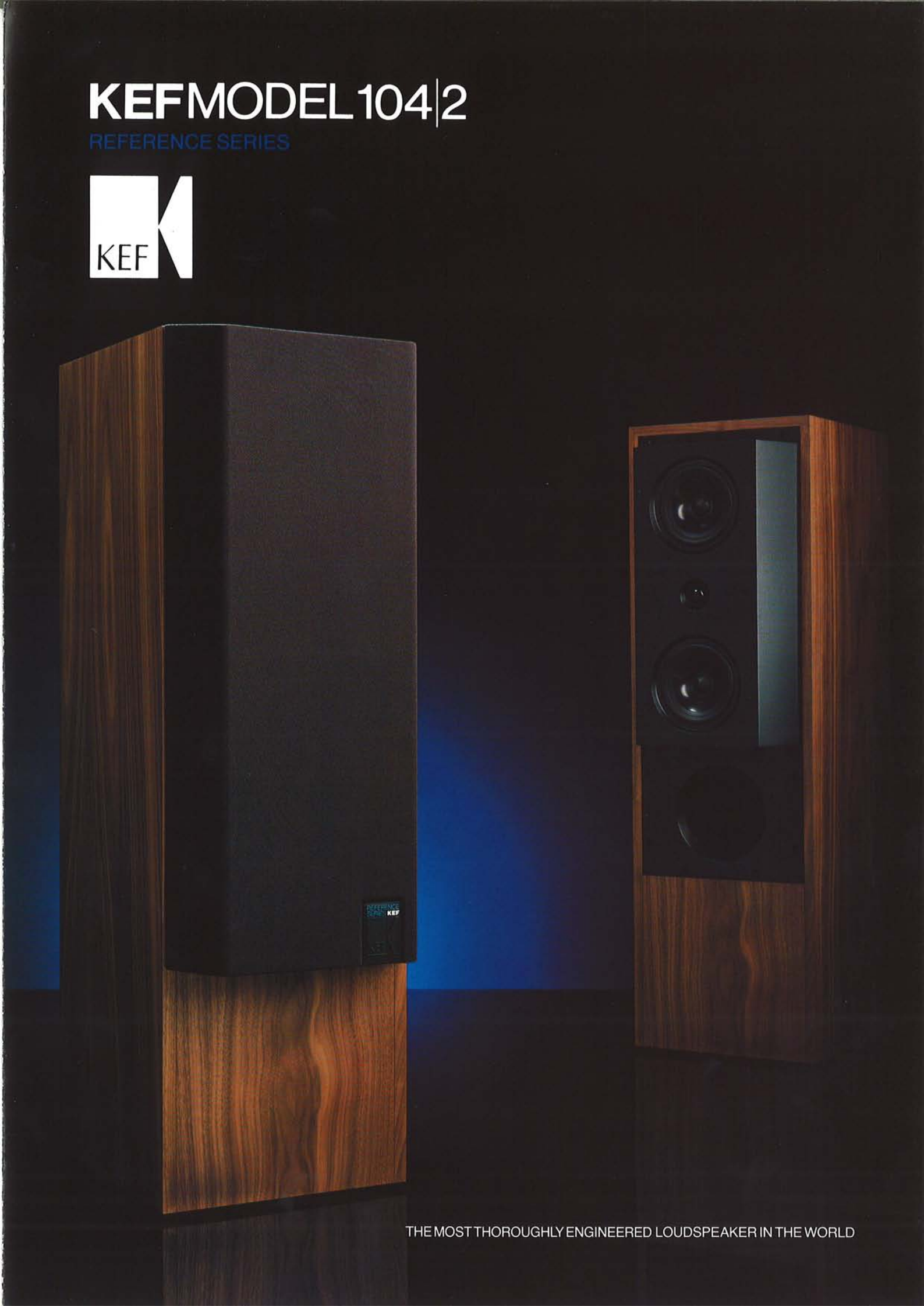
