

NEXO



MSUB15

GEO M10 – MSUB15

GEO M1012 & GEO M1025 Tangent Array Modules

MSub15 Subwoofer



Setup Manual

GEO Technology is radically new thinking

The GEO R&D Project has, to date, resulted in the following patent applications:

The GEO Hyperboloid Reflective Wavesource™ differs radically from the megaphone-variant type horns you know and love (or hate). “Tried and true” methods will produce entirely unexpected results. HRW technology produces precise and predictable results.

The Configurable Directivity Flange. A waveguide that allows the operator to alter its behaviour. An unprecedented NEXO development that is easy to use – once you know how and when.

The Phase Directivity Device needs no operator input to function, but it is reassuring to know that the coupling of the midrange of the system is considered as important as the high frequencies...

DSP-driven Directional Sub-bass devices are a new approach to controlling LF/VLF acoustic energy.

GEO is not hard to use when you understand how...

The technology behind GEO is revolutionary, but it is grounded in years of practical experience with the problems of delivering high quality professional sound to large audiences at high SPL levels. The GEO toolbox includes NS-1 - a simple yet powerful and highly predictive design tool. The array assembly system is keyed to the design software and will easily enable you to deploy your design with great precision. NEXO Digital TDcontroller technology provide driver protection and system optimization for the GEO M and MSUB series.

GEO is a high precision system

The GEO HRW™ controls acoustic energy more precisely than other multiple element waveguides. It also makes GEO less forgiving of mistakes. Whilst conventional horns never combine into a coherent array, they may deliver acceptable results even if the design and deployment of the system is less than optimal. This is not the case with GEO where careless installation produces catastrophic results.

A GEO Tangent Array is not a “line array”

GEO Technology is equally effective in designing and deploying tangent curved vertical arrays. For best results in a specific application the user needs to know how multi-speaker arrays interact with audience geometry, along with the benefits and drawbacks of curved vertical arrays and horizontal arrays.

Curved tangent arrays require different design techniques

In the past, sound reinforcement professionals have worked with horizontal arrays that use conventional horns to deliver [more or less] ‘equal power to equal *angles*’. Curved vertical arrays are now designed to deliver [more or less] equal power to equal *areas*’. When arrays use conventional horns, the lack of precision, overlap and interference masks errors in array design and aiming. The highly precise GEO wavesource responds accurately, consistently and predictably to the design and deployment of a curved vertical tangent array. This is why the GEO rigging system is designed to control angular splay to 0.1° precision.

GEO curved tangent arrays require different operational techniques

Over the years, system designers and operators have developed a number of signal processing techniques to disguise and partly overcome the limitations of horn design. “Frequency shading,” “amplitude shading,” “High Frequency compensation”, all of these are tools of the advanced sound system operator. **NONE OF THESE TECHNIQUES ARE APPLICABLE TO GEO TANGENT ARRAYS.** Instead of enhancing the array’s performance they will severely degrade it.

Take time to learn how to get great results with GEO Technology. It is an investment that will pay off in more satisfied clients, more efficient operating procedures and more recognition for your skill as a sound system designer and operator. A comprehensive understanding of GEO theory, tangent arrays, and specific features of the GEO M Series will help you to operate your system at its full potential.

PLEASE READ CAREFULLY BEFORE PROCEEDING**BASIC PRECAUTIONS**

Do not open the speaker system or attempt to disassemble the internal parts or modify them in any way. The speaker system contains no user-serviceable parts. If it should appear to be malfunctioning or damaged, discontinue use immediately and have it inspected by qualified NEXO service personnel.

Water exposure: Do not expose the speaker system to direct rain, do not use it near water or in wet conditions. Do not place containers with liquid on speaker system as they might spill into openings. If any liquid such as water seeps into the speaker system, have it inspected by qualified NEXO personnel.

Sun exposure: Do not expose the speaker system to direct sun.

Operating temperature with temperate climate: 0°C to +40°C (-20°C to +60°C for storage).

SYSTEM DEPLOYMENT SAFETY RULES

Read User Manual before deployment. Before use of enclosed speaker system, please ensure that anyone involved in system deployment understands the rigging – stacking – pole mounting safety rules as described in the speaker system User Manual. Failure to do this exposes people to potential injury or death.

Please check the web site nexo-sa.com for the latest update.

Always consult qualified NEXO personnel if the device installation requires construction work and make sure to observe the following precautions:

Mounting precautions

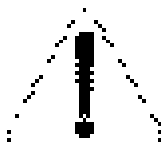
- choose mounting hardware and an installation location that can support 4 times the weight of the speaker system;
- do not use speaker system handles for suspended installation;
- do not expose speaker system to excessive dust or vibration, or extreme cold or heat to prevent possibility of component damage;
- do not place the speaker system in an unstable position from which it might fall accidentally;
- if speaker systems use a stand, ensure that stand specifications are adapted, and that stand height does not exceed 1.40m/55"; never move the stand while the speaker is in position.
- in case of wind greater than 8 on Beaufort scale (72km/h – 45mph), a touring system has to be landed or an additional securing has to be implemented.
- for fixed installations, wind loading has to be taken into account in accordance to the national standards.

Connection and powering precautions

- remove all connected cables before moving the speaker system;
- turn off AC power of all power amplifier units before connecting the speaker system;
- when turning on the AC power to the audio system, always turn on the power amplifier last; when turning the AC power off, always turn off the power amplifier first;
- when used in cold conditions, a gradual power ramp up should be applied to the system on a 5 mn period to allow the loudspeaker components to stabilize during the very first minutes of usage.

Inspect the speaker system periodically.

HIGH SOUND PRESSURE LEVELS



Exposure to extremely high noise levels may cause permanent hearing loss. Individuals vary considerably in susceptibility to noise-induced hearing loss but nearly everyone will lose some hearing if exposed to sufficiently intense noise for a sufficient period of time. The U.S. Government's Occupational and Health Administration (OSHA) has specified the following permissible noise level exposures: Sound Duration Per

Day In Hours	Sound Level dBA, Slow Response
8	90
6	92
4	95
3	97
2	100
1 ½	102
1	105
½	110
¼ or less	115

According to OSHA, any exposure in excess of the above permissible limits could result in some hearing loss. Ear plugs or protectors to the ear canals or over the ears must be worn when operating this amplification system in order to prevent permanent hearing loss, if exposure is in excess of the limits as set forth above. To ensure against potentially dangerous exposure to high sound pressure levels, it is recommended that all persons exposed to equipment capable of producing high sound pressure levels such as this amplification system be protected by hearing protectors while this unit is in operation.

DISPOSAL OF OLD ELECTRICAL & ELECTRONIC EQUIPMENT



This symbol on the product or on its packaging indicates that it shall not be treated as household waste. Instead it shall be handed over to the applicable collection point for the recycling of electrical and electronic equipment. By ensuring this product is disposed of correctly, you will help prevent potential negative consequence for the environment and human health, which could otherwise be caused by inappropriate waste handling of this product. The recycling of materials will help to conserve natural resources. For more detailed information about recycling of this product, please contact your local city office, your household waste disposal service or the shop where you purchased the product.

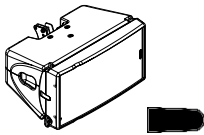
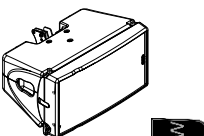
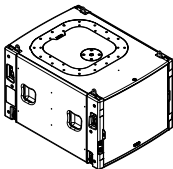
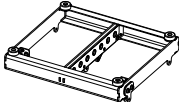
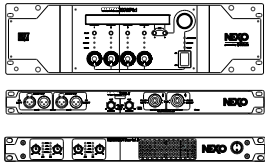
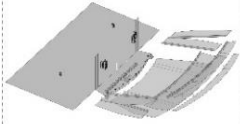

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1 INTRODUCTION

Thank you for selecting a NEXO GEO M10 Series Tangent Array System. This manual is intended to provide you with necessary and useful information about your GEO M10 & MSUB15 System, which includes the following products:

	<ul style="list-style-type: none"> GEO M1012 is a 12.5° Tangent Array Module. It comprises 1x10" (25cm) 8 ohms long excursion Neodymium LF/MF driver loaded by a Phase Directivity Device (PDD™) and 1x1.4" throat 1driver 16 Ohm HF Neodymium driver loaded by a 6° Hyperboloid Reflective Wavesource (HRW™).
	<ul style="list-style-type: none"> GEO M1025 is a 25° Tangent Array Module. It comprises 1x10" (25cm) 8 ohms long excursion Neodymium LF/MF driver loaded by a Phase Directivity Device (PDD™) and 1x1.4" throat 1driver 16 Ohm HF Neodymium driver loaded by a 25° Hyperboloid Reflective Wavesource (HRW™).
	<ul style="list-style-type: none"> MSUB15 is GEO M10 companion subwoofer. It comprises 1x15" (38cm) long excursion Neodymium driver, and features very high efficiency as well as high acoustic output. MSUB15 has fittings for transporting, flying and stacking.
	<ul style="list-style-type: none"> A full range of accessories provides safe, flexible and simple means of installing GEO M10 and MSUB15 in fixed installation as well as in touring applications.
	<ul style="list-style-type: none"> GEO M10 and MSUB15 are controlled, powered and monitored by NEXO TDcontrollers. For a complete description of these controllers, please refer to User Manuals. NEXO TDcontrollers DSP algorithms and parameters are fixed in software and updated regularly: Please consult the NEXO web site (nexo-sa.com) for the latest software releases.
	<ul style="list-style-type: none"> NS-1 simulation software assists in the design and implementation of vertical tangent GEO arrays. Please consult the NEXO web site (nexo-sa.com) for the latest software releases.
	<ul style="list-style-type: none"> Available for Mac, iPad and iPhone, NEXO NeMo provides full remote control over a digital audio network from anywhere in the venue, thanks to an intuitive and graphically attractive user interface. NeMo is available on iTunes.

Please devote your time and attention to reading this manual. A comprehensive understanding of GEO M10 and MSUB15 specific features will help you to operate your system at its full potential.

2

GEO M10 GENERAL SET-UP INSTRUCTIONS

2.1

Speaker connection

GEO M10 and MSUB15 are connected with Speakon NL4FC plugs (not supplied). A wiring diagram is printed on the connection panel located on the back of each cabinet. The 4 pins of the Speakon sockets identified in / out are connected in parallel within the enclosure.

Either connector can be used to connect amplifier or to link to an additional GEO M10 cabinet or to link to an optional MSUB15 (if present). Therefore, a single 4-conductor cable can connect two amplifier channels to various GEO M10s and/or MSUB15 subwoofers.

2.1.1

GEO M10 connectors

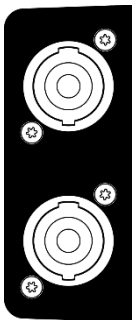


Speakon Connector		M1012 & M1025
1(-)	⇒	Through
1(+)	⇒	Through
2(-)	⇒	GEO M10 (-)
2(+)		GEO M10 (+)

2.1.2

MSUB15 connectors

MSUB15 features 2 connector panels with 2 Speakon NL4 each so that cabling is always done at the back independently of cabinet being set frontwards or rearwards for cardioid configurations.



Speakon Connector		MSUB15
1(-)	⇒	MSUB15 (-)
1(+)	⇒	MSUB15 (+)
2(-)	⇒	Through
2(+)		Through

2.2 Cabling

NEXO recommends the exclusive use of multi-conductor cables to connect the system: the cable kit is compatible with all the cabinets, and there is no possible confusion between LF, MF and HF sections.

Cable choice consists mainly of selecting cables of the correct sectional dimension (size) in relation to the load resistance and the cable length. Too small a cable section will increase both its serial resistance and its capacitance; this reduces the electrical power delivered to the loudspeaker and can also induce response (damping factor) variations.

For a serial resistance less or equal to 4% of the load impedance (damping factor = 25), the recommended cable length is given by:

$$L_{\max} = Z \times S \quad S \text{ in mm}^2, Z \text{ in Ohm, } L_{\max} \text{ in meters}$$

The table below indicates these values, for 3 common sizes.

Load Impedance (Ω)	2	3	4	6	8
1,5 mm ² (AWG #14)	3m/10ft	4.5m/13ft	6m/20ft	9m/30ft	12m/39ft
2,5 mm ² (AWG #12)	5m/16ft	7.5m/23ft	10m/33ft	15m/49ft	20m/66ft
4 mm ² (AWG #10)	8m/26ft	12m/39ft	16m/52ft	24m/79ft	32m/105ft

Maximum allowed length is 4 times recommended length.

Example:

GEO M10 module has a 8 Ω nominal impedance. When connecting 4 modules in parallel, total load impedance become 2 Ω .

Recommended length for 4mm² / (AWG#10) is 8 m / 26 ft, maximum allowed length is 32 m / 105 ft.

IMPORTANT

Long speaker cables induce capacitive effects – up to hundreds of pF depending on the quality of the cable - with a low-pass effect on high frequencies. If long speaker cables must be used, ensure that they do not remain coiled while in use.

2.3 GEO M10 & MSUB15 recommended amplification

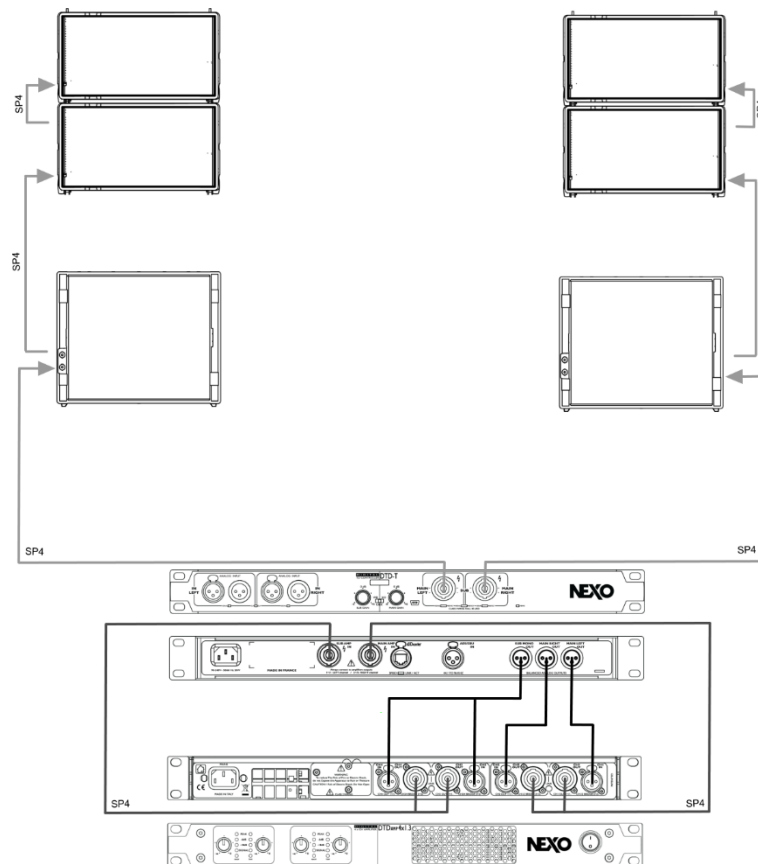
NEXO TD Controllers	Recommended amplification
DTD Controller + DTDAMP4x1.3 (4x1.3 kW/4 Ω)	2 x GEO M10 per channel 1x MSUB15 per channel
NXAMP4x1 Powered Controller 4 channels mode (4x1300W/2 Ω)	1 x GEO M10 per channel
NXAMP4x1 Powered Controller Bridged Stereo mode (2x2600W/4 Ω)	2 x GEO M10 per bridged channel 2 x MSUB15 per bridged channel
NXAMP4x4 Powered Controller 4 channels (4x4kW/2 Ω)	4 x GEO M10 per channel 3 x MSUB15 per channel

2.4 GEO M10 & MSUB15 setups on NEXO TD Controllers

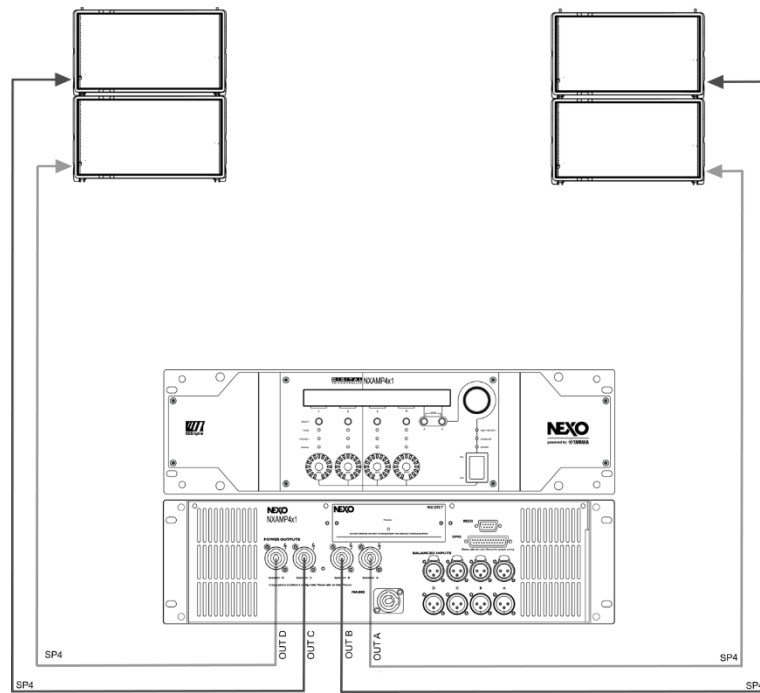
Please consult nexo-sa.com for NEXO TD Controllers firmware information.

3 CONNECTION DIAGRAMS

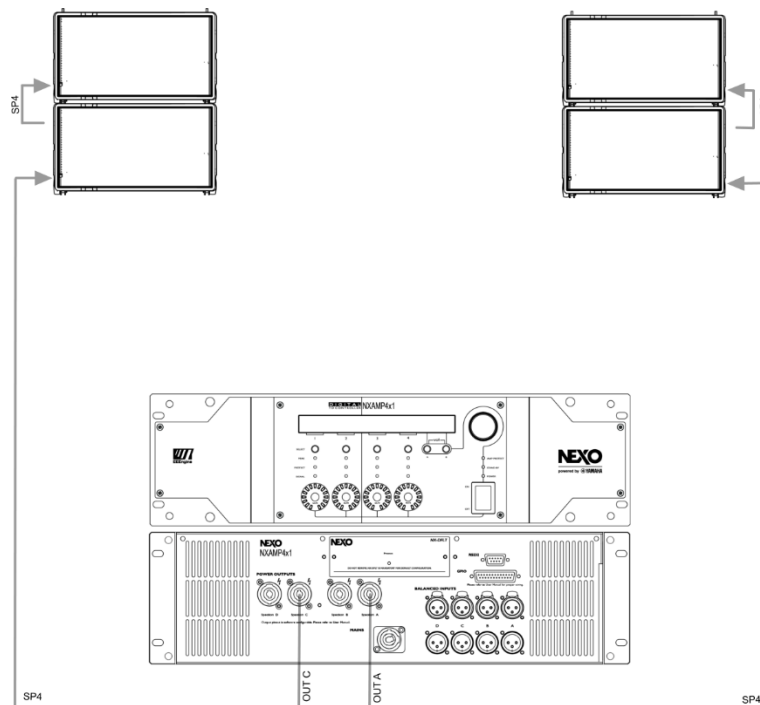
3.1 MSUB15 & GEO M10 / DTDController & DTDamp1.3



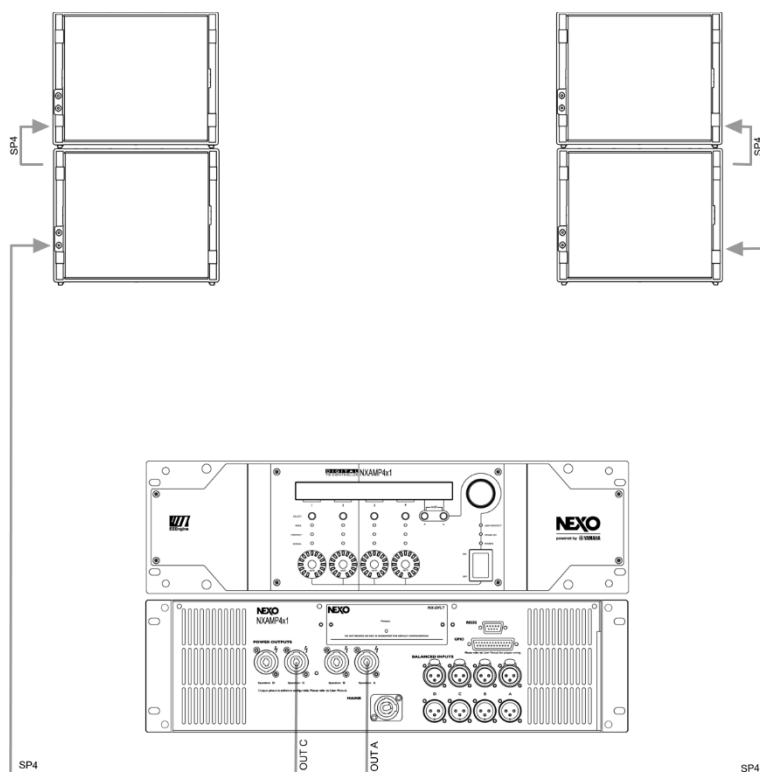
3.2 GEO M10 / NXAMP4x1 (4 channels)



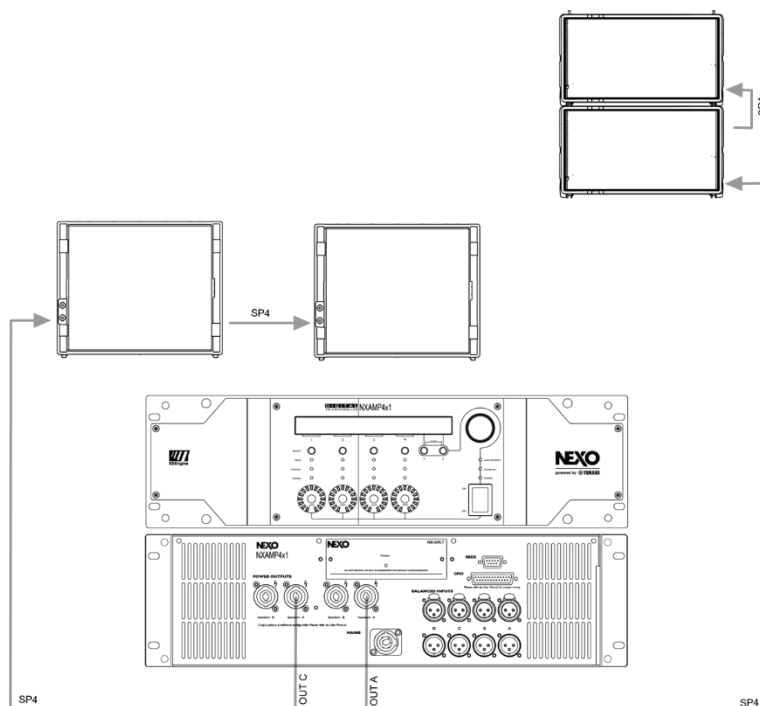
3.3 GEO M10 / NXAMP4x1 (Bridge Stereo)



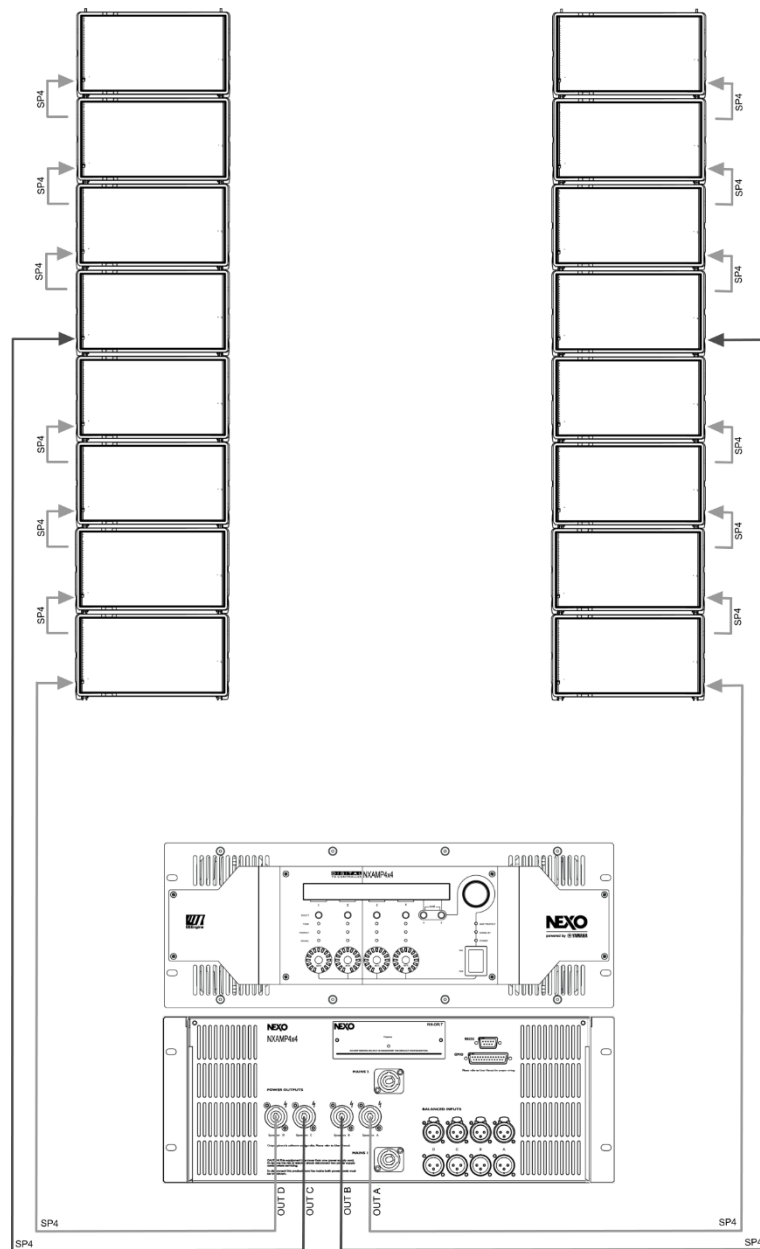
3.4 MSUB15 / NXAMP4x1 (Bridge Stereo)



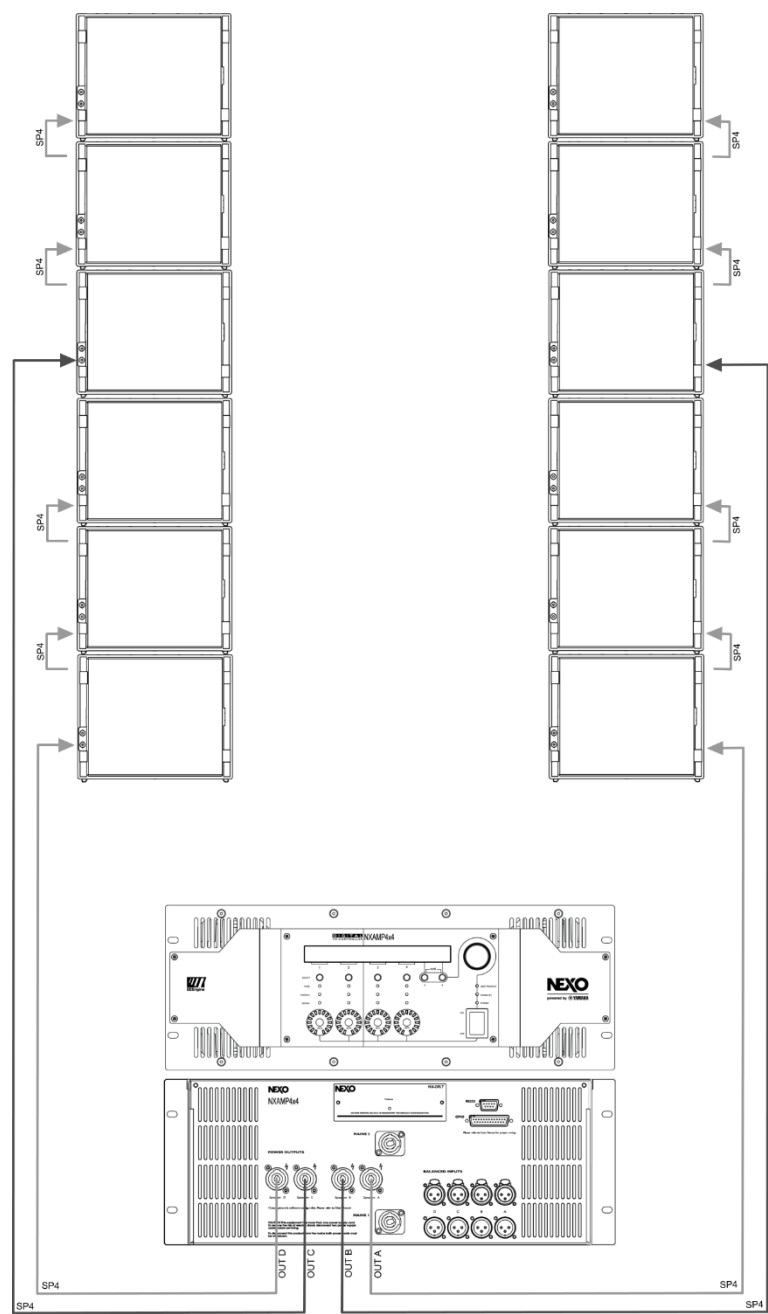
3.5 MSUB15 & GEO M10 / NXAMP4x1 (Bridge Stereo)



