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The Ferrograph Monitor Speaker S1



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The Ferrograph S1 speaker is a three-unit system in a reflex enclosure of novel design. It is capable of radiating pure sine-wave power down to frequencies below 30Hz.

The frequency response is within the limits $\pm 3\text{dB}$ between 45Hz and 20kHz.

Cross-over points between units are at 400Hz and 3.5kHz. The choice of these frequencies is important so that the polar distribution of energy is as wide as possible, and also independent of frequency.

The units have been selected to achieve the lowest degree of coloration from the system.

Coloration is a term used to describe one form of distortion which speaker diaphragms give to the original sound. It is caused by resonances that occur in the loudspeaker cone system and it tends to give the artificial brilliance associated with many hi-fi systems. The presence of coloration is not normally shown up by frequency response measurements. Indeed, speakers having an excellent frequency response and low harmonic distortion can still "colour" the sound and produce disappointing results.

It has been one of the principal design objectives of Ferrograph engineers to reduce coloration to a minimum as this is of fundamental importance for the reproduction of the closest replica of the original sound.

To obtain quantitative measurements of coloration is a difficult procedure. In the case of the S1 the design has been optimised by subjective listening to diaphragms radiating white noise, in which the presence of coloration is readily identified.

No diaphragm so far produced can radiate "colour-free" sound over a wide frequency band, but those used in the S1 perform well in this respect over the frequency band in which they are required to operate.

The S1 incorporates a complex 18-element cross-over network, which, besides performing its normal function of allocating the power-spectrum to the three units, reduces, by means of "notch" filters, the radiation of coloration by the diaphragms outside their respective nominal pass-bands.

The response of the S1 to very low frequencies is characterised by a low level of distortion. This is achieved by a new approach to enclosure design.

In the case of conventional reflex enclosures, the use of a small port is, in practice, necessary in order to achieve a low system resonance in an enclosure of reasonable size. But a small port has two major disadvantages. First, it gives a very poor bass damping to the system. Secondly, the high air velocities at the port give rise to turbulent flow, and this is a source of non-linear distortion.

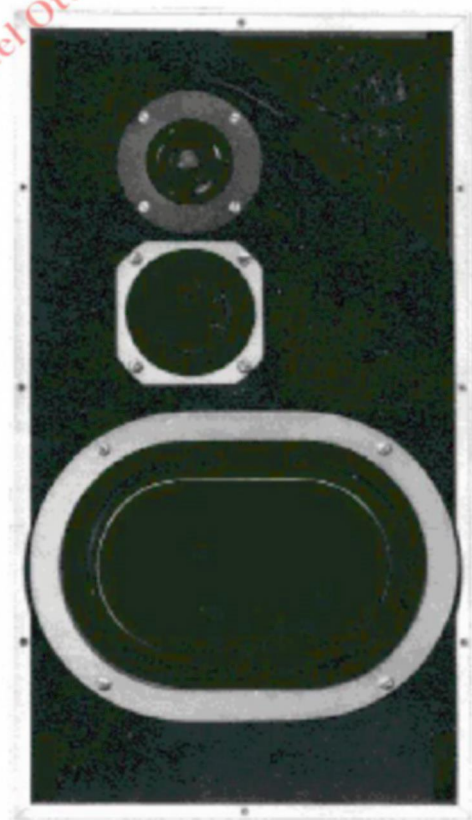
The Ferrograph design employs a large port but with a tube at the rear filled with natural wool. The mass of the wool and the air enclosed by the tube reduces the system resonance to the required figure. The effect of this arrangement is that more low-distortion bass can be radiated for a given volume of enclosure. In addition, the high damping of the system gives improved bass transient response.

Returning to the polar distribution of energy. In the case where the wavelength of sound radiated by a diaphragm is large in relation to its size, the polar distribution of energy is omni-directional in free space. At shorter wavelengths the distribution departs from the omni-directional pattern and becomes more and more directional. When the wavelength of sound radiated is small compared with the dimensions of the diaphragm, the radiation pattern is a relatively narrow beam. In the case of the S1 speaker, the cross-over points are set so that the power is handed over to a small diaphragm before the larger diaphragm starts to become directional. The set of curves (right) show that the distribution of energy in a horizontal plane is relatively independent of frequency.