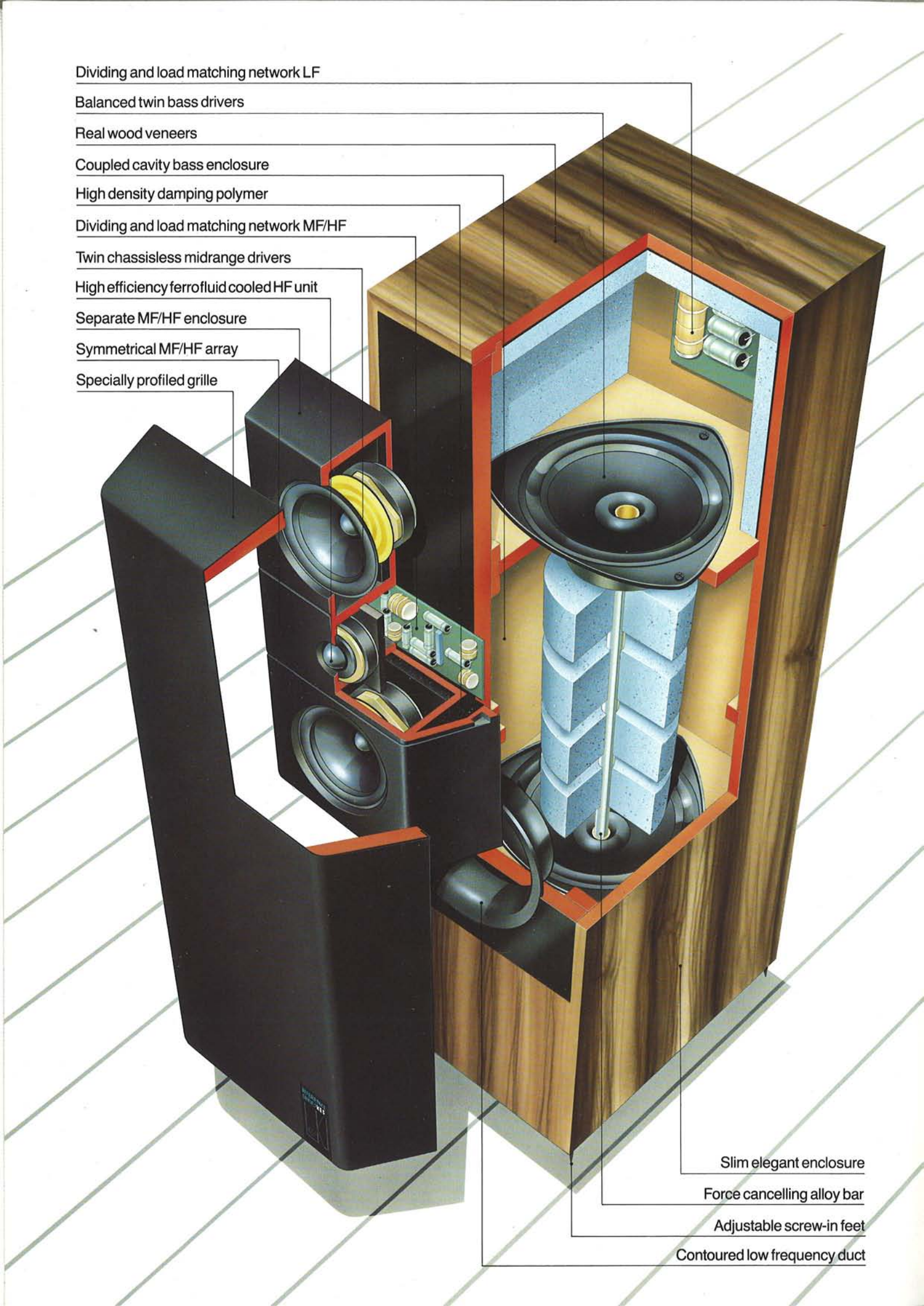
KEF MODEL 104|2

