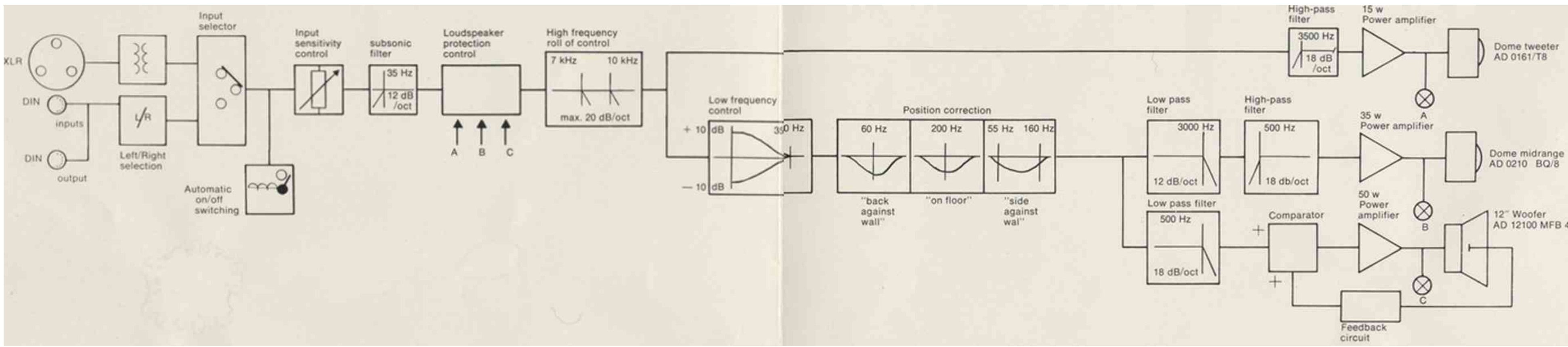
Philips 545MFB Studio Loudspeaker

- 3-way loudspeaker with integrated 100 W 3-channel power electronics
- transmission range 20 to 20000 Hz
- over-all sound pressure at a distance of 1 m: 108 dB
- electronic precision filter for accurate adjustment of sound pressure to positioning of loudspeaker box (positional matching)
- high reliability
- overload protection
- loudspeakers:
  woofer 50-watt sine-wave 12" MFB loudspeaker
  squawker 35-watt sine-wave 2" dome loudspeaker
  tweeter 15-watt sine-wave 1" dome loudspeaker
- volume of housing 70 litres

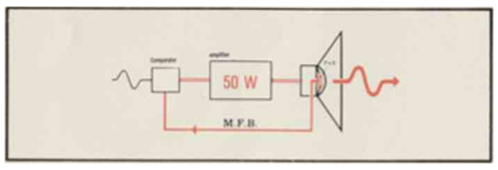
PHILIPS

Philips545MFB Studio Loudspeaker



BRIEF DESCRIPTION

A 70-litre box houses three special loudspeakers together with trimming and control circuitry, and three integrated power amplifiers.
A 50-watt amplifier drives the woofer in accordance with the input signal it receives. The woofer carries at the centre of its cone an acceleration transducer in the form of a piezoelectric element (PXE for short*) This produces a voltage proportional to the acceleration of the cone, which is compared with the original input signal of the amplifier in a comparator stage.
A correction signal, produced by the comparator as the result of the difference between the original signal and the PXE-signal, is fed back by the comparator, with reversal of phase, to the amplifier, thus making it possible for the motional errors of the woofer cone, which would be inevitable in the absence of MFB**'. to be eliminated at the source.
The acoustic signal emitted by the woofer is thus a faithful replica of the original driving signal.
A 35-watt power amplifier drives the medium-frequency dome loudspeaker (squawker), while a 15-watt power amplifier drives the tweeter (also a dome loudspeaker). The over-all transmission range is divided into three frequency bands (crossoverpoints at 500 and 3000 Hz) by precision active filters situated before the power amplifiers.
Three high-precision electronic filters (with gyrators). which can be used in any desired combination, make it possible to correct the distortion of the sound-pressure field due to the positioning of the box.
An active low-frequency filter with an adjustment range of ± 10 dB and a passive high-frequency filter with a choice of cut-off frequency (7 or 10 kHz) and an adjustable damping slope (max. 20 dB/octave) serve for matching the box to the acoustics of the room.
A high-pass filter with a cut-off frequency of 35 Hz protects against infrafrequencies below 20 Hz. Each of the three loudspeaker channels has its own overload protection unit, which interrupts the amplifiers in question as long as the overload lasts.
Apart from the symmetrical studio input, the box is also provided with an asymmetrical input (mainly intended for use in the home studio).
The latter is connected to a signal-controlled relay which automatically switches the box from "ready" to "on", and back to "ready" again if no signal is received for longer than 2 minutes: this function can be switched off if desired.



This active 3-way loudspeaker has been designed in accordance with the state of the art to meet the high requirements of the professional studio With its realistic acoustics, it represents an ideal audio monitor for use m mixing work
Thanks to the use of motional feedback (MFB) m the low-frequency channel, the over-all dimensions of the box could be kept so low that it can easily be mounted on the wall, m a rack or on a stand, as desired This permits free radiation of the sound, even at low frequencies, unhindered by the mixing control desk

Philips research shows the way

Motional feedback in loudspeakers
JA. Klaassen and S.H. de Koning. Philips Research Laboratories Eindhoven 1968

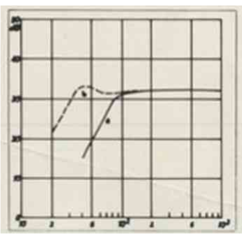


Fig. 1. Amplitude characteristics determined with the loudspeaker in an enclosed 10-litre housing, a) without motional feedback, b) with acceleration feedback

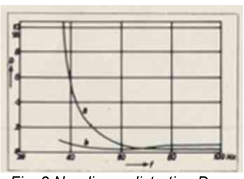
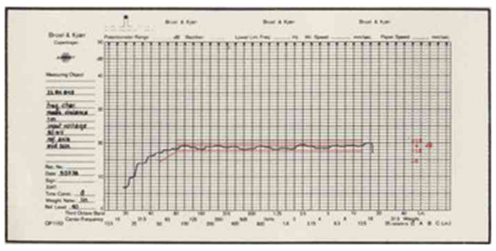


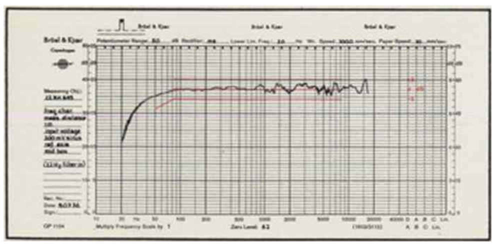
Fig. 2 Non-linear distortion D as a function of frequency for the woofer 9710. a) without motional feedback, b) with acceleration feedback corresponding to the amplitude characteristic b of Fig. 1.

Vibration and sound radiation of loudspeaker cones
F.J.M Frankorter. Philips Research Laboratories. Eindhoven 1975

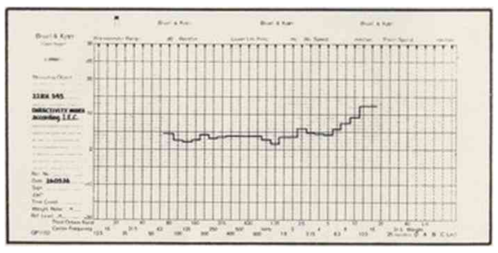
A computer programme (involving 12 simultaneous equations) for a large number of frequencies and different cone types makes it possible to build loudspeakers with predetermined characteristics
For example, a woofer cone must vibrate as a rigid whole within its transmission range. Holograms show that a woofer designed with the aid of this programme does not start to show standing waves until two octaves above its transmission range



Its transmittance (as determined in free-field measurements with noise having a bandwidth of a third of an octave) remains frequency-independent within tolerances of ± 1.5 dB (in accordance with recommendations of the IRT) from 45 Hz to 17 kHz

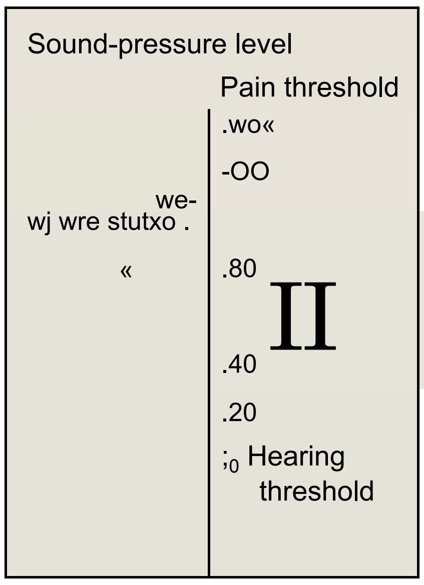


With a sinusoidal signal, the free-field transmittance is frequency-independent between 40 Hz and 18 kHz within tolerances of ± 3dB (in accordance with recommendations of the IRT).



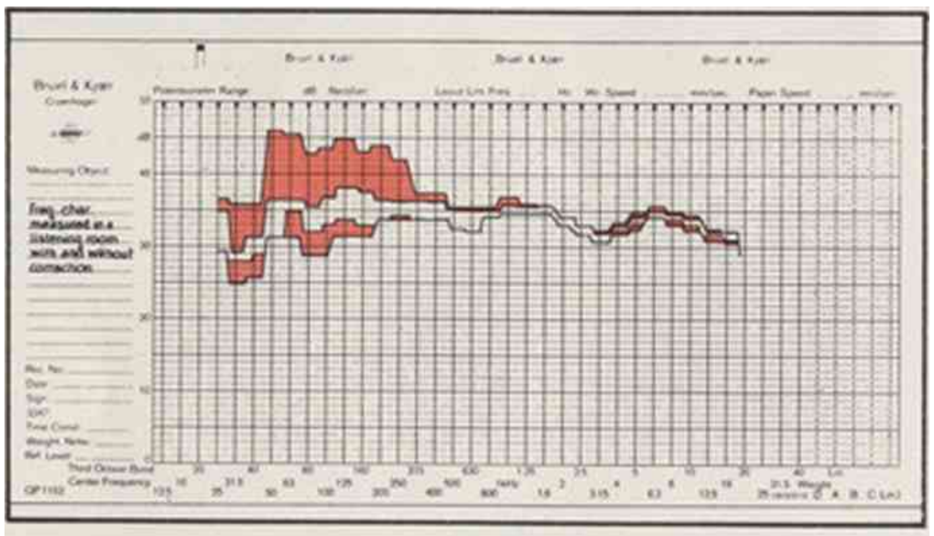
The bundling required for proper directional hearing shows low frequency dependence, and is largely in accordance with the stringent requirements of the IRT

