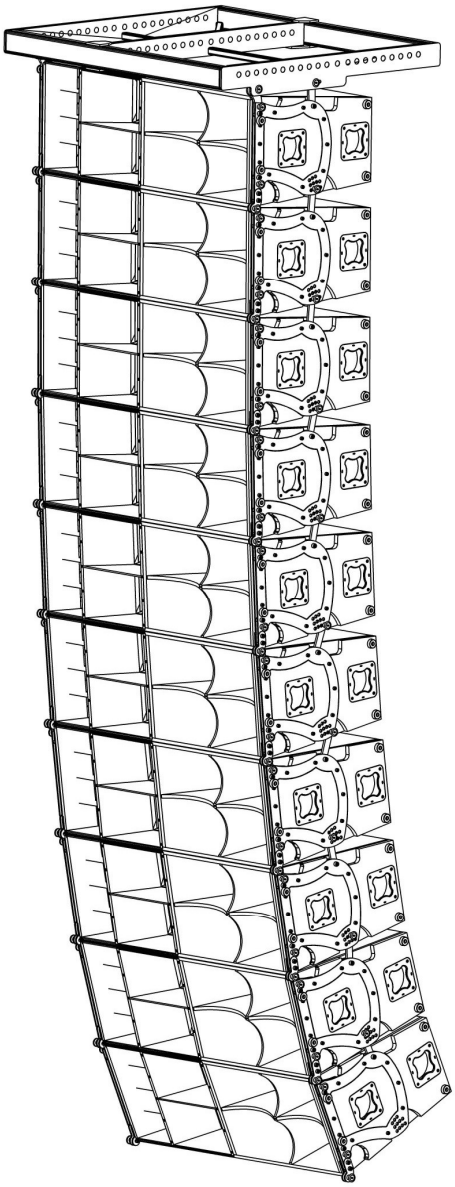
Clear Sound Ltd.
Sofia 1700, Bulgaria
Prof. Hristo Vakarelski Str. 4
VAT BG201105102
www.clearsound.bg
office@clearsound.bg

Clear Sound
LA V3
Line Array

Operation Manual



Clear Sound Ltd.
Sofia 1700, Bulgaria
Prof. Hristo Vakarelski Str. 4
VAT BG201105102
www.clearsound.bg
office@clearsound.bg

April 2023

Clear Sound
LA V3
Operation Manual

1. Content

Clear Sound Ltd.
Sofia 1700, Bulgaria
Prof. Hristo Vakarelski Str. 4
VAT BG201105102
www.clearsound.bg
office@clearsound.bg

Clear Sound Ltd.
Sofia 1700, Bulgaria
Prof. Hristo Vakarelski Str. 4
VAT BG201105102
www.clearsound.bg
office@clearsound.bg

2. Introduction

2.1 Appreciation

Congratulations for purchasing LA V3 Line Array!

We appreciate that you choose Clear Sound as your supplier. Now you possess a powerful sound reinforcement device which can satisfy almost all customers' requirements in the field of professional audio equipment.

The main advantages you receive are extended frequency response, wide and smooth coverage and big dynamic capabilities. Easy operation and high reliability are other benefits you get by choosing LA V3 Line Array.

2.2 Notes for this Document

All specifications, data and dimensions included here concern only LA V3 and cannot be applied to other products! You have to use the information to obtain a competent advice and to understand some specific situations.

Clear Sound Ltd. must not be held responsible for any equipment damages, lost profits or any faults caused by misunderstanding of this manual or lack of experience!

As a result of our continuing progress, we reserve the right to make changes in our products in order to improve them without prior notice. The latest changes cannot be included in this manual. However, we will make the best to refresh the information in our website regularly. Please, contact Clear Sound in case of any questions or difficulties concerning the information in this manual!

The purpose of this manual is to equip you, the user of LA V3 Line Array, with the most important information of how it is used, its parameters, and yours and your property safety. We assume in advance that you have some basic knowledge, skills and training in this field. There are many sources from which you may gain knowledge, there are many courses concerning safety etc., and the skills are going be improved with the time and the right practice.

You should read this instruction with understanding, keep it and follow it carefully. Also, you should do the same with all other equipment you use and you have to keep your local regulations and laws.

3. Safety Warnings and Precautions

3.1 General Safety

LA V3 speakers can easily make a sound pressure level (SPL) sufficient to cause permanent hearing damage to the artists, the crew and the audience. You must avoid high

levels for a long time and you have to keep all local regulations which are too strict in some countries.

Avoid smoking at the location / venue, especially for the fire safety.
The crew should have basic skills in first aid and rescue.

3.2 Rigging Safety

LA V3 must be rigged and lifted up ONLY by professional riggers or by trained personnel under a supervision of a professional rigger. The rigging is a work with a high potential of risk for the people and for the equipment. **It's not a job for amateurs!** If you are a novice, you or a part of your crew should graduate from a rigging course with a corresponding license, or you must employ professional riggers, or use such company like a co-contractor. If you or your crew will rig the system, you should discuss this with your insurer.

LA V3 Speakers are designed for vertical rigging of maximum 10 (ten) speakers per side according to the present Clear Sound Operation Manual.

Please, check and keep the relevant regulations concerning this object in your area or country!

The duty of the riggers is to mount safely and to adjust the system. The whole system and its components must be inspected carefully from safety point of view before they are put into operation. ***All damaged components must be removed and replaced!*** If there is a doubt about the safety and the function of some component, it must not be used.

Also, the system safety is directly related to the weather and site conditions. For example, strong winds can negatively affect the riggers' work and construction stability.

All mechanical and moving parts are subject of wearing out, corrosion and other degradation of parameters. Bad treatment, transportation, usage and storage can significantly accelerate the aging process and may lead to cracking / malfunction of the components or bigger unit. All components must be carefully inspected before usage. Care should be taken of and protective measures should be fulfilled so that you can use all devices without any accidents for as long as it is possible.

Riggers and the other technicians, like all other people, are able to make mistakes. The general rule is "check three times". The people must check the others' work and their work must be checked by the others. Nobody should be affected by this, because it's made for public and your safety.

Always keep the load limits indicated on any kind of equipment!

It is absolutely forbidden to stand under the Line Array when it is lifted up and / or taken down!

Clear Sound Ltd.
Sofia 1700, Bulgaria
Prof. Hristo Vakarelski Str. 4
VAT BG201105102
www.clearsound.bg
office@clearsound.bg

Only people who are directly involved in the process must enter the working area.

The riggers must have and use safety protective equipment and suitable climbing outfit. They have to be competent to choose fall-arresting systems and equipment against falling from height. Helmets are necessary for them and for the people on the ground. The tools used by riggers must be securely tied / bounded to them. A tool dropped from several meters can seriously hurt the people down!

When the Line Array is lifted up either with motorized or with manual chain hoists, there should be an experienced person who will supervise and co-ordinate the others' job. He must choose a position with good visibility of the site, the Line Array, the chains, etc. Simple and clear signals must be used, indicating lifting start / stop, unbalancing or other obstacles.

The required safety factor of the equipment may be different in different countries. You must check what your local regulations are before rigging.

	**Warning:** **Use only certified lifting equipment (chain hoists, ropes, chains, etc.)! Before use verify their compliance, conformity, technical condition and completeness.**

	**Warning:** **When you use a cart, be careful when you move it in order to avoid injury from tip-over.**

3.3 Electrical Safety

LA V3 is 3-way fully active connected (tri-amp) speaker operating with external amplifiers connected to it with long cables. The amps are not a part from LA V3 Line Array; it can operate with many different types. Here the theme about the amps and the power is described from the safety point of view because it is significant for the whole system's safety.

The power of the components used is significant. This means that when the system plays there are big voltages applying on the speaker connectors and high current flows through the cables.

WARNING: Use only certified and approved electrical equipment (cables, connectors, distributors, etc.)! Before use verify their technical parameters, compliance, conformity, technical condition and completeness.

WARNING: In order to reduce the risk of fire or electric shock, do not expose the amps or amps rack to rain or moisture. Do not expose them near dripping or splashing liquids and ensure that no objects filled with liquids are placed on the equipment!

Clear Sound Ltd.
Sofia 1700, Bulgaria
Prof. Hristo Vakarelski Str. 4
VAT BG201105102
www.clearsound.bg
office@clearsound.bg

Never block the ventilation openings, leave a lot of space in front of and at the back of the amp rack. Inspect and clean regularly!

Install and use in accordance with the manufacturer's instructions! Use only spare parts / accessories specified by the manufacturer.

CAUTION: Risk of electric shock! Do not open the amplifier's covers!

Always replace the electrical fuses with the same type, size and rating (in Amperes / Volts). Never make the burned fuse "stronger" by replacing the wire with such with bigger cross-section.
This means you should have spare fuses on the location.

Do not install near any heat sources such as radiators, ovens, stoves, fire, candles or other apparatus (including other amplifiers) that produce much heat! Avoid direct sunshine, it is a heat source.

The crew must have basic skills of fire-fighting. You must have fire extinguishers in good working order at the appropriate places. One extinguisher per each amp rack is a good choice at normal venues.

All services must be done by trained personnel. Servicing is needed when the apparatus or part of it has been damaged in any way, for example damaged power supply cord or plug; when liquid has been spilled or objects have fallen into the apparatus; the apparatus has been exposed to rain or moisture; it does not operate normally or has been dropped or stressed. This means you must have at least one spare amp on the location.

Protect the power cord and all the cables – power, speaker, signal, data, etc. from being walked on or pinched with a cart, carriage, trolley etc. Use cable protectors where needed. Avoid bending and flexing the cable, especially in the points where they exit from the apparatus and power connector.

Verify the correct mains voltage and frequency and then connect each device.

Verify that your mains have enough power for your equipment.

Be sure that the power connectors and circuit breakers are accessible to the operator for supervising and servicing.

The electric devices must be powered exclusively from ground connected mains sockets / connectors in electrical mains compliant to the IEC365 or similar rules. This is a fundamental safety requirement so it's necessary to be checked. In a case of any doubt, you should ask for an accurate check from a qualified person.

The power plug / connector without proper grounding must not be used. It is widely spread to remove the ground connection from the power plug in the case of hum and other

Clear Sound Ltd.
Sofia 1700, Bulgaria
Prof. Hristo Vakarelski Str. 4
VAT BG201105102
www.clearsound.bg
office@clearsound.bg

noises in the system – this is unacceptable in the terms of safety. If the apparatus has not LIFT-GND switch you should use proper ground loop isolating device.

3.4 Other activities concerning safety

When the location is in the field, in the mountain, etc., far from city buildings, the PA truss or stage construction becomes the highest point around and attracts lightning in case of a storm. In such conditions any work near the structures must be avoided. The constructions must be well grounded.

It's impossible to describe here, in this manual, all aspects of safety work so ***every person should take care of and should protect himself, the others and the others' property in the best way he can.***

3.5 Disposal and Recycling

	**Please dispose!** **At the end of the life of this product bring it to your local collection point for such equipment. Check the regulations in your area.**

	**Please recycle!** **This product contains recyclable parts and components. At the end of the life of this product bring it to your local recycling centre for such equipment. Check the regulations in your area.**

4. Clear Sound LA V3 System Description

4.1 Brief System Overview

LA V3 is a 3-way fully active connected (tri-amp) speaker with flying hardware. All drivers are horn-loaded with an appropriate type of horns, thus high SPL in each driver's frequency range is achieved. All three frequency ranges are carefully matched together to achieve maximum spectral response (90 Hz – 20 kHz at 4 speakers per side). The limits are chosen according to driver and horn characteristics and specifications without overlaps and missing frequencies.

LA V3 speaker boxes are designed to be right and left. The left and right speakers' orientation should be done in such a way that Hi-frequency section to be inside, towards the stage. This applies only to cases when the speakers are hanged on vertically. The speakers

Clear Sound Ltd.
Sofia 1700, Bulgaria
Prof. Hristo Vakarelski Str. 4
VAT BG201105102
www.clearsound.bg
office@clearsound.bg

are marked with L and R on the covers and on the speaker frame. When we say Right, we mean Right according to the FOH position (FOH Right); the same goes for Left. The speaker on Figure 1 is a right one.

4.2 System Components

One LA V3 speaker consists of three sections: LO, MID and HI. For subs, please refer to Chapter 10.

LO section is designed with 2 custom made 10" loudspeakers loaded with frontloaded horn. We use our own brand loudspeakers – Sound Definition.

MID section is designed with 2 custom made 8" Sound Definition loudspeakers which are horn-loaded with a planar wave module.
Option: MID section can be designed with 8" loudspeakers with FERROFLUID™, which increases power handling and decreases distortions and thermal compression. Please, consult Clear Sound for more information.

HI section is designed with 4pcs 1" BMS drivers with planar wave module.

6. Technical Specifications, outline drawings and performance plots

6.1 Technical Specifications

Type	3 - way horn-loaded high quality Line Array
Application	Minimum 4, maximum 18 units line array
Frequency response	100 Hz - 21 kHz (- 3 dB) single box
Power handling AES	1100 W (Low), 600 W (Mid), 320 W (High)
Sensitivity	1 W@1 m - 104 dB (Low), 109 dB (Mid), 114 dB (High)
Max. SPL peak	140 dB (Low), 144 dB (Mid), 146 dB (High)
Dispersion	90° x 10°
High frequency	4 x 1" BMS neodymium with planar wave module (1.75" voice coil)
Mid frequency	2 x 8" ultra-low distortion middle speakers (2" voice coil)
Low frequency	2 x 10" ultra-low distortion woofers (3" voice coil)
Crossover points	90 Hz (Low), 300 Hz (Mid), 1800 Hz (High)
Nominal Impedance	16 Ω (Low), 16 Ω (Mid), 16 Ω (High),
Input connectors	2 x Neutrik™ NL8MPR
Enclosure material	15 mm Baltic birch plywood
Finish	Textured paint
Dimensions	1412 x 670 x 478 mm (W x L x H (incl. hardware))

5.2 Outline Dimensions Drawings

For components description, please refer to corresponding chapters of this manual.

