
KEF REFERENCE SERIES
MODEL 103.2

PRODUCT DESIGN STORY



KEF ELECTRONICS LIMITED

MODEL 103.2 - DESIGN STORY

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Introduction

Despite recent advances in large floor standing loudspeakers there is a continuing demand for bookshelf speakers. Not that many people actually place them on bookshelves, but the term is a convenient and accepted word to describe a fairly compact loudspeaker system which can be conveniently incorporated into an already furnished room without too much rearrangement. There are other advantages resulting from the flexibility of small enclosures. They are more easily located relative to the listeners where they can produce sharp stereo images and satisfactory tonal balance.

KEF were pioneers of high quality bookshelf speakers starting with the original Celeste in 1962. Since then there has been a continuous series of developments. Several "marks" of Celeste have appeared, later joined by Chorale and Corelli. More recently the original Model 103 incorporated some important innovations.

With the introduction of Model 103.2 the design of a high quality bookshelf system is brought right up to date with an increase of 4 dB in characteristic sensitivity compared with Corelli. Reference Series production methods are employed, ensuring consistent high quality and good pair matching. The incorporation of electronic overload protection removes the biggest danger to the continued good health of small loudspeakers in those markets where hi-fi users seem particularly accident prone.

General Description

Model 103.2 is a two-way loudspeaker system employing a 200 mm diameter Bextrene cone LF unit SP1075 in a sealed enclosure together with a T33 HF unit type SP1074. The acoustic crossover frequency is 3,000 Hz.

The enclosure is designed to stand only in the upright position at a height which places the bottom of the cabinet 90 cm above the floor for seated listeners.

Electronic overload protection (S-STOP) is incorporated to guard against accidental fault conditions and visual indication of overloading is provided by means of an LED display.

LF System

The low frequency section comprises a new 200 mm diameter LF/MF drive unit in a 19 litre sealed enclosure. The drive unit is fitted with a Bextrene diaphragm and a narrow PVC surround. The mechanical parameters were chosen to optimise performance in this particular system. The standard pressed steel trochoidal chassis is used together with a modest ferrite magnet assembly and a 32.6 mm diameter high temperature voice coil wound on an aluminium former. See appendix for full specification of SP1075.

As with all new Reference Series products, the LF drive unit is compliantly mounted to isolate reaction forces from the enclosure. In early production, mountings will consist of moulded rubber grommets used with metal spacers. These will be replaced later by specially fabricated components.

Due to the efficacy of the mounting arrangement in reducing cabinet excitation, panel damping has been omitted without audible deterioration in performance. It should be noted however that the enclosure panels will "ring" if tapped. It is important therefore to be aware that such elementary knock tests can be misleading. Many modes of vibration are not excited under normal operating conditions and certain modes do not radiate anyway. The enclosure design and drive unit mounting have been optimised during development using modal analysis techniques.

Acoustical absorbent material in the form of blocks of expanded polyurethane foam is installed in precise quantity to achieve the required Q factor.

To extend the low frequency performance below that normally expected from a nominal 20 litre enclosure of 86 dB characteristic sensitivity, series capacitor feed is used - now a common feature of all KEF Reference Series products. The output at low frequencies extends smoothly from the upper cut off frequency of 3,000 Hz down to 60 Hz and the useful output continues below 40 Hz..

The enclosure is constructed from 18 mm particle board and houses the dividing network and electronic overload protection circuit on a single printed circuit board fixed to the bottom of the cabinet. The network board is accessible through the LF drive unit aperture.

Connections are made via spring loaded clips located at the rear of the enclosure.

HF Drive Unit

High frequency output above 3,000 Hz is handled by a T33 type SP1074. This unit was chosen for its high sensitivity and thermal ruggedness. The Model 103.2 is not only rated at 150 watts but it is also capable of delivering sound pressure levels of 106 dB peak as a result of careful choice of drive units. In this respect its maximum output approaches that of Model 105.2.

Electronic Overload Protection

The use of electronic overload protection is perhaps more important in a bookshelf speaker than in larger models because they are more likely to be used with small amplifiers which may be driven into severe clipping from time to time.

The S-STOP sensor module monitors voice coil temperature of both drive units and activates the protection relay if either voice coil is thermally threatened.

The sensing module also monitors peak voltage and operates the protection relay if the peak input exceeds 60 volts so as to obviate damage to components in the dividing network and protection circuit. It is interesting to note that by limiting the peak input voltage it has been found unnecessary to provide separate excursion limiting for the LF drive unit as the relay will operate before the bass unit bottoms.

