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**Test Studio-Monitor Neumann KH 120**

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# Sound & Recording

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[Neumann KH120] Test

## Studio-Monitor

# Neumann KH 120

The name Neumann usually evokes thoughts of excellent studio microphones based on a long history of electro-acoustic products from Berlin. With the KH 120 Neumann is now introducing their first studio monitor – which combines the tradition of high quality manufacturing with new technological know-how. Our test shows that it could become a new reference – and it is even affordable.

It is not the product of pure chance that Neumann is now manufacturing studio monitors. The legendary monitor maker „Klein+Hummel“ and the microphone factory Neumann have both been parts of the Sennheiser group for several years. Marketing decisions then led to closing the Klein+Hummel brand. This decision, which was surprising for many insiders, did not mean the end of the monitor loudspeakers of K+H, which are still highly respected worldwide. The development of monitors will continue under the brand of Neumann with the company hoping for higher name recognition on the world markets.

The development team and facilities in Wedemark will continue unchanged for now, which also applies to the existing products of K+H. Successively though all studio monitors will be updated or redesigned by Neumann. The first model in the range is the KH 120, whose name still reminds of the origins – while everything else is completely redesigned down to the smallest detail.

As the base of the new series, new drivers, new enclosures and totally new electronics were developed with the considerable expense of several man-years. For the developers this meant finding a compromise between the high demands coming from the tradition of

## Overview

**Frequency range:** 46 Hz – 24 kHz (-6 dB)

**Ripple:** 3 dB (100 Hz – 10 kHz)

**Horizontal directivity:**

116 degrees (-6 dB ISO 1 kHz -10 kHz)

**Horizontal standard deviation:**

16 degrees (-6 dB ISO, 1 kHz-10 kHz)

**Vertical directivity:**

92 degrees (-6 dB ISO, 1 kHz-10 kHz)

**Vertical standard deviation:**

29 degrees (-6 dB ISO, 1 kHz-10 kHz)

**Max. useable level:** 104 dB (3% THD 100 Hz – 10 kHz)

**Max. bass:** 98 dB (10% THD 50 – 100 Hz)

**Deviation between pairs:**

0.44 dB (maximum 100 Hz – 10 kHz)

**Noise level (A-weighted):** 19.9 dBA (distance 10 cm)

**Size:** 182 x 277 x 220 mm (WxHxD)

**Weight:** 6.3 kg

**Price per pair:** approx. 1.398.00 Euro incl. VAT.

**Ferrofluid**

Ferrofluid is a magnetic fluid placed in the air gap of a driver. The ferrofluid dampens the resonances of the driver and – which is even more important – improves the heat dissipation from the moving coil to the magnet. The driver is better protected against thermal overload through this. Ferrofluid is almost exclusively used with mid and high frequency drivers.

**Class-AB power amplifier**

Class AB is a design concept for power amplifiers with the amplifier working in Class A mode for lower power and in Class B for strong power demands. Class A delivers very low distortion, but with extremely high standby current and high losses (rarely). Class AB: has low distortion as well, but with less losses (standard for power amplifiers below 1000 W)

Neumann and the goal of affordable pricing for the product. As a matter of course the Neumann customer, who is usually well versed in the highest class of studio microphones, expects similar qualities from studio monitors from this brand name. After all only the combination of a microphone for the recording and the monitors for working with the recordings can lead to a good final result. Even with the microphone carrying a large burden in this workflow, the role of the monitor should not be underestimated.

The Neumann KH 120 is recommended as a typical near-field monitor for short distances or as a surround loudspeaker in combination with larger main systems. At the market introduction at the beginning of 2011 only the version KH 120 A with analog input will be available, with the KH 120 D with additional digital inputs following later.

**New drivers**

During the development phase of the KH 120 two completely new drivers were designed: a 5¼" woofer and a 1" dome tweeter. Both drivers are magnetically shielded and feature powerful double magnets. The tweeter also features **ferrofluid** damping to reduce resonances and better disperse heat from the moving coil to the magnet. The sandwich membrane of the very long-throw driver is optimized for neutral and uncoloured projection of the midrange. For 2-way systems like these there is always the need to reach the best possible compromise between solid low range and a good midrange. This is not always easy, but was well done in this case.