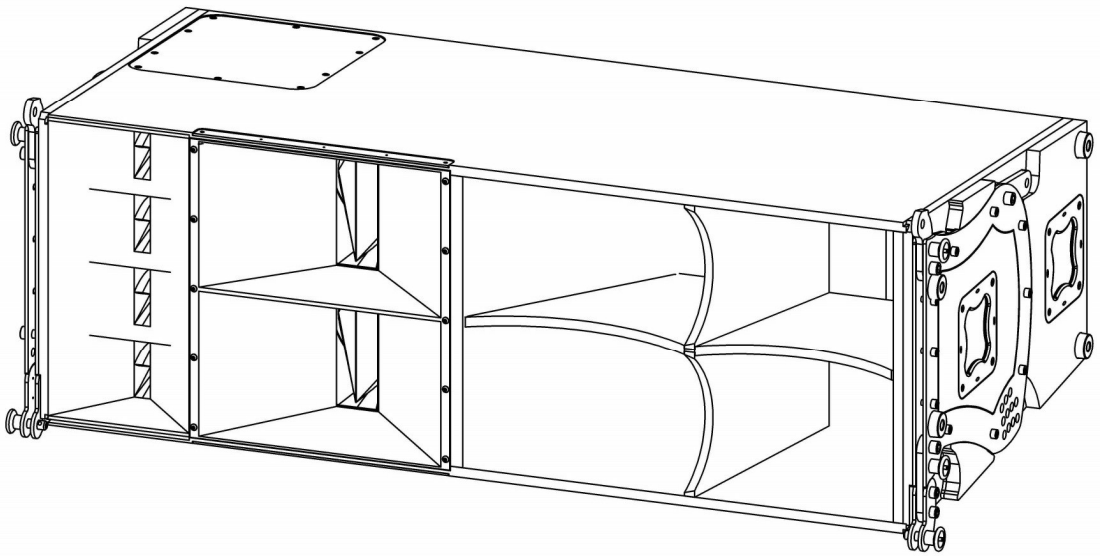


Figure 1. LA V3 – Isometric View

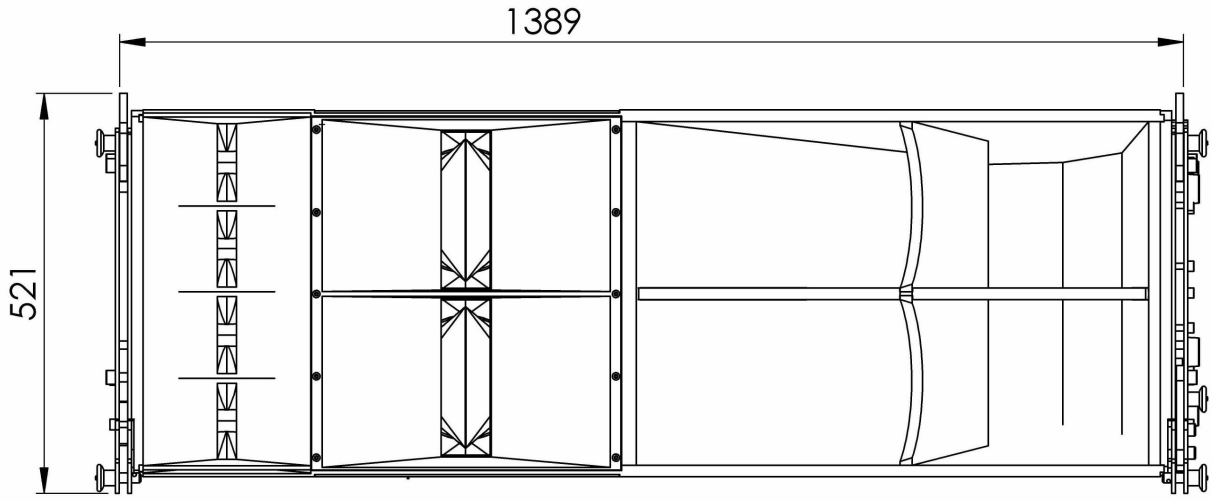


Figure 2. LA V3 – Front View

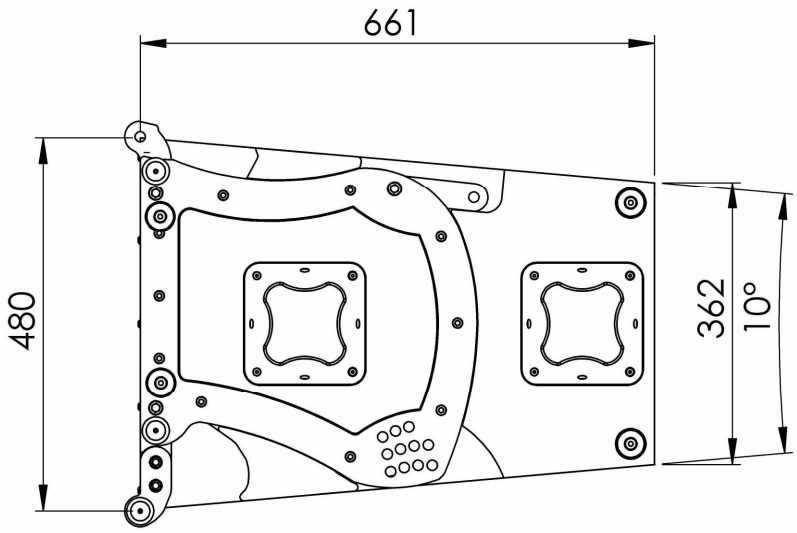


Figure 3. LA V3 – Side View

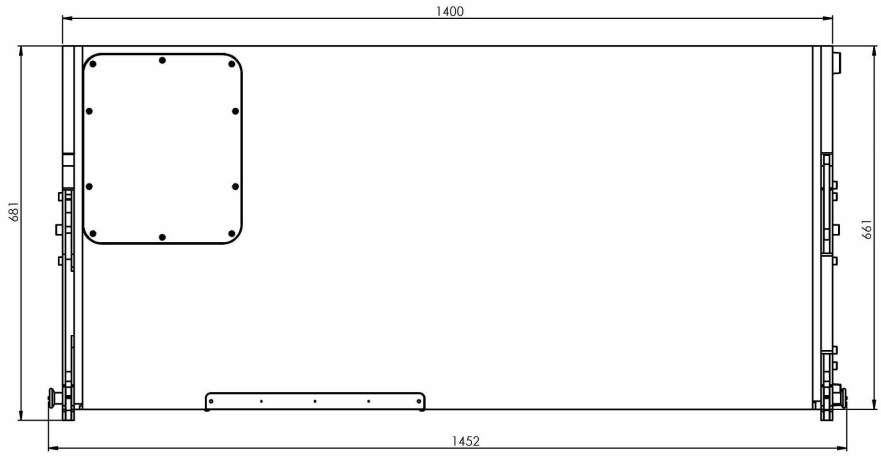


Figure 4. LA V3 – Top View

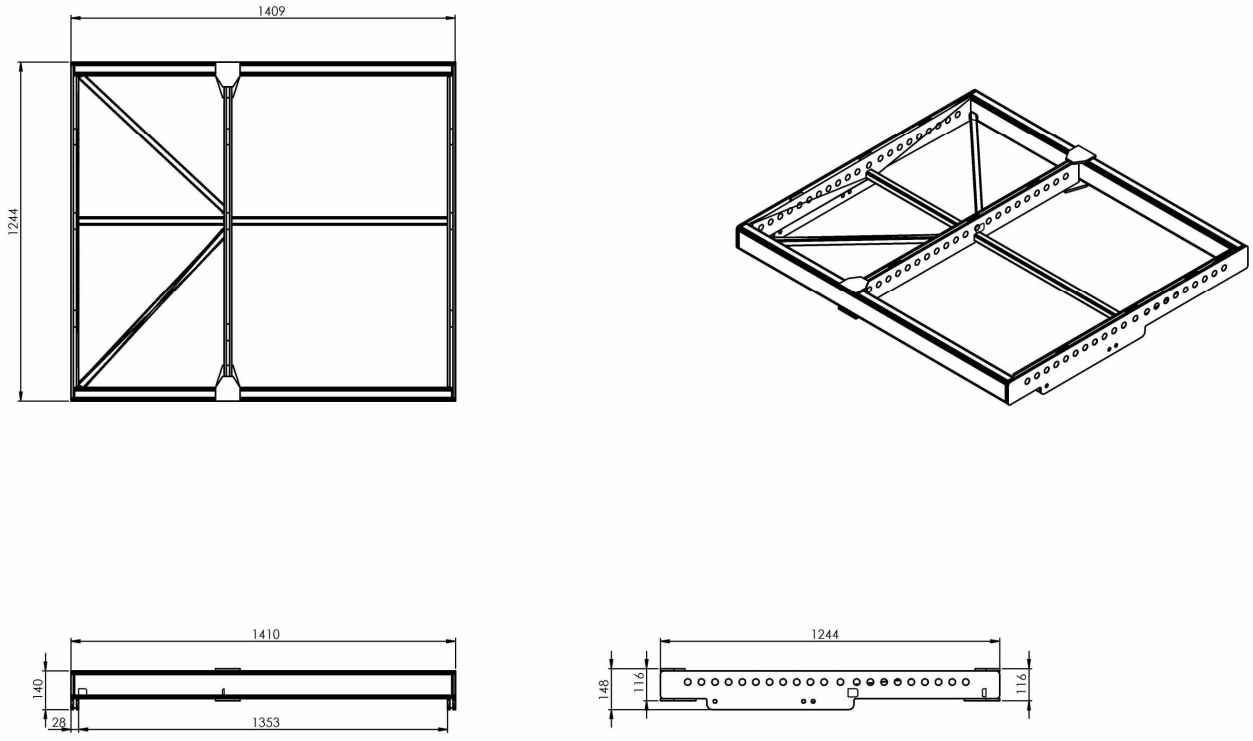


Figure 5. Line Array Flying Frame - Flybar

Clear Sound Ltd.
Sofia 1700, Bulgaria
Prof. Hristo Vakarelski Str. 4
VAT BG201105102
www.clearsound.bg
office@clearsound.bg

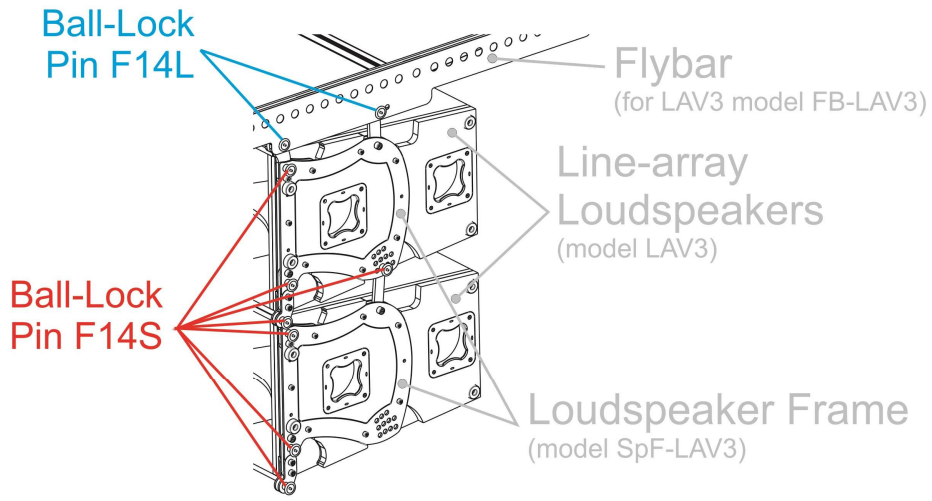


Figure 6a. Ball-Lock Pin types and position.

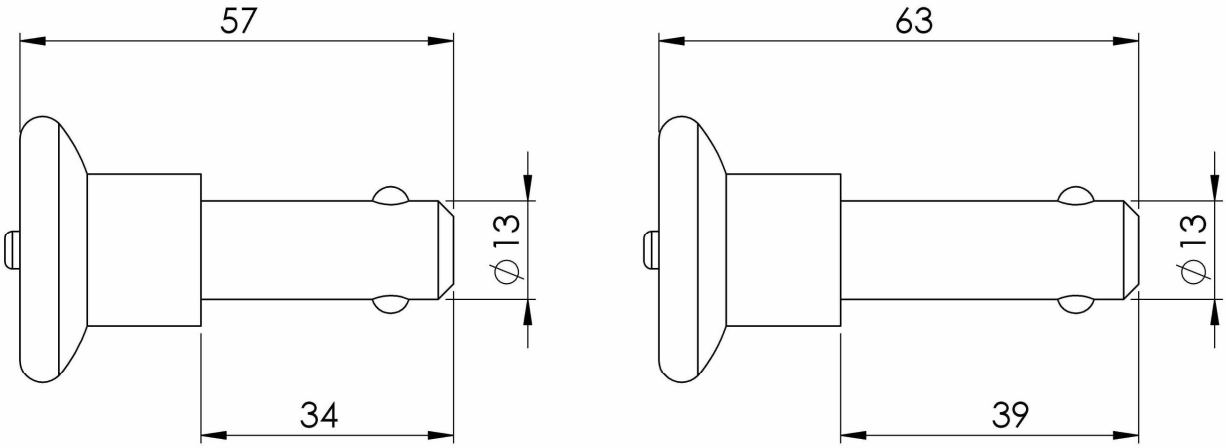


Figure 6b. Ball-lock Pin F14S (left picture) and Ball-lock Pin F14L (right picture).

Clear Sound Ltd.
Sofia 1700, Bulgaria
Prof. Hristo Vakarelski Str. 4
VAT BG201105102
www.clearsound.bg
office@clearsound.bg