PXE - piezoxide element, a piezoceramic Philips product
* * MFB - Motional feedback



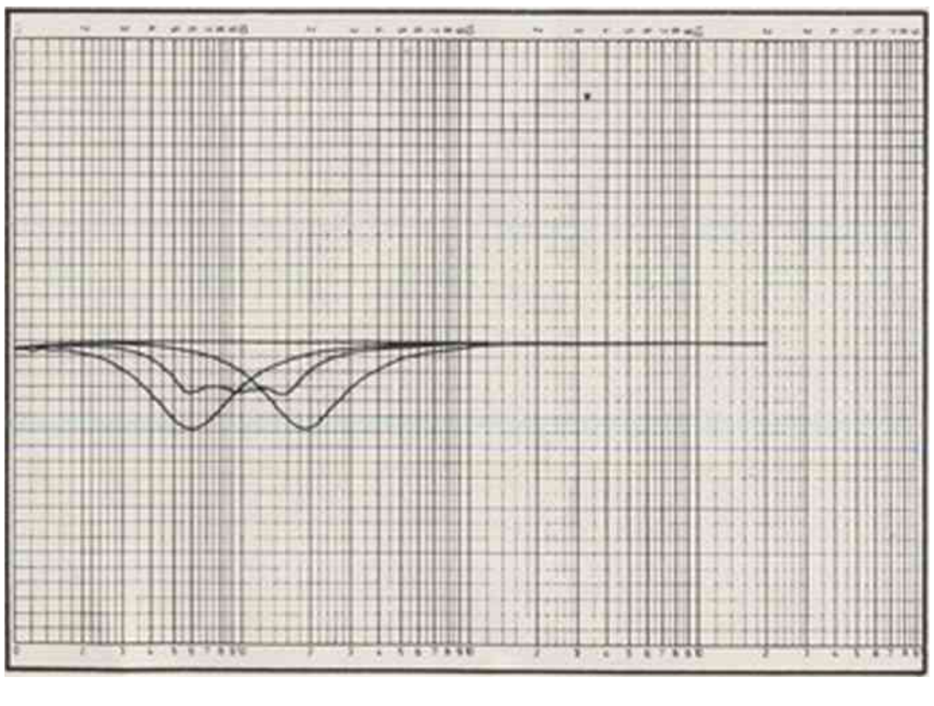
In order to provide the high playback volume generally required for audio mixing work, the over-all sound-pressure level (over the full range of *Vh* octaves) as determined in a free-field measurement at a distance of 1 m is 108 dB

Since the sound radiation at low frequencies is highly dependent on the positioning of the loudspeaker, three precision electronic filters (with high quality-factor gyrators) are provided for accurate correction of the sound pressure. This eliminates the potential sources of sound distortion otherwise present when the box is positioned against a rear wall, a side wall, or on the floor, and making the sound-pressure characteristic independent of the positioning of the loudspeaker. In many cases, this makes it unnecessary to calibrate the loudspeaker after installation in the studio.

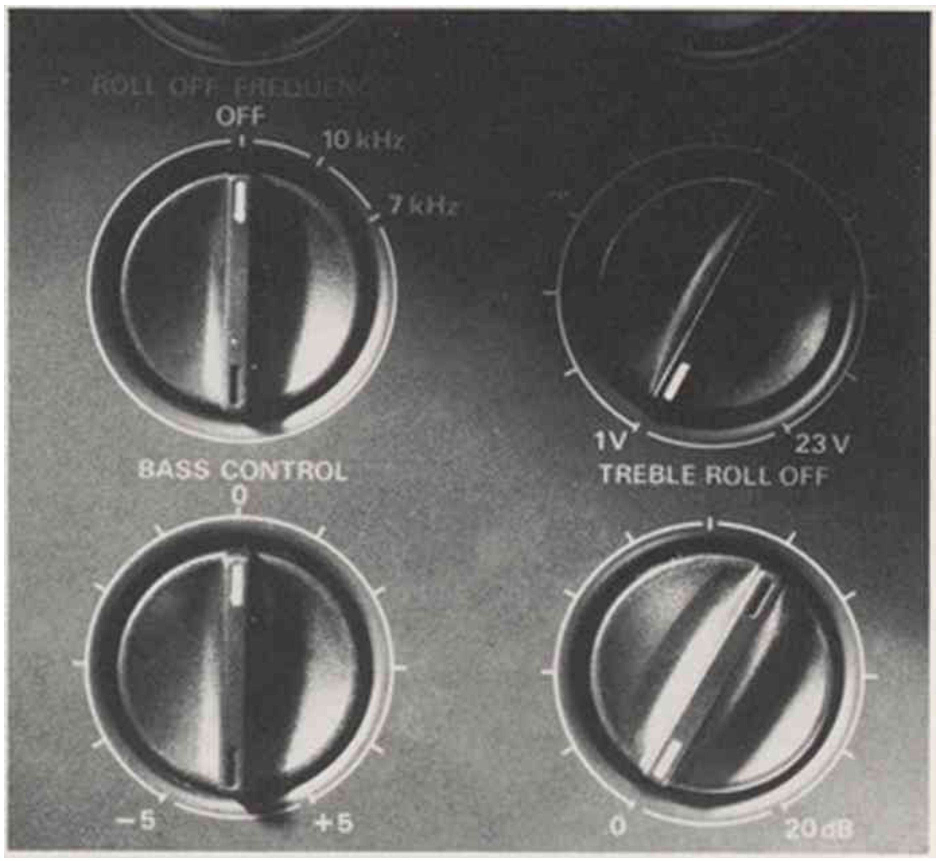


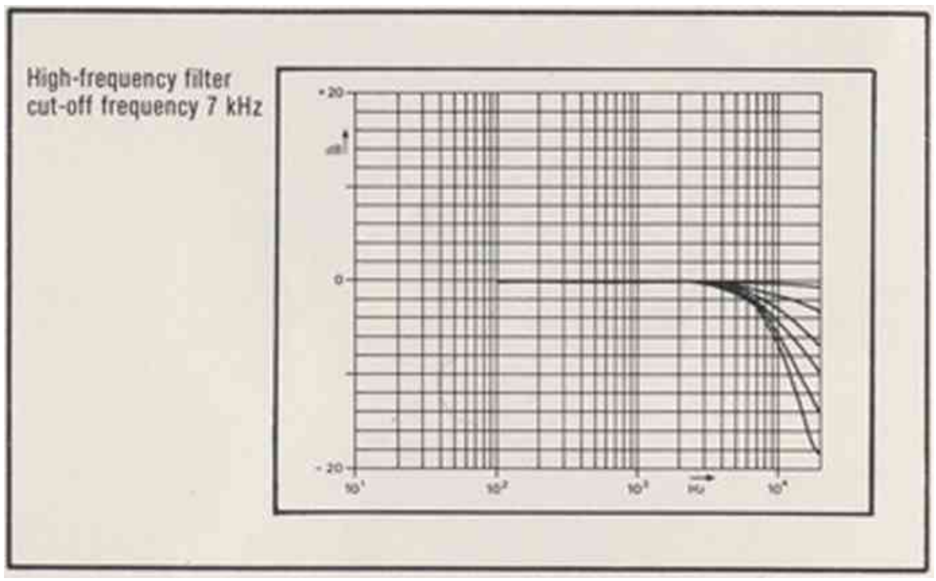
The damping curves of the three positional matching filters, which can be used in any desired combination.

Sound-pressure curves with and without positional matching filter, with the boxes at various places in the playback room.

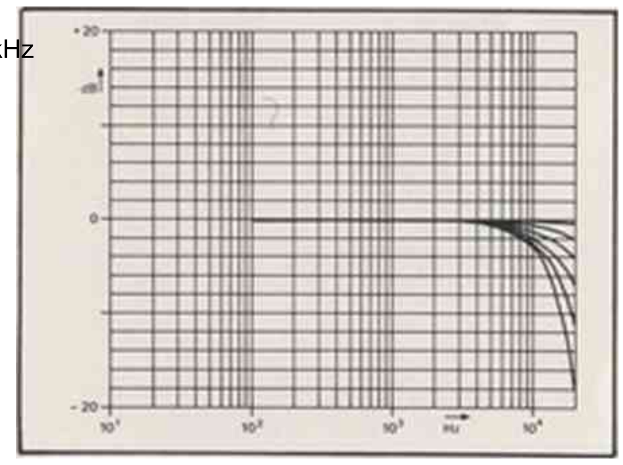


For matching the box to the acoustics of the room, an active low-frequency filter and a high-frequency filter with a choice of two cut-off frequencies and adjustable damping slope are available.

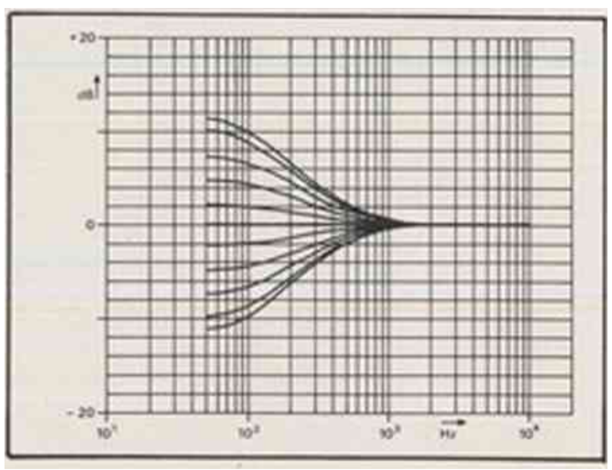




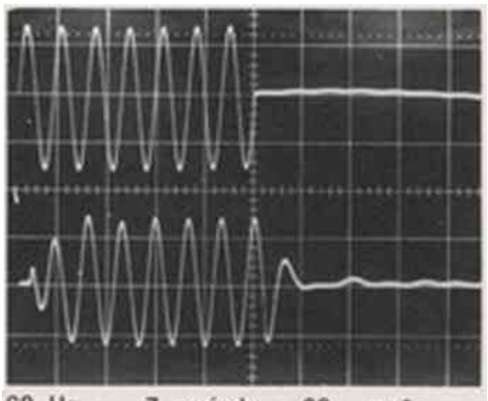
High-frequency filler
cut-off frequency 10 kHz



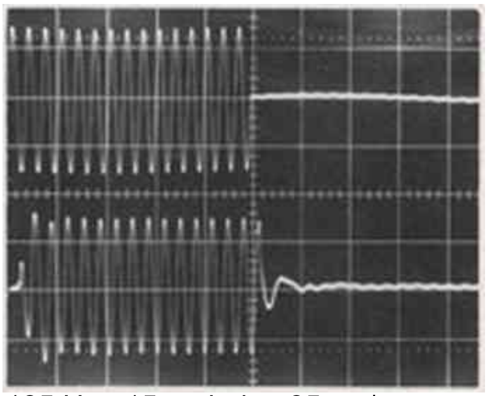
Low-frequency
filter



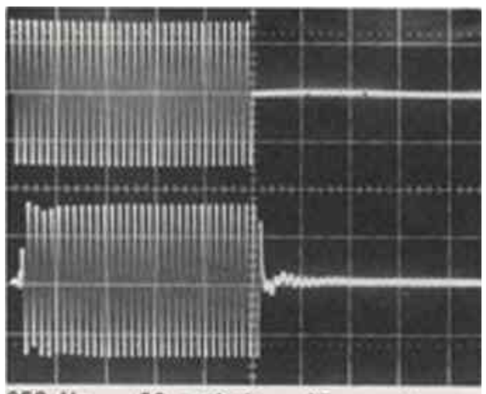
The oscillograms of the build-up and decay of the notes from various musical instruments, as reproduced by the 545 MFB STUDIO, shown alongside illustrate the excellent pulse response of this loudspeaker, which is very important for faithful reproduction of complicated sound structures.