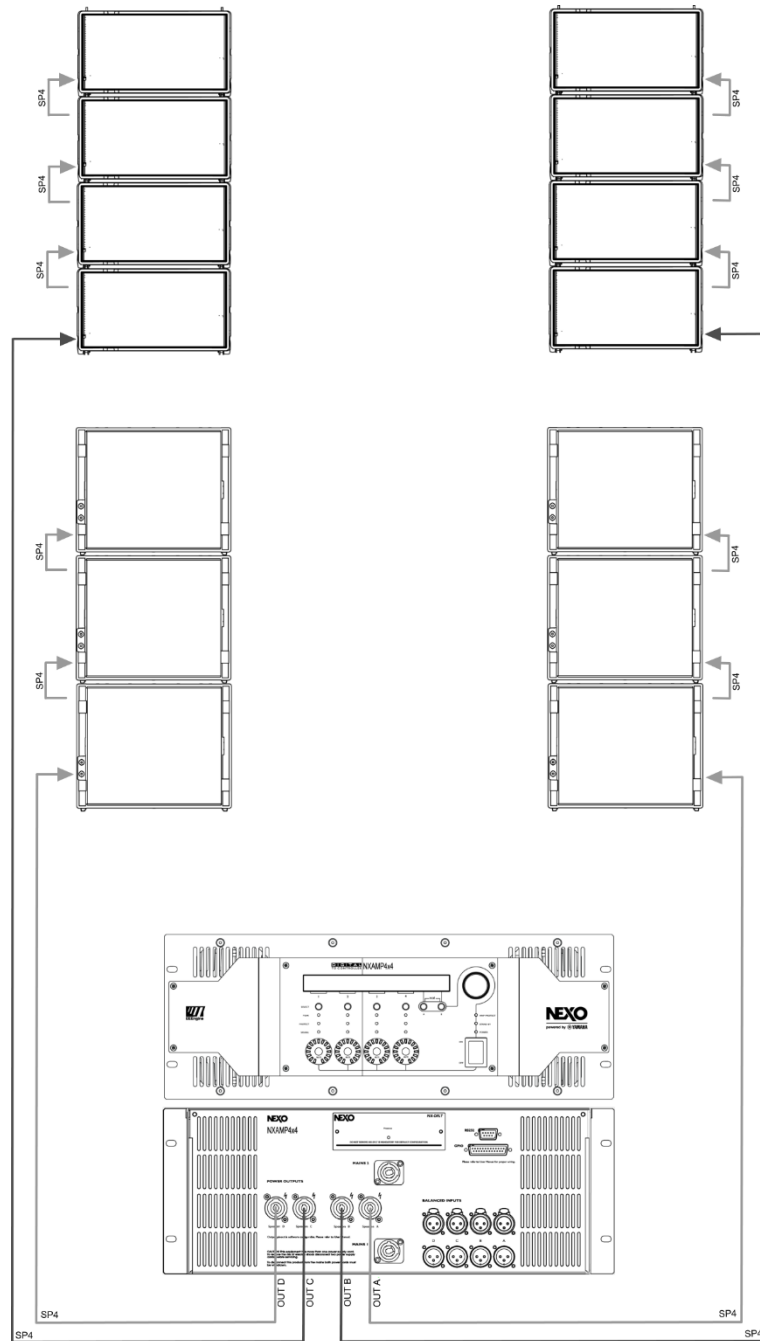
3.6 GEO M10 / NXAMP4x4 (4 Channels)



3.7 MSUB15 / NXAMP4x4 (4 channels)



3.8 MSUB15 & GEO M10 NXAMP4x4 (4 channels)



4 NS-1 SIMULATION SOFTWARE

NS-1 software is a R&D simulation tool derived application. It processes measured speaker data with complex mathematical algorithms to assist the user in optimizing system design. Due to the complexity of the interaction of multiple cabinets, it is simply not possible to reliably design curved vertical arrays without using the processing power of a computer to predict the optimum array structure for a given audience geometry. The design logic is far more complex than looking at a section drawing of the venue, measuring the overall angle needed to cover the audience from the cluster location, and dividing by 12 degrees to determine the required amount number of GEO M1012 cabinets.

NS-1 is an easy to use tool that allows to shape the energy leaving the cluster to fit the audience. It predicts pressure levels radiated from the system to ensure enough cabinets are provided for the application, as well as mechanical constraints for safe flown systems.

In addition, it provides mechanical information for all clusters in agreement with Structural Analysis Reports (available in the Help section): dimensions, weight, gravity center position, forces, moments, working load and safety factor.

GEO M10 and MSUB15 Structural Analysis Report is currently being certified by German Certification Organization RWTUV systems GmbH.

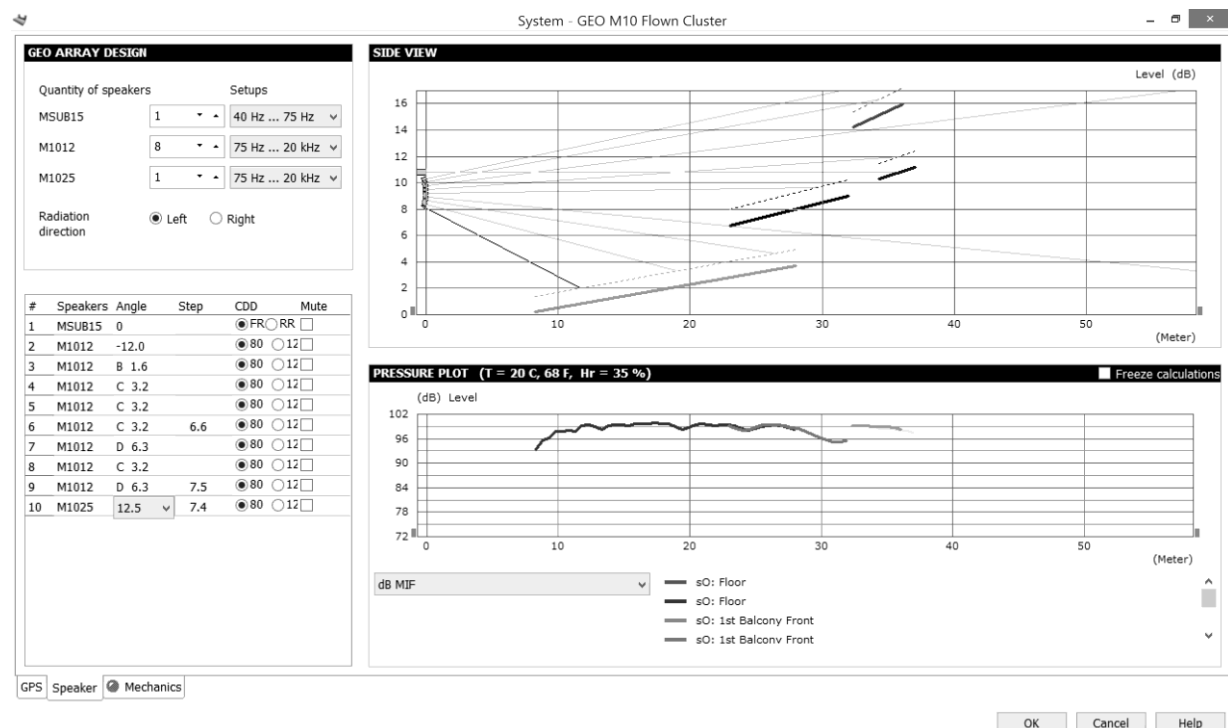
NS-1 installation package includes all NEXO User Manuals, Structural Analysis Reports and Certificates PDF files (which can be found in the last section of User Manuals).

NS-1 is a freeware available on nexo-sa.com

IMPORTANT

Never install a GEO M10 and/or MSUB15 cluster without checking its acoustical performances and mechanical safety in NS-1 prior to installation.

Any question or bug report please contact technical@nexo.fr



5 CONFIGURABLE DIRECTIVITY DEVICE

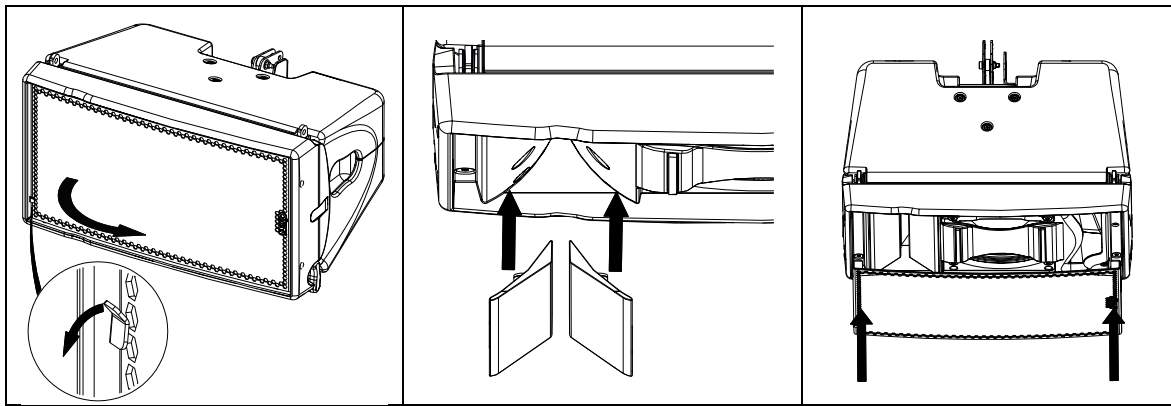
The GEO Wavesource controls dispersion of acoustic energy using a hyperboloid acoustical reflector in the “coupling plane” (the vertical plane of a curved vertical tangent array) and a diffraction slot in the “non-coupling plane” (the horizontal plane of a curved vertical tangent array). The patented Configurable Directivity Device consists of flanges that alter the diffraction slot’s exit flare rate.

5.1 Installing & removing GEO’s Configurable Directivity Devices

GEO M10 are shipped in the 80° dispersion configuration, 120° CDD™ flanges are an optional accessory (GMT-FLGM10).

To change dispersion in the non-coupling plane to 120°:

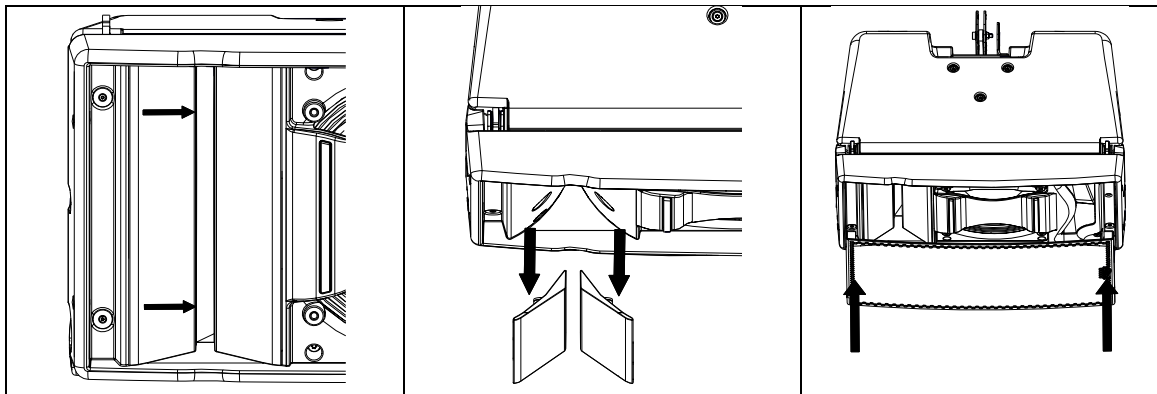
- Pull the lever to remove the grille on the side (attached with a sling);
- Position the CDD™ flanges on the waveguide output magnetic clips;
- Reinstall the grille and lock it with the lever



To remove the 120° CDD™ flanges:

- Pull the lever to remove the grille on the side (attached with a sling)
- Remove the CDD™ flanges from the waveguide output magnetic clips
- Reinstall the grille and lock it with the lever

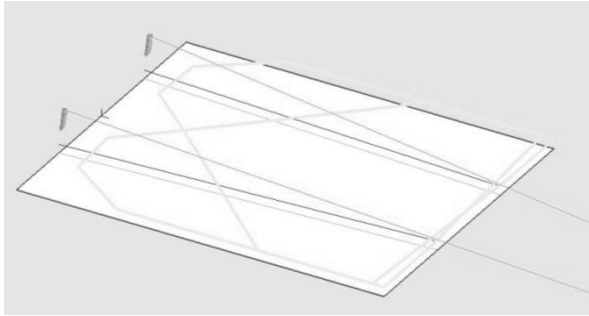
NB: In case of GEO M10-I versions, proceed as above by removing the side grille screws



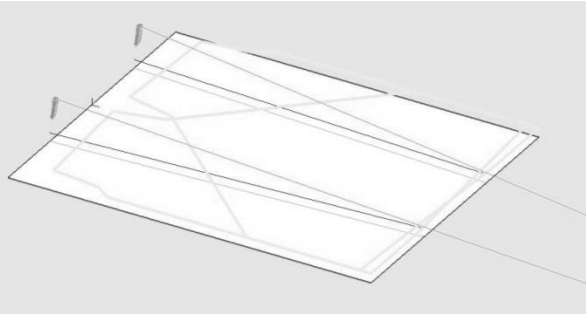
5.2 When & where to use Configurable Directivity flanges

The diagrams show audience area coverage for a stereo system. While the GEO cluster will deliver even SPL from the front to the rear of this audience area, there are “holes” near the front in the centre and at the outside edges. We cannot fill the outside coverage gaps without enlarging the centre gap, and vice versa (left figure below).

If 120° Configurable Directivity Devices are installed at the bottom cabinet of the clusters, coverage will look more like the pattern in right figure below.



-6dB coverage, all GEO M10 in 80° configuration



-6dB coverage, bottom GEO M10 in 120° configuration

In curved vertical arrays, the 120° Configurable Directivity Device can be used:

- On the bottom row of curved vertical arrays, to fill in coverage gaps in the front rows.
- On all rows of curved vertical arrays, in cases where 120° of horizontal coverage is preferred to 80°.

IMPORTANT

Installing or removing one of the two flanges anticipating asymmetrical coverage will degrade both coverage and frequency response.

6 GEO M10 HARDWARE SETUP PROCEDURE

Before proceeding with assembly of GEO M10 & MSUB15 arrays, please ensure that the components are present and undamaged. A component list is appended to this manual. In the event of any shortage, please contact your supplier.

For maximum efficiency the GEO M10 & MSUB15 rigging system requires three experienced persons for set-up: typically one motor hoist operator, and one operator per side of the array. Good synchronisation and crosscheck between the operators are key elements for a reliable and safe set-up.

6.1 **SAFETY FIRST**

GEO M10 & MSUB15 Rigging System structural computations and related documents are available in NS-1 or at Nexo (info@nexo.fr) upon request.

We include this section to remind you of safe practice when flying the GEO M10 & MSUB15 system. Please read it carefully. However, user must always apply his or her knowledge, experience and common sense. If in any doubt, seek advice from your supplier or NEXO agent.

This manual offers guidance only for GEO M10 & MSUB15 loudspeaker systems. References in this manual to other rigging equipment such as motor hoists, steels, shackles etc. are made to clarify the description of rigging procedures. The user must ensure that operators are properly trained by other agencies in the use of these items.

The GEO M10 & MSUB15 Rigging System has been optimised for the deployment of curved vertical tangent arrays of GEO M10 & MSUB15 loudspeakers. Angle adjustment between cabinets has been limited to specific settings to ensure correct acoustic coupling.

The GEO M10 & MSUB15 Rigging System is a professional precision tool set, and should be handled with extreme care. Only persons who are fully conversant with the operation of the GEO M10 & MSUB15 Rigging System and provided with suitable safety equipment should deploy GEO Arrays. Misuse of the GEO M10 & MSUB15 Rigging System could lead to dangerous consequences.

Used and maintained correctly, the GEO M10 & MSUB15 Rigging System will give many years of reliable service in portable systems. Please take the time to read and understand this manual. Always use NS-1 to determine the optimum angle settings for a particular venue, hang point and curved vertical GEO M10 & MSUB15. Applied forces and moments are strongly cabinet quantity and angle configuration dependent. Cluster configuration must be implemented and validated in NS-1 prior to installation.

6.1.1 **Flown Systems Safety**

Always inspect all the rigging components and cabinets for damage before assembly. Pay special attention to the lifting points, and safety clips. If you suspect that any of the components are damaged or defective, DO NOT USE THE AFFECTED PARTS. Contact your supplier for replacements.

Read this manual carefully. Also be familiar with the manuals and safe working procedures for any ancillary equipment that will be used with the GEO M10 & MSUB15 Rigging System.

Applied forces and moments are strongly cabinet quantity and angle configuration dependent. Cluster configuration must be implemented and validated in NS-1 prior to installation.

Ensure that all local and National regulations regarding the safety and operation of flying equipment are understood and adhered to. Information on these regulations can usually be obtained from Local Government Offices.

When deploying a GEO M10 & MSUB15 system always wear protective headwear, footwear and eye protection.

Do not allow inexperienced persons to handle a GEO M10 & MSUB15 system. Installation personnel should be trained in loudspeaker flying techniques and should be fully conversant with this manual.

Ensure that motor hoists, hoist control systems and ancillary rigging components are currently certified as safe and that they pass a visual inspection prior to use.

Ensure that public and personnel are not allowed to pass beneath the system during the installation process. The work area should be isolated from public access.

Never leave the system unattended during the installation process.

Do not place any object, no matter how small or light, on top of the system during the installation procedure. The object may fall when the system is flown and is likely to cause injury.

Secondary safety steels must be installed once the system has been flown to the operating height. Secondary steels must be fitted irrespective of requirements of the local safety standards applicable to the territory.

Ensure that the system is secure and prevented from pivoting around the motor hoist.

Avoid any form of excessive dynamic loading to the assembly (structural computations on GEO M10 & MSUB15 Rigging System are based on a 1/1.2 factor for hoist or motor acceleration).

NEVER attach any item to the GEO M10 & MSUB15 system other than the GEO M10 & MSUB15 accessories.

When flying outdoor systems ensure that the system is not exposed to excessive wind or snow loads and is protected from rainfall.

In case of wind greater than 8 on Beaufort scale (72km/h – 45mph), a touring system has to be landed or an additional securing has to be implanted.

For fixed installations, wind loading has to be taken into account in accordance to the national standards.

The GEO M10 & MSUB15 Rigging System requires regular inspection and testing by a competent test centre. NEXO recommend that the system is load tested and certified annually or more frequently if local regulations require.

When de-rigging the system ensure that the same duty of care is given to the procedure as for the installation. Pack GEO M10 & MSUB15 components carefully to prevent damage in transit.

6.1.2 Ground Stacking Safety

Statistically, many more injuries occur due to unstable ground stacked PA systems than those associated with flown systems. There are several reasons for this fact, however the message is clear:

Always survey the supporting structure upon which a ground stack is to be built. Always look beneath PA wings to inspect the deck support and if necessary ask for the stage scrims and dressings be removed to allow access.

If the stage surface slopes, as it does in some theatres, ensure that the system is prevented from sliding forwards due to vibration. This may require the fitting of timber battens to the stage floor.

For outdoor systems ensure that the system is protected from wind forces which might cause the ground stack to become unstable. Wind forces can be huge, especially upon large systems, and should never be underestimated. Observe meteorological forecasts, calculate the “worst case” effect upon the system prior to erection and ensure that the system is secured appropriately.

Take care when stacking cabinets. Always employ safe lifting procedures and never attempt to build stacks without sufficient personnel and equipment.

Never allow anyone, whether operators, artists or members of the public to climb onto a ground stacked PA system. Anyone who needs to climb over 2m (6 ft) high should be fitted with suitable safety equipment including a clip-on harness. Please refer to local Health and Safety legislation in your territory. Your dealer can help with advice on access to this information.

Apply the same attention to all safety matters when de-stacking systems.

Be aware that safety procedures are as important in the truck and in the warehouse as they are at the venue.

6.1.3 Contacts

Correct training is fundamental to safe practise when working with loudspeakers flying systems. NEXO recommend that users contact local industry associations for information on specialist course.

Information for International training agencies can be obtained by contacting either:

The Production Services Association
(PSA),
School Passage,
Kingston-upon-Thames,
KT1 SDU Surrey,
ENGLAND
Telephone: +44 (0) 181 392 0180
www.psa.org.uk/

Rigstar Training and Testing Center
82 Industrial Dr. Unit 4
Northampton, Massachusetts
01060 U.S.A.
Phone: 413-585-9869
www.rigstar.com/

ESTA
Entertainment Services & Technology
Association
875 Sixth Avenue, Suite 1005
NEW YORK, NY 10001 USA
Phone: 212-244-1505
www.esta.org

6.2 General Description

6.2.1 GEO M1012 and GEO M1025

IMPORTANT

GEO M1012 & GEO M1025 share the same geometry and fittings, but different wavefront curvatures. In order to distinguish one from the other,

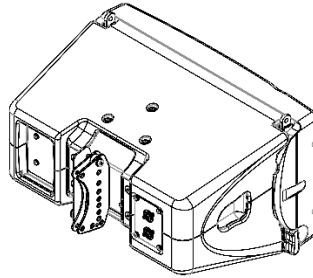
GEO M1012 is marked with the following sign on its sides:



GEO M1025 is marked with the following sign on its sides:

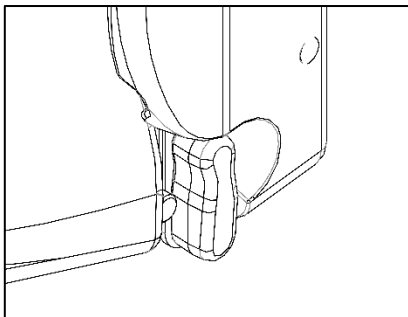


6.2.2 GEO M10 rigging system

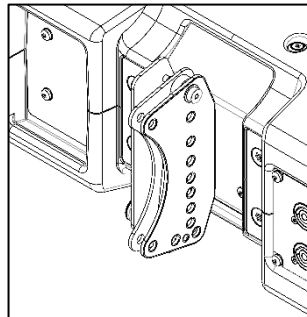


GEO M10 features a 3 points rigging system, 2 for front connection, and 1 for rear connection and angle splay settings.

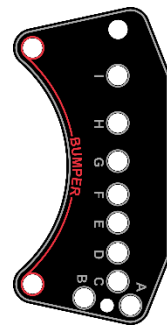
- Front connection of two subsequent modules is ensured by an AutoRig™ system, with 3 positions: open / ready to lock / locked (only on touring version).
- Rear connection of two subsequent modules is ensured by a link bar, with one safety point on a latch and one quick release pin to adjust angle settings.



GEO M10 front rigging points



GEO M10 rear rigging points



GEO M10 angle settings

Angle splay setting sequences are as follow:

- GEO M1012 to GEO M1012: 0.6° (A) / 1.6° (B) / 3.2° (C) / 6.3° (D) / 9.5° (E) / 12.5° (F)
- GEO M1012 to GEO M1025: 12.5° (F) / 16° (G)
- GEO M1025 to GEO M1025: 16° (G) / 20° (H) / 25° (I)

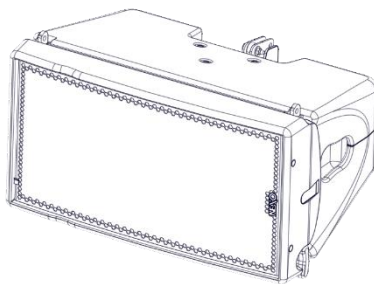
RIGGING ANGLES		
A = 0.6°	D = 6.3°	G = 16°
B = 1.6°	E = 9.5°	H = 20°
C = 3.2°	F = 12.5°	I = 25°

6.2.3 GEO M10 “Left” and “Right” configuration

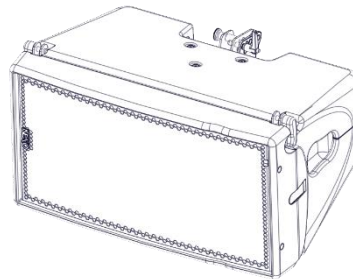
GEO M10 can be installed “Left” or “Right”:

- “Left” means HF waveguide is left as seen from front
- “Right” means HF waveguide is right as seen from front

GEO M10 can be connected to bumpers “Left” or “Right” by simply flipping the cabinets. Whenever possible, NEXO recommends symmetrical designs (preferably HF waveguide inwards in stereo configurations)

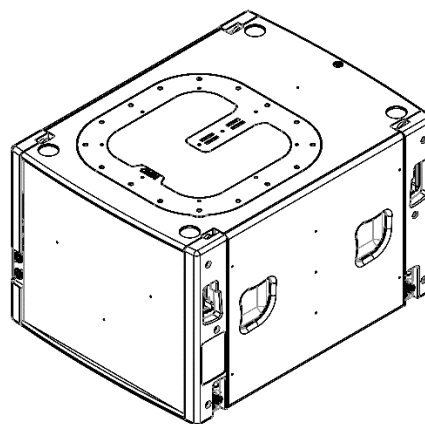


GEO M10 “Left”



GEO M10 “Right”

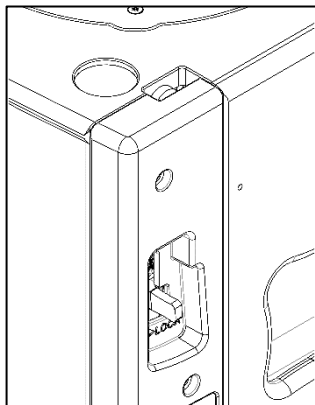
6.2.4 MSUB15 rigging system



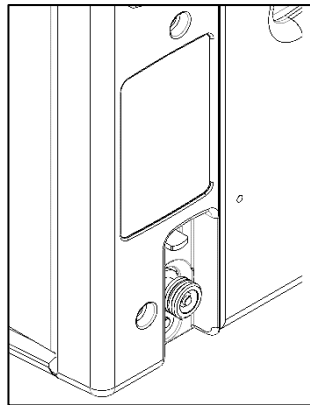
MSUB15 features a 4 points rigging system:

- Upper connection features retractable rigging links that can be unlocked from the sides
- Lower connection features semi-auto lock rigging points that lock with latches on the sides

Front and rear rigging points are identical so that MSUB15 count be mounted reverse for cardioid setups



MSUB15 upper rigging points



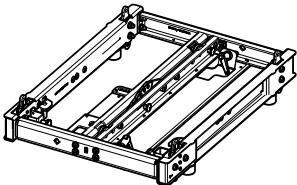
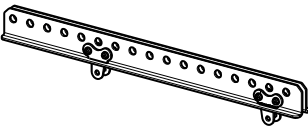
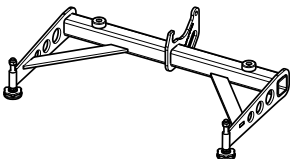
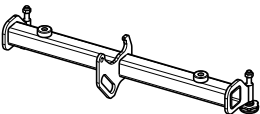
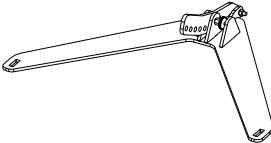
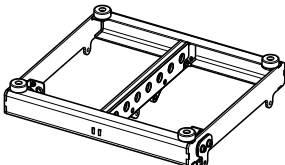
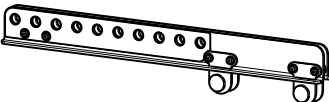
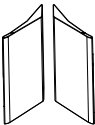
MSUB15 lower rigging points

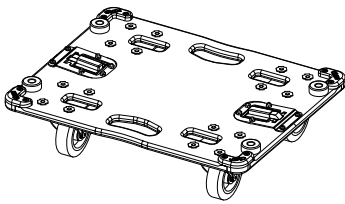

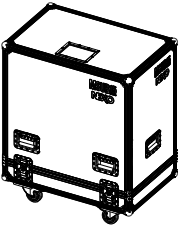
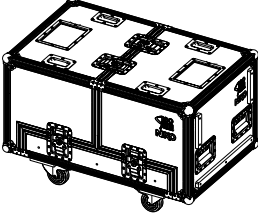
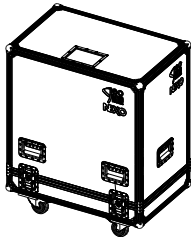
Angle splay setting sequences are as follow:

- MSUB15 to MSUB15: 0°
- MSUB15 to GEO M1012 (or M1025): -12° / -9° / -6° / -3° / 0° / +3° / +6° / +9°

6.2.5 Accessories

GEO M10 & MSUB15 accessories are:

VNT-BUMPM10 	VNT-EXBARM10 	
VNT-GSTKM10L 	VNT-GSTKM10S 	VNT-MNSTKM10 
GMT-LBUMPM10 	GMT-EXBARM10L 	GMT-FLGM10 

<p>MST-WBMSUB15</p> 	<p>MST-COVMSUB15</p> 	
<p>MST-2CASEMSUB15</p> 	<p>GMT-3CASEM10</p> 	<p>GMT-6CASEM10</p> 

6.2.1 WARNINGS ON GEO M10 & MSUB15 ACCESSORIES

WARNING



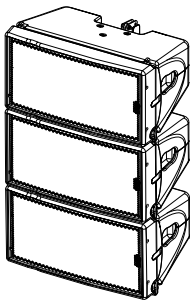
All GEO M10 Accessories are specifically rated in agreement with structural computations.

