NEUMANN.BERLIN

KH 810 II / KH 870 II

Active Subwoofer

with 7.1.4 / 0.1 Bass Management™

Instruction manual

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Contents

KH 810 II / KH 870 II Subwoofers

Thank you for purchasing a Neumann subwoofer. Neumann subwoofers are designed to complement Neumann's extensive range of monitor systems. They can be used in music, broadcast, and post production studios for tracking, mixing, mastering and home recording. They can be positioned away from a wall, next to a wall or in a corner and can be mixed freely with other loudspeakers and subwoofers from the Neumann range.

State-of-the-art circuitry design and the specially developed long-throw bass driver have been used to ensure the most accurate sound reproduction possible. Neumann products are designed for longevity so we hope you enjoy many happy years of using this product.

The subwoofer is equipped with a 7.1.4 / 0.1 Bass Manager. It is therefore ideally suited for setting up and supporting large multi-channel systems. The subwoofer performs best in conjunction with the optional MA 1 Automatic Monitor Alignment Software. An exact description of the software and its scope of functions can be found in the MA 1 software.

This manual describes the device itself and how to operate it with the setting options provided on the device.

Uses

- Bass extension for loudspeakers
- Increasing the maximum SPL of loudspeakers
- Reducing harmonic distortion and intermodulation distortion of loudspeakers attached to the subwoofer
- Playback of the LFE channel
- Playing the bass portion of a multi-channel system with up to 11 speaker channels (7.1.4)
- Making a Plane Wave Bass Array™ (PWBA™)
- Improving the consistency of the room through optimal placement of the subwoofer in the room
- Possibility of calibrating the subwoofer and all connected Neumann loudspeakers, including analog speakers (requires optional MA 1 Automatic Monitor Alignment Software)

Delivery includes

KH 810 II / KH 870 II

1 KH 810 II / KH 870 II subwoofer
4 power cords (EU/KR, UK, US and China)
1 quick guide
1 safety guide

About this manual

This operating manual describes the physical setup and autonomous operation of the subwoofer. See the app for information about controlling it in a network with the Neumann MA 1 Monitor Alignment Software.

Using the Neumann MA 1 Monitor Alignment Software in conjunction with the subwoofer offers the following advantages, among others:

- More extensive acoustic options for precise adaptation to listening conditions
- Support for analog Neumann studio monitors connected to the subwoofer
- System-wide settings, e.g. volume control, logo brightness setting, etc.
- Rapid system reconfiguration.

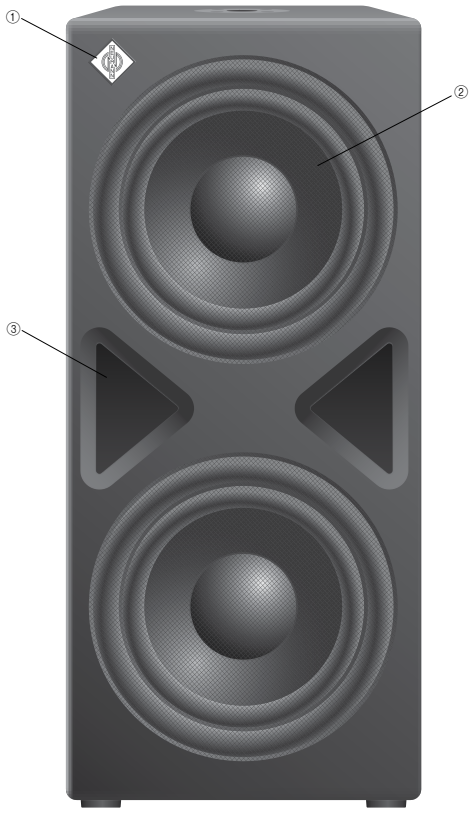
The Neumann MA 1 Monitor Alignment Software for Windows and MAC can be found on the Neumann website using the search term "MA 1".

The current instruction manual, the quick guide and the safety instructions can also be downloaded from the “Downloads” area on the product page at www.neumann.com.

Note that imperial dimensions are approximate.

Product overview

KH 810 II

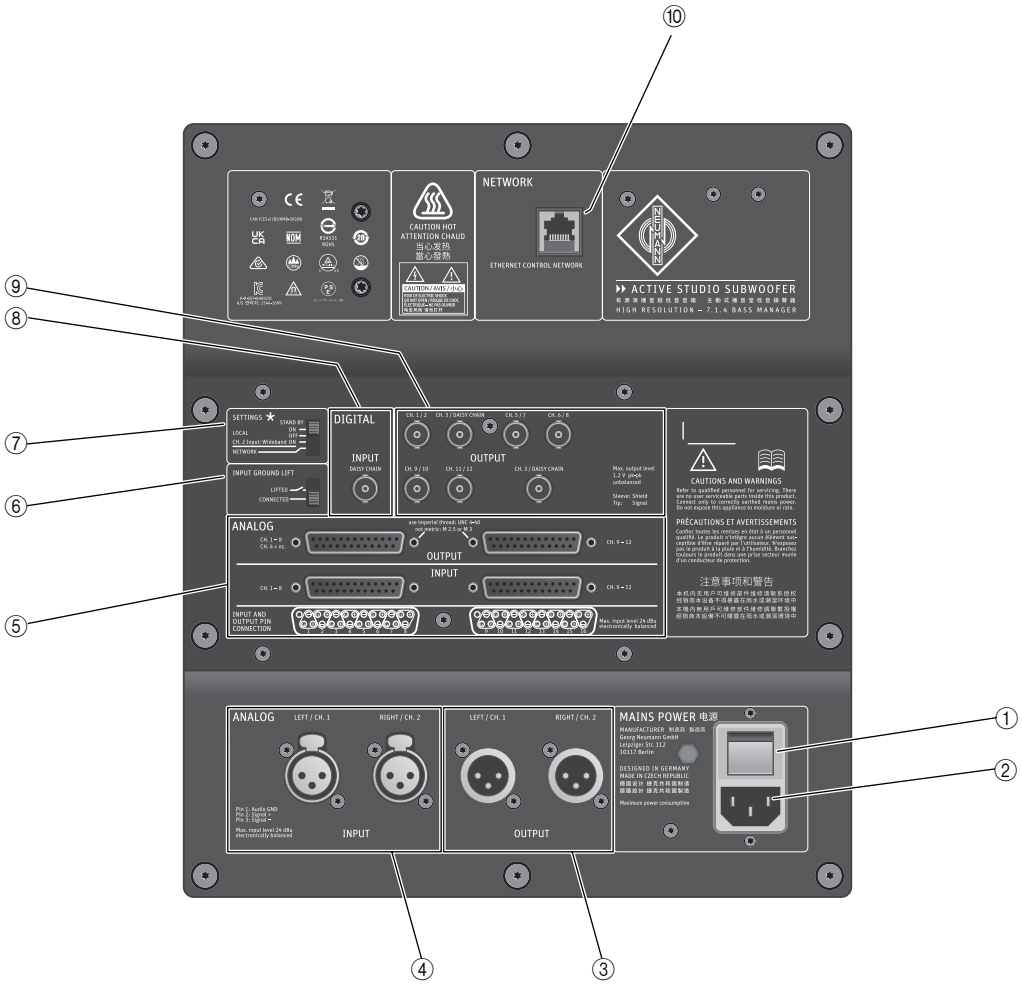


KH 870 II

① Neumann logo
white = on
red = protection active
pink = other status displays

② Metal grille

③ Port



① MAINS POWER switch

② IEC mains socket with protective ground contact

③ XLR3-M sockets
ANALOG OUTPUT | LEFT/CH. 1
ANALOG OUTPUT | RIGHT/CH. 2

④ XLR3-F sockets
ANALOG INPUT | LEFT/CH. 1
ANALOG INPUT | RIGHT/CH. 2

⑤ ANALOG INPUT/OUTPUT
INPUT: 2x SUB-D 25
OUTPUT: 2x SUB-D 25

⑥ INPUT GROUND LIFT switch

⑦ SETTINGS switch (Local/Network Mode, Stand By)

⑧ DIGITAL INPUT
BNC: Daisy Chain

⑨ DIGITAL OUTPUT
7x BNC: Channels 1-3, Channels 5-12, Daisy Chain Out

⑩ NETWORK: RJ45 Network Control

Positioning the subwoofer

Have the product installed and connected by a specialist. Due to his/her technical training, know-how and experience as well as knowledge of relevant provisions, regulations and standards, the specialist must be able to assess assigned tasks, recognize potential hazards and ensure appropriate safety measures. The following safety and mounting instructions are addressed to this specialist.

CAUTION
Danger of injury and material damage due to tipping/dropping of the product!

If improperly mounted, the product and/or the mounting hardware (e.g. rack) can tip over or fall.

- ▶ Always have the product mounted by a qualified specialist according to local, national and international regulations and standards.
- ▶ Use the mounting systems recommended by Neumann and always provide sufficient additional protection against tipping or falling.

CAUTION
Damage to the product due to overheating!

If air cannot circulate freely behind the product, the amplifiers may overheat and trigger the thermal protection system. This reduces the maximum output level of the subwoofer and can cause damage to the product.