An external LED warning device is fitted to the front panel to indicate when the protection relay has been tripped. The circuit resets itself automatically when overloading ceases.

Listening Window

One of the greatest weaknesses of previous bookshelf speakers was the indeterminacy of the listening window. In earlier designs this feature was generally disregarded and the user was invited to stand the enclosures in any attitude which pleased him, hence the custom of veneering all four sides. In some cases, the left hand speaker would be in a different attitude from the right - small wonder that stereo imaging was often unsatisfactory.

When this problem became better understood KEF introduced the original Model 103 in 1975. This speaker was provided with a rotatable baffle enabling the radiating system to assume its correct position independently of cabinet attitude. Model 103 was generally accepted by reviewers and critics as a very good bookshelf loudspeaker. Many preferred it to Model 104aB and continue to use it as a reference. It did not succeed commercially however and was eventually withdrawn.

The modern counterpart is designed to stand in the upright position only. Its design axis is normal to the plane of the baffle midway between the drive units (see Fig.3). The listening window extends $\pm 5^\circ$ vertically with respect to the design axis specified above and frequency response remains within 1 dB up to 10 kHz at $\pm 20^\circ$ horizontally. This is therefore ample coverage for domestic use provided always that the speakers are located at the correct height of approximately 90 cm for seated listeners.

Optional Finishes

Model 103.2 will be available in a choice of walnut, teak or rosewood veneers as well as in black ash. The grille will be covered in black fabric.

Packaging

Model 103.2 will be packed in matched pairs in a single carton.

Performance

The most impressive feature of Model 103.2 is the sharpness and stability of the stereo images which it creates due mainly to the excellence of the pair matching. Performance in this respect has not been achieved in previous bookshelf speakers except by accident. There is also an effortless ease about the general quality of reproduction resulting from smooth frequency response, low distortion and high power handling capacity.

Quality Assurance

All loudspeaker manufacturers promise quality control but few do little more than make a cursory examination of random samples. Model 103.2, like other systems in the KEF Reference Series, is produced by a unique process which incorporates quality assurance at every stage of assembly.* All components are inspected individually. Each drive unit is measured using high speed precision impulse methods pioneered by KEF. Digitally recorded data is then used to computer match sets of drive units which are complemented with paired dividing networks. These novel and precise production methods guarantee the frequency response of Model 103.2 within fine limits and stereo reproduction of outstanding perspective and sharpness.

* KEFTOPICS Volume 3 No. 3.

Specification

Frequency Range	60Hz to 20kHz \pm 3dB at 2m on design axis (-10dB at 37Hz and 30kHz)
Directional Characteristics	Within 1dB of response on design axis up to 20,000 Hz for \pm 5 ^o vertically up to 10,000 Hz for \pm 20 ^o horizontally
Characteristic Sensitivity Level	86dB spl at 1m on design axis for pink noise input of 1W (anechoic conditions)
Maximum Output	106dB spl on programme peaks under typical listening conditions
Distortion	Second Harmonic: less than 2% from 20Hz to 150Hz less than 1% from 150Hz to 20kHz Third Harmonic: less than 2% from 20Hz to 50Hz less than 1% from 50Hz to 20kHz Measured at 1m on measuring axis at mean spl of 90dB, anechoic conditions
Enclosure	19 litres
Power Handling Capacity*	
Programme Rating	150W
Maximum Continuous Sinusoidal Input	20V rms, 100-2500Hz falling to 8V rms from 4,000-20,000Hz
*Electronic Protection (S-STOP) The System is protected against any continuous or intermittent fault conditions which produce input signals not greater than 60V peak from DC to 50kHz.	
Nominal Impedance	8 ohms
Dimensions	510 x 265 x 240mm
Weight	8.6kg

T33 Specification Number SP 1074

Net weight: 0.55 kg

Nominal impedance: 8 ohms

Nominal frequency range: 3,000 - 20,000Hz

Power handling: 100 W programme
continuous sine wave 9V rms (see note)

Magnet: Flux density 1.2T
Total flux 2.9×10^{-4} Wb

Voice coil: Diameter 25.4mm
Max. continuous service temperature (30 min) 120°C
Max intermittent temperature (5 sec) 200°C
Nominal DC resistance, R_{DC} (tolerance 5.6 - 6.4 ohms)

Diaphragm: Effective area, S_D 6.29 cm²
Effective moving mass, M_D 0.36 g

Free air resonance frequency, f_s :
Nominal 950 Hz \pm 200 Hz

Total mechanical resistance of suspension, R_{MS} : 0.5 mech ohms

Suspension compliance, C_{MS} : 7.8×10^{-5} mN⁻¹

Force factor, Bl: 3.5NA⁻¹

Damping: Mechanical Q_M 4.39
Electrical Q_E 1.04
Total Q_T 0.84

Note

1 Continuous power rating (Pc) $PC = \frac{V^2}{R}$

V is the rms voltage which can be applied to the unit continuously without thermal overload. At low frequencies the continuous power rating of the speaker may be reduced because of limitations imposed on diaphragm excursion.

