

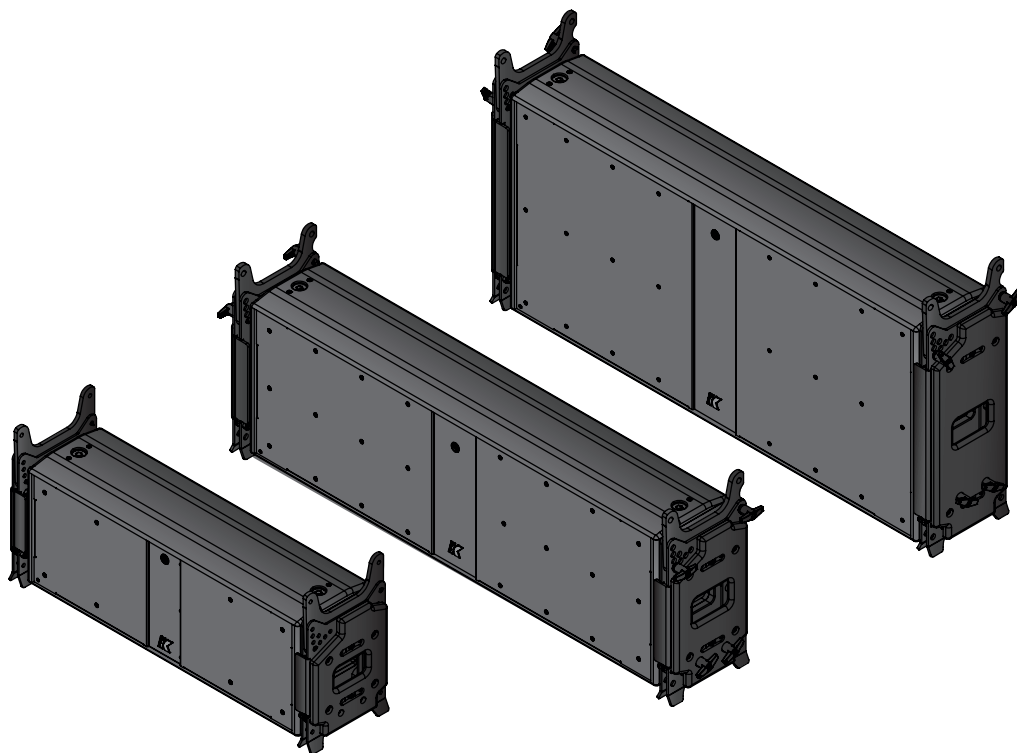
Mugello-KH I

Line array elements with
Electronic Beam Steering

USER GUIDE



• 20221121 •



K-ARRAY
Unique Audio Solutions

IMPORTANT SAFETY INSTRUCTIONS



CAUTION
RISK OF ELECTRIC SHOCK
DO NOT OPEN



ATTENTION: RISQUE DE CHOC ELECTRIQUE NE PAS OUVRIR

CAUTION: TO REDUCE THE RISK OF ELECTRIC SHOCK,
DO NOT REMOVE COVER (OR BACK).
NO USER-SERVICEABLE PARTS INSIDE.
REFER SERVICING TO QUALIFIED SERVICE PERSONNEL.



This symbol alerts the user to the presence of recommendations about the product's use and maintenance.



The lighting flash with arrowhead symbol within an equilateral triangle is intended to alert the user to the presence of uninsulated, dangerous voltage within the product enclosure that may be of magnitude to constitute a risk of electrical shock.



The exclamation point within an equilateral triangle is intended to alert the user to the presence of important operating and maintenance (servicing) instructions in this guide.



Operator's manual; operating instructions

This symbol identifies the operator's manual that relates to the operating instructions and indicates that the operating instructions should be considered when operating the device or control close to where the symbol is placed.



For indoor use only

This electrical equipment is designed primarily for indoor use.



WEEE

Please dispose of this product at the end of its operational lifetime by bringing it to your local collection point or recycling center for such equipment.



This device complies with Restriction of Hazardous Substances Directive.



WARNING
Failure to follow these safety instructions could result in fire, shock or other injury or damage to the device or other property.

General heed and warnings

- Read these instructions.
- Keep these instructions.
- Heed all warnings.
- Follow all instructions.
- Do not use this apparatus near water.
- Clean only with dry cloth.
- Do not block any ventilation openings. Install in accordance with the manufacturer's instructions.
- Do not install near any heat sources such as radiators, heat registers, stoves, or other apparatus (including amplifiers) that produce heat
- Do not defeat the safety purpose of the polarized or grounding plug. A polarized plug has two blades with one wider than the other. A grounding plug has two blades and a third grounding prong. The wide blade or the third prong is provided for your safety. If the provided plug does not fit into your outlet, consult an electrician for replacement of the obsolete outlet.
- Only use attachments/accessories specified by the manufacturer.
- Protect the power cord from being walked on or pinched particularly at the plugs, convenience receptacles, and at the point where they exit from the apparatus.
- Clean the product only with a soft and dry fabric. Never use liquid cleaning products, as this may damage the products cosmetic surfaces.
- Use only with the cart, stand, tripod, bracket, or table specified by the manufacturer, or sold with the apparatus. When a cart is used, use caution when moving the cart/apparatus combination to avoid injury from tip-over.
- Unplug this apparatus during lightning storms or when unused for long periods of time.
- Avoid placing the product in a location under direct sunlight or near any appliance that generates UV (Ultra Violet) light, as this may change the product surface finishing and cause a change in color.
- Refer all servicing to qualified service personnel. Servicing is required when the apparatus has been damaged in any way, such as power-supply cord or plug is damaged, liquid has been spilled or objects have fallen into the apparatus, the apparatus has been exposed to rain or moisture, does not operate normally, or has been dropped.
- CAUTION: These servicing instructions are for use by qualified service personnel only. To reduce the risk of electric shock, do not perform any servicing other than that contained in the operating instructions unless you are qualified to do so.
- WARNING: Only use attachments/accessories specified or provided by the manufacturer (such as the exclusive supply adapter, battery, etc.).



This apparatus is intended for professional use.

Installation and commissioning may only be carried out by qualified and authorized personnel.

- Before turning the power on or off for all devices, set all volume levels to minimum.
- Use only speaker cables for connecting speakers to the speaker terminals. Be sure to observe the amplifier's rated load impedance particularly when connecting speakers in parallel. Connecting an impedance load outside the amplifier's rated range can damage the apparatus.
- K-array cannot be held responsible for damage caused by improper use of the loudspeakers.
- K-array will not shoulder any responsibilities for products modified without prior authorization.

CE Statement

K-array declares that this device is in compliance with applicable CE standards and regulations. Before putting the device into operation, please observe the respective country-specific regulations!



FCC Statement

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:



1. Reorient or relocate the receiving antenna.
2. Increase the separation between the equipment and receiver.
3. Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
4. Consult the dealer or an experienced radio/TV technician for help.

FCC Radiation Exposure Statement

This device complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment must be installed and operated in accordance with provided instructions and the antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. this device may not cause harmful interference, and
2. this device must accept any interference received, including interference that may cause undesired operation.

CAUTION! Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Canadian Statement

This device complies with Industry Canada's licence-exempt RSSs. Operation is subject to the following two conditions:

- this device may not cause interference, and
- this device must accept any interference, including interference that may cause undesired operation of the device.

The device meets the exemption from the routine evaluation limits in section 2.5 of RSS 102 and compliance with RSS-102 RF exposure, users can obtain Canadian information on RF exposure and compliance.

This equipment should be installed and operated with a minimum distance of 20 centimeters between the radiator and your body.

Trademark Notice

All trademarks are the property of their respective owners.

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Thank you for choosing this K-array products!

To ensure proper operation, please carefully read the owner's manuals and safety instruction before using the products.

After reading this manual, be sure to keep it for future reference.

Should you have any questions about your new device please contact K-array customer service at support@k-array.com or contact the official K-array distributor in your country.

The Mugello family comprises the KH2, KH3 and KH5 line array elements. Incredibly compact and light, capable of combining high power density with intelligibility and complete performance control, the Mugello KH2, KH3 and KH5 are designed for quick and easy installation, they are the ideal solution to reduce transport and handling costs.

Enhanced performance and easy tuning are now managed by the Integrated Electronic Brain – IEB – implemented into K-array amplifiers. More than a traditional DSP, the built-in micro electronics driven by the integrated operating system osKar features extensive sound processing, offering complete user control over the system performance: Volumes, Signal Routing, Presets as well as a complete USB player, are directly manageable from the device via mobile app and dedicated professional interface.

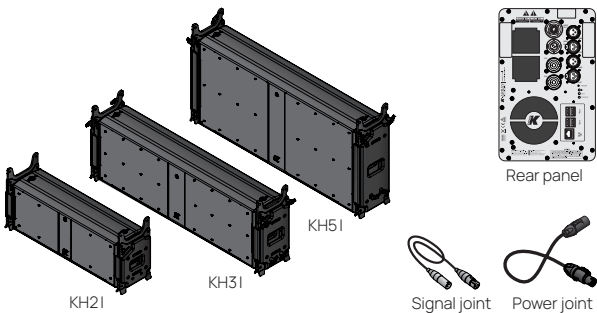
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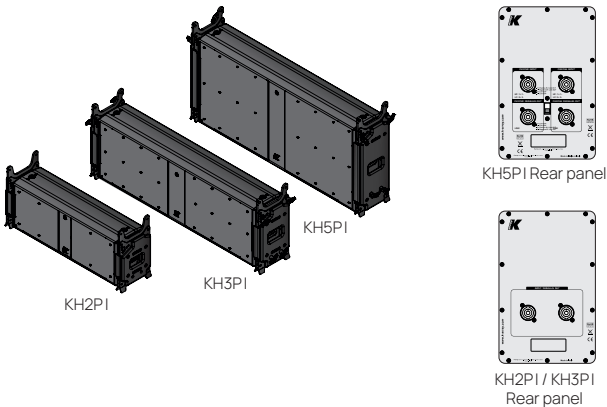
Unpacking

Each K-array product is built to the highest standard and thoroughly inspected before leaving the factory. Upon arrival, carefully inspect the shipping carton, then examine and test your new device. If you find any damage, immediately notify the shipping company.