Never use other accessories – including push-pins - when assembling GEO M10 cabinets than the ones provided by NEXO: NEXO will decline responsibility over the entire GEO M10 accessory range if any component is purchased from different supplier.

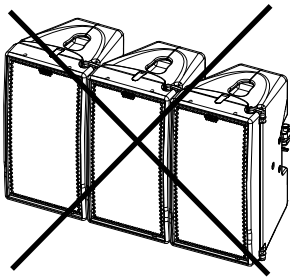
WARNING



All GEO M10 accessories have been designed so that cabinets are arrayed vertically. GEO M10 horizontal assemblies as shown in figure below- are UNSAFE and STRICTLY PROHIBITED.



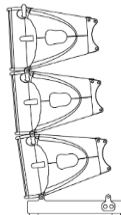
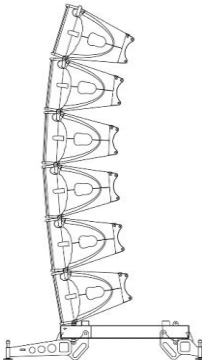
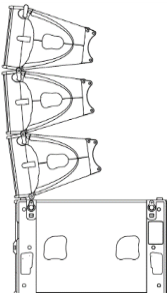
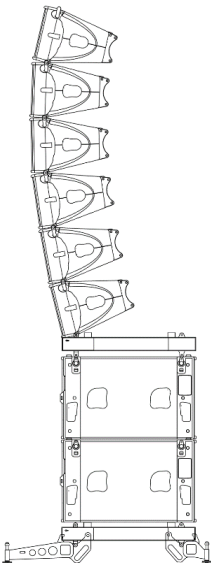
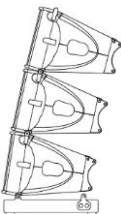
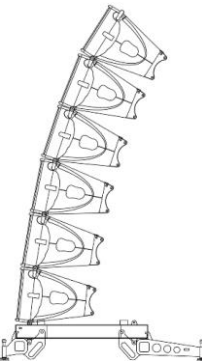
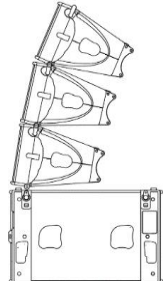
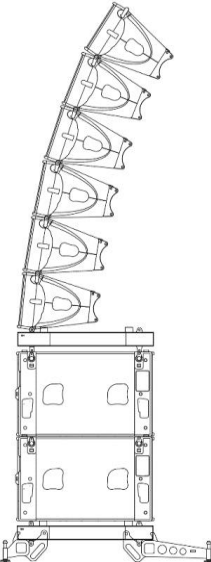
YES



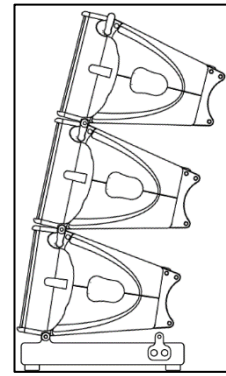
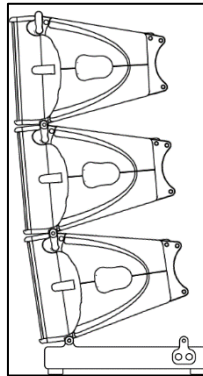
NO

6.3 **Ground Stack setups**

6.3.1 **Described configurations**

GEO M10 only Light Bumper	GEO M10 only Touring Bumper + Extensions	MSUB15 + GEO M10 Ministack	MSUB15 + GEO M10 Touring Bumper + Extensions
			
			

6.3.2 GEO M10 only on Lightweight Bumper



Required item

- 1 x GMT-LBUMPM10

IMPORTANT

LBUMPM10 is rated for a maximum of 3 stacked GEO M10 in any inter cabinet angle configuration with $\pm 3^\circ$ initial angle, provided the stack is assembled according to below rules:

- **LBUMPM10 must always be installed on a horizontal surface**
- **Public is not allowed within a safety area which radius is equal or higher than assembly height.**

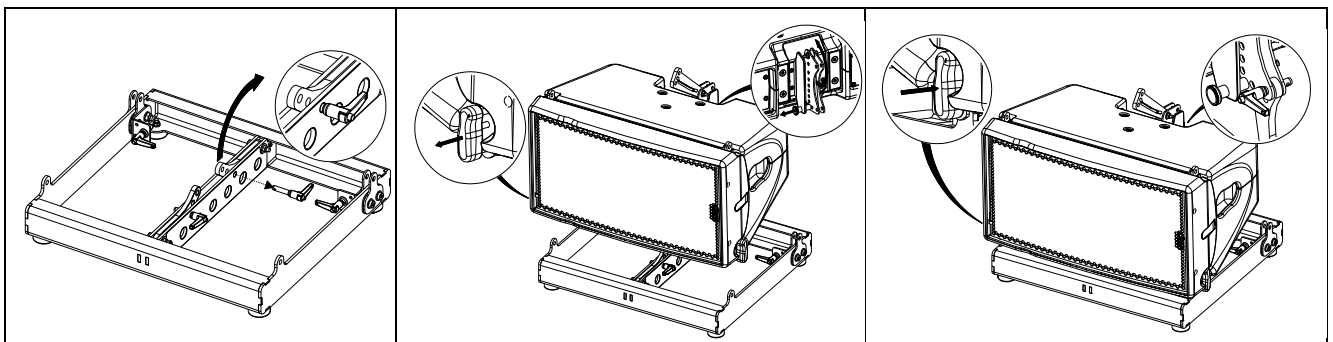
Procedure

GMT-LBUMPM10 can be flipped front and back depending if it connects to GEO M10 Right or Left.

- When connecting GEO M10 Left, bumper front is on the “G” hole index side
- When connection GEO M10 Right, bumper front is on the “A” hole index side

GEO M10 Left

- Set the bumper on the ground so that front is on the “G” hole side
- Remove the BL825 quick release pin of rear LBUMPM10 link bar, and rotate it upwards
- Release first GEO M10 link bar, and set AutoRig in automatic lock position
- Position first GEO M10 on top of the bumper, front points will lock automatically
- Connect the bumper link bar (selection of $-3^\circ / 0^\circ / +3^\circ$) to GEO M10 rear rigging plate (hole marked “bumper”) Lock with the quick release pin BL0825.

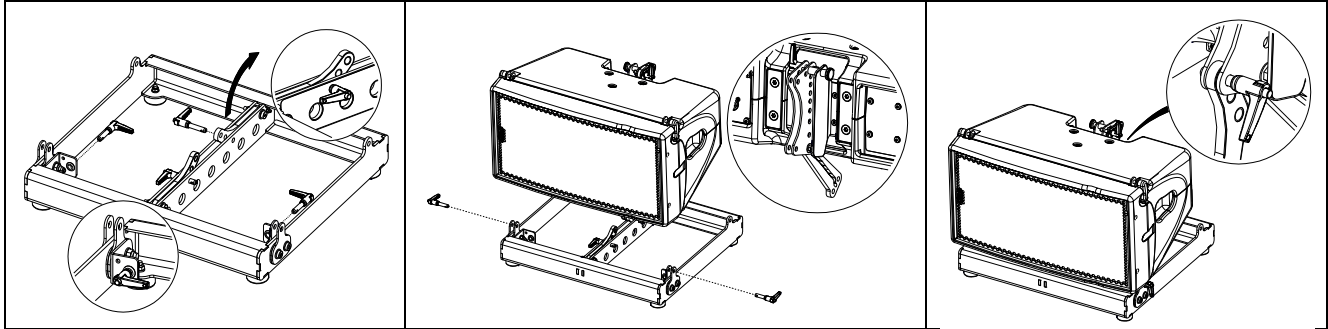


IMPORTANT

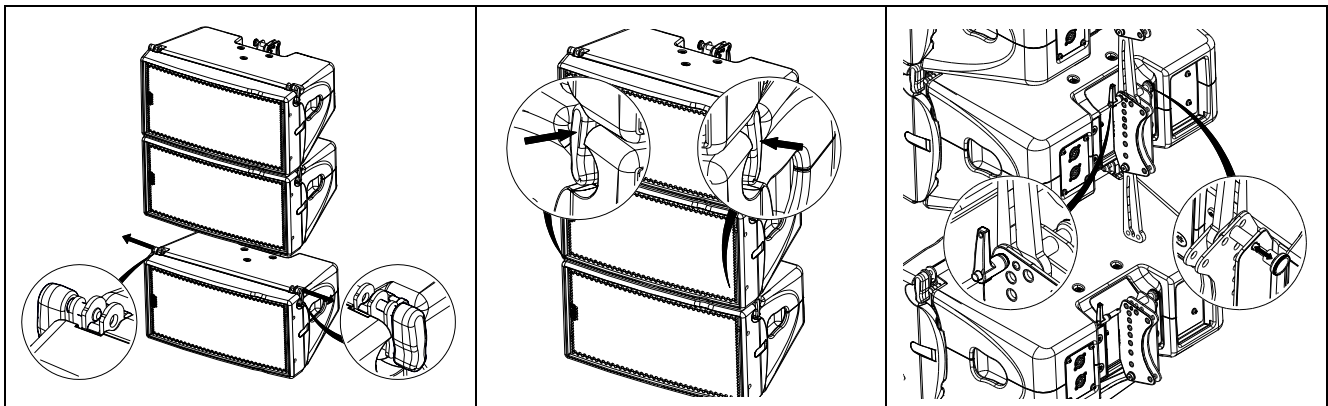
Ensure that all AutoRig™ systems are locked

GEO M10 Right

- Set the bumper on the ground so that front is on the “A” hole side
- Remove the two BL820 quick release pins from their side storage position, and the BL825 quick release pin of rear LBUMPM10 link bar.
- Release GEO M10 link bar.
- Position first GEO M10 on top of the bumper, and lock it to the bumper with the 2 BL820 quick release pins.
- Connect the bumper link bar (selection of -3° / 0° / $+3^{\circ}$) to GEO M10 rear rigging plate (hole marked “bumper”) Lock with the quick release pin BL0825.

Subsequent GEO M10s

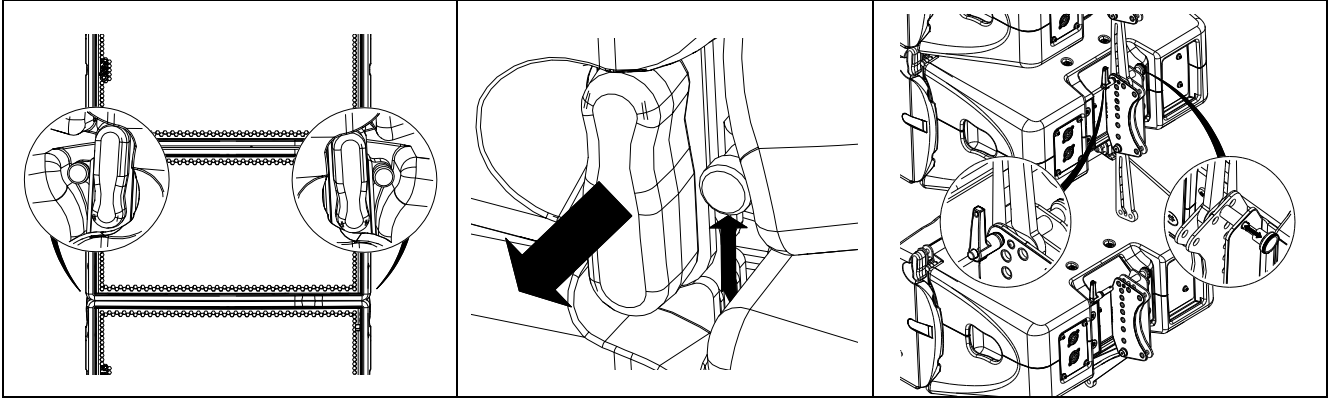
- Position second GEO M10 cabinet with AutoRig™ in automatic lock position, and lock front points to first GEO M10
- Unlock GEO M10 link bar
- Pull the latch to engage the guide in GEO M10 rear slot.
- Adjust the angle by inserting quick release pin BL820 in proper hole.
- Connect subsequent GEO M10 cabinets as with second.

**IMPORTANT**

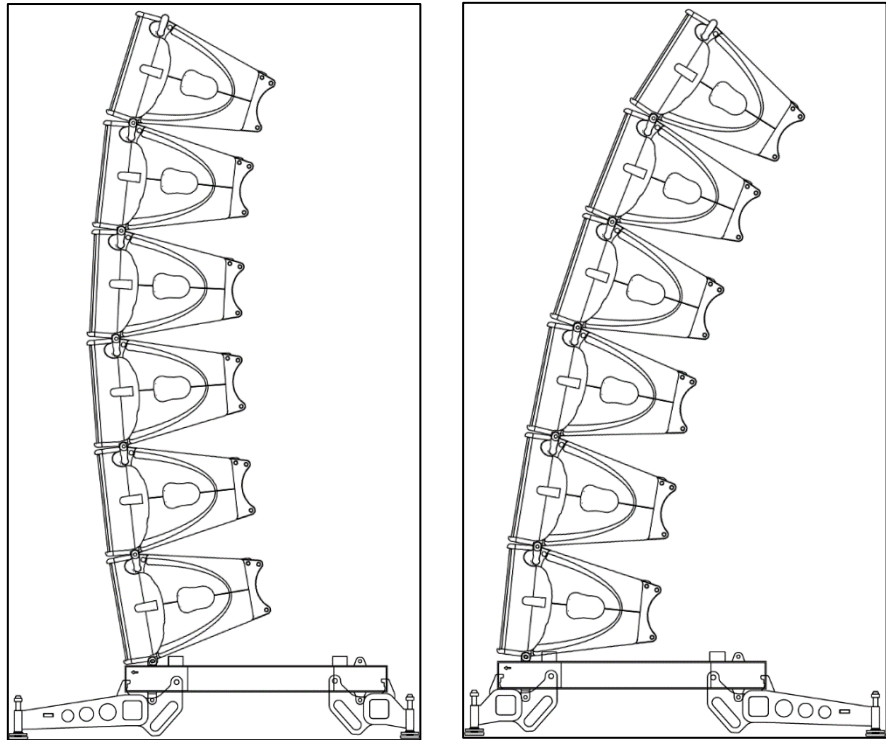
Ensure that bumper quick release pins are properly locked into GEO M10, and that all AutoRig™ and rear pins are locked

Disassembly

- On both side, pull AutoRig™ and hold the side knob (AutoRig™ remains in the open position).
- Remove the rear quick release pin BL820
- Unlock the GEO M10 link bar by pulling the latch.
- Disassemble GEO M10s



6.3.3 GEO M10 only on Touring Bumper with stacking extensions



Required item

- 1 x VNT-BUMPM10
- 1 x VNT-GSTKM10S
- 1 x VNT-GSTKM10L

IMPORTANT

Ground stack assembly BUMPM10 + GSTKM10S + GSTKM10L is rated for a maximum of 6 x GEO M10 in any inter cabinet angle configuration with $\pm 12^\circ$ initial angle, provided this device is assembled according to below rules:

- BUMPM10 must be adjusted to be horizontal
- Public is not allowed within a safety area which radius is equal or higher than assembly height.
- It is highly recommended to secure the system to a fix point located at the back of the stack.

Procedure

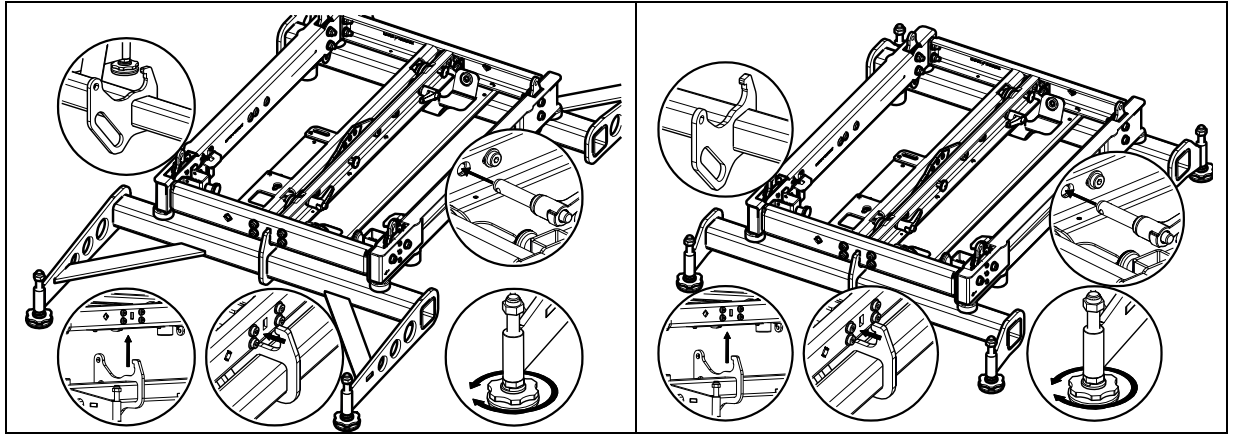
- Set the bumper on the ground so that front with front direction indicated by side arrows
- Insert GSTKM10L and/or GSTKM10S guides into bumper front and rear center slots

IMPORTANT

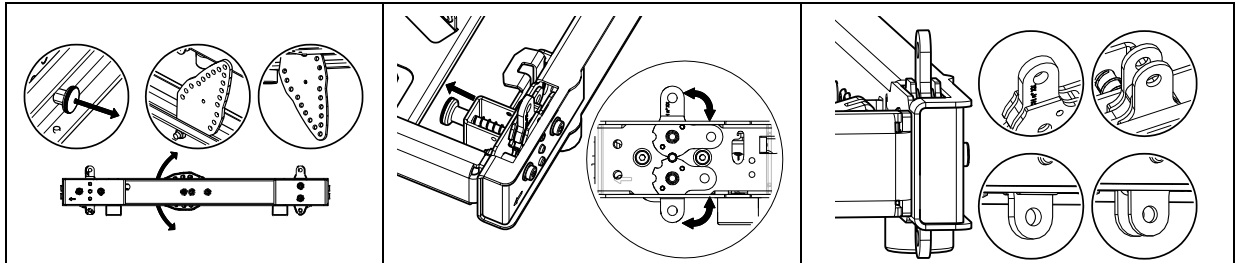
If bottom GEO M10 angle is negative, GSTKM10L must be connected at the front and GSTKM10S at the back

If bottom GEO M10 angle is positive, GSTKM10S must be connected at the front and GSTKM10L at the back

- Lock GSTKM10L and/or GSTKM10S into bumper with BUMPM10 quick release pin 1240.
- Adjust feet height so that bumper is horizontal



- Pull latch to release the BUMPM10 center link bar, and rotate it upwards
- Pull the bumper front latches, rotate the upper link so that connection points are single leg (GEO M10 Left) or double leg (GEO M10 Right) and release the latches to lock in required position



GEO M10 Left

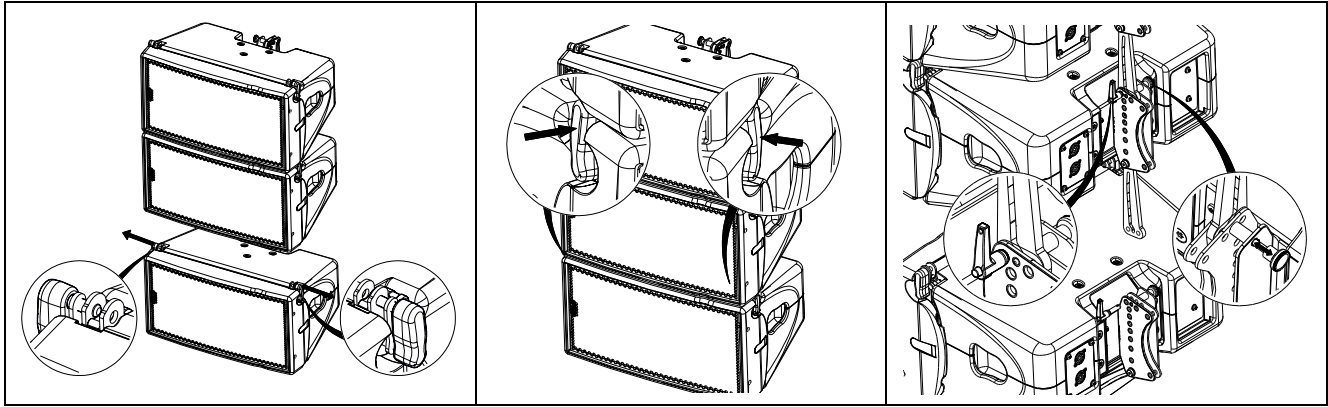
- Release first GEO M10 link bar, and set AutoRig in automatic lock position
- Position first GEO M10 on top of the bumper, front points will lock automatically
- Connect the bumper link bar (selection from -12° to $+12^{\circ}$ in 3° steps) to GEO M10 rear rigging plate (hole marked "bumper") Lock with the quick release pin BL0820.

GEO M10 Right

- Release first GEO M10 link bar.
- Position first GEO M10 on top of the bumper, and lock it to the bumper with the 2 BL820 quick release pins.
- Connect the bumper link bar (selection from -12° to $+12^{\circ}$ in 3° steps) to GEO M10 rear rigging plate (hole marked "bumper") Lock with the quick release pin BL0825.

Subsequent GEO M10s

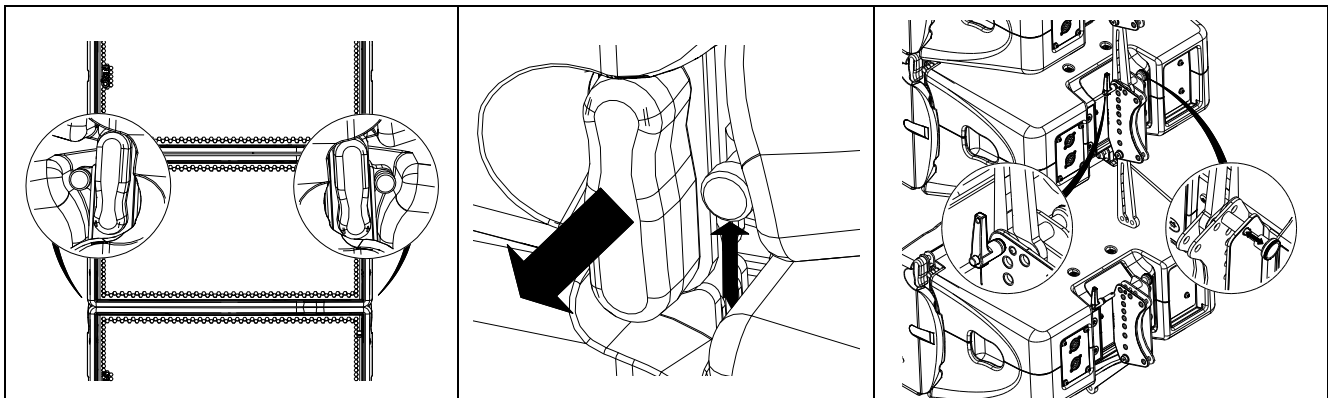
- Position second GEO M10 cabinet with AutoRig™ in automatic lock position, and lock front points to first GEO M10
- Unlock GEO M10 link bar
- Pull the latch to engage the guide in GEO M10 rear slot.
- Adjust the angle by inserting quick release pin BL820 in proper hole.
- Connect subsequent GEO M10 cabinets as with second.

