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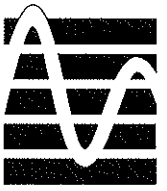

THE AUDIO RECORDING HANDBOOK

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sounds are reduced in level without affecting the rest of the program.

Some compressors have a second input, which accesses the detector input only. This "side-chain" or "key" input allows the engineer to use a separate signal to trigger the gain reduction of the program material passing through the compressor. This type of device is often used as a voice-over compressor or "ducker," and permits an announcer's voice to take precedence over a musical background. The musical program is routed through the compressor, and the voice signal (or a multiple of it) is routed to the key input. The voice signal is what actuates the compressor, causing gain reduction in the musical background, but not in the voice path itself. Voice and music are then combined into a mono or stereo program as the case may warrant. As the announcer speaks, the background level of the music is automatically lowered. As a further refinement, the threshold of the compressor can be adjusted separately from the key input threshold. This provides voice-actuated gain reduction only when the musical program is above a certain level. Therefore, if the music is already sufficiently low in level so as not to obscure the announcer's voice, no further gain reduction is provided.

EXPANDERS

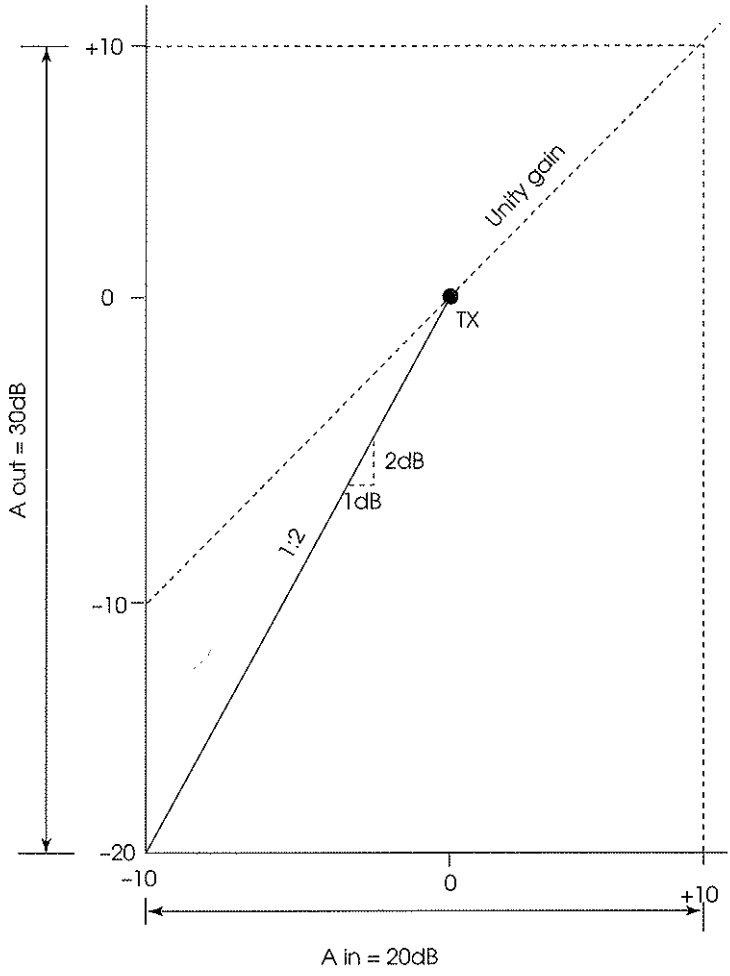
Like the compressor, the expander affects the dynamic range of a program. But, as its name suggests, the expander widens or expands the dynamic range, rather than restricting it. Two definitions describe its operation:

Expander: An amplifier whose gain decreases as its input level is decreased.

Threshold: The level below which the expanding action takes place. (Note that the expander functions below the threshold—just the opposite of a compressor.)

