

**ARE YOU STILL
MIXING IN
BLACK AND WHITE?**

AUDIO, signal processing

**Bring out the
Natural Color with the
*EXR EXCITER***



What is a Psychoacoustic Audio Processing System?

The word psychoacoustic, derived from the words, psycho-, signifying a relationship to the mind, and acoustic, something designed to assist hearing, literally means "an audio processing system that uses the mind to help in hearing". To help remove the ambiguity from this definition and understand the basic theory of operation behind the EXR Exciter, the following background is presented.

Audio Information Reception by Human Beings

Research into the area of human hearing has made great strides in the last decade. Knowledge derived from this research is still considered to be very basic yet has added greatly to the understanding of audio stimuli reception and interpretation by the human hearing mechanism. A simplified chain of audio perception is as follows. Sound waves cause vibrations in the ear and body, which in turn encodes the information and sends it on to the brain. The brain then sorts and reacts to the information. Exactly how this process is achieved is still in the speculative stage but it is now known that information is received and reacted upon by the brain at two levels, consciously and subconsciously.

Extensive research into the areas of subliminal information reception by the brain has verified that even though a human being is only consciously aware of a small amount of the environmental stimuli bombarding his senses at any given moment, his subconscious monitoring system is continually receiving, sorting and reacting to a much greater amount of information than he is consciously aware of.

The brain deals with consciously received information thoughtfully, therefore deliberately. Too much conscious information causes confusion and indecision. For the brain to operate at its optimum level of efficiency, the level of conscious perception must be kept below this confusion point, there must be limits to prevent perceptual overload. (Note: Autism is partially attributed to the inability of the brain to properly limit the amount of conscious stimuli reception.)

Information outside these limits of conscious attention must be received and sorted by the brain without conscious thought, therefore subconscious information is processed instinctually by the brain. Instinctual behavior in the human species is controlled by the autonomic nervous system. This system is one of the least understood yet considered to be the most complex and accurate mechanism that has ever evolved on this planet. This same system controls all our involuntary functions, from digestion to the blinking of the eye.

The autonomic nervous system uses information stored in memory banks to instantly make its decisions. Information stored in these memory banks is broken into two basic categories, inherited and learned. Hereditary information is passed on genetically and relates to the survival of the species. Learned information is accumulated from the time a person comes into existence.

Both hereditary and learned information stored in the human memory are used by the human hearing mechanism simultaneously in making interpretive decisions about all audio stimuli received by an individual. Information considered to be well below the conscious level of hearing, such as small time delays and finite volume changes, are used by the brain to determine both direction and distance. The accuracy of these decisions has allowed the human species to survive for many millions of years. Even the most advanced computers in the world today cannot rival the complexity or amount of information that the human mind is capable of deciphering instantaneously. No audio measuring device ever invented can rival the human hearing mechanism.

Professional Audio Industry Standards of Performance

Manufacturers of professional audio components used in the professional recording, broadcasting, film production and live sound reinforcement fields adhere to a somewhat mutually accepted set of standards of performance for their products. These standards vary only slightly from manufacturer to manufacturer. They are determined by two basic factors, the state of electronic technology and agreed upon parameters of human hearing. Technological development in audio components derives its direction and impetus from the agreed upon parameters of human hearing.

Presently accepted parameters come from testing the response of the human hearing mechanism. These tests have been subjective in nature and only dealt with the conscious aspects of human hearing. The standards of performance for most audio components, therefore, are set at or just below the threshold of conscious reception. Audio stimuli outside of these agreed upon limits are generally considered of little importance if any at all. What this means is that the professional audio industry basically has ignored the most accurate part of the human hearing mechanism. Information below 20hz and above 20,000hz is usually rolled off, small volume changes of plus or minus 1 db are considered not heard and small percentages of distortion are considered to have little or no influence on audio perception.

By the time an audio signal has completed the audio reproduction chain, it may have been processed by a hundred different components. The signal must pass through microphones, mixing consoles, enumerable outboard processing devices, magnetic tape recorders, disk mastering lathes, transmitters, tuners and speakers. As a result of this the multiplier effect sets in, even the slightest variations become magnified. The delicate detail drops off dramatically as a signal is electronically processed and consequently the fundamental parts of the signal become more prominent. When you add the information lost by the unrealistically set standards of performance to the deterioration caused by the multiplier effect, it is amazing that the remaining signal retains any resemblance to the original signal.