**IMPORTANT**

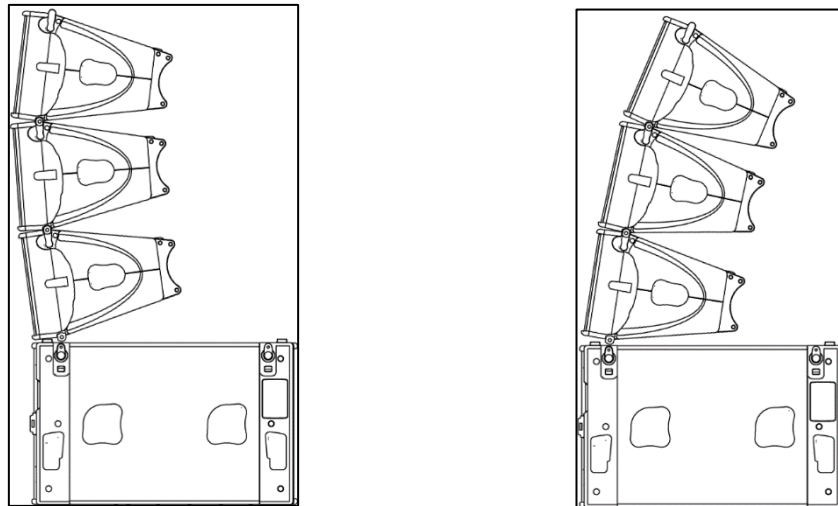
Ensure that bumper quick release pins are properly locked into GEO M10, and that all AutoRig™ and rear pins are locked

Disassembly

- On both side, pull AutoRig™ and hold the side knob (AutoRig™ remains in the open position).
- Remove the rear quick release pin BL820
- Unlock the GEO M10 link bar by pulling the latch.
- Disassemble GEO M10s



6.3.4 MSUB15 and GEO M10 with Ministack adaptor



Ministack adaptor only allows to stack GEO M10 in "left" configuration

Required item

- 1 x VNT-MNSTKM10

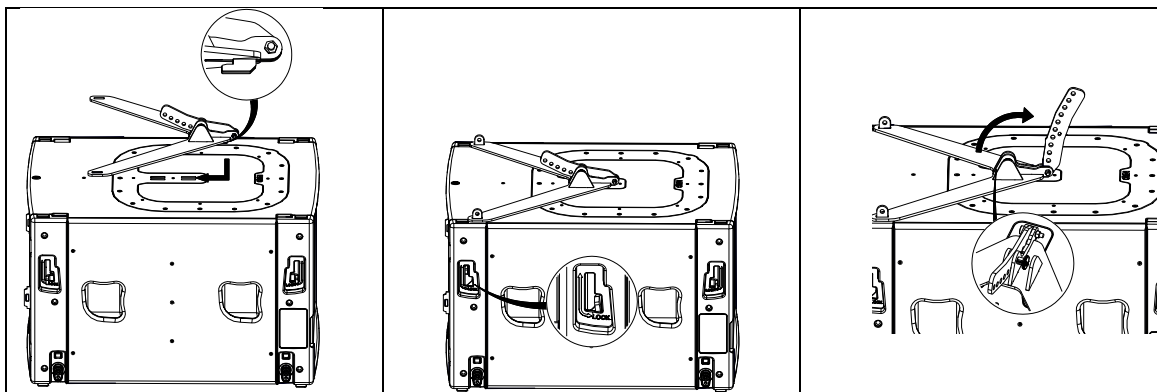
IMPORTANT

Ground stack assembly is rated for a maximum of 2 x SUBM15 + 3 x GEO M10 in any inter cabinet angle configuration with $\pm 12^\circ$ initial angle, provided this device is assembled according to below rules:

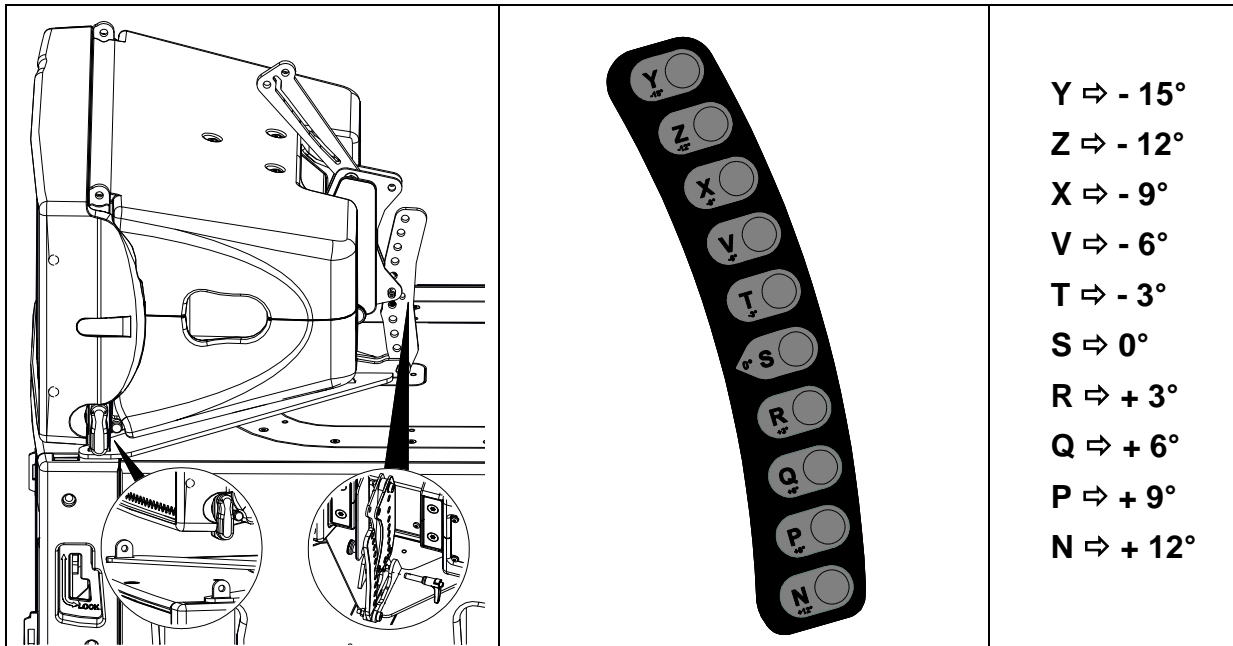
- MSUB15 must always be installed on a horizontal surface
- Public is not allowed within a safety area which radius is equal or higher than assembly height.

Procedure

- Position first MSUB15 on the ground
- Position second MSUB15 (front or back) on top of first, and lock front and rear connecting points
- Insert MNSTKM10 back into MSUB15 rear upper slot, and push it forward so that front opening are aligned with MSUB15 front connecting points.
- Unlock upper MSUB15 connecting points
- Pull the latch to unlock the link bar

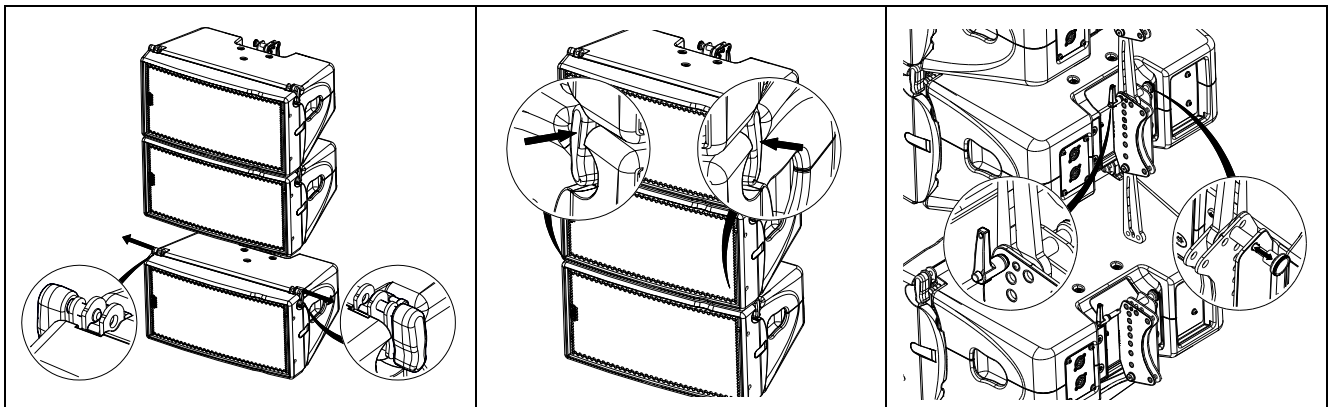


- Release first GEO M10 link bar, and set AutoRig in automatic lock position
- Position first GEO M10 on top of the MNSTKM10, front points will lock automatically
- Connect the MNSTKM10 link bar (selection from -15° to $+12^{\circ}$ in 3° steps) to GEO M10 rear rigging plate (hole marked "bumper") Lock with the quick release pin BL0820.



Subsequent GEO M10s

- Position second GEO M10 cabinet with AutoRig™ in automatic lock position, and lock front points to first GEO M10
- Unlock GEO M10 link bar
- Pull the latch to engage the guide in GEO M10 rear slot.
- Adjust the angle by inserting quick release pin BL820 in proper hole.
- Connect subsequent GEO M10 cabinets as with second.

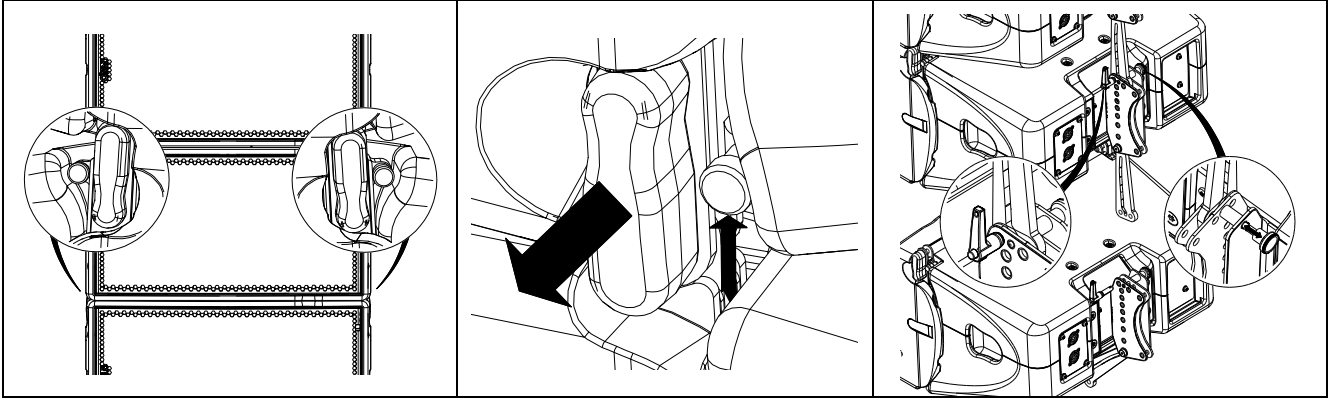


IMPORTANT

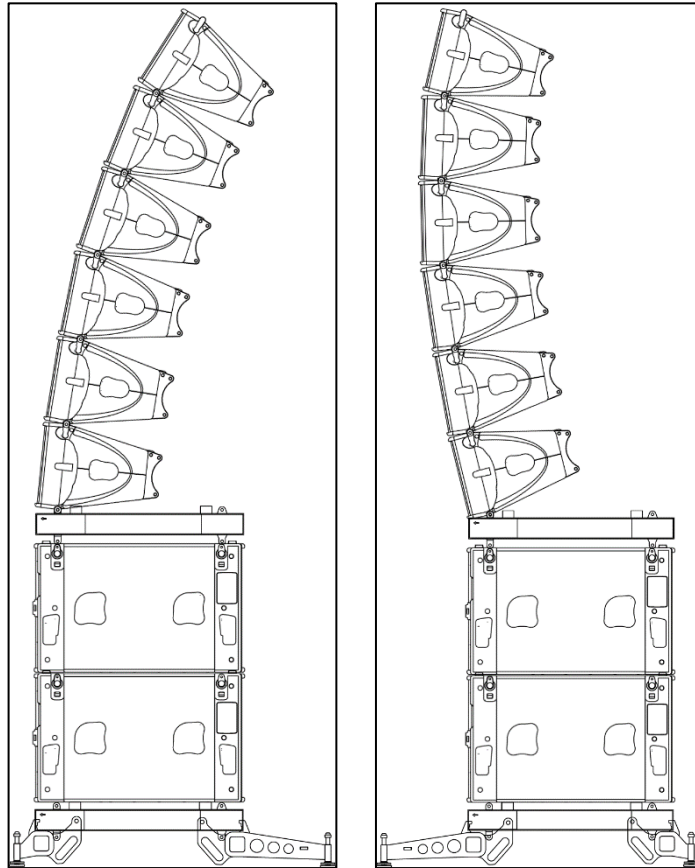
Ensure that bumper quick release pins are properly locked into GEO M10, and that all AutoRig™ and rear pins are locked

Disassembly

- On both side, pull AutoRig™ and hold the side knob (AutoRig™ remains in the open position).
- Remove the rear quick release pin BL820
- Unlock the GEO M10 link bar by pulling the latch.
- Disassemble GEO M10s



6.3.5 MSUB15 and GEO M10 on Touring Bumper with stacking extensions



Required item

- 2x VNT-BUMPM10
- 1 x VNT-GSTKM10S
- 1 x VNT-GSTKM10L

IMPORTANT

Ground stack assembly BUMPM10 + GSTKM10S + GSTKM10L is rated for a maximum of 2 x MSUB15 + 6 x GEO M10 in any inter cabinet angle configuration with $\pm 12^\circ$ initial angle, provided this device is assembled according to below rules:

- BUMPM10 must be adjusted to be horizontal
- Public is not allowed within a safety area which radius is equal or higher than assembly height.
- It is highly recommended to secure the system to a fix point located at the back of the stack.

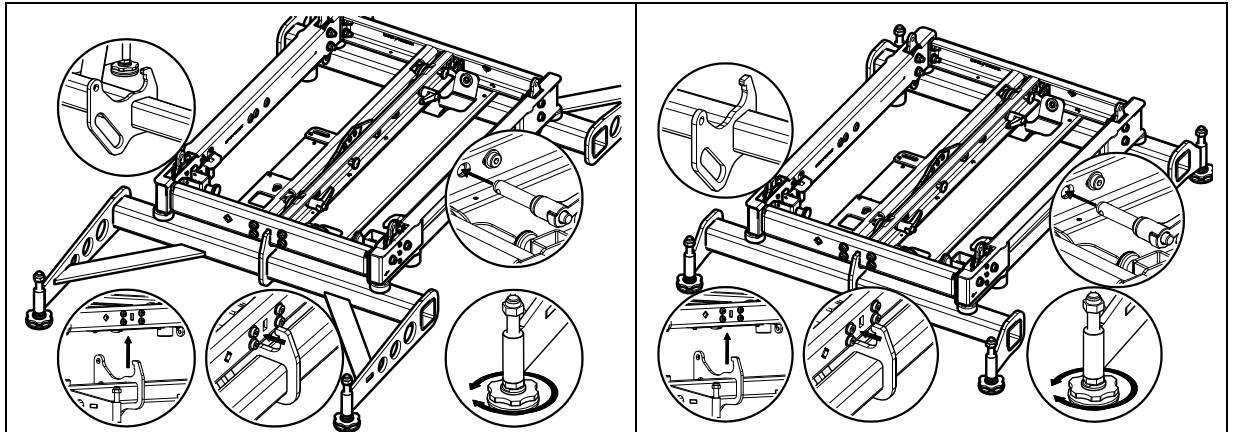
Procedure

- Set the bumper on the ground so that front with front direction indicated by side arrows
- Insert GSTKM10L and/or GSTKM10S guides into bumper front and rear center slots

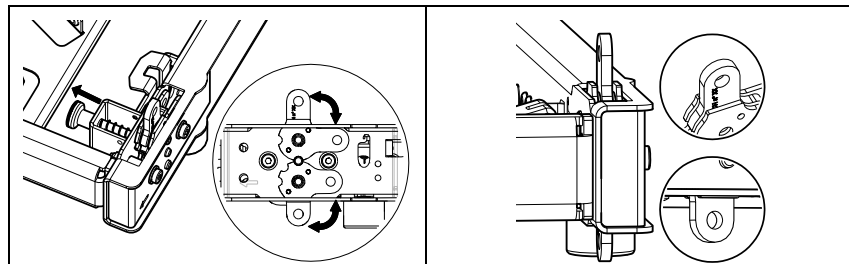
IMPORTANT

- If bottom GEO M10 initial angle is negative, GSTKM10L must be connected at the front and GSTKM10S at the back
- If bottom GEO M10 initial angle is positive, GSTKM10S must be connected at the front and GSTKM10L at the back

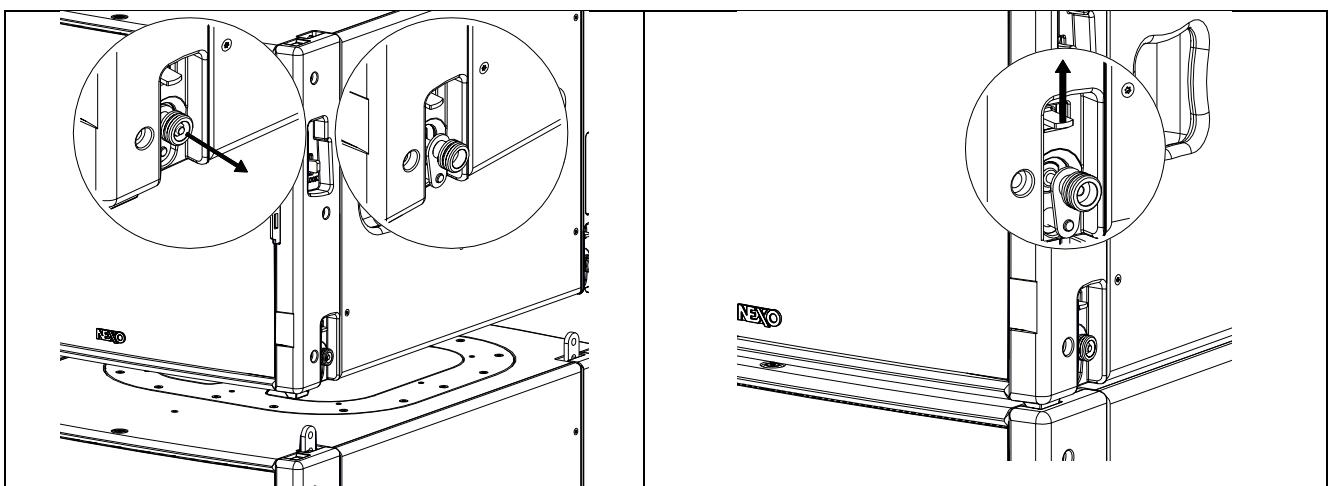
- Lock GSTKM10L and/or GSTKM10S into bumper with BUMPM10 quick release pin 1240.
- Adjust feet height so that bumper is horizontal

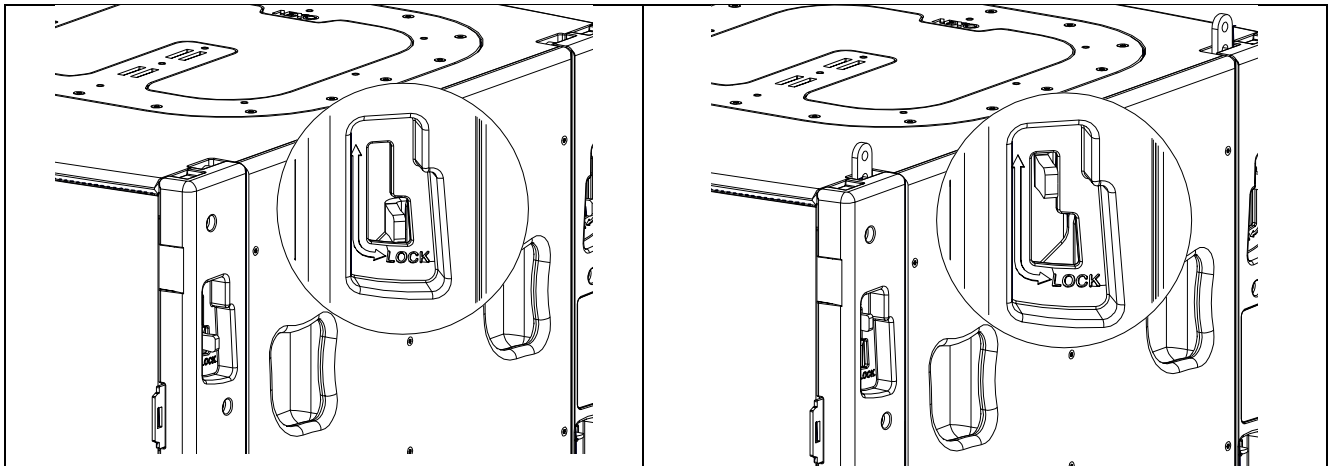


- Pull the bumper front latches, rotate the upper links so that connection points are single leg and release the latches.



- Align first MSUB15 on top of BUMPM10, and lock them by releasing front and rear MSUB15 bottom latches connecting points
- Unlock the 4 MSUB15 upper connecting points
- Align second MSUB15 on top of first, and lock them by releasing front and rear upper MSUB15 latches connecting points





- Position second BUMPM10 on top of MSUB15
- Pull the bumper front latches, rotate the lower links so that connection points are double leg leg and release the latches.

GEO M10 Left

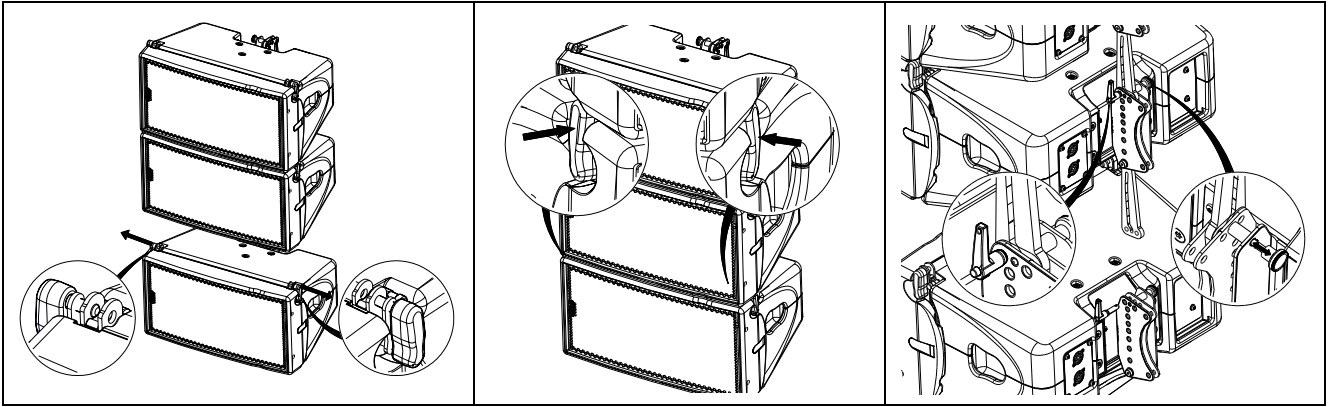
- Pull the bumper front latches, rotate the upper links so that connection points are single leg and release the latches.
- Release first GEO M10 link bar, and set AutoRig™ in automatic lock position
- Position first GEO M10 on top of the bumper, front points will lock automatically
- Connect the bumper link bar (selection from -12° to +12° in 3° steps) to GEO M10 rear rigging plate (hole marked "bumper") Lock with the quick release pin BL0820.

GEO M10 Right

- Pull the bumper front latches, rotate the upper links so that connection points are single leg and release the latches.
- Release first GEO M10 link bar.
- Position first GEO M10 on top of the bumper, and lock it to the bumper with the 2 BL820 quick release pins.
- Connect the bumper link bar (selection from -12° to +12° in 3° steps) to GEO M10 rear rigging plate (hole marked "bumper") Lock with the quick release pin BL0825.

Subsequent GEO M10s

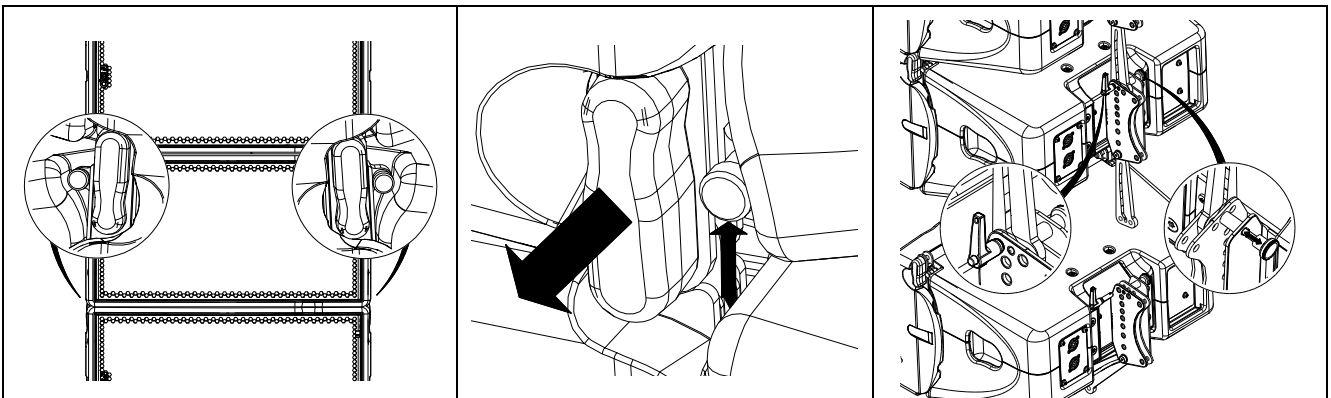
- Position second GEO M10 cabinet with AutoRig™ in automatic lock position, and lock front points to first GEO M10
- Unlock GEO M10 link bar
- Pull the latch to engage the guide in GEO M10 rear slot.
- Adjust the angle by inserting quick release pin BL820 in proper hole.
- Connect subsequent GEO M10 cabinets as with second.

**IMPORTANT**

Ensure that bumper quick release pins are properly locked into GEO M10, and that all AutoRig™ and rear pins are locked

Disassembly

- On both side, pull AutoRig™ and hold the side knob (AutoRig™ remains in the open position).
- Remove the rear quick release pin BL820
- Unlock the GEO M10 link bar by pulling the latch.
- Disassemble GEO M10s

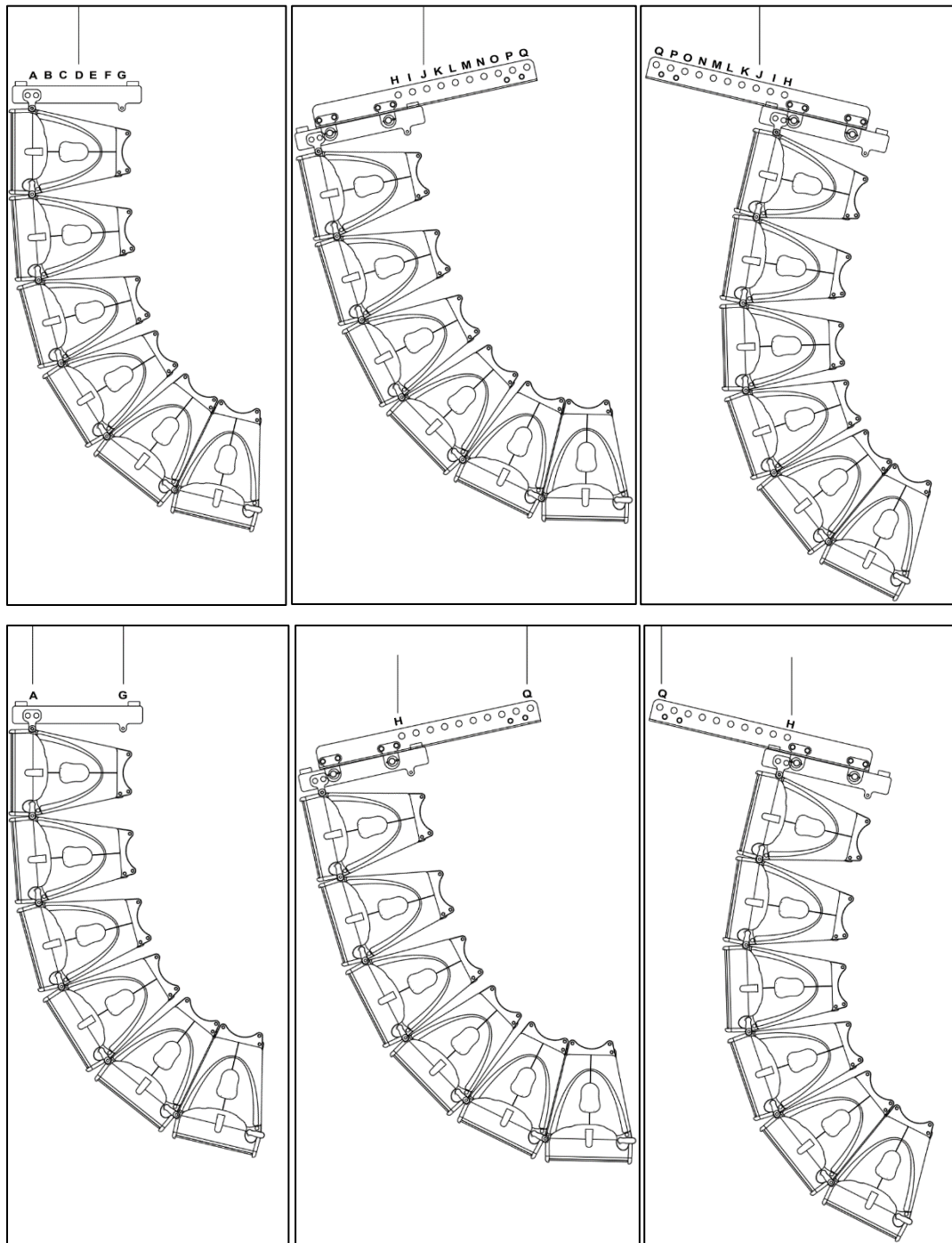


6.4 **Flown clusters setups**

6.4.1 Described configurations

	GEO M10 only Light Bumper	GEO M10 only Touring Bumper	MSUB15 only Touring Bumper	MSUB15 + GEO M10 Touring Bumper
1 rigging point				
2 rigging points				

6.4.2 GEO M10 only flown with Lightweight Bumper



Required items

- 1 or 2 hoists (not provided).
- 1 x GMT-LBUMPM10
- 1 x GMT-EXBARM10L for extended positive and negative bumper angles

IMPORTANT

Maximum GEO M10 quantity for flown vertical cluster with GMT-LBUMPM10 is 12 (and eventually less).