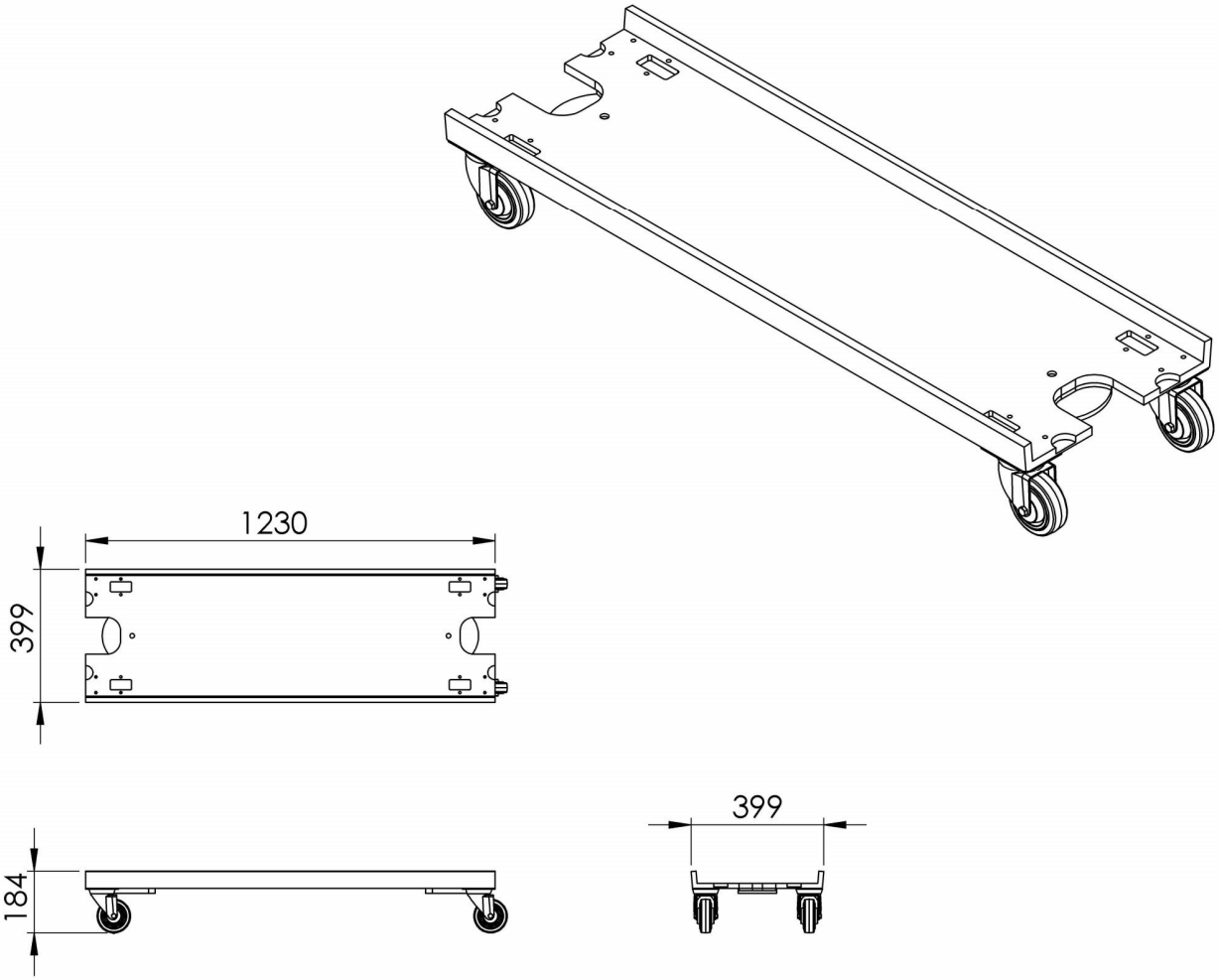


Figure 7. Dolly Board

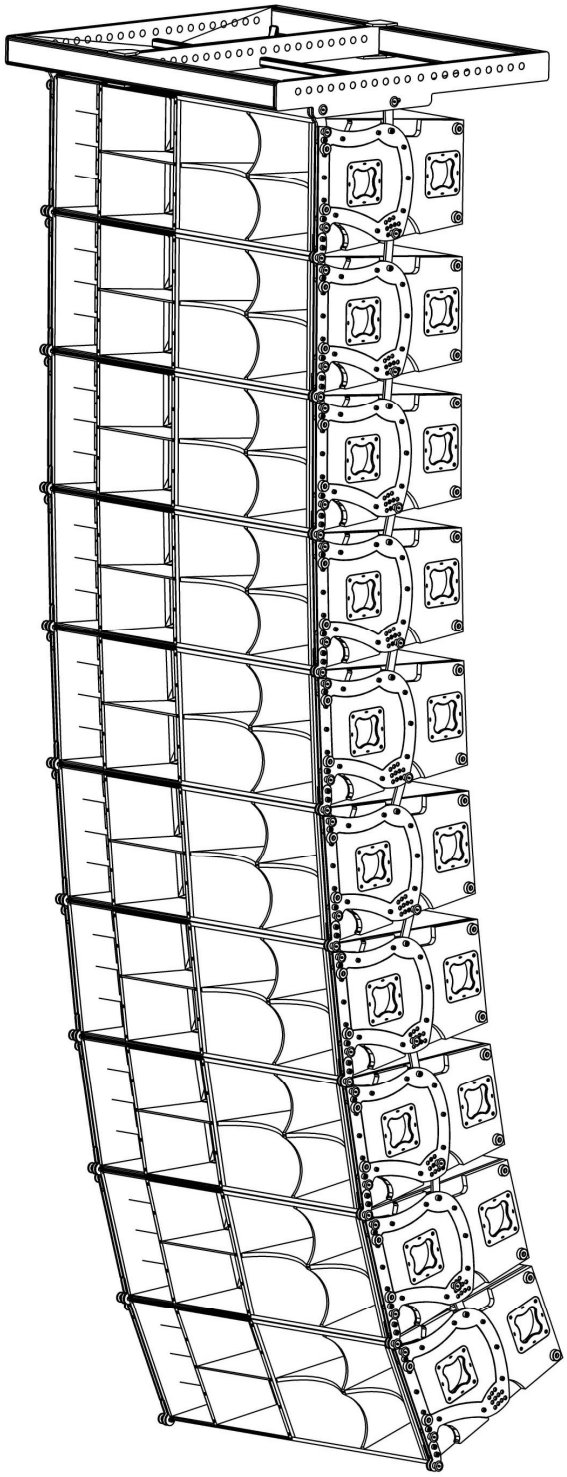
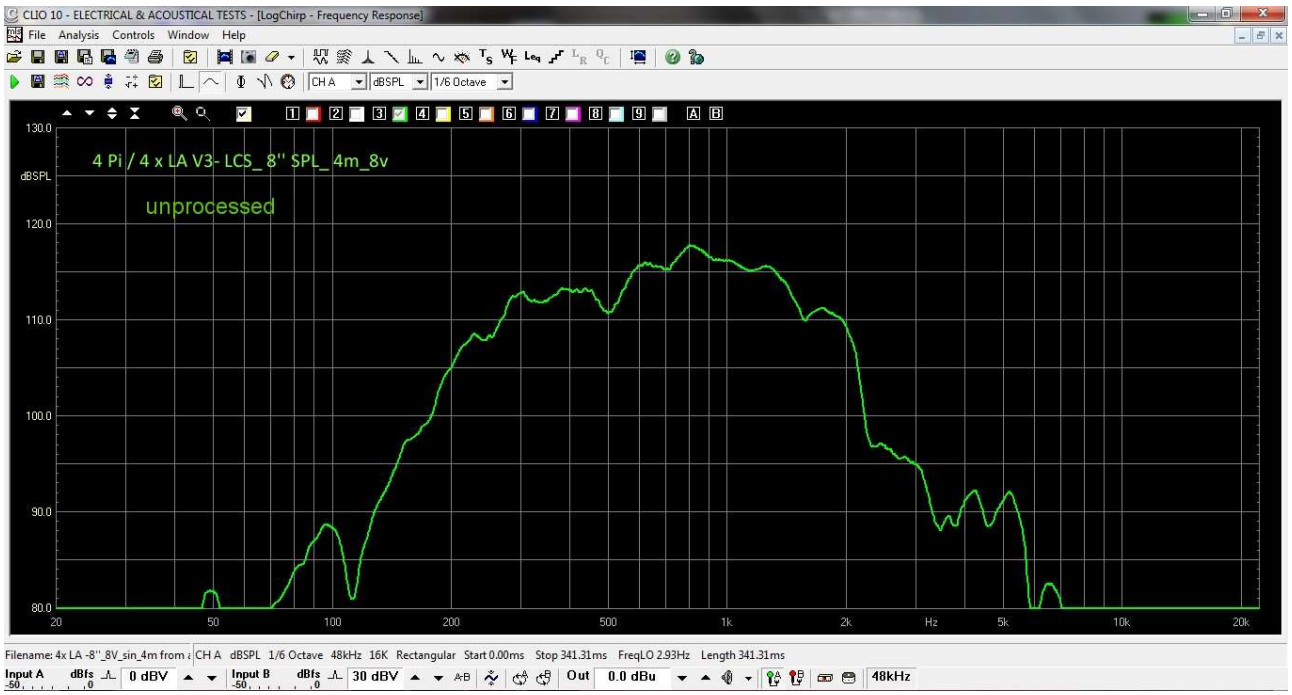


Figure 8. LA V3 10 right speakers rigged together. FOH right side.

5.3 Frequency Response Graphics

Figure 9a. LO Section - Frequency Response of LO Section of 4xLA V3, free space (4xPi), 8Vrms, at 4m on axis, unprocessed



Clear Sound Ltd.
Sofia 1700, Bulgaria
Prof. Hristo Vakarelski Str. 4
VAT BG201105102
www.clearsound.bg
office@clearsound.bg

Figure 9b. MID Section - Frequency Response of MID Section of 4xLA V3, free space (4xPi), 8Vrms, at 4m on axis, unprocessed

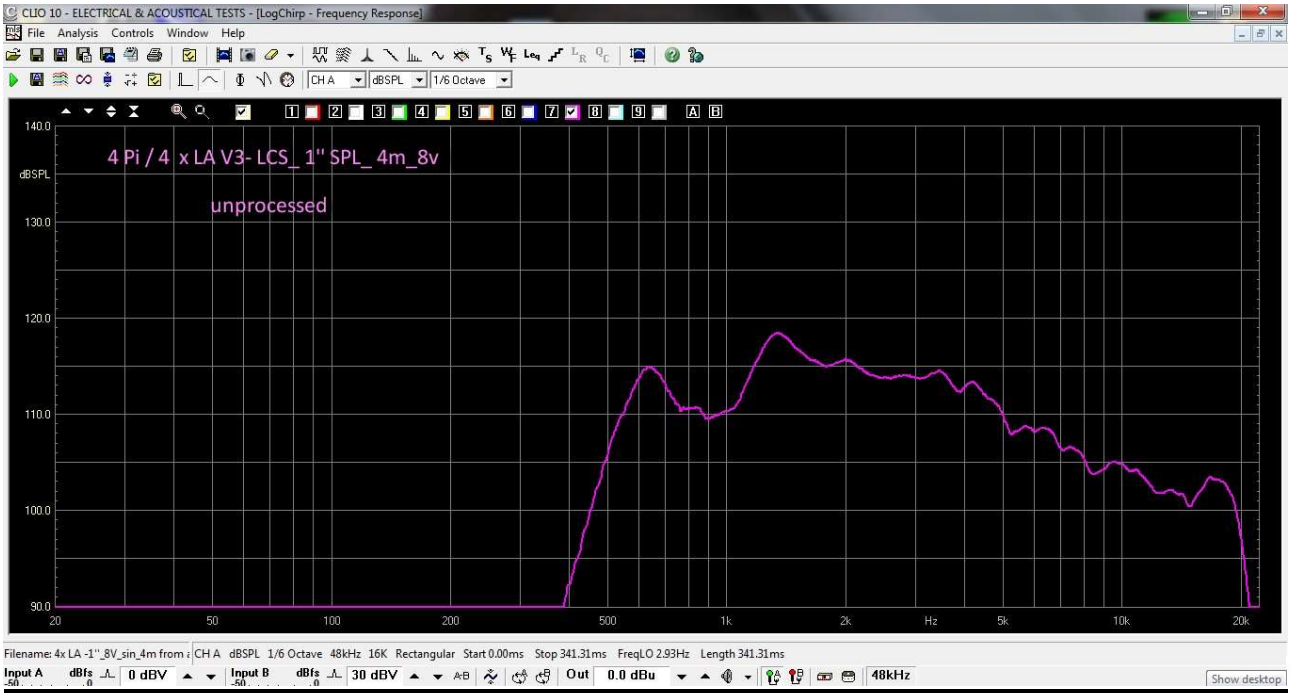


Figure 9c. HI Section - Frequency Response of HI Section of 4xLA V3, free space (4xPi), 8Vrms, at 4m on axis, unprocessed

6. Rigging the Line Array

6.1 General Safety and Important Rigging Precautions

Please refer to Chapter 3.1 for General Safety and Chapter 3.2 for Rigging Safety.

6.2 Flying or Stacking

Flying means that all speakers are connected together with a flying hardware and gone down from a Line Array Frame - Flybar. Please, see Figure 8. The Line Array Frame, on the other hand, goes down from the ceiling of the building or from the stage structure, or from specially built PA tower. ***Please note that this is a very heavy load!***

Stacking (ground-stacking) means that the speakers are built up on a solid surface (ground, stage, etc.) one over the other using their hardware.

The choice between flying and stacking depends on the venue dimensions, the area covered, the scene height and other specific factors.

Clear Sound Ltd.
Sofia 1700, Bulgaria
Prof. Hristo Vakarelski Str. 4
VAT BG201105102
www.clearsound.bg
office@clearsound.bg

The maximum number of vertically placed LA V3 is **10 (ten)**.

The maximum number of stacked (ground-stacked) LA V3 is **4 (four)**. Please, consult Clear Sound for suitable frame for stacking! Note: The frame for stacking cannot be used for flying!

6.3 Originally Supplied Rigging Hardware

6.3.1 Line Array Frame - Flybar

The Flybar, see Figure 5, goes down from the ceiling, from the stage structure, or from specially built PA tower with chain hoists (either manual or motorized), capable to carry the load with sufficient safety factor. The chain hooks are hanged to the flybar shackles. Ten or less speakers hangs down from the bottom (please, note that maximum number of speakers per side is 10 pcs). They are suspended to the frame and between themselves with ball-lock pins. ***Please, note that this is a very heavy load!*** For safety information, please refer to Chapter 3.1 for General Safety and Chapter 3.2 for Rigging Safety.

The flybars are left and right. These on Figure 5 and Figure 8 are right. Right speakers hang on right flybar and vice versa. The speaker on Figure 1 is right one.

6.3.2 Ball Lock Pins

Ball Lock Pins are devices for suspending speakers using their loudspeaker frames together and to the flybar. We have 2 different types of Ball Lock Pins. To connect the upper speaker to the flybar we use Ball-Lock Pin F14-**L** (L is from Long). To connect the speakers together we use Ball-Lock Pin F14-**S** (S is from Short). Please, see Figure 06.

When you insert a pin into the working hole you should press the button on the cap. Then to push the pin until it goes all into the hole. **Always check if the pin is locked in position by rotating and pulling back the cap without pressing the button!**

6.4 Other Rigging Hardware You Must Have

For hanging you may use:

- The ceiling structure of the building / venue, if it is capable to carry such loads. You need a written permission from the owner of the venue. A qualified engineer must show you the appropriate points. The local regulations differ in different countries. A professional rigger must hang the hoists with appropriate accessories. Please, note that LA V3 Line Array is a heavy one and the total load from the ceiling structure will be big.

- The stage structure, if it is strong enough. Refer to stage documentation, stage owner, stage engineer. LA V3 Line Array is a heavy one and only a few stage types can be used for hanging.

Clear Sound Ltd.
Sofia 1700, Bulgaria
Prof. Hristo Vakarelski Str. 4
VAT BG201105102
www.clearsound.bg
office@clearsound.bg

- You may build PA tower yourself using appropriate scaffolding. In Europe, the most commonly used for heavy duty applications is Layher Allround Scaffold System. Please, visit http://www.layher.de. Some local regulations may require you to have a license for building and using the scaffolding. Also, you may have to put ballast in the base of the tower.

No matter what you use for hanging, you will need chain hoists (motorized or manual). The Line Array Frame – Flybar has points of suspension, equipped with appropriate shackles. There are a lot of chain hoist models available on the market. Have in mind the safety factor (bigger or equal to 4). Again, you must be familiar with the device and keep its operation manual. For safety information please, refer to Chapter 3.2 Rigging Safety. Also, you must use only approved chain hoists and supporting equipment and you have to follow carefully the manufacturer's instructions. Some local regulations will demand, when operating with chain hoists, to have an appropriate license, etc. Always consult a professional rigger.

There may be some additional hardware but it depends on the type of the other equipment used. When choosing and buying such equipment you must use only high quality and approved components with appropriate certificates, capable to carry the load with sufficient safety factor. Refer to manufacturer's documentation.

6.5 Rigging Steps

First, you must be familiar with Chapter 3.2 Rigging Safety. The following pictures shows Right Side Speakers only (FOH Right).

Step1. Initial Conditions

We should assume the following initial conditions:

a) You, in generally, know what to do, you have all hardware and the crew wear protective equipment. All hardware and equipment is inspected and found OK.

b) A proper number of suitable chain hoists are lifted up and tightly fixed high on proper places on a special PA tower / venue ceiling. (Please, note that this is just an example - you may use other structures to fly the Line Array). The place of the tower and tower's direction depends on the venue, stage placement, audience position, etc.

c) The flybar shackles are in the correct position in their correct main holes, determined by appropriate calculators or other way. The shackles are placed over the flybar and correctly tighten.

d) All chain hoists' hooks are down to the ground.

e) You know the correct angles between each speakers. Each angle is already known, determined with suitable calculators or in other way.

