air gap height		9.5 mm.
X damage (peak to peak)		24 mm.



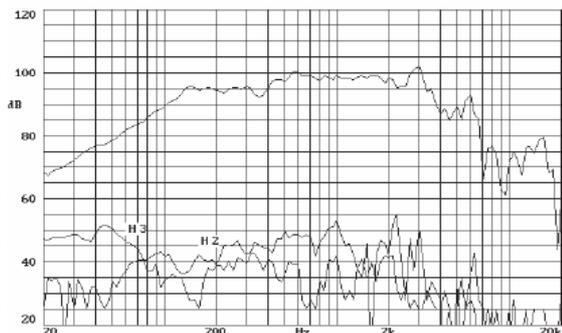
MOUNTING INFORMATION

Overall diameter	260.5 mm.	10.25 in.
Bolt circle diameter	243.5 mm.	9.58 in.
Baffle cutout diameter:		
- Front mount		228 mm. 9 in.
- Rear mount		230 mm. 9.05 in.
Depth	120 mm.	4.72 in.
Volume displaced by driver	3 l	0.10 ft. ³
Net weight	7.1 kg.	15.6 lb.
Shipping weight	7.5 kg.	16.5 lb.



THIELE-SMALL PARAMETERS**

Resonant frequency, fs	89 Hz
D.C. Voice coil resistance, Re	6.2 ohms.
Mechanical Quality Factor, Qms	7.2
Electrical Quality Factor, Qes	0.26
Total Quality Factor, Qts	0.25
Equivalent Air Volume to Cms, Vas	20 l
Mechanical Compliance, Cms	95 μm / N
Mechanical Resistance, Rms	2.6 kg / s
Efficiency, η ₀ (%)	5.2
Effective Surface Area, Sd (m ²)	0.0380 m ²
Maximum Displacement, Xmax	2 mm.
Displacement Volume, Vd	75 cm. ³
Voice Coil Inductance, Le @ 1 kHz	2.3 mH



BEYMA LINE ARRAY SYSTEM PROJECT LA10-3V AND SUB218



4° HF VIA: WL4 + TDWL4

This combination of high power neodymium compression driver with wave guide gives a straightforward solution to build a Line Array System, solving the difficult problem of achieving an optimum coupling between adjacent high frequency transducers. Instead of using expensive and complicated wave-shaping devices, a simple but effective wave guide transforms the circular aperture of the compression driver into a rectangular surface, without excessive angle aperture to provide low curvature to the acoustic wave front, arriving to fulfil the curvature requirement for optimal acoustic coupling between adjacent sources until 18 kHz. This is achieved with the minimum possible length for low distortion, but without being excessively short, which would cause strong high frequency interferences. This waveguide can be combined with loudspeakers of different diameters but it specially matches with 8", 6" and 5" loudspeakers.

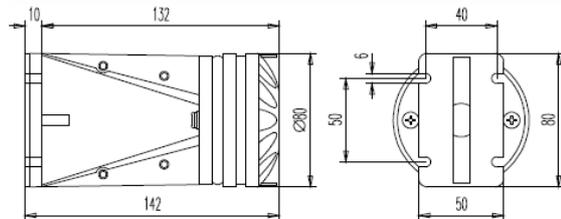
TECHNICAL SPECIFICATIONS

Throat diameter	20.5 mm. 0.8 in.
Rated impedance	8 ohms.
Minimum impedance	5.5 ohms. @ 4.5 kHz
D.C. Resistance	5.6 ohms.
Power capacity *	40 w AES above 1.5 kHz
Program power	80 w above 1.5 kHz
Sensitivity **	105 dB 1 w @ 1 m coupled to a 90° x 5° horn
Frequency range	0.7 - 20 kHz
Recommended crossover	1500 Hz or higher (12 dB/oct. min.)
Voice coil diameter	44.4 mm. 1.75 in.
Magnetic assembly weight	0.6 kg. 1.32 lb.
Flux density	1.8 T
BL factor	8 N/A



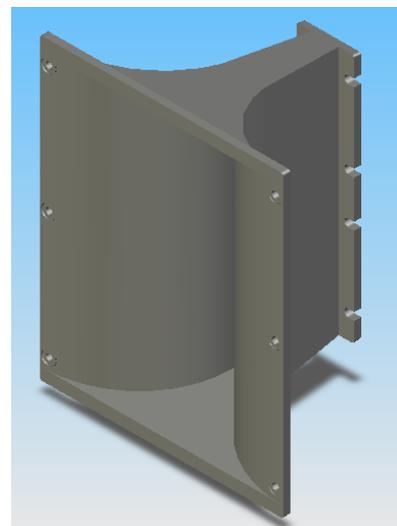
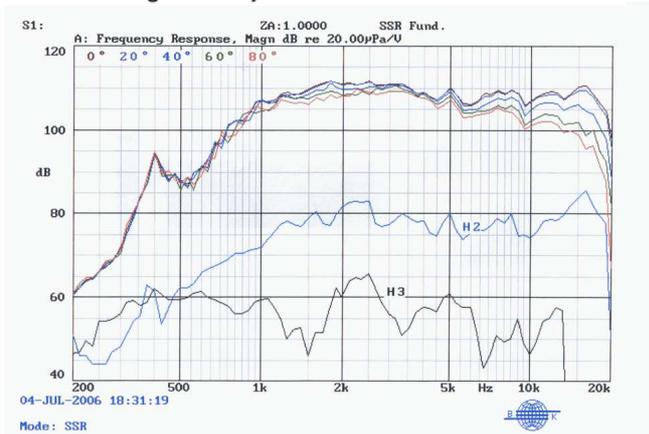
MOUNTING INFORMATION

Overall diameter	80 mm. 3.15 in.
Depth	195 mm. 7.68 in.
Mounting	Four 6 mm. diameter holes
Net weight (1 unit)	1.1 kg. 2.42 lb.
Shipping weight (2 units)	2.6 kg. 5.72 lb.



MATERIALS

- **Waveguide:** aluminium.
- **Driver diaphragm:** polyester.
- **Driver voice coil:** edgewound aluminium ribbon wire.
- **Driver voice coil former:** kapton.
- **Driver magnet:** neodymium.



5° DESCRIPTION OF THE SYSTEM.

The beyma philosophy behind this system is as follows: :

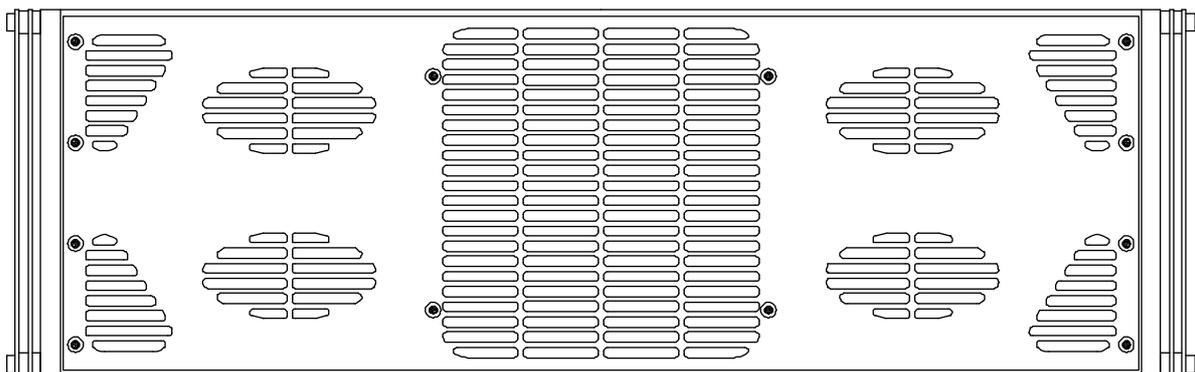
- 1° So that the result of the sound system is comparable to other positioned systems is essential:
- A) That it does not have appearance of "Kit" but of professional product.
 - B) That all the appearance of the system is solved, without the costumer must take pat of it.
 - C) And that the performance in terms of sonorous quality, as well as in the angle calibration of the system are the necessary for a Line Array system.