The 1" tweeter will become the new standard for all new monitors in the KH-series by Neumann. The selection was therefore done extremely carefully using countless prototypes and tests until the desired properties were reached. The final choice was a titanium sandwich cone. Developer Markus Wolff told us that the decision in favour of a metal cone instead of a pure fabric membrane was based on the significantly more pistonic motion of the metal cone. This usually comes with the disadvantage of a pronounced resonance,

but this is above 30 kHz and in this case very well damped. Actually a resonance in this frequency range way above the audible spectrum would not be a problem anyhow. But if the resonance is started, it could lead to intermodulation distortion even within the audible frequency range, which makes suppression of the resonance worthwhile. A pure fabric tweeter cone does not have this problem, but would vibrate unevenly way below 20 kHz and therefore would lead to an uncontrollable dispersion behaviour. Special attention was given to this area, which can easily be recognized externally from the large waveguide surrounding the tweeter. This waveguide, which is integrated into the aluminium front, is called "MMD Waveguide", which stands for "Mathematically Modelled Dispersion".

**Aluminium cast enclosure**

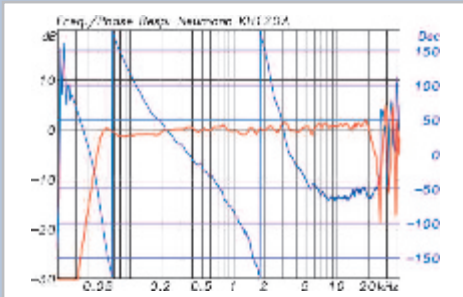
The enclosure of the KH 120 consists of two aluminium cast parts with everything, like form, edges, cooling etc., being integrated. The manufacturing of moulds causes high initial costs for the manufacturer - but with high unit numbers as planned for the KH 120, this is quickly recouped. Both drivers are protected by transparent grilles, which do not cause any noticeably negative effect (all test measurements here were done with them). For the woofer grille the imitation of a conical membrane does not only constitute an optically pleasing new solution, but is also very sturdy and low on resonances.

**Electronics for perfect matching**

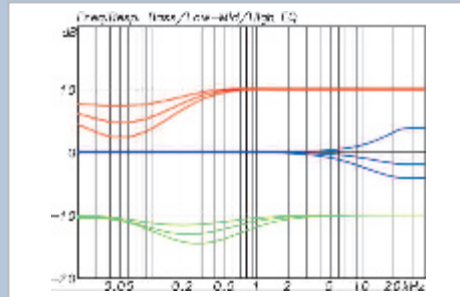
The electronics for the KH 120 are also a completely new design. A controlled HF switching power supply for mains voltages between 100 and 240 V feeds two traditional analog **Class AB** power amps with 50/80 W power. All the filters within the Neumann KH 120 are also analog circuits. DSP-technology does not exist here, which is neither a disadvantage nor an advantage. The two bands of the KH 120 are separated at 2 kHz with 4th order high- and low-pass filters. For protection of the woofer there is a 30 Hz high-



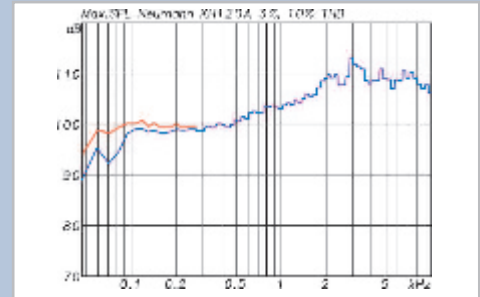




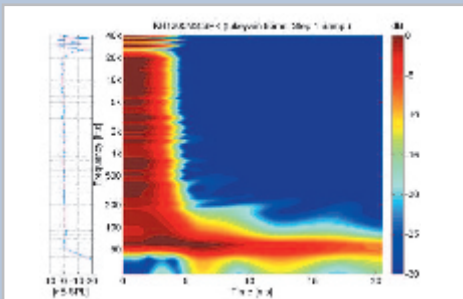
**Pict. 1: Frequency response on axis at 4 m distance (red, phase response in blue)**



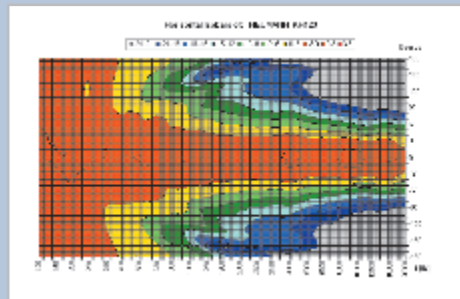
**Pict. 2: Filter functions for matching to placement: bass-EQ (red), low-mid EQ (green), high-EQ (blue)**