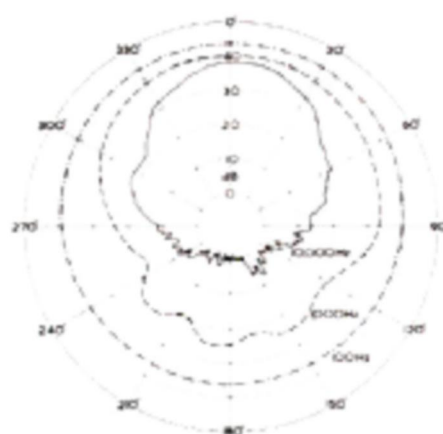
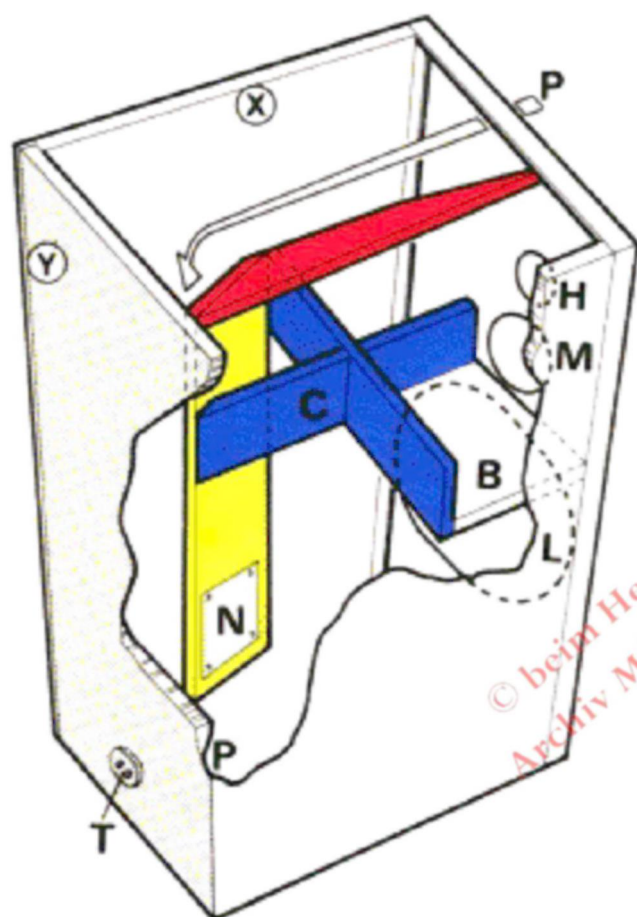
This is an important feature, as a poor performance in this respect not only results in a sound field whose frequency response is dependent on the position of the listener, but also the position of the stereo image changes with the frequency being radiated.

The capability of the S1 to radiate low frequencies at low distortion levels is important, as the speaker pressure response can be equalised electrically if some degree of bass lift is required for operation in large studios. For normal domestic listening the pressure response curve is about what is required, as the floor, the walls and the ceiling will provide a lift to the response below 45Hz.

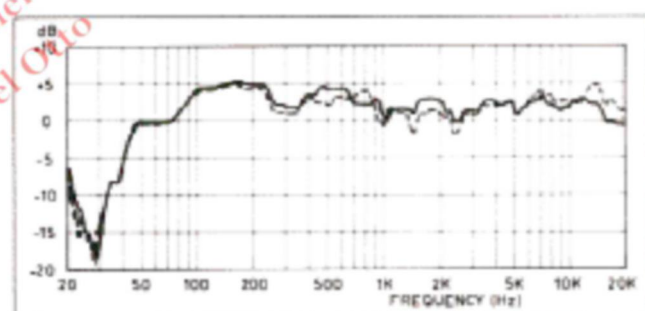
The detailed attention which Ferrograph engineers have given to these factors has resulted in the clean and natural sound of the Ferrograph S1, and in a performance comparable with the most expensive monitor speakers used in professional recording studios and in broadcasting.



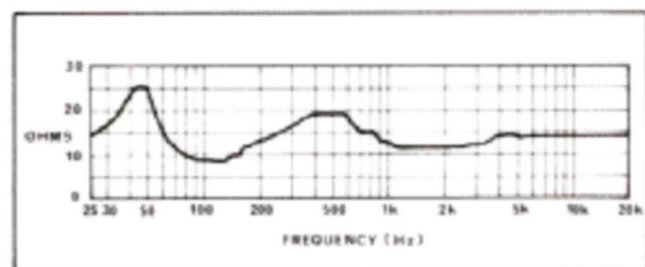
Front view of the S1 with grille removed.



Polar response diagram.



Axial frequency response of two S1 speakers, showing close correlation.



Impedance frequency curve. (Note - this does not indicate frequency response).

- P** Port (45° to X and Y)
- C** Cross-bracing
- B** Isolating Baffle
- H** H.F. Unit
- M** Mid-freq. Unit
- L** L.F. Unit
- N** Cross-over Network
- P** Polyester finished chipboard (18mm)
- T** Terminal Panel

The polar response and axial frequency response curves are reproduced from The Gramophone by kind permission of the publishers.

Specification

| | |
|-------------------------------|---|
| Frequency Response | 45Hz - 20kHz \pm 3dB. Pure sine wave radiation down to 30Hz in free space. |
| Power Rating | 100W peak. 25W continuous (sine wave). |
| Impedance | 8 Ω nominal 6 Ω minimum. |
| Cross-over Frequencies | 400Hz and 3.5kHz. |
| Drive Units | LF 330 \times 241mm (13 \times 9 $\frac{1}{2}$ in.). MF 102mm dia. (4 in.). HF 25mm dia. (1 in.). |
| Enclosure | Reflex, constructed of polyester-faced high density chipboard. Finished in American Walnut. Grille of acoustically transparent 'Gender' style folk weave fabric. |
| Stand | Single pillar aluminium finished in white, fitted with three swivelling castors. |
| Connections | Two colour-coded press terminals, fully recessed at the lower rear of the cabinet. |
| Dimensions | Cabinet Height 64 cm (25 in.). Width 35 cm (14 in.). Depth 44 cm (17 $\frac{1}{2}$ in.). Volume 74 000 cu.cm (2.6 cu.ft.). Stand Height 37cm (14 $\frac{1}{2}$ in.). |
| Weight | Cabinet 25kg (56 lb.). Stand 2.7kg (6 lb.). |

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