The human ear has become accustomed to these variations in recorded material and accepts them as part of the listening experience. People still enjoy listening to reproduced audio signals such as music but this does not mean that they can't hear these slight variations. Have a person stand in the middle of a room and say a statement and also play a recorded copy of that statement by the same person through a speaker in about the same position in the room. A blindfolded listener can tell instantly which of the two signals is live. That listener may not consciously be able to tell you what the difference is but he knows that it is not natural. The missing and inaccurate information considered outside the industry accepted limits of perception is easily detected by his subconscious monitoring system.

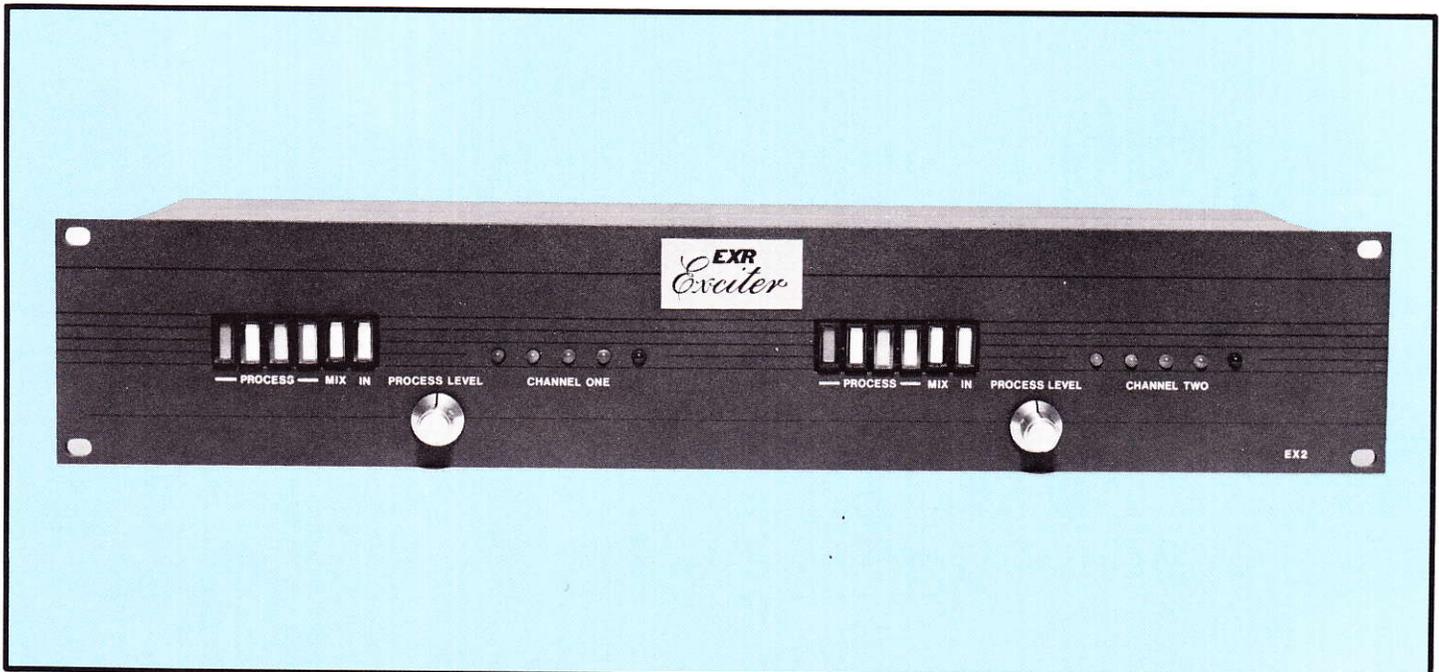
EXR Exciter Model EX2

Theory Behind the Design

The original concept behind the EXR Exciter several years ago, was to build an audio processing device which would make tape recorded material sound like it was a direct to disk recording. Electronic measuring devices proved useless so therefore the first unit was designed totally by ear. The original unit had only one enhancement setting (the third setting from the left). Only after thousands of hours of research was it understood how and why the unit worked. This understanding plus hundreds of hours of studio application led to the present four enhancement settings. Electronic measuring instruments were used to perfect every aspect of the design along the way, but the final and most critical tests were always done by ear. To this day, every unit manufactured by EXR Corporation has to pass the final test by the human ear.

