Knowles®

TB16

TECHNICAL BULLETIN

ELECTRONIC RESPONSE SHAPING OF DIRECTIONAL MICROPHONES

In those applications where necessary, the frequency response of the Knowles directional microphones can be modified electrically. It is the purpose of this bullletin to discuss the modifications and the circuitry.

The frequency response characteristic of "omnidirectional" microphones (such as the BT-1751 and BT 1754) is essentially flat, although the lower frequencies of the BT-1751 have been acoustically treated to produce a controlled attenuation. The frequency response characteristic of the directional microphones (such as the BW-1784 and BW-1788) are different.

The forward (0° incidence) response has approximately a 6 dB per octave rising characteristic, and the rear response a 6 to 9 dB per octave rising characteristic up to a high frequency resonance. As the frequency bandwidth of a directional microphone increases, it may be desirable in many applications to flatten or "equalize" the frequency respose electronically. This can be done with a resistor/capacitor compensating network in the amplifier chain.

The following example is based upon the BW-1784 but would have similar results for other Knowles directional microphones. The network attenuates the 1000 Hz signal by 6.0 dB and the A-weighted noise by 5.5 dB with a resultant increase in the equivalent noise SPL of +0.5 dB.

Figure 1 shows the frequency response of a typical Knowles Electronics BW-1784 microphone with and without the compensation network.

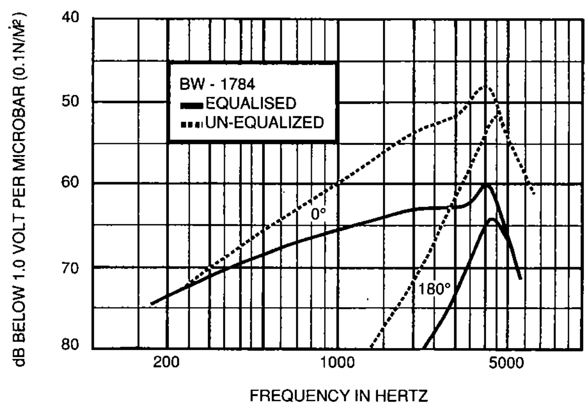

FIGURE 1. Frequency response of a typical Knowles Electronics BW-1784 microphone.

The electrical network described below is intended to equalize the BW-1784 directional microphone for 0° incidence so as to be approximately flat to 5.5K Hz with a low frequency cutoff of 500 Hz. Figure 2 is a circuit diagram of a network that provides the appropriate transmission characteristic.

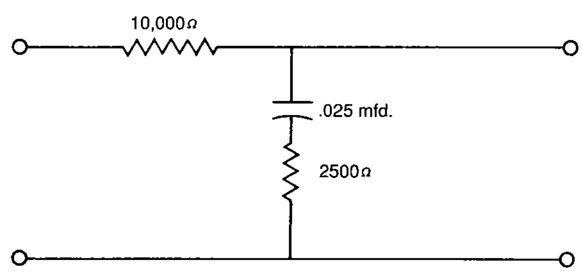

FIGURE 2. Equalization Network for Low Impedance Source and High Impedance load.

The network shown in Figure 3 is more general and will be used to describe how to produce this equalization in existing amplifiers.

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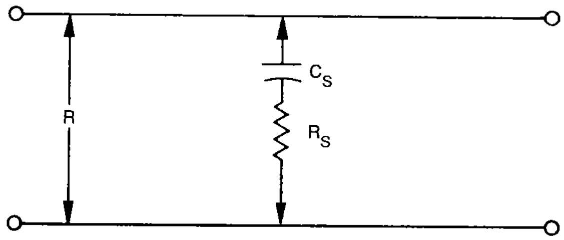

FIGURE 3. Shunt Branch used to determine the Circuit Impedance (R) at the connection point.

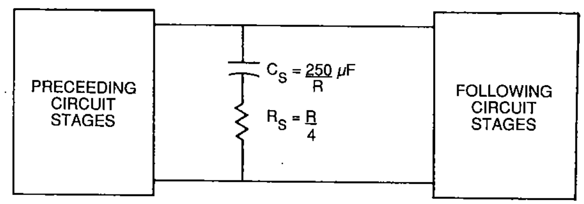

FIGURE 4. Shunting Equalization Network.

To determine the impedance of the circuit, select an appropriate point in the amplifier circuitry where (1) the impedances are not expected to be changed by a control setting and (2) the circuit is not currently contributing to frequency response shaping. This portion of the circuit should be essentially resistive. Introduce a shunt branch as shown in Figure 3 using a large DC blocking capacitor, Cs, and adjust Rs until the transmission through the circuit is reduced by 6.0 dB or to 1/2 the initial gain. The value of Rs under this adjustment is R, the impedance of the circuit where the equalization network will be connected.

To design the equalizer shown in Figure 4, reduce the value of Rs to 1/4 of the value of R as determined above, and reduce the value of the capacitor to a value in microfarads determined by the relation 250/R (where R is Ohms).

An alternative method to determine the value of Cs is to reduce the value of Cs until the sensitivity at 1000 Hz has been decreased to 6.0 dB below the sensitivity with the circuit disconnected.