- ▶ The whole of the backplate should have a free flow of air to ensure good cooling.
- ▶ When installing the product into tight spaces such as wall recesses, maintain an air gap of at least 5 cm (2") around the subwoofer's backplate and ensure sufficient air flow.

For information on installation, please refer to the supplied "Quick Guide" supplement. This will help you set up the subwoofers and loudspeakers in a way that will give you the best acoustic performance from the system. For further information on setting up subwoofers and loudspeakers, please refer to the "Questions & Answers" section at www.neumann.com.

Preparing the subwoofer

CAUTION
Risk of staining surfaces!

Some surfaces treated with varnish, polish or synthetics may suffer from stains when they come into contact with other synthetics. Despite a thorough testing of the synthetics we use, we cannot rule out the possibility of staining.

- ▶ Do not place the subwoofer on delicate surfaces.

To place the subwoofer on a flat surface:

- ▶ Place the subwoofer on the rubber feet attached to the bottom of the subwoofer. These decouple the subwoofer acoustically from the ground.
- ▶ In the case of strongly resonating substrates, additional acoustic decoupling (e.g. layers of foam) may be useful. An ideal decoupling effect is achieved when the subwoofer swings slowly back and forth when tapped, at a frequency lower than the bottom limit frequency (18 Hz) of the subwoofer. Make sure that the subwoofer is still stable, cannot tip over, and that there is nothing on the subwoofer that can fall off.

If you want to hide the subwoofer:

- ▶ Use a thin open weave cloth. To provide visual cover, you can use two layers of the cloth.

Preparing the room

- ▶ Arrange all acoustically relevant surfaces and objects symmetrically on either side of the listening axis of the studio monitors.
- ▶ Minimize the sound that is reflected back to the listening position of the loudspeakers by using angled surfaces and/or acoustical treatment.
- ▶ The subwoofer can generate very low frequencies at high levels. This can cause objects and parts of the room to vibrate, which can then lead to buzzing or rattling. Avoid this vibration by using resonating surfaces or treated surfaces.

This product has been optimized for use in recording studios. In order to avoid affecting the quality of reproduction, make sure that the product is used in an EMC environment.

Positioning the subwoofer

Choosing the type of setup

The driver and bass reflex ports are located on the front of the subwoofer. This allows the subwoofer to be placed in the room or in a wall recess with the front flush with the wall.

Flush mounting the subwoofer into a wall recess or placing it directly against the wall offers the following advantages:

- A solid wall increases the sound pressure level that the subwoofer delivers into the room. This can be compensated for by reducing the subwoofer's output level. This also reduces distortion resulting in a cleaner sound reproduction.
- It prevents reflections from the wall behind the subwoofer, which can cancel out certain frequencies.
- The subwoofer does not occupy space in the room when flush mounted.

If you want to flush mount the subwoofer into a wall recess:

- ▶ Have the wall constructed by an experienced acoustical engineer. At least the following points should be observed:
  - The wall should be solid (stone, brick, concrete, several layers of gypsum or MDF).
  - There must be unimpeded air flow at the subwoofer's backplate to ensure adequate cooling of the electronics.

Using one or several subwoofers

- ▶ Use ...

one subwoofer	several subwoofers
... if your room does not offer sufficient space for several subwoofers.	... if you require a higher output power or less distortion with the same output power.
	... to suppress lateral modes or cross modes in the room by means of a Plane Wave Bass Array (PWBA™).
	... if many smaller cabinets are easier to position than one large cabinet.

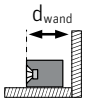
To reduce low-frequency distortion, the uncalibrated output level of your subwoofer should always be higher than the output level of your loudspeakers. We recommend using arrays with several subwoofers, in which case the uncalibrated maximum output level of the subwoofer array should also be higher than the maximum output level of all the loudspeakers in the system. Subwoofers can then be calibrated to a lower output level. This reduces distortion and provides cleaner reproduction of low frequencies.

For information on building a balanced system, please refer to the "Product Selection Guide" at www.neumann.com.

If several subwoofers are used, they must be controlled in parallel by using Y cables to feed the signals to all subwoofers. Only in conjunction with the MA 1 Automatic Monitor Alignment Software can the daisy chain output be used to connect additional subwoofers. The daisy chain output should not be used in Local mode.

Positioning the subwoofers

Regardless of whether you are setting up one or several subwoofers:



- Always ensure that the distance d_{wall} between the wall behind the subwoofer and the subwoofer's front is less than 0.8 m. At distances of more than 0.8 m, comb filtering occurs due to reflections, which has a negative effect on the frequency response.

If you are setting up **one** subwoofer:

- Position the subwoofer against the front wall, left or right of the middle of the front wall ideally at ¼ or ¾ of the room width.
- If possible, position the subwoofer at ¼ or ¾ of the room height.
- Do not place the subwoofer at the side wall or rear wall of the room as sometimes proposed for domestic applications.

If you are setting up several subwoofers as a Plane Wave Bass Array™ (PWBA™):

- Use two to four subwoofers for smaller rooms and three to four subwoofers for larger rooms.
- Set up the subwoofers along the front wall within half a wavelength of the upper limit frequency of each other. The maximum spacing of the subwoofer cabinets is determined by the setting of the routing mode or crossover frequency:

Setting	Max. spacing of the subwoofer cabinets
Local	approx. 2 m
CH. 2 Input: Wideband: external bass management	depends on crossover frequency setting in the source equipment
80 Hz	approx. 1.4 m
120 Hz	approx. 2 m

If you observe the stated spacing, the subwoofers form a horizontal, cylindrical source and generate a plane wave down the room, a so-called Plane Wave Bass Array™ (PWBA™). The PWBA™ reduces stationary waves between the side walls, improves the bass response and suppresses lateral room resonances. As a result, the low frequency response becomes more linear and overhang is reduced.

You can adjust overemphasis on low frequencies by raising the level on the connected loudspeakers using the INPUT GAIN potentiometer and/or the OUTPUT LEVEL switch on the loudspeakers (see table on page 23).

Utilizing the acoustical gain

If you set up several subwoofers, you can utilize their mutual coupling to achieve an acoustical gain. The following acoustical gains are possible:

Number of subwoofers	Acoustical gain
1	0.0 dB
2	6.0 dB
3	9.5 dB
4	12.0 dB

To operate several subwoofers in Local mode, they are controlled in parallel using Y-cables (not included with delivery) and set up identically in a balanced setup. The level of the individual subwoofers must then be adapted to the connected loudspeakers. For these, the level must be adjusted according to the above table.

Positioning and orienting subwoofers and loudspeakers

In their typical frequency response range, subwoofers exhibit spherical dispersion because the wavelength of the radiated signals is greater than the sound-generating area. Therefore, it does not matter in which direction the subwoofer is oriented when it is positioned in the listening environment. It is therefore highly recommended to place the subwoofer parallel to and directly against the front wall to avoid reflections.

For your loudspeakers, however, an accurate positioning and orientation is vital.

▶ Position your loudspeakers as follows:

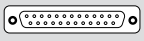
System	Position and orientation
2.0 (stereo)	±30°
5.1	ITU-R BS.775-1: 0°, ±30°, ±110° (center, front left/right, surround left/right)
	ANSI/SMPTE 202M: 0°, ±22.5°, arrays to the surround left and to the surround right, plus optional subwoofer(s)
6.1	as 5.1 systems plus 180° (back center)
Dolby Atmos 7.1.4	0°, ±30°, ±100°, ±135° (center, front left/right, side left/right, back left/right) ±45°, ±135° (45° vertical) (left/right top front, left/right top rear)

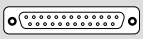
For detailed information on the positioning and orientation of your loudspeakers, please refer to the operating manuals of the loudspeakers.

Make sure that the listening distance to the subwoofer is the same as that to the loudspeakers, otherwise the time of flight differences will result in phase cancellations and less accurate bass response. When the system is configured using the MA 1 Automatic Monitor Alignment Software, such time of flight differences are compensated for, resulting in perfect acoustic addition of subwoofers to loudspeakers, regardless of the individual spacing.