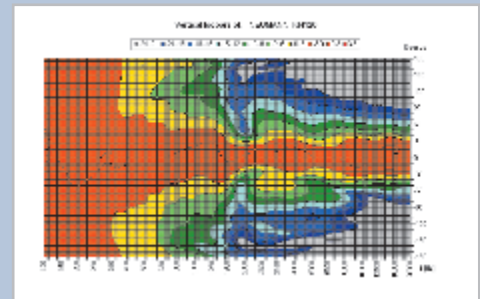
**Pict. 3: Maximum level at a distance of 1 m at max. 3% THD (blue) and 10% THD (red). (10% test only up to 250 Hz)**



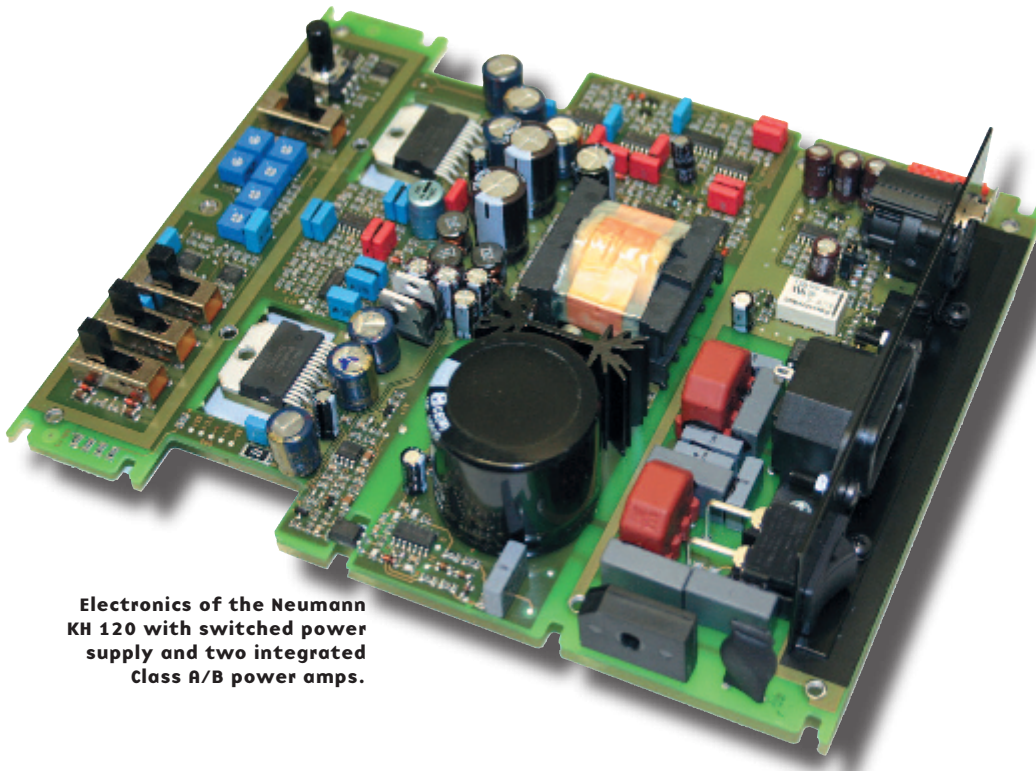
**Pict. 4: Spectrogram with decay of the loudspeaker**



**Pict. 5: Horizontal isobarics (-4 dB isobarics from yellow to light green)**



**Pict. 6: Vertical isobarics**



**Electronics of the Neumann KH 120 with switched power supply and two integrated Class A/B power amps.**

pass filter of the 1st degree, which is initially surprising in such a small loudspeaker. Indeed this filter is only there to keep real infrasound from the loudspeaker. All the other protection functions are handled by the limiters, with each channel having its own thermo- and peak-limiter. The lack of a steep

electronic high pass filter is an important plus: it would otherwise cause strong phase changes and a pronounced rise in delays to the lower frequencies.

Another specialty are the six individually matched filters in each cabinet for precise equalisation of the frequency response. The

difference between two random units of a Neumann KH 120 is therefore so minimal that each loudspeaker is seen as pair-matched with any other one. A difference of only 0.44 dB between our test samples is impressive proof of this. Within the manufacturing process this means that each loudspeaker unit is individually matched to a perfectly even frequency response in an anechoic chamber – one of the many details showing the high standards Neumann applies to the manufacturing of its loudspeakers. During this process it is also checked whether all the seals are tight, whether there are any mechanical noises from the enclosure and harmonic- and intermodulation-distortion is up to specification and that there are no air-stream noises coming from bass reflex channels.