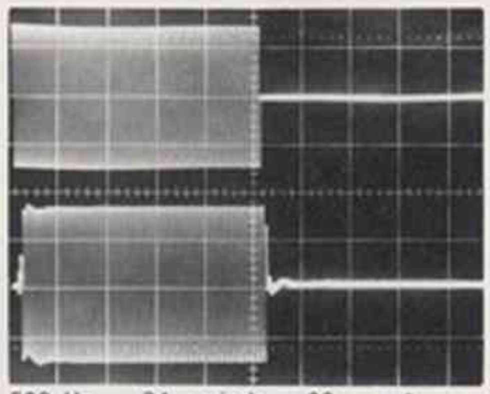
63 Hz - 7 periods - 20 ms*



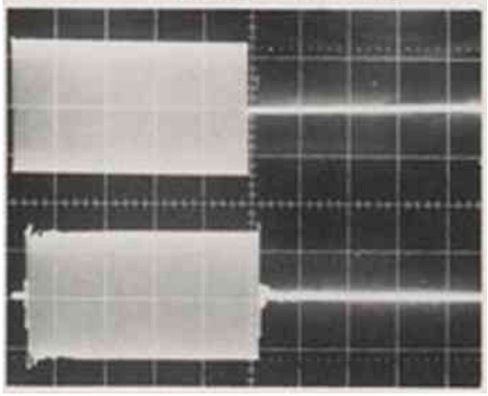
125 Hz - 15 periods - 25 ms*



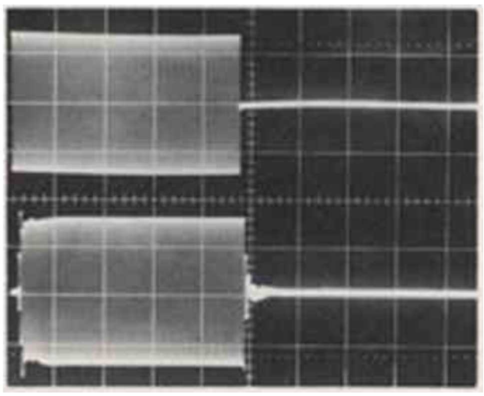
250 Hz - 32 periods - 25 ms*



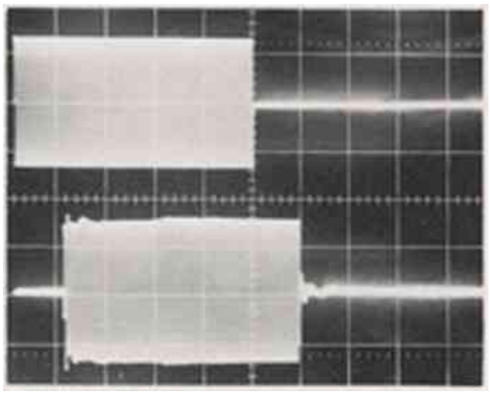
500 Hz - 64 periods - 33 ms*



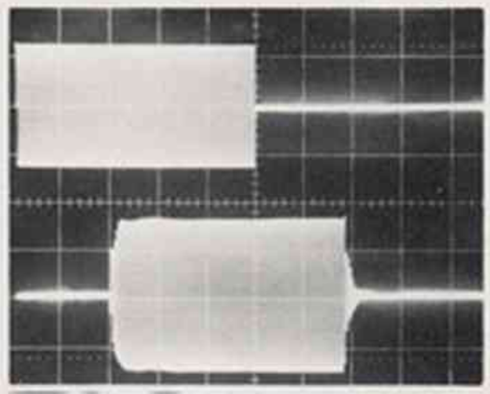
1000 Hz -128 periods - 25 ms*



2000 Hz -128 periods - 12.5 ms*

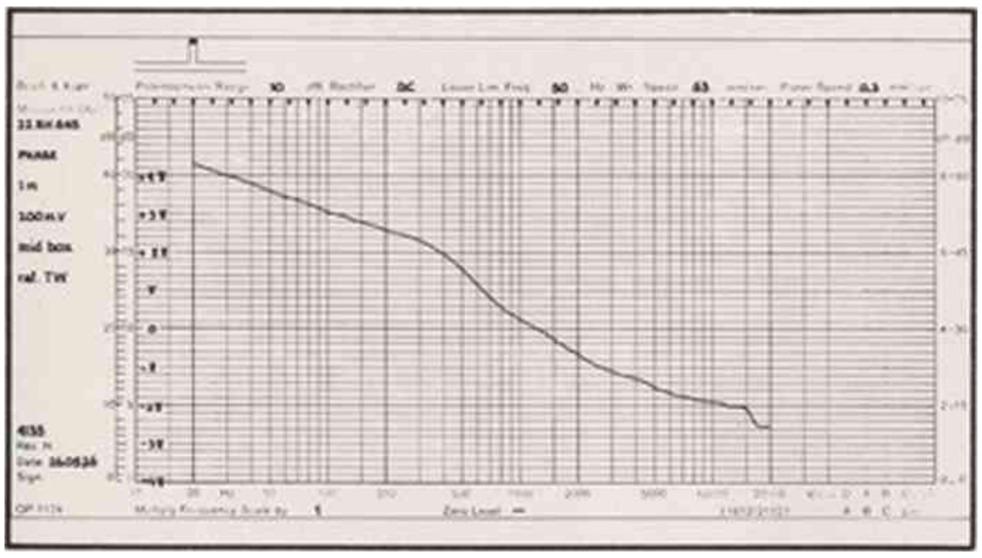


8150 Hz - 128 periods - 4 ms*



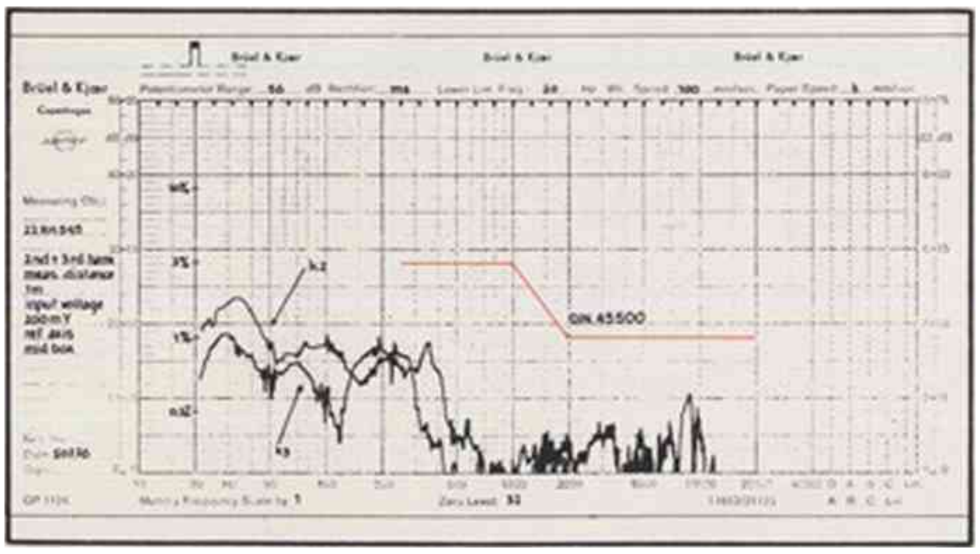
16000 Hz - 125 periods - 2 ms'

The phase response of the loudspeaker is highly linear.

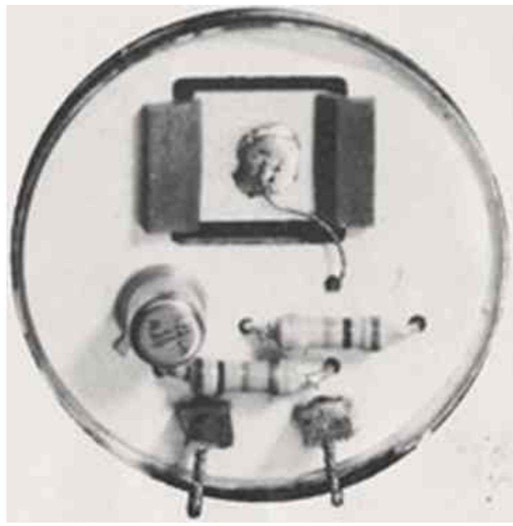


No complete answer has yet been given to the question of whether phases" can actually be heard.
So far, the direct audibility of phase changes has only been scientifically demonstrated for speech, but not for music
Consequently, the phase response is not so important for the audibility of "phases"; but (together with the amplitude response) it is very important for the complete description of the pulse behaviour of a "converter" such as a loudspeaker. The more linear the amplitude and phase response, the more accurately will pulsed signals be reproduced. This is particularly important for contemporary music, where such tones occur relatively often.