Figure 8-10 is an input/output graph for an expander with a 1:2 expansion ratio. Note that when the input level lies below the expander threshold, the output level changes 2dB for every 1dB change in input level. As drawn, an input signal with a 20dB dynamic range produces an output with a 30dB range. Although maximum output level equals maximum input level, the dynamic range has

Figure 8.10 Graph of an expander with a 1:2 ratio.



been expanded since minimum output level is now 10dB less than minimum input level. In other words, the dynamic range has been expanded downward.

Expansion, when used prior to recording to increase the dynamic range of a program, must be approached with caution since the low-level components of the signal are now even closer to the residual noise floor or minimum level of the recording medium. On the other hand, if the overall level is raised after expansion, the high-level

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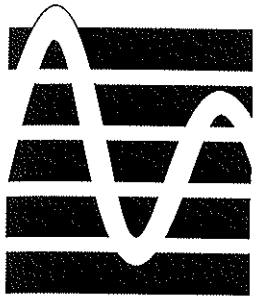

ONE

The Raw Materials of Sound

THE DECIBEL

The decibel (dB) is the commonly used unit for the measurement of sound levels. It is always abbreviated small "d" capital "B" since it stands for one-tenth (deci) of a Bel. The Bel is a rather large unit of measure to work with, hence the decibel. Sound, such as a jet aircraft taking off or a quiet sail on a placid lake, can be measured with a sound level meter. We think of a jet taking off, which creates a noise level of around 130dB, as very loud, and a peaceful sail, about 35dB, as very quiet. The sound level meter usually measures sound levels between 0dB and 140dB or more. Interestingly, 0dB is not the total absence of sound but is equated to the threshold of hearing: that is, the lowest sound pressure level that an average listener with good hearing can detect. The mathematical formula for the decibel is:

$$dB = 10 \log \frac{P}{P_R}$$

where: P = the power to be measured
P_R = the reference power

This zero reference level corresponds to a sound pressure of 0.00002 dynes/cm^2. In terms of intensity, this is equivalent to 0.000000000001 watts/meter^2.

Even a place as quiet as an acoustically correct recording studio has a certain amount of background noise. The simple movement of

air may be around 25dB at some frequencies. Therefore, we can say that the ambient noise level is 25dB greater than our reference level of 0dB.

Anyone who has ever spent time with a tape recorder has surely noted that the readings on the VU meter are not necessarily related to the actual volume heard in the room. Even with the playback loudspeakers turned off, the meters will still register if a signal is applied to the tape recorder. Changing the listening level in the room will have no effect whatever on the meter readings. Typical meter readings of -10 to +3 suggest that a different zero reference value is being used.

THE LOGARITHM

From the above formula, it should be clear that the decibel is defined in terms of logarithms (abbreviated log). Therefore, some comprehension of the mathematical significance of the log is essential to an understanding of the decibel. The reader who is completely familiar with logarithms may wish to skip ahead. Others may also wish to do so, but should avoid the temptation.

Below, several very simple multiplication problems are solved. To the right of each answer, there appears a shorthand notation, consisting of the number 10 followed by a superscript. In mathematics, this superscript is known as an exponent, and to help realize its significance, we may say that an exponent indicates how many times the number 1 is to be multiplied by 10. In the last problem, the exponent, x, is equal to 5, and is read as "ten, raised to the fifth power," or simply, "ten to the fifth." The fact that $10^0 = 1$ may be difficult to understand. It may help to understand that 10^0 is not 1 multiplied by 10 at all, and so it remains simply 1. This explanation may not please the mathematicians, but it will enable us to get on with our introduction to the decibel with a minimum of pain.

$$1 = 1 \text{ or } 10^0$$
$$10 = 10 \text{ or } 10^1$$
$$10 \times 10 = 100 \text{ or } 10^2$$
$$10 \times 10 \times 10 = 1{,}000 \text{ or } 10^3$$
$$10 \times 10 \times 10 \times 10 = 10{,}000 \text{ or } 10^4$$
$$10 \times 10 \times 10 \times 10 \times 10 = 100{,}000 \text{ or } 10^x$$
$$(x = 5)$$