REFERENCE SERIES



THE MOST THOROUGHLY ENGINEERED LOUDSPEAKER IN THE WORLD


Dividing and load matching network LF
Balanced twin bass drivers
Real wood veneers
Coupled cavity bass enclosure
High density damping polymer
Dividing and load matching network MF/HF
Twin chassisless midrange drivers
High efficiency ferrofluid cooled HF unit
Separate MF/HF enclosure
Symmetrical MF/HF array
Specially profiled grille
Slim elegant enclosure
Force cancelling alloy bar
Adjustable screw-in feet
Contoured low frequency duct

Anatomy of an audiophile loudspeaker

Conjugate Load Matching

Or How to Double The Power of Your Amplifier Without Having to Buy a New One

The reproduction of a wide dynamic range at high output levels has traditionally meant using a large amplifier with large loudspeakers, making heavy demands on both.

But every good amplifier is overdesigned to cope with a wide range of loudspeaker loads, some of them notoriously 'difficult.' Thus there is 60-100% more untapped power locked inside every amplifier.

The key to unlock this extra power is 'conjugate load matching.'

Most amplifiers are rated for operation with a nominal load impedance of 8 ohms. But the load presented by a typical '8 ohm' loudspeaker is not at all like that of an 8 ohm resistor. It varies, both in magnitude and phase, with frequency.

For pure sine wave test signals, the current drawn by such a loudspeaker is seldom more than, and for some frequencies less than, that of a resistor of 8 ohms. But on complex musical signals with harmonic structure, the peak current requirement may be more than double that of an 8 ohm resistor, corresponding more closely to that of a 4 ohm resistor (Fig 1).

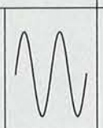
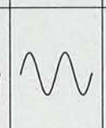
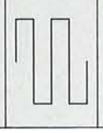
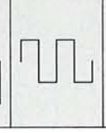
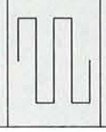
AMPLIFIER OUTPUT VOLTAGE		CURRENT DRAWN BY LOAD			
		8 OHM RESISTOR	8 OHM LOUDSPEAKER OF GOOD DESIGN	4 OHM RESISTOR	KEF MODEL 104|2
SINE WAVE TEST SIGNAL					
COMPLEX MUSIC-LIKE SIGNAL					

Fig 1

This is why good amplifiers must have extra peak current capacity.

Advanced computer design techniques, pioneered by KEF more than a decade ago, have enabled the Model 104/2 to be built with a dividing network that, in addition to the usual filtering and shaping components, includes load matching elements which make the input impedance flat and resistive over the range 20Hz to 20kHz. Having a purely resistive characteristic enables the loudspeaker's impedance to be reduced, over the whole audio band, to 4 ohms and yet demand no more peak current from an amplifier.

The result is that the sensitivity and maximum output level are effectively doubled, without any need for a more powerful amplifier.

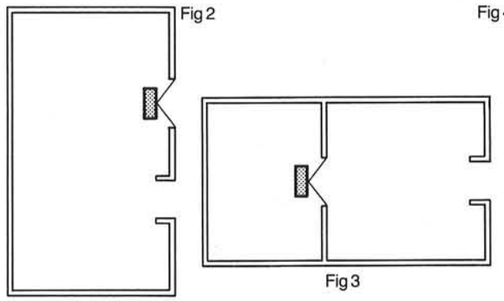


Fig 2

Fig 3

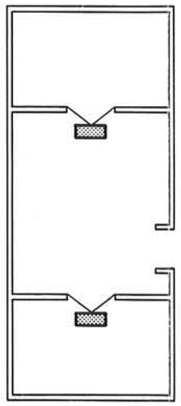


Fig 4

Coupled Cavity Bass Loading

Or How to Get More Bass Output and Power Handling with Reduced Distortion, without increasing the Size of the Cabinet

In conventional loudspeakers, bass output and extension is directly related to cabinet size. It is well known that a reflex system (Fig 2) will give higher output with lower distortion from any given enclosure size. This is achieved by making use of the sound radiated by the back of the bass unit. Instead of being 'lost' in the cabinet, as in a closed box, this sound is phase inverted by the port and adds to the sound radiated from the front of the unit.