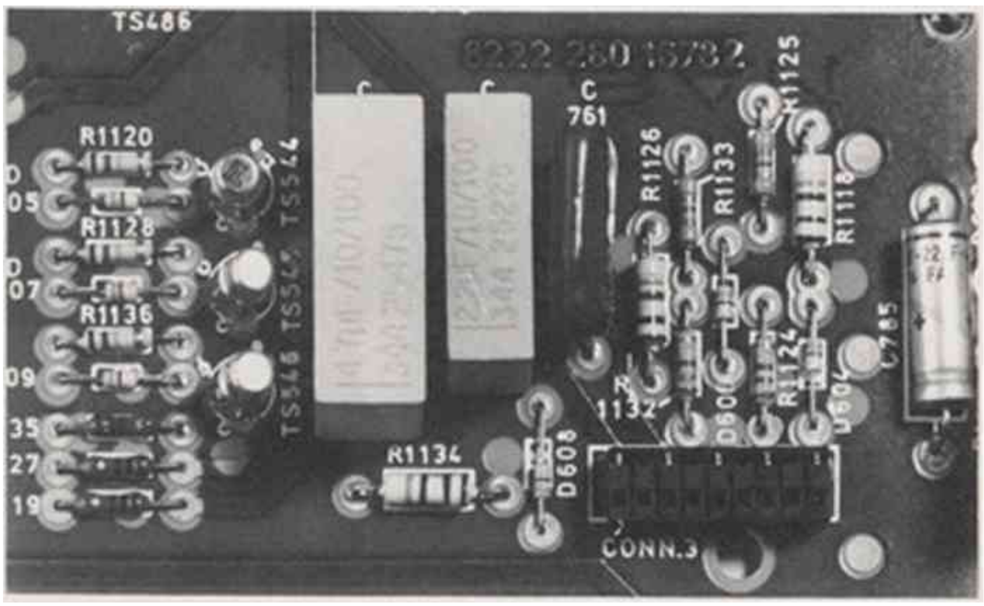
The following values were measured for the non-linear distortion at a sound-pressure level of 80 dB and a distance of 1 m:
between 300 and 450 Hz. K, < 0.6%, K_3 < 0.6%;
above 450 Hz. K_2 < 0.3%, K_3 < 0.3%.



This little print card with the PXE acceleration transducer and field-effect transistor is the heart of each MFB loudspeaker. It is mounted at the centre of the loudspeaker cone. This element is subjected to high loads, as it vibrates with the cone and undergoes the full changes in acceleration affecting the latter. Careful design with over-dimensioned components and stringent life testing ensure reliable operation for the loudspeaker as a whole.

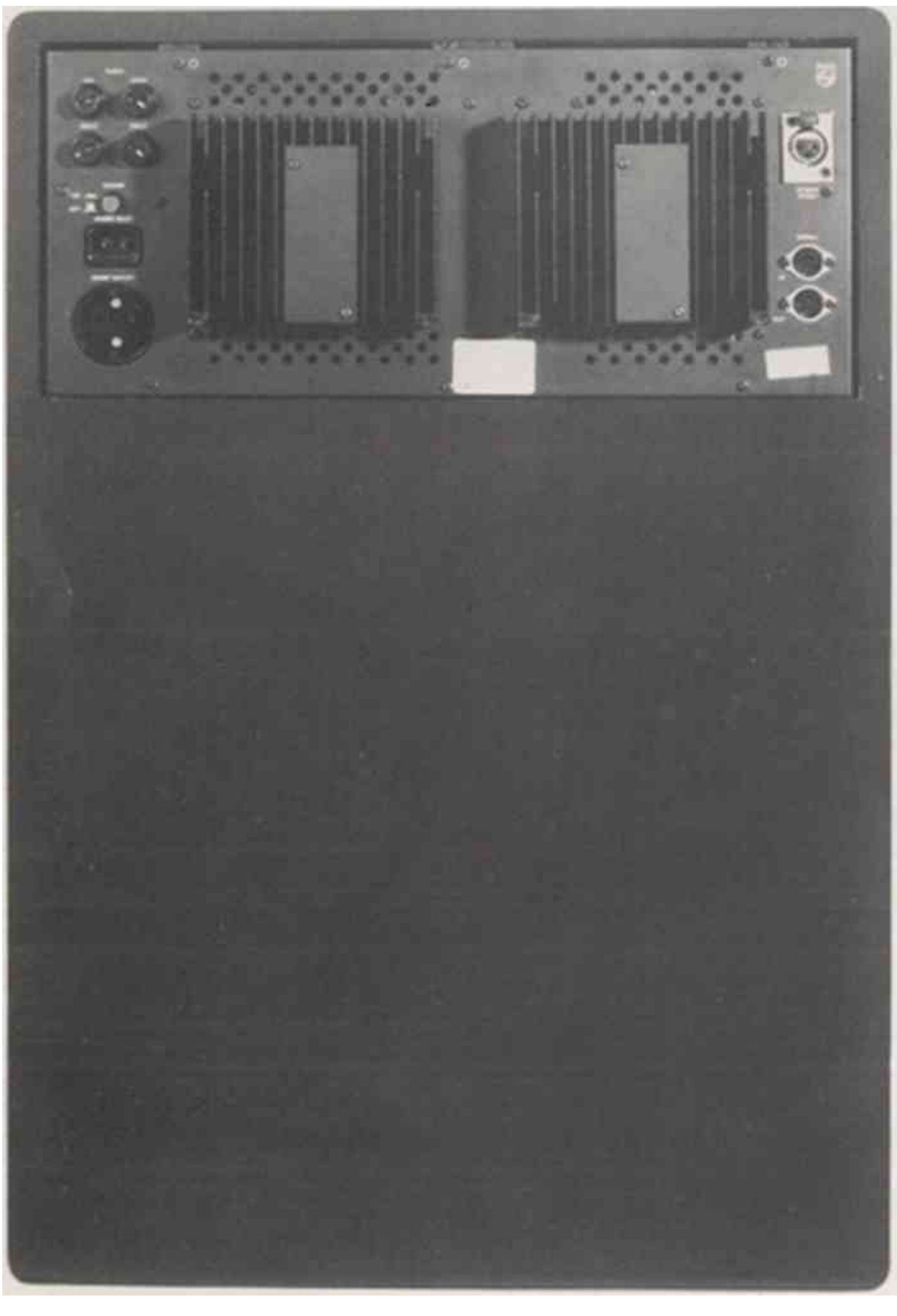


In the interests of high reliability of operation, all components are over-dimensioned. and all transistors used have metal housings. The circuits are built up on reinforced epoxy print cards with fully metallized mounting holes.
The loudspeaker has passed the loading test of DIN 45 573 sheet 2. according to which the full load power is applied to the loudspeaker without interruption for 100 hours.



The 545 MFB STUDIO can be connected to many different kinds of high-quality amplifiers;
- without power output stage, with symmetrical 1-V output
- without power output stage, with asymmetrical 1-V output
- with power output stage up to 100 W.

When asymmetrical inputs are used, several boxes can if desired be connected together to form a group. For this purpose, each input terminal is connected in parallel with a corresponding output terminal.

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Technical data

Transmission range	20 - 20000 Hz
Sound pressure level (over full 7'£-octave range)	108 dB at distance of 1 m
Volume	70 litres (acoustic section 501. electronics 20 1)
Loudspeaker systems	tweeter 1" dome loudspeaker A0 0162/T8 squawker 2" dome loudspeaker A0 0210/Sq 4 woofer 12" low-tone loudspeaker A0 121 00/W4
Cross-over frequencies	500 Hz and 3 kHz (active filter)
Amplifiers:	
Low-frequency channel	output power 50 W sine-wave (at 100 Hz. 40 W: k < 0.1%) Bandwidth 5 Hz- 5 kHz
Medium-frequency channel	output power 35 W sine-wave (at 1000 Hz. 25 W: k < 0.1%) Bandwidth 40 Hz - 30 kHz
High-frequency channel	output power 15 W sine-wave (at 5 kHz. 10 W: k < 0.1%) Bandwidth 40 Hz - 50 kHz
Sound-pressure correction filters	Positional matching: 200 Hz -5 dB 60 Hz -5 dB 55-160 Hz -3 dB

	Bass tone control: Down from 350 Hz: ± 10 dB at 60 Hz. in 11 steps. treble tone control: continuously variable from 7 or 10 kHz. 0 - 20 dB/octave (a pilot light shows when this control is switched on)
Electronic automatic 0N/0FF switching (only with 0IN asymmetrical input; can be switched off)	response time: < 1 second for input signals above about 1.5 mV decay time > 2 minutes A pilot light shows when this function is switched on
Input sensitivity	Continuously adjustable 1 - 23 V symmetrical 1 V into 10 kohm asymmetrical 1 V into 100 kohm
Connections	CANNON studio input connector (symmetr.) 0IN input corrector. 5-pole (asymmetr.) mains input terminal. 0IN/IEC mains output terminal. DIN/IEC
Semiconductors	85 transistors. 39 diodes
Mains	220 V. 50/60 Hz (il desired, can be adjusted by our service technicians to 110. 127 or 240 V)
Power consumption	200 W max. consumption A pilot light shows when the box is connected to the mains
Housing	wooden cabinet (black ash) textile front panel (removable)
Dimensions	436 x 650 x 320 mm (width x height x depth)

• *This delay of approx. 3 ms which can be seen in the loudspeaker oscillograms results from the sound transmission time between the loudspeaker and the test microphone.*