- Powered loudspeakers: KH2 I, KH3 I, KH5 I
1x Active Mugello-KH I line array element with rigging hardware
1x 0,5 m (1,6 ft) power joint cable with powerCON TRUE plugs
1x 0,5 m (1,6 ft) signal joint cable with XRL connectors



- Passive loudspeakers KH2P I, KH3P I, KH5P I
1x Passive Mugello-KHPI line array element with rigging hardware



Default Rigging Hardware

Each Mugello-KH I line array element is equipped with a dedicated rigging hardware that allows to join multiple elements in loudspeakers systems to be either suspended or ground stacked.

The default rigging hardware comprises:

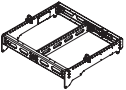
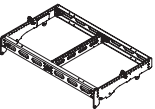
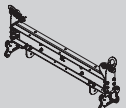
- A. 2x side plates with handles and holes for ball lock pins;
- B. 8x Ø 6 mm (Ø 0.23 in) quick release pins with handle;
- C. 2x rigging brackets.

	A	B	C
KH2I / KH2PI			
KH3I / KH3PI			
KH5I / KH5PI			

Rigging Accessories

According to the actual configuration to achieve, either the ground stack system accessories or the suspended system accessories shall be added to the loudspeaker system.

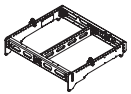
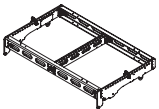
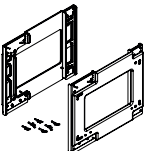
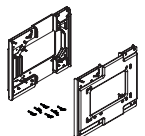
Suspended Installation Accessories

Name	Description	Image	Apply to
K-HCFLY2 I	Bumper for KH2I-KS3I - BLACK		KH2I / KH2PI
K-HCFLY2W I	Bumper for KH2I-KS3I - WHITE		
K-HCFLY35 I	Bumper for KH5I-KH3I-KS4I - BLACK		KH5I / KH5PI KH3I / KH3PI
K-HCFLY35W I	Bumper for KH5I-KH3I-KS4I - WHITE		
K-HCFLYST2	Fly bar for KH2I step array		KH2I / KH2PI
K-HCFLYST	Fly bar for KH5I-KH3I step array		KH5I / KH5PI KH3I / KH3PI
K-STEPM2 I	Step array hardware for KH2I (kit for 1 unit)		KH2I / KH2PI
K-STEPM3 I	Step array hardware for KH3I (kit for 1 unit)		KH3I / KH3PI
K-STEPM5 I	Step array hardware for KH5I (kit for 1 unit)		KH5I / KH5PI
K-HCLINK2/35	Adapter to join KH2I to a KH3I or a KH5I (or cluster)		KH5I / KH5PI KH3I / KH3PI KH2I / KH2PI

Ground Stack Installation Accessories

Name	Description	Image	Apply to
K-HCBASE2	Stacking hardware for KH2I		KH2I
K-HCBASE	Stacking hardware for KH3I and KH5I		KH5I KH3I

Accessories For Rigging The Subwoofers

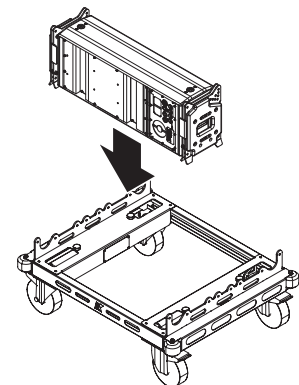
Name	Description	Image	Apply to
K-HCFLY2 I	Bumper for KH2I-KS3I - BLACK		KS3I / KS3PI
K-HCFLY2W I	Bumper for KH2I-KS3I - WHITE		
K-HCFLY35 I	Bumper for KH5I-KH3I-KS4I - BLACK		KS4I / KS4PI
K-HCFLY35W I	Bumper for KH5I-KH3I-KS4I - WHITE		
K-EXTFRAME3	Rigging hardware for KS3I / KS3PI - BLACK		KS3I / KS3PI
K-EXTFRAME3W	Rigging hardware for KS3I / KS3PI - WHITE		KS3I / KS3PI
K-EXTFRAME4	Rigging hardware for KS4I / KS4PI - BLACK		KS4I / KS4PI
K-EXTFRAME4W	Rigging hardware for KS4I / KS4PI - WHITE		KS4I / KS4PI

Mugello-KH I

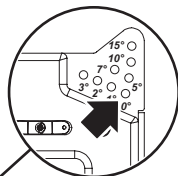
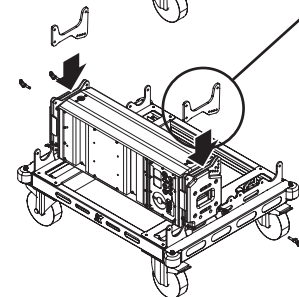
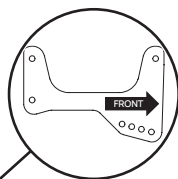
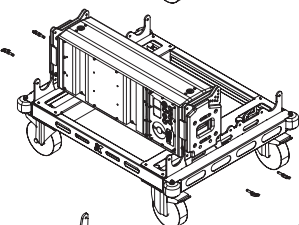
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Preparing the dolly

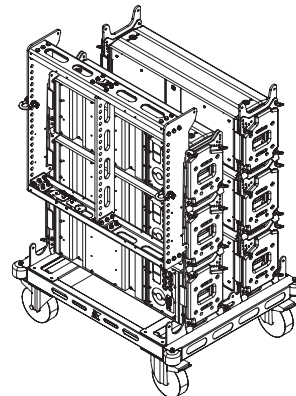
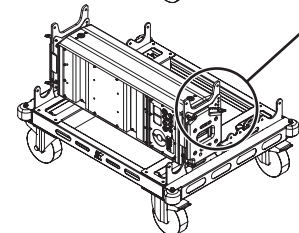
Prepare the stack of line array elements on top of the dolly.



Stack the
loudspeaker units
facing inward.



Set the loudspeakers
stack straight
using pin hole at 0°



Respect the K-HCDOLLY loading limits

K

KH2 - K-HCDOLLY2

WEIGHT: 28 Kg

MAX LOAD 290 kg

K-array s.r.l. via P.Romagnoli 17 - 50038 Scarperia e San Piero
Firenze - ITALIA



K-HCDOLLY2 can hold up to 10x KH2I/KH2PI
(5 units per side)

K

KH5-KH3 - K-HCDOLLY35

WEIGHT: 30 Kg

MAX LOAD 366 kg

K-array s.r.l. via P.Romagnoli 17 - 50038 Scarperia e San Piero
Firenze - ITALIA



K-HCDOLLY35 can hold up to
8x KH3I/KH3PI (4 units per side) or
6x KH5I/KH5PI (3 units per side)

Wiring

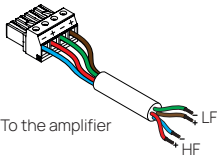
Passive Array Elements - Audio Wiring KH2PI, KH3PI and KH5PI

Once set on the dolly, the passive array elements KH2PI, KH3PI and KH5PI can be pre-wired using speakON joint cables according to the number of units to be driven in parallel per stack. Complete the loudspeakers-to-amplifier wiring once the stack is ready to be suspended or ground stacked.

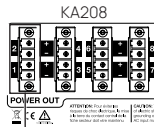
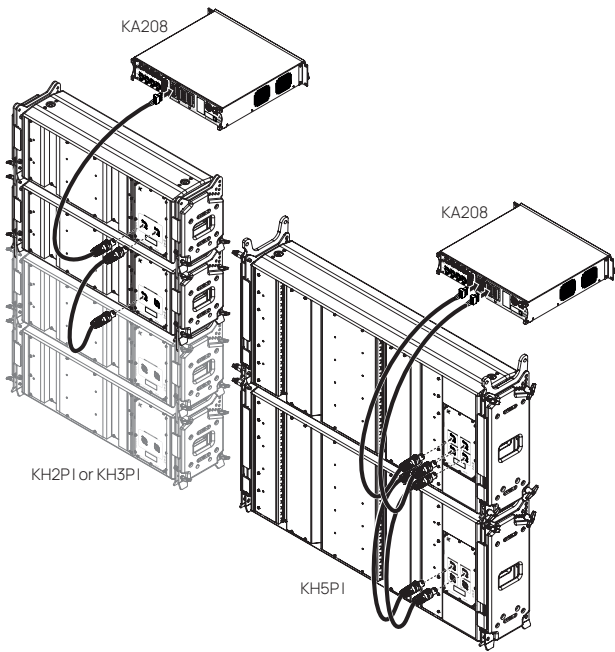
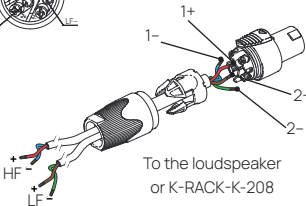
	KH2PI	KH3PI	KH5PI
Power handling	Bi-amp: HF: 250 W _{peak} LF: 1200 W _{peak}	Bi-amp: HF: 250 W _{peak} LF: 1200 W _{peak}	Quad-amp: HF: 2x 250 W _{peak} LF: 2x 800 W _{peak}
Nominal Impedance	HF: 16 Ω LF: 8 Ω	HF: 16 Ω LF: 8 Ω	HF: 2x 16 Ω LF: 2x 8 Ω
Connectors	Speaker input/parallel output 2x SpeakON NL4 HF: IN and Link 1+/1- LF: IN and Link 2+/2-		Speaker input/parallel output 4x SpeakON NL4 HF: IN and Link 1+/1- LF: IN and Link 2+/2-
Rear panel			

Connectors

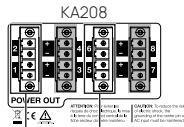
PC 4/4-ST-762
connector



SpeakON NL4
connector



up to 2x KH2PI
up to 2x KH3PI



up to 2x KH5PI



Improve system performance and reliability
alternating TOPs and SUBs on adjacent channels

Mugello-KH I

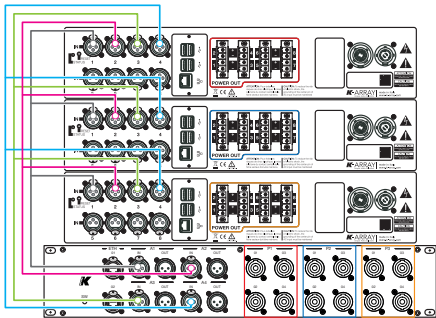
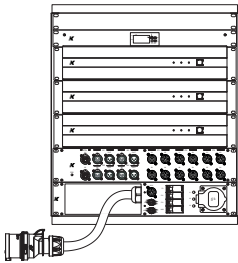
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K-RACK-M-208 Power And Signal Distributor

The K-RACK-M-208 is a complete power and signal distributor assembly degned to drive KH2PI, KH3PI and KH5PI passive array elements.