B200 Specification Number SP 1075

Net weight: 1.35 kg

Nominal Impedance: 5 ohms

Nominal frequency range: 25-3,500 Hz

Typical enclosure volumes: totally enclosed box: 20-25 litres

Power handling: Continuous sine wave: 28V RMS

Magnet: Flux density: 1.1 T
Total flux: 7.15×10^{-4} Wb

Voice Coil: Diameter: 32.6 mm
Max. continuous service temperature (30 min) 250°C
Max. intermittent temperature (5 sec) 340°C
Nominal DC resistance, R_{DC} : 4.7 ohms (tolerance $\pm 5\%$)
Minimum impedance (in nominal frequency range):
5.3 ohms at 160 Hz

Diaphragm: Effective area, S_{D} : 246 cm^2
Effective moving mass, M_{D} : 24.3 g
Max. linear excursion, X_{D} : 6 mm peak-peak
Max. damage limited excursion: 20 mm peak-peak

Free air resonance frequency, f_{S} :
Nominal: 27 Hz

Total mechanical resistance of suspension, R_{MS} : 1.38 mech ohms

Suspension compliance, C_{MS} : 1.4×10^{-3} m/N

Force factor, Bl: 6.82 N/A

Damping: Mechanical Q_{M} : 3.03
Electrical Q_{E} : 0.42
Total Q_{T} : 0.37

Fig.1

MODEL 103.2 DIVIDING NETWORK

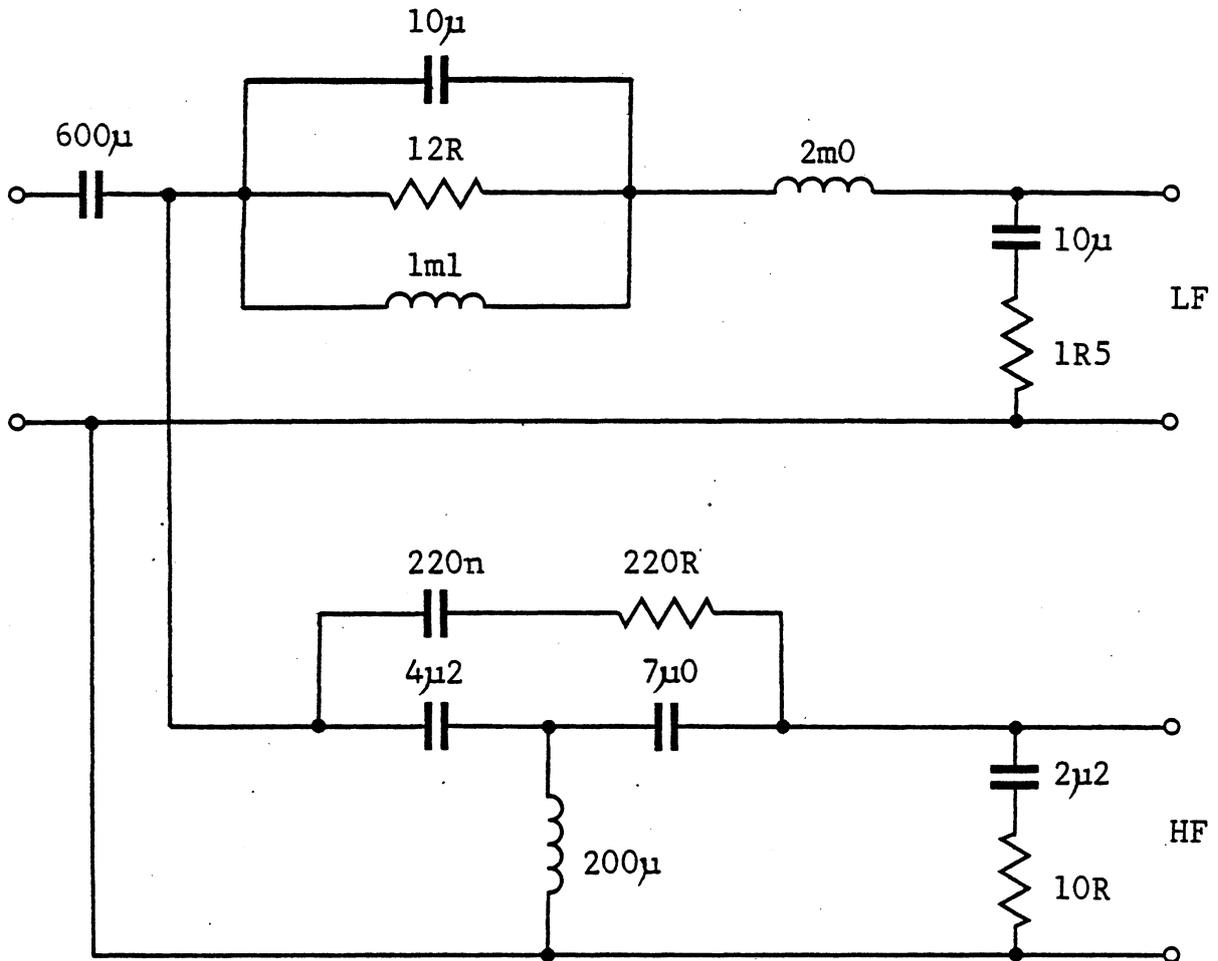


Fig. 2
MODEL 103.2 AMPLITUDE RESPONSE

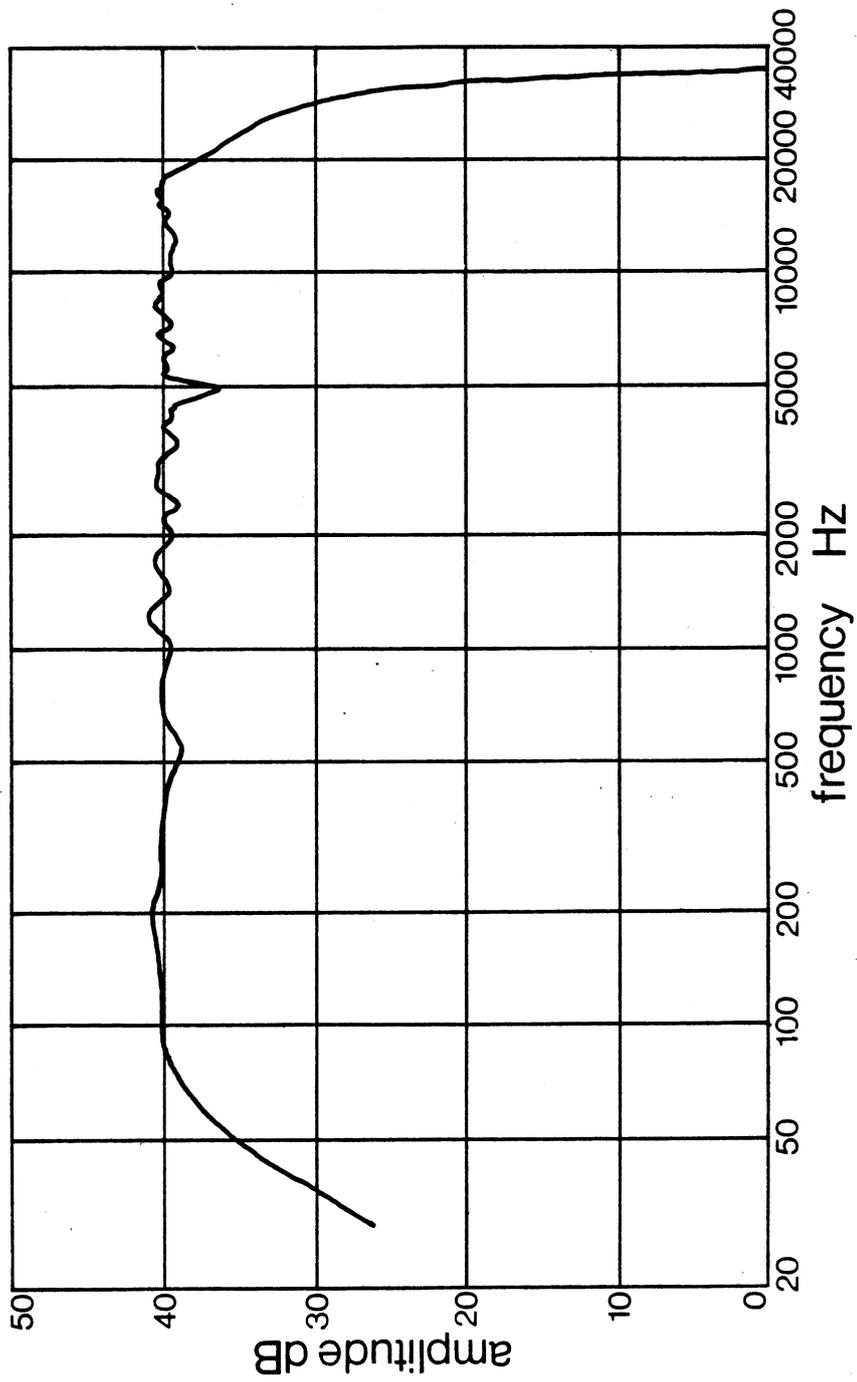
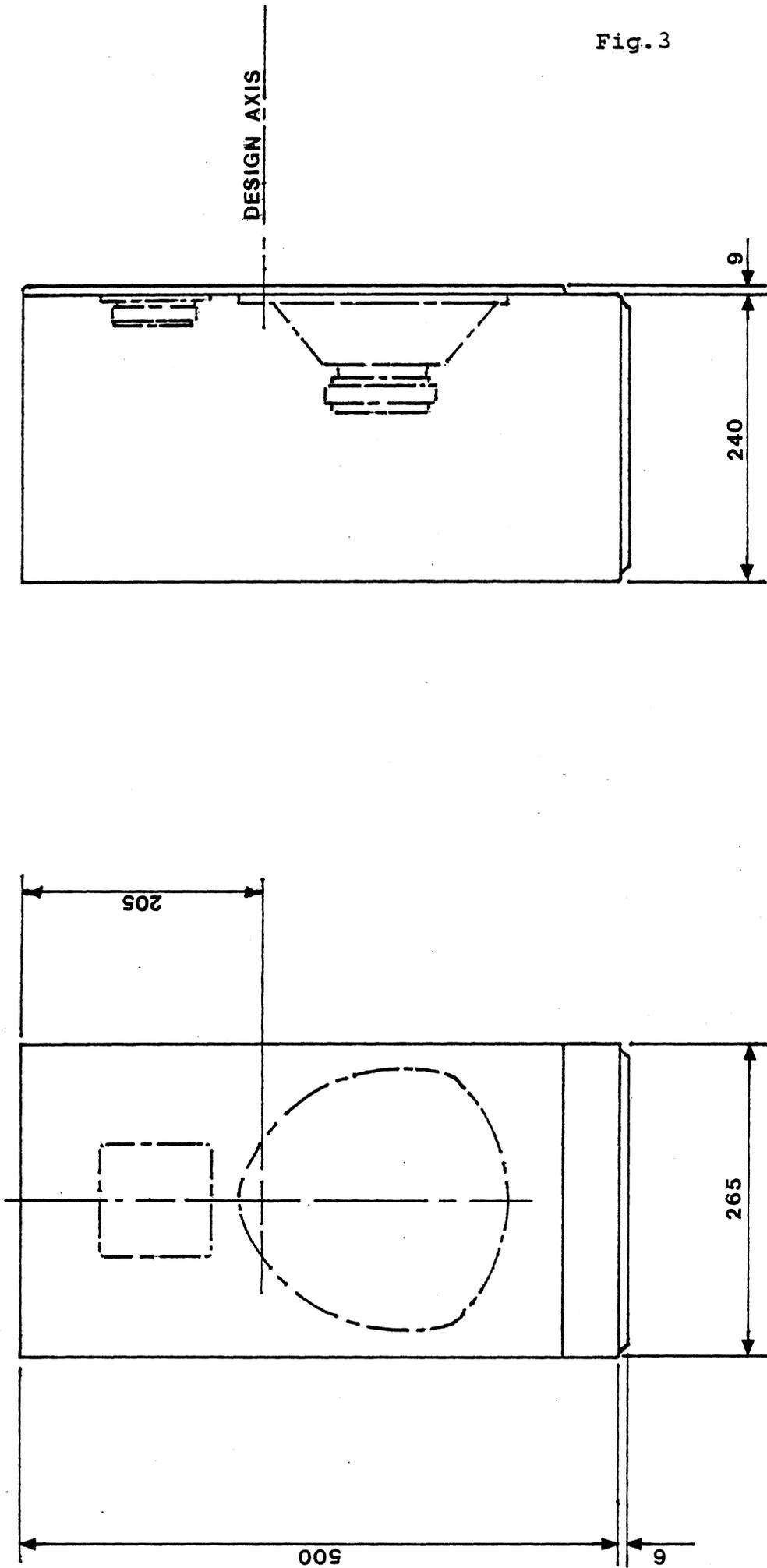


Fig. 3



MODEL 103.2 OUTLINE DRAWING



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