Step2. Hanging the Flybar

You have to put the flybar in correct position that all chain hoists' hooks are close to all flybar shackles. The shackles are in their correct main holes, determined by proper calculators or other way. The flybar has to be horizontally placed on the ground with the shackles up and the front direction of the flybar has to be directed towards the audience.

You have to hang / suspend all hooks to their appropriate frame shackles. Then lift up the flybar 50cm above the ground with all chain hoists together. The frame has to remain horizontal. **All four chains must remain tight; this way the load will be divided between all hoists, not only part of them.** This is important, always keep it.

Step3. Preparing the upper speaker

One of the speakers for each side has a special rigging hardware. We named it upper speaker. This speaker is hanged directly and only to the flybar and is marked with a red text CONNECT THIS SIDE TO FLY BAR ONLY on the speaker frame as shown on Figure 10. For this connection you should use 4 pcs of Ball Lock Pins F-14L. In one PA system there are one left and one right upper speaker.

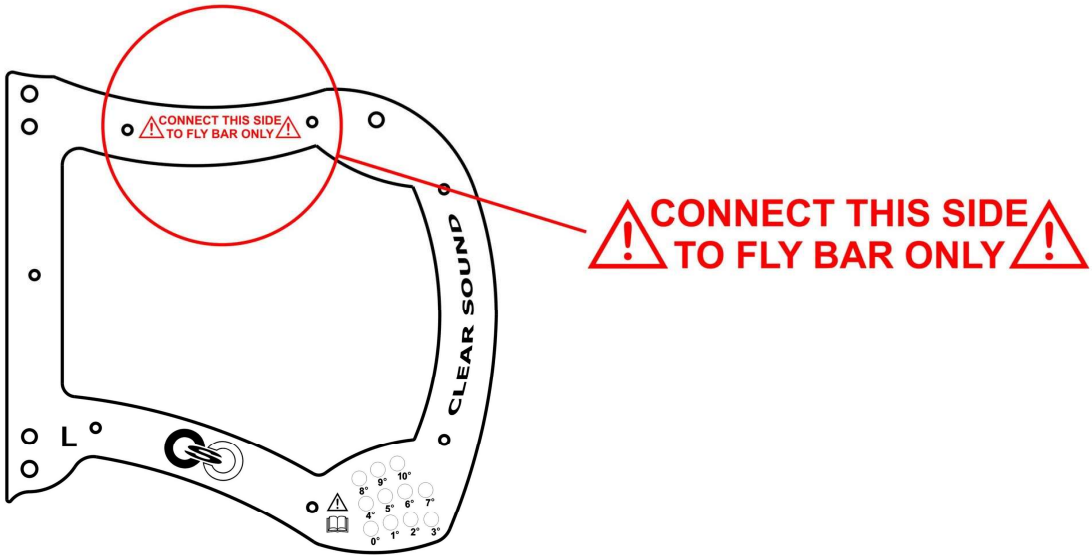


Figure 10. The Upper Speaker is marked with a red text CONNECT THIS SIDE TO FLY BAR ONLY. Here is shown the left upper speaker. Similar for the right one.

Every speaker has 4 moving bars in each side of the speaker frame. In transport position they are locked inside the frame with a magnet lock, as shown on Figure 11. Before hanging the speaker, you should take out every moving bar from the speaker frame. Lock them in position using Ball Lock Pin F-14S, as shown on Figure 12.

Clear Sound Ltd.
Sofia 1700, Bulgaria
Prof. Hristo Vakarelski Str. 4
VAT BG201105102
www.clearsound.bg
office@clearsound.bg

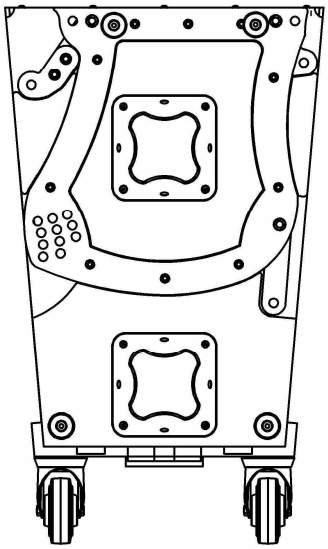


Figure 11. LA V3 speaker with 2 moving bars inside the speaker frame. Bars are in transport position. The speaker is over the dolly board.

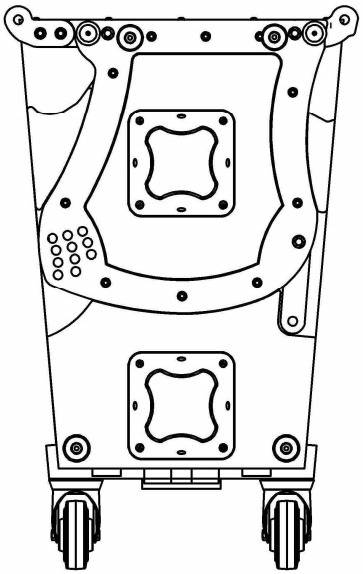
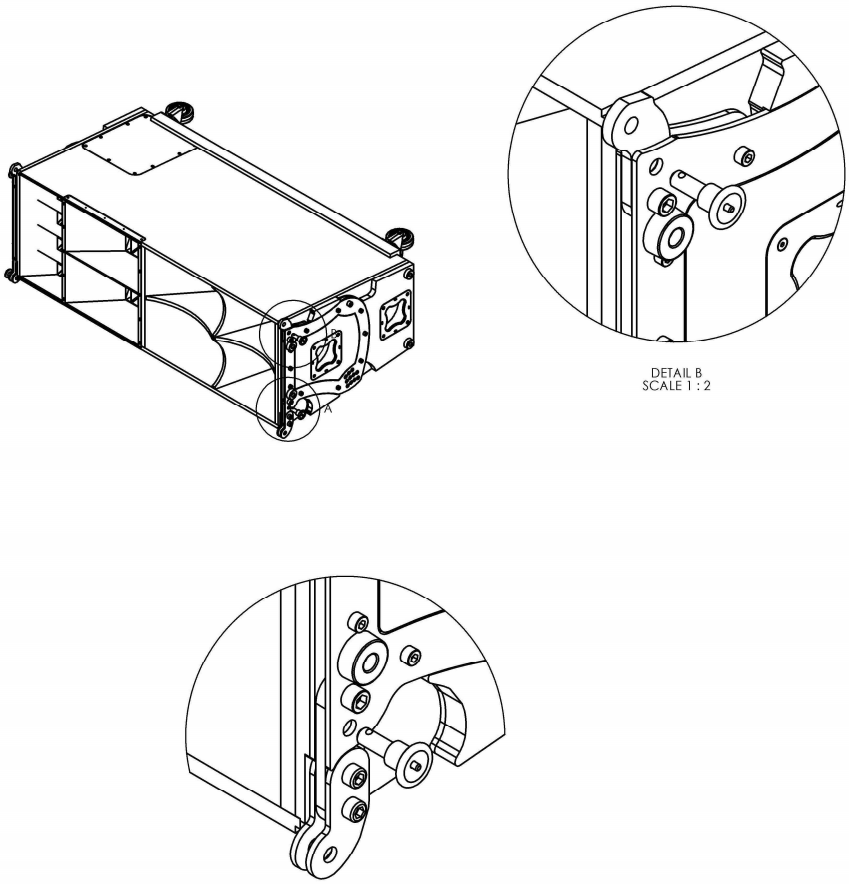


Figure 12. LA V3 speaker with the moving bars outside the speaker frame. Bars in working position, locked with 2 pcs Ball Lock Pins F-14S. Two more pins of the same type lock the bars from the other side.

For details about how to lock the moving bars into working position please see Figure 13



.

Figure 13. How to lock the moving bars into working position with Ball Lock Pins F-14S.

Step 4. Hanging the First / Upper Speaker

Sort the left and right speakers on the appropriate side of the stage and inspect all the hardware and frames.

Move the first / upper speaker near the flybar. Connect carefully both upper moving bars of the speaker to the front holes of the flybar using Ball Lock Pins F-14L, as shown on Figure 14. Note different pins type.

Clear Sound Ltd.
Sofia 1700, Bulgaria
Prof. Hristo Vakarelski Str. 4
VAT BG201105102
www.clearsound.bg
office@clearsound.bg

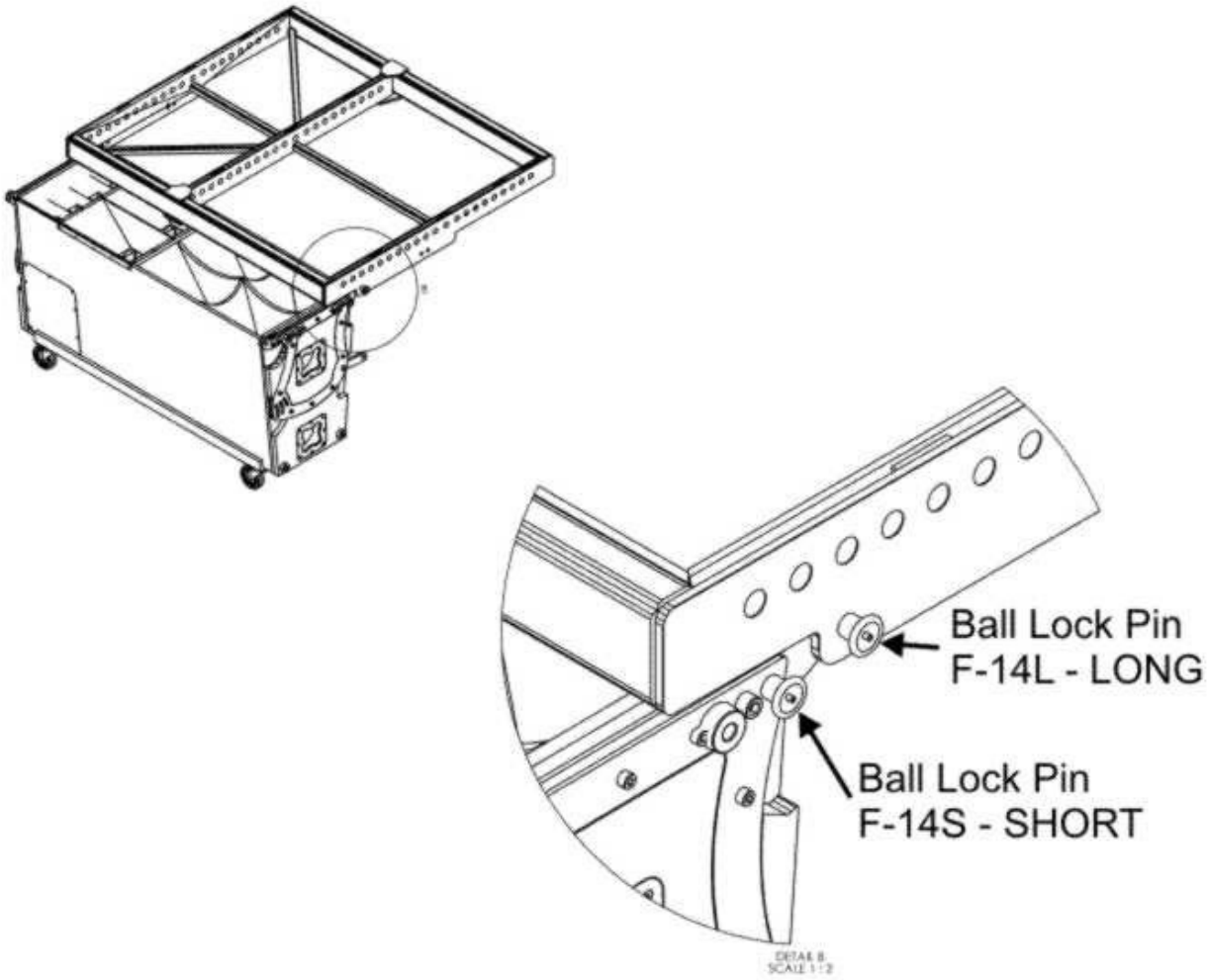


Figure 14. First speaker on the dolly board near the Flybar. The upper moving bars of the speaker are connected to the front holes of the flybar using Ball Lock Pins F-14L.

Lift up the flybar with the first speaker using all chain hoists together. The flybar have to be horizontal all the time. Remove the dolly board. Flybar must be approx. 1m from the ground.

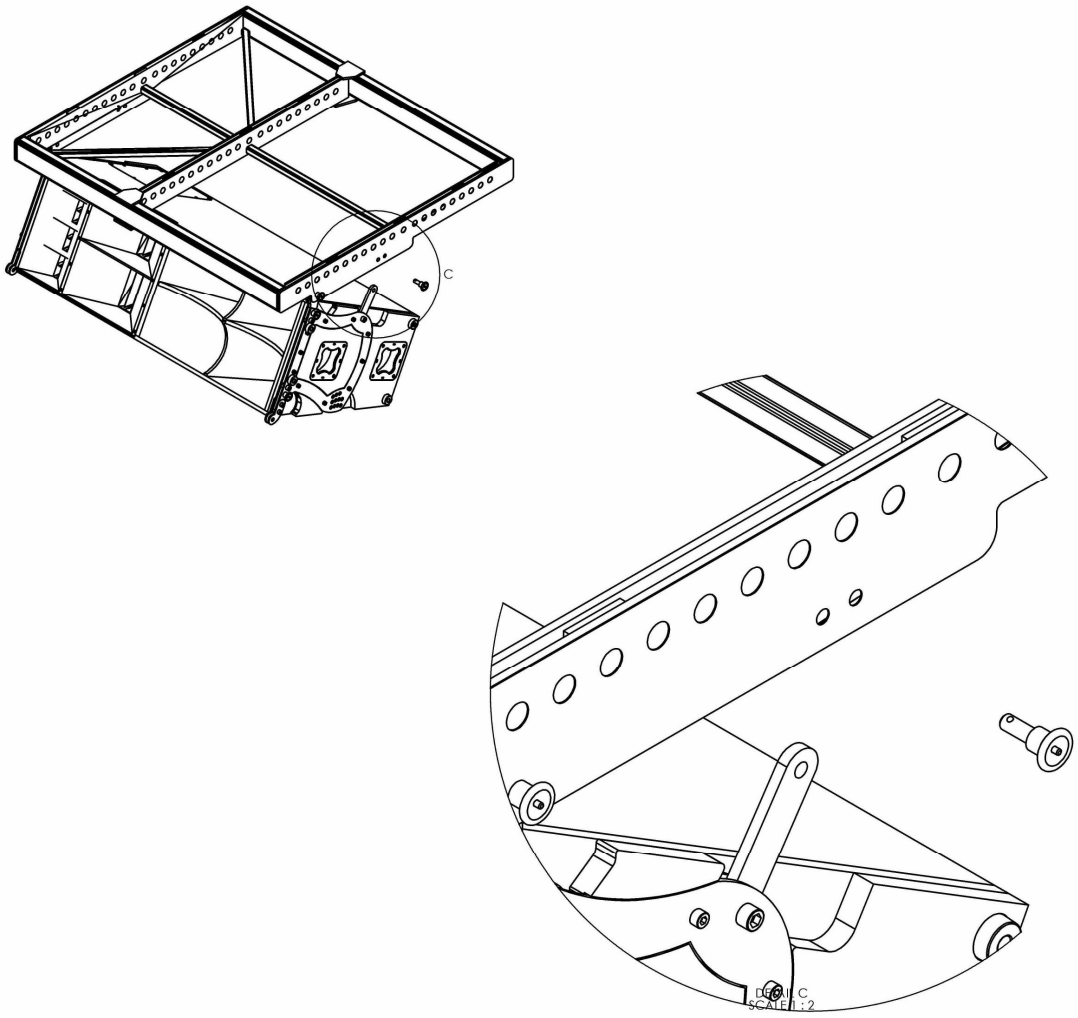


Figure 15. Locking the back side of the first speaker to the flybar with two Ball Lock Pins F14-L.