The K-RACK-M-208 is a 12 units rack with wheels containing:

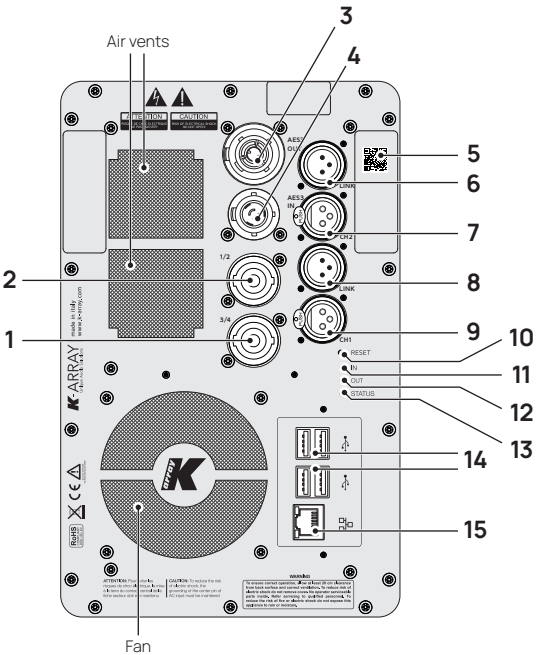
- the power panel with 3-phase CEE 3P+N+T 32A 400V main socket and switches;
- 1x powerCON auxiliary AC main out,
- 3x Kommander-KA208 8-ch audio power amplifiers with DSP,
- 1x Ethernet Switch 100Mbps;
- I/O data panel with:
 - 2x RJ45 ports,
 - 4x XLR input with link;
 - 12x NL4 SpeakON connectors (32 channels).



INPUT ↓	KA208 TOP	KA208 MID	KA208 BTM
A1	INPUT 1	INPUT 1	INPUT 1
A2	INPUT 2	INPUT 2	INPUT 2
A3	INPUT 3	INPUT 3	INPUT 3
A4	INPUT 4	INPUT 4	INPUT 4

Active Array Elements: Audio Wiring KH2I, KH3I and KH5I

Once set on the dolly, the active array elements KH2I, KH3I and KH5I can be pre-wired using signal and power joint cables. Complete the loudspeakers-to-amplifier wiring once the stack is ready to be suspended or ground stacked.



Rear panel:

1. SpeakON NL4 speaker output channels 3 & 4
2. SpeakON NL4 speaker output channels 1 & 2
3. PowerCon TRUE link (AC mains out)
4. PowerCon TRUE inlet (AC mains in)
5. QR Code for the K-array Connect app remote connection
6. XLR-M channel 2 link output

7. XLR-F channel 2 balanced line input or channels 3 & 4 AES3 input (user selectable via app or software)
8. XLR-M channel 1 link output
9. XLR-F channel 1 balanced line input
10. Reset button
11. Input signal LED monitor
12. Output signal LED monitor
13. System status LED
14. USB ports
15. RJ45 Ethernet port

The active array elements KH2I, KH3I and KH5I can be driven by either analog or digital signals, the latter via an AES3 or Dante® connection.

The AES3 connectivity is available via the XLR-F CH2/AESIN input connector. By default the XLR-F CH2/AESIN connector is configured as analog input: use the K-array Connect app or the K-framework3 software to set the XLR-F CH2/AESIN connector as AES3 digital input.

The Mugello-KH active array elements are Dante Ready devices: Dante connectivity can be achieved by purchasing a Dante licence via the Dante Ready Activator included in Dante Controller version 4.5.0.9 or later.

Status LED chart

Color		Mode	Description
	orange	solid	Booting: DSP software loading Operating: high temperature warning
	green	solid	System ready
	red	solid	Amplifier module error
	blue	solid	Booting: Firmware loading Operating: system identification
	any color	blinking	Fault detected

Active Array Elements: AC Main Power KH2I, KH3I and KH5I

All active line array elements within a cluster of Mugello-KH self powered loudspeakers shall be properly connected to an AC power distribution system. Mugello-KH active line array units implement autorange power amplifier suiting AC operating voltage in the range 100 V - 230 V.



Make sure the operating voltage is steadily between 100 V and 230 V AC



To operate safely and effectively, it is extremely important that the entire system is properly grounded.

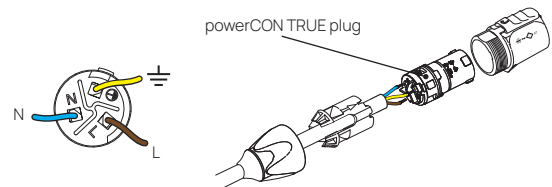


Refer to professionals for selecting the proper wire gauge according to local regulations.



Use power cable with powerCON TRUE connector for powering the Mugello-KH active array units.

Wiring	Europe	USA/Canada
L	 BROWN -  BLACK -  GREY	 BLACK -  RED -  BLUE
N	 BLUE	 WHITE-  GREY
	 GREEN/YELLOW	 GREEN



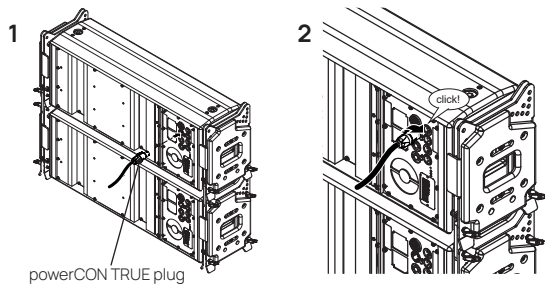
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	KH2I	KH3I	KH5I
Power consumption	600 W @ 8 Ω load, Pink noise, 1/4 rated power	600 W @ 8 Ω load, Pink noise, 1/4 rated power	600 W @ 8 Ω load, Pink noise, 1/4 rated power

Use power cable with powerCon TRUE connector for powering the Mugello-KH active array units:

1. insert the powerCon TRUE flying plug into the unit inlet;
2. rotate the powerCon TRUE plug clockwise. Once properly plugged and powered, the system status LED lights on.



The power joint cable with powerCON TRUE plugs provided can be used to daisy chain multiple Mugello-KH active array elements. Refer to the following table for the maximum number of units that can be driven by a single AC main power line.

Device	max number of units powered by a single 230 V _{AC} 16 A line	max number of units powered by a single 120 V _{AC} 20A line
Mugello-KH2I	4 (3 joints)	2 (1 joint)
Mugello- KH3I	4 (3 joints)	2 (1 joint)
Mugello- KH5I	2 (1 joint)	1



Never exceed the maximum number of units powered by a single AC main power line.

230 V AC, 3-Phase Wye System

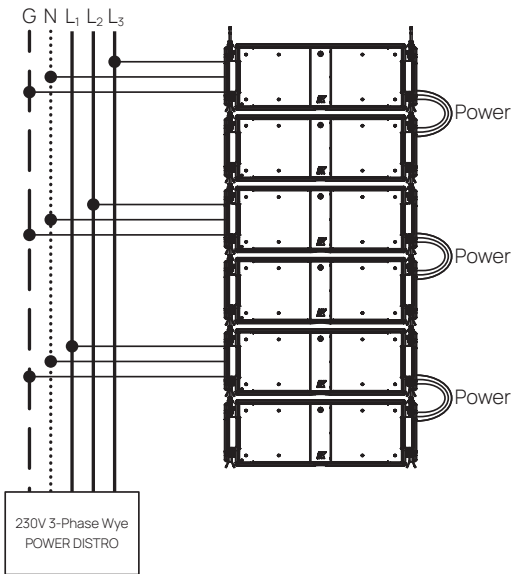
Distribute the loudspeaker loads across the three phases.



Never connect two lines to the loudspeaker AC Main input.



Always be sure that each power cord is connected to a single power line and the common neutral and earth/ground.



Even if more units can be powered by the same line, try to keep the load balanced by connecting the loudspeakers evenly among the three phase lines.

max number of units powered by a single 230 V_{AC} 16 A line

Line-Neutral 230 V _{AC} 16 A	4x KH2I (3 joints)	4x KH3I (3 joints)	2x KH5I (1 joint)
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120 V AC, 3-Phase Wye System

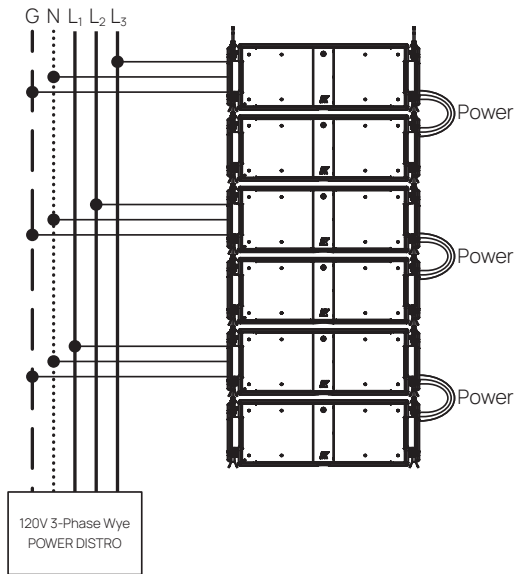
Distribute the loudspeaker loads across the three phases. Even



Never connect two lines to the loudspeaker AC Main input.



Always be sure that each power cord is connected to a single power line and the common neutral and earth/ground.