Please check NS1 for mechanical Safety Working Load and acoustic computations.

IMPORTANT

Motor hoist must be rated to support entire cluster weight. Please check configuration in NS1 for proper motor hoist rating

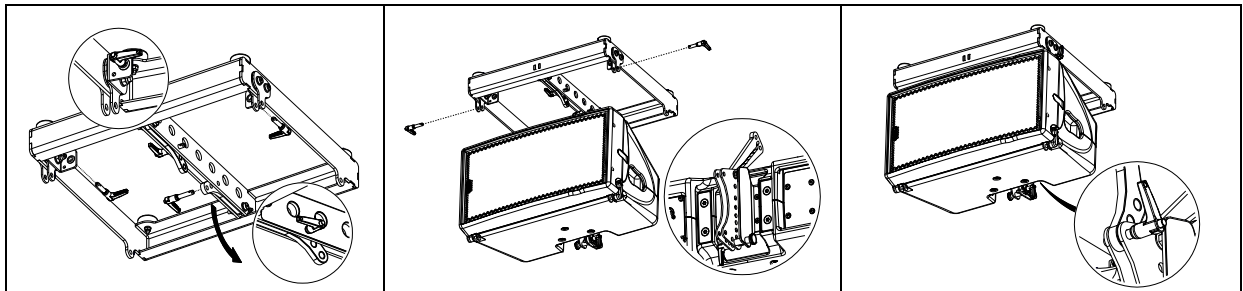
Procedure

GMT-LBUMP10 can be flipped front and back depending if its connects to GEO M10 Right or Left.

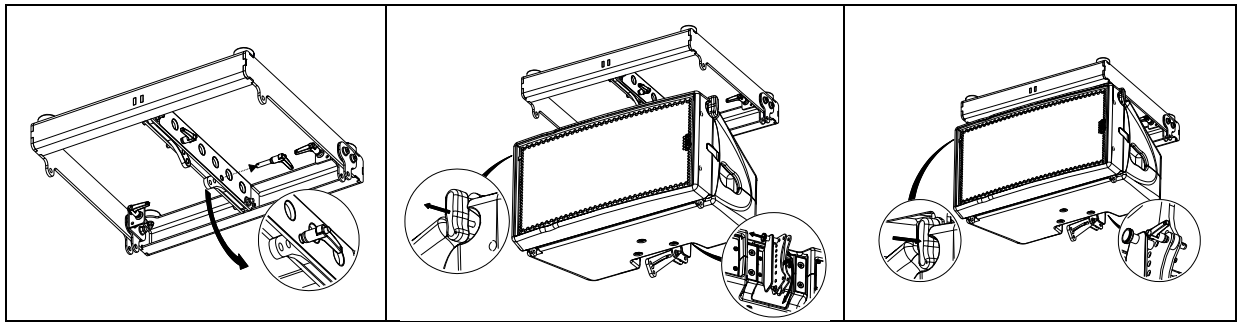
- When connecting GEO M10 Left, bumper front is on the “A” hole index side
- When connection GEO M10 Right, bumper front is on the “G” hole index side

GEO M10 Left

- Position first GEO M10 so that Autorig™ is at the bottom
- Position bumper (“A” hole at front) on top of first GEO M10
- Remove the two BL820 quick release pins from their side storage position, and the BL825 quick release pin of rear bumper link bar.
- Connect bumper front points to GEO M10 with the BL820 quick release pins
- Connect the bumper link bar (0° position) to GEO M10 rear rigging plate (hole marked “bumper”) Lock with the quick release pin BL0825.

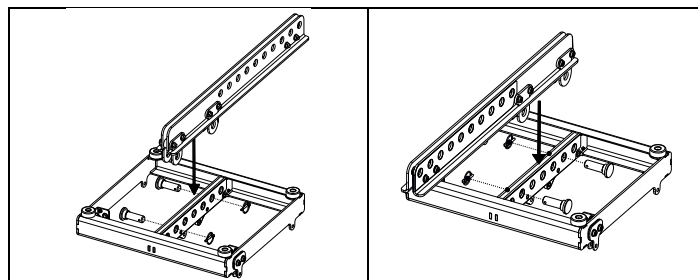
**GEO M10 Right**

- Position GEO M10 so that Autorig™ is at the top and set in automatic lock position
- Position bumper (“G” hole at front) on top of first GEO M10
- Remove the the BL825 quick release pin of rear bumper link bar.
- Connect bumper front points to GEO M10, front points will lock automatically
- Connect the bumper link bar (0° position) to GEO M10 rear rigging plate (hole marked “bumper”) Lock with the quick release pin BL0825.



Subsequent GEO M10s

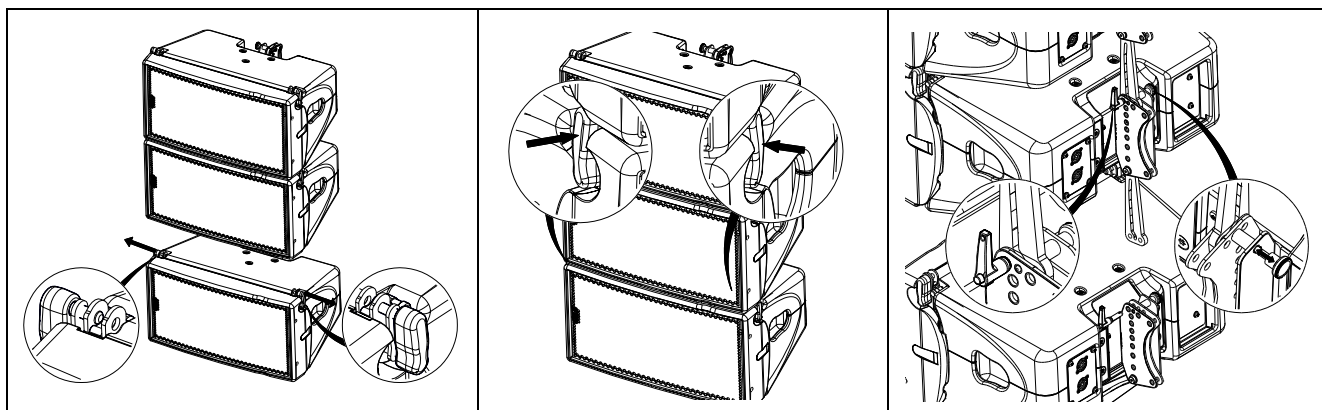
- If required, connect GMT-EXBARM10L to GMT-LBUMPM10 by inserting EXBAR clevis pins into GMT-LBUMPM10 “B” and “F” holes



IMPORTANT

Ensure hoist hook(s) is (are) properly secured to GMT-LBUMPM10 or GMT-EXBARM10L
Ensure that all quick release pins are locked

- Insert shackle(s) in bumper or in extension in required hole(s) as indicated in NS1 design and secure shackle bolt(s);
 - o “A” to “G” on GMT-LBUMPM10
 - o Or “H” to “Q” if using GMT-EXBARM10L
 - o If using 2 hoists, connect these using extreme points (“A” and “G”, or “H” and “Q”)
- Connect hoist hook(s) to shackle(s) and lift assembly to sufficient height in order to connect a second GEO M10;
- Position second GEO M10 cabinet with AutoRig™ in automatic lock position, and lock front points to first GEO M10
- Unlock GEO M10 link bar
- Pull the latch to engage the guide in GEO M10 rear slot.
- Adjust the angle by inserting quick release pin BL820 in proper hole.
- Connect subsequent GEO M10 cabinets as with second.



IMPORTANT

Ensure that bumper quick release pins are properly locked into GEO M10, and that all AutoRig™ and rear connecting points are locked

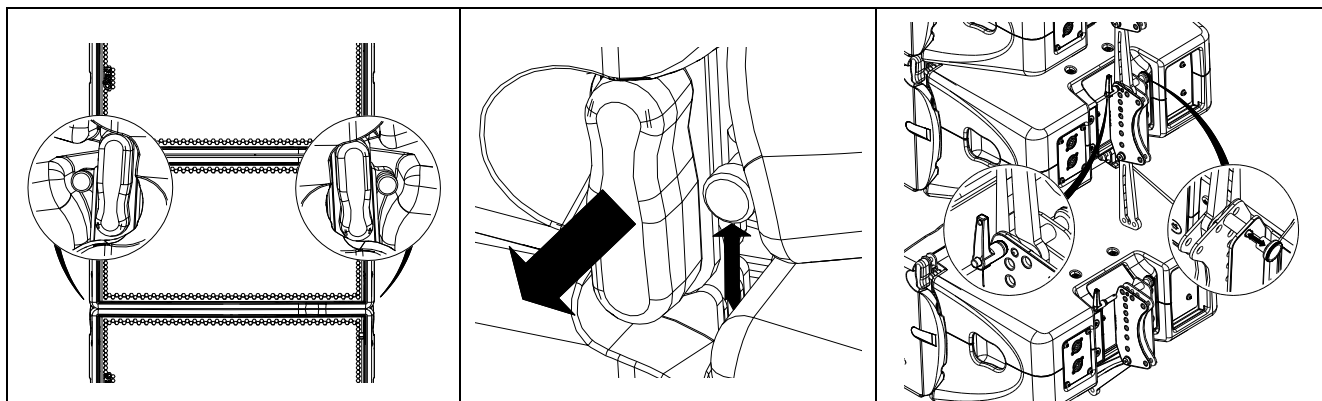
- Lift cluster to NS-1 defined rigging height, secure cluster horizontally to prevent it from rotating;
- Secure bumper with secondary safety steel.

IMPORTANT

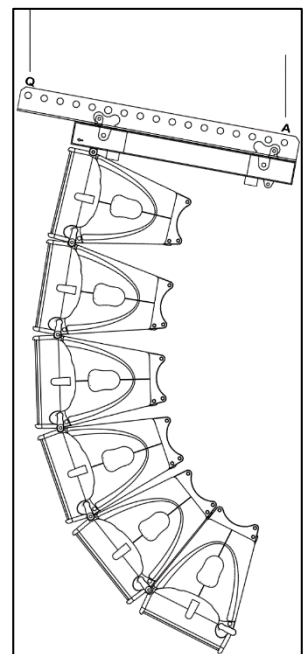
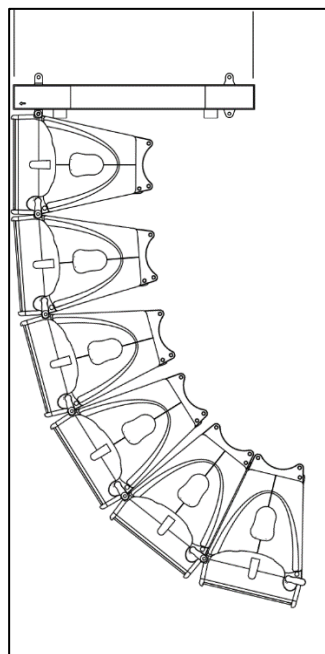
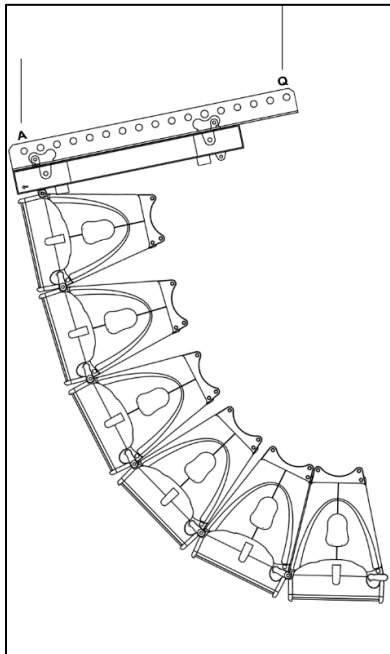
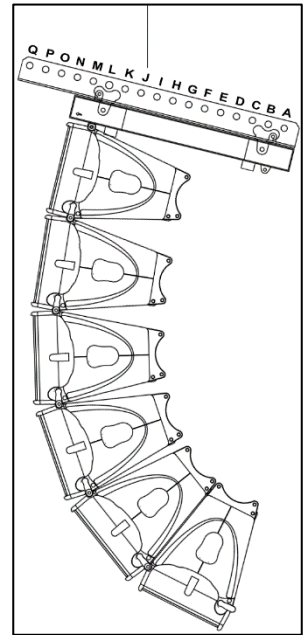
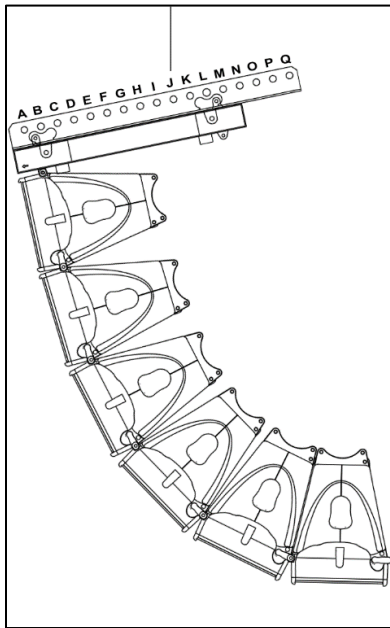
The requirements for secondary safety systems vary with territories. However, the secondary safety steel MUST have a SWL equivalent or greater than that of the rigging system.

Disassembly

- While holding GEO M10 to be dismantled, pull AutoRig™ on both sides and hold the side knob (AutoRig™ remains in the open position).
- Remove the rear quick release pin BL820
- Unlock the GEO M10 link bar by pulling the latch.
- Remove GEO M10



6.4.3 GEO M10 flown with Touring Bumper



Required items

- 1 or 2 hoists (not provided).
- 1 x VNT-BUMPM10
- 1 x VNT-EXBARM10 for extended positive and negative bumper angles

IMPORTANT

Maximum GEO M10 quantity for flown vertical cluster with VNT-BUMPM10 is 12 (and eventually less).

Please check NS1 for mechanical Safety Working Load and acoustic computations.

IMPORTANT

Motor hoist must be rated to support entire cluster weight. Please check configuration in NS1 for proper motor hoist rating

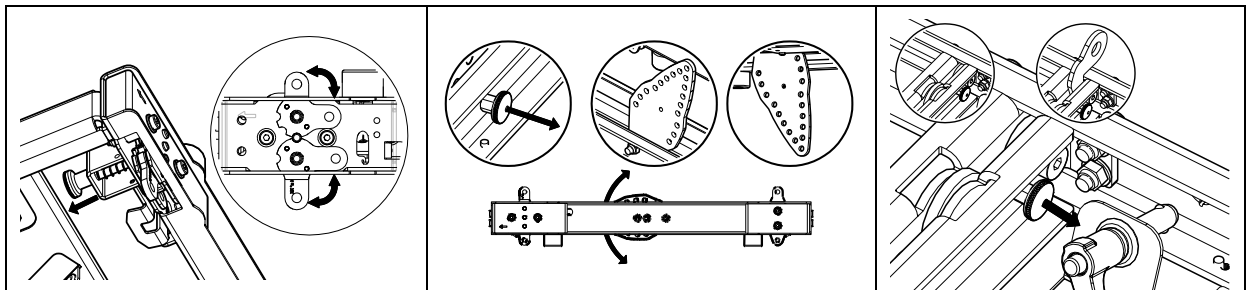
Procedure

GEO M10 Left

- Position first GEO M10 so that Autorig™ is at the bottom
- Pull the bumper front latches, rotate the lower links so that connection points are double leg and release the latches.
- Position bumper on top of first GEO M10 and lock front points to the bumper with 2 BL820 quick release pins.
- Connect the bumper link bar (0° / "S" position) to GEO M10 rear rigging plate (hole marked "bumper") Lock with the quick release pin BL0825.

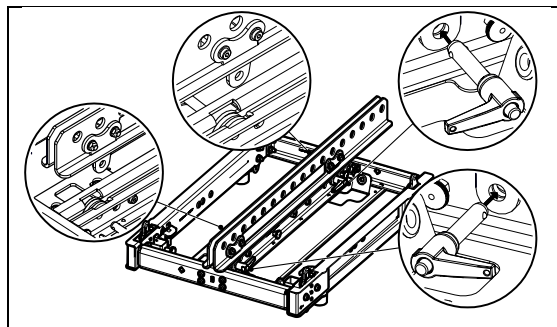
GEO M10 Right

- Position first GEO M10 so that Autorig™ is at the top and set in automatic lock position
- Pull the bumper front latches, rotate the lower links so that connection points are single leg and release the latches.
- Position bumper on top of first GEO M10, front points will lock automatically
- Connect the bumper link bar (0° / "S" position) to GEO M10 rear rigging plate (hole marked "bumper"). Lock with the quick release pin BL0825.
- If flying with bumper only, pull front and rear center latches, and release front and rear bumper connecting points.



Subsequent GEO M10s

- If required, position VNT-EXBARM10 frontwards or rearwards into VNT-BUMPM10 slots and lock devices with the quick release pins 12x40 stored on VNT-BUMPM10.

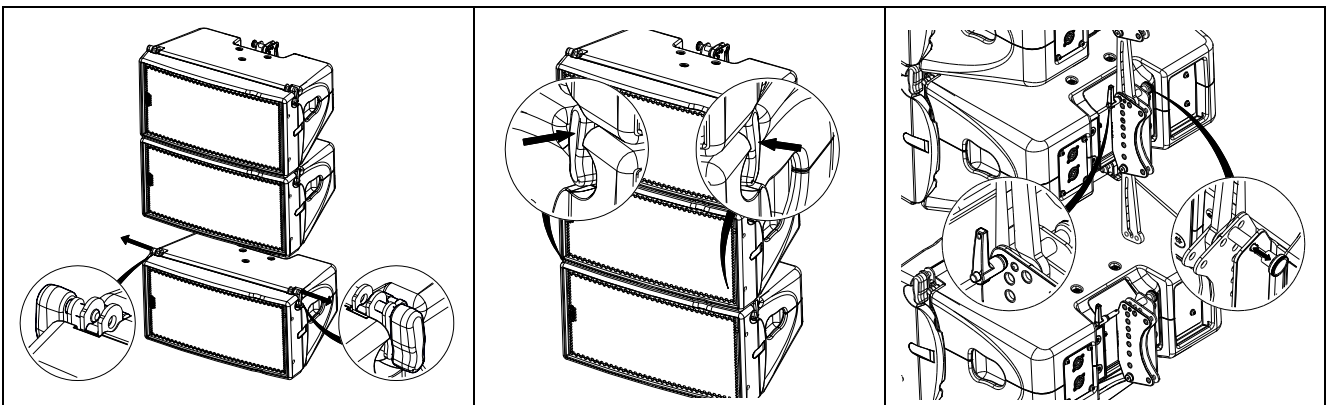


IMPORTANT

Ensure hoist hook(s) is (are) properly secured to VNT-BUMPM10 or VNT-EXBARM10 shackle(s)

Ensure that all quick release pins are locked

- Insert shackle(s) in bumper or in extension bar in required hole(s) as indicated in NS1 design and secure shackle bolt(s)
 - o If using 1 hoist on VNT-EXBARM10, holes are “A” to “Q”
 - o If using 2 hoists on VNT-EXBARM10, connect these using extreme holes (“A” and “Q”)
 - o VNT-BUMPM10 without extension bar can only be flown with 2 hoists from front and rear rigging points
- Connect hoist hook(s) to shackle(s) and lift assembly to sufficient height in order to connect a second GEO M10
- Position second GEO M10 cabinet with AutoRig™ in automatic lock position, and lock front points to first GEO M10
- Unlock GEO M10 link bar
- Pull the latch to engage the guide in GEO M10 rear slot.
- Adjust the angle by inserting quick release pin BL820 in proper hole.
- Connect subsequent GEO M10 cabinets as with second.

**IMPORTANT**

Ensure that bumper quick release pins are properly locked into GEO M10, and that all AutoRig™ and rear connecting points are locked

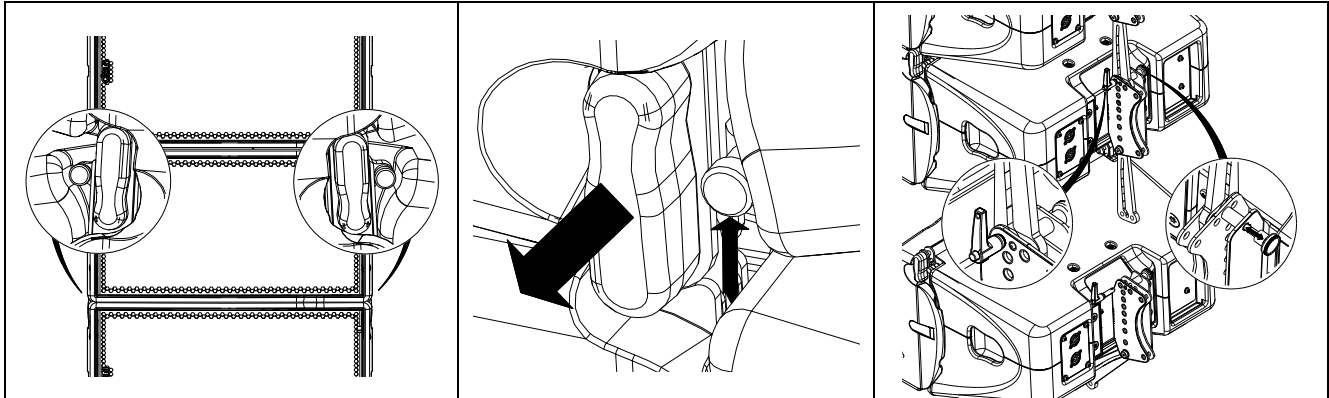
- Lift cluster to NS-1 defined rigging height, secure cluster horizontally to prevent it from rotating;
- Secure bumper with secondary safety steel.

IMPORTANT

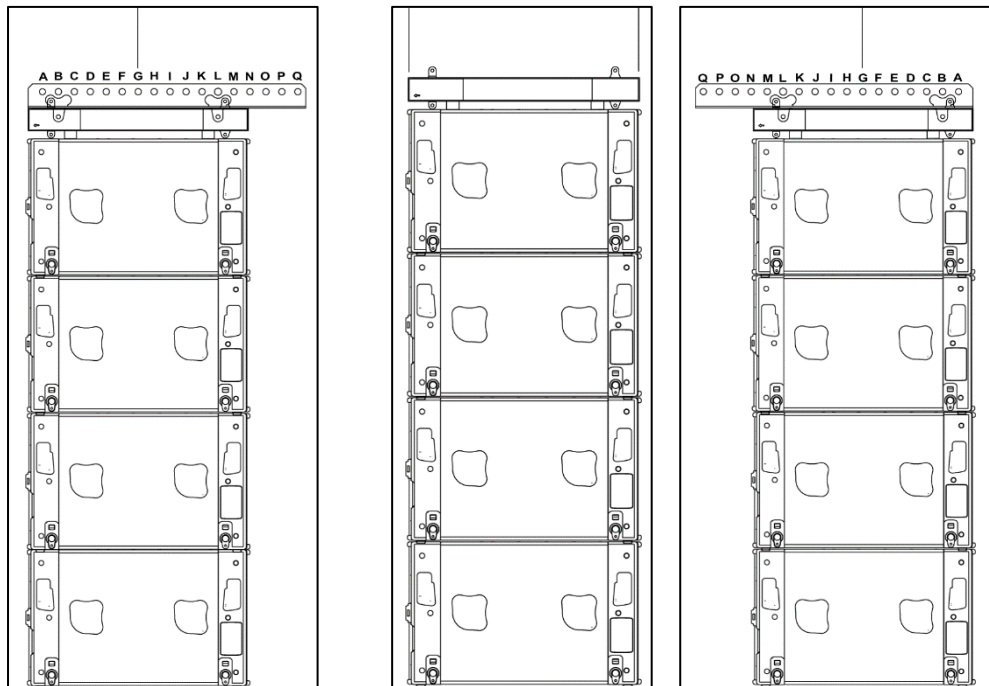
The requirements for secondary safety systems vary with territories. However, the secondary safety steel MUST have a SWL equivalent or greater than that of the rigging system.

Disassembly

- While holding GEO M10 to be dismantled, pull AutoRig™ on both sides and hold the side knob (AutoRig™ remains in the open position).
- Remove the rear quick release pin BL820
- Unlock the GEO M10 link bar by pulling the latch.
- Remove GEO M10



6.4.4 MSUB15 flown with Touring Bumper



Required items

- 1 or 2 hoists (not provided).
- 1 x VNT-BUMPM10
- 1 x VNT-EXBARM10 to fly on a single rigging point

IMPORTANT

When flying MSUB15 cluster, VNT-BUMPM10 must be set at 0°

- If cluster is flown from 2 points, bumper must be maintained horizontal in its definitive position as well as when lifting or lowering the cluster
- If cluster is flown from a single point, extension bar must be used and hoist connected to “G” position

IMPORTANT

Maximum MSUB15 quantity for flown vertical cluster with VNT-BUMPM10 is 8.

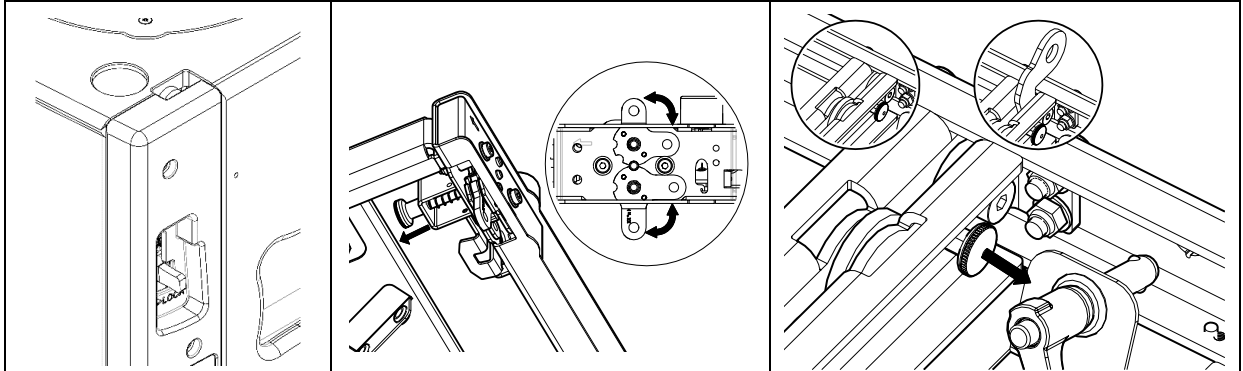
Please check NS1 for mechanical Safety Working Load and acoustic computations.

IMPORTANT

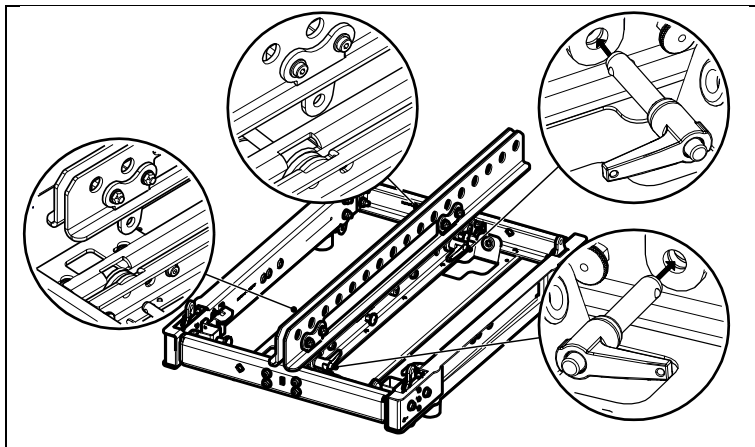
Motor hoist must be rated to support entire cluster weight. Please check configuration in NS1 for proper motor hoist rating

Procedure

- Position first MSUB15 and unlock front and rear rigging points
- Pull the bumper front latches, rotate the lower links so that connection points are double leg and release the latches.
- Position bumper on top of first MSUB15 and lock front and rear points to the bumper with 2 BL820 quick release pins.
- If flying with bumper only, pull front and rear center latches, and release front and rear bumper connecting points.