Now lift up the back side of the speaker up and lock it with 2 Ball Lock Pins F-14L to the back holes of the Flybar.

Use holes closer to the front if you use LA V3 speaker.

Use holes closer to the back of the flybar if you use LAV2 speaker.

Be sure to connect the other side of the speaker too.

For right PA side you should use 4 pcs of Ball Lock Pin F-14L.

Two people have to lift the back of the speaker up while other two people have to put the Ball Lock Pins F-14L. Please, see Figure 15. Be sure that all 4 pins are correctly inserted. Check them by rotating and pulling up the cap without pressing the button. See Figures 15 and 16.

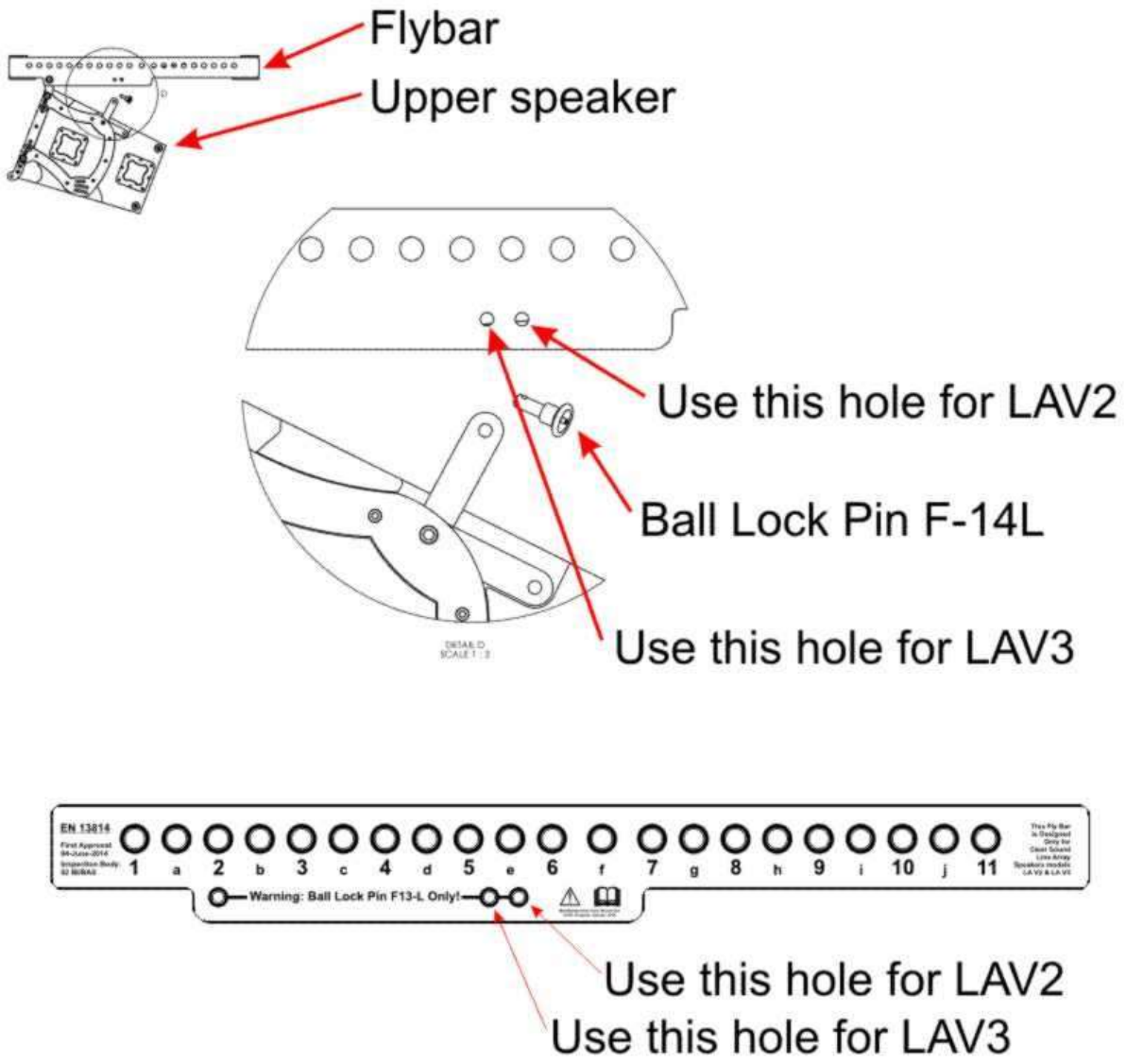


Figure 16. Locking the back side of the first / upper speaker with Ball Lock Pin F-14L depending of the speaker model.

Please note that Ball Lock Pin F13-L and Ball Lock Pin 14-L are the same devices.

Lift up the flybar with the first speaker so another speaker with dolly board can be attached from down.

Step 5. Attaching the second speaker

Similar way connect the second speaker to the first one. The exact locking position of the back moving bar depends of the determined angle between the first and second speaker, please see Chapter 6.7 - Setting the Correct Angles between the Speakers.

You must use Ball Lock Pins F14-S only. See Figure 17. Remove the dolly board.

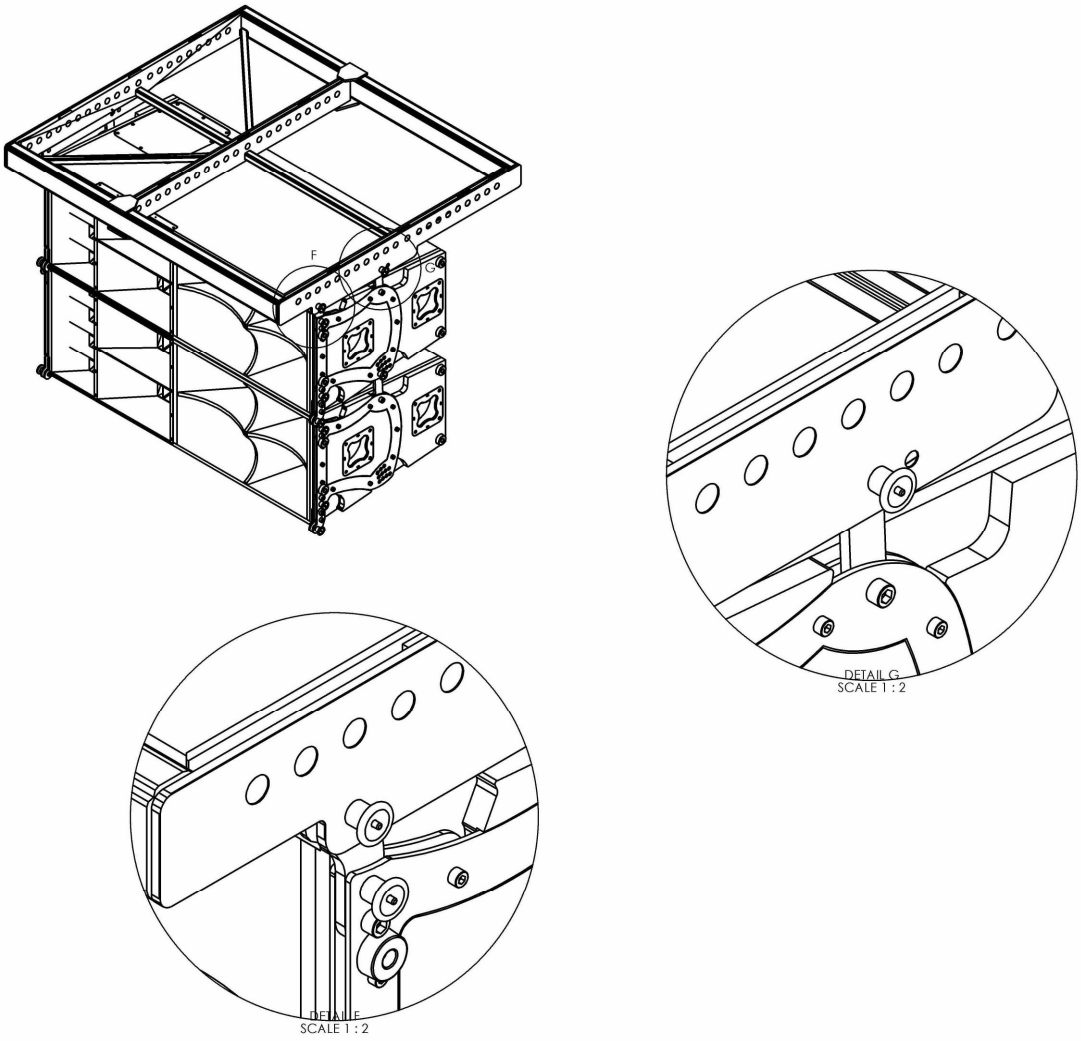


Figure 17. Second speaker attached to the first one with 4pcs of Ball Lock Pins F14S.

Step 6. Attaching the third speaker and so on

Same way connect the third speaker to the second one and so on.

Connect the cables.

Lift up the speakers with all chain hoists simultaneously, keeping the flybar horizontal all the time.

Clear Sound Ltd.
Sofia 1700, Bulgaria
Prof. Hristo Vakarelski Str. 4
VAT BG201105102
www.clearsound.bg
office@clearsound.bg

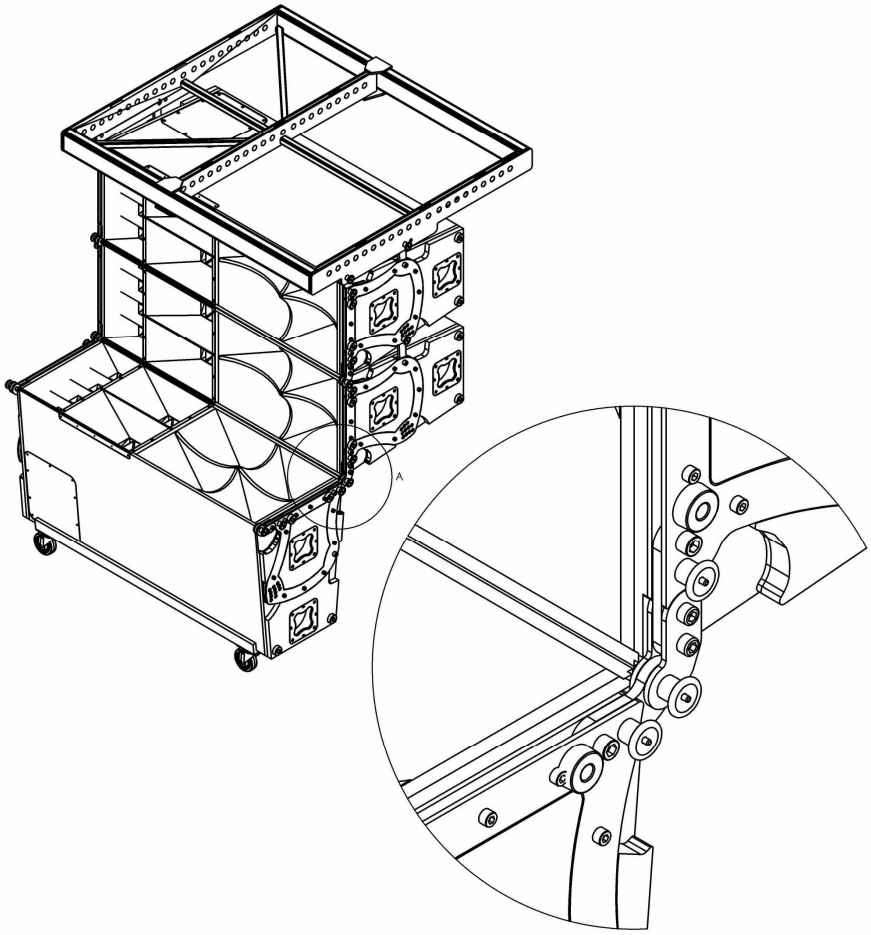


Figure 18. Attaching the third speaker with Ball Lock Pins F-14S.

Plug in the attack (main) cable for the group of speakers. Fix the cable in an appropriate way so that the connector should not carry the weight of the long cable. Be careful about the cable while lifting up.

Step 7. Lifting the Line Array up

Attention! Very heavy load! Do not stay under it while lifting!

Lift the Line Array up using simultaneously all chain hoists and keep all chains tight. The Flybar has to remain horizontal all the time. This is the main function of the person supervising the process from the side, see Chapter 3.2.

Step 8. Setting up the site angle

Please, see Chapter 6.6

Step 9. Secure everything

Finally, you must secure the chains so that nobody except your crew to move them. Secure the cables too so that nobody can pull them down.

6.6 Setting the Correct Site Angle

In the vertical plane, this is the angle between the horizon and the direction of the upper speaker. The general rule is that the upper speaker has to be directed towards the most distant listener in the audience. The desired angle is achieved by lowering the front chain hoists down while the rear chain hoists are fixed. The other way is to use other main holes for the shackles.

6.7 Setting the Angles between the Speakers

In the vertical plane this is the angle between each two nearby speakers. Please, see the holes on the speaker frame, they are marked from 0o to 10o, as it is shown on Figure 19.

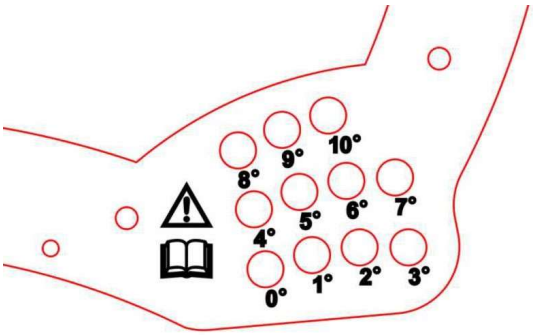


Figure 19. Holes for setting the angle between the speakers

You should assemble the hole of speaker's moving rear bar with the desired hole of the speaker frame which shows the chosen angle and then you have put a Ball Lock Pin F14-S in, see Figure 20.

The ball-lock pin must lock the moving bar into the frame tightly and then the pushbutton of the pin have to be released.

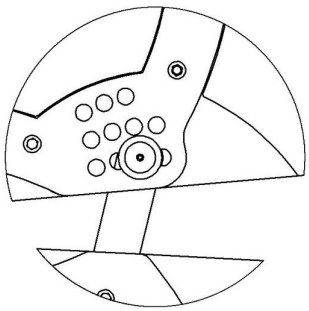


Figure 20. The angle between two speakers is set to 2o.

There are calculators able to determine the right angles depending on the venue, height, distance covered, etc.