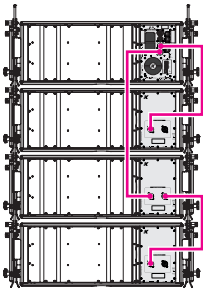
if more units can be powered by the same line, try to keep the load balanced by connecting the loudspeakers evenly among the three phase lines.

max number of units powered by a single 120 V _{AC} 20 A line			
Line-Neutral 120 V _{AC} 20 A	2x KH2I (1 joint)	2x KH3I (1 joint)	1x KH5I

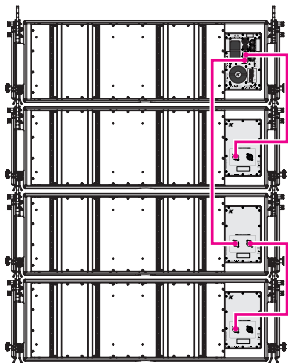
Active Elements Driving Passive Elements:
Audio Wiring

The power amplifiers embedded into the Mugello-KH active line array elements feature power audio output speakON connectors designed to drive passive line array units of the same model. The next tables show the suggested configurations.

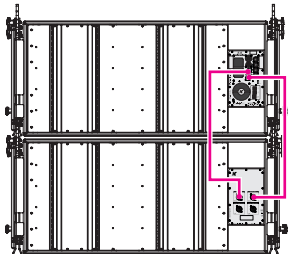
SpeakON	CH	KH2I	
	1	High 1+ 1-	1x KH2PI
	2	Low 2+ 2-	
	3	High 1+ 1-	2x KH2PI
	4	Low 2+ 2-	



SpeakON	CH	KH3I	
	1	High 1+ 1-	1x KH3PI
	2	Low 2+ 2-	
	3	High 1+ 1-	2x KH3PI
	4	Low 2+ 2-	



SpeakON	CH	KH5I	
	1	High 1+ 1-	1x KH5PI
	2	Low 2+ 2-	
	3	High 1+ 1-	1x KH5PI
	4	Low 2+ 2-	



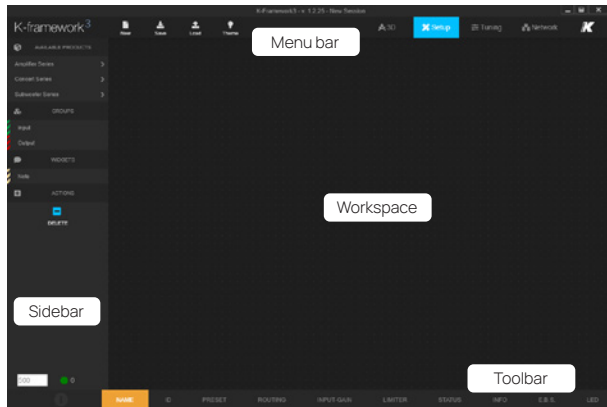
K-framework3

The Mugello-KH active array elements can be remotely controlled with the dedicated K-framework3 software available for PC and MAC on K-array website.

The K-framework3 is the managing and control software dedicated to professionals and operators looking for a powerful tool for designing and managing a large number of units in demanding applications.



Windows and OS software:
K-framework3

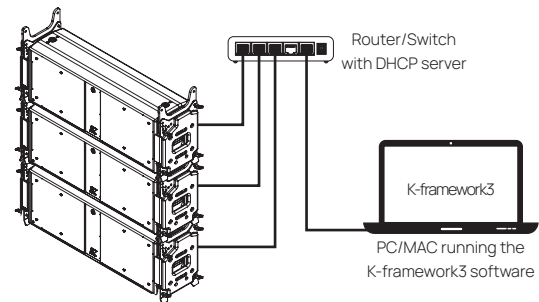


The K-framework3 operates in three modes:

- 3D – Design a loudspeaker system for your venue in a full 3D environment and make free field acoustic simulations;
- SETUP – import from the 3D design the active components into the workspace or build from scratch a PA system composed of active loudspeakers and amplifiers; use the input and output groups to allow full control of the system;
- TUNING – Manage and control the loudspeaker system in real time: optimize the performance of the loudspeaker system during the tuning session and control its behavior in live events.

The K-framework3 can work either off-line with virtual devices or on-line with real active loudspeakers and amplifiers connected over the same Ethernet network.

The K-framework3 allows you to start designing the PA system off-line and sync the virtual devices to the real ones on site, when the devices are available, or import from scratch in the workspace the real active loudspeakers and amplifiers available on the network. In both cases, in order to discover and sync the active devices, both the PC or Mac running the K-framework3 and the real units shall be properly connected to the same Local Area Network – LAN – with star topology.



The network shall comprise:

- single PC or MAC, running the K-framework3 software with network interface 100Mbps (or higher);
- router with DHCP server 100Mbps (or higher);
- Ethernet switch (usually integrated into the router) 100Mbps (or higher);
- Cat5 (or higher) Ethernet cables.

A DHCP server is highly recommended even if the Mugello-KH active units implement the zeroconf network technologies: if a DHCP service is not available, each Mugello-KH active array element will self assign an IP address in the range 169.254.0.0/16 (auto-IP).

Discovery

1. Ensure that any Mugello-KH units and the PC/Mac running the K-framework3 are properly connected to the same network.
2. Power up the Mugello-KH units.
3. Launch the K-framework3.
4. Open the Network window and launch the discovery:



- For back compatibility with legacy Mugello-KH units, by default the discovery over the RS485 serial communication is active: in case no legacy Mugello-KH units are present, disable the discovery over the RS485 serial communication.



- If the K-framework3 finds two or more devices with the wrong ID, a dialog window appears where unique IDs can be assigned to the units.



5. Once discovered, the real units are shown in the left columns, following the order of their ID number; if the workspace contains virtual devices of the same type you can eventually modify the IDs in order to match the units and allows the synchronization. The synchronization can be in either directions: Workspace-to-Real or Real-to-Workspace. Select the sync direction and synchronize all or the single units separately

Grouping

The working paradigm in the K-framework3 is to group the input and output channels of the active units on the workspace and adjust the system performance within the groups.

Groups can be created working both off-line and on-line and are retained by the real units even once unplugged: if a real device belongs to a group, the group is re-created on the workspace during the synchronization process.

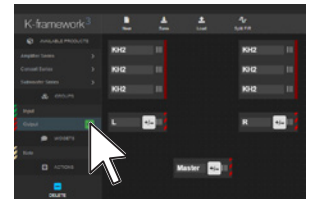
An active loudspeaker or amplifier might belong to multiple groups sharing its features (eq filters, time delay, volume, etc).



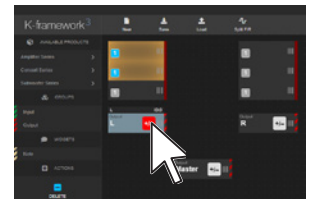
The K-framework3 synchronization process reset to default the EQ, delay and volume parameters edited with the K-array Control mobile app and the embedded Web app.

- A. In Setup mode, set the Mugello-KH units local parameters (presets, routing, input gains, limiters, etc).

- B. Add INPUT and OUTPUT groups as needed.



- C. Assign the Mugello-KH units' channels to the groups.



- D. Switch to Tuning mode.
- E. Align the system using the tools available on the groups (eq, delay, polarity, etc).



Rigging Procedures

Suspended Array



Key rigging components must be inspected before each use.

Any rigging components found to be defective, or even suspect might be defective should be replaced with equivalent approved part.



Always use properly rated rigging hardware.



K-array is not responsible for any rigging equipment and accessories that are not manufactured by K-array.



K-array loudspeaker and hardware are intended for suspension from approved rigging points only. Ensure that the total weight of the loudspeakers and additional hardware assembly in use is lower than the Working Load Limit (WLL) of the suspension points.



Rigging and flying loudspeaker systems shall be accomplished by knowledgeable and experienced professionals.



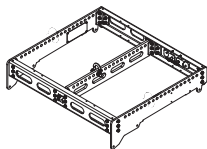
It is the user's responsibility to ensure that the use and suspension of heavy loudspeaker systems conform to all applicable laws and regulations in force at the time and location.

Needed Equipment

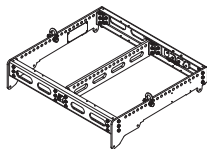
Name	Description	Image	Apply to
K-HCFLY2I	Bumper for KH2I-KS3I - BLACK		KH2I / KH2P1 KS3I / KS3P1
K-HCFLY2WI	Bumper for KH2I-KS3I - WHITE		KH2I / KH2P1 KS3I / KS3P1
K-HCFLY35I	Bumper for KH5I-KH3I-KS4I - BLACK		KH5I / KH5P1 KH3I / KH3P1 KS4I / KS4P1
K-HCFLY35WI	Bumper for KH5I-KH3I-KS4I - WHITE		KH5I / KH5P1 KH3I / KH3P1 KS4I / KS4P1
K-HCFLYST2	Fly bar for KH2I step array		KH2I / KH2P1
K-HCFLYST	Fly bar for KH5I-KH3I step array		KH5I / KH5P1 KH3I / KH3P1
K-STEPM2I	Step array hardware for KH2I (kit for 1 unit)		KH2I / KH2P1
K-STEPM3I	Step array hardware for KH3I (kit for 1 unit)		KH3I / KH3P1
K-STEPM5I	Step array hardware for KH5I (kit for 1 unit)		KH5I / KH5P1
K-HCLINK2/35	Adapter to join KH2I to a KH3I or a KH5I (or cluster)		KH5I / KH5P1 KH3I / KH3P1 KH2I / KH2P1

Rigging Procedure: Splay Line Array

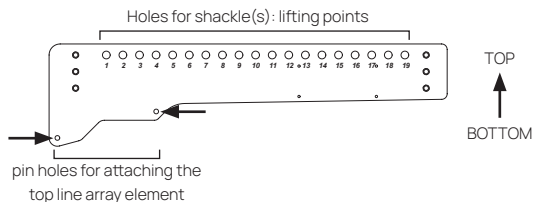
1. Set the bumper under the rigging position.
Set the shackle(s) in the proper pick-up hole positions according to the loading configuration and tilting angle.



Single shackle lifting point



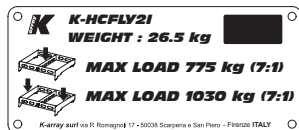
Twin shackle lifting points



Never exceed the maximum weight limit according to the load configuration.