- If flying from a single point, position VNT-EXBARM10 frontwards or rearwards into NT-BUMPM10 slots and lock devices with the quick release pins 12x40 stored on VNT-BUMPM10.



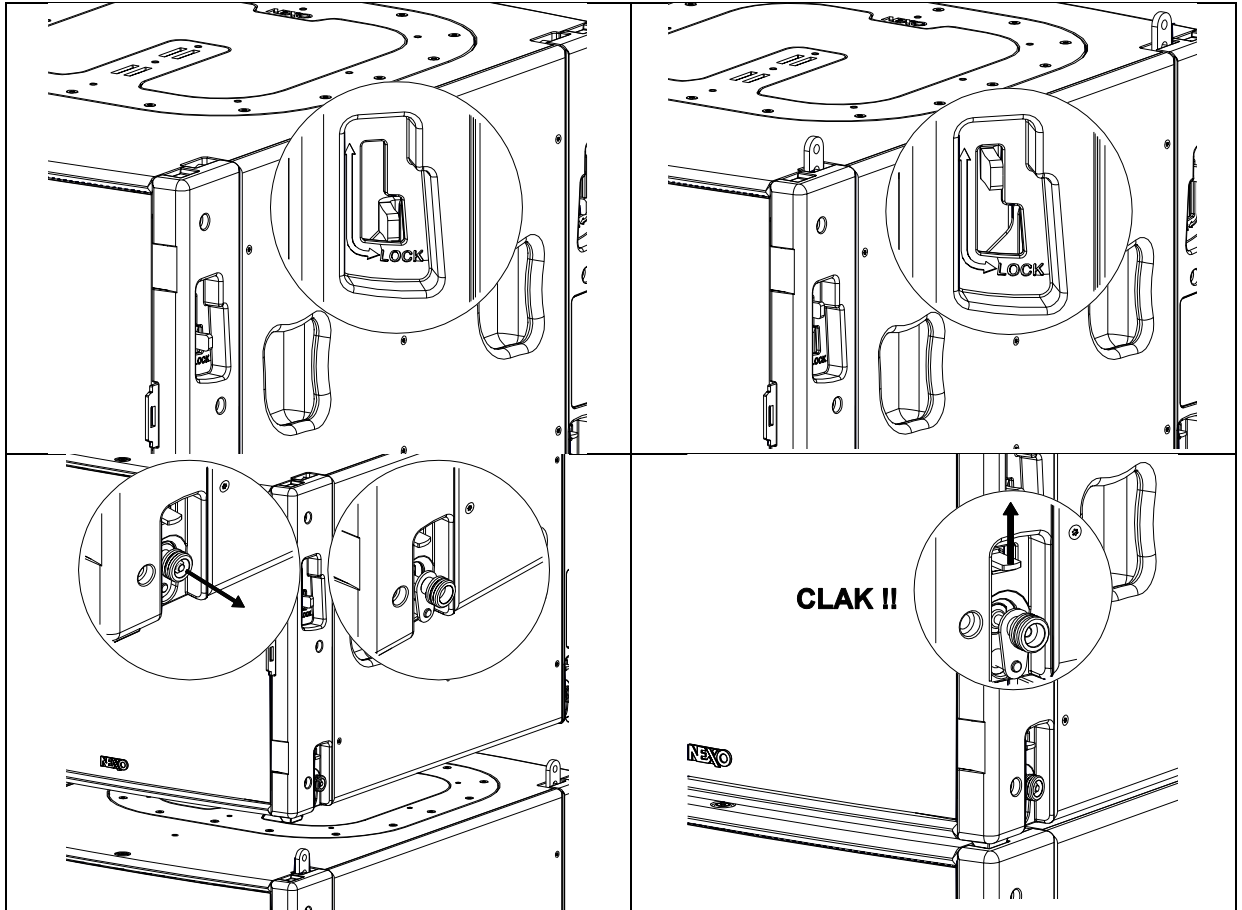
IMPORTANT

Ensure hoist hook(s) is (are) properly secured to VNT-BUMPM10 or VNT-EXBARM10 shackle(s)

Ensure that all quick release pins are locked

- Insert shackle(s) in bumper or in extension bar in required hole(s), ie:
 - o If using 1 hoist on VNT-EXBARM10, it must be connected to hole "G"
 - o VNT-BUMPM10 without extension bar can only be flown with 2 hoists
- Connect hoist hook(s) to shackle(s) and lift assembly to sufficient height in order to connect a second MSUB15;

- Release first MSUB15 bottom connecting points latches and unlock second MS15SUB top front and rear rigging points
- Align both MSUB15s rigging points, lower second MSUB15 on first and lock them together
- Connect subsequent MSUB15 subwoofers by unlocking upper points and setting lower points in auto-lock mode.



IMPORTANT

Ensure that all connecting points are locked

- Lift cluster to NS-1 defined rigging height, secure cluster horizontally to prevent it from rotating;
- Secure bumper with secondary safety steel.

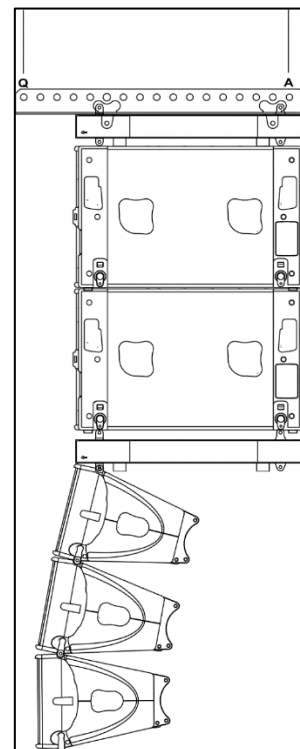
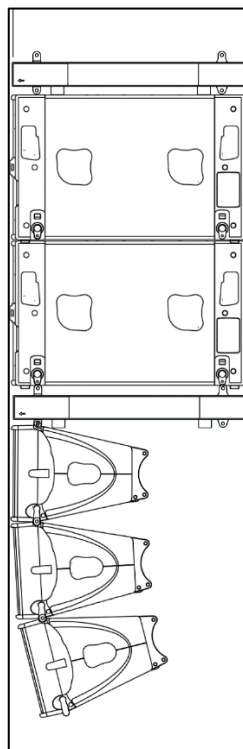
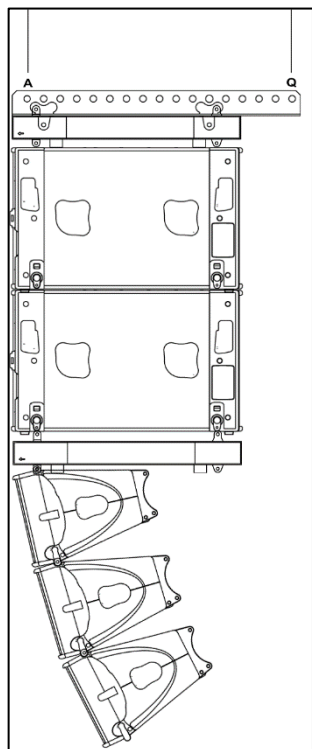
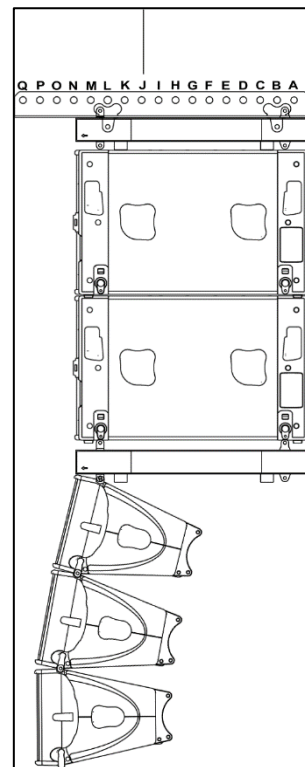
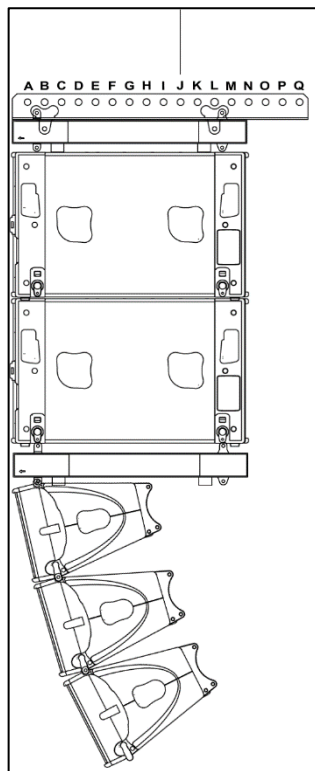
IMPORTANT

The requirements for secondary safety systems vary with territories. However, the secondary safety steel **MUST** have a SWL equivalent or greater than that of the rigging system.

Disassembly

- Lower MSUB15 cluster on the ground, unlock front and rear rigging points and lift cluster to remove bottom MSUB15.
- Repeat until last MSUB15 is removed
- Disassemble top bumper.

6.4.5 MSUB15 and GEO M10 flown with Touring Bumper



Required items

- 1 or 2 hoists (not provided).
- 2 x VNT-BUMPM10
- 1 x VNT-EXBARM10 for extended positive and negative bumper angles

IMPORTANT

When flying MSUB15 & GEO M10 cluster, VNT-BUMPM10 must be set at 0°

- If cluster is flown from a single point, select rigging point position from NS1 design
- If cluster is flown from 2 points, bumper must be maintained horizontal in its definitive position as well as when lifting or lowering the cluster

IMPORTANT

Maximum quantity for flown vertical cluster with VNT-BUMPM10 is:

$$N_{\text{GEO M10}} + 1.5 \cdot N_{\text{MSUB15}} \leq 12$$

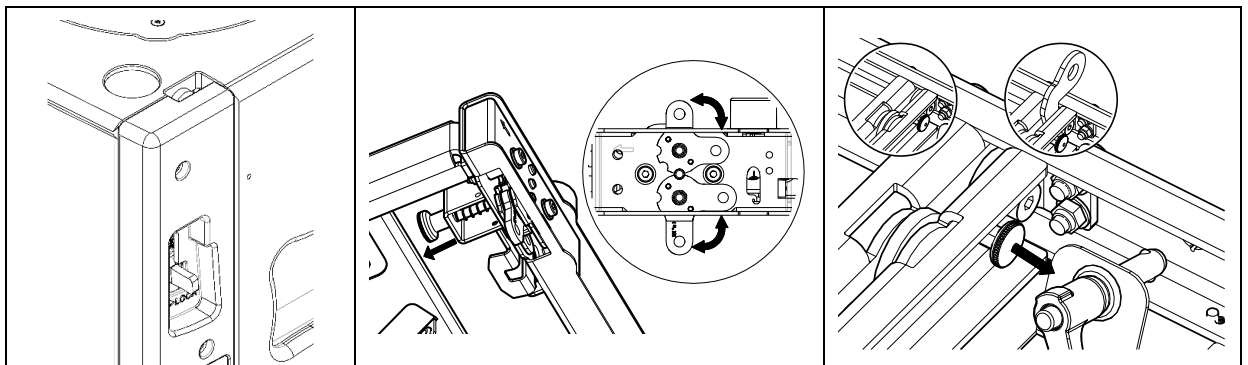
Please check NS1 for mechanical Safety Working Load and acoustic computations.

IMPORTANT

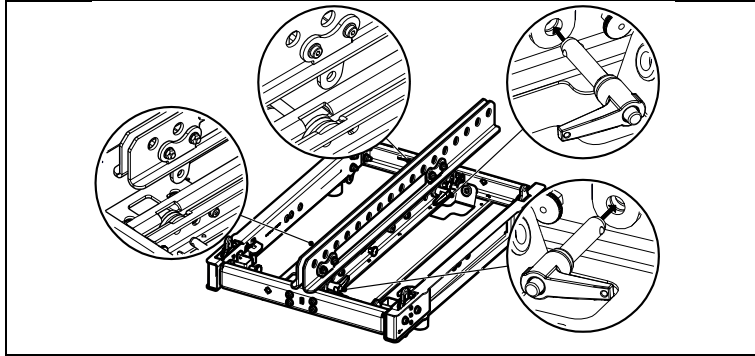
Motor hoist must be rated to support entire cluster weight. Please check configuration in NS1 for proper motor hoist rating

Procedure

- Position first MSUB15 and unlock front and rear rigging points
- Pull the bumper front latches, rotate the lower links so that connection points are double leg and release the latches.
- Position bumper on top of first MSUB15 and lock front and rear points to the bumper with 2 BL820 quick release pins.
- If flying with bumper only, pull front and rear center latches, and release front and rear bumper connecting points.



- If required, position VNT-EXBARM10 frontwards or rearwards into NT-BUMPM10 slots and lock devices with the quick release pins 12x40 stored on VNT-BUMPM10.

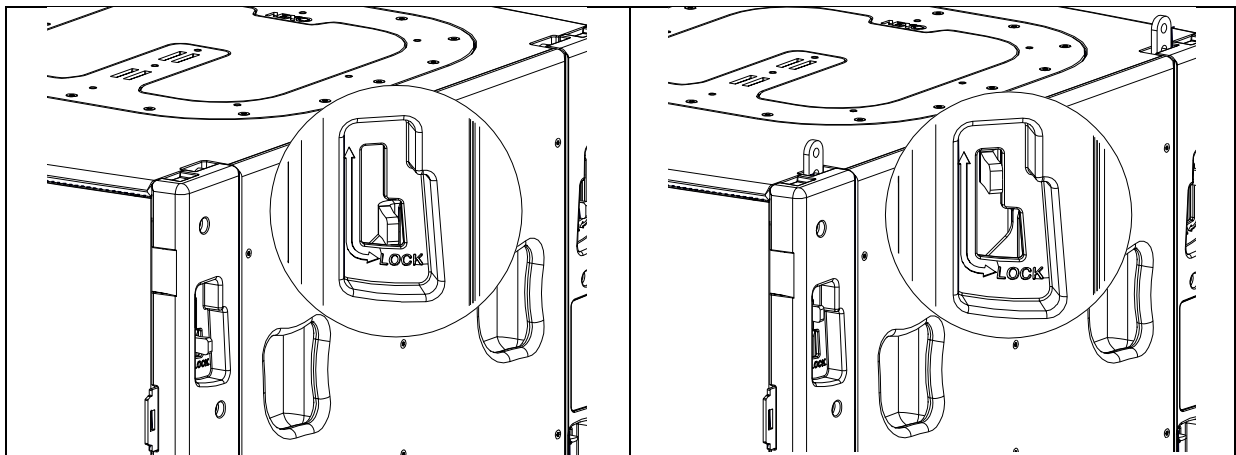


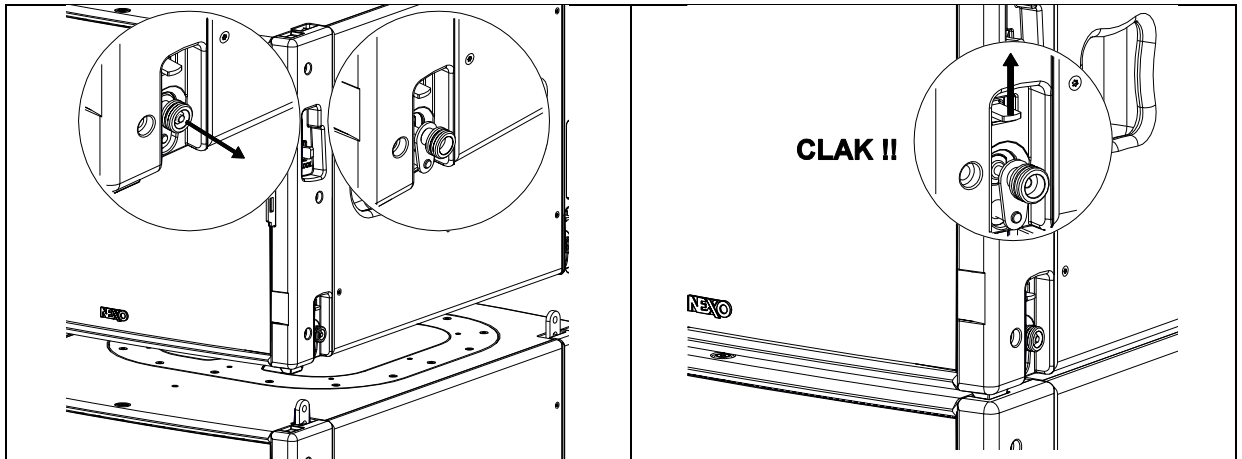
IMPORTANT

Ensure hoist hook(s) is (are) properly secured to VNT-BUMPM10 or VNT-EXBARM10 shackle(s)

Ensure that all quick release pins are locked

- Insert shackle(s) in bumper or in extension bar in required hole(s), ie:
 - o If using 1 hoist on VNT-EXBARM10, it must be connected to a hole position determined in NS1 design
 - o If using 2 hoists on VNT-EXBARM10, connect these using extreme holes ("A" and "Q")
 - o VNT-BUMPM10 without extension bar can only be flown with 2 hoists from front and rear rigging points
- Connect hoist hook(s) to shackle(s) and lift assembly to sufficient height in order to connect a second MSUB15;
- Release first MSUB15 bottom connecting points latches and unlock second MS15SUB top front and rear rigging points
- Align both MSUB15s rigging points, lower second MSUB15 on first and lock them together
- Connect subsequent MSUB15 subwoofers by unlocking upper points and setting lower points in auto-lock mode.





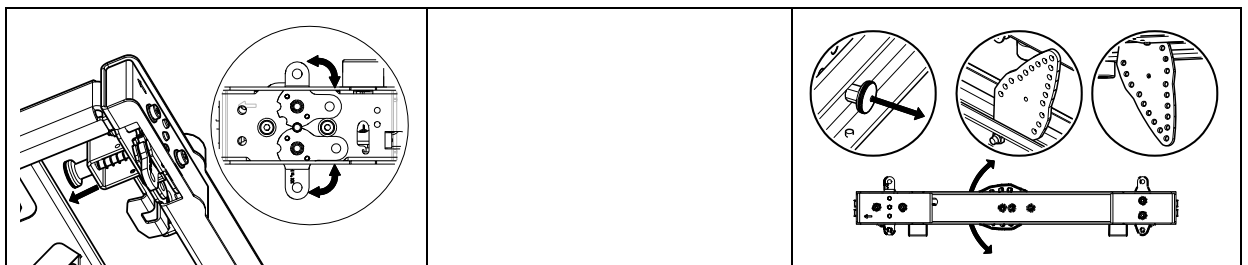
- Once all MSUB15 are off the ground, position second VNT-BUMPM10 below last MSUB15
- Pull bottom bumper front latches, and rotate the upper links so that single leg, and release the latches
- Unlock last MS15SUB top front and rear rigging points
- Connect bottom bumper to last MSUB15 by locking front and rear rigging points

GEO M10 Left

- Position first GEO M10 below bottom bumper so that Autorig™ is at the bottom
- Pull the bottom bumper front latches, rotate the lower links so that connection points are double leg and release the latches.
- Position first GEO M10 below bottom bumper and lock front points to the bumper with 2 BL820 quick release pins.
- Connect the bumper link bar at required angle (selection from -12° to $+12^{\circ}$ in 3° steps) to GEO M10 rear rigging plate (hole marked "bumper") and lock with the quick release pin BL0825.

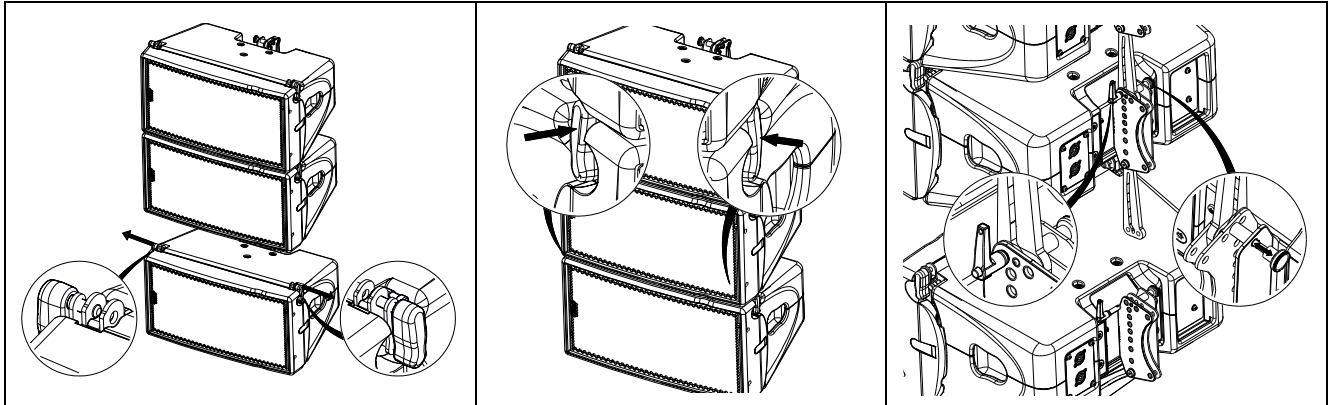
GEO M10 Right

- Position first GEO M10 so that Autorig™ is at the top and set in automatic lock position
- Pull the bumper front latches, rotate the lower links so that connection points are single leg and release the latches.
- Position bumper on top of first GEO M10, front points will lock automatically
- Connect the bumper link bar at required angle (selection from -12° to $+12^{\circ}$ in 3° steps) to GEO M10 rear rigging plate (hole marked "bumper"), and lock with the quick release pin BL0825.



Subsequent GEO M10s

- Lift assembly to sufficient height in order to connect a second GEO M10;
- Position second GEO M10 cabinet with AutoRig™ in automatic lock position, and lock front points to first GEO M10
- Unlock GEO M10 link bar
- Pull the latch to engage the guide in GEO M10 rear slot.
- Adjust the angle by inserting quick release pin BL820 in proper hole.
- Connect subsequent GEO M10 cabinets as with second.

**IMPORTANT**

Ensure that bumper quick release pins are properly locked into GEO M10, and that all AutoRig™ and rear connecting points are locked

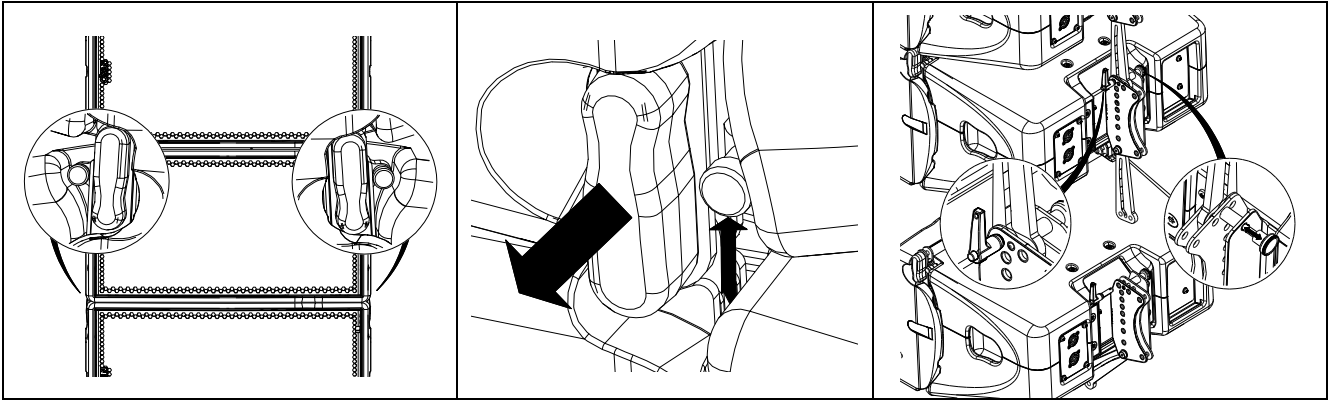
- Lift cluster to NS-1 defined rigging height, secure cluster horizontally to prevent it from rotating;
- Secure bumper with secondary safety steel.

IMPORTANT

The requirements for secondary safety systems vary with territories. However, the secondary safety steel MUST have a SWL equivalent or greater than that of the rigging system.

Disassembly

- While holding GEO M10 to be dismantled, pull AutoRig™ on both sides and hold the side knob (AutoRig™ remains in the open position).
- Remove the rear quick release pin BL820
- Unlock the GEO M10 link bar by pulling the latch.
- Remove GEO M10



- Once last GEO M10 has been removed, unlock and remove bottom bumper
- Lower MSUB15s on the ground, unlock front and rear rigging points and lift cluster to remove bottom MSUB15.
- Repeat until last MSUB15 is removed
- Disassemble top bumper.

6.5 **Testing and Maintenance of the system**

General: GEO is a precision piece of equipment and requires regular attention to maintenance in order to give long and reliable service. NEXO recommends regular testing of loudspeaker rigging components, preferably using a suitable test rig coupled with a visual inspection.

Fasteners: there are several critical points in the MSUB15 and GEO M10 cabinets.

Of primary concern are:

- a) The screws or magnets attaching the grid to the cabinet
- b) The machine screws attaching the connecting plates to the cabinet.
- c) The magnets attaching the directivity flanges to the front of the cabinet.

These fasteners should be regularly checked and tightened as necessary.

Cleaning: The exterior of the cabinet and the rigging system can be cleaned with a damp cloth soaked in mild soapy water. On no account use solvent based cleaners, which may damage the finish of the cabinet

After cleaning, the rigging system must be treated with a suitable lubricant to prevent rusting. NEXO recommends the use of Scottoil FS365 which is a water-based lubricant with a mixture of machine oil, surfactant and anti-rust treatment.

7 SYSTEM CHECK ALIGNMENT GUIDELINES

The NEXO TD Controllers factory delay presets are optimised to provide the best possible crossover between the GEO M10 and MSUB15 systems. The reference point for this adjustment is the front of each cabinet. (This means that the internal delays needed to achieve a correct time alignment are set for cabinets standing next to each other with both fronts aligned). We recommend that the system is adjusted so that arrivals from GEO M10 and MSUB15 are coincident at a fairly distant listening position.

7.1 GEO M10 Vertical Cluster design

Cluster design must be done with NS, which provides very intuitive and fast method to determine all cluster geometry parameters in relation to venue where cluster is implemented.

NS-1 is a freeware available for all Nexo users at nexo-sa.com

IMPORTANT

Never install a GEO M10 and/or MSUB15 cluster without checking its acoustical performances and mechanical safety in NS-1 prior to installation.

Please contact your local distributor for assistance and/or training NS-1

7.2 Stacked MSUB15 and Flown GEO M10

In the example below, r_1 being the distance from GEO M10 array to listener position, and r_2 being the distance from MSUB15 to listener position, the distance difference is then $r_1 - r_2$ (specified meters or feet).

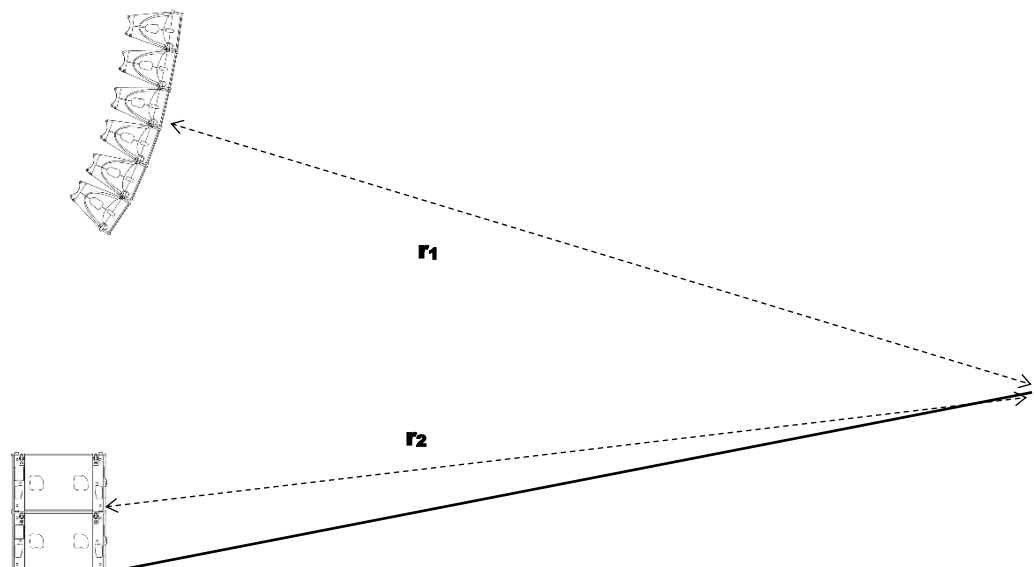
$r_1 > r_2$, the delay should be set on the MSUB15 NEXO TDcontroller channel.