Connections

Socket and channel assignments

Input					
Source signal		Analog			Digital
					
7.1.4		SUB-D connector		XLR connector	BNC connector
L	Left	1	1	LEFT / CH. 1	
R	Right	1	2	RIGHT / CH. 2	
C	Center	1	3		
LFE	Low frequency effects	1	4		
Ls	Left surround	1	5		
Rs	Right surround	1	6		
Lrs	Left rear surround	1	7		
Rrs	Right rear surround	1	8		
Ltf	Left top front	2	1		
Rtf	Right top front	2	2		
Ltr	Left top rear	2	3		
Rtr	Right top rear	2	4		
Master subwoofer (not available in Local mode)		–	–	–	DAISY CHAIN

Output						
Signal	Bass management	Analog			Digital	
						
	Active	SUB-D connector		XLR connector	BNC connector	Subframe
L	YES	1	1	LEFT / CH. 1	CH. 1/2	A / Digital L
R	YES	1	2	RIGHT / CH. 2	CH. 1/2	B / Digital R
C	YES	1	3		CH.3/DAISY CHAIN	A / Digital L
DAISY CHAIN	NO	1	NC		CH.3/DAISY CHAIN	B / Digital R
Ls	YES	1	5		CH. 5/6	A / Digital L
Rs	YES	1	6		CH. 6/8	B / Digital R
Lrs	YES	1	7		CH. 5/6	A / Digital L
Rrs	YES	1	8		CH. 6/8	B / Digital R
Ltf	YES	2	1		CH. 9/10	A / Digital L
Rtf	YES	2	2		CH. 9/10	B / Digital R
Ltr	YES	2	3		CH. 11/12	A / Digital L
Rtr	YES	2	4		CH. 11/12	B / Digital R
DAISY CHAIN	NO	–	–	–	CH.3/DAISY CHAIN	B

Signal (source connector)	Source impedance	Cable length	Subwoofer connection method
Analog (RCA)	low	up to 10 m (30')	via an adapter (RCA-XLR) to the ANALOG INPUT socket (XLR) ④ (see below)
		Up to 100 m (300')	Directly to the ANALOG INPUT (XLR) socket ④ (see below) or via an adapter (XLR-SUB-D) to the ANALOG INPUT (SUB-D) socket (5)

Connecting the subwoofer to the source

Connecting analog signals to the subwoofer

- To connect your audio source to the subwoofer, use either balanced XLR cables to connect to the two Analog Input XLR sockets ④ or balanced analog cables to connect to the corresponding ANALOG INPUT SUB-D sockets ⑤ on the subwoofer. You can feed up to 12 analog signals into the subwoofer (11 full-range channels plus 1 LFE channel).

Connecting unbalanced cables

- Use an XLR adapter (not included with delivery) to connect unbalanced cables (e.g. RCA cables). Use the following wiring if you want to make your own XLR adapter:

Wiring	Pin	Signal
	1	Audio ground
	2	Signal +
	3	Signal –

The level delivered by devices with RCA outputs (–10 dBV) is usually less than the studio level (+4 dBu):

- If necessary, use active unbalanced-to-balanced converters in order to be able to connect devices with unbalanced signals.
- We do not recommend passive unbalanced to balanced converters using transformers. They usually limit low frequency levels and increase high frequency distortion.

Connecting digital signals to the subwoofer

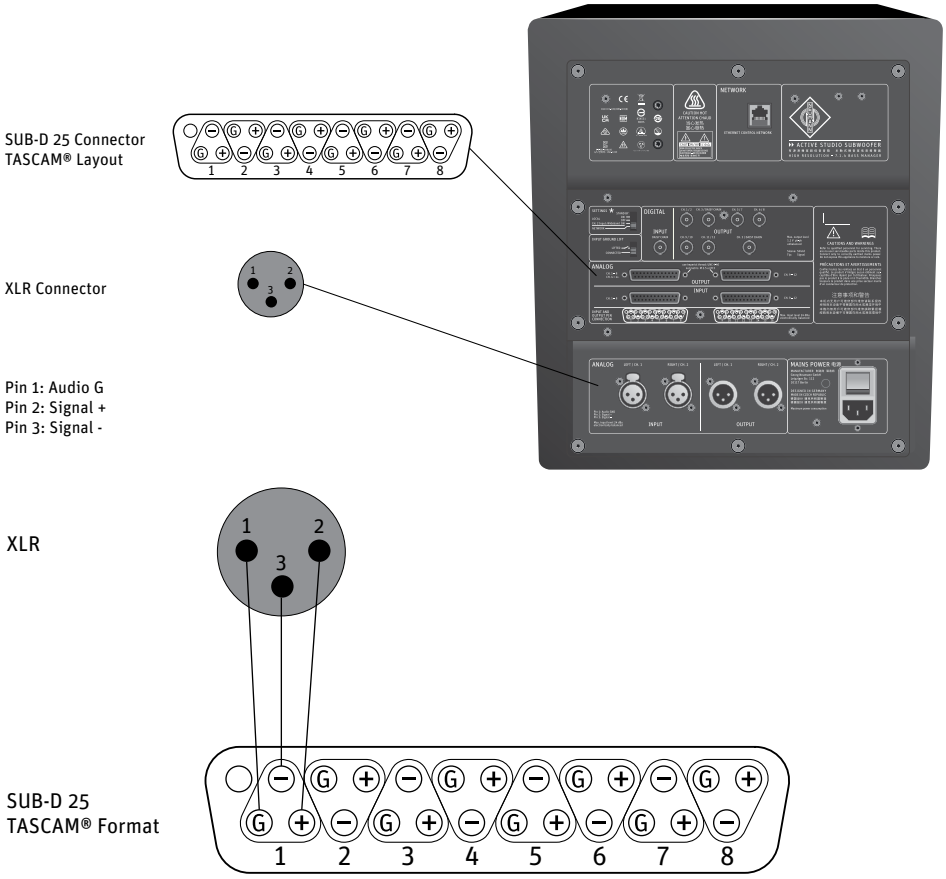
- Do not connect digital signals from your source to the Digital Input socket ⑧ of the subwoofer. This socket is used only to transmit the output signal of a subwoofer connected upstream to this subwoofer in conjunction with the MA 1 Automatic Monitor Alignment Software.

Connecting loudspeakers to the subwoofer

For a simplified representation, the following connection examples show loudspeakers in combination with the subwoofer. Each of the examples only shows one possible combination of loudspeakers and subwoofers. For information on building a balanced system, please refer to the “Product Selection Guide” at www.neumann.com.

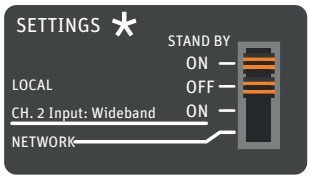
To connect analog loudspeakers, use the SUB-D 25 sockets ⑤ to connect up to 11 loudspeakers to the subwoofer. Output channels 1 and 2 are additionally routed to the outside via the XLR sockets ③, so that you can connect the two front channels (L) and (R) directly to the loudspeakers via XLR cables, for example.

Assignment of analog input and output sockets



Analog connection of loudspeakers

Playback of formatted signals from up to 11 main channels and 1 LFE channel with analog connection to the bass-managed loudspeakers:

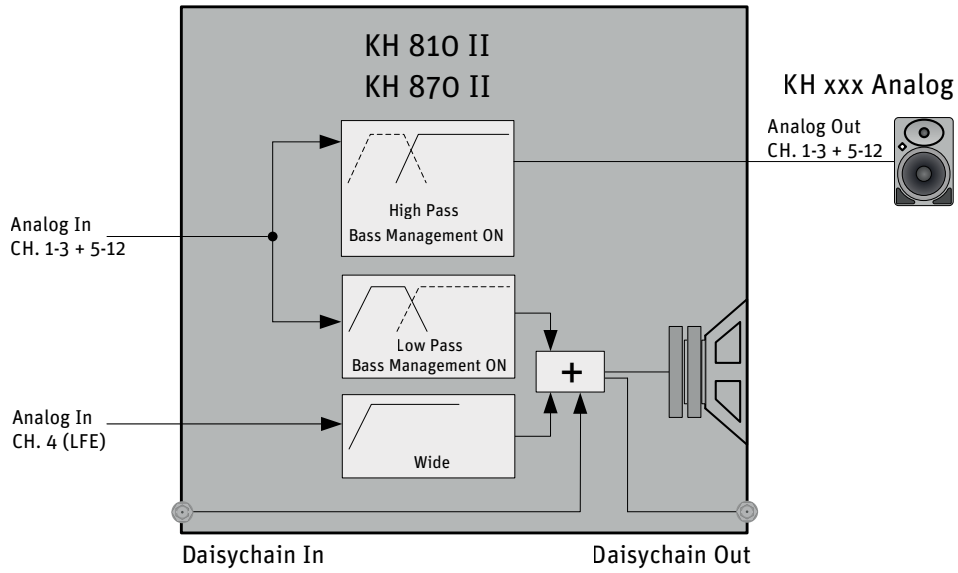


The signals present at analog inputs 1-3 and 5-12 are high-pass filtered (>80 Hz, 24 dB/octave) and passed to the analog outputs to which the loudspeakers are connected.