hi fi HIGH FIDELITY INTERNATIONAL

MOTIONAL FEEDBACK

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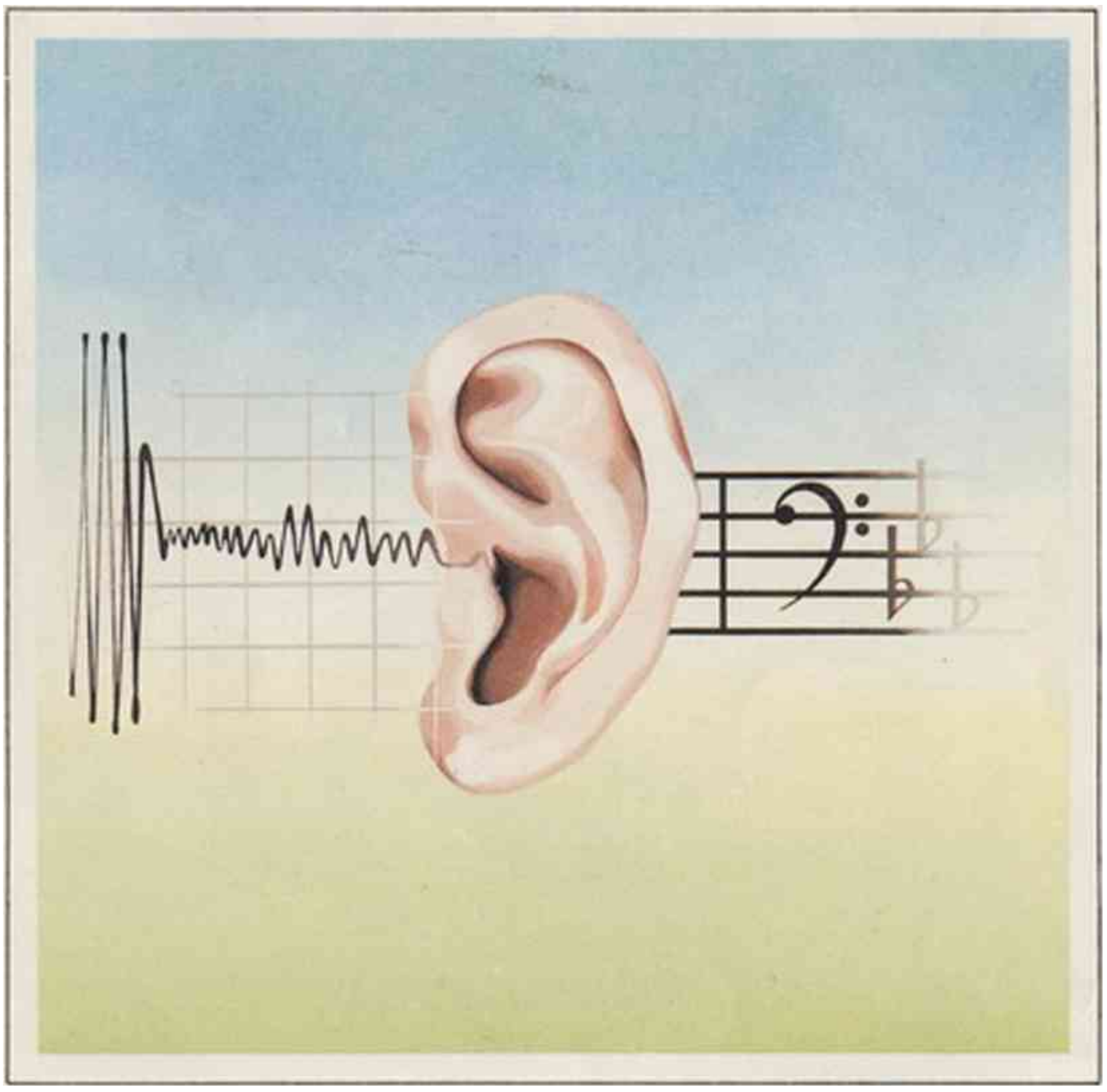
Philips 545 MFB Studio



Less than a thousandth

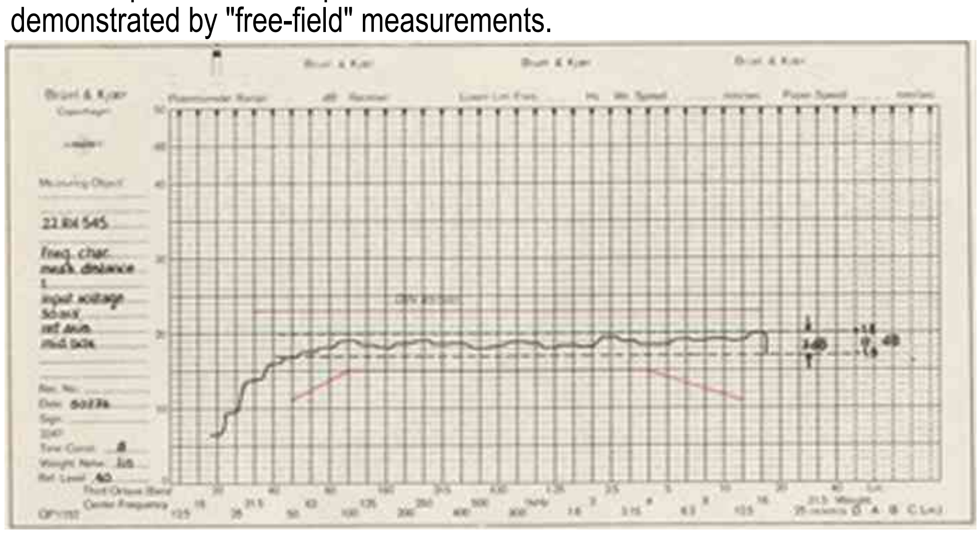
of the thickness

ofthissheetofpaper...

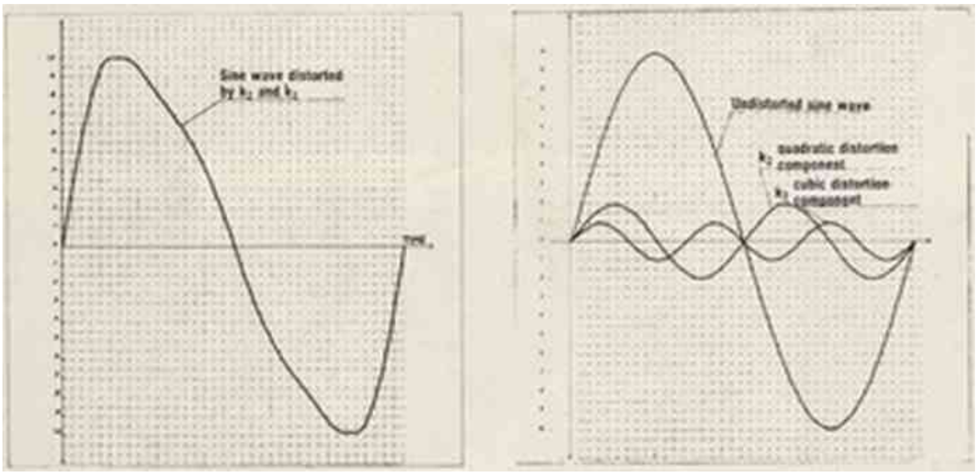
Less than a thousandth of the thickness of this sheet of paper...

Have you ever paused to consider what a wonderful instrument our ear is? For example, at a party we have no trouble in hearing people talking a yard away. Nothing very special in that, you may say... and yet it means that our ear is capable of detecting sound waves with an amplitude of no more dan 1/10000 mm, or 1/1000th of the thickness of this sheet of paper. And what is more, we are able to distinguish tiny details of these sound waves. The range in which the human ear experiences vibrations as audible sounds runs roughly from 20 to 16000 Hz. In the frequency range around 1000 Hz, the limit of detectability of differences in sound pressure is about 3 dB.

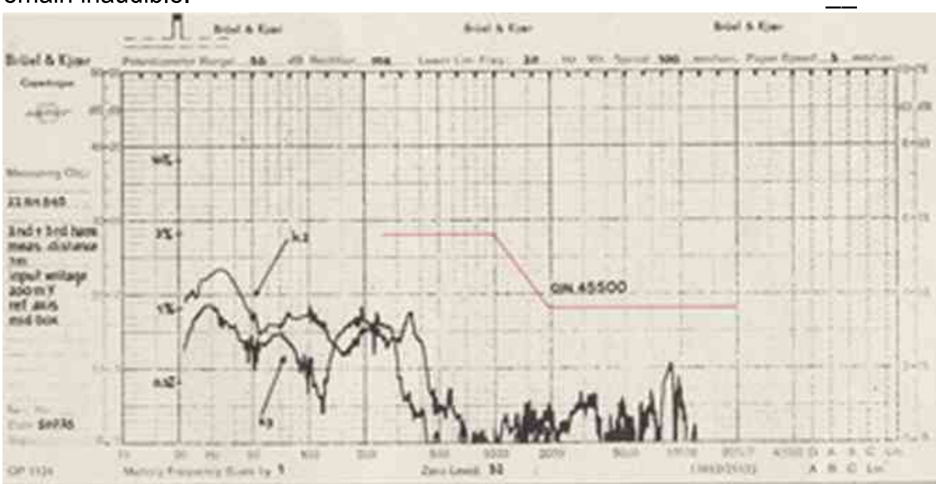
The PHILIPS 545 MFB Studio loudspeaker has a transmission range extending from 20 to 20 000 Hz. Between 45 and 17000 Hz. fluctuations in its sound pressure are kept within the narrow tolerances of ± 1.5 dB. as demonstrated by "free-field" measurements.



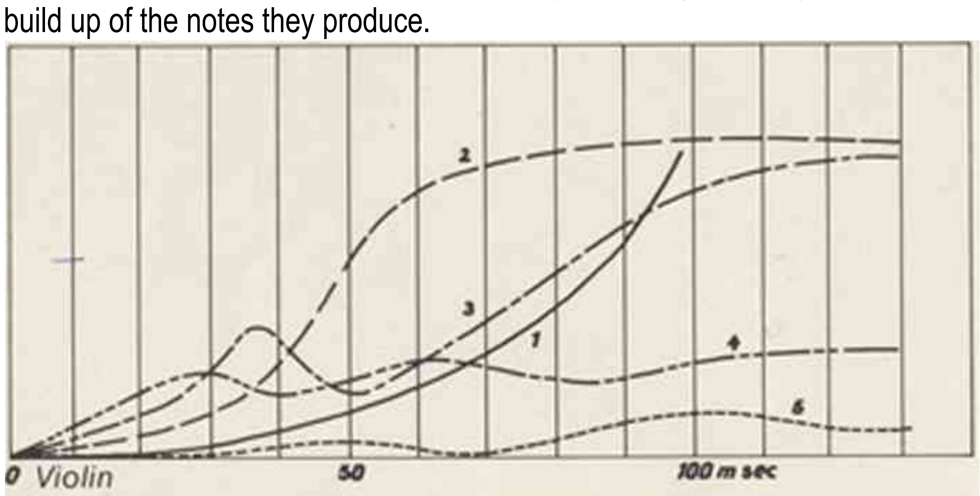
A high-quality loudspeaker must possess extreme purity of tone.
The extent to which we experience tones which are not present in the original sound (because they are first produced during the transformation of electrical vibrations into acoustic ones) as impurity of tone, or distortion, depends on the playback volume and the complexity of the original sound. Even when only two notes are played together, combination tones and difference tones will be produced in addition to the harmonics of the original notes. We will experience these as annoying if they are too loud and if they don't harmonize with the original tones
The discord will be greater when the chord in question is not played quite cleanly - and this is almost inevitable in music-making, since no musical instrument is perfectly pitched. The audibility limits of such discord are lowest in the sound-pressure range from 50 to 70 dB. Only in this range, above about 300 Hz. and only under extremely ..favourable" conditions is non-linear quadratic distortion (K_2) audible down to 1%. and non-linear cubic distortion (K_3) down to 0.5%.