Below the tuning frequency of the port, however, the two outputs are no longer in phase and cancellation ensures loss of output. The roll-off rate below this frequency is double that of a closed box resulting in poorer transient performance and susceptibility to subsonic signals as the bass unit is unloaded at very low frequencies.

The coupled cavity system of bass loading used in the Model 104/2 is the result of some nine years research by KEF engineers.

By isolating the bass unit and using only the output of the reflex port, (Fig 3) no output is lost through cancellation, and the tuning frequency can be placed where the musical demands are greatest. Such a system gives very low distortion with very high power handling capability. Transient performance is superior to that of a reflex system, and protection is afforded against subsonic problems. Also a lower frequency can be used for crossover to the midrange than is normal; around 150Hz instead of the more usual 250-350Hz. Additionally it confers all these benefits where the mechanical demands of music reproduction are at their highest.

In the Model 104/2 two bass units are used in 'balanced' mode, (Fig 4) facing vertically upwards, coupled together by a non-ferrous alloy bar bolted rigidly between their magnet structures. This arrangement doubles the low frequency output, and reduces distortion whilst cancelling the forces set up in the units themselves thereby preventing the transfer of energy to the main enclosure.

Such energy is a principal cause of the delayed resonances which give rise to 'boxy' colouration.

The Integrated Midrange

Or How To Eliminate Colouration by Eliminating its Source

The main sources of colouration in the crucial midrange region are structural resonances in the midrange chassis and the enclosure.

In the KEF 104/2, chassis resonance is eliminated by simply dispensing with the chassis altogether! The two midrange diaphragm assemblies are fixed directly to a separate high frequency and midrange enclosure (Fig 5), the magnet systems being bolted to the rear of it.

Enclosure resonances are effectively suppressed by damping the entire structure with a new high-density polymer, moulded in situ (Fig 6).

This unique midrange and high-frequency enclosure incorporates a centrally located high efficiency tweeter, ferrofluid cooled to ensure maximum power handling capability.

The combination of this heavily damped assembly, the total weight of which exceeds 6.5 kg (14 lb) with the non-resonant coupled cavity bass configuration, produces a full-range system of high efficiency, capable of astonishingly high sound pressure levels. The 104/2 reproduces music with a clarity and freedom from colouration that is startling in its ability to communicate all the dynamics and fine detail of which music is composed.

Fig 5

Fig 6

Controlled Directivity

Or How To Create Lifelike Sound Pictures

The creation of stable, focussed sound images in space is achieved through a combination of very close frequency response and sensitivity matching between the two speakers in the stereo pair, and by closely controlled on and off-axis response. To achieve the former, the KEF Reference Series design and production philosophy was the reference, using computer-controlled drive unit matching within 0.5dB, and component tolerance matching in the dividing network.

To help control off-axis response the special midrange/high frequency enclosure mentioned above is carefully contoured to minimise disturbances in the sound distribution caused by diffraction, resulting in response being maintained well off axis.

This assembly alone reproduces around 85% of normal musical programme and the use of two identical midrange units, in addition to improving power handling, allows them to operate over an unusually wide bandwidth (nearly a full octave lower than is usual). Widening the practical bandwidth of the midrange system means that, in conjunction with the bass loading method employed, a low crossover point at 150Hz can be used, thus achieving a smoother distribution of energy through the important 200-400Hz region, with reduced colouration in the voice region, and improved imaging.

The 104/2's entire low-frequency output is radiated by a smoothly contoured duct placed below the mid/high frequency enclosure. This duct, effectively a 5″ air diaphragm of very low mass, (approx. 3 gm!) is of similar diameter to the midrange units. Its directional characteristics therefore match those of the midrange, ensuring an exceptionally smooth acoustical integration which further enhances the 104/2's imaging capabilities.