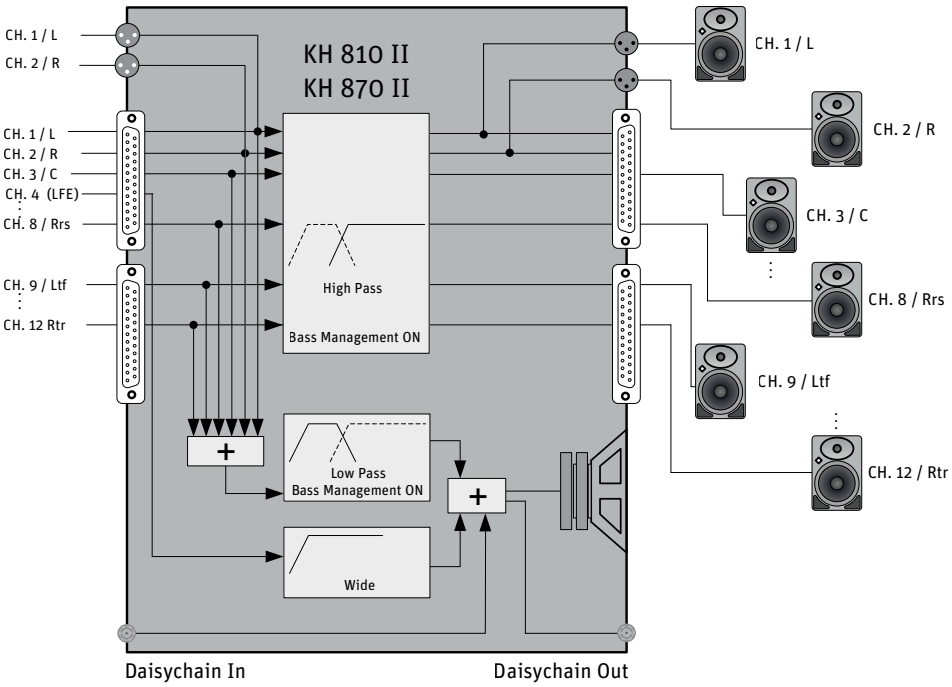
The bass component (<80 Hz, 24 dB/octave) of the CH. 1-3 & 5-12 inputs is added together and played back via the subwoofer itself.

The LFE signal fed in via CH. 4 is added unfiltered to the bass components of all main input channels and is also played back via the subwoofer itself.

Simplified block diagram

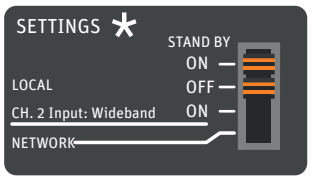


Detailed block diagram

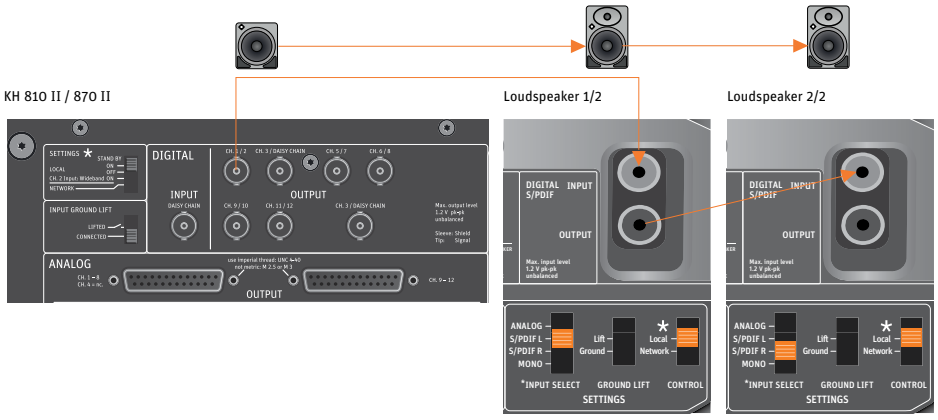


Digital connection of loudspeakers

Playback of formatted signals from up to 11 main channels and 1 LFE channel with digital connection to the bass-managed loudspeakers:



The signals present at analog inputs 1-3 and 5-12 are high-pass filtered (>80 Hz, 24 dB/octave) and passed to the digital outputs to which the loudspeakers are connected. One BNC output socket is assigned 2 channels. With the exception of the center channel, the first loudspeaker of a loudspeaker pair (e.g. CH. 1, L) is connected to the output socket (e.g. CH. 1/2) on the subwoofer, and the second loudspeaker (e.g. R, CH. 2) of this pair is connected to the output socket of the first loudspeaker.

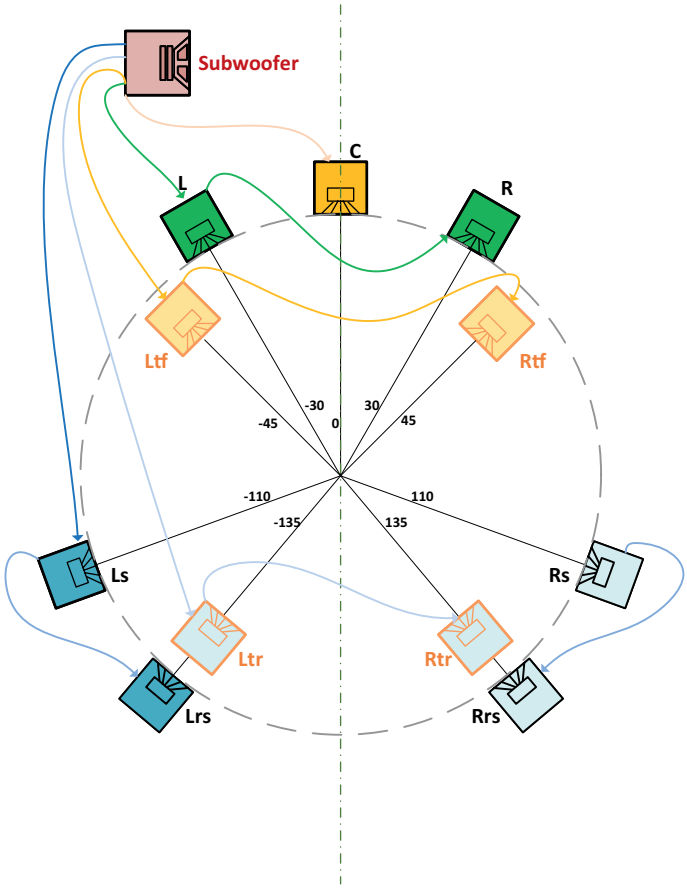


The bass component (<80 Hz, 24 dB/octave) of all main input channels is added together and played back via the subwoofer itself.

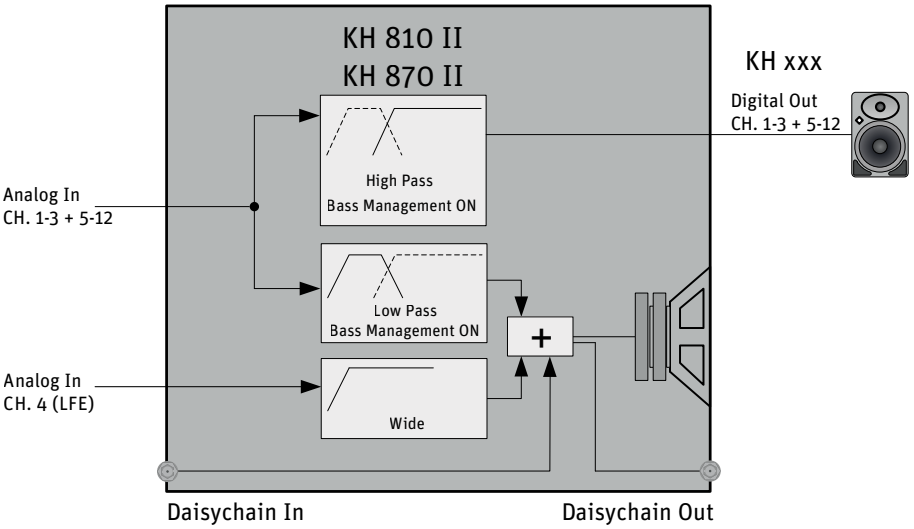
The LFE input signal is fed in via input channel 4 and is added unfiltered to the bass components of all main input channels and is also played back via the subwoofer itself.

The digital daisy chain input, coming from a subwoofer connected upstream, or the digital output for daisy-chaining the internally mixed low-frequency signal to further subwoofers are not supported in Local mode.