All the necessary control elements are found at the back of the enclosure. Only the (dim-mable) Neumann logo is placed on the front panel and unobtrusively turns red when the

limiters are working. Three solid slide switches with four stepped positions each are used to adjust the filters for the location in the areas bass, low-mid and treble. Our lab tests of the filters in picture 2 show that they exactly match the stated functions. A further exactly calibrated switch sets the input sensitivity in dBu for specific SPL levels at a distance of one meter. In addition there is a trimmer offering continuously variable adjustment. A row of small switches offer ground lift as well as a dimmer for the Neumann logo. The latter function is not a gimmick but a useful function when the monitor is used in a dark environment or behind a screen. The balanced input and the mains connector are placed facing downwards on the back panel to avoid any plugs protruding from the enclosure. Two M8 mounting threads are also set into the back panel, enabling mounting of the Neumann KH 120 in every imaginable position with the huge range of available accessories.

### Lab tests: highest perfection

The high standards of Neumann are reflected by our lab test results. The frequency response for example is flat from 46 Hz to 24 kHz with a maximum deviation of +/- 1.5 dB – with no smoothing applied. This requires no further discussion. In picture 1 we also see the phase response drawn in blue. Here the 360° phase change at the crossover frequency of 2 kHz can be seen as well as a further 360° caused by the bass-reflex enclosure acting as an acoustic 4th order high pass system. Here we find a further distinction: usually bass-reflex loudspeakers which have to be driven far into the midrange (which applies to almost every two-way system) often have trouble with tube resonances within the working range. This is mainly happening if the loudspeakers are tuned low and the reflex tubes are long. Within the KH 120 the tubes are therefore treated with a patent applied for technique which effectively prevents tube resonances.

The spectrogram in picture 4 proves that resonances of any kind are no concern of the KH 120. The longer decay at 60 Hz is caused by the bass-reflex resonator and intentional in this sense. The test of maximum levels in picture 3 shows the levels reached by the Neumann monitor at a distance of 1 m (drawn in blue for up to 3% THD and red for up to 10% THD). The 10% test was only done to 250 Hz. The woofer is in the range of 100 dB (with a maximum of up to 3% THD) with a rise to the middle. The tweeter delivers an impressive 110 dB. The difference between the two channels is easy to explain: the tweeter in the KH 120, which is more sensitive anyhow, is also supported by the waveguide. Both drivers seem to be able to use the offered amplification power without any weaknesses. We can therefore be more or less sure that the signal is not significantly distorted at any point as long as the limiters are not active.

A view of the horizontal and vertical **Isobaric charts** shows the advantages of the amply designed waveguide of the

tweeter. The isobaric lines flow with the highest perfection with a slight narrowing to the higher frequencies. In the vertical plane the curve inevitably is a bit more uneven because the delay differences between the channels are causing some interference effects in the crossover range around 2 kHz. These are quite small in the case of the KH 120 – and they are almost symmetrical to the central axis. To the point: the dispersion characteristics are as perfect as all the other test results of the KH 120.

### Listening test: neutral, powerful, detached

With the results of our lab tests the expectations for the listening test of the Neumann KH 120 were of course extremely high. Does a loudspeaker with such perfect test results and no reasons for criticism in any way actually sound great as well? We were not disappointed. The KH 120 performed extremely well in our control room at a distance of three meters. Neutrality: no discussion of course. Low frequency playback: extraordinary for the size. Power level handling: no problem as well. This list could be continued. When the limiter finally had to work occasionally, it was unobtrusive and could really only be noticed by looking at the logo display turning red.

In addition to all these listed properties the spatial playback aspects became noticeable here. The spatial delivery of the Neumann KH 120 seems to be completely detached from the loudspeakers and presents the sound in a wonderfully spacious way even outside of the line between the loudspeakers – and stays perfectly differentiated as well.

### Conclusion

The microphone company presents their first studio monitor from the KH-series with the KH 120, which is a completely new design for compact nearfield- or surround-monitoring. The result is plainly impressive and therefore fully justifies the almost frightening level of perfectionism applied during the long development phase. The lab tests are perfect and the listening test was impressive in all aspects while the manufacturing quality is as high as expected from the Neumann brand.

Those who are now a bit afraid of the price tag will be positively surprised to read that the suggested retail price is only around € 700 per loudspeaker unit. Success on the market can therefore be forecast without clairvoyant talents. →

Text and lab tests: Anselm Goertz

Translation: Alex Merck

Photos: Anselm Goertz (1) and Dieter Stork

#### Isobaric charts

The directivity is shown here with so-called isobaric charts instead of many single polar diagrams. The chart's colours show how far the level falls off from the middle axis.