



Product

Selection Guide

Studio Products



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Introduction

The choice of a loudspeaker or subwoofer from the Klein + Hummel Studio Systems range depends on a number of factors:

- System configuration
- Listening distance / room volume
- Required low frequency cut-off / replay level
- Available space
- Budget

Furthermore, the system should be balanced, i.e. one component in the system is not weaker than the rest of the system. For example, a system with under-specified subwoofer(s) will have limited low-frequency headroom. Or a system with small rear loudspeakers will struggle with high level sound panned to the rear channels.

It is possible to deliberately under-specify the entire system whilst keeping it balanced: the cost of this is limited maximum SPL and/or LF cut-off, but the system will be smaller and cheaper. Alternatively, one can deliberately over-specify the entire system whilst keeping it balanced: the advantage is that the system's distortion will be lower for a given replay level, however the cost is higher and more space is required.

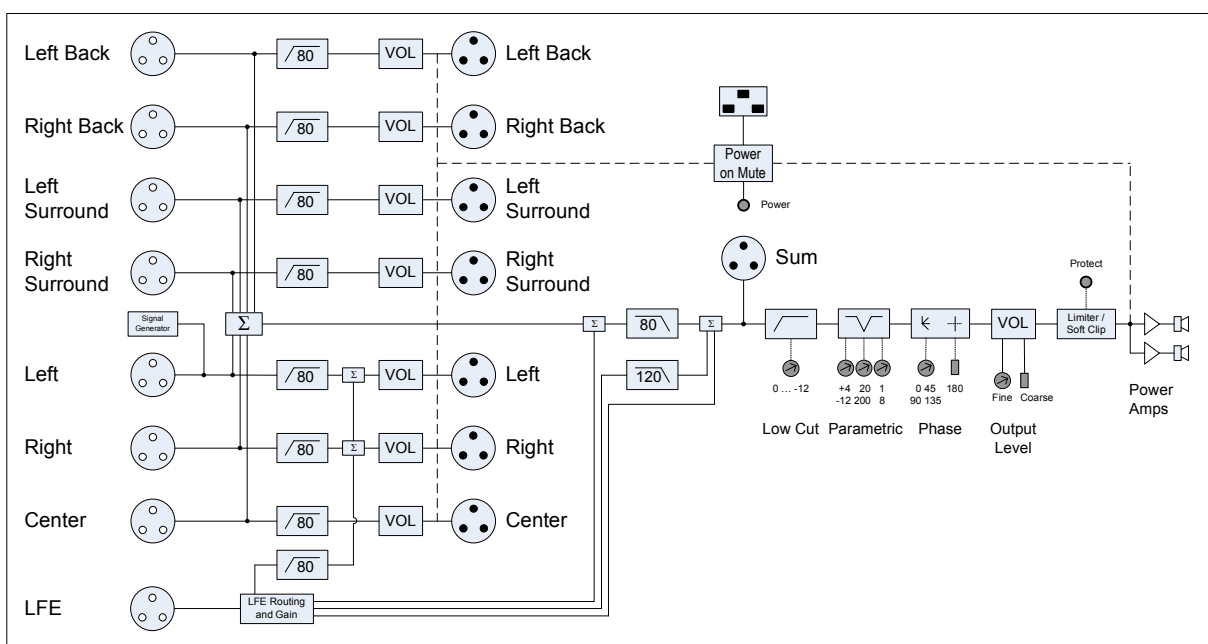
One exception to this is over-specified subwoofer(s), which will have reduced low-frequency distortion resulting in a cleaner sounding bass.

Bass Management

Bass management redirects the LF energy of the main channels and some, or all, of the LFE channel energy to the subwoofer(s) in the reproduction system. The advantages of bass management are:

- Subwoofer extends the LF cut-off of the system downwards
- Higher maximum system SPL
- Lower distortion
- Same phase, level, and frequency response of low frequency energy of the main and LFE channels
- Same coupling of the low frequency energy to the room on all main channels
- More flexibility in coupling the low frequency energy to the room as the subwoofer can be moved

A block diagram of the Klein + Hummel 7.1 Channel High Definition Bass Manager™, as fitted to the **O 810** and **O 870** subwoofers is shown below:



Note that the **O 800** has a 3-Channel bass manager, no volume control, and a reduced acoustical control set.