$r_1 < r_2$, the delay should be set on the GEO M10 NEXO TDcontroller channel

To convert the result in time delay (specified in seconds), apply:

$$\Delta t = (r_1 - r_2) / C \text{ and } r_2 \text{ in meters, } C \text{ (sound speed)} \approx 343 \text{ m/S.}$$

Set the units to meters, feet or seconds according to your preference). Delay will have to be adjusted according to the distance difference $r_1 - r_2$ (see figure below).



7.3 Driving the MSUB15s from the AUX send

It is quite common to use the AUX send of a mixing desk to drive the Sub section of a PA system. This gives the mixing engineer more flexibility to set the level of the subbass relative to the main PA, apply special effects, or to use a different EQ on the Sub. However, it also raises some serious issues for the performance & safety of the system (mostly time alignment).

At NEXO, great care is taken to design optimum phase alignment from one octave above to one octave below the crossover frequency point. By doing so, drivers are working perfectly together and providing the best efficiency possible. It is then up to the user to adjust the delay on the NEXO TD Controllers to match the physical path difference of the different systems. It is thus possible to get a well adjusted system, even without measuring instruments.

If MSUB15s are driven from an AUX output, NXAMPs are fed with two signals coming from different sources. If those two sources (MAIN output & AUX send) are not exactly in phase, delay is introduced into the crossover between the GEO M10 array and the MSUB15s. It is then mandatory to use proper measurement tool to optimize phase response.

Why is it unlikely that AUX and MAIN outputs have the same phase?

- Signal paths are likely to be different; any filter modifying the bandwidth and EQ of the signal is also affecting the phase.
Example: a 24dB/oct high pass filter set at 15Hz is affecting amplitude of the signal by only 0.6dB at 30Hz, but the phase shift is 90°!! At 100Hz we can still measure 25° of phase shift.
- Limiting bandwidth with a low pass filter can introduce a phase difference of up to 180° (completely out of phase) at the cross over point.
- If the signal is passing through any digital equipment, between 1.4ms and 2.2ms is being added (around 70° phase shift at 100Hz) due solely to the converter delay! The additional delay due to the processing itself (look ahead compressor, delay...) can be quite important as well.

If both outputs are not measured in the actual configuration, it is very likely that phase alignment will not be correct.

Consequences of badly aligned systems

Mis-aligned systems have lower efficiency: i. e. for the same SPL the system will have to be driven harder, activating the displacement & temperature protection at lower output levels. Both sound quality and reliability will decrease as the system is stressed.

Precautions & Checks

Before using the AUX of a mixing desk, ensure that MAIN and AUX outputs are in phase;

Always apply identical EQ or processing on both channels, so that the phase relationship will not be altered;

Never add additional low pass filtering on the SUB or high pass filtering on the main system;

Inverting polarity on one channel should always result in a massive difference near the crossover point. If that is not the case, the system is no longer aligned.

7.4 Recommended installation tools and equipment

Tape measure – should be 30m/100ft in length and be of durable fibre material. Have one per array available to speed up the installation process.

Spirit level – used to ascertain the trueness of the surface from which the angle measurements originate.

Rangefinder measuring device – either a Disto type laser measure or an optical laser rangefinder can be used. Devices such as the Bushnell 'Yardage Pro' sports rangefinders provide sufficiently accuracy and are easy to use. They have the additional advantage of working very well in bright sunlight.

Electronic calculator with trigonometric functions to calculate the height from ground level to points in the room. The formula to calculate height of a point from measured angle and distance is:

Height of point = $\sin(\text{vertical angle in degrees}) \times \text{distance to point}$

NB: Take care when using spreadsheets as they calculate using radians by default. To convert degrees to radians use the formula:

Angle (in radians) = $3.142 \times \text{Angle (in degrees)} / 180$

Computer – Laptop or Desktop PC running Windows 8 with the current version of NEXO NS-1 installed. It is not possible to configure a GEO tangent array properly without using NS-1. Note that, when NS-1 designs are prepared prior to arrival at the venue, it is often necessary to modify or update the design to accommodate special circumstances. A PC is absolutely essential to make such changes.

Audio Analysis Software – recommended but not absolutely essential, programs such as Systune™, Smaart™ enable rapid and detailed analysis of the installation. Consider taking a training course in using one of these tools if you are not already competent with them – it will pay dividends in increased performance of the system.

7.5 GEO M10 – MSUB15 System Check List

It is essential to execute all these check steps prior to perform a sound check on the “front end” to the system. Following this checklist step by step will prevent many troubles and will save time in the end.

Are the speakers properly connected and angled ?

Attach the first series of modules to the bumper.

Before flying, verify that all channels of all modules are functioning properly.

To check that all elements have the proper amplitude and phase, you should listen to the upper boxes at a close distance (<1 meter). You should be able to move from the top to the bottom of the cluster without hearing any change in the tonal balance.

Verify that the angle settings are the same on both sides of each module.

Raise the bumper, attach the next series of modules and repeat the above checks.

Make sure that these series of modules sum properly with the modules above them.

When all the modules are flown, check that the aiming angles are the same left and right.

Make sure that multiple GEO M10 and MSUB15 are summing properly: 6 dB gain per doubling of quantity.

Final Pre-Sound Check Check

Play a CD track mono left, and then right: both sides must sound strictly identical. When listening in the centre between Left and Right GEO M10s, everything from LF to HF should be located to the “phantom centre” position. If not, repeat the above check sequence to identify the source of the problem.

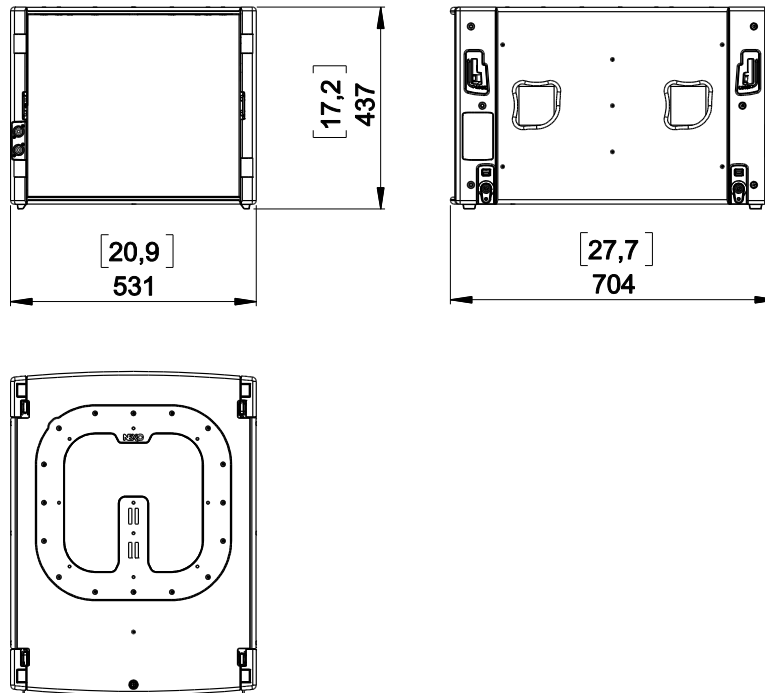
8 TECHNICAL SPECIFICATIONS

8.1 MSUB15 Subwoofer

8.1.1 System specifications

	MSUB15
MSUB15 WITH NEXO TDCONTROLLER SETUP	
Frequency Response @-6 dB	40 Hz to 120 Hz
Sensitivity 1W@1m	101 dB SPL Nominal
Peak SPL@1m	136 dB
Available Crossover Frequencies	40-65, 40-75, 40-85, 40-95, 40-120 Hz
Nominal Impedance	8 Ohms
Recommended Power	900 Watts
PRODUCT FEATURES	
Component	1 x 15" 8 Ohms long excursion Neodymium driver
Height x Width x Depth	437mm x 531mm x 704mm (17.2" x 20.9" x 27.7")
Weight: Net	40 kg / 89 lbs
Connectors (Touring version)	4 x NL4, 4 poles connectors (1+/1- MSUB15 / 2+/2- Through)
Connectors (Install version)	2 x Cable gland with 2 cores cables
Construction	Baltic Birch Plywood & textured black or white coating
Fittings	4 x Side handles
Front Finish (Touring version)	Steel front grill + back mesh
Front Finish (Install version)	Acoustic fabric fitted from grill
Operating temperature range	0°C - 40 °C
Storage temperature range	-20 °C - 60 °C
SYSTEM OPERATION	
Recommended powering solution	NXAMP4x4 Powered TDcontroller: up to 3 x MSUB15 per channel
Optional powering solution	NXAMP4x1 Powered TDcontroller (Bridged): up to 2 x MSUB15 per channel
	DTD TDcontroller + DTDAMP4x1.3 Power amplifier: 1 x MSUB15 per channel

8.1.2 Dimensions (mm/inches)

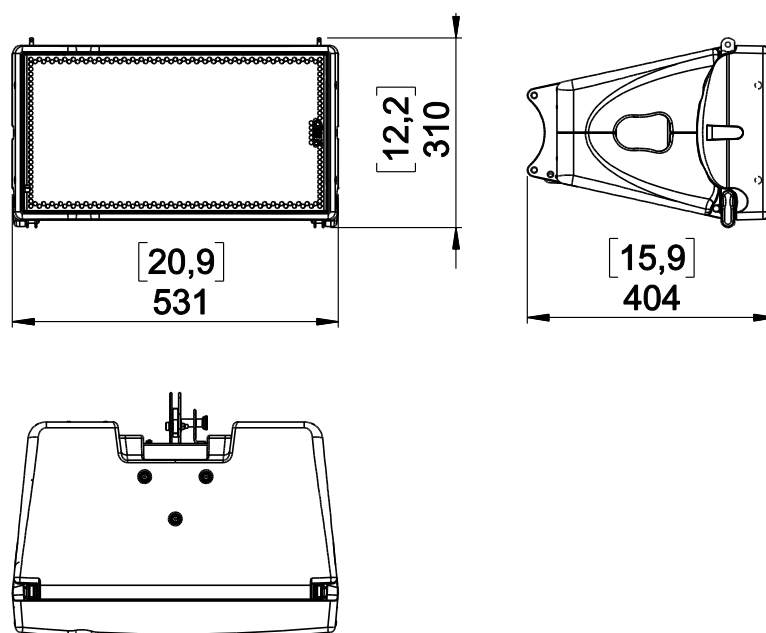


8.2 GEO M1012 & GEO M1025

8.2.1 System specifications

	GEO M1012 (without CDD™)	GEO M1012 (with CDD™)	GEO M1025 (without CDD™)	GEO M1025 (with CDD™)
GEO M10 WITH NEXO TDCONTROLLER SETUP				
Frequency Response @ -6 dB	59 Hz to 20 kHz			
Sensitivity 1W@1m	100 dB SPL Nominal			
Peak SPL@1m	131 dB			
Vertical Dispersion	12°		25°	
Horizontal Dispersion	80°	120°	80°	120°
Passive Crossover Frequency	1.3 kHz			
Nominal Impedance	8 Ohms			
Recommended Power	750 Watts			
PRODUCT FEATURES				
LF Component	1 x 10' 8 Ohms long excursion Neodymium driver with PDDTM			
HF Component	1 x 1.4' throat driver on a BEA/FEA optimized HR Wavesource™			
Height x Width x Depth	288mm x 531mm x 355 mm (11.3' x 20.9' x14.0")			
Weight: Net	21 kg (47 lbs)			
Connectors (Touring version)	2 x NL4, 4 poles connectors (1+/1- Through, 2+/2- GEO M10)			
Connectors (Install version)	2 x Cable gland with 2 cores cables			
Construction	Lightweight Polyurethane Composite			
Fittings	4 x Side handles (2 vertical + 2 horizontal) + back grip			
Front Finish (Touring version)	Steel front grill + back mesh			
Front Finish (Install version)	Acoustic fabric fitted from grill			
Operating temperature range	0°C - 40 °C (32° F - 104° F)			
Storage temperature range	-20 °C - 60 °C (-4 ° F - 140° F)			
SYSTEM OPERATION				
Recommended powering solution	NXAMP4x4 Powered TDcontroller: up to 4 x GEO M10 per channel			
Optional powering solution	NXAMP4x1 Powered TDcontroller: 1 x GEO M10 per channel			
	NXAMP4x1 Powered TDcontroller (Bridged): up to 2 x GEO M10 per channel			
	DTD TDcontroller + DTDAMP4x1.3 Power amplifier: up to 2 x GEO M10 per channel			

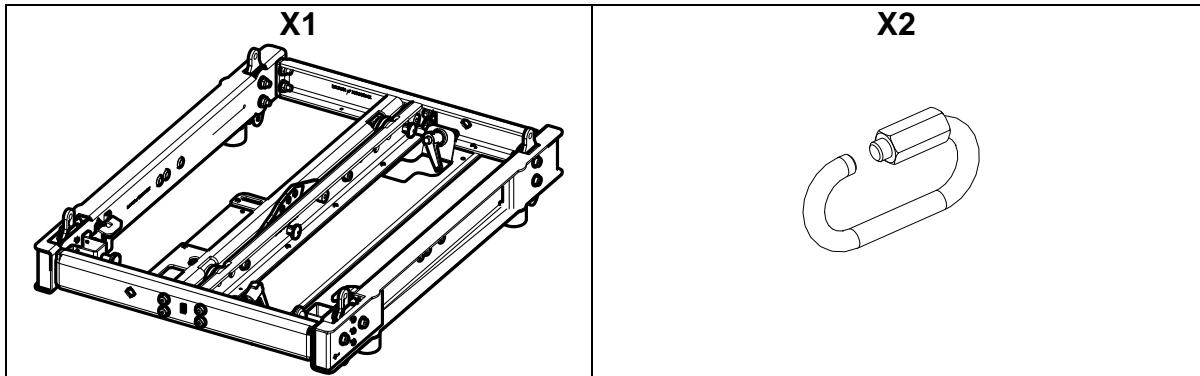
8.2.2 Dimensions (mm/inches)



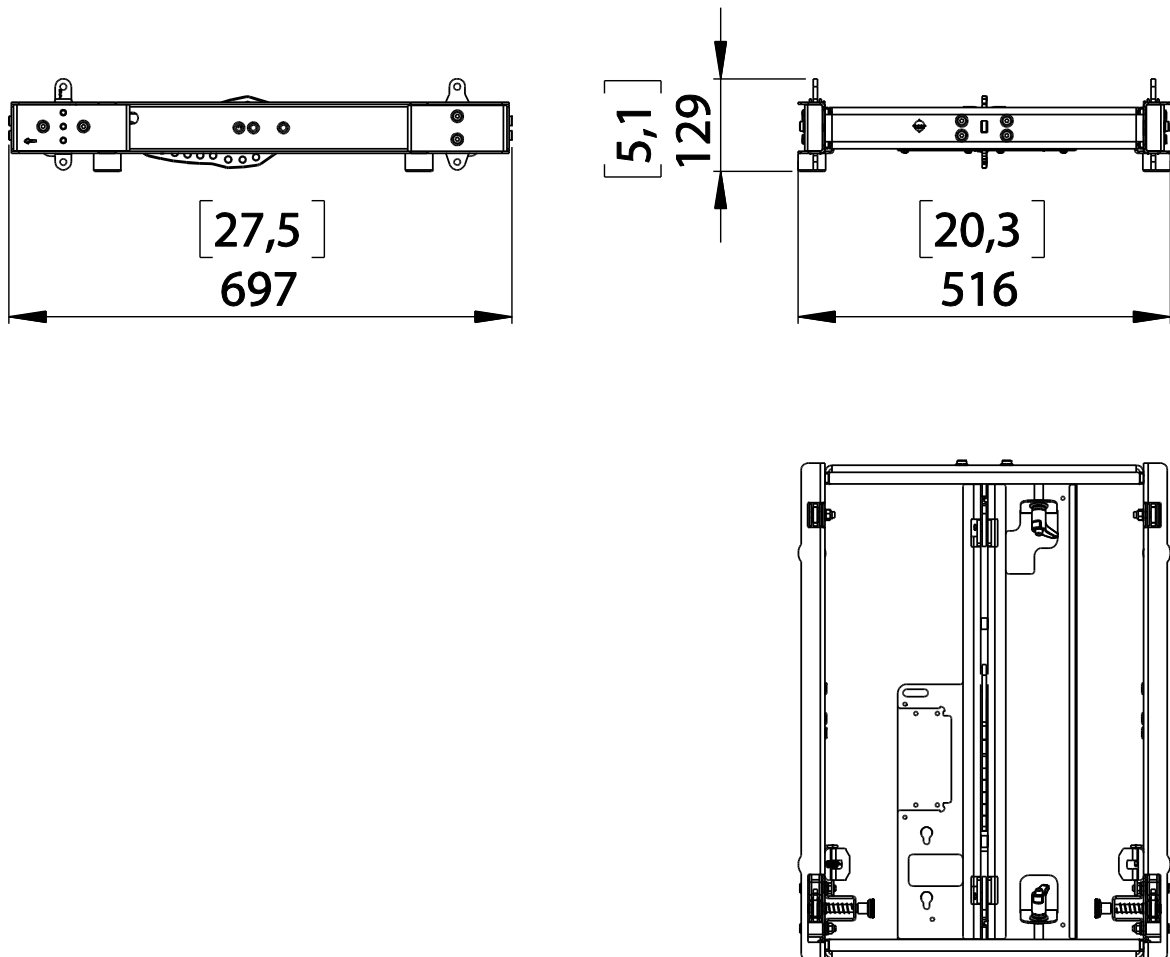
8.3 GEO M10 accessories

8.3.1 VNT-BUMPM10

Parts



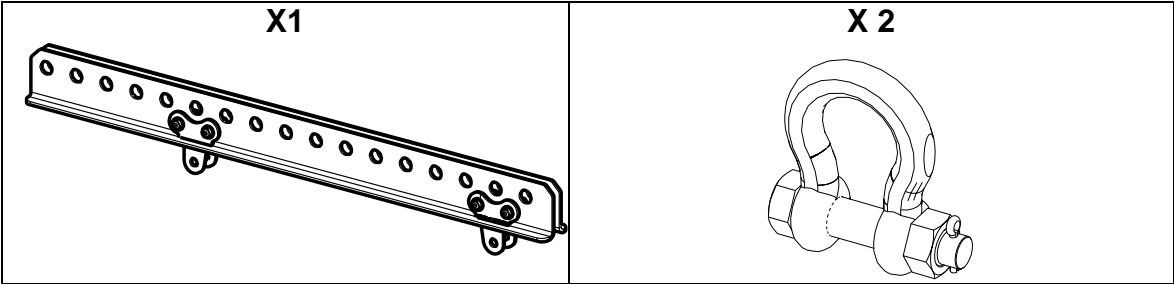
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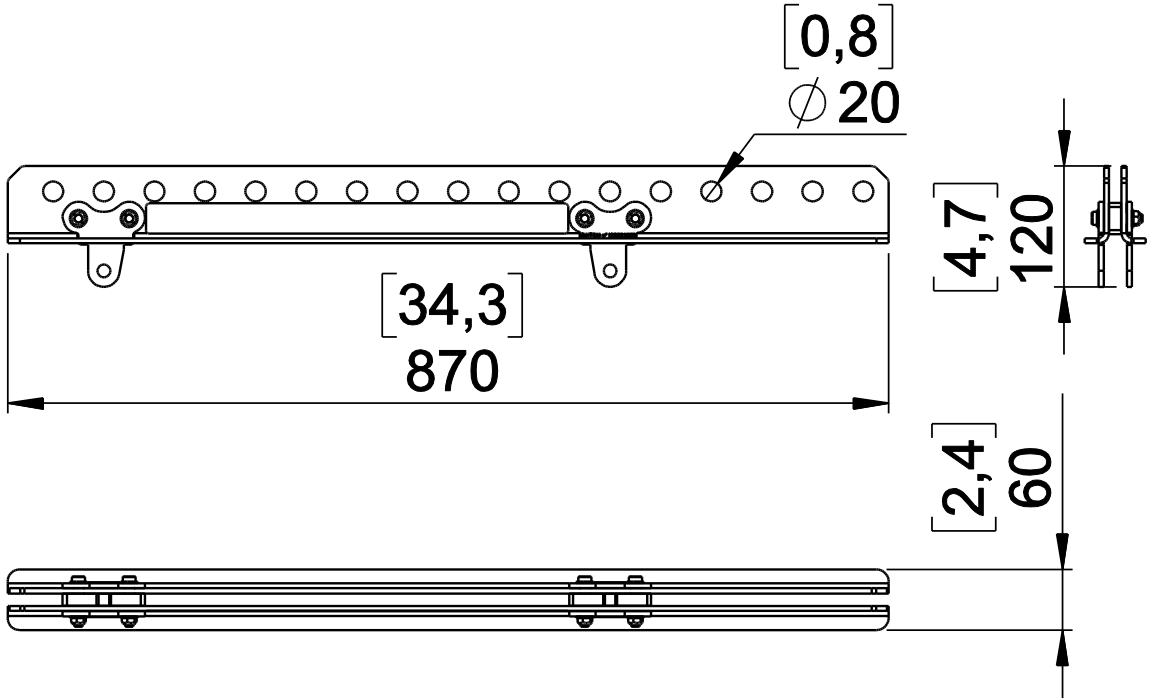
Weight: 20 kg / 44 lb

8.3.2 VNT-EXBARM10

Parts



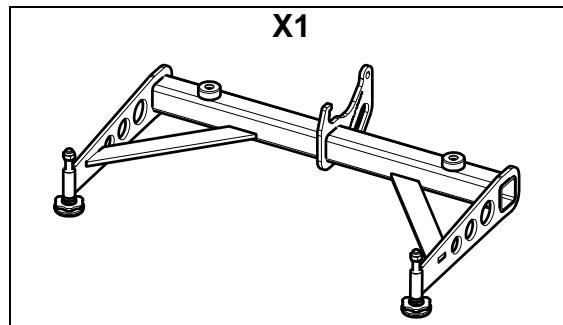
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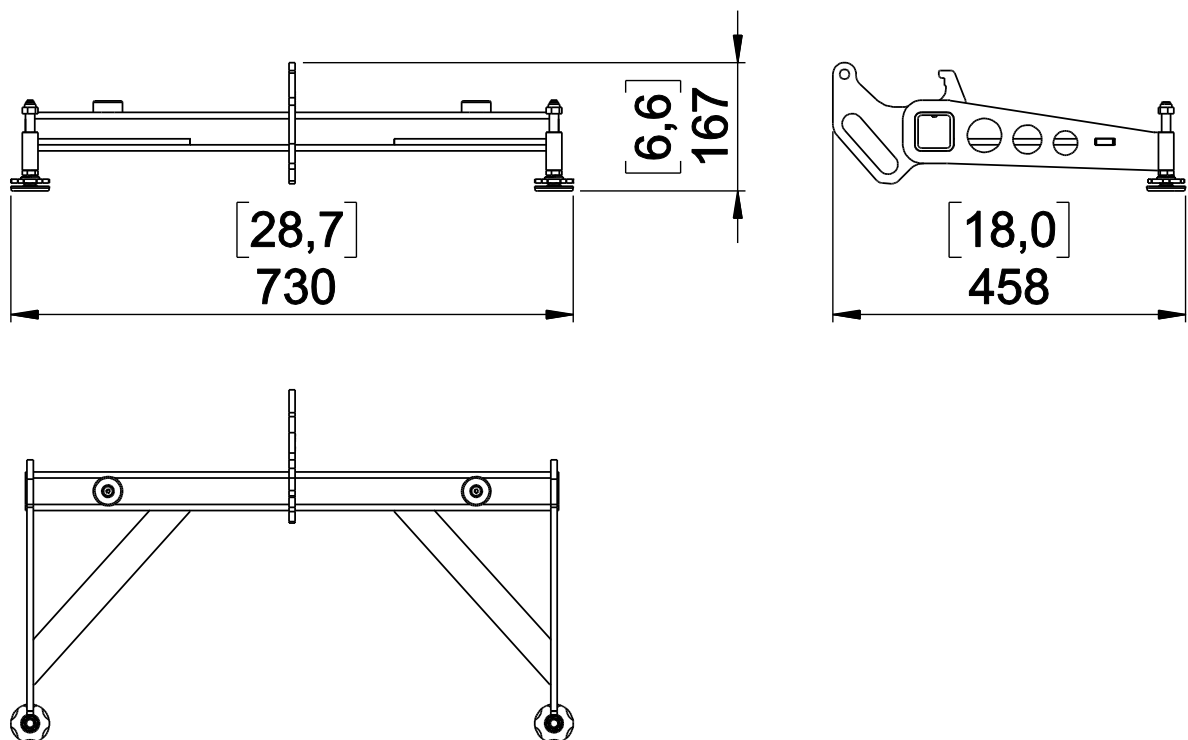
Weight: 7 kg / 15.5 lb (without shackles)