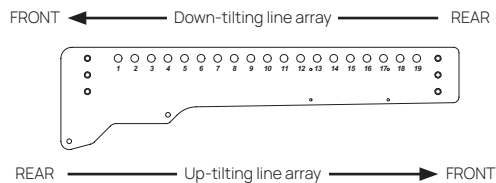
KH2I, KH2PI,
KS3I, KS3PI

KH3I, KH3PI, KH5I, KH5PI,
KS4I, KS4PI



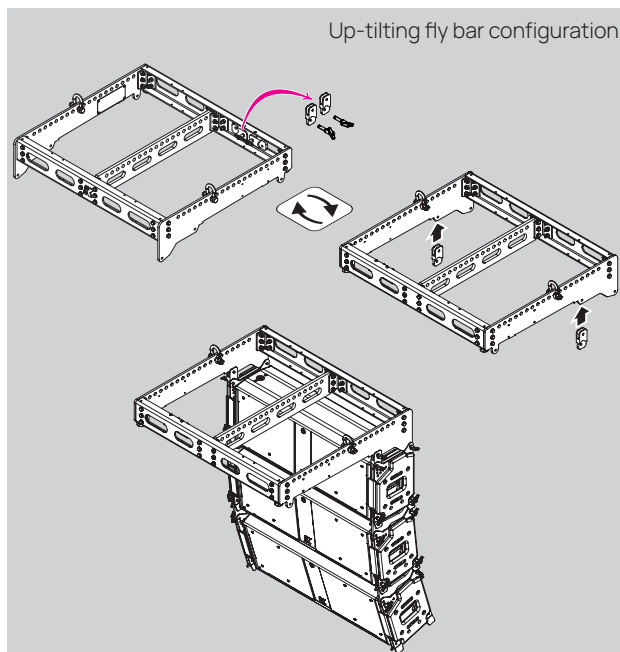
KH2I	KH3I	KH5I	KS3I	KS4I
29 kg / 63.93 lb	43,6 kg / 96,12 lb	64 kg / 134.5 lb	56 kg / 123.4 lb	60 kg / 132.3 lb
KH2PI	KH3PI	KH5PI	KS3PI	KS4PI
24 kg / 53 lb	38,6 kg / 85 lb	59 kg / 130 lb	49,2 kg / 108.5 lb	53,2 kg / 117.3 lb

The line array is usually down-tilted from a high position over the listening area. The K-HCFLY2I and K-HCFLY35I bumpers can be reversed for up-tilting the line array.



In order to up-tilt the line array:

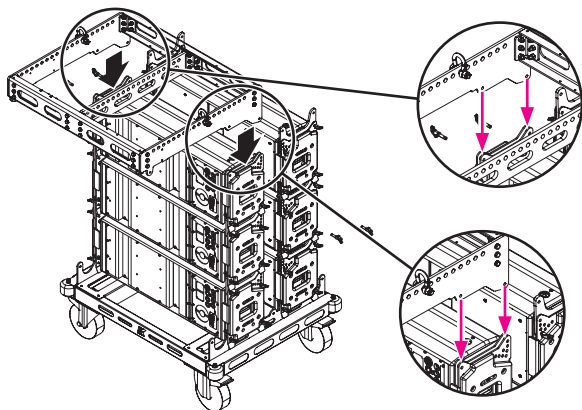
- take out the couple of quick-release pins and accessories attached to the bumper;
- reverse the bumper;
- set the accessories as described in the following pictures:



Mugello-KH I

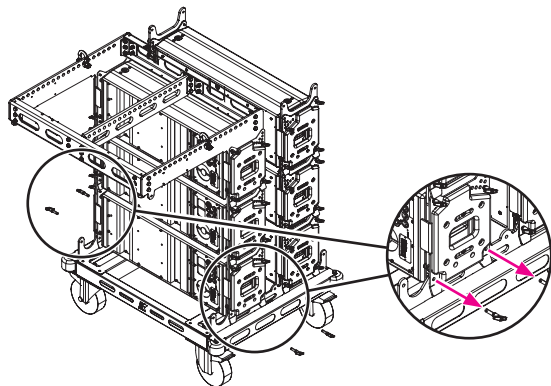
User Guide

2. Attach the bumper to the rigging hardware.
3. Attach the first array element to the bumper. Use four quick-release pins to secure the bumper to the top array element.

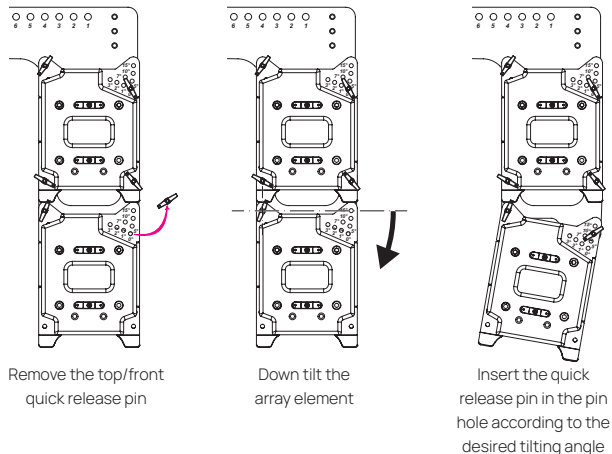


Verify that the bumper is secured to the top line array element with all four quick-release pins before proceeding to the next step .

4. Once the bumper is secured to the line array, remove the bottom quick-release pins so that to release the array from the dolly.



5. Set the mechanical tilting of each line array element according to the acoustic simulation made with the K-framework3 software.

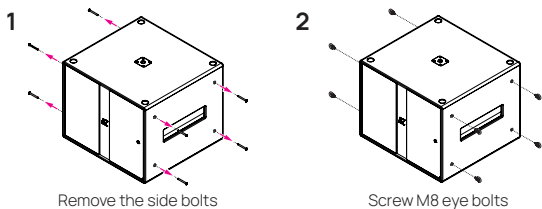


Available tilting angles per array unit: 0°, 1°, 2°, 3°, 5°, 7°, 10°, 15°.

Suspended Stand Alone Subwoofer

The subwoofers Thunder-KS3 I/KS3P I and Thunder-KS4 I/KS4P I can be suspended as stand alone unit.

Screw at least four M8 eye bolts (two per side) at the sides of the unit and hang it to the rigging point.



Subwoofer Array

The subwoofers Thunder-KS3 I/KS3P I and Thunder-KS4 I/KS4P I can be stacked on top of a line array of Mugello-KH loudspeakers or used as basements for ground stacked array of Mugello-KH units.

Needed Equipment

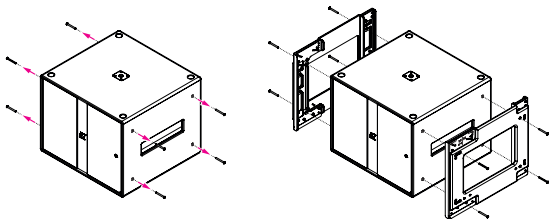
Name	Description	Image	Apply to
K-EXTFRAME3	Rigging frame KS3 I / KS3P I - BLACK		KS3 I / KS3P I
K-EXTFRAME3W	Rigging frame KS3 I / KS3P I - WHITE		KS3 I / KS3P I
K-EXTFRAME4	Rigging frame KS4 I / KS4P I - BLACK		KS4 I / KS4P I
K-EXTFRAME4W	Rigging frame KS4 I / KS4P I - WHITE		KS4 I / KS4P I

Thunder/Mugello Mechanical Compatibility

Subwoofer	Array Element	
Thunder-KS3 I Thunder-KS3P I	Mugello-KH2 I Mugello-KH2P I	
Thunder-KS4 I Thunder-KS4P I	Mugello-KH3 I Mugello-KH3P I	Mugello-KH5 I Mugello-KH5P I

Rigging Procedure: Suspended Subwoofer Array

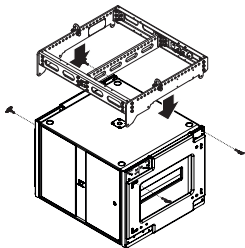
1. Remove the eight M8 side bolts at the subwoofer sides.
2. Install the rigging frame at the subwoofer sides.



3. Attach the bumper to the rigging hardware at the suspension point.
4. Attach the Thunder-KS subwoofer to the bumper. Use four quick-release pins to secure the bumper to the subwoofer.



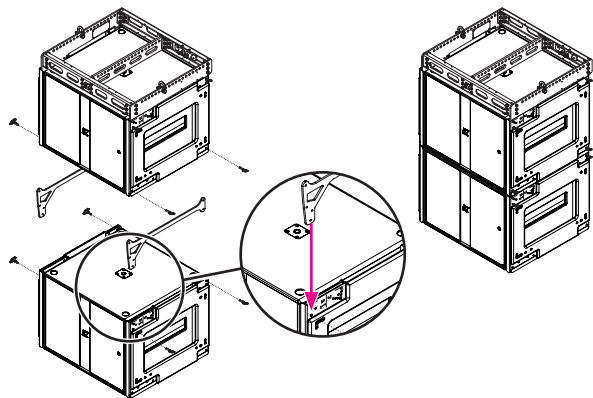
The Thunder-KS subwoofers shall be set on top of the Mugello-KH array elements in suspended line array systems



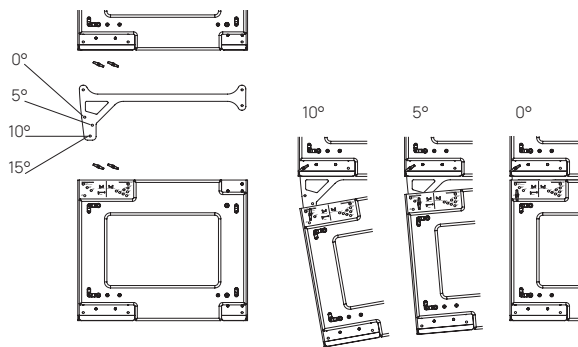
Mugello-KH I

User Guide

- Use the frame brackets to attach further subwoofers.

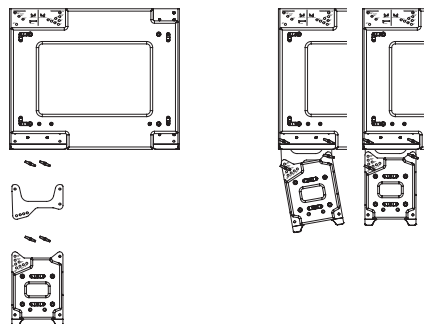


- After completing the subwoofer line array, set the tilting angle of each unit.



Available tilting angles per subwoofer unit: 0°, 5°, 10°, 15°.

