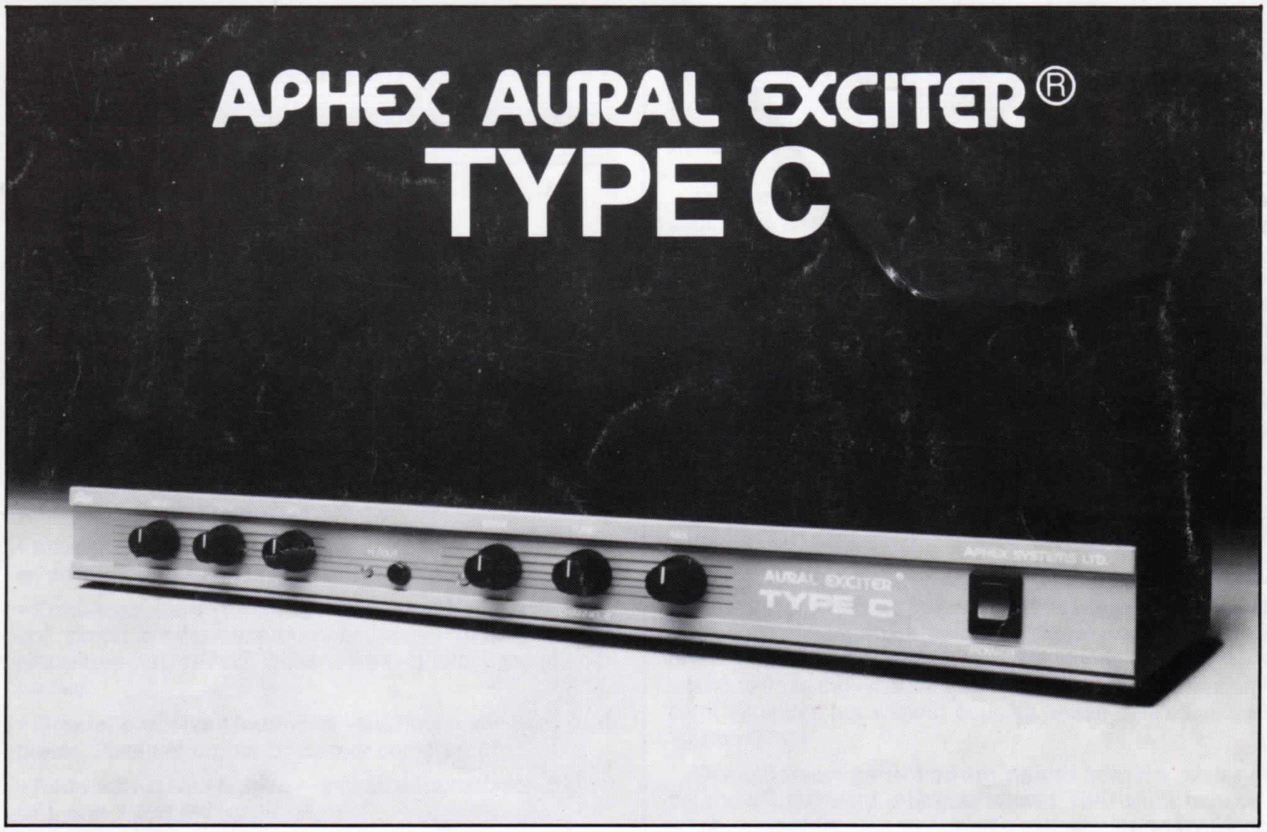
#AJC 3000

APHEX AURAL EXCITER®
TYPE C



OPERATING GUIDE

APHEX SYSTEMS LTD.

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I. INTRODUCTION

Since its introduction in 1975, the Aphex Aural Exciter® has rapidly become a standard in the recording and broadcast industries. It has been used on thousands of albums, movies, broadcast productions, commercials and concerts. Aphex Aural Exciters are also on the air on the top AM & FM stations throughout the U.S.A. and the rest of the world.

Whatever the application, you will find the following results from your Aphex Type C Aural Exciter.