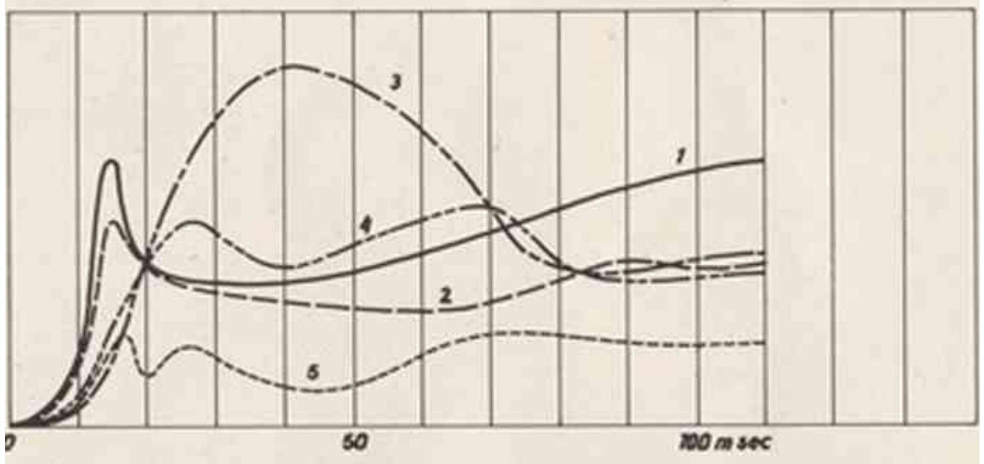


In the PHILIPS 545 MFB Studio loudspeaker, the non linear distortion lies practically outside the audibility range Typical values ol this distortion are: *from 300 to 450 Hz: κt < 0.6%.* Ks « 0.6%; above 450 *Hz:* K? < 0.3%. Ki < 0.3%
Both the quadratic and the cubic distortion components lall off from 0 6% to less than 0 3% between 300 Hr and 450 Hr Distortion peaks with a width of less than a third remain inaudible.



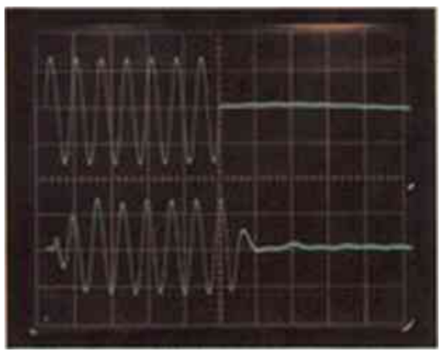
For the real music lover, there is nothing finer than following the individual instruments in an ensemble. Our ability to do this depends on the ear's astonishing capacity for hearing very quick changes in sounds. In the range from 50 to 10003 Hz. the ear can distinguish the slightest differences in the build-up of a no'e, even when the time involved is no more than 0.25 ms. The build-up tine of a note produced by a musical instrument is much longer than this.
For example, a trumpet note can be built up to full volume in 20 ms under optimum conditions, while a saxophone takes 36 to 40 ms. a clarinet 50 to 70 ms and a flute 200 to 300 ms. It is generally known that the timbre of the notes produced by the various musical instruments is determined by the harmonics in these notes. What is not generally appreciated, however, is that these harmonics can only be accurately identified during the build-up of the note in question
If we don't hear this build-up. we cannot tell the difference between a flute, violin. French horn or trumpet, despite the presence of the characteristic harmonics. Musical instruments can thus only be distinguished by the build up of the notes they produce.



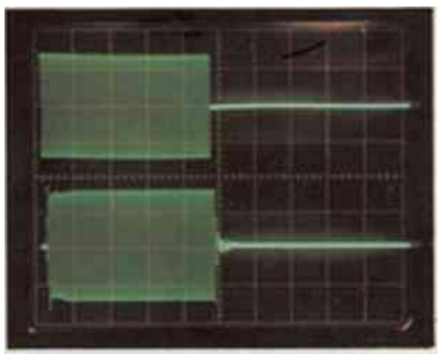


Trumpet

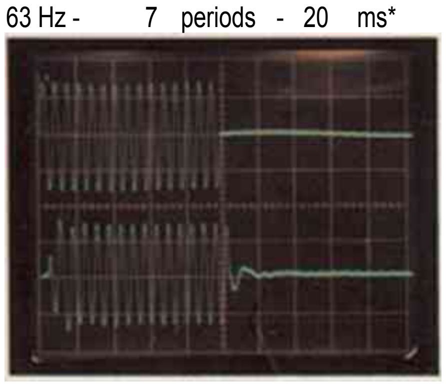
This means that a studio-class loudspeaker must have a very high-speed, precise amplitude response, so that it is able to reproduce the form of the amplitude build-up of a sound exactly.



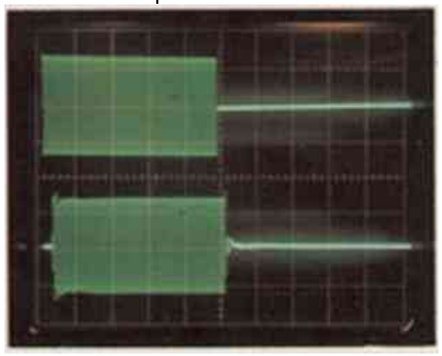
63 Hz - 7 periods - 20 ms*



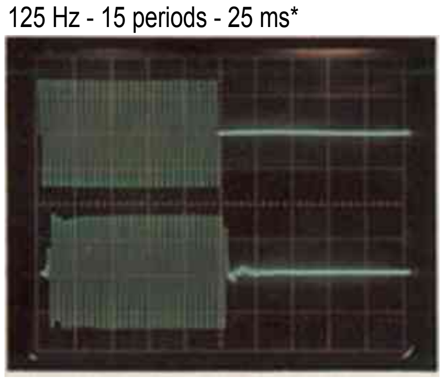
1000 Hz - 128 periods - 25 ms*



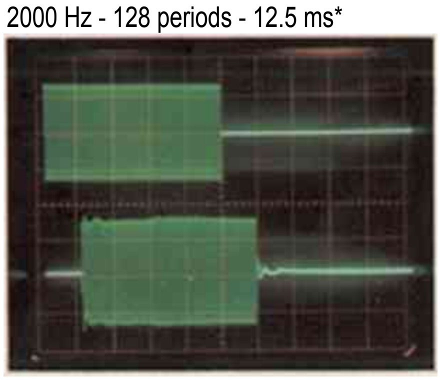
125 Hz - 15 periods - 25 ms*



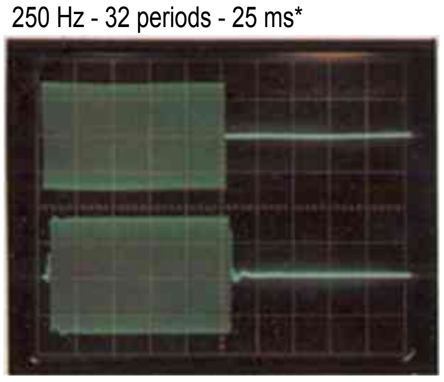
2000 Hz - 128 periods - 12.5 ms*



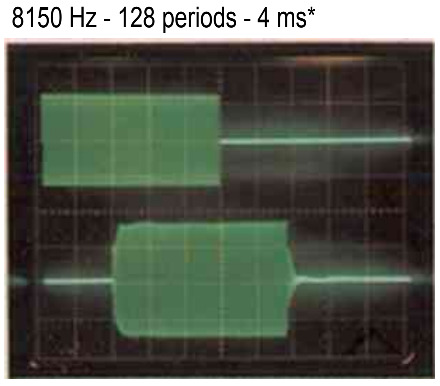
250 Hz - 32 periods - 25 ms*



8150 Hz - 128 periods - 4 ms*

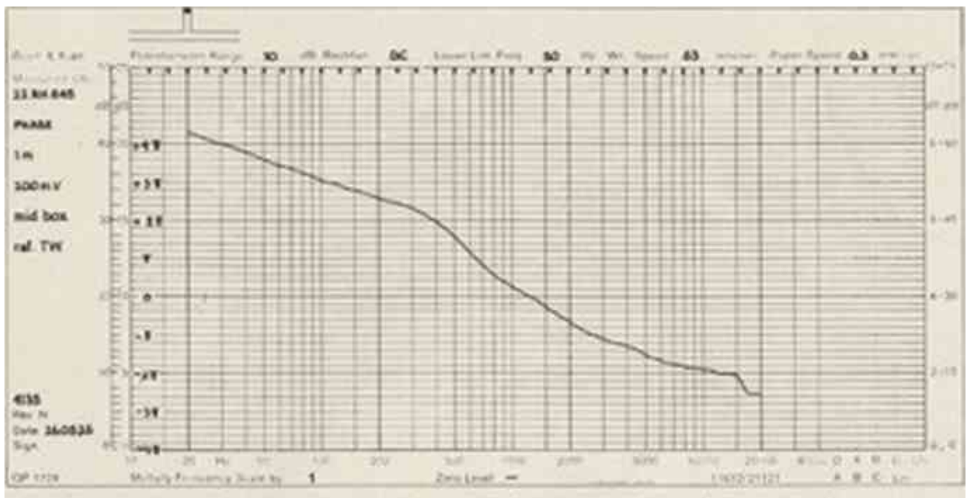


500 Hz - 64 periods - 33 ms*



16000 Hz -125 periods - 2 ms*

For complete characterization of the high-speed response of a loudspeaker (its "pulse response"), we need to know how its sound pressure and acoustic phase vary with time. The more linear the amplitude and phase response, the more exactly will pulsed signals be reproduced. This is especially important in contemporary music, where pulsed tones are relatively common.



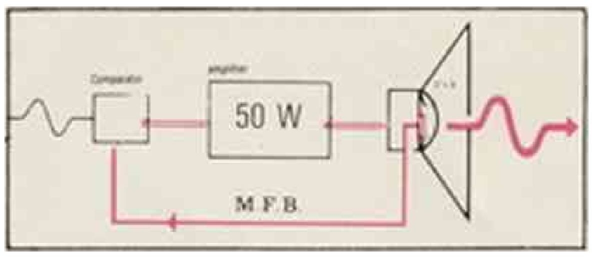
So far, we have been concentrating on the main characteristics of your own personal acoustic "receiver" - your ear. We will now tell you something about the corresponding quality characteristics of an acoustic "transmitter" - the PHILIPS 545 MFB Studio loudspeaker - which matches your ear very well. We felt obliged to present you with both sets of data, because technical data without reference to the reality of hearing satisfy us (your Philips HiFi team) no more than they do you

The team responsible for the development of the 545 MFB Studio was given the task of building a loudspeaker whose tone reproduction was realistic enough to meet all requirements made by professional studio workers - a real "specialist" among specialists.