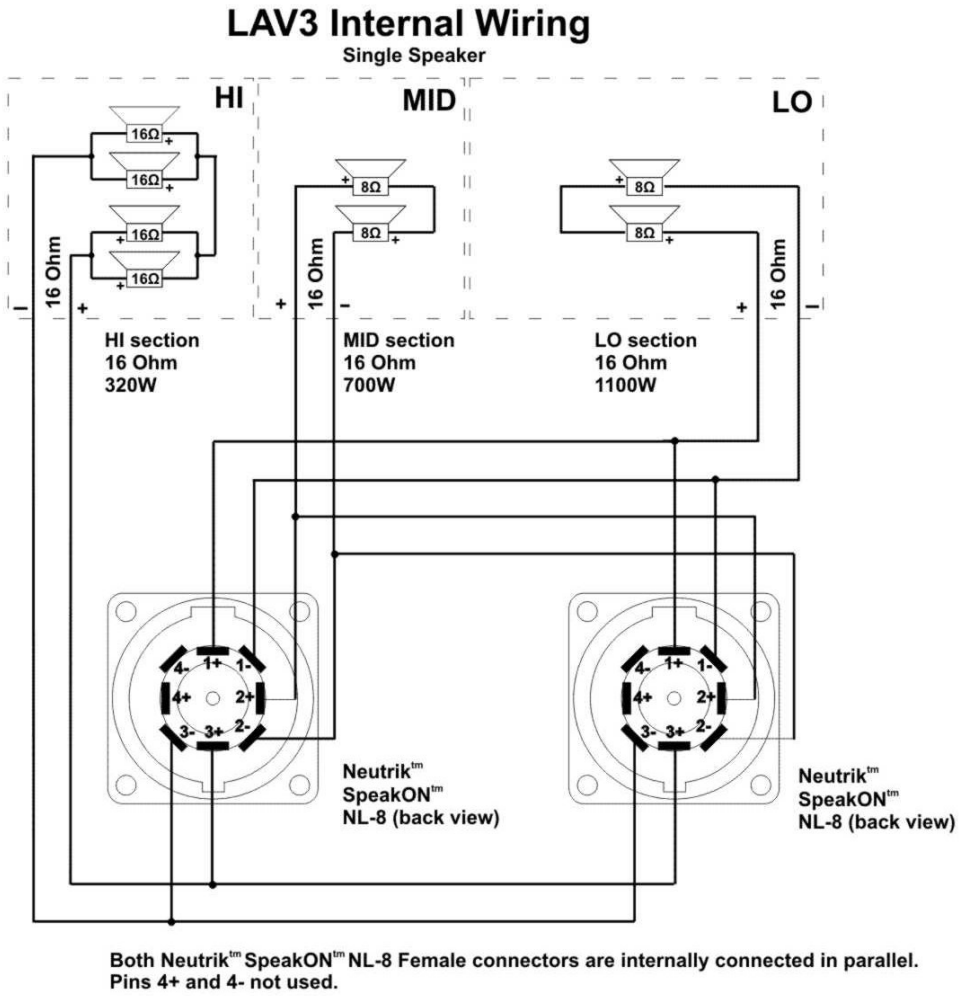
7. Electrical Connections

7.1 General Safety

Please, refer to Chapter 3.3 for Electrical Safety.

7.2 Speaker Internal Diagram

LA V3 is 3-way fully active connected (tri-amp) speaker. All drivers are internally connected and their external terminals are wired to NL-8 connectors as shown on Figure21.



Clear Sound Ltd.
Sofia 1700, Bulgaria
Prof. Hristo Vakarelski Str. 4
VAT BG201105102
www.clearsound.bg
office@clearsound.bg

Figure 21. LA V3 Internal Electrical Wiring Diagram

7.3 General System Block Diagram

The maximum number of speakers per side is 10 (ten). The minimum number of speakers that forms Line Array is 4 (four). You may use one speaker or two speakers per side but there will be no good sound coverage at the distance. That is why we recommend the usage of minimum four speakers per side. Here are shown configurations with 1, 2, 3, 4, 6, 8 and 10 speakers per side. The other side should be the same.

When you have 6 speakers per side you have to use two configurations with 3 speakers.

When you have 8 speakers per side you have to use two configurations with 4 speakers.

Please, see next figures for different types of system connections, one side only. Just for clarity the angle between speakers is 0°. Because of impedance reasons there is a limit of boxes (sections) connected to one amp. So, the diagrams may be different for your amps. Always consider your amp's impedance capabilities before choosing the number of boxes connected to one amp.

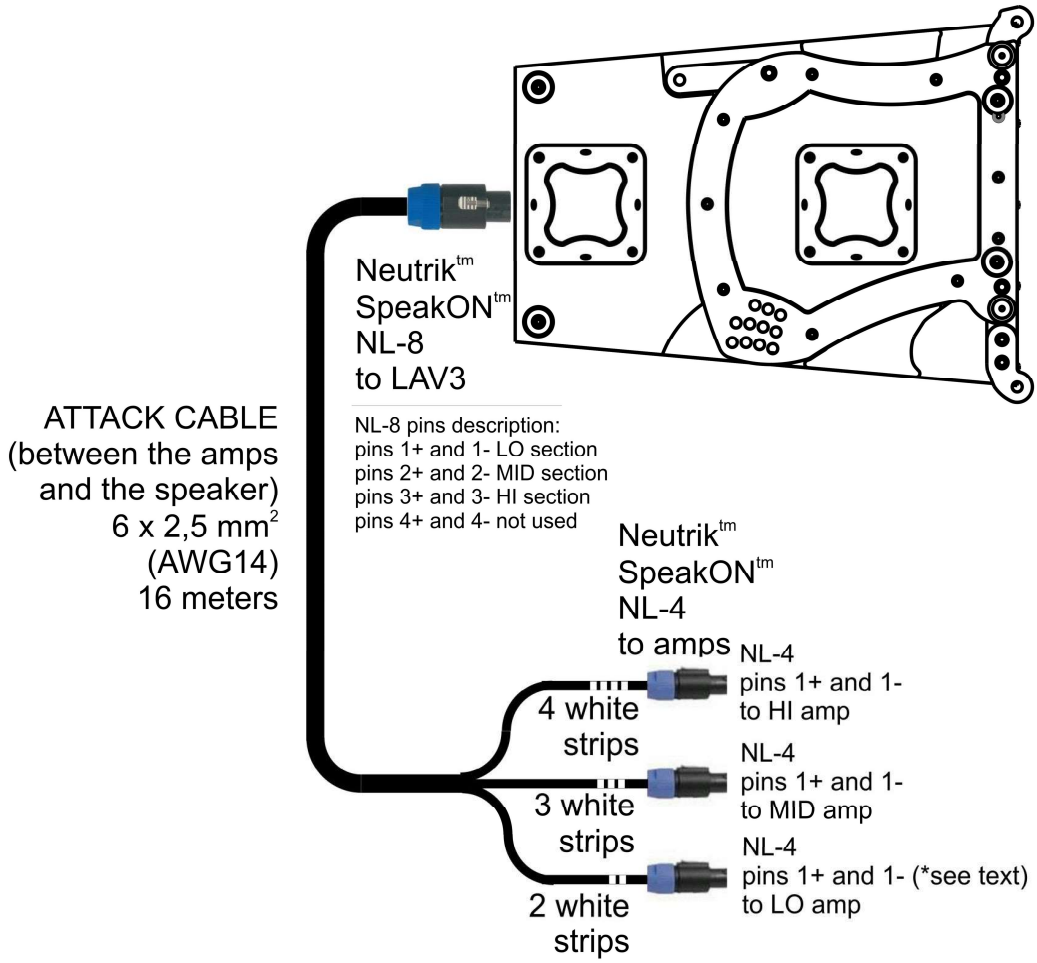


Figure 22. Single Speaker Connection

(*) Note about Neutrik™ SpeakON™ type NL-4 supplying LO section at amps side:
Standard cable manufactured by Clear Sound is wired 1+ to be positive and 1- to be negative signal to the LO section. Other's connections (say 1+ positive and 2+ negative signal) are available on request.