- **Increased presence and clarity** — Program material sounds bright and real again.
- **Increased intelligibility** — Vocal articulation is much cleaner, easier to hear and understand.
- **Enhanced stereo imaging** — The sound seems to "open up," giving greater separation and detail making speaker placement less critical, while still being totally mono compatible.
- **Greater perceived loudness** — without adding any extra power. Does not trigger limiters or compressors.
- **Reduced listener fatigue** — Increased penetration at lower SPL and distortion levels.
- **No decoding needed** — Aural Excitement is a single ended process. Once it is encoded into the material it stays, even through succeeding processes and generations of tape copies.

By now you are probably wondering how the Aural Exciter can do all these things and why it has become necessary in the first place. The answer is that the audio recording and reproduction process is far from perfect. Every step of the way, from the original microphone, through countless mixes, amplifiers, processors, tape machines and the final loudspeaker, something gets lost. What gets lost each time is *realism.* And you know it's happening because things just don't sound *live* anymore. What's missing are the tiny, fragile parts of any sound which give it its character and allow it to be differentiated from other sounds. Other conventional types of processors, such as equalizers, expanders and reverb or echo fail to restore this realism because they only work on what's left of the original signal, often increasing noise and distortion in the process. The patented method used in the Aural Exciter actually *recreates* this missing information and adds it back in to produce a psychoacoustic cue signal that is perceived in the *subconscious* part of the brain. Because of this, the added signal can be so small that it adds virtually no power to the signal, is easily reproduced, even by low quality systems, and is not affected by normal acoustic problems. These factors make the Aphex Aural Exciter a powerful tool in *any* studio application.

II. BRIEF PSYCHOACOUSTICS

The term "psychoacoustics" is the latest buzzword in the audio field. It refers to our psychological interpretation of what we hear, as opposed to the mechanics of hearing. It is a fairly new field with much yet to be discovered, but we do know that most of the factors that affect our interpretation of what we hear are incredibly small, such as the minute cues that let us tell left from right in a stereo image. There are also minute cues which our subconscious mind interprets as "presence" or "realness." It is these missing cues that the Aural Exciter re-creates and adds back to the main signal to change the way you *perceive* what you hear.

The Aphex enhancement signal involves frequency dependent phase shift and amplitude dependent harmonic generation.

The phase shift, or delay which is too short to be perceived as an echo or reverb, is perceived as increase in impulse or transient duration, which makes the signal seem louder. The phase shifted signal also "beats" slightly against the main signal, simulating what happens to sound in a normal ambient situation, but without causing phase cancellation or "phasing."

The harmonics generated are derived from the main signal and are, therefore, musically related. The natural harmonics or overtones are the most fragile, yet integral parts of sound and are the most likely to be lost. The louder the fundamental produced by an instrument or voice, the greater the overtones. The Aural Exciter generates harmonics in the same manner. The harmonic structure of each sound or instrument is thus strengthened, allowing it to stand out from others. The increased harmonic structure also creates the illusion of a much fuller, brighter top end to your sound. You will swear there is at least 10dB of treble boost, but a spectrum analyzer would show less than 1/2dB!

III. HOW IT WORKS

As can be seen in the block diagram (figure 1) the main signal goes through the Aural Exciter unchanged. All the processing is done in an outside loop (called a sidechain) and then added in a very small amount to the main signal. The sidechain is a tap off the main signal which goes through the DRIVE pot for setting the level. It then goes through the tunable high pass filter which removes unneeded low end material and creates the necessary frequency dependent phase shift. This material is next metered for correct input level to the next stage, the *harmonics generator.* This is where the musically related harmonics are generated and mixed with the high-passed information. The complex signal then goes to the MIX pot where it's added (typically 20dB down) to the main signal. Although this amount of added information is so small it shouldn't even be heard, the listener perceives a large increase in mid and high frequency energy.

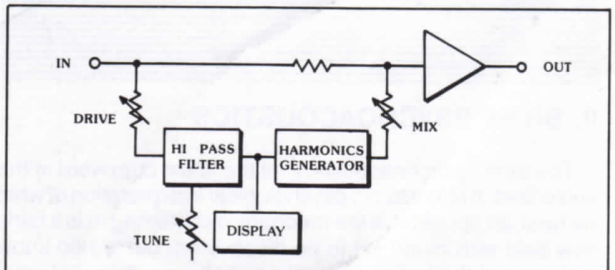

FIGURE 1. APHEX TYPE C BLOCK DIAGRAM

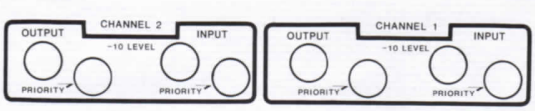

FIGURE 2. REAR PANEL INPUT AND OUTPUT JACKS

IV. BASIC OPERATION

A. The ins and outs of the Aphex Type C Aural Exciter

The Aphex Type C Aural Exciter has a high input impedance (47k Ohms, unbalanced) and low output impedance (150 Ohms). The high input impedance means that it will work well when fed from equipment with an output impedance of 4.7k ohms or lower. It means that you can "mult" (parallel) the input of your Exciter with the inputs of other similar equipment if you need to "split" the signal.