This "specialist" had to have the following interesting "qualifications", among others:

- a small housing, which still permits faultless reproduction of low notes right down to 20 Hz;
- playback volume characteristics which meet all studio requirements, without audible distortion;
- simple adjustment of the linear acoustic response characteristic to meet the requirements of the playback room ("positional matching");
- special filters for matching the loudspeaker to the acoustics of the room in the high- and low-frequency ranges.

These stringent specifications could never have been met without the help of the exhaustive work carried out in Philips' Research Laboratories.



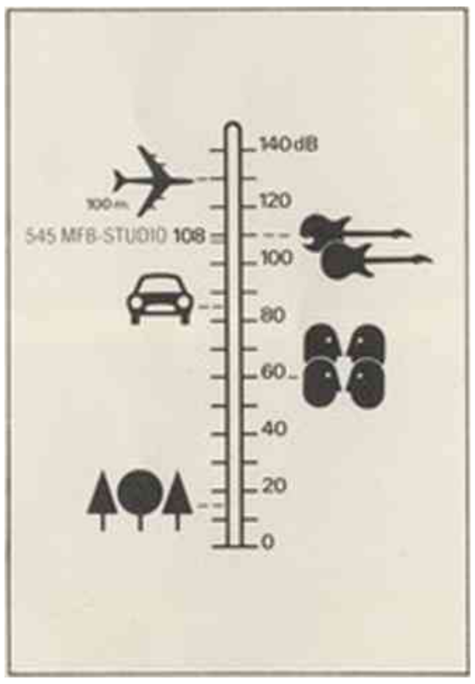
Some of thî concrete results of Philips research in the 545 MFB Studio loudspeaker are as follows:

A 70-litre box into which are built three special loudspeakers together with trimming and control circuitry, and three power amplifiers with outputs of 50.35 and 15 watt R.M.S. sine-wave.

The 50-watt amplifier drives the woofer in accordance with the input signal it receives. The woofer carries at the centre of its cone an acceleration transducer in the form of a piezoelectric element (PXE for short). This produces a voltage proportional to the acceleration of the cone, which is compared with the input signal of the amplifier in a comparator stage. A correction signal produced by the comparator as the result of the difference between the original signal and the PXE-signal. is fed back by the comparator, with reversal of phase, to the amplifier, thus making it possible for the motional errors of the woofer cone, which would be inevitable in the absence of MFB (motional feedback), to be eliminated at the source. The acoustic signal emitted by the woofer is hence a faithful replica of the original driving signal.

The 35-watt amplifier drives the medium-frequency dome loudspeaker (squawker). while the 15-watt amplifier drives the tweeter (also a dome loudspeaker). The over-all transmission range is divided into three frequency bands (at 500 and 3000 Hz) by precision cross-over filters situated before the power amplifiers.

Since it is important for HiFi reproduction that the amplitude response should be correct, even for the big dynamic peaks which occur relatively often in big orchestral performances, the 545 MFB STUDIO can deliver a total sound-pressure level (over its entire 7Voctave range) of 108 dB at a distance of 1 metre from the box.



Philips research shows the way

Motional feedback in loudspeakers
J A Klaassen and S.H. de Koning. Philips Research Laboratories. Eindhoven 1968.

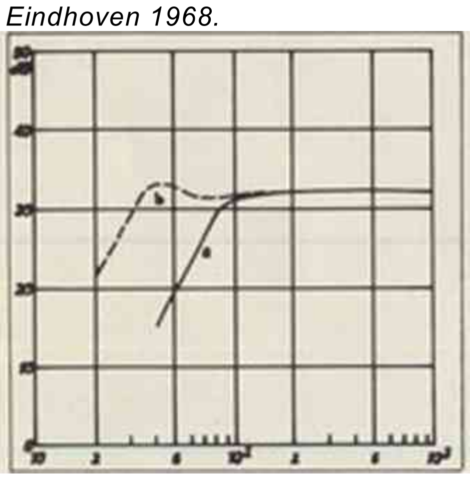


Fig. 1. Amplitude characteristics determined with the loudspeaker in an enclosed 10-litre housing, a) without motional feedback, b) with acceleration feedback

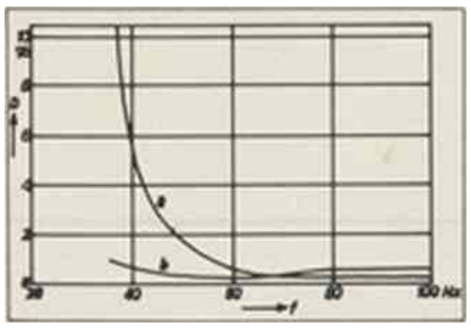


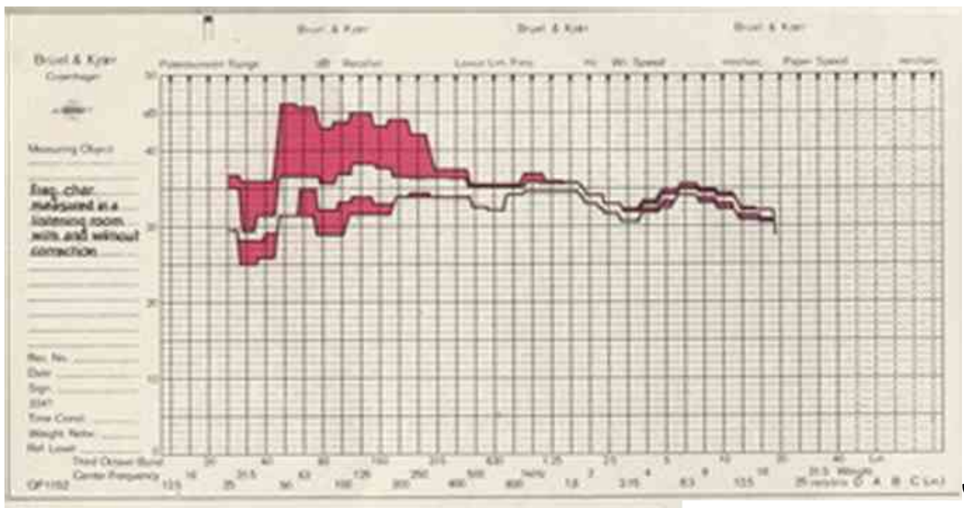
Fig. 2 Non linear distortion D as a function of frequency for the woofer 9710. a) without motional feedback, b) with acceleration feedback corresponding to the amplitude characteristic b of Fig 1

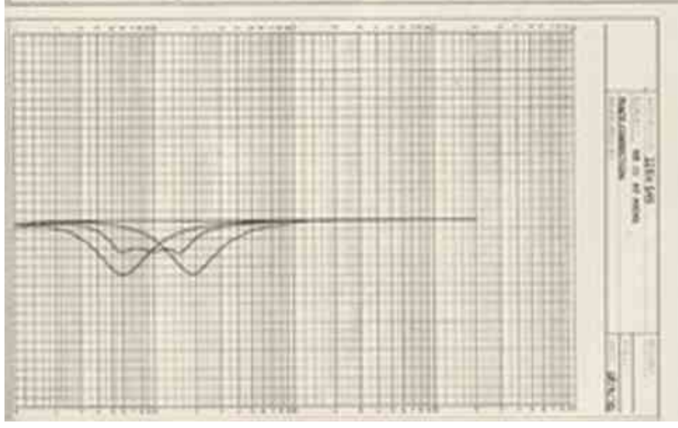
Vibration and sound radiation of loudspeaker cones
F.J.M. Frankorter. Philips Research Laboratories. Eindhoven 1975

A computer programme (involving 12 simultaneous equations) for a large number of frequencies and different cone types makes it possible to build loudspeakers with predetermined characteristics.

For example, a woofer cone must vibrate as a rigid whole within its transmission range. Holograms show that a woofer designed with the aid of this programme does not start to show standing waves until two octaves above its transmission range

Since the sound radiation at low frequencies is highly dependent on the positioning of the loudspeaker, three high-precision electronic filters (with gyrators) are provided for accurate correction of the sound pressure (positional matching). This eliminates the potential sources of sound distortion otherwise present * when the box is positioned against a rear wall, a side wall, or on the floor, and making the sound-pressure characteristic independent of the positioning of the loudspeaker. What that means to you in practical terms is that the low tones are reproduced without the slightest distortion.

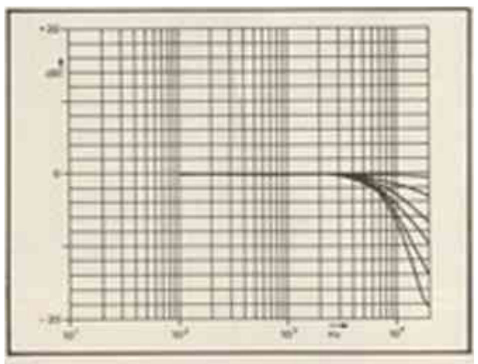




The damping curves of the three positional matching fitters, which can be used m any desired combination

Sound-pressure curves with and without positional matching filler, wilh the boxes at vanous places in the playback room

An active low-pass filter with an adjustment range of ± 10 dB and a passive high-pass filter with a choice of cut-off frequencies (7 or 10 kHz) and an adjustable damping slope (max. 20 dB/octave) serve for matching the box to the acoustics of the room
For example, the effect of an unwelcome rise in reverberation in the low-frequency range can be cut out with the aid of the low-pass filter

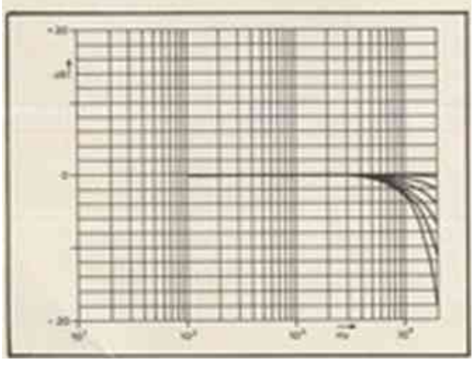


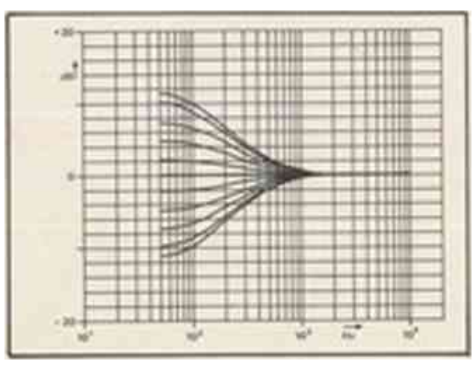
A high-pass filter with a cut-off frequency of 35 Hz protects against distortion from infrafrequencies below 20 Hz.