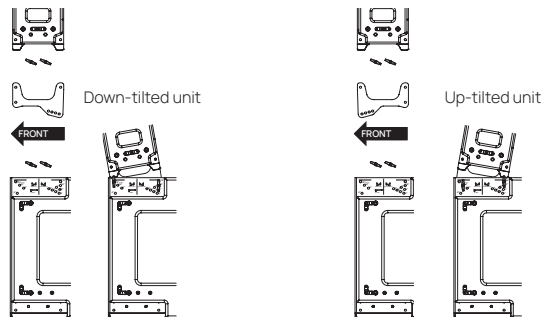
- Attach the Mugello-KH array elements below the bottom subwoofer.
- Set the tilting angle of the Mugello-KH array element.



- Proceed completing the line array with further units.

Rigging Procedure: Ground Stacked Subwoofer Array

- Remove the eight M8 side bolts at the subwoofer sides.
- Install the rigging frame at the subwoofer sides.
- Use the frame brackets to attach further subwoofers.
- Attach the Mugello-KH array elements above the top subwoofer.
- Set the orientation of the Mugello-KH bracket in order to allow the unit to tilt upward or downward.
Set the unit tilting angle.



Ground Stack Array



Key hardware components must be inspected before each use.

Any rigging components found to be defective, or even suspect might be defective should be replaced with equivalent approved part.



Always use properly rated installation hardware.



K-array is not responsible for any installing equipment and accessories that are not manufactured by K-array.



Check building codes for weight distribution requirements. Ensure that the total weight of the loudspeakers and additional hardware assembly in use is lower than the Working Load Limit (WLL).



Ground stacking the loudspeaker systems shall be accomplished by knowledgeable and experienced professionals.



Install the loudspeaker stack on a plain horizontal surface.



Ensure that the location for the loudspeakers stack and its support system provides for the minimum clearances required for safety.



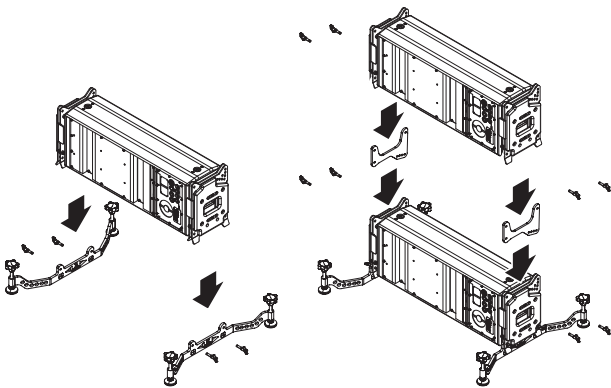
It is the user's responsibility to secure the loudspeakers stack and its support system to ground in order to avoid any damage or failure due to any unintended hits, gust of wind, vibrations or such.

Needed Equipment

Name	Description	Image	Apply to
K-HCBASE2	Stacking hardware for KH2I		KH2I/KH2PI
K-HCBASE	Stacking hardware for KH3I and KH5I		KH3I/KH3PI KH5I/KH5PI

Rigging Procedure: Ground Stacked Line Array

1. Set the K-HCBASE or K-HCBASE2 stacking hardware on the position.
2. Attach the bottom Mugello-KH unit to the base using four quick-release pins.



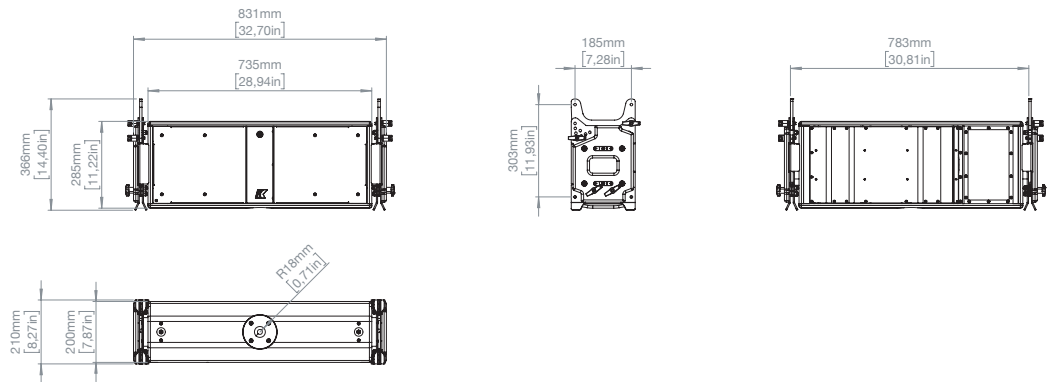
3. Proceed stacking further line array elements on top.
4. Set the unit tilting angles.