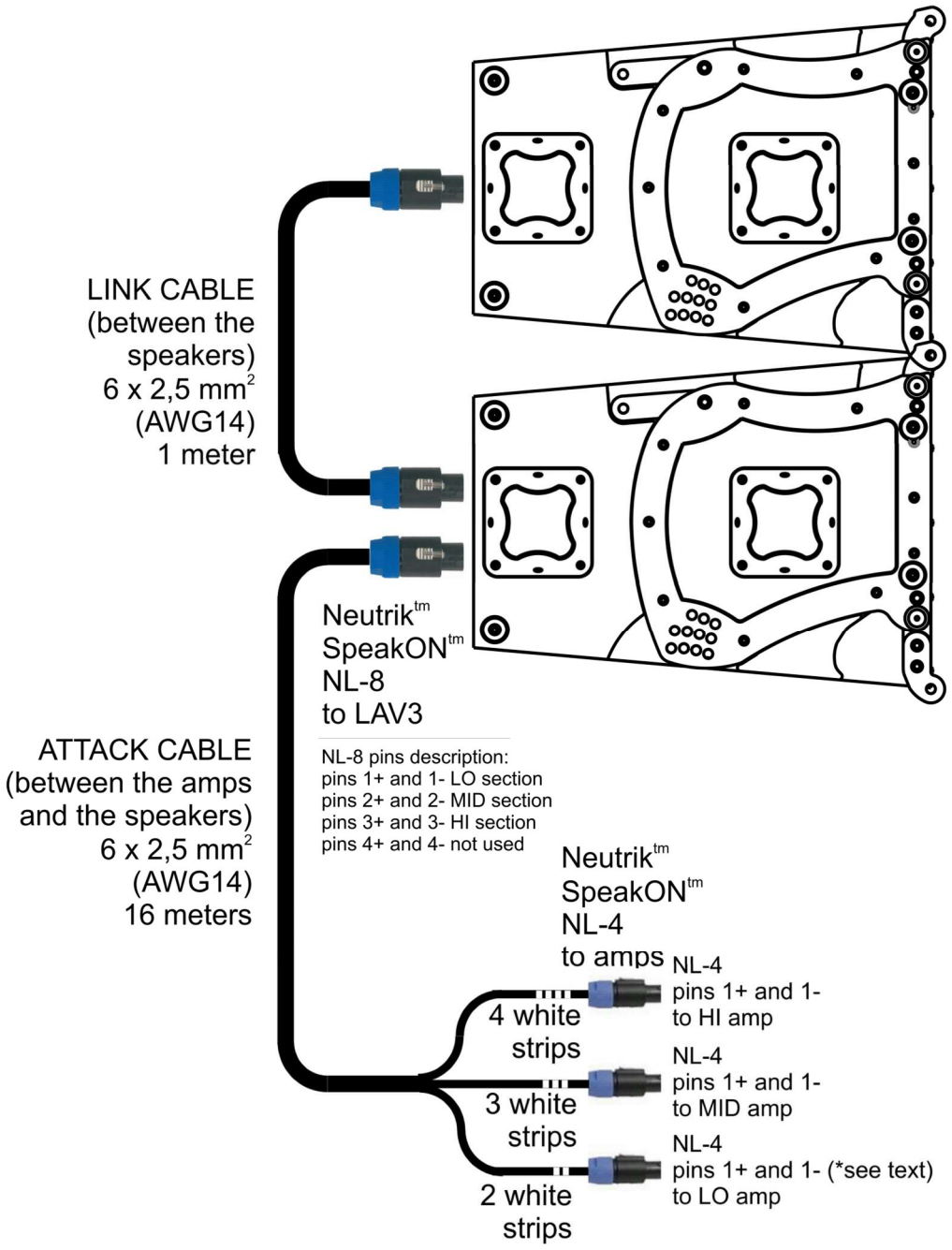


Figure 23. System Connection with Two Speakers

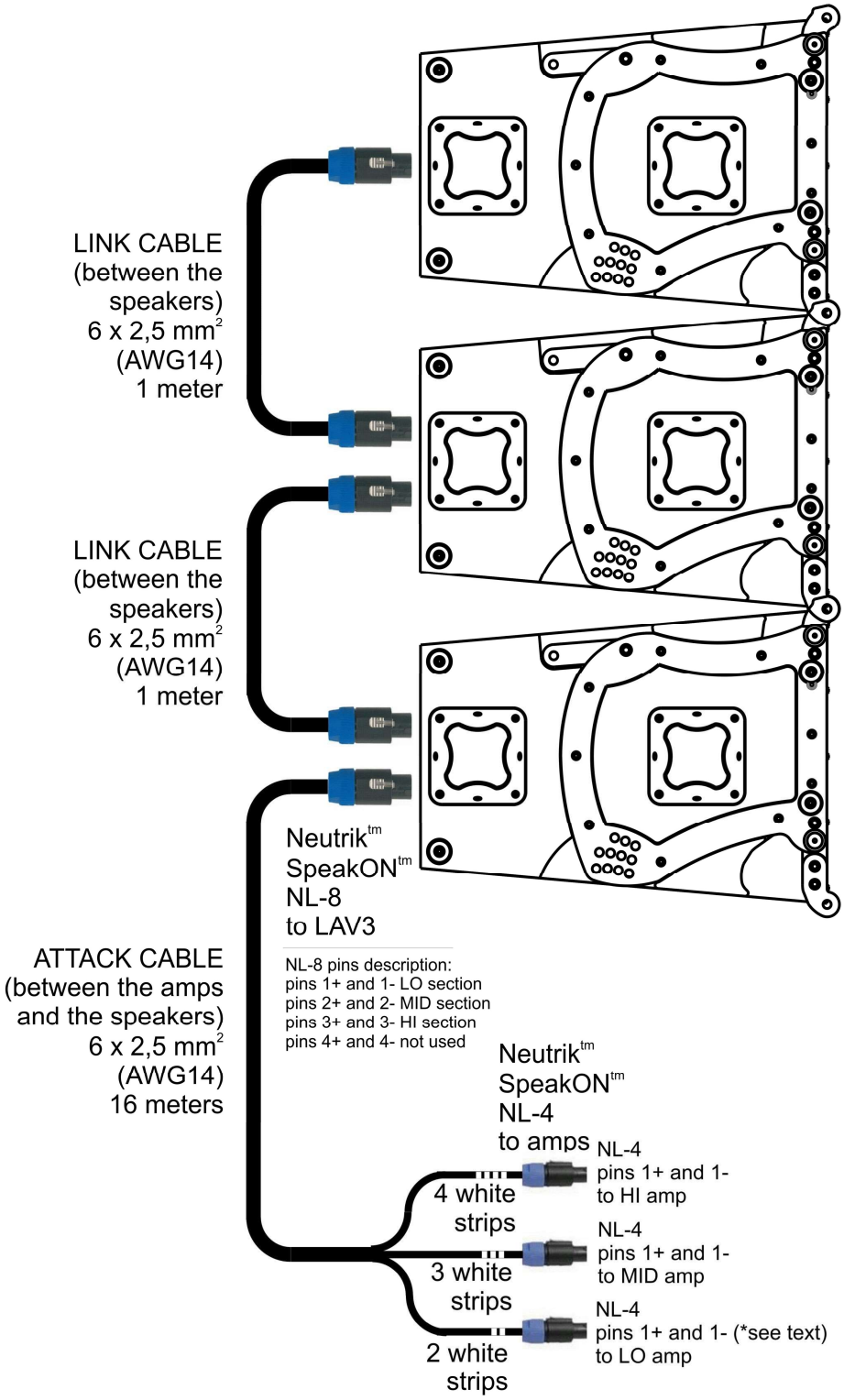


Figure 24. System Connection with Three Speakers

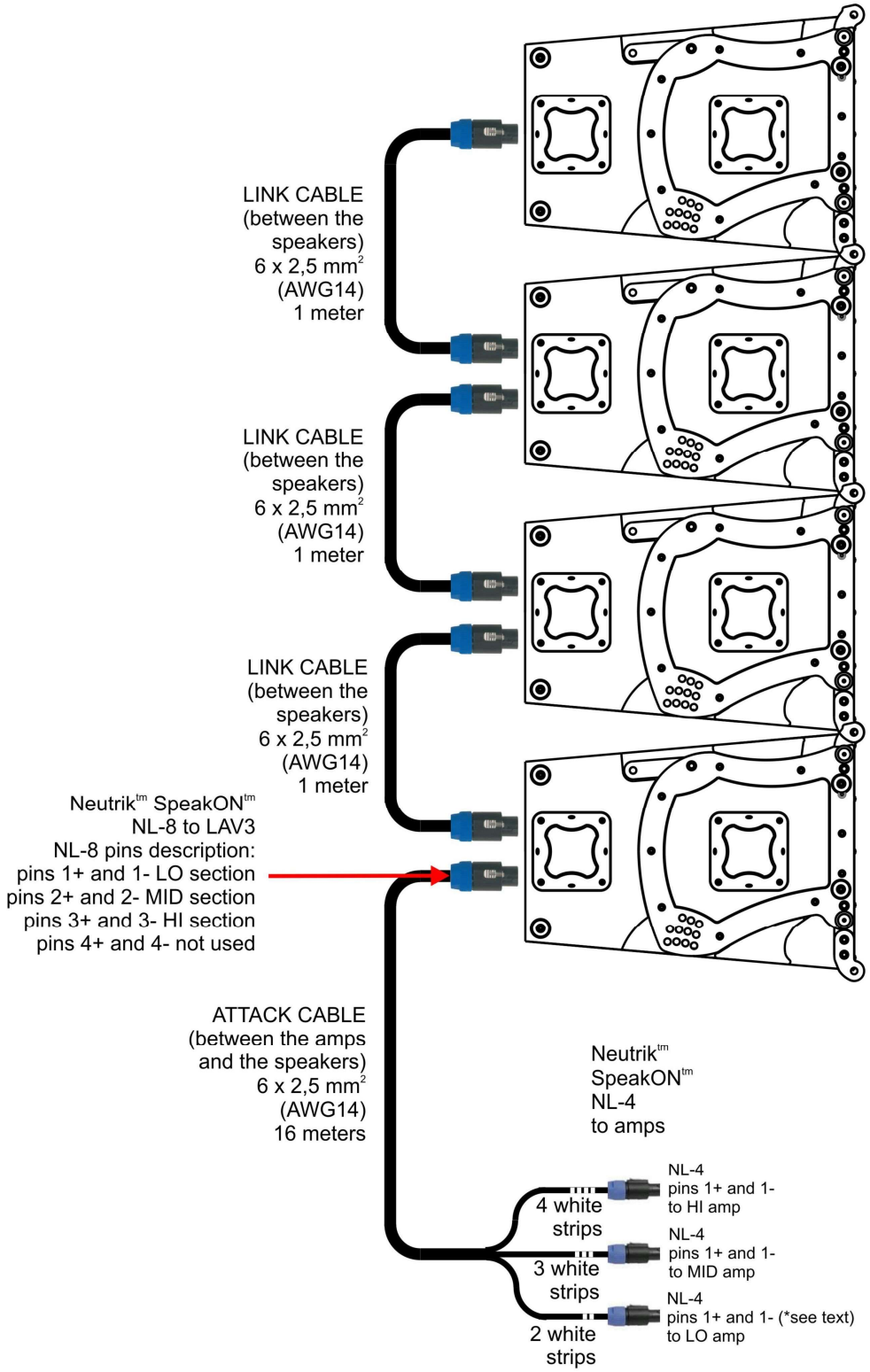


Figure 25. System Connection with Four Speakers

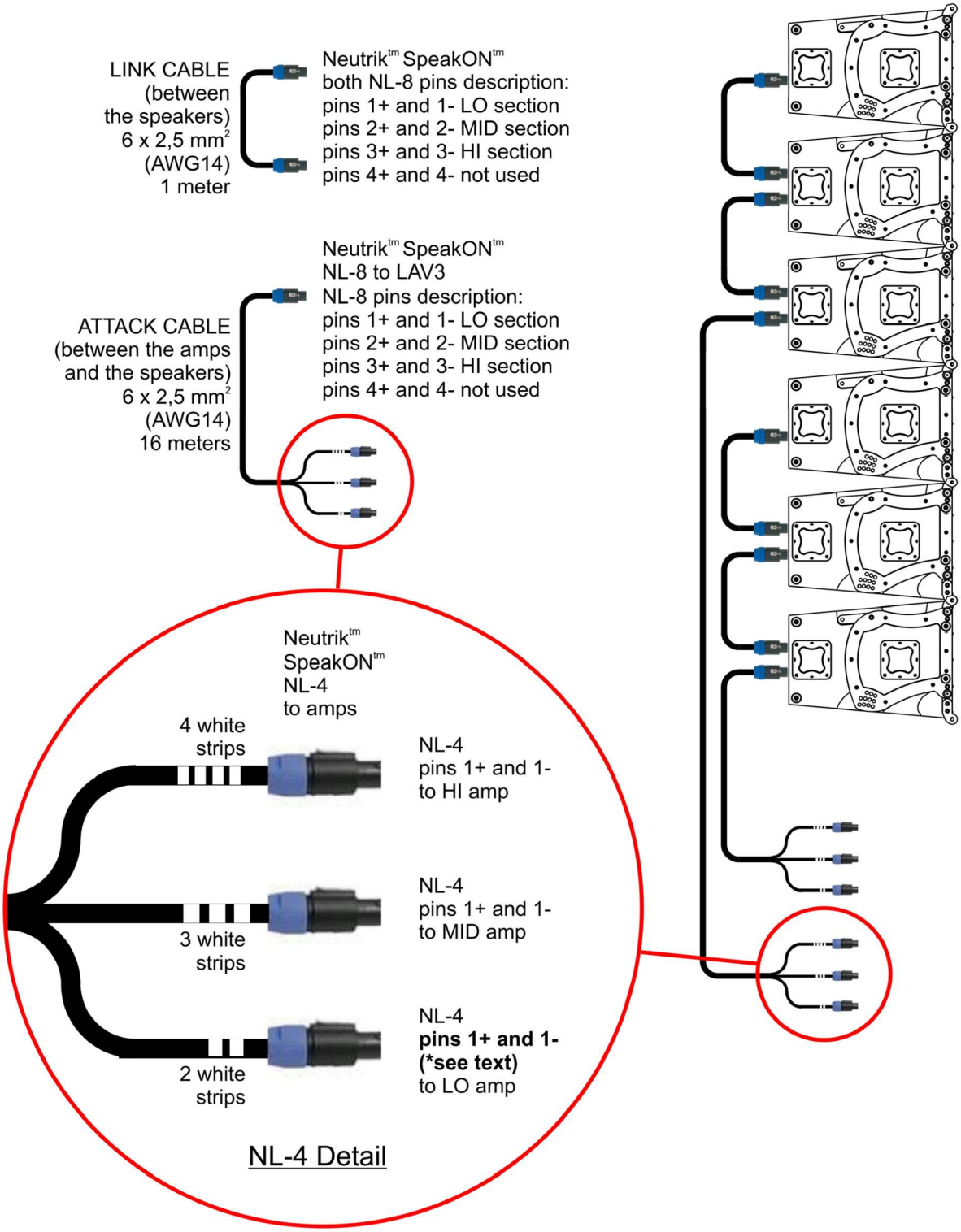


Figure 26. System Connection with Six Speakers. Please note 2 group of amps.

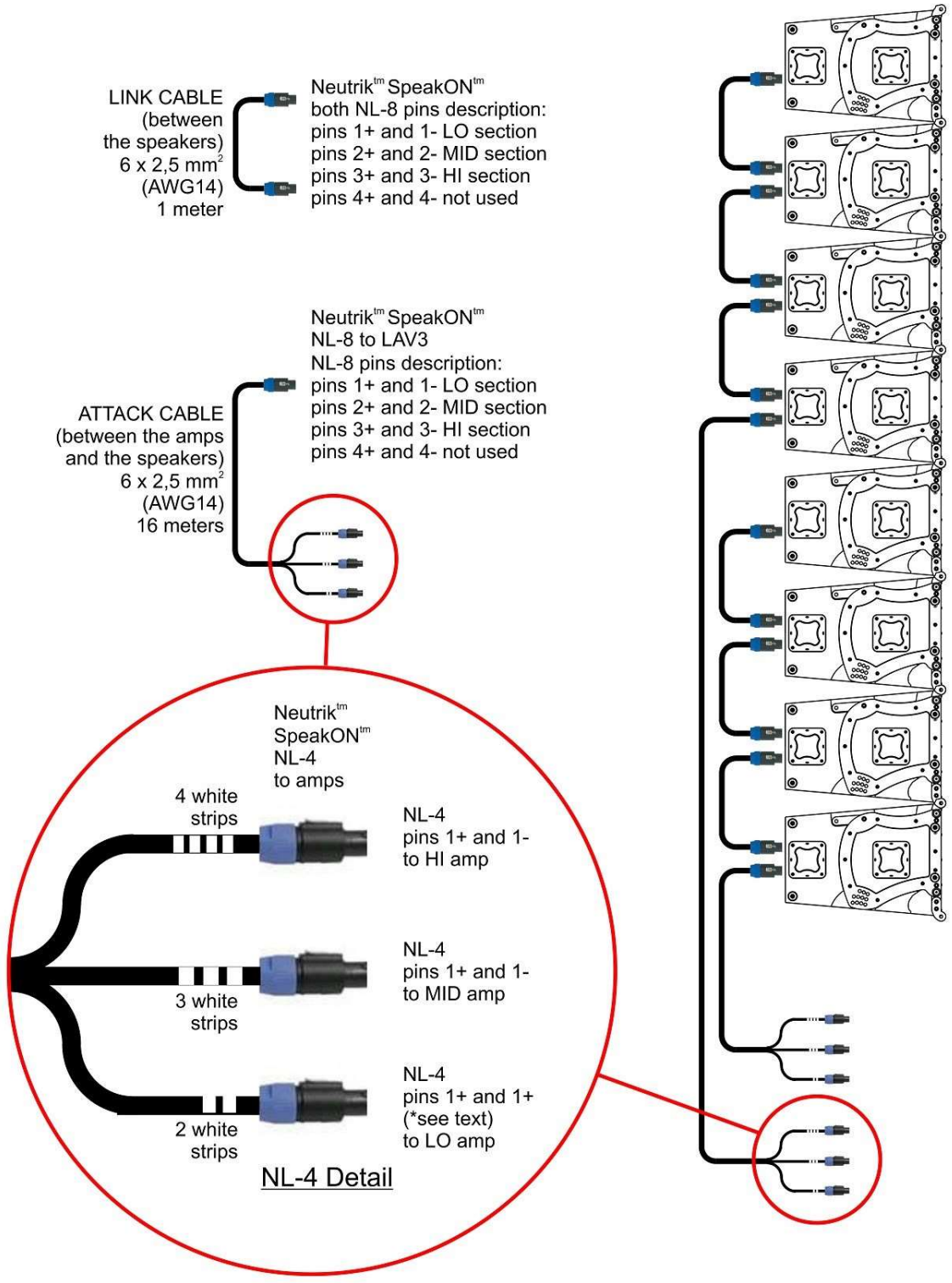


Figure 27. System Connection with Eight Speakers. Please note 2 group of amps.

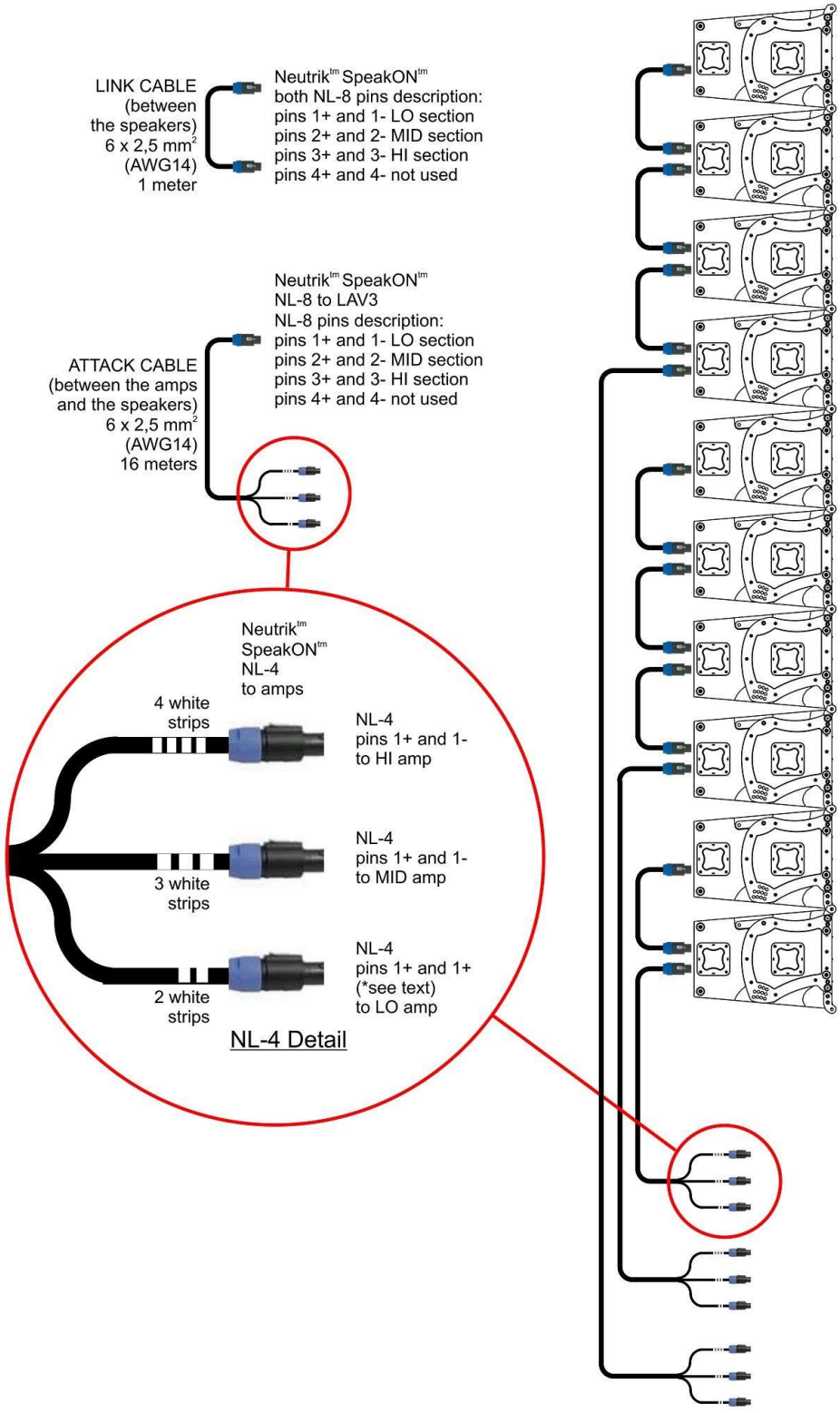


Figure 28. System Connection with ten Speakers per side. Note the 3 groups of amps.
The maximum number of speakers per side is 10.