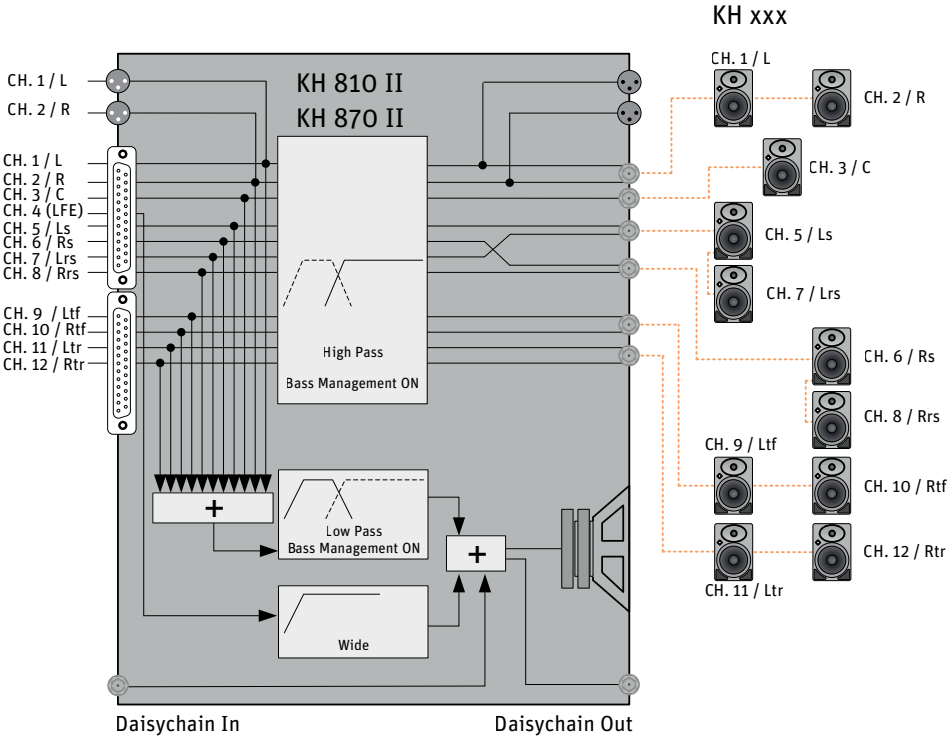
AES3 cabling



Simplified block diagram



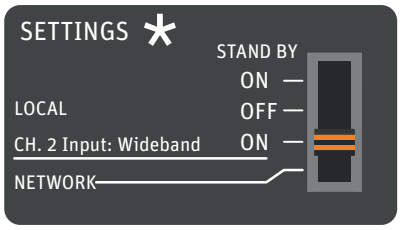
Detailed block diagram

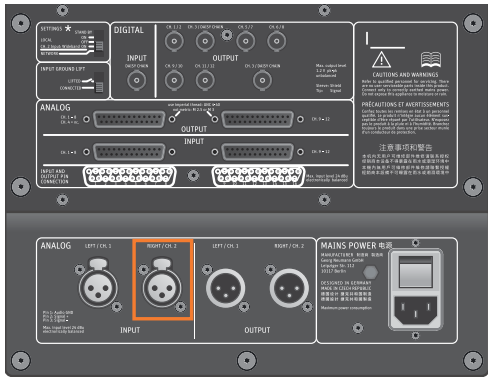


Playback of signals without band limitation via XLR (socket 2):

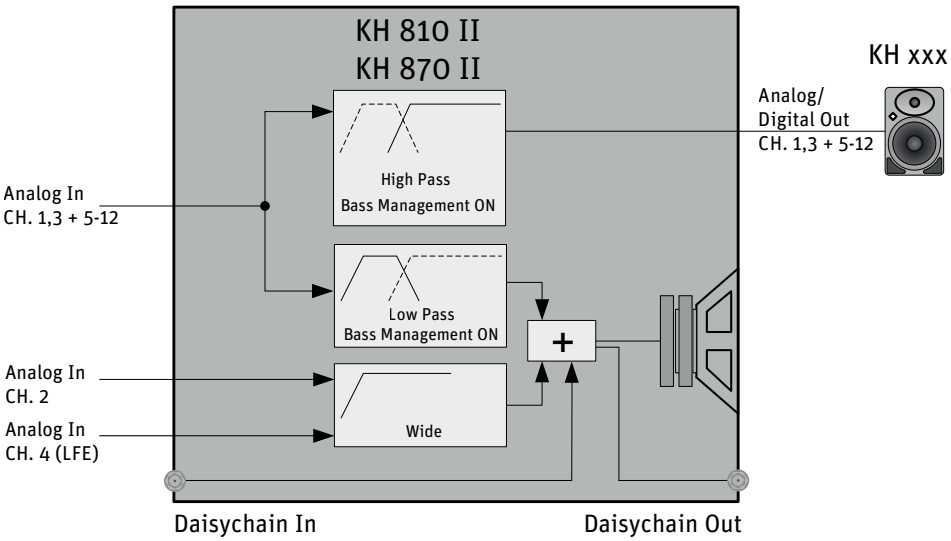
This configuration allows an LFE signal or external bass management to be easily connected to the subwoofer via XLR. The input signal fed in via inputs 2 or 4 is played back unfiltered via the subwoofer itself.

Apart from the function of the CH. 2 input, the remaining cabling is otherwise identical to Local mode as described above.





Simplified block diagram



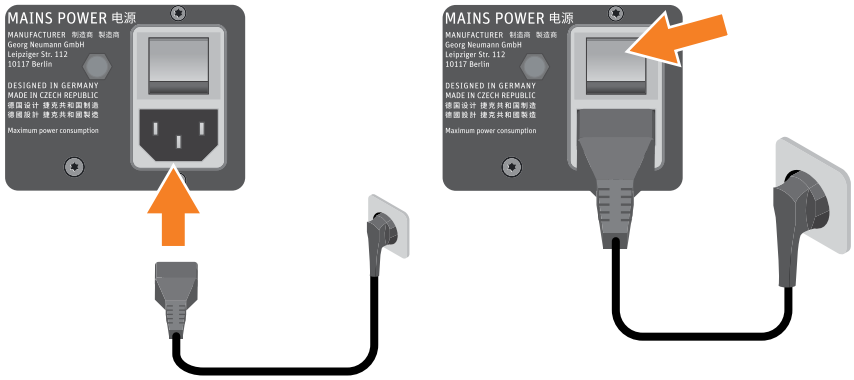
Connecting network cables

To use the functionality of the separately available MA 1 software, the subwoofer must be connected to a computer via a network.

To do this, use a standard Ethernet cable (Cat 5 or higher; not included with delivery) to connect directly to the network port on the computer or to a network to which the machine is also connected.

For audio-side connection of the subwoofer in other scenarios, see the instructions in the software and the online manual.

Connecting/disconnecting the subwoofer to/from the mains power supply



To connect the subwoofer to the power supply system:

- ▶ Make sure that the MAINS POWER switch is set to “OFF”.
- ▶ Connect the IEC connector of the supplied mains cable to the IEC mains socket.
- ▶ Connect the wall plug on the mains cable to a suitable wall outlet.

To disconnect the receiver from the power supply system:

- ▶ Set the MAINS POWER switch to “OFF”.
- ▶ Pull the wall plug out of the wall outlet.

There is an approximately five second delay before sound can be heard from the subwoofer and the loudspeakers connected to the outputs in order to avoid noises (pops) from preceding equipment switched on at the same time. Conversely, switching off the subwoofer immediately mutes the audio.

Configuring and using the subwoofer

You can switch the subwoofer **on and off** using the MAINS POWER switch.

Set the MAINS POWER switch to:

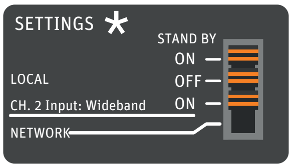
- ▶ “ON” to switch the subwoofer on. The Neumann logo on the front glows red for approximately 5 seconds. Meanwhile, the subwoofer is muted (see below). The Neumann logo then glows white.
- ▶ “OFF” to switch the subwoofer off. The Neumann logo glows red for a few seconds and then switches off. The subwoofer mutes immediately when it is switched off.

Functionality of the Neumann logo

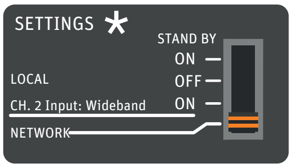
Action Firmware activities	Display of the front Neumann logo
Subwoofer is booting up	Solid red
Subwoofer boot up error	Flashing red
Subwoofer firmware is being updated	Solid pink
Subwoofer resetting to factory default settings	Flashing red
Normal operation	
Operating normally	Solid white
Subwoofer system output level is muted (mute activated in MA 1)	Solid pink
Protection	
Protection system is activated (takes priority over other indications)	Red
Configuration with MA 1	
Setup: Identify the subwoofer	Flashing pink

SETTINGS switch

Local / Network



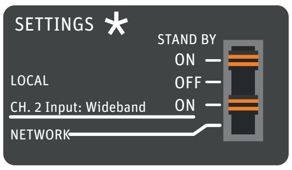
The SETTINGS switch selects the operating mode for controlling the subwoofer. In the top 3 switch positions (Local), the subwoofer behaves as described in this manual. The subwoofer can only be controlled using the switches on the backplate. The subwoofer does not respond to network commands from the MA 1 Automatic Monitor Alignment software.



In the bottom switch position (Network), the subwoofer can only be configured via the MA 1 Automatic Monitor Alignment software. You can find out more about the advantages and functionality of MA 1 at https://www.neumann.com/en-us/produkte/monitor-accessories/ma-1

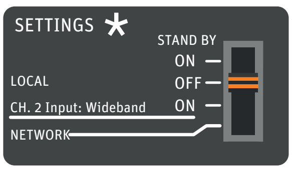
All settings made in MA 1 and transferred to the subwoofer remain permanently stored in the subwoofer. This is also the case if the network cable has been removed, the subwoofer has been switched off and on again, and/or the SETTING switch has been temporarily set to the Local position. Thus, by switching between NETWORK and one of the upper LOCAL positions, a simple A/B comparison can be made between the configuration carried out with MA 1 and the factory setting. If the MA 1 Automatic Monitor Alignment software has not been connected to the subwoofer before, the default settings will be used in Network mode.

Stand By

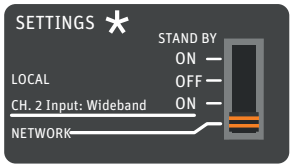


When the SETTING switch is set to either of the two Stand By ON positions, the subwoofer enters Stand By mode after 20 minutes with no or very low analog input signal present. If the digital input has a valid clock from a digital source, the subwoofer does not go into Stand By mode.