Electronic time delay is incorporated in the dividing network to tilt the preferred axis towards the seated listener. This helps stereo imaging without having recourse to offset or stepped drive units.

Flexibility, Compatibility and Pleasing Appearance

Or How To Reconcile The Irreconcilable

Speakers capable of giving the high level of performance of the 104/2 have generally been big and ugly. The relatively compact dimensions (it takes up less than 1sq ft of floor space) and elegant appearance of the 104/2 have been a part of the design brief since its inception. In addition, it is generally acknowledged that most speakers actually perform better with their grilles removed, revealing what are, to many people, unsightly drive unit arrangements. The 104/2 is specifically designed to be operated with the grille on. Careful contouring and matching of the grille assembly to the midrange enclosure (Fig 7) produces an improved response with the grille in place.

The conjugate load-matching technique ensures compatibility with a very wide range of associated equipment by presenting the kindest possible load to the driving amplifier.

Finally, the most unpredictable and variable element in hi-fi is the listening room. The 104/2 allows greater flexibility of positioning because it suffers less from the aberrations normally introduced when placing speakers of more conventional design.

Screw-in feet allow the speaker to be set perfectly upright to avoid the stability problems often encountered with tall, slim enclosures. This also ensures that the speaker is correctly coupled to the room.

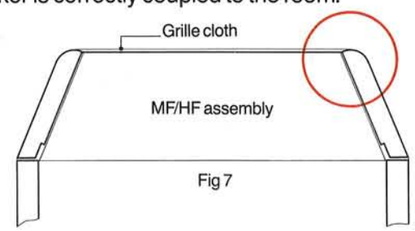


Fig 7

The most significant advance in dynamic loudspeaker technology in a decade

The 'state of the art,' as any hi-fi enthusiast knows, moves forward by way of a constant flow of tiny improvements and innovations.

But every so often, something remarkable happens that seems to push the whole process forward by several years at a single stroke.

The KEF Reference Series 104/2 is just such a development.

Valuable experience gained in both domestic and professional surroundings with KEF's new high level, high quality monitor, the KM1, have enabled many of the KM1 design features to be adapted to this new domestic loudspeaker system.

The 104/2 employs new mechanical and electrical ideas, some bordering on the revolutionary. However, its design philosophy is still the same as that on which its distinguished predecessor, the original 104, was based 12 years ago.

The original concept was, and so remains today, simply to build the best speaker possible to meet the musical demands of the time.

Recording technology has greatly advanced over the past 12 years. The new 104/2 has been designed to meet today's challenge.

Today's digital recordings possess a wider dynamic range than ever before. Reduced background noise reveals more fine musical detail. To realise the full potential of these recordings a new breed of speaker is demanded.

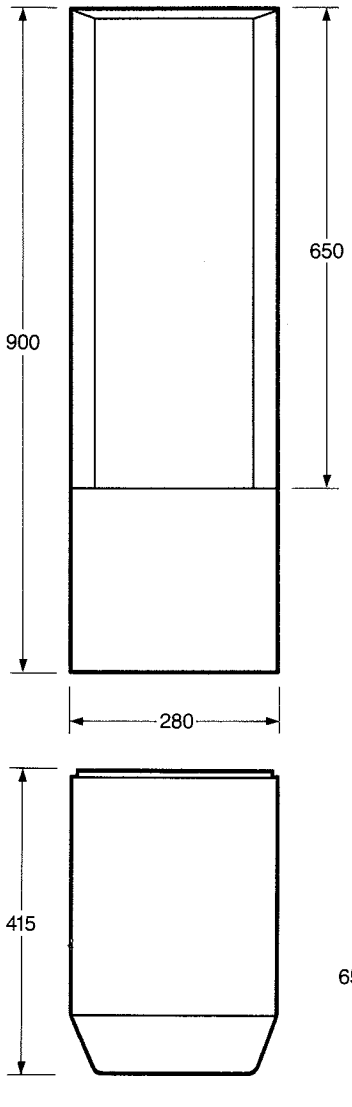
What are the characteristics which this new breed of speaker should have?