2° That fulfills all and each one of the necessary requirements of a Line Array:

- A) That the distance between the axes of the transducers is the correct one.
- B) That the intermodulation distortion is as small as possible.
- C) That the angle calibration between boxes is strictly exact.

3° That the assembly from the point of view of the client is easy, fast and without possibility of error, for it:

- A) All the complexity is in the "hardware", accessories and rest of components that are supplied to the costumer.
 - B) the product once finished, is versatile, practical and of easy handling. In summary, a good working tool.
- All the "hardware" of the system is cut by laser accurately of hundredth of millimetre.
 - The frontal grid acts like a phase corrector to as much obtain greater sound pressure in the mid via, as well as in the low frequency via. In addition, it solves the problem of the distance between centres of the midrange via for the fulfilment of the coherent sum of the wave front created by all the boxes, as well as providing excellent horizontal dispersion.
 - All the accessories are constructed in F1 steel grade, that confers the maximum mechanical resistance. Finished in satin black colour, with resistant painting to scratches and aging
 - The "hardware" is calculated to support in series 20 units hung in vertical with a safety factor of 7 to 1.
 - The pins are made of solid stainless steel, with a system of magnetic anchorage.
 - The plate of connections mounts a double Speakon connector of 8 contacts in parallel with a circuit plate that includes the internal wiring of the system.
 - It includes all the screws, nuts and bolts and the necessary pieces for the complete assembly of the system.
 - The bumper or flown system frame is calculated to support 20 units suspended in series with a safety factor of 7 to 1 and it is provided aside.

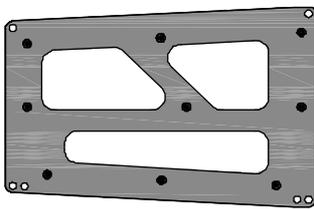


6° DESCRIPTION OF THE ALIGNMENT “HARDWARE”.

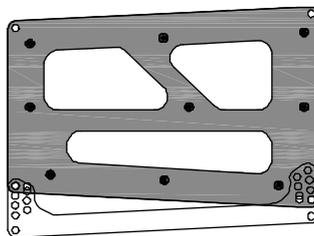
The alignment hardware for a LA10-3V box has to lateral steel plates and an alignment steel arm. In every lateral side of the acoustic enclosure, we will find:

- Two lateral steel frames 3 mm. thick, F1 grade steel, to be tighten in the lateral side of the box.
- One vertical alignment steel arm, 5 mm. Tic, F1 grade steel.
- Nine nº 10 harpoon nuts, inlaid in the inner said of the wooden box.
- Eighteen steel rings, 7 mm. Tic, to be fitted between the lateral steel frames and the lateral of the box.
- Four solid stainless steel with magnetic securing system.

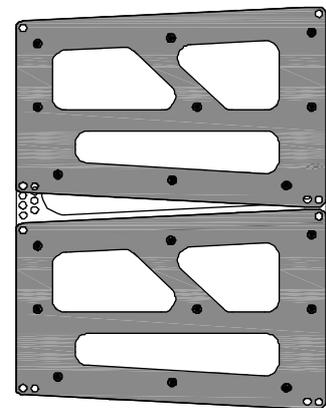
Lateral frame



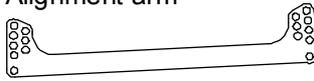
Lateral frame with arm in 0° angle



Lateral frames with arm in 0° angle

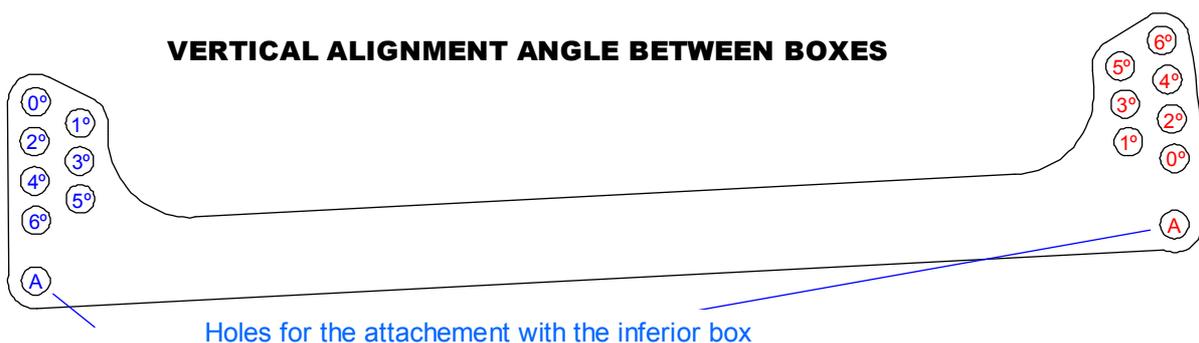


Alignment arm



The vertical orientation system has a steel alignment arm, with 16 holes which are used as follows:

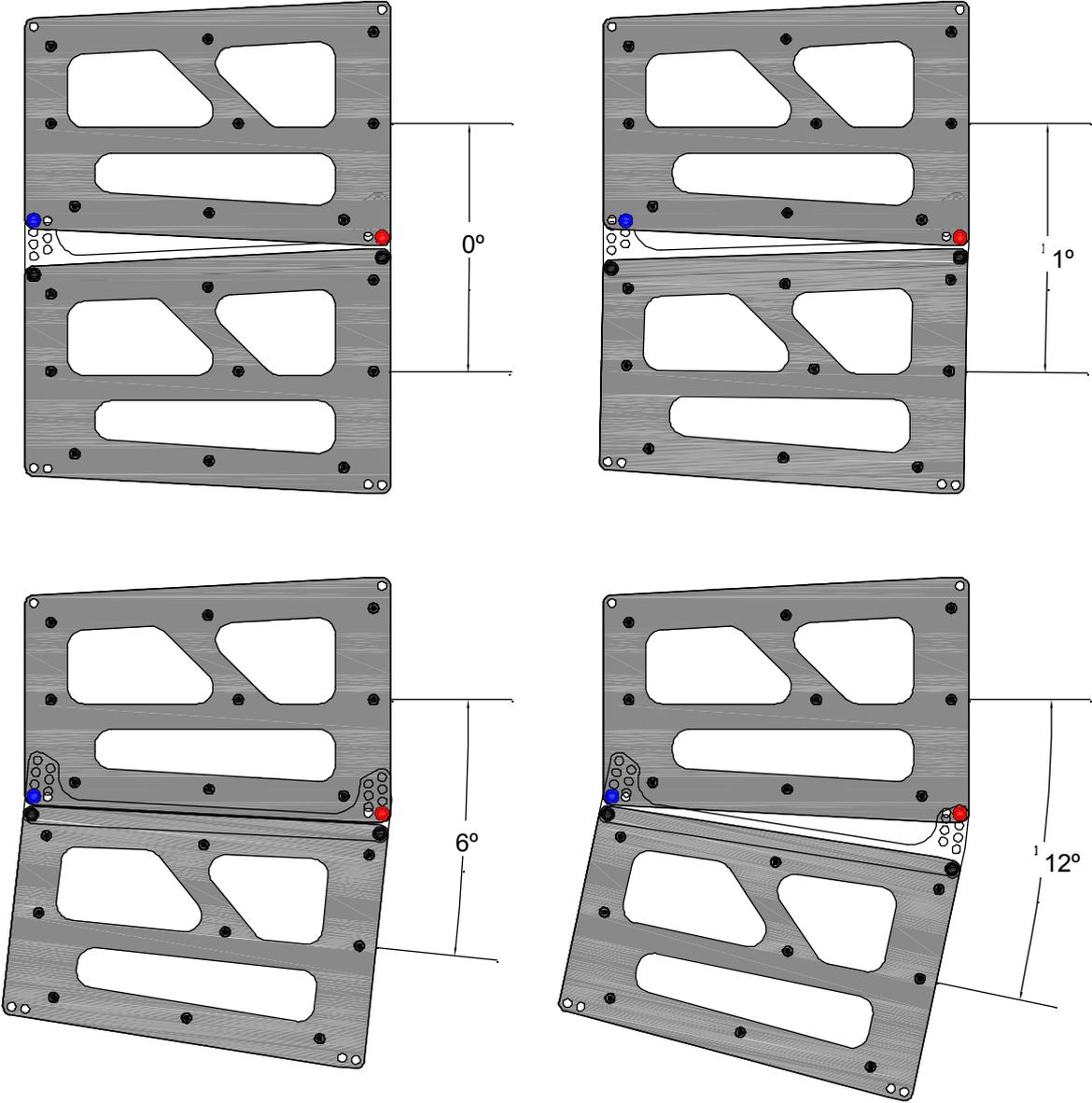
- For normal use, the front part of the arm should be used always with the pin in the 0° hole (red color in the drawing).
- To regulate the angle between adjacent boxes in the vertical direction, the back part of the arm should be used, by introducing the pin in the required hole, ranging from 0° to 6° angle between boxes. (blue color in the drawing).
- For alternative applications, as p. instance as a front fill, the front pin can be used to open the front angle of the box and direct the coverage of the box to a different audience area, arriving to a maximum of 12° angle in the front.



7° CONFIGURATION EXAMPLES

The vertical alignment system allows an orientation in 1° steps between boxes from 0° to 6°,

Next it can be seen some configuration examples with different angles between the boxes, with 0°, 1°, 6° and the special 12° degrees angle, for use of the box as a “front fill”



8° THE BUMPER

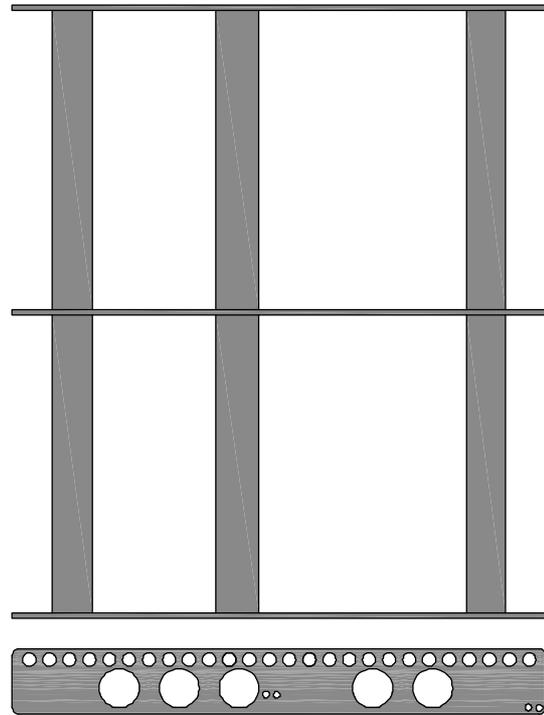
The bumper consists of 3 plates of 8 mm of thickness, united by 3 square tubes of 60x60 mm with 5 mm thickness, all made out of steel F1 grade. The finished is painted in black color, anti-scratching.

In order to be able to suspend the system, it incorporates 25 drills of 20 mm of diameter, with a separation of 30 mm between centres. This way the necessary angle of all the system can be obtained.

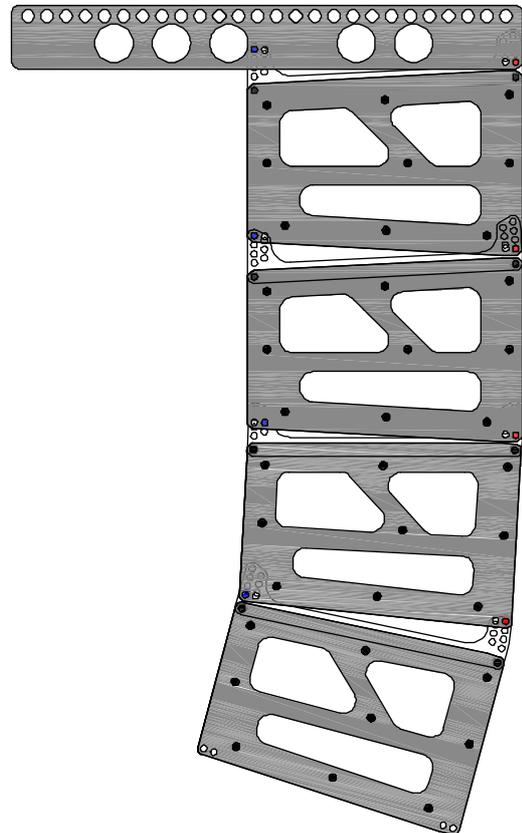
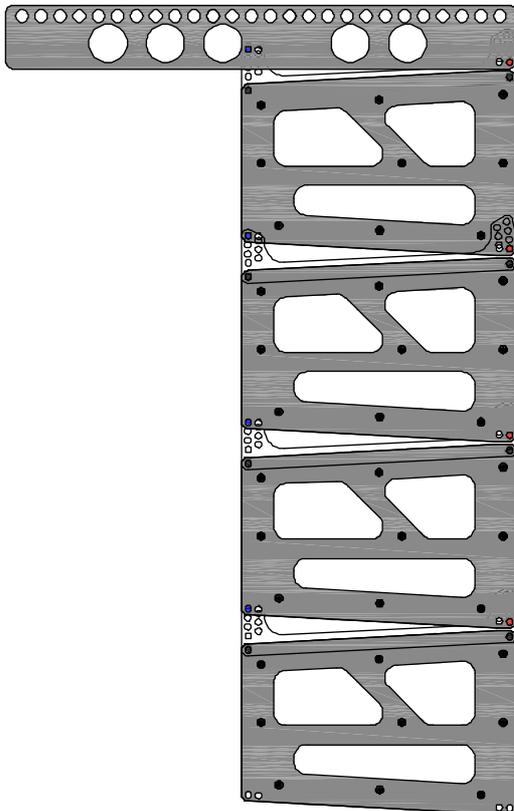
The system also incorporates 5 drills of 60 mm of diameter by side to be able to pass any type of additional sling.