8.3.3 VNT-GSTKM10L

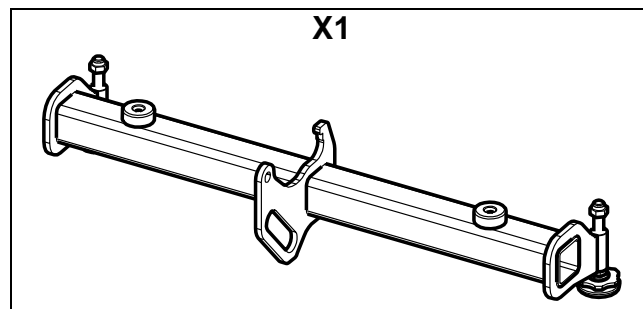
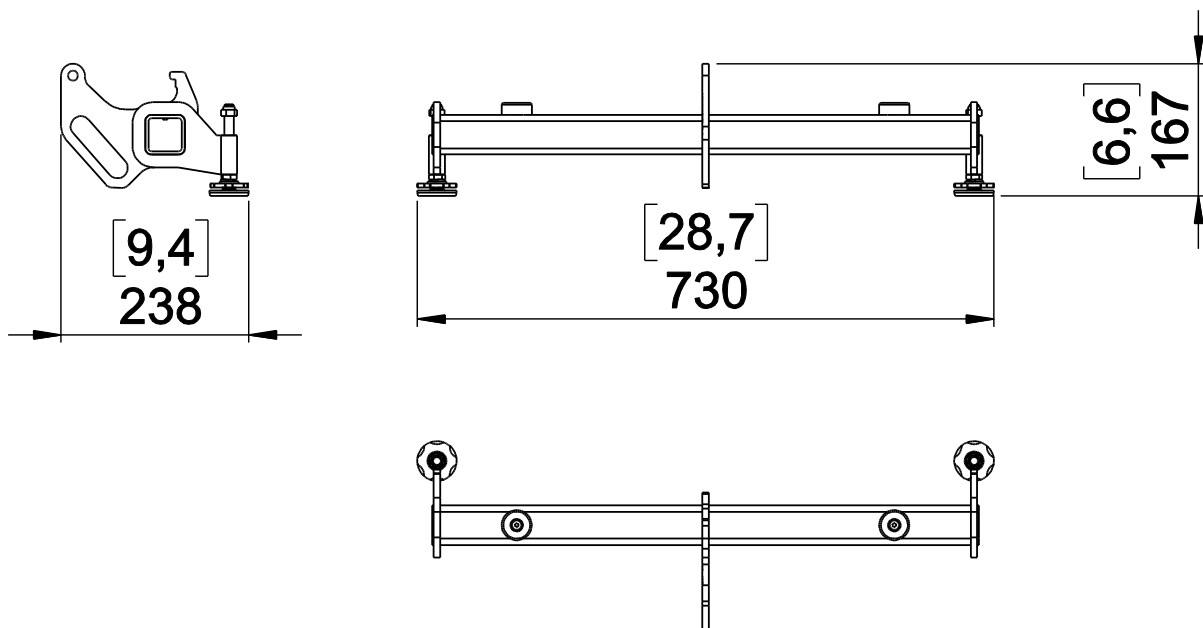
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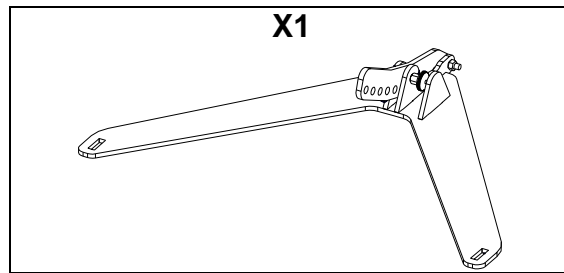
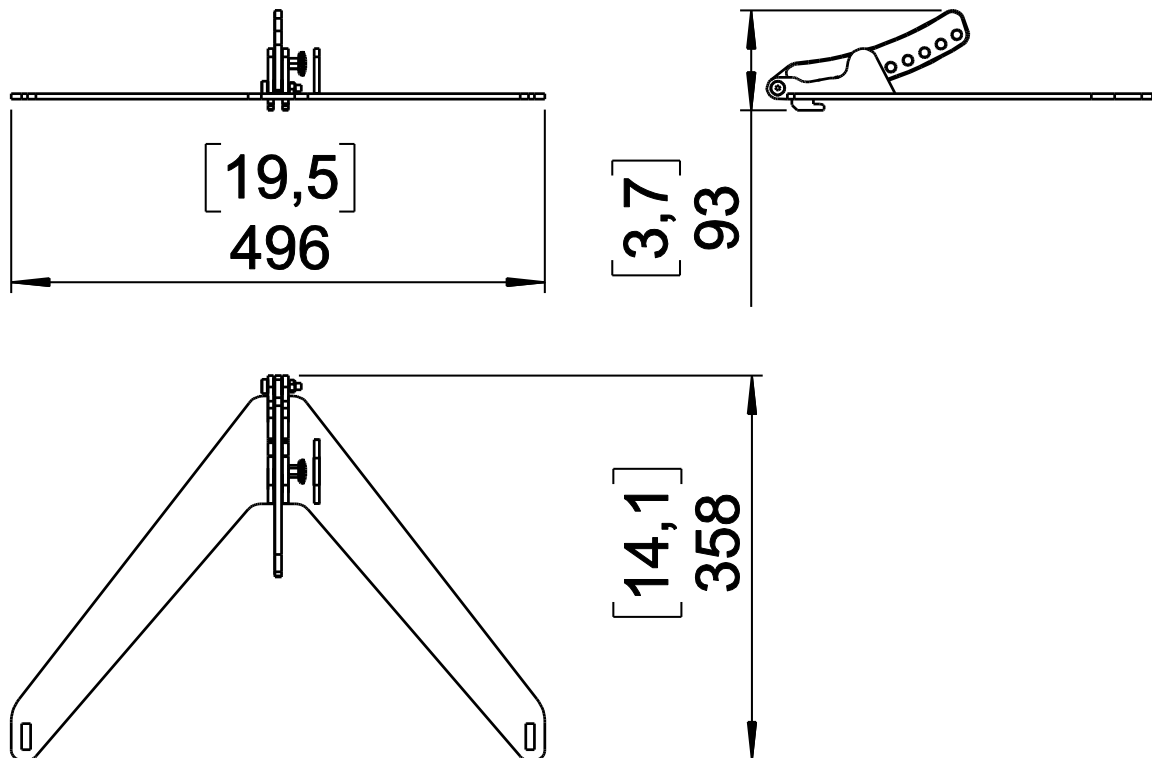


Dimensions



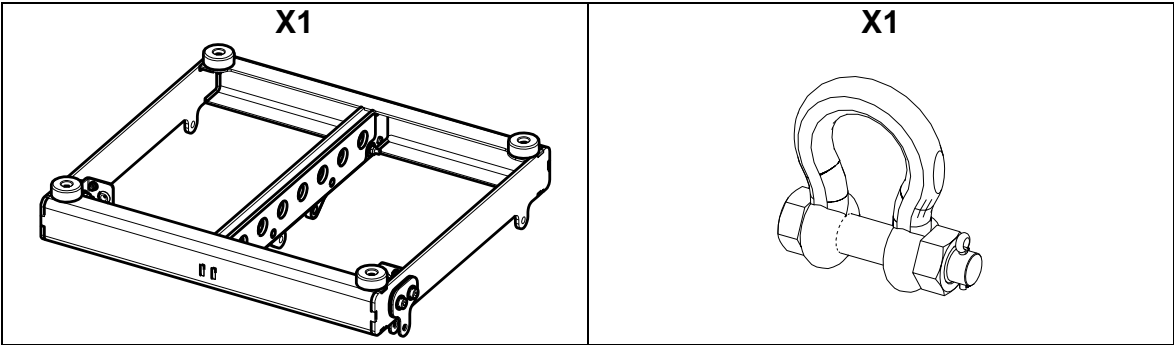
Weight: 9 kg / 20 lb

8.3.4 VNT-GSTKM10S**Parts****Dimensions****Weight:** 6 kg / 13.3 lb

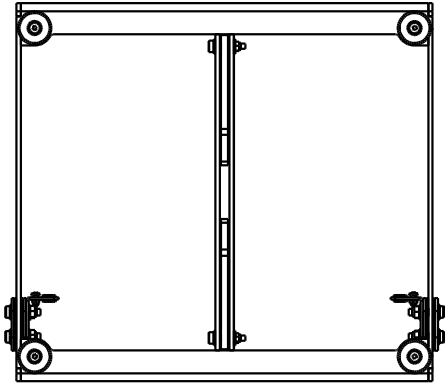
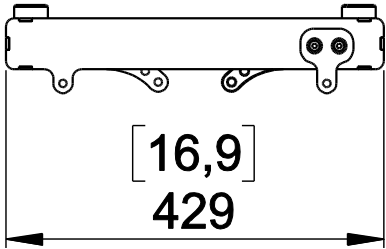
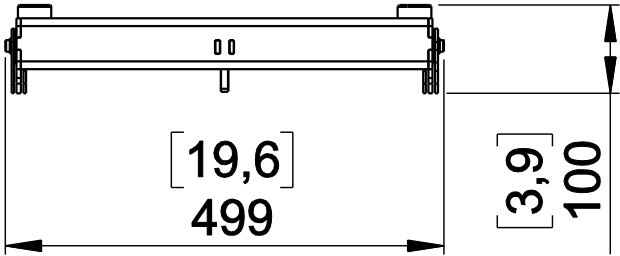
8.3.5 VNT-MNSTKM10**Parts****Dimensions****Weight:** 2.2 kg / 5 lb

8.3.6 GMT-LBUMPM10

Parts



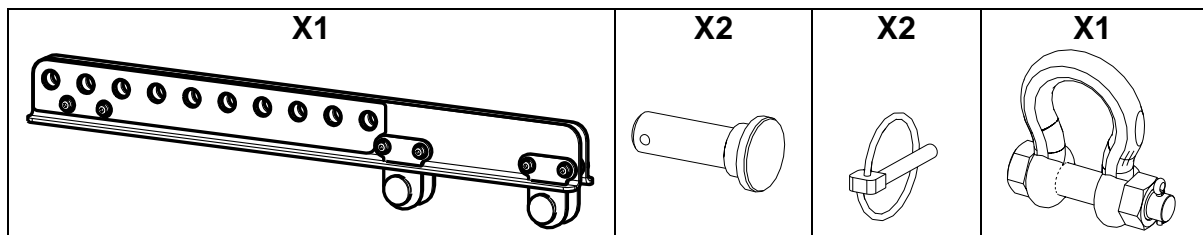
Dimensions



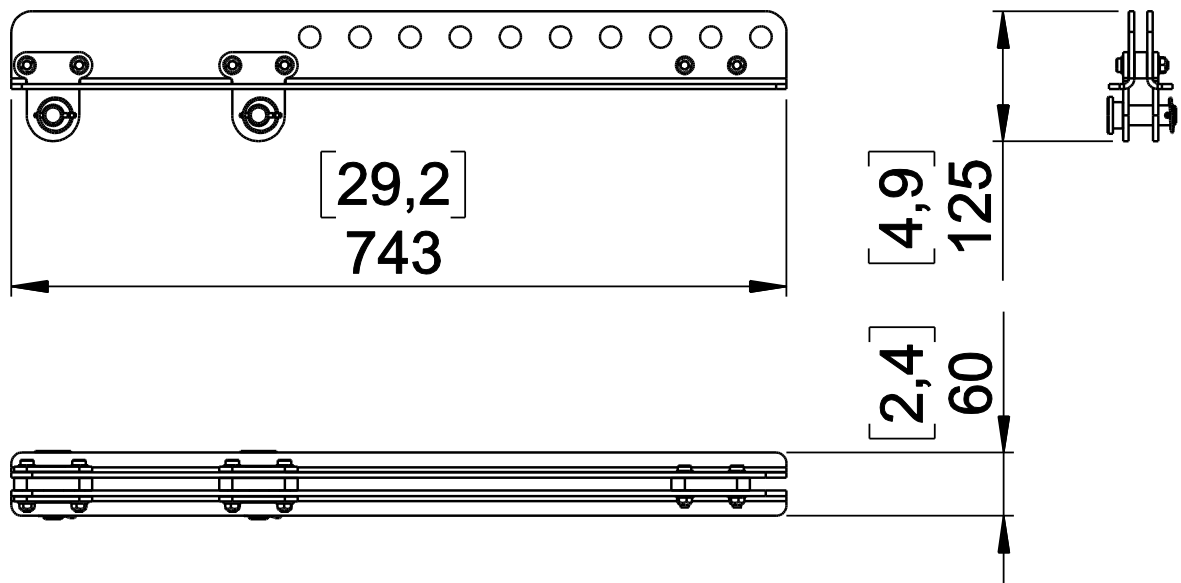
Weight: 8 kg / 18 lb

8.3.7 GMT-EXBARM10L

Parts



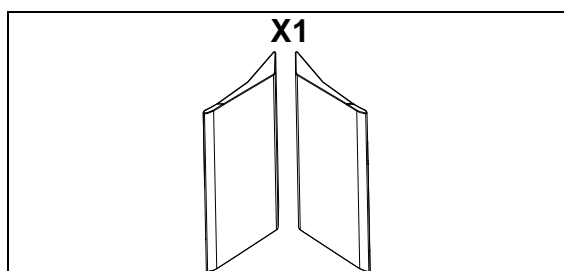
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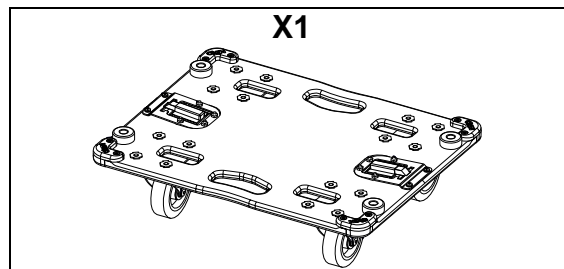
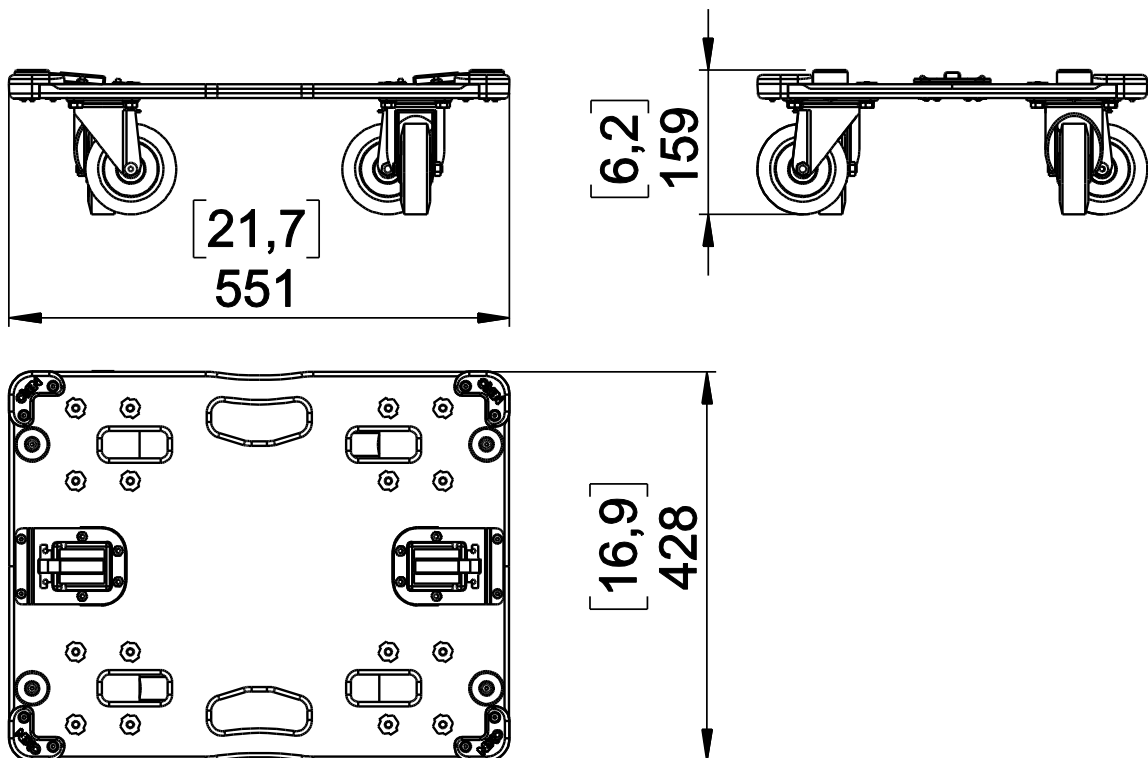
Weight: 7 kg / 15.5 lb

8.3.8 GMT-FLGM10

Parts



Weight: 0.3 kg / 0.7 lb

8.3.9 MST-WBMSUB15**Parts****Dimensions****Weight:** 6 kg / 13.3 lb

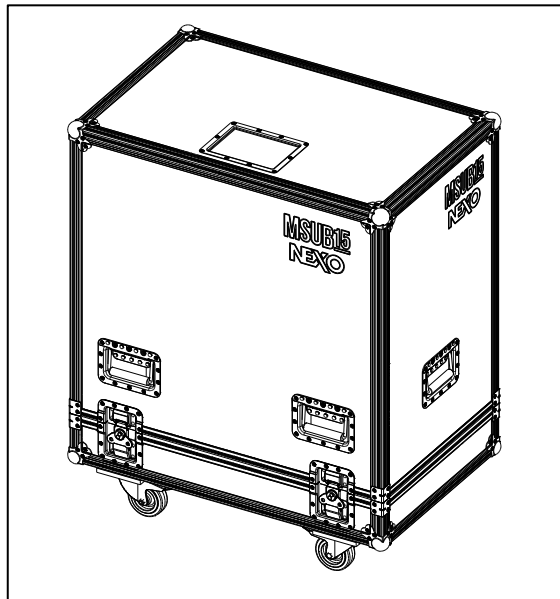
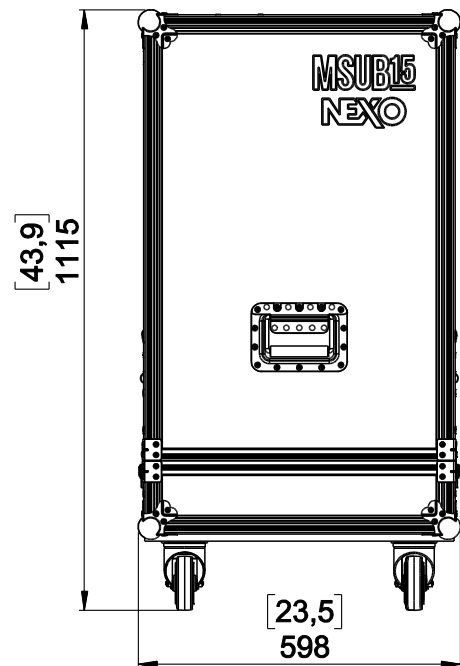
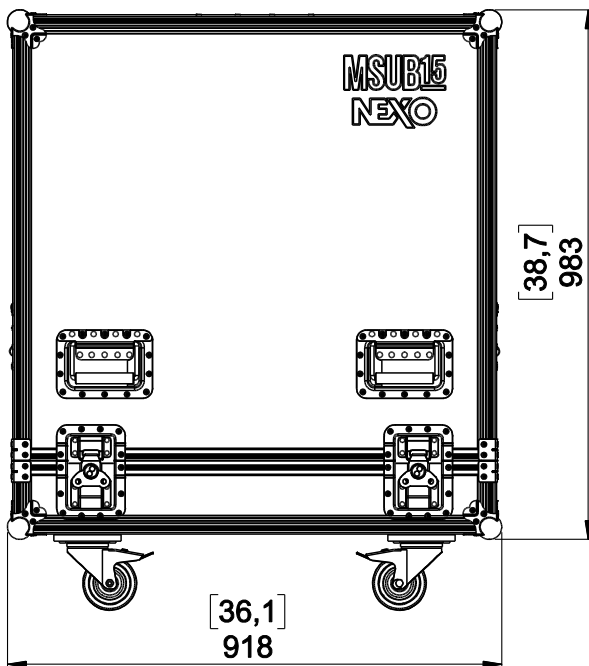
8.3.10 MST-COVMSUB15

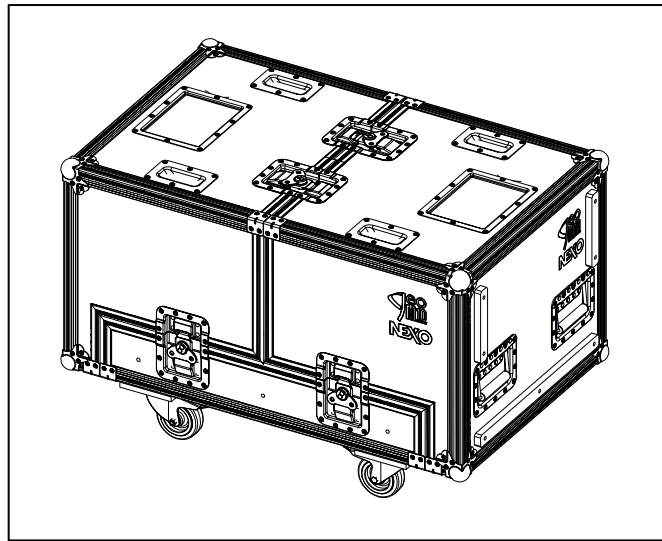
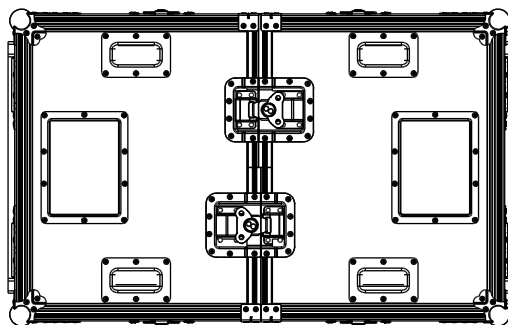
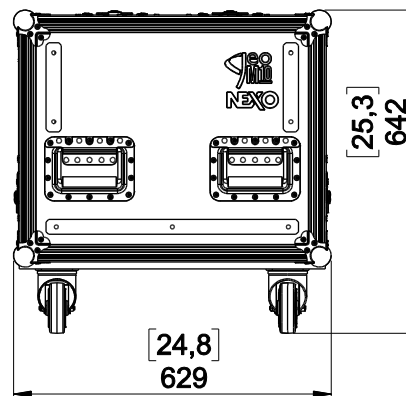
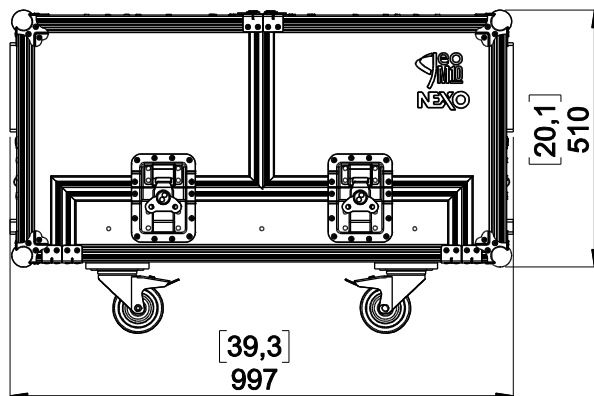


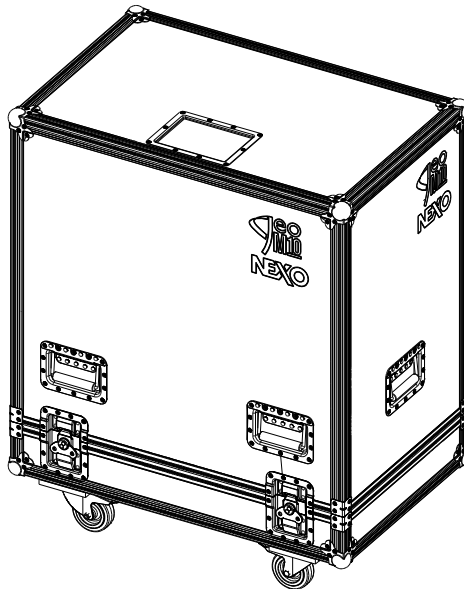
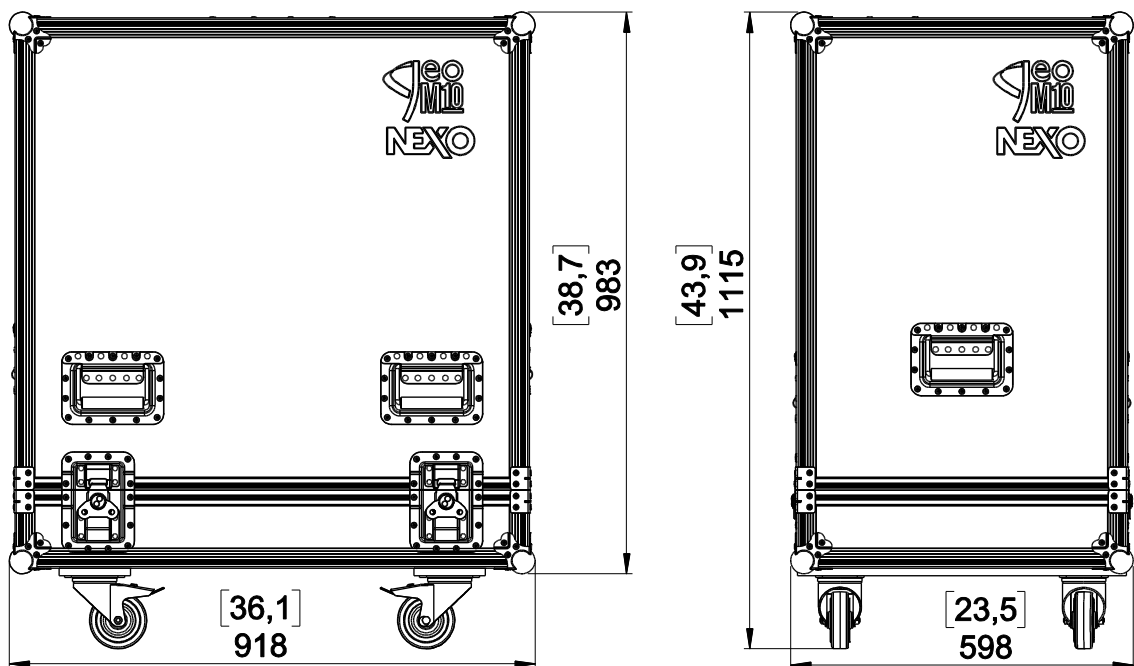
Parts



Weight: 2kg / 4.4 lb

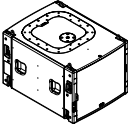
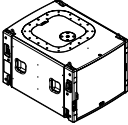
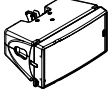
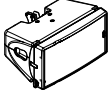
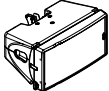
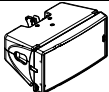
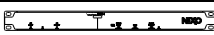


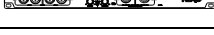
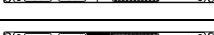
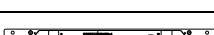

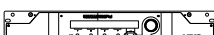
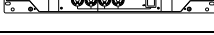
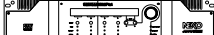
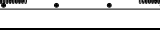

8.3.11 MST-2CASEMSUB15**Parts****Dimensions****Weight:** 43 kg / 95 lb

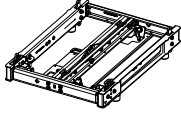
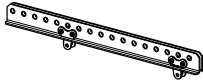
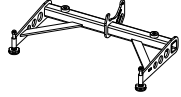
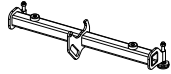
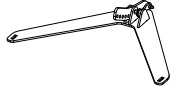
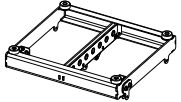
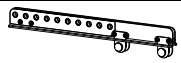

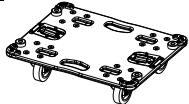


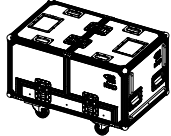

8.3.12 GMT-3CASEM10**Parts****Dimensions****Weight:** 40 kg / 88 lb

8.3.13 GMT-6CASEM10**Parts****Dimensions**

Weight: 45 kg / 100 lb

9 GEO M10 & MSUB15 MODULES & ACCESSORIES LIST

REFERENCE	DRAWING	DESCRIPTION
MSUB15		15" Subwoofer Touring Version
MSUB15-I		15" Subwoofer Installation Version
GEO M1012		10" - 12° Tangent Array Touring Version
GEO M1012-I		10" - 12° Tangent Array Installation Version
GEO M1025		10" - 25° Tangent Array Touring Version
GEO M1025-I		10" - 25° Tangent Array Installation Version
DTD-IU		Digital TD Controller Installation Version
DTD-IN		Digital TD Controller Installation Version - Dante
DTD-TU		Digital TD Controller Touring Version
DTD-TN		Digital TD Controller Touring Version - Dante
DTDAMP4x1.3C		Power Amplifier 4x1250W / 220V
DTDAMP4x1.3U		Power Amplifier 4x1250W / 110V
NXAMP4x1C		Powered Digital TD Controller 4x1300W / 220V
NXAMP4x1U		Powered Digital TD Controller 4x1300W / 110V
NXAMP4x4C		Powered Digital TD Controller 4x4000W / 220V
NXAMP4x1U		Powered Digital TD Controller 4x4000W / 110V
NX.ES104		Ethersound Network Card for NXAMP
NX.DT104MK2		Dante Network Card for NXAMP
NX.AE104		AES Card for NXAMP

REFERENCE	DRAWING	DESCRIPTION
VNT-BUMPM10		Lifting / Stacking Bumper for GEO M10 and MSUB15
VNT-EXBARM10		Extension Bar for VNT-BUMPM10
VNT-GSTKM10L		Long Stacking Extension for VNT-BUMPM10
VNT-GSTKM10S		Short Stacking Extension for VNT-BUMPM10
VNT-MNSTKM10		Stacking Accessory for GEO M10 on top of MSUB15
GMT-LBUMPM10		Lifting / Stacking Bumper for GEO M10
GMT-EXBARM10L		Extension Bar for GMT-LBUMPM10
GMT-FLGM10		Pair of Magnetic Flanges for GEO M1012 & GEO M1025 120° horizontal dispersion
MST-WBMSUB15		Wheelboard for MSUB15
MST-COVMSUB15		Cover for MSUB15
MST-2CASEMSUB15		Flight Case for 2 x MSUB15
GMT-3CASEM10		Flight Case for 3 x GEO M10
GMT-6CASEM10		Flight Case for 6 x GEO M10

10 USER NOTES

France

Nexo S.A.

Parc d'activité de la dame jeanne

F-60128 PLAILLY

Tel: +33 3 44 99 00 70

Fax: +33 3 44 99 00 30

E-mail: info@nexo.fr

nexo-sa.com