In Stand By mode, the network interface, signal connectivity, amplifiers and main power supply are switched off. The subwoofer wakes up from Stand By mode as soon as a sufficiently strong audio signal is present at the analog input or a valid digital signal is present at the digital input. The time taken to resume normal operation and hear sound is 5 seconds. The subwoofer can also be awakened from Stand By mode by moving the SETTINGS switch to another position or by turning the power switch off and on again.



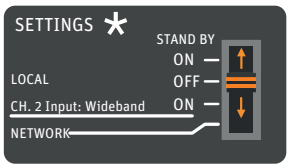
In the Stand By OFF switch position, the subwoofer does not go into Stand By mode.



In the Network switch position, the status byte behavior is determined by the settings in the MA 1 Automatic Monitor Alignment software.

The power consumption of the subwoofer is significantly reduced in stand by mode (from over 30 W to less than 0.5 W). This reduces energy consumption and the associated costs, as well as heat loss, which lowers the temperature in the room and reduces the strain on the electronic components in the device, thereby extending its service life. We therefore recommend that you always leave the automatic stand by function activated.

Resetting the subwoofer settings



To reset the internal parameters to the factory settings:

- Switch on the subwoofer.
- While the front Neumann logo is solid red during the boot up phase, quickly move the SETTINGS switch up and down repeatedly until the logo turns to white for a few seconds. The logo then flashes red until all values are reset to the default settings. The logo then glows white.

A reset restores all data and parameters entered in the device via MA 1 or otherwise to the factory settings. Any previously created alignment will be deleted. Factory calibration data is retained.

Firmware update

Firmware updates are done via the MA 1 – Automatic Monitor Alignment software. When you open the MA 1 software, it scans the network for connected subwoofers and checks if the firmware is up to date. If a firmware update is required, you will be notified. Follow the instructions shown on screen. The update only takes a few minutes.

The Neumann.Control iPad app is no longer supported and is not compatible with this subwoofer. Please do not use this app with the subwoofer.

Calibrating the subwoofer

The subwoofer is designed to optimally interact with the attached loudspeakers and the monitoring environment. The best results can be achieved in conjunction with the MA 1 Automatic Monitor Alignment system (available separately).

Automatic calibration

The MA 1 software, in conjunction with the MA 1 measurement microphone, determines a room-specific target curve via a series of measurements, to which the loudspeaker system is adjusted. For this purpose, the acoustically relevant parameters (frequency response, reverberation, consistency, reflections, phase behavior, etc.) of the loudspeakers' interaction with the subwoofer and with the room are analyzed and, taking into account these parameters, correction data is computed, which is then in turn transmitted to the subwoofer and possibly loudspeaker.

We therefore strongly recommend the use of this MA 1 system in conjunction with the subwoofers.

Manual calibration

If you are using the subwoofers without the MA 1 software, please proceed as follows:

- First, adjust the frequency response of the loudspeakers to the environment and the room acoustics using their acoustical controls (see the instruction manual of the loudspeakers).

Application	Recommended frequency response	Comments
Studio	Flat	A largely flat response ensures neutral reproduction. Different reverberation times and listening distances may require a deviation from a flat frequency response.
Film	X-curve shape	ANSI/SMPTE 202M: the shape of the X-curve depends on the size of the room.
Home	Subjective evaluation	Not necessarily a flat response; a gently downward sloping response with increasing frequency is often preferred.

All the loudspeakers in the system should have the same level at the listening position. This is often measured using a pink noise test signal that is set to -18 dBFS (Europe) or -20 dBFS (USA) on the mixing console's output level meters and a sound pressure level meter set to "C-weighted" and "slow".

- Before adjusting the level, the loudspeakers must be adapted to the listening conditions.
- To do this, connect all loudspeakers directly to your signal source or the measuring system, bypassing the subwoofer, so that the loudspeakers reproduce the complete frequency response applied, and the bass component is not reproduced via the subwoofer.
- Then adjust the frequency response of all loudspeakers individually using their acoustical switches (see loudspeaker instructions) to a flat or other desired frequency response, which should be the same for all loudspeakers if possible.
- Then loop the subwoofer back into the signal path. The applied signal is then divided by frequency, so that the bass component (<80 Hz) of all applied signals is played by the subwoofer and the high-frequency component (>80 Hz) is played by the loudspeakers.
- Adjust the level of the connected loudspeakers to the level of the subwoofer using their level adjusters (see the loudspeaker instructions).

A: Calibration using an acoustical measurement system

Calibrating the frequency response and sound pressure level with an acoustical measurement system should always be the first choice if calibration using the MA 1 Automatic Monitor Alignment software is not an option, as this achieves the highest accuracy. This method is described below.

B: Calibration using Neumann test signals

In the absence of an acoustical measurement system, you can adjust the level of your subwoofer using Neumann test signals (see page 23).

C: Calibration with music signals

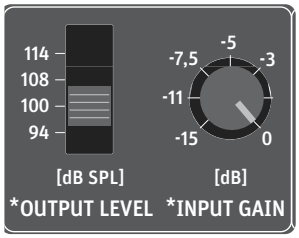
A calibration by means of music signals is also possible but should always be the last choice.

A. Calibration using the backplate controls and an acoustical measurement system

Adjustment of the level between the subwoofer and the loudspeakers is made via the controls on the loudspeakers (see the instructions of the respective loudspeakers).

The frequency response of a subwoofer depends on its position in the room and on the room geometry. The same subwoofer installed in different positions in the same room may require different settings on the loudspeakers' level adjusters.

The following table shows the level settings to use as start values on the connected monitors.



Subwoofer position	Setting the potentiometers on the loudspeakers INPUT GAIN | OUTPUT LEVEL
In a corner	+0 dB | 108 dB SPL
Next to or flush mounted in an acoustically solid wall (e.g. brick, concrete)	-4 dB | 108 dB SPL
Next to or flush mounted in an acoustically soft wall (e.g. gypsum)	-6 dB | 108 dB SPL
Free standing in a room without acoustic treatment	-6 dB | 108 dB SPL
Free standing in a room with acoustic treatment	0 dB | 100 dB SPL

- Check the frequency response at the listening position using your acoustical measurement system: In enclosed spaces, significant deviations from a flat frequency response can easily occur due to reflections and spatial modes. Try to minimize this when positioning the subwoofer in the room (see also chapter "Positioning the subwoofer").
- Measure the sound pressure level of each channel (subwoofer and loudspeaker) at the primary listening position.
- Adjust the sound pressure level of the loudspeaker so that the level of the frequency response of the subwoofer below 80 Hz corresponds to the level of the frequency response of the loudspeakers above 80 Hz. Depending on the properties of the room, slightly reducing the level of the loudspeakers (1-2 dB) may result in more neutral playback.

Your system is now configured.

B. Calibration using the backplate controls and Neumann test signals

- Download the Neumann test signals and the instructions for use (PDF file, in English) from the KH 810 II / KH 870 II product page at www.neumann.com.
- Follow the steps described there.

C. Level adjustment with music signals

- Remove the subwoofer from the signal path by connecting your signal source directly to the loudspeakers.
- Feed music signals into your loudspeaker system that range down to the lower loudspeaker limit frequency.
- Play only one channel, preferably L, R, or Center.
- Focus on bass depth response.
- Connect the subwoofer to your system by connecting the signal source to the appropriate subwoofer input and the loudspeakers to the appropriate subwoofer output.
- Compare the bass depth response. Decrease or increase the level on the loudspeaker until its bass level matches that of the subwoofer.
- Repeat this procedure several times if necessary.
- Now adjust the level of all other loudspeakers to match that of the first matched loudspeaker. To do this, it is best to play a broadband signal (e.g. pink noise) that is as constant as possible, first on the loudspeaker that has been balanced first and then on all others, and match the levels to each other.

Compensating for time of flight differences

The subwoofer is designed to be optimally adapted to the listening conditions using the MA 1 Neumann Monitor Alignment software. This software is also able to compensate for differences in time of flight and associated phase differences between loudspeakers and subwoofer. To ensure crisp bass depth response, it is important that the signals emitted simultaneously from the subwoofer and loudspeakers have the correct playback timing. It is not possible to adjust the time of flight using the setting options on the subwoofer and the acoustic switches on the loudspeakers.

To ensure that the signal components from the subwoofer and loudspeakers add together well in the 80 Hz crossover frequency range, proceed as follows:

- Position the subwoofer at a distance to the listening position that is similar to that of the front loudspeakers L and R.
- Download the “Test Signals and Instruction for Setting up Subwoofer-based Systems” from the Neumann website.
- Adjust the level between the subwoofer and the loudspeakers as described above.
- Play the narrowband pink noise (4 - Pink Noise 75Hz-85Hz) from one loudspeaker (e.g. L) and the subwoofer. Set the SETTINGS switch to one of the two upper positions.
- Move the subwoofer or loudspeaker toward or away from the listening position until it reaches its highest level at the listening position. The difference over which this shift takes place should not be more than about 1 m.
- Verify the result using test signals 7 and 8 and verify that these signals have crisp playback. If necessary, repeat the procedure.