In the inferior figure we presented/displayed two systems of 4 units with different angles using the bumper.

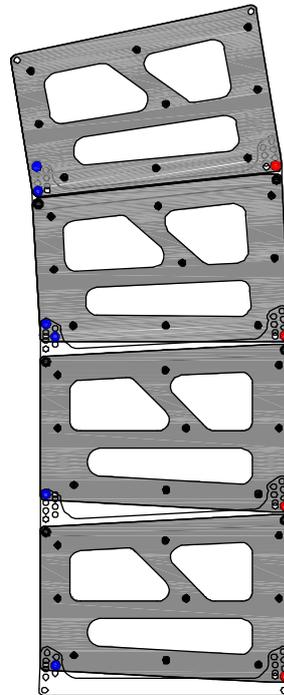
THE BUMPER



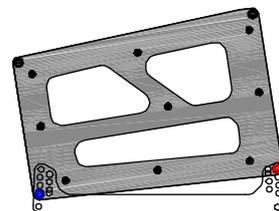
FLYING EXAMPLES



The system can be used without being obligated to fly it, which make it a very versatile tool for its use. The lateral steel arms can be used as a support for maximum 4 boxes stacked over the stage.



STAGE



STAGE

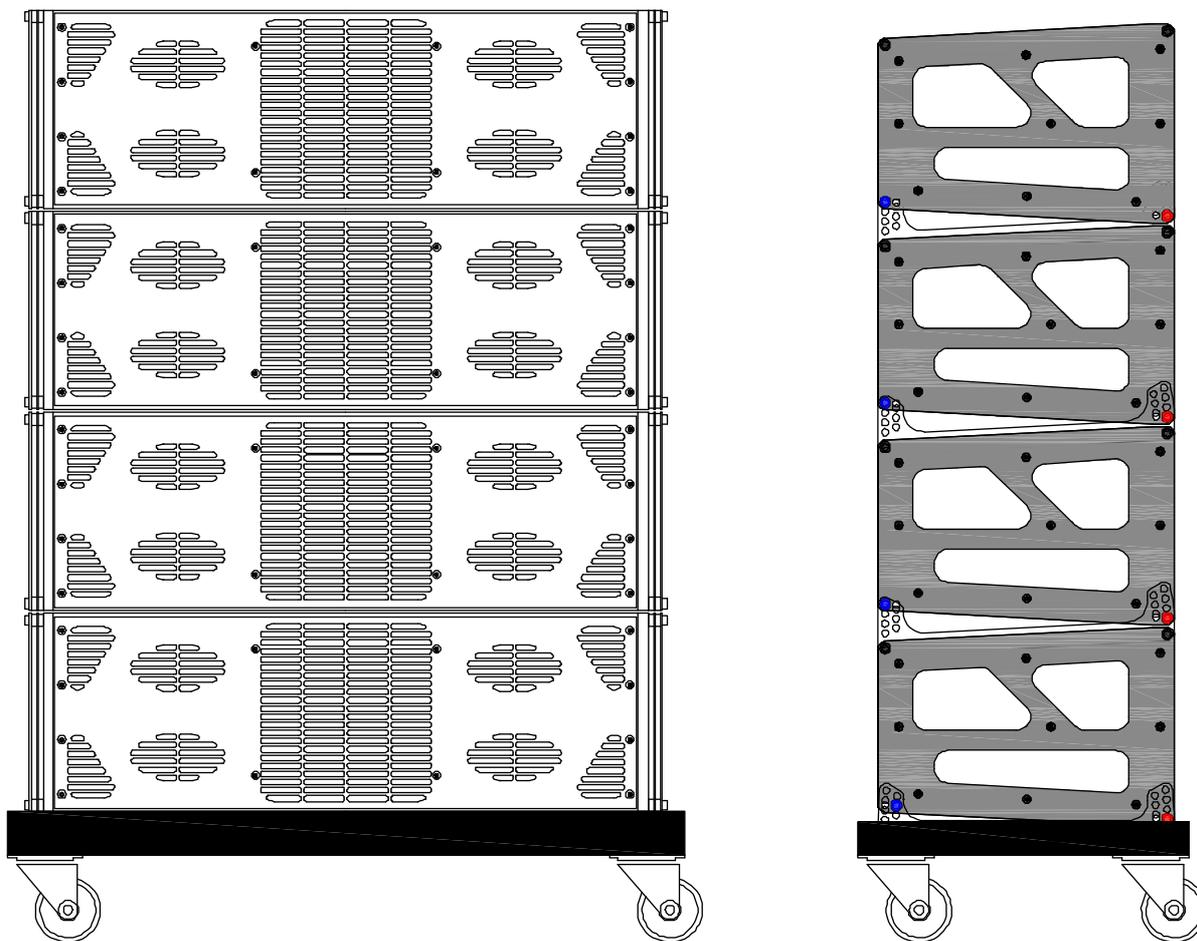
BEYMA LINE ARRAY SYSTEM PROJECT LA10-3V AND SUB218

Another useful point in the use of the lateral arm to stack the boxes in vertical is also applicable for transport.

The optimal number for packing and transport is four units. By preparing the transport of the system in vertical by groups of four, allows for a tremendous save on the truck space.

Thus, it is a very practical and useful way to pack and arrive to the stage very easily. By taking into account this possibility, the flight case can be also made to allow the boxes to be transport with vertical angles that should be used in the performance, allowing a much faster set-up of the system.

In the next figure it can be seen an example. Care should be taken to use the 3° angle fixing hole in the box placed at the bottom, to allow for a perfect horizontal alignment of the four units, fixing the angle of the other 3 units in the 0° fixing hole.