Mugello-KH I

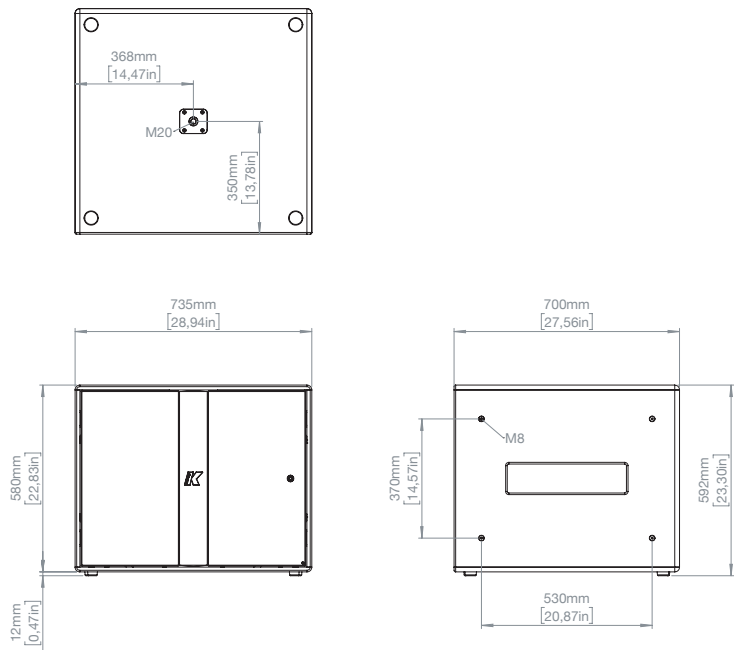
User Guide

Mechanical Drawing

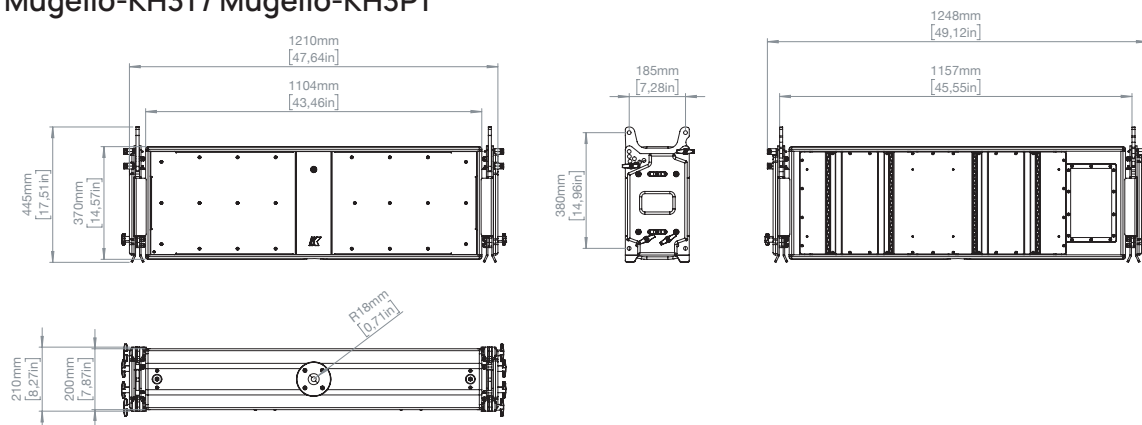
Mugello-KH2I / Mugello-KH2PI



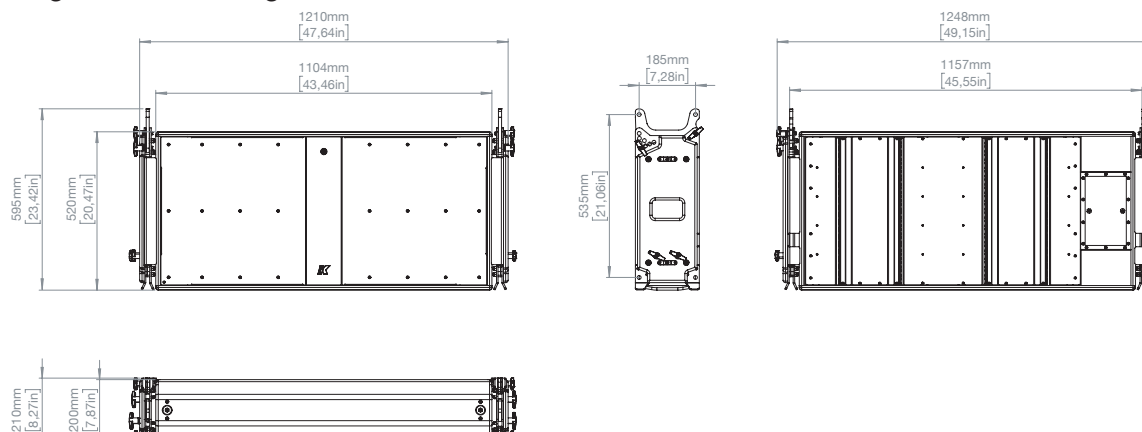
Thunder-KS3I / Thunder-KS3PI



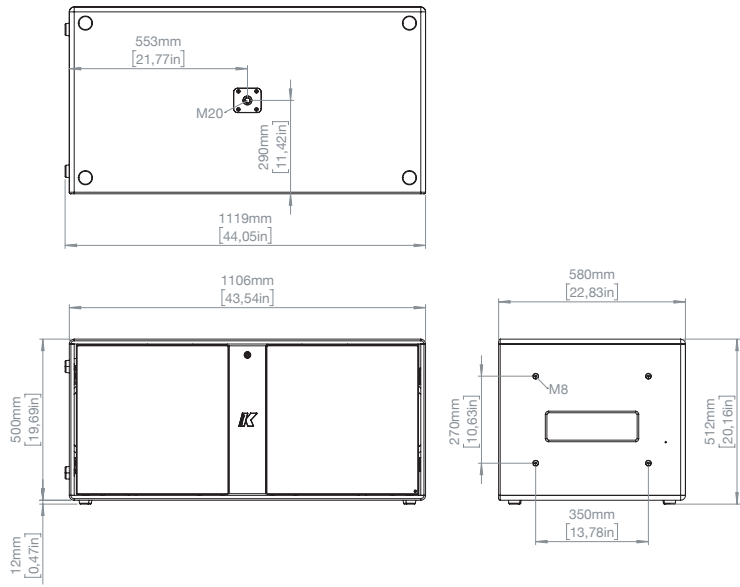
Mugello-KH3I / Mugello-KH3PI



Mugello-KH5I / Mugello-KH5PI



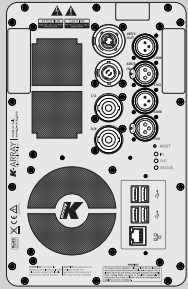
Thunder-KS4 I / Thunder-KS4PI



Technical Specifications

Mugello-KH2 I

Technical specifications	
Type	Self powered line array element
Transducers	2x 8" neodymium magnet woofers with 2.5" voice coil 2x horn loaded compression drivers with 2.5" voice coil
Frequency Response ¹	120 Hz – 19 kHz (-6 dB)
Max SPL ²	142 dB peak
Coverage	V. 20° digitally adjustable in array H. 110°
Connectors	Line Input: 2x XLR-F analog balanced / AES3 input Line Output: 2x XLR-M Link analog balanced / AES3 output Speaker Output: 2x SpeakON NL4 (Ch1 1+/1- // Ch2 2+/2-) Mains: powerCON TRUE1 TOP, 16 A true mains Networking and Data: 1x RJ45, 4x USB-A
DSP	Input gain, routing matrix, delay, full parametric IIR filters (Peaking, Shelving, Hi/Lo pass, Hi/Lo Butterworth), FIR filters, Onboard preset, Remote monitoring
Remote Control	Ethernet connectivity: Web APP and K-framework3 software
Amplifier Module	4-channel switching mode, Class D
Output Power	4x 1500 W @ 4 Ω
MAINS Operating Range	100-240V AC, 50-60 Hz with PFC
Power Consumption	600 W @ 8 Ω load, Pink noise, 1/4 rated power
Protections	Over Temp. (Power Limiting – Thermal Shutdown), Short Circuit/Overload Output Protection, Power Limiting, Clip Limiter/Permanent Signal Limiter, High Frequency Protection

Technical specifications	
Rear Panel	

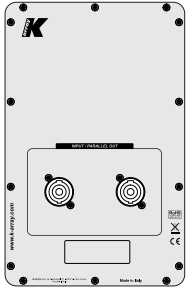
Handling & Finishes	
Material	Polyurea coated birch plywood
Colors	Black, Custom RAL
IP Rating	IP53
Dimensions (WxHxD)	net dimensions: 735 x 285 x 200 mm (28,94 x 11,22 x 7,87 in) with rigging hardware : 831 x 285 x 210 mm (32,7 x 11,22 x 8,27 in)
Weight	29 kg / 63.93 lb with rigging hardware

¹ With dedicated preset.

² Maximum SPL is calculated using a signal with crest factor 4 (12dB) measured at 8 m then scaled at 1 m.

Mugello-KH2P I

Technical specifications	
Type	Passive line array element
Transducers	2x 8" neodymium magnet woofers with 2.5" voice coil 2x horn loaded compression drivers with 2.5" voice coil
Frequency Response ¹	120 Hz – 19 kHz (-6 dB)
Max SPL ²	142 dB peak
Coverage	V. 20° digitally adjustable in array 1 H. 110°
Power handling	Bi-amp: HF: 250 W _{peak} LF: 1200 W _{peak}
Nominal Impedance	HF: 16 Ω LF: 8 Ω
Connectors	Speaker input/parallel output 2x SpeakON NL4 HF: IN and Link 1+/1- LF: IN and Link 2+/2-

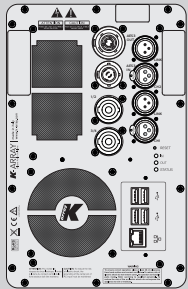
Technical specifications	
Rear Panel	

Handling & Finishes	
Material	Polyurea coated birch plywood
Colors	Black, Custom RAL
IP Rating	IP54
Dimensions (WxHxD)	net dimensions: 735 x 285 x 200 mm (28,94 x 11,22 x 7,87 in) with rigging hardware : 831 x 285 x 210 mm (32,7 x 11,22 x 8,27 in)
Weight	24 kg / 53 lb with rigging hardware

¹ With dedicated preset.
² Maximum SPL is calculated using a signal with crest factor 4 (12dB) measured at 8 m then scaled at 1 m.

Mugello-KH3I

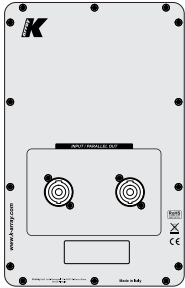
Technical specifications	
Type	Self powered line array element
Transducers	2x 12" neodymium magnet woofers with 2.5" voice coil 2x horn loaded compression drivers with 2.5" voice coil
Frequency Response ¹	120 Hz – 19 kHz (-6 dB)
Max SPL ²	144 dB peak
Coverage	V. 20° digitally adjustable in array H. 110°
Connectors	Line Input: 2x XLR-F analog balanced / AES3 input Line Output: 2x XLR-M Link analog balanced / AES3 output Speaker Output: 2x SpeakON NL4 (Ch1 1+/1- // Ch2 2+/2-) Mains: powerCON TRUE1 TOP, 16 A true mains Networking and Data: 1x RJ45, 4x USB-A
DSP	Input gain, routing matrix, delay, full parametric IIR filters (Peaking, Shelving, Hi/Lo pass, Hi/Lo Butterworth), FIR filters, Onboard preset, Remote monitoring
Remote Control	Ethernet connectivity: Web APP and K-framework3 software
Amplifier Module	4-channel switching mode, Class D
Output Power	4x 1500 W @ 4 Ω
MAINS Operating Range	100-240V AC, 50-60 Hz with PFC
Power Consumption	600 W @ 8 Ω load, Pink noise, 1/4 rated power
Protections	Over Temp. (Power Limiting – Thermal Shutdown), Short Circuit/Overload Output Protection, Power Limiting, Clip Limiter/Permanent Signal Limiter, High Frequency Protection

Technical specifications	
Rear Panel	

Handling & Finishes	
Material	Polyurea coated birch plywood
Colors	Black, Custom RAL
IP Rating	IP53
Dimensions (WxHxD)	net dimensions: 1104 x 370 x 200 mm (43,46 x 14,57 x 7.87 in) with rigging hardware: 1210 x 370 x 210 mm (47.64 x 14.57 x 8.27 in)
Weight	43,6 kg / 96.12 lb with rigging hardware

¹ With dedicated preset.
² Maximum SPL is calculated using a signal with crest factor 4 (12dB) measured at 8 m then scaled at 1 m.

Mugello-KH3P I

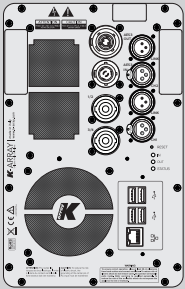
Technical specifications	
Type	Passive line array element
Transducers	2x 12" neodymium magnet woofers with 2.5" voice coil 2x horn loaded compression drivers with 2.5" voice coil
Frequency Response ¹	120 Hz – 19 kHz (-6 dB)
Max SPL ²	144 dB peak
Coverage	V. 20° digitally adjustable in array H. 110°
Power handling	Bi-amp: HF: 250 Wpeak LF: 1200 Wpeak
Nominal Impedance	HF: 16 Ω LF: 8 Ω
Connectors	Speaker input/parallel output 2x SpeakON NL4 HF: IN and Link 1+/1- LF: IN and Link 2+/2-
Rear Panel	

Handling & Finishes	
Material	Polyurea coated birch plywood
Colors	Black, Custom RAL
IP Rating	IP54
Dimensions (WxHxD)	net dimensions: 735 x 285 x 200 mm (28,94 x 11,22 x 7,87 in) with rigging hardware : 831 x 285 x 210 mm (32,7 x 11,22 x 8,27 in)
Weight	38,6 kg / 85 lb with rigging hardware

¹ With dedicated preset.
² Maximum SPL is calculated using a signal with crest factor 4 (12dB) measured at 8 m then scaled at 1 m..

Mugello-KH5 I

Technical specifications	
Type	Self powered line array element
Transducers	2x 15" neodymium magnet woofers with 2.5" voice coil 4x horn loaded compression drivers with 2.5" voice coil
Frequency Response ¹	120 Hz – 19 kHz (-6 dB)
Max SPL ²	147 dB peak
Coverage	V. 7° digitally adjustable in array H. 110°
Connectors	Line Input: 2x XLR-F analog balanced / AES3 input Line Output: 2x XLR-M Link analog balanced / AES3 output Speaker Output: 2x SpeakON NL4 (Ch1 1+/1- // Ch2 2+/2-) Mains: powerCON TRUE1 TOP, 16 A true mains Networking and Data: 1x RJ45, 4x USB-A
DSP	Input gain, routing matrix, delay, full parametric IIR filters (Peaking, Shelving, Hi/Lo pass, Hi/Lo Butterworth), FIR filters, Onboard preset, Remote monitoring
Remote Control	Ethernet connectivity: Web APP and K-framework3 software
Amplifier Module	4-channel switching mode, Class D
Output Power	4x 1500 W @ 4 Ω
MAINS Operating Range	100-240V AC, 50-60 Hz with PFC
Power Consumption	600 W @ 8 Ω load, Pink noise, 1/4 rated power
Protections	Over Temp. (Power Limiting – Thermal Shutdown), Short Circuit/Overload Output Protection, Power Limiting, Clip Limiter/Permanent Signal Limiter, High Frequency Protection

Technical specifications	
Rear Panel	

Handling & Finishes	
Material	Polyurea coated birch plywood
Colors	Black, Custom RAL
IP Rating	IP53
Dimensions (WxHxD)	net dimensions: 1104 x 520 x 200 mm (43.46 x 20.47 x 7.87 in) with rigging hardware: 1210 x 520 x 210 mm (47.64 x 20.47 x 8.27 in)
Weight	64 kg / 134.5 lb with rigging hardware

¹ With dedicated preset.
² Maximum SPL is calculated using a signal with crest factor 4 (12dB) measured at 8 m then scaled at 1 m.