Bass management processing

Outputs

The subwoofer outputs (Analog or AES3) always emit the same signal.

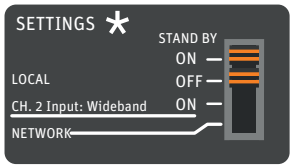
The sampling rate on the digital output is fixed at 48 kHz.

At the loudspeaker outputs, the input signal is present at the same level but is bass-managed, i.e. with an 80 Hz, 24 dB/octave high-pass filter.

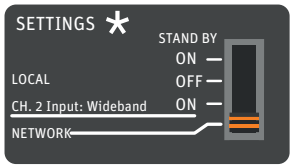
In Network mode, the signal connectivity applied to the analog and digital outputs depends on the configuration of the subwoofer.

- If the satellites are configured as analog studio monitors using MA 1, bass management is active at the analog outputs with an 80 Hz high-pass filter (global bass management). The alignment made with MA 1 is also applied to the outputs.
- If KH 80 DSP are configured as satellites using MA 1, bass management is active at the analog outputs with an 80 Hz high-pass filter (global bass management). Optional MA 1 room alignment is applied within the KH 80 DSP loudspeakers.
- If Neumann DSP studio monitors other than the KH 80 DSP are configured as satellites using MA 1, e.g. KH 120 II or KH 150, the input signal remains unchanged at the analog and digital AES3 outputs, without a high-pass filter and without MA 1 alignment (distributed bass management). Both high-pass filtering and alignment are applied to the satellites.

LOCAL



NETWORK



Analog output assignments

	SETTINGS			
	LOCAL		NETWORK	
Loudspeakers	Any	KH 120, KH 310, KH 420	KH 80 DSP	KH 120 II, KH 150
MA 1 correction	—	In the subwoofer output	In the loudspeaker	In the loudspeaker
Bass management (80 Hz X-over)	In the subwoofer output. Always active	In the subwoofer output. When MA 1 is enabled	In the subwoofer output. When MA 1 is enabled	In the loudspeaker. When MA 1 is enabled

Remote control of bass management (MA 1 required)

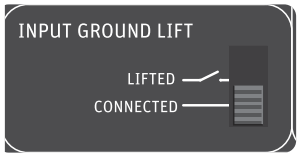
It is possible to activate and deactivate the bass management filters remotely using the MA 1 Automatic Monitor Alignment software. This allows you to listen to the source as if there is no subwoofer connected in the system because the loudspeakers play the full frequency range without filtering when bass management is deactivated and the subwoofer only reproduces the CH. 4 signals.

Connecting the LFE input

The LFE input (CH. 4, or CH. 2 and CH. 4 in “CH. 2 Input Wideband” mode) is primarily used to connect the effects channel (LFE) contained in the multi-channel source signal. This LFE signal should already be low-pass filtered (usually 120 Hz) on the source side. This signal is played back via the subwoofer without any further low-pass filtering and the subwoofer plays only the signals present in CH. 4.

Furthermore, this input is used if there is separate bass management processing upstream of the subwoofer, e.g. a monitor controller, a DAW ... with integrated bass management or an AV amplifier with activated bass management and loudspeakers set to “small”. In addition, this input is used when a discrete LFE output from a source device is connected directly to the subwoofer (i.e. after coding of the program material). This mode prevents double filtering of the bass-managed signal.

Activating ground lift



If you can hear a humming or buzzing noise coming from the woofer of the subwoofer, first search for the cause of the noise:

- Disconnect all input and output signal cables from the subwoofer. If the noise disappears, it is probably coming from the audio source or source cabling. It might be possible to eliminate the noise by disconnecting the ground from the input signals (activating ground lift). To activate ground lift:
- Reconnect the signal cables and set the switch INPUT GROUND LIFT ⑥ to “LIFTED”.

This disconnects pin 1 of all XLR input sockets and the ground pin (G) of the SUB-D input sockets internally from the chassis ground of the subwoofer electronics (see table on page 11).

CAUTION
Risk of fatal injury!

For safety reasons, the electronics chassis ground is always connected to the ground contact of the power supply.

- Never disconnect the ground contact of the power cable from ground.
- Even if ground lift is enabled, the power supply ground connection remains connected to the device chassis.

Cleaning and maintaining the subwoofer

CAUTION
Damage to the product caused by liquids!

Liquids entering the product can cause a short-circuit in the electronics and damage or even destroy the product.

- Keep all liquids away from the product.

- Before cleaning, disconnect the product from the mains power supply (see page 19).
- Use a soft, dry, and lint-free cloth to clean the product.

Troubleshooting

Problem	Cause	Solution
There is a hum or buzz coming from the subwoofer when an analog audio cable is connected.	A cable is defective, the cabling is bad, there is ground loop in the installation or the level of the audio source is too low.	Check all the cabling to eliminate the cause of the fault, do not run signal cables parallel to power cables, use balanced cables, use the ground lift switch (see page 26).
There is a sudden reduction of the subwoofer's output level, the Neumann logo (1) changes from white to red, the output level is reduced.	The temperature of the power amplifier or the electronics is too high.	Ensure sufficient ventilation of the subwoofer and/or reduce the input signal level, or add extra subwoofers to increase LF headroom. When the temperature has dropped again, the Neumann logo (1) glows white and the output level reduction is canceled.
The Neumann logo glows red when the input signals are low frequency.	The signal level is too high, the protection system is active.	Reduce the signal level or add additional subwoofers to increase the LF headroom.
The Neumann logo does not light up or is dimmed.	The logo is switched off or dimmed via the MA 1 software.	Connect the subwoofer to your network and use MA 1 to set the logo brightness to the desired value.
The Neumann logo does not light up, the subwoofer produces no sound.	The device's main internal fuse has blown.	Have the product checked by an authorized Neumann service partner.
	The subwoofer is in Stand By mode.	Disable Stand By mode by sending audio signals to the subwoofer at a sufficient level, or by turning the subwoofer off and back on.
The subwoofer sounds very "thin" in the bass. The bass depth response is very low.	Incorrect wiring in the analog audio cable.	Check the cabling, especially if unbalanced cabling has been used - see the cable wiring digram on page 11.
No signal is coming out of the subwoofer and the connected loudspeakers.	The subwoofer is on Network mode (8) and the level is greatly reduced by MA 1.	Switch the subwoofer to Local (8) or connect it over your network to a computer with the MA 1 software installed. Raise the level there.
The subwoofer is behaving abnormally. None of the above will solve the problem.	The microcontroller has frozen or contains corrupt data.	Reset the microcontroller: see "Resetting the subwoofer settings"

For further information, please refer to the "Questions & Answers" section at www.neumann.com.

Specifications

For a complete list of the product specifications please refer to the product page at www.neumann.com.

Product properties		
Mains voltage		100 to 240 V ~, 50/60 Hz
Power handling (Stand By / idle / maximum performance)	(KH 810 II) (KH 870 II)	<0.3 W, 35 W, 252 W <0.3 W, 41 W, 510 W
Dimensions (H x W x D)	(KH 810 II) (KH 870 II)	368 x 330 x 645 mm 737 x 330 x 645 mm
External volume	(KH 810 II) (KH 870 II)	78 l 157 l
Weight	(KH 810 II) (KH 870 II)	25.5 kg 44.5 kg
Driver	(KH 810 II) (KH 870 II)	1 x 265 mm (10") 2 x 265 mm (10")
Cabinet surface finish, color		Painted wood (MDF and multiplex), metallic anthracite (RAL 7021), painted back panel (RAL 9005)
Driver protection		Metal grille (RAL 9005)
Temperature		
Operation and storage, unpacked		+10 °C to +40 °C
Transport and storage, packed in original packaging		–25 °C to +60 °C
Relative humidity		
Operation and storage, unpacked		Max. 75% (non-condensing)
Transport and storage, packed in original packaging		Max. 90% (non-condensing)

Acoustical measurements and block diagram

Additional technical information such as acoustical measurements and a block diagram of the subwoofer can be found on the product page at www.neumann.com.

Trademarks

Neumann® is a registered trademark of Georg Neumann GmbH. The following are trademarks of Georg Neumann GmbH:

- Plane Wave Bass Array™
- PWBA™
- Neumann.Control™

iPad® is a trademark of Apple Inc., registered in the U.S. and other countries.

Other company, product, or service names mentioned in this operating manual may be the trademarks, service marks, or registered trademarks of their respective owners.

Technical information & glossary

Absolute level

In Europe, the absolute level of 0 dBu is –18 dBFS (EBU standard R68). In the US, +4 dBu is –20 dBFS (SMPTE standard RP155). These dBu values should lead to the following sound pressure levels:

Application	Sound pressure level
Film	85 dB(C)
Broadcast	79 dB(C) (reference level)
Music	No defined reference levels

Near field loudspeakers can be as close as 1 m from the listening position, whereas loudspeakers in a Dolby® certified movie mixing room should be at least 5 m from the listening position.

In the examples below, it is assumed that the listener is inside the room radius and thus the sound field decays according to 20 $\log_{10}$ (r) (level reduction of 6 dB as distance doubles). However, this may not always be the case.