9° SUB ENCLOSURE FOR LA10-3V: THE SUB218

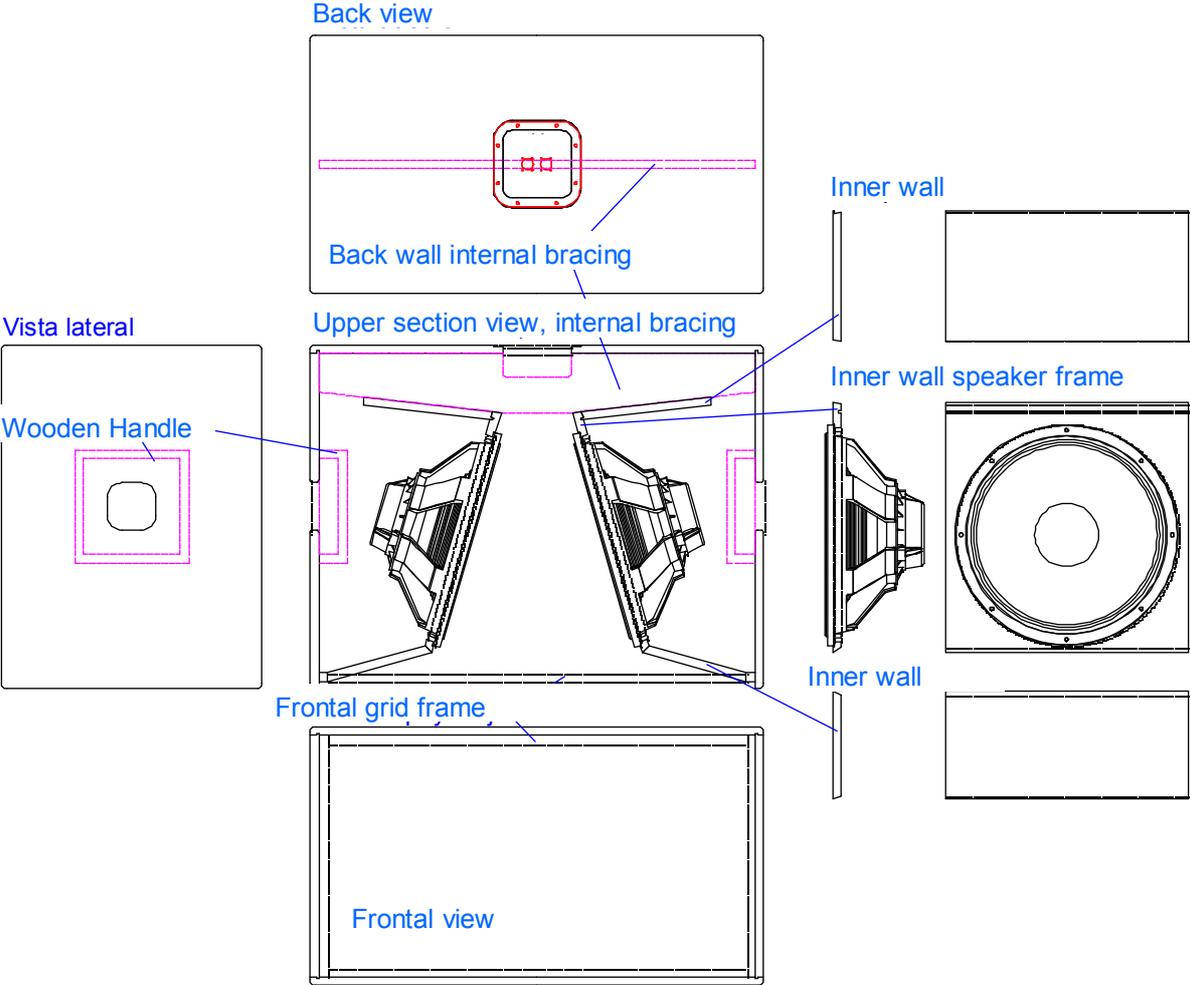
This acoustic enclosure **SUB218** has been designed for two 18P1200ND.

The sub, therefore, is able to admit 2400W AES power at 4 ohms and 4000W Program.

The wooden enclosure has been designed to withstand the impressive sound pressure and vibrations produced by the woofers, made of 18 mm. Plywood birch.

The exterior finish is in satin black, with weather resistant and anti-scratch painting.

It has been purpose designed to work with the LA10-3V, although it can be used as very compact, powerful sub, with incredible sub reproduction even in such a small enclosure.



BEYMA LINE ARRAY SYSTEM PROJECT LA10-3V AND SUB218

10° SUB VIA MODEL: 18P1200ND

This model is the result of an extensive and intense research of every single constituent part of an electro-dynamic loudspeaker, rethinking the basics and taking care of every detail, to withstand the extreme power conditions it has been designed to work in. All this investigation is reflected in the new and innovative technologies developed by Beyma and applied in this new transducer.

- Real 1200 W AES power handling
- Sensitivity: 98 dB @ 2.83V
- 4. duo technology voice coil
- Forced air convection circuit for low power compression
- Extended controlled displacement: $X_{max} \pm 9.5$ mm.
- Massive mechanical displacement capability: 52 mm p-p

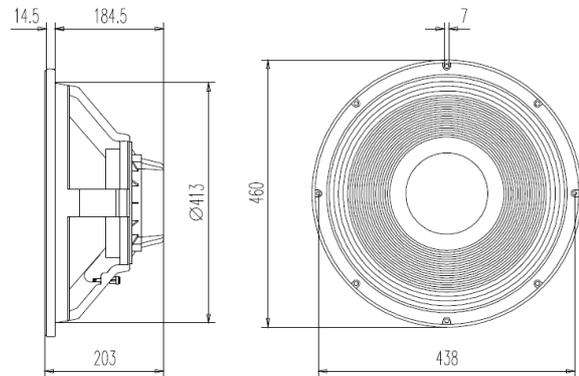
TECHNICAL SPECIFICATIONS

Nominal diameter	460 mm. 18 in.
Rated impedance	8 ohms
Minimum impedance	6 ohms
Power capacity*	1200 w AES
Program power	2400 w
Sensitivity	98 dB 2.83v @ 1m @ 2 π
Frequency range	25 - 2000 Hz
Recom. enclosure vol.	80 / 200 l 2.8 / 7 ft. ³
Voice coil diameter	100 mm. 4 in.
Magnetic assembly weight	6 kg. 13.2 lb.
BL factor	26.3 N / A
Moving mass	0.199 kg.
Voice coil length	25 mm
Air gap height	14 mm
X damage (peak to peak)	52 mm



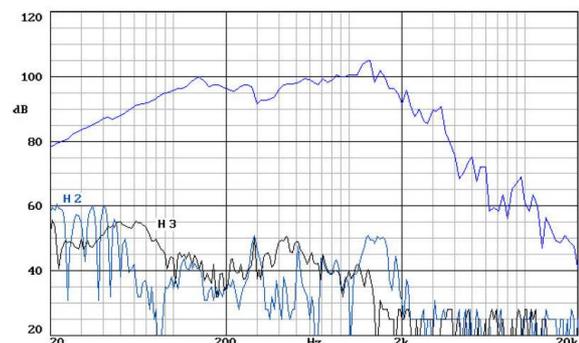
MOUNTING INFORMATION

Overall diameter	460 mm. 18.11 in.
Bolt circle diameter	438 mm. 17.24 in.
Baffle cutout diameter:	
- Front mount	415 mm. 16.34 in.
- Rear mount	400 mm. 15.75 in.
Depth	203 mm. 7.99 in.
Volume displaced by driver	13 l 0.46 ft. ³
Net weight	8.5 kg. 18.7 lb.
Shipping weight	10 kg. 22 lb.