Mugello-KH5P I

Technical specifications		
Type	Passive line array element	
Transducers	2x 15" neodymium magnet woofers with 2.5" voice coil 4x horn loaded compression drivers with 2.5" voice coil	
Frequency Response ¹	120 Hz – 19 kHz (–6 dB)	
Max SPL ²	147 dB peak	
Coverage	V. 7° digitally adjustable in array 1 H. 110°	
Power handling	Quad-amp: HF: 2x 250 Wpeak LF: 2x 800 Wpeak	
Nominal Impedance	HF: 2x 16 Ω LF: 2x 8 Ω	
Connectors	Speaker input/parallel output 2x SpeakON NL4 HF: IN and Link 1+/1- LF: IN and Link 2+/2-	Speaker input/parallel output 2x SpeakON NL4 HF: IN and Link 1+/1- LF: IN and Link 2+/2-
Rear Panel		

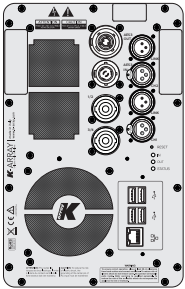
Handling & Finishes	
Material	Polyurea coated birch plywood
Colors	Black, Custom RAL
IP Rating	IP54
Dimensions (WxHxD)	net dimensions: 1104 x 520 x 200 mm (43.46 x 20.47 x 7.87 in) with rigging hardware: 1210 x 520 x 210 mm (47.64 x 20.47 x 8.27 in)
Weight	59 kg / 130 lb with rigging hardware

¹ With dedicated preset.

² Maximum SPL is calculated using a signal with crest factor 4 (12dB) measured at 8 m then scaled at 1 m.

Thunder-KS3I

Technical specifications	
Type	Active subwoofer
Transducers	21" neodymium magnet woofer
Frequency Response ¹	30 Hz – 150/300 Hz (-6 dB) crossover dependant
Crossover	DSP-controlled, Low Pass @ 150 Hz up to 300 Hz, preset dependant
Max SPL ²	139 dB peak
Coverage	Omni
Connectors	Line Input: 2x XLR-F analog balanced / AES3 input Line Output: 2x XLR-M Link analog balanced / AES3 output Speaker Output: 2x SpeakON NL4 (Ch1 1+/1- // Ch2 2+/2-) Mains: powerCON TRUE1 TOP, 16 A true mains Networking and Data: 1x RJ45, 4x USB-A
DSP	Input gain, routing matrix, delay, full parametric IIR filters (Peaking, Shelving, Hi/Lo pass, Hi/Lo Butterworth), FIR filters, Onboard preset, Remote monitoring
Remote Control	Ethernet connectivity: Web APP and K-framework3 software
Amplifier Module	4-channel switching mode, Class D
Output Power	4x 2500 W @ 4 Ω
MAINS Operating Range	100-240V AC, 50-60 Hz with PFC
Power Consumption	600 W @ 8 Ω load, Pink noise, 1/4 rated power
Protections	Over Temp. (Power Limiting – Thermal Shutdown), Short Circuit/Overload Output Protection, Power Limiting, Clip Limiter/Permanent Signal Limiter, High Frequency Protection

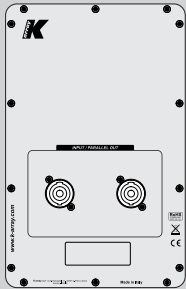
Technical specifications	
Rear Panel	

Handling & Finishes	
Material	Polyurea coated birch plywood
Colors	Black, Custom RAL
IP Rating	IP53
Dimensions (WxHxD)	735 x 580 x 700 mm (28.9 x 22.83 x 27.56 in)
Weight	56 kg (123.4 lb)

¹ Extensible with dedicated preset according to the midrange crossover point.

² Maximum SPL is calculated using a signal with crest factor 4 (12dB) measured at 1 m.

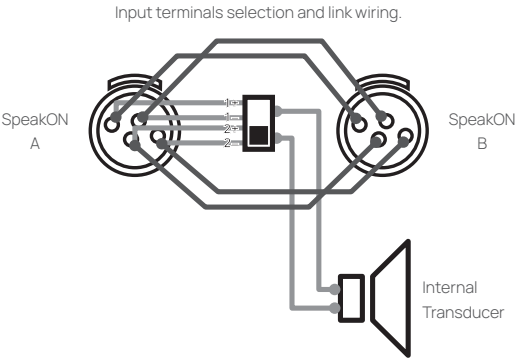
Thunder-KS3PI

Technical specifications	
Type	Passive subwoofer
Transducers	21" neodymium magnet woofer
Frequency Response ¹	30 Hz - 150/300 Hz (-6 dB) crossover dependant
Crossover	External DSP-controlled, Low Pass @ 150 Hz up to 300 Hz, preset dependant
Max SPL ²	139 dB peak
Nominal Impedance	4Ω
Power handling	2800 Wpeak
Coverage	Omni
Connectors	Speaker input/parallel output 2x SpeakON NL4 Input terminals selectable: IN+Link 1+/1- (parallel), Link 2+/2- Link 1+/1- , IN+Link 2+/2- (DEFAULT)
Rear Panel	

Handling & Finishes	
Material	Polyurea coated birch plywood
Colors	Black, Custom RAL
IP Rating	IP54
Dimensions (WxHxD)	735 x 580 x 700 mm (28.9 x 22.83 x 27.56 in)
Weight	49,2 kg (108.5 lb)

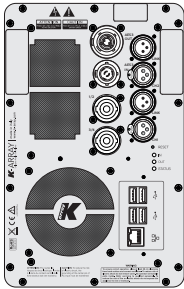
¹ Extensible with dedicated preset according to the midrange crossover point.

² Maximum SPL is calculated using a signal with crest factor 4 (12dB) measured at 1 m.



Thunder-KS4 I

Technical specifications	
Type	Active subwoofer
Transducers	2x18" neodymium magnet woofer
Frequency Response ¹	30 Hz – 150/300 Hz (-6 dB) crossover dependant
Crossover	DSP-controlled, Low Pass @ 150 Hz up to 300 Hz, preset dependant
Max SPL ²	141 dB peak
Coverage	Omni
Connectors	Line Input: 2x XLR-F analog balanced / AES3 input Line Output: 2x XLR-M Link analog balanced / AES3 output Speaker Output: 2x SpeakON NL4 (Ch1 1+/1- // Ch2 2+/2-) Mains: powerCON TRUE1 TOP, 16 A true mains Networking and Data: 1x RJ45, 4x USB-A
DSP	Input gain, routing matrix, delay, full parametric IIR filters (Peaking, Shelving, Hi/Lo pass, Hi/Lo Butterworth), FIR filters, Onboard preset, Remote monitoring
Remote Control	Ethernet connectivity: Web APP and K-framework3 software
Amplifier Module	4-channel switching mode, Class D
Output Power	4x 2500 W @ 4 Ω
MAINS Operating Range	100-240V AC, 50-60 Hz with PFC
Power Consumption	600 W @ 8 Ω load, Pink noise, 1/4 rated power
Protections	Over Temp. (Power Limiting – Thermal Shutdown), Short Circuit/Overload Output Protection, Power Limiting, Clip Limiter/Permanent Signal Limiter, High Frequency Protection

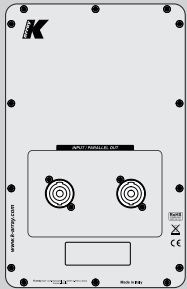
Technical specifications	
Rear Panel	

Handling & Finishes	
Material	Polyurea coated birch plywood
Colors	Black, Custom RAL
IP Rating	IP53
Dimensions (WxHxD)	1106 x 500 x 580 mm (43.5 x 19.7 x 22.8 in)
Weight	60 kg (132.3 lb)

¹ Extensible with dedicated preset according to the midrange crossover point.

² Maximum SPL is calculated using a signal with crest factor 4 (12dB) measured at 1 m.

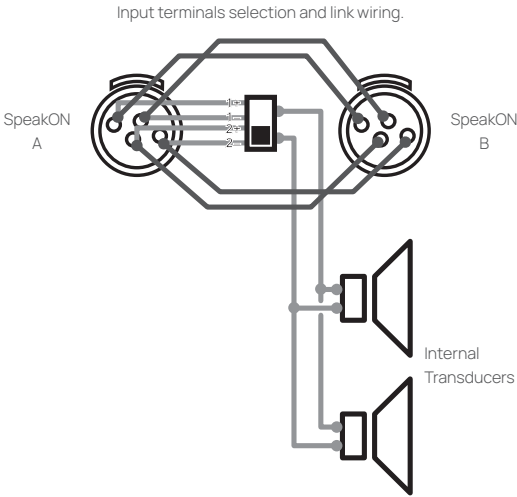
Thunder-KS4PI

Technical specifications	
Type	Passive subwoofer
Transducers	2x18" neodymium magnet woofer
Frequency Response ¹	30 Hz - 150/300 Hz (-6 dB) crossover dependant
Crossover	External DSP-controlled, Low Pass @ 150 Hz up to 300 Hz, preset dependant
Max SPL ²	141 dB peak
Nominal Impedance	4Ω
Power handling	2800 Wpeak
Coverage	Omni
Connectors	Speaker input/parallel output 2x SpeakON NL4 Input terminals selectable: IN+Link 1+/1- (parallel), Link 2+/2- Link 1+/1- , IN+Link 2+/2- (DEFAULT)
Rear Panel	

Handling & Finishes	
Material	Polyurea coated birch plywood
Colors	Black, Custom RAL
IP Rating	IP54
Dimensions (WxHxD)	1106 x 500 x 580 mm (43.5 x 19.7 x 22.8 in)
Weight	53,2 kg (117.3 lb)

¹ Extensible with dedicated preset according to the midrange crossover point.

² Maximum SPL is calculated using a signal with crest factor 4 (12dB) measured at 1 m.





Designed and Made in Italy

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