Performance Highlights:

- The EXR Exciter restores natural presence, clarity, fullness and individual signal separation lost in the audio reproduction chain.
- The new model of the EXR Exciter, the EX2, now has internal mix capabilities that were added to allow the system to be added in line at the final stages of the broadcast chain or disk mastering process.
- The EXR Exciter adds to the apparent signal strength without noticeable triggering limiters or compressors.
- With a S/N ratio of better than 90db, its operational simplicity and its avoidance of the use of distortion or compression, the EXR Exciter may be introduced into the system at any point in the reproduction chain, from cutting basic tracks to broadcasting.



EXR
Exciter

The first Psychoacoustic Audio Processing System to be offered for sale

Technical Description

Each of the four enhancement settings are a precise variation of the five integral functions performed within the EXR Exciter:

- 1) Pre selective phase notching
- 2) Time manipulation
- 3) Frequency manipulation
- 4) Psychoacoustic juxtapositioning
- 5) Psychoacoustic replacement

The first three functions cause an interference signal which when added back into the original signal, reverse the primary or fundamental build-ups and losses caused by the multiplier effect in the audio reproduction chain. The last two functions deal with restoring and simulating sonic realities which, because of the inaccurately set standards of performance, were rolled off or ignored. Delicate details that are still present are amplified and spread out. Information has to be extracted from one part of the spectrum, processed, then used to replace parts that were totally lost.

Some Applications

- **RECORDING STUDIOS AND DISK MASTERING:** The Exciter can be used at any point in the recording chain, from cutting basic tracks to the final disk cutting. It can be used to spotlight a certain track without losing its naturalness. By using different enhancement settings on different instruments or vocals it can be used as a layering effect to give depth separation to a mix. It can also be used on an overall mix to open it up and restore the natural presence destroyed by generation loss.
- **BROADCASTING:** Since there are no multiplier effects or phase problems introduced to the broadcast chain, the EXR Exciter is totally compatible with previously enhanced program material. The Exciter should

be installed just before the final compressor/limiter. It will add to the apparent signal strength and reach of the station without noticeably triggering compressors or limiters. The EXR Exciter should be used in the broadcast production studio to give clarity and separation to the talk overs.

- **MOTION PICTURE SOUND:** The EXR Exciter will give a clarity and naturalness to dialogue that was never possible with graphic equalizers. It can be used to match the audio depth to the visual depth without any sacrifice in intelligibility. The Exciter can also be used to spotlight a particular dialogue and make it stand out from a group of people talking or from background sounds.
- **LIVE SOUND REINFORCEMENT:** Professional sound reinforce-

ment companies should utilize two EXR Exciters on each P.A., one on the frontals and one on the monitors. When there are several vocals or instruments going through the monitors, the Exciter will add the clarity and separation that is needed for each person to hear clearly without causing feedback or hurting the ears. The Exciter adds a clarity and separation to the frontal mix that has never been possible in a live situation. It will also eliminate the piercing effect at high volumes.

- **DISCOS:** The EXR Exciter adds a new excitement to the sound of a disco. It will bring out subtle aspects of the records that the clientele never noticed before. It will also get rid of the harshness while it adds crisp clarity and enhanced stereo separation to the disco's sound system.

SPECIFICATIONS: EXR Exciter Model EX2

Inputs: 47K ohms, line level — unbalanced

Outputs: 600 phms, line level — unbalanced

Connectors: barrier terminal block

Frequency Response: + - ½ db from DC to 50 khz

S/N Ratio: better than 90db

Controls for Each of Two Independent Channels:

Four interlocking enhancement selects

Direct/Mix select

Process level control

Rear panel phase select for use in direct mode

Indicators — five segment LED bargraph

Dimensions: 3½" height, 19" width, 3¼" depth

Power Requirements: 105 to 125 VAC, 50-60 Hz

Shipping Weight: 7½ lbs.

The EXR Exciter, the first in a line of audio enhancers by

EXR CORPORATION

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