THIELE-SMALL PARAMETERS**

Resonant frequency, f_s	37 Hz
D.C. Voice coil resistance, R_e	5.3 ohms.
Mechanical Quality Factor, Q_{ms}	10.39
Electrical Quality Factor, Q_{es}	0.35
Total Quality Factor, Q_{ts}	0.34
Equivalent Air Volume to C_{ms} , V_{as}	198 l
Mechanical Compliance, C_{ms}	93 μ m / N
Mechanical Resistance, R_{ms}	4.5 kg / s
Efficiency, η_0 (%)	2.7
Effective Surface Area, S_d (m ²)	0.1225 m ²
Maximum Displacement, X_{max}^{***}	9.5 mm
Displacement Volume, V_d	1164 cm ³
Voice Coil Inductance, L_e @ 1 kHz	2.3 mH

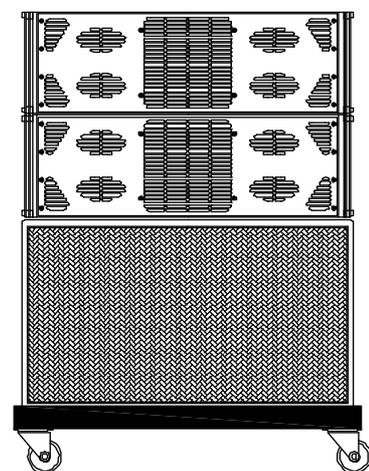
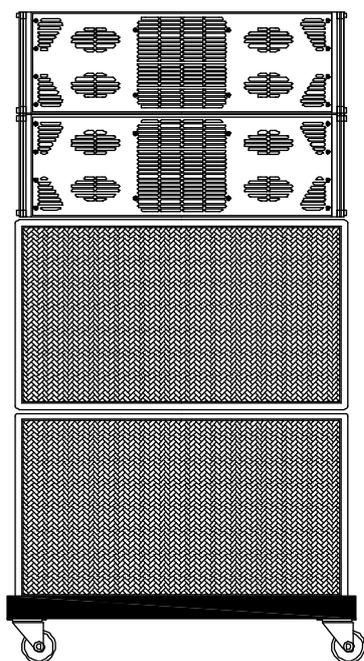
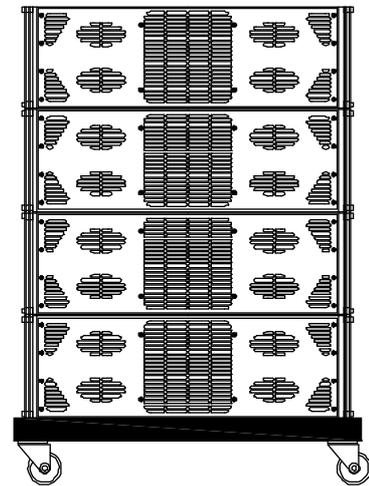
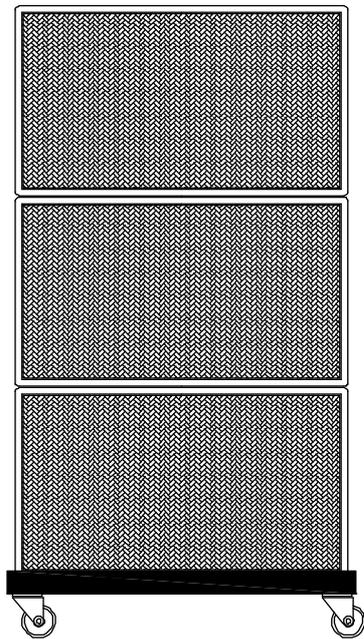


11° POSSIBLE TRANSPORT CONFIGURATIONS

In the next figures different examples of transport combinations can be seen.

It is not recommended to use these examples as a performance stacking possibility, being only recommended for transport.

It is shown how the sub box can be combined with the Line Array box easily to save space in the truck.



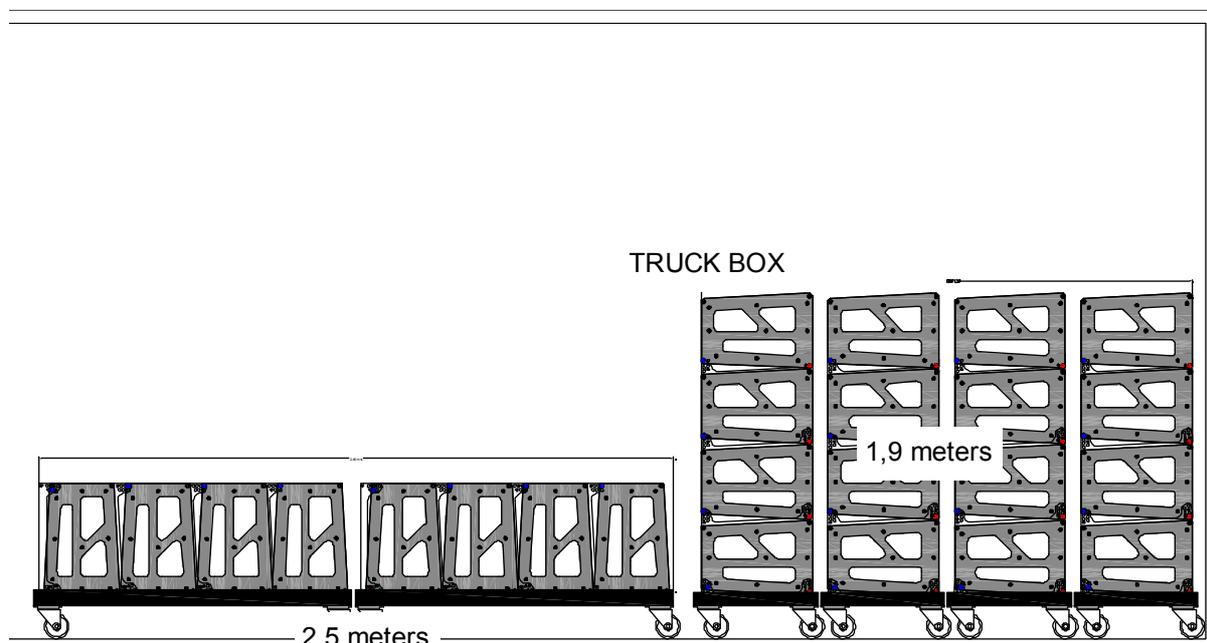
12° TRANSPORT

In the next figure, it is shown what's the difference between using the vertical stacking possibility or the more typical horizontal configuration, which it can be used as well.

At the end, the more possibilities, the more versatile the system will be.

As it can be seen in the figure, letting the boxes stacked in horizontal take more than 2.5m. Long in the truck, meanwhile by using the vertical position, the double number of boxes can be transport in even less space.