High-frequency filler
cut-off frequency 7 kH?

Hiqh frequency filler cut nit frequency 10 kH/

low-frequency filter

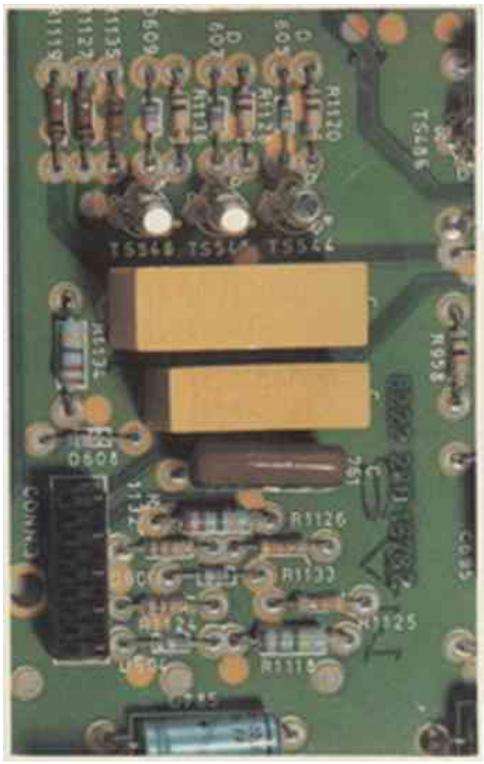


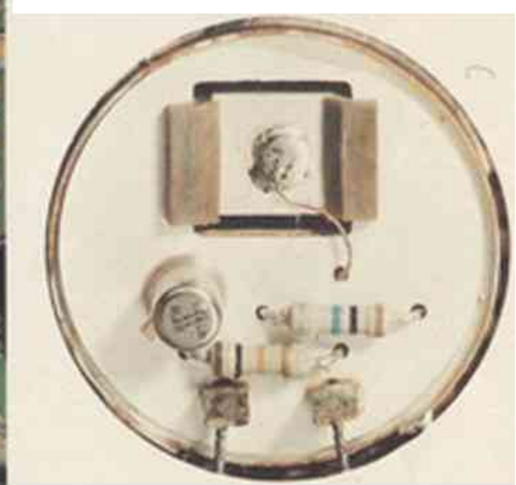


Thanks to the well thought out design, the boxes are easy to operate despite the relatively large amount-of circuitry they house. For example, only 6 switches are needed to adjust the box to the acoustics of the room - 3 for positional matching and 3 for reverberation matching. The 3 remaining controls on the neat little control panel are for facilitating the connection of the box. The first of these is for selecting the nature of the input: symmetrical (studio norm) or asymmetrical (OIN home-studio norm 45500). With the asymmetrical input, there is no need to switch the box on and off manually. A signal-, controlled relay switches automatically from "ready" to "on", and back to "ready" again if no signal is received for more than 2 minutes. The second control adjusts the input sensitivity to the desired level in 11 steps, while the third and last adjusts the box for connection to the right-hand or left-hand stereo channel.
The 545 MFB STUDIO can thus be connected to several different types of signal source:
amplifier without power output stage, with symmetrical 1-V output.

amplifier without power output stage, with asymmetrical 1-V output;
HiFi amplifier with power output stage, up to 100 W
If the output power available is inadequate. it is possible to connect several boxes to form a group. For this purpose, each input connector has a corresponding output connector in parallel with it.

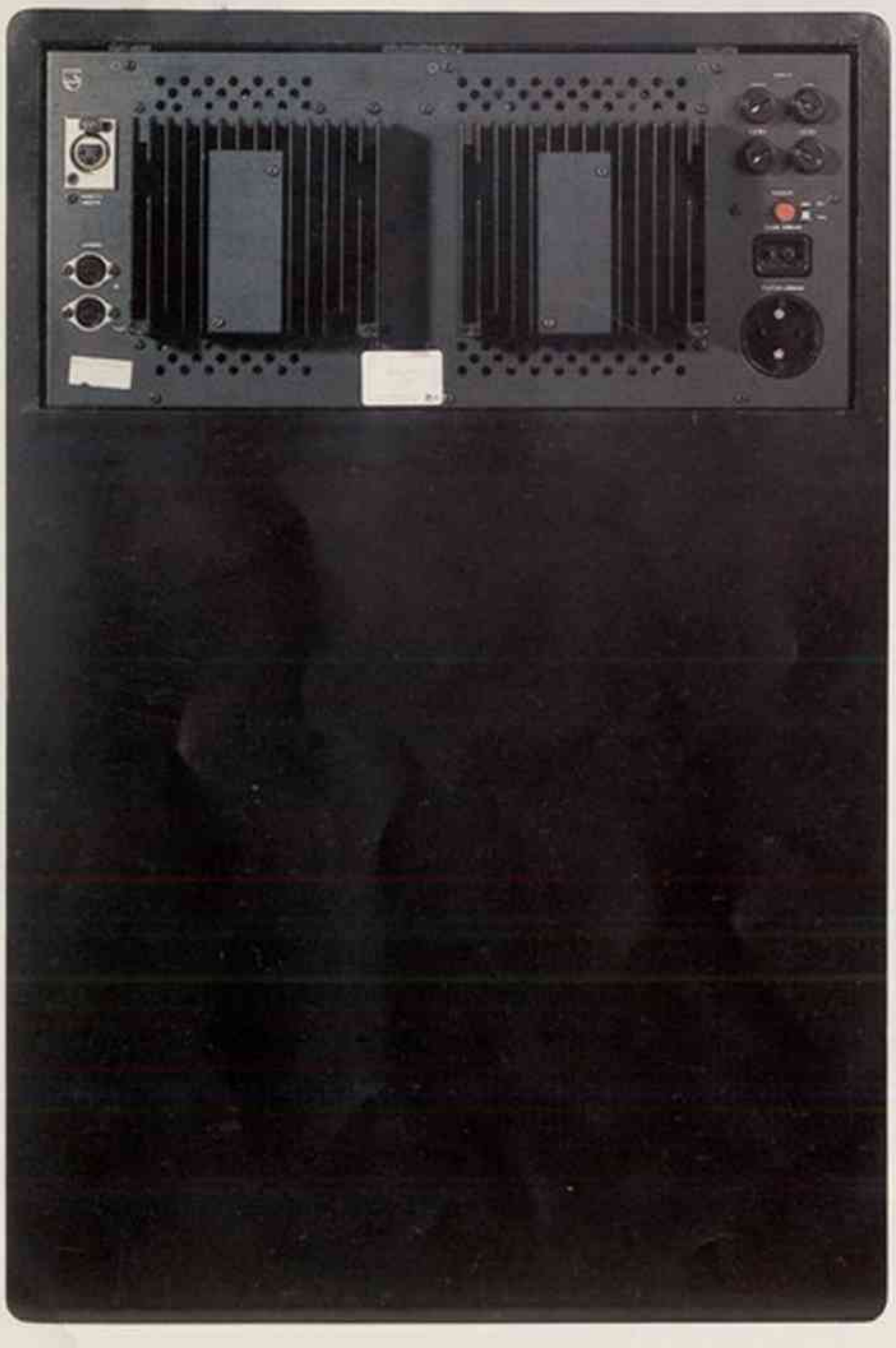
This little print card with the PXE acceleration transducer and field-effect transistor is the heart of each MFB loudspeaker. It is mounted at the centre of the loudspeaker cone This element is subjected to high loads, as it vibrates with the cone and undergoes the full changes in acceleration affecting the latter Careful design with over-dimensioned components and stringent life testing ensure reliable operation for the loudspeaker as a whole





The three loudspeakers are protected against overload by means of a safety circuit which interrupts the channels in question for the duration of the overload (e g. an overvoltage).
In the interests of reliable operation, all components are overdimensioned. and all transistors used are mounted in metal housings. The circuits are built up on reinforced epoxy print cards, with fully metallized mounting holes.

This delay of approx. 3 ms which can be seen in the loudspeaker oscillograms results from the sound transmission time between the loudspeaker and the test microphone.




PHILIPS

Technical data

Transmission range	20 - 20000 Hz
Sound pressure level (over full 77z-octave range)	108 dB at distance of 1 m
Volume	70 litres (acoustic section 501, electronics 201)
Loudspeaker systems	tweeter 1" dome loudspeaker AO 0162/T8 squawker 2" dome loudspeaker AO 0210/Sq 4 woofer 12" low-tone loudspeaker AO 121 00/W4
Cross-over frequencies	500 Hz and 3 kHz (active filter)
Amplifiers:	
Low-frequency channel	output power 50 W sine-wave (at 100 Hz. 40 W: k < 0.1%) Bandwidth 5 Hz- 5 kHz
Medium-frequency channel	output power 35 W sine-wave (at 1000 Hz. 25 W: k < 0.1 %) Bandwidth 40 Hz - 30 kHz
High-frequency channel	output power 15 W sine-wave (at 5 kHz. 10 W: k < 0.1%) Bandwidth 40 Hz - 50 kHz
Sound-pressure correction filters	Positional matching: 200 Hz -5 dB 60 Hz -5 dB 55-160 Hz -3 dB Bass tone control: Down from 350 Hz: ± 10 d8 at 60 Hz. in 11 steps. treble tone control: continuously variable from 7 or 10 kHz. 0 - 20 dB/octave (a pilot light shows when this control is switched on)
Electronic automatic ON/OFF switching (only with DIN asymmetrical input: can be switched off)	response time: < 1 second for input signals above about # 1.5 mV decay time > 2 minutes A pilot light shows when this function is switched on
Input sensitivity	Continuously adjustable 1 - 23 V symmetrical 1 V into 10 kohm asymmetrical 1 V into 100 kohm
Connections	CANNON studio input connector (symmetr.) DIN input corrector. 5-pole (asymmetr.) mains input terminal. DIN/IEC mains output terminal. DIN/IEC
Semiconductors	85 transistors. 39 diodes
Mains	220 V. 50/60 Hz (if desired, can be adjusted by our service technicians to 110. 127 or 240 V)
Power consumption	200 W max. consumption A pilot light shows when the box is connected to the mains
Housing	wooden cabinet (black ash) textile front panel (removable)
Dimensions	436 x 650 x 320 mm (width x height x depth)

Comparison of the main points of various Philips HiFi loudspeaker boxes

		545	544	541
No. of channels/ No. of amplifiers		3/3	3/2	3/1
Sound pressure total, at a distance of 1 m	dB	108	105	102
Transmission range	Hz	20-20000	30-20000	35-20000
Volume, net	1	70	15	8
Output power	W	100	60	30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