Absolute voltage level of input signal	0 dBu (0.775 V)	+4 dBu (1.23 V)
Setting SUBWOOFER GAIN | INPUT GAIN ⑫	–1 dB	–5 dB
Setting SUBWOOFER GAIN | OUTPUT LEVEL ⑪	100	100
Listening distance [m] (dB change)	5 m (–14 dB)	5 m (–14 dB)
Measured output level in dB SPL at 1 m	85 dB SPL	85 dB SPL
Maximum input signal before activation of the protection system	17 dBu	17 dBu

Absolute acoustic level calibration for signal channels is generally achieved using a sound pressure level meter set to “C-weighted” and “Slow”. Play a broadband pink noise test signal set to –18 dBFS (Europe) or –20 dBFS (USA) on the meters of the mixing console and measure the sound pressure level at the listening position. Then adjust each channel’s source level, not the loudspeakers and subwoofer(s) so that the above stated sound pressure levels are achieved.

Acoustical axis

The acoustical axis is a line perpendicular to the subwoofer’s front panel along which the microphone was placed when tuning the subwoofer’s crossover during design. The acoustical axis is located at the midpoint of the subwoofer’s bass driver. Note that the subwoofer emits very low frequencies which are emitted omnidirectionally. That is why the orientation of the subwoofer cabinet in the room does not matter.

Acoustical output level

The subwoofer provides an output level of 100 dB SPL at a distance of 1 m under free-field conditions when an input signal with a level of 0 dBu is applied in its frequency response range.

Depending on the location of the subwoofer in the room, its output level changes as follows:

Subwoofer position	Free field	On the floor	Against a wall	In a corner
Change in output level	0	6	12	18

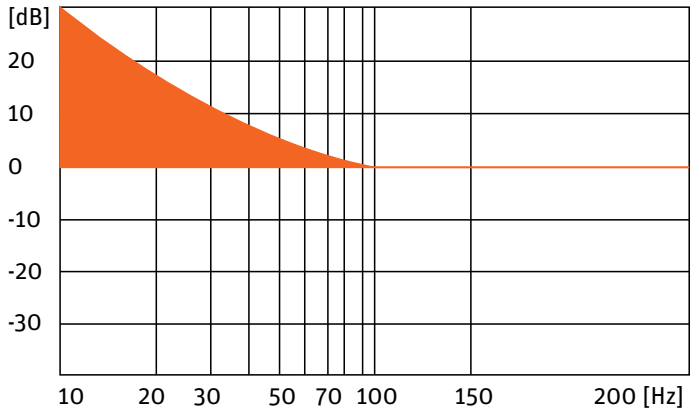
In the free field, the output level decreases by 6 dB each time the distance doubles. Especially in the low-frequency range where the subwoofer operates, the conditions in the room are significantly different. In this case, a considerably lower level decrease is to be expected.

Acoustical response

Neumann subwoofers are designed to have a flat frequency response in anechoic rooms. When a subwoofer is installed in a listening environment, the frequency response changes. This depends on the subwoofer's location and the dimensions and behavior of the room and will probably be different for the same subwoofer type installed in different locations in the same room. Even changing the subwoofer position by as little as 50 cm can drastically change the frequency response, requiring an adjustment back to a flat frequency response.

The best way to achieve this is to use the MA 1 Automatic Monitor Alignment software, which optimally adapts the subwoofer to the environment and the interaction with the loudspeakers.

One factor that affects the frequency response of the subwoofer is room gain. This causes the level at low frequencies to rise by approx. 12 dB/octave in enclosed spaces. The cut-off frequency of this effect is inversely proportional to the room size. So, the smaller the space, the higher the frequency at which the level rises at low frequencies.



The majority of the acoustical effects listed here, which result from the interaction of the subwoofer with the room, lead to an increase in the output level. It is therefore very likely that the reproducible maximum sound pressure of the subwoofer is significantly higher than the free-field or half-space levels specified in the technical data.

Acoustical controls

The acoustical controls on the backplate of the loudspeakers are low-order DSP filters designed to compensate for some of the acoustical issues commonly found in listening environments. Their settings depend on the installation location and the acoustical properties of the room. There are three things to consider when configuring subwoofers: Resonances in the room, as well as levels and phase in relation to the main loudspeakers.

Bass management In this manual, bass management refers to the handling of low-frequency signal components of the available channels.

Bass management separates the low frequencies (<80 Hz) of all available main channels (up to 7 lower channels and 4 ceiling channels) from the higher frequencies (>80 Hz), adds them up and passes them to the subwoofer. The signal components above 80 Hz are forwarded directly to the connected loudspeakers.

Furthermore, the low-frequency effects channel LFE is also added to the bass component of all channels without filtering and is reproduced via the subwoofer. This thus transmits the frequency range of all main input channels from below 18 Hz to the cut-off frequency of 80 Hz, as well as the complete spectrum of the LFE channel.

Crossover Using 4th order filters, the crossover divides the input signal of each main channel into two bands for reproduction by the subwoofer or the main loudspeakers. The crossover frequency for the main channels is 80 Hz. This frequency was chosen to achieve the best compromise between conflicting requirements: on the one hand, a high crossover frequency to relieve the main loudspeakers of their low-frequency duties while reducing distortion and having the lowest possible group delay, and on the other hand, the need for a low crossover frequency to minimize the chances of localizing the subwoofer, which provides greater flexibility when positioning the subwoofer in the room. In addition, by choosing 80 Hz, there is a compatibility with the replay conditions commonly found in consumer products.

Loudspeakers In this manual, loudspeaker refers to wide-range studio monitors that act as a satellite in conjunction with the subwoofer.

When operating with the subwoofer and with bass management enabled, the signal on each channel is split into the low frequency (<80 Hz), which is played back through the subwoofer, and the high frequency (>80 Hz), which is heard through the loudspeaker.

Power amplifier The high efficiency power amplifier of the subwoofer minimizes power dissipation and is run in bridged mode to minimize distortion.

LFE channel “Low Frequency Effects” (Dolby®) or “Low Frequency Enhancement” (dts®). The LFE channel has a limited bandwidth. Because of the limited frequency range of the LFE channel, it is referred to as “.1” when describing, for example, a 5.1 or 7.1.4 system. The designation “LFE channel” and the format specifications (5.1, 7.1, 9.1.4, etc.) always refer to the source channels and not to the loudspeaker arrangement.

Protection system A comprehensive protection system prevents damage to the subwoofer if excessive levels are requested. The logo display will then change from white to red, indicating that the protection system is active. In this case, reduce the input signal level. If this happens regularly, use a larger subwoofer with a higher possible maximum level or add more subwoofers to the system to increase the LF headroom.

The protection system consists of peak limiters that prevent the amplifier from starting to distort when the levels are too high and the woofer from reaching its maximum excursion and becoming distorted or damaged. It also incorporates thermal protection circuitry that protects the driver from excessive continuous stress and protects the electronic system from overheating. The protection system cannot protect the subwoofer during excessive use, e.g., prolonged operation of the subwoofer while the logo is glowing red. Avoid excessive use of the subwoofer so as to not compromise the product’s long service life.

Signal routing

For analog signals, the subwoofer has two input channels and two output channels: LEFT / A and RIGHT / B, which are connected via XLR sockets. In addition, a total of 12 analog inputs via 2 SUB-D 25 sockets and 11 analog and digital outputs are available for connecting the loudspeakers via SUB-D 25 (analog) and BNC (digital AES3).

When the SETTINGS switch is in the upper two positions, the electronically balanced input stages are followed by an 80 Hz fourth order high-pass filter for the main channels, followed by electronically balanced analog output stages and digital outputs.

Channel 4 of the SUB-D input socket is used to connect the LFE channel of the source. This input passes the applied signal unfiltered to the subwoofer. Channel 4 of the analog SUB-D output socket is therefore not assigned.

At switch position CH.2 Input: Wideband, the analog input channel 2 (XLR and SUB-D) is identical to the LFE input 4 of the SUB-D socket. This input is suitable if bass management is carried out via an external device and the sum of the already low-pass filtered main channels is routed to the subwoofer. No additional low-pass filtering is then performed in the subwoofer. No additional SUB-D 25 to XLR adapters are required.

All other input channels behave identically to local switch positions 1 and 2.

All outputs have protection circuits to avoid power on/off noises: The outputs switch on after a short delay when the power supply is applied/switched on and mute instantaneously when the power is removed.

Additionally, you can operate several subwoofers using Y cables.

Daisy chain

Note!

The digital daisy chain input and output is only supported in Network mode, not in Local mode. Signals present at the daisy chain input are played back via the subwoofer, but they do not add up correctly to an upstream subwoofer, as its latency cannot be taken into account in the arrangement.

The signal output at the daisy chain output can thus not be used in Local mode for integration into a multi-subwoofer system.

Subwoofer

The subwoofer is the bass loudspeaker described in this manual, through which the bass component of all main channels and the LFE channel are played back.

Driver

The long throw, efficient, low-distortion bass loudspeaker ensures precise playback even at high volumes.