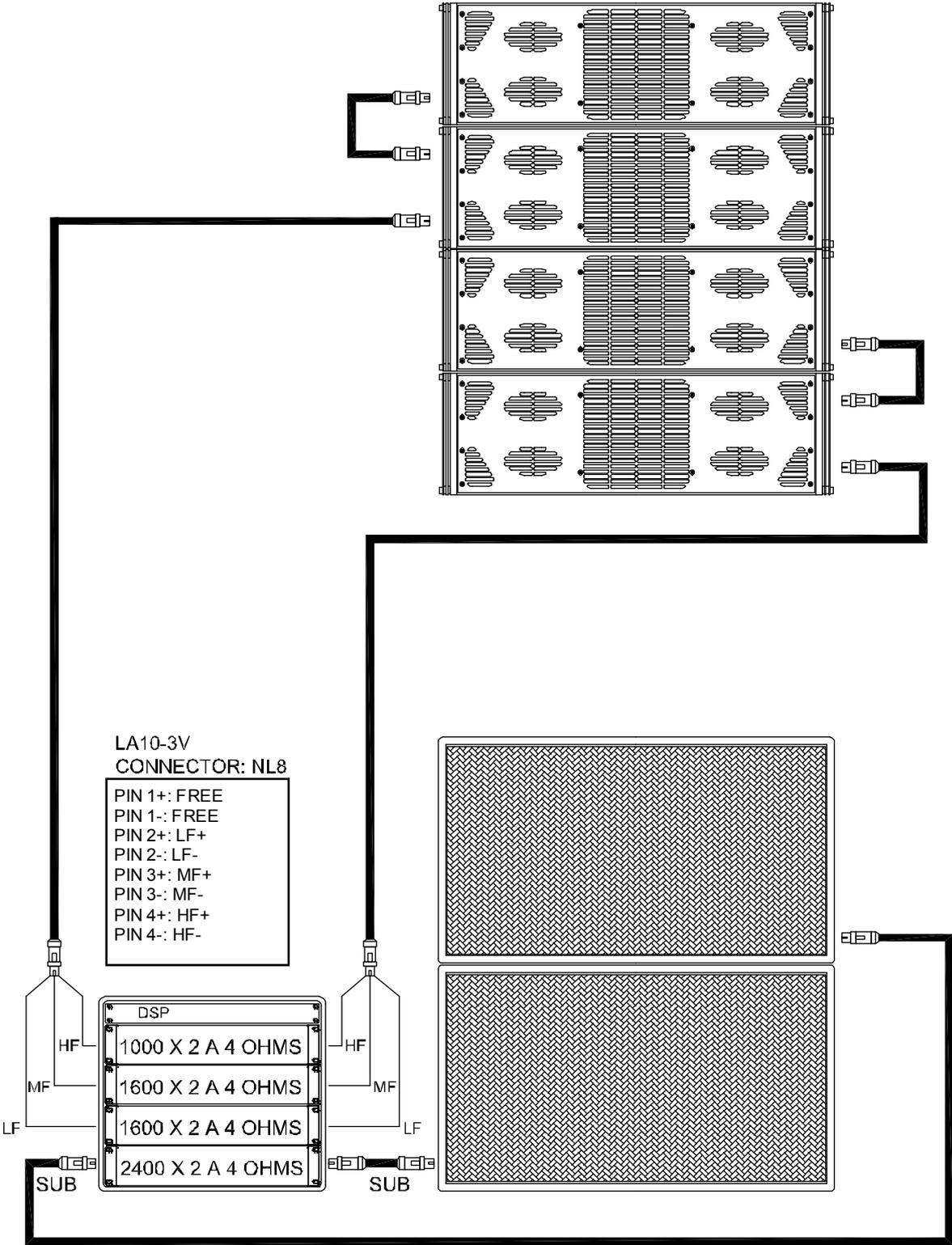
It is not recommended to stack more than four units. Nevertheless, it is possible to transport the boxes with the angles to be used in the performance beforehand, if the transport flight case it is designed with this possibility in mind.



**BEYMA LINE ARRAY SYSTEM PROJECT
LA10-3V AND SUB218**



10° BASIC CONFIGURATION



BEYMA LINE ARRAY SYSTEM PROJECT LA10-3V AND SUB218

11° HARDWARE ASSEMBLY OF THE LA10-3V

As it has been mentioned before in this manual, the metal hardware is composed of:

- Four lateral frames.
- Two steel arms.
- One frontal grid.
- Thirty two stainless steel spacer rings.
- Eight magnetic pins.
- One back panel connector with 8NL SPEAKON and wire connection.
- All the screws, bolts, nuts, etc. to fix all the parts.
- Neoprene segment to damp the front grid.



LATERAL FRAME



STEEL ARM



CONNECTIONS PANNEL

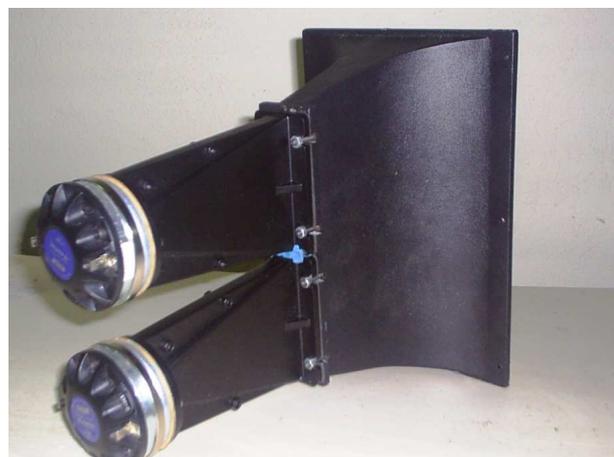


SOLID FIXING PIN



SPACER RING

NOTE: The screws needed to fix the two WL4 are not included, although although they are quite standard ones.
It is recommended 8 ALLEN head screws of 6x20 mm. and 8 6 mm. nuts.



11° HARDWARE ASSEMBLY OF THE LA10-3V

The recommended assembling process is suggested to be made in three simple steps, as follows: :

- A) Lateral frames assembly
- B) Connections panel and speakers.
- C) Front grid assembly.

A) LATERAL FRAMES ASSEMBLY

- 1) Place the box over one of the lateral sides.
- 2) Place 9 of the steel spacer rings over the lateral side, each of them over one of the 10 mm. fixing holes.
- 3) Place one of the lateral frames over the steel rings, aligning the holes of the frame with the rings and the holes.
- 4) Place another 9 steel rings over the frame, once again aligned with the holes.



STEP 1



STEP 2



STEP 3



STEP 4

11° HARDWARE ASSEMBLY OF THE LA10-3V

A) LATERAL FRAMES ASSEMBLY

- 5) Place the second steel lateral frame over the second batch of steel rings, taking care again of aligning and centering all the holes.
- 6) Insert the ALLEN 10 mm. screws in all the holes and tight the 9 screws. Fixing the complete assembly
- 7) Repeat from step 1) to step 6) for the other side of the wooden box.



STEP 5



STEP 6

B) CONNECTIONS PANEL AND SPEAKERS

- 1) Place the box with the back side upwards to assembly the connections panel.
- 2) Be sure of placing the connections panel with the SPEAKON connector in the upper position, this means with the wider slot of the connector up letting the closed mid range side of the box in the right side, when looking the box from the front.
- 3) Screw the connections panel to the box. .
- 4) Turn the box, with the speakers hole side looking up.
- 5) Lead the mid range wire, mark with a black sign, thru the small hole you should find in the back part of the mid range enclosure for the 10MI100.
- 6) Screw first the WL4 to the TDWL4 horn. **NOTE:** It is very important to place a small piece of neoprene between both WL4, to seal the mouth perfectly. This piece should be placed at the same time of the 2° WL4 to be fixed, so that the neoprene segment is compressed between both WL4.
- 7) Connect the wires for the WL4. They are easily identified thru the FASTON connector already placed in the wires. The wire with the blue line should be connected to the positive (+) terminal of the WL4.
- 8) Place the WL4/TDWL4 assembly in the box and tight the screws.