A Wide Dynamic Range requires a loudspeaker of high efficiency, coupled with adequate power handling and low distortion.

Low Colouration is achieved by freedom from spectral distortion both on and off axis, and by freedom from structural resonances in the enclosure and drive units.

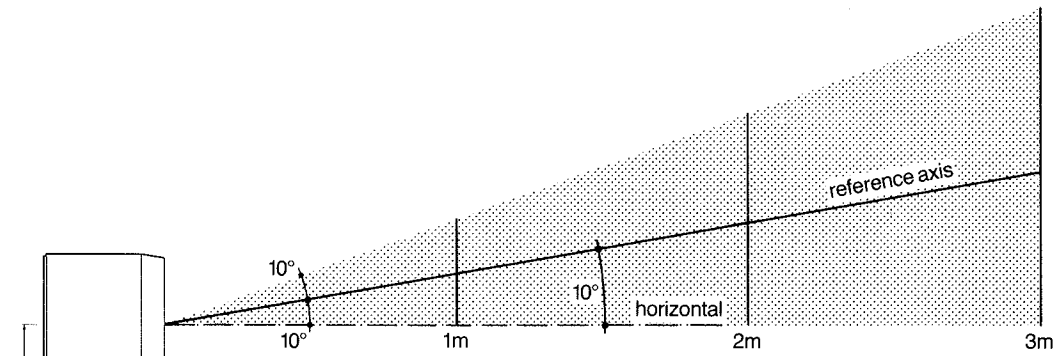
Stable Stereo Imaging requires exceptionally close matching between left and right hand loudspeakers, with uniform on and off axis response, under all conditions.

Pleasing appearance. Speakers are necessarily part of the furniture in the home, and must truly be 'lived with.' Industrial design, compatible with the engineering demands, should therefore ensure that the loudspeaker looks as elegant and unobtrusive as possible. It should also give of its best in all rooms irrespective of their shape and size, allow flexibility of positioning, and operate with as wide a range of associated electronics as possible, whilst extracting the best from each.



Frequency Range:	55Hz-20kHz ± 2dB at 2m on reference axis
Directional Characteristics:	Within 2dB of response on reference axis up to 15kHz for ± 10° vertically up to 10kHz for ± 30° horizontally up to 6kHz for ± 45° horizontally
Maximum Output:	112dB spl on programme peaks under typical listening conditions
Characteristic Sensitivity Level:	92dB spl at 1m on reference axis for pink noise input of 2.83V rms (anechoic conditions)
Distortion:	Second harmonic: less than 0.5% from 20-20,000Hz Third harmonic: less than 0.5% from 20-20,000Hz Measured at 1m on reference axis at mean spl of 94dB (anechoic conditions)
Enclosures:	Low frequency enclosure: 50 litres MF/HF enclosure: 3 litres
Amplifier Requirements:	Suitable for use with amplifiers capable of providing between 25 and 200W into 4 ohms resistive load
Nominal Impedance:	4 ohms resistive from 20-20,000Hz
Weight:	32kg (70½lb)
Dimensions:	900 (h) x 280 (w) x 415 (d) mm, 35½ (h) x 11 (w) x 16⅜ (d) in

KEF reserve the right to incorporate developments and amend specifications without prior notice in line with continuous research and product improvement.



The shaded band shows the limits of the listening window (in the vertical plane) within which the optimum sound reproduction is obtained.

KEF ELECTRONICS LTD., Tovil, Maidstone, Kent ME15 6QP. Telephone: 0622 672261. Telex: 96140.
Distributed in the U.S.A. by: KEF Electronics of America Inc, 14120-K Sullyfield Circle, Chantilly, VA 22021.
Telephone: (703) 631 8810. Telex: 510 100 2304.

Part No. PL 502 EN OI