Listening Distance

To choose the appropriate **front** loudspeakers for your system, first use the listening distance to the front loudspeakers to find a model in the table below that fits within the **recommended** listening distance range column. Do not select a model where the listening distance is less than the **minimum** or greater than the **maximum** values shown. In all cases, the **front** loudspeakers (including the center) should be the same as each other.

Product	Most Common Application	Listening Distances		
		Minimum	Recommended	Maximum
O 500 C	Far-field monitoring	1.5 m (5')	2.0 - 3.0 m (6' - 9')	15 m (45')
O 410	Mid-field monitoring	1.25 m (4')	1.5 - 3.0 m (5' - 9')	11 m (33')
O 300 (D)	Near-field monitoring	0.75 m (2.5')	1.0 - 2.5 m (3' - 8')	6 m (18')
O 110 (D)	Near-field monitoring	0.75 m (2.5')	1.0 - 2.0 m (3' - 6')	4 m (12')
M 52 (D)	Near-field monitoring	0.6 m (2')	1.0 - 2.0 m (3' - 6')	3 m (9')

In a studio application, the loudspeakers should be placed according to the ITU-R BS.775-1 recommendations so there is consistency of reproduction when compared to other listening environments. For movie applications, ANSI/SMPTE 202M is the preferred standard for system setup. For home use, as materials are mixed in ITU style rooms, one should get as close as possible to this configuration to maximize replay authenticity.

Loudspeaker Name	ITU-R BS.775-1 Angle	ANSI/SMPTE 202M Angle
Left	-30°	-22.5°
Center	0°	0°
Right	30°	22.5°
Left Surround	-110°±10°	An array to the left
Right Surround	110°±10°	An array to the right

For two-channel stereo, $\pm 30^\circ$ should be used. There are currently no internationally agreed standards for 6.1 or 7.1 formats. However common practice is to use one or two loudspeakers in the centre back location of a 6.1 system. In a 7.1 system common practice is to place side loudspeakers at $\pm 90^\circ$ and to push the surround loudspeakers back to $\pm 150^\circ$.

The loudspeaker should be placed on a circle to ensure equal time of arrival of the audio from all loudspeakers. Failing this, appropriate electronic time delays should be added between the subwoofer and each loudspeaker to compensate for time of flight differences.

Balancing the System

Next, the other loudspeakers in the system (if required) should be chosen to match the main loudspeakers chosen.

Rear loudspeakers are typically the same model as the front loudspeakers, although it is possible to reduce the specification if space or budget is limited.

The **subwoofer(s)** should have sufficient output to keep up with the main loudspeakers, but can be over-specified for improved low-frequency system performance. Over-specifying the subwoofer section of system leads to lower LF distortion (cleaner audio), as each subwoofer does not have to work as hard.

Multiple smaller subwoofers (2 - 4 depending on the width of the room) distributed along the front wall create a plane wave that propagates from the front to the back of the room. This has the effect of reducing the interaction of the plane wave with the side wall. The consequence is less excitation of the side-to-side room modes and a better time-domain response. From a sound quality point of view, the low frequency reproduction will be tighter and cleaner. This is called a Plane Wave Bass Array™ (PWBA™).

The table on the next page ensures a well balanced system:

	Fronts	Rears		Subwoofer(s)			- 3 dB LF Cut-off (Max SPL at 3% THD)	
		Recommended	Smaller	Recommended	High Performance	Plane Wave Bass Array™	Without Sub	With Sub
2- Channel Stereo (2.0)	O500C	-	-	2 x O900	4 x O900	3-4 x O900	27 Hz (123.4 dB)	17 Hz (123.4 dB)
	O410	-	-	O870	2 x O870	3-4 x O810	30 Hz (120.0 dB)	20 Hz (120.0 dB)
	O300(D)	-	-	O810	O870	2-4 x O810	35 Hz (112.8 dB)	20 Hz (112.8 dB)
	O110(D)	-	-	O810	O810	2-4 x O810	56 Hz (107.7 dB)	20 Hz (107.7 dB)
	M52(D)	-	-	O810	O810	2-4 x O810	90 Hz (103.0 dB)	20 Hz (103.0 dB)
Matrix Multichannel Dolby Surround (3/1.0)	O500C	O500 C	O410, O300(D), O110(D)	2 x O900	4 x O900	3-4 x O900	27 Hz (123.4 dB)	17 Hz (123.4 dB)
	O410	O410	O300(D), O110(D)	O870	2 x O870	3-4 x O810	30 Hz (120.0 dB)	20 Hz (120.0 dB)
	O300(D)	O300(D)	O110(D), M 52(D)	O810	O870	2-4 x O810	35 Hz (112.8 dB)	20 Hz (112.8 dB)
	O110(D)	O110(D)	M52(D)	O810	O810	2-4 x O810	56 Hz (107.7 dB)	20 Hz (107.7 dB)
	M52(D)	M52(D)	-	O810	O810	2-4 x O810	90 Hz (103.0 dB)	20 Hz (103.0 dB)
Discrete Multichannel 5.1 (3/2.1) 6.1 (3/3.1) 7.1 (3/4.1)	O500 C	O500 C	O410, O300(D), O110(D)	3 x O900	6 x O900	3-4 x O900	27 Hz (123.4 dB)	17 Hz (123.4 dB)
	O410	O410	O300(D), O110(D)	2 x O870	3 x O870	3-4 x O810	30 Hz (120.0 dB)	20 Hz (120.0 dB)
	O300(D)	O300(D)	O110(D), M52(D)	O870	2 x O870	2-4 x O810	35 Hz (112.8 dB)	20 Hz (112.8 dB)
	O110(D)	O110(D)	M 52(D)	O810	O870	2-4 x O810	56 Hz (107.7 dB)	20 Hz (107.7 dB)
	M52(D)	M52(D)	-	O810	O810	2-4 x O810	90 Hz (103.0 dB)	20 Hz (103.0 dB)
Larger systems	Please contact your local distributor or Klein + Hummel for guidance as we have much experience with custom designed solutions for special applications.							

Table Notes:

- The “**Recommended**” column specifies the minimum recommended subwoofer solution to balance the entire system. Selecting a smaller subwoofer will limit the maximum output of the system.
- The “**High Performance**” column gives +6 dB of headroom over the recommended minimum subwoofer solution. The lower required replay level from the subwoofer(s) results in a substantially reduced low-frequency distortion. This specification is recommended for reproducing bass-heavy material in large and well-damped rooms.
- The “**Plane Wave Bass Array™**” column specifies two to four subwoofers (three to four for larger systems) that should be positioned along the front wall to generate a plane wave down the room. This reduces the side wall interaction thereby improving the side-to-side bass reproduction. The number of subwoofers arranged in a bass array depends on the width of the room: wider rooms, more subwoofers.
- If the system will eventually be upgraded for a larger channel count, select the loudspeakers and subwoofer(s) from the subwoofer(s) from that section.
- The same subwoofer specification is appropriate for 5.1 to 7.1 multichannel systems, even if the main channels are run full range, i.e. not bass managed.
- If space is insufficient for large cabinets, two **O 810** subwoofers may be substituted in place of one **O 870**.
- An **O 800** can be used in place of an **O 810**. It has the same maximum output level, the bass extends to 27 Hz, and there is a 3 channel bass manager. This is reflected in the lower retail price.
- Products written with “(D)” after the number signifies that the digital input version (e.g. **O 300 D**) or non-digital input version (e.g. **O 300**) can be used. Be careful to ensure that desired interconnectivity (source-to-subwoofer AND subwoofer-to-main loudspeakers) of the system is possible.
- The **O 500 C** has a 20 Hz mode, but the extra bass extension comes at the expense of maximum SPL.

Checking the System Solution

Finally, using the table, check that the chosen system fulfills the requirements for LF cut-off and maximum SPL. If the chosen system does not satisfy the specification, a larger system will be required.

Also check interconnectivity:

- If you have analog outputs, choose “not D” versions of the products (e.g. **M 52**, **O 110**, and **O 300**). If you have digital outputs, choose “D” versions of the products (e.g. **M 52 D**, **O 110 D**, and **O 300 D**).
- The **O 410** is fitted with an analog input as standard, but also has a digital input option.
- The **O 500 C** has analog and digital inputs fitted as standard.
- The **O 810** and **O 870** subwoofers have an optional digital input card that replaces the standard analog input card. The outputs of the bass manager are always analog, so “D” main loudspeakers are not necessarily required.
- The **O 800** has analog inputs and outputs only.
- The **O 900** can use the analog subwoofer output of the **O 500 C** and an external amplifier (Powersoft K6 or K8 recommended).