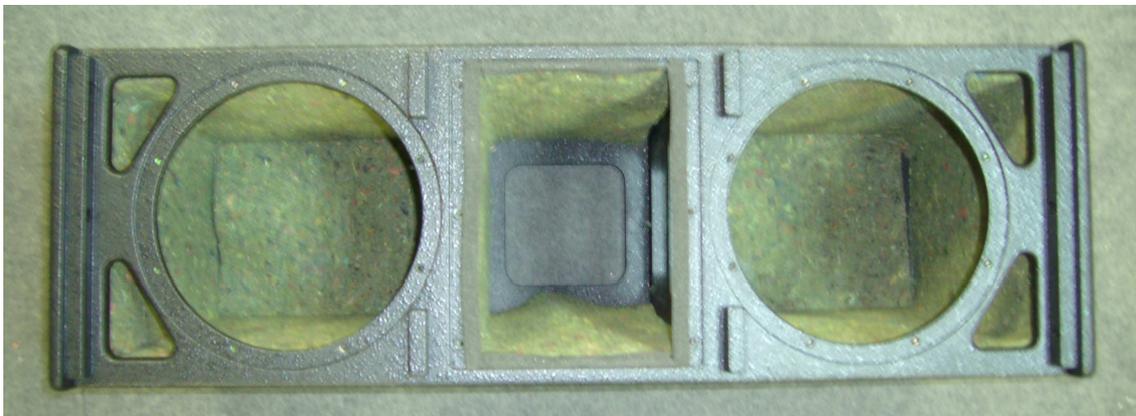
STEP 1



STEP 2 AND 3

**BEYMA LINE ARRAY SYSTEM PROJECT
LA10-3V AND SUB218**

- 9) Connect the wires mark with a red sign to the 10G40. The wire with the blue line should be connected to the positive (+) terminal of the 10G40.
- 10) Looking to the front side of the box, fix the 10MI100 in the closed part of the box, which should be in the right side.
- 11) Looking to the front side of the box, fix the 10MI100 in the closed part of the box, which should be in the right side.



STEP 4



STEP 5



STEP 6 AND 7

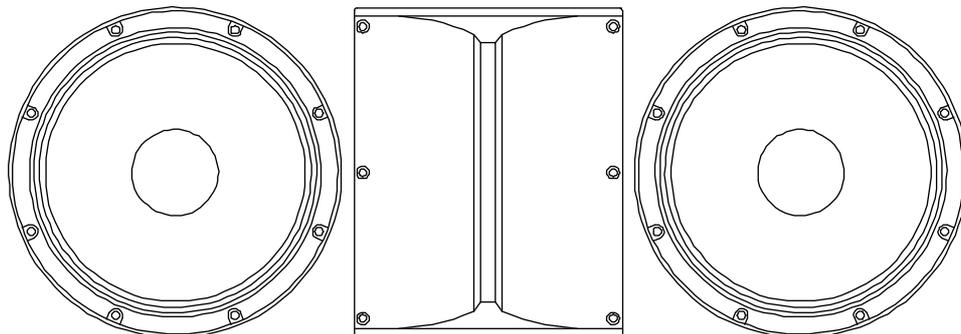
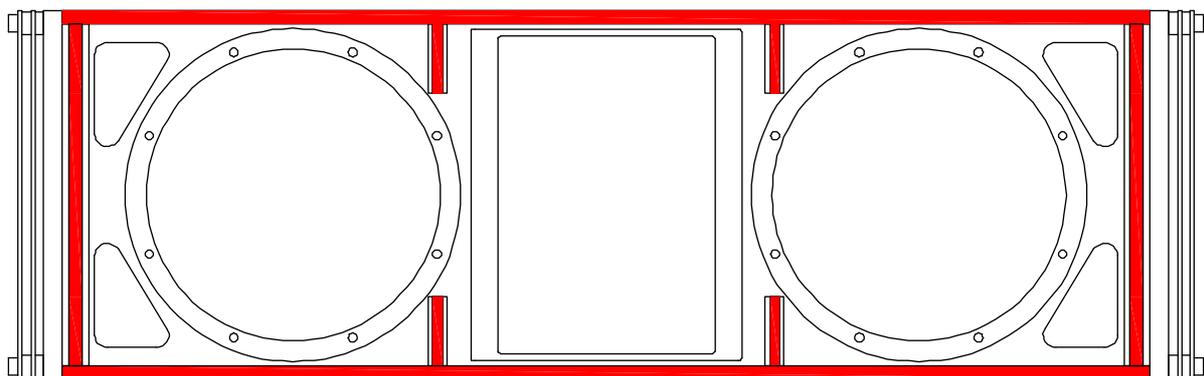
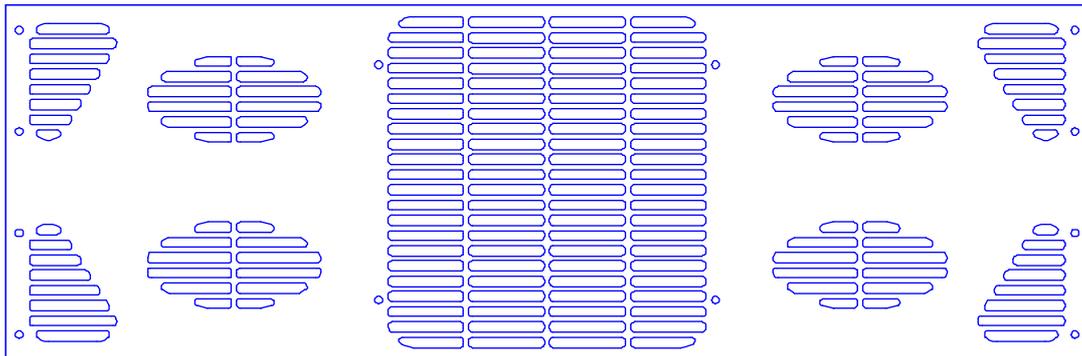
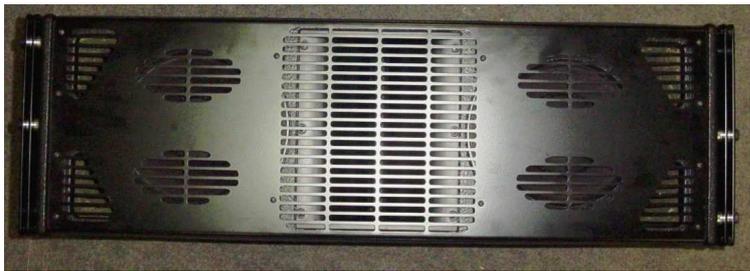


STEP 8, 9, 10 AND 11

BEYMA LINE ARRAY SYSTEM PROJECT LA10-3V AND SUB218

C) FRONTAL GRID ASSEMBLY

- 1) Looking to the front of the enclosure, place the TDWL4 horn with the two WL4 connected correctly and screw it to the box.
- 2) Place the neoprene segment in all the places where the frontal grid will be resting over the wood (look to the figure where the red strips are the neoprene segments).
- 3) Screw the front grid.



BEYMA LINE ARRAY SYSTEM PROJECT LA10-3V AND SUB218



12° TECHNICAL CHARACTERISTICS:

LF: 10G40, 800W Program
 MF: 10MI100, 700W Program
 HF: two WL4, 160W Program in horn TDWL4

Coverage: 90° Horizontal, Vertical dependent on the n° of boxes.
 Angles between boxes: from 0° to 6°.
 Sensitivity: 97 dB 1W@1m.
 Range of frequencies: 80 Hz to 16 kHz.
 Maximum Peak Sound Pressure Level: 130 dB
 Weight of complete box: 46,5 kg.
 Dimensions (HxWxD): 290x940x430 mm. (wooden box with rigging)

SUB: two 18P1200ND, 4000W Program

Sensitivity: 99 dB, 1W@1m
 Range of frequencies: 40-200 Hz
 Maximum Peak Sound Pressure Level: 141 dB
 Weight of complete box: 72 kg.
 Dimensions (HxWxD): 540x940x720 mm. (wooden box)