7.4 System Cables. The system cables are 2 types:

7.4.1 Attack Cables (Attacks)

Attack Cable connects speakers to the amps. The cable is 16m long which is enough when the amps are near to the PA tower. The cross-section of each conductor (wire) is 2,5mm2 (AWG14). On the first side (the speaker's side) there is a NeutrikTM SpeakONTM NL-8 connector. On the other side (the amp side) the attack cable is divided into three cables each one with NeutrikTM SpeakONTM NL-4 connector, and in this way supplying tree different sections of LA V3 (LO, MID, HI) with different signals from the different amps. Please, see Figure 29.

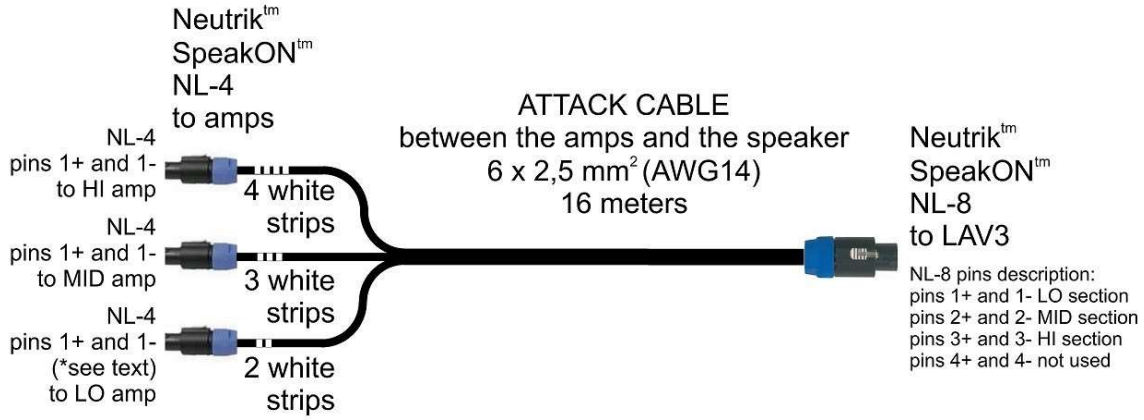


Figure 29. Attack Cable, Connectors and Pins Description

In order to avoid wrong connections, the three NL-4 cables are marked with several white strips which number determines the cable purpose:

LO section cable is marked with **2** white strips
MID section cable is marked with **3** white strips
HI section cable is marked with **4** white strips

The white strips are usually visible in the dark. Please, see Figure 29 for detailed attack cable description.

The LO section usually requires very high-power outputs. Normally they are wired 1+ positive and 1- negative. On request we can wire them **for bridge mode amplifier** (pins 1+ positive and 2+ negative).

The other sections (MID and HI) NL-4 SpeakONtm connectors are normally wired (1+ and 1-).

Clear Sound Ltd.
Sofia 1700, Bulgaria
Prof. Hristo Vakarelski Str. 4
VAT BG201105102
www.clearsound.bg
office@clearsound.bg

⚠	**Warning:** **A mistake in system connection may damage your speakers!**

7.4.2 Link Cables (Links)

Link Cables are used to connect the speakers in parallel between each other. The cable is 1m long. From both sides there are Neutriktm SpeakONtm NL-8 connectors. Please, see Figure 30. You can connect up to 4 (four) speakers in parallel for impedance reasons. Please be sure that your amps can work normally with few parallel speakers impedance. For four speakers in parallel you need 3 Link Cables and 1 Attack Cable.

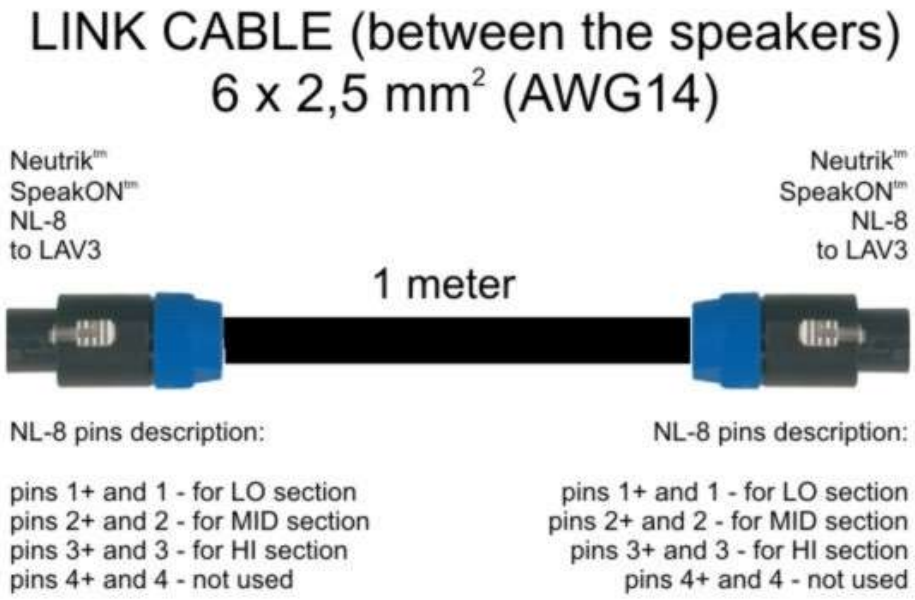


Figure 30. Link Cable, Connectors and Pins Description

7.5 Amplifiers

For supplying LA V3 you may use different types of amps according to your needs and other specific conditions. Figure 31 shows the most important system parameters: Section Rated Power (AES) and Section Impedance vs. Number of Speakers connected in parallel.

Section Rated Power (AES) and Section Impedance vs Number of Parallel Boxes

Number of	**LO** Section	**MID** Section	**HI** Section

Clear Sound Ltd.
Sofia 1700, Bulgaria
Prof. Hristo Vakarelski Str. 4
VAT BG201105102
www.clearsound.bg
office@clearsound.bg

LA V3 boxes in parallel	Section Rated Power AES [W]	Section Impedance [Ohm]	Section Rated Power AES [W]	Section Impedance [Ohm]	Section Rated Power AES [W]	Section Impedance [Ohm]
4	4400	4	2800	4	1280	4
3	3300	5.33	2100	5.33	960	5.33
2	2200	8	1400	8	640	8
1	1100	16	700	16	320	16

Figure31. Section Rated Power (AES) and Section Impedance vs. Number of Parallel Speakers

For the normal operation of the amplifier, its output power at given impedance should be above the required loudspeaker's power in order to have power reserve (enough headroom) without limit or clipping. Also, the amplifier outputs have to be wired in an appropriate way.

Please note that LO section in case of 4 speakers needs 4400W at 4Ohm. In most amps this is achievable in **bridge mode only** so the NL-4 pins for LO section **are connected 1+ and 2+.** The amp should be able to drive 4Ohm load in bridge mode.

8. Electrical Power

8.1 General Safety

Please, refer to Chapter 3.1 for General Safety and Chapter 3.3 for Electrical Safety.

We assume that you, in generally, know what to do, and have basic electrical knowledge and skills to protect yourself from electric shock and your equipment from damaging in case of wrong electric connection. Always consult qualified electrician in case of misunderstanding!

8.2 How Much Power I Need

The sum of AES power for all sections (LO, MID, HI) for four speakers is approximately 9kW, see Figure30. The electrical power required for all amps depends on many factors but in generally we recommend it to be equal to the sum of AES power for all sections. So, it's better to

accept that 9kW amps are active and constant load to the mains without any correction coefficients (crest-factor, power factor, etc.). Otherwise, the voltage drop at the end of the cable at the peak moments will decrease the mains voltage which supplies the amps during the peaks, which is unacceptable. Some amps with SMPS (switching-mode power supply) draw

Clear Sound Ltd.
Sofia 1700, Bulgaria
Prof. Hristo Vakarelski Str. 4
VAT BG201105102
www.clearsound.bg
office@clearsound.bg

more current from the mains at low voltages and in this way the voltage drop is becoming bigger, which from the other hand lowers the voltage supplying the amp, etc.

So, you have to choose your cables cross-section and connector current ratings like you will supply active and constant load. Please, refer to manufacturer's data for choosing cables and connectors and leave at least 20% safety margin below their maximum values. This will provide you long-term and trouble-free operation.

8.3 AC Mains Requirements

Everything written above is true and can be recommended for the mains too. The mains itself must provide enough current so that the voltage drop at the peak moments should be small enough and should stay within the voltage tolerances, which are different in different countries. For example in EU the mains voltage is nominally 230 V ± 6% at 50 Hz.

8.4 Power Distribution Principles

Because the power drawn by the amps is relatively high, the domestic single-phase system usually cannot give sufficient power. So we recommend the usage of industrial three phase system. Of course it is necessary for you to measure the voltage between each phase and the neutral.

You have to distribute the power supply of the amps so that each phase to be equally loaded. WARNING: Use only certified and approved electrical equipment (cables, connectors, distributors, etc.). Before use verify their technical parameters, compliance, conformity, technical condition and completeness. In case you make this equipment yourself, you have to consider and fulfil all local requirements.

For supplying the amps you should use other power outlet different from the one used for stage and effect lighting.

8.5 Electrical Protection and Grounding

All your equipment must be electrically grounded!

There are different types of electric protection devices but there are two major groups of them: maximum current breakers and residual current breakers (or combination of them). You must choose maximum current breakers so that they are able to carry the load current without triggering and to protect the equipment in case of failure. In addition, maximum current breakers should be slow enough not to trigger by the inrush (initial start-up) current when you switch-on the amps.

The usage of residual current breakers is mandatory in some areas. Please, check your local regulations!

8.6 Using a Generator

Clear Sound Ltd.
Sofia 1700, Bulgaria
Prof. Hristo Vakarelski Str. 4
VAT BG201105102
www.clearsound.bg
office@clearsound.bg

In this case everything written above is true plus the requirement that the voltage and the frequency of the generators remain constant between minimal and maximal load. Please, read the generator's data before use. Also there are different local regulations concerning generator usage in different areas. The generator's earth should be grounded.

8.7 Other Important Protections

There are other electrical protections available, for example devices that disconnect the load in case of under-voltage or over-voltage conditions or absorb the peaks (such as lightning peaks) in mains voltage. The usage of any kind of protection increases the safety of the people and the equipment but it hides risks of false triggering in some rare cases. You have to check the regulations in your area.

9. Audio-controllers and Presets

9.1 General Safety

Please, refer to Chapter 3.3 for Electrical Safety.

Audio-controllers are electrical devices so you must use them with all safety requirements concerning electrical equipment. In addition, because they play a major role in the whole system behaviour and determine the major system parameters you must use them with great caution and full understanding.

Attention: The improper setting of the parameters of the audio-controller may lead to bad sound results or may damage the loudspeakers!

9.2 What Audio-controller I Can Use

You can use different types of audio-controllers if they can satisfy the conditions below. In addition they must have big enough sample rate (bits per second), enough propagation delay, low THD, low noise, etc. A good practice is to hear the device in real conditions before purchase it.

9.3 General Principles

The role of the audio-controller (also known as digital crossover, audio-processor, etc.) is important and can be briefly described as:

- It makes the desired routing of signals between inputs and outputs;
- It divides the full audible spectrum of frequencies into several bands (in our case 4). We call them SUB, LO, MID and HI;
- It is used for setting different gains for each band.
- It is used for setting different delay time for each band because the sound waves paths from the loudspeakers through the different horns are different. As a result of

Clear Sound Ltd.
Sofia 1700, Bulgaria
Prof. Hristo Vakarelski Str. 4
VAT BG201105102
www.clearsound.bg
office@clearsound.bg

the delay time all three wave-fronts must come to the acoustical output of the speaker simultaneously;

- It is used for setting different delay time between the subwoofers and the Line Array because of the different distances to the listener. As a result, the wave-fronts from the Line Array and from the subwoofers must come to the listener simultaneously;
- It is used for setting different levels and parameters of protection of the limiters or

- compressors which protect the loudspeakers from overloading and other abnormal conditions. The levels depend of used amps.

9.4 Routing

In generally you may configure the outputs for stereo (L and R) for the Line Array and mono (L+R sum) for the subwoofers.

9.5 Setting up the Crossover Points

Each section of LA V3 is carefully designed to operate only in a certain frequency range. See Figure 32 for recommended cross-over points and signal polarity.

Recommended Crossover Points

Section	LO Section		MID Section		HI Section	
	Lower	Upper	Lower	Upper	Lower	Upper
Frequency [Hz]	90	280	300	1900	2000	

Figure 32. Recommended Crossover Points

Warning:
Wrong settings in cross-over points can damage your loudspeakers!

9.6 Gains

The correct gains depend on the number of speakers used per side. We recommend you to use reliable measurement devices in order to tune the whole sound system up and to determine its parameters.

9.7 Delay Times

The sound waves need different time to pass the different lengths of the horns inside LA V3 speaker. See Figure 33 for the required delay times for one Line Array speaker. When

Clear Sound Ltd.
Sofia 1700, Bulgaria
Prof. Hristo Vakarelski Str. 4
VAT BG201105102
www.clearsound.bg
office@clearsound.bg

you use horn-loaded subwoofers there should be an additional delay so that the wave-fronts from the Line Array and from the subwoofers should come to the listener simultaneously.

Recommended Delay Times			
Section	LO Section	MID Section	HI Section
Delay Time [ms]	0	4	4.3
Polarity	+	-	-

Figure 33. Recommended Delay Times

9.8 Setting the Limiters / Compressors

The correct setting of these parameters determines the whole system's safety and reliability. ***Incorrect settings can produce distortion or damage your loudspeakers.***

You can set the parameters according to your preferences and experience, keeping in mind Section Power (Figure 30) and Recommended Crossover Points (Figure 31). The values depends of the amps you use: their gain, power, sensitivity etc.

Warning:
Wrong limiter / compressor settings can damage your loudspeakers!

10. SUBWOOFERS

10.1 General Safety

The subwoofers, like other speakers can easily make a sound pressure level (SPL) sufficient to cause permanent hearing damage to the artists, the crew and the audience. You must avoid high levels for a long time and you have to keep the local regulations, which are too strict in some countries. In addition, due to vibrations the subwoofers can move from their position (or to move other objects) so they have to be fixed in an appropriate way.

10.2 Recommended Subwoofers

For Horn-loaded Line Array we recommend Horn-loaded subwoofers, as they can reach the sensitivity of the Line Array speakers. Clear Sound models RLH118SX, HL118BR and HL121 are very good choice. You can use different types of subwoofers depending on your needs.

Clear Sound Ltd.
Sofia 1700, Bulgaria
Prof. Hristo Vakarelski Str. 4
VAT BG201105102
www.clearsound.bg
office@clearsound.bg

There are many different theories concerning the subwoofers position and the subwoofers' configuration but they are not subject of this manual. Electrical connections depend on the number and the amps used.

Notes