Systems for Movie Mixing

The above table assumes that all the channels in the system are bass managed – typical in the broadcast and music industries. In the movie industry, the main channels are produced entirely by the main loudspeakers, and only the LFE channel is reproduced by the subwoofer(s). In addition, each rear channel is often reproduced using multiple loudspeakers over, typically, half the listening distance. Each channel should reproduce long-term pink noise at a level of 85 dB(C) at the listening position. Use the table below for this type of system:

Front Loudspeakers	Subwoofer(s) for LFE only	Number of surround loudspeakers and type per channel			
		1	2	3	4
O500C	2 x O900	O410	O410	O300(D)	O110(D)
O410	O870	O410	O300(D)	O110(D)	M52(D)
O300(D)	O810	O110(D)	O110(D)	M52(D)	M52(D)
O110(D)	O810	M52(D)	M52(D)	M52(D)	M52(D)
M52(D)	O810	M52(D)	M52(D)	M52(D)	M52(D)

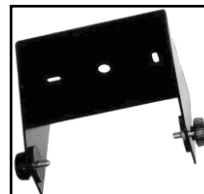
Mounting Hardware Selection Matrix

Our mounting hardware range philosophy is to supply the parts required to mount our loudspeakers onto commonly available third-party mounting products. For each product is listed in the table below the hardware that may be used to mount the loudspeaker in the specified way.

Location of Loudspeaker	O 500 C	O 410	O 300 (D)	O 110 (D), P110	M 52 (D)
Flush Mounted	WMK O 500 C for electronics	REK 1 and CP <i>nn</i> for electronics	-	-	M6 threaded inserts in side of cabinet
On a Floor Stand (tripod, TV spigot, or with a 5/8" thread)	LH35 LH35+LH28 LH35+LH29	LH41+LH28 LH41+LH36+LH28 LH41+LH29 LH41+LH36+LH29	LH25 LH25+LH28 LH25+LH29	LH31 LH31+LH28 LH31+LH29 LH31+LH28+LH33	LH11
On a Stand (table or mic with a 5/8" thread)	-	-	-	LH31+LH7 LH31+LH8	LH11 3/8" thread in base of cabinet
On a Subwoofer (fitted with a flange)	LH36+LH37 LH35+LH36+LH37	LH41+LH37 LH41+LH36+LH37	LH25+LH37	-	-
On a Meter Bridge	-	-	No hardware required	KG 30	LH11
In 19" Racking	-	-	-	-	MA19
On a Wall	-	LH42+LH45	LH25 Included rear panel brackets	LH32 KG30	LH11
Off a Ceiling	LH35	LH42 LH42+LH43 LH43+LH46+LH42	LH25	LH38 LH38+LH27	LH11
Off a Lighting or Truss Bar	LH35+LH29	LH42+LH29	LH25+LH29	LH38+LH29	-



MA 19



LH 11



LH 31 (W)



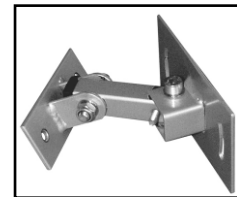
LH 38 (W)



LH 25 (W)



LH 35



LH 32 (W)



LH 27 (W)



KG 30 (W)



LH 36



LH 7/ LH 8



LH 28 (W)



LH 29



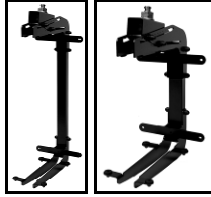
LH 37



LH 33



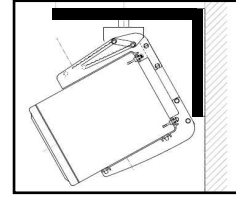
LH 41



LH 42



LH 43



LH 45

LH 46 – hardware to vertically position a loudspeaker suspended off a ceiling (picture not yet available).

Mounting hardware codes with a (W) are also available in white.



REK 1

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- "Plane Wave Bass Array" and "PWBA"
- "7.1 Channel High Definition Bass Manager" and "7.1 HD Bass Manager"
- "7.1 Channel High Definition Bass Management" and "7.1 HD Bass Management"

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