The low output impedance means two things:

1. You can feed the signal from the exciter into an input load of 2k Ohms or greater. Most of the equipment you encounter will also have a high input impedance, but remember that paralleling inputs lowers the combined impedance as seen by the Exciter.

2. The low output impedance of the Exciter also means that the signal will not be degraded by moderate cable lengths (20-30 feet of typical "guitar cord" shielded wire).

Connections are made via standard RCA jacks and 1/4 inch phone jacks on the rear of the chassis (figure 2). To prevent problems, the RCA jacks have "priority" and automatically disconnect the 1/4 inch phone jacks when used.

B. Nominal Operating Levels — What is "0 VU?"

The Type C Aural Exciter is designed to work at line levels such as an output from a tape machine or pre-amplifier. Generally in cassette recorders, hi-fi equipment, consumer tape machines, and some P.A. equipment, 0 VU = -10dBv (350 mv peak). In other P.A. equipment and tape machines 0 VU = 0dBv (1.1 volts peak). Studio grade equipment usually operates at 0 VU = +4dBv (1.74 volts peak). Finally some broadcast operations operate at 0 VU = +8dBv (2.76 volts peak).

The Type C Aural Exciter is designed to work at a nominal level of -10dBv. This will interface with most consumer audio equipment with RCA jacks, and musical instrument gear with 1/4 inch connections.

Your Aural Exciter uses the latest Aphex technology to create this enhancement. It is called mAx, for monolithic Aural Exciter. Aphex engineers have reduced the patented Aural Exciter circuit to a single integrated circuit, resulting in highest performance at the lowest cost.

The Type C is not recommended for use with professional audio systems operating at 0dBv and above. The reduced headroom will make input and drive overloading likely, causing audible distortion.

C. The Controls

The DRIVE control sets the proper input level to the enhancement generating circuitry. Its tri-color LED should show mostly green/yellow with program, occasionally flashing red on peaks. Too much green (or no color) will underdrive the circuit, causing minimal effect generation. Too much red will overdrive it, perhaps causing distortion.

The MIX control varies the amount of enhancement mixed back in with your program, from none to maximum. Your setting will depend on the effect you wish, from just a touch of naturalness for a fine sound system to grinding out maximum intelligibility in a terrible paging/PA system. *It's very common to over use this control at first. Remember, the goal is to sound clean and natural, not blistering!*

The TUNE control allows you to adjust the range of the enhancement from the tops of cymbals down into the voice and lower instrument range. Experimentation with your program will show you what setting is right for you. This control interacts with the DRIVE level, so be sure you verify correct DRIVE after setting the TUNE control (try starting in the 12 o'clock position).

The IN/OUT switch switches the effect instantly in and out of your system for A/B comparison of your settings to the dry program material. The adjacent LED indicates AC power ON as well as effect OUT (green), and effect IN (red).

An Aural Exciter is usually hooked up as the last item in the sound chain before the power amp or recording deck and after any other processing that may be done.

A typical set-up procedure is as follows:

1. With the IN/OUT button in the IN position, set the TUNE control at about 12 o'clock, and adjust the DRIVE control so that the tri-color LED flashes green to mostly yellow. Occasional flashes of red on peaks are acceptable.

2. Set the MIX control at minimum and switch the Aural Exciter in. Slowly bring up the enhancement signal until you begin to hear those extra edges and cues we talked about.

3. You can control the nature of the enhancement signal by adjusting the TUNE control to include more or less of the audio spectrum. Of course, since this varies the amount of the signal being processed, you may have to adjust the DRIVE level accordingly.

Until you get used to the Aural Exciter, a good way to hear the effects of the controls is to set MIX to the maximum. The effects of the other controls will now be clearly audible. After determining proper settings, reduce the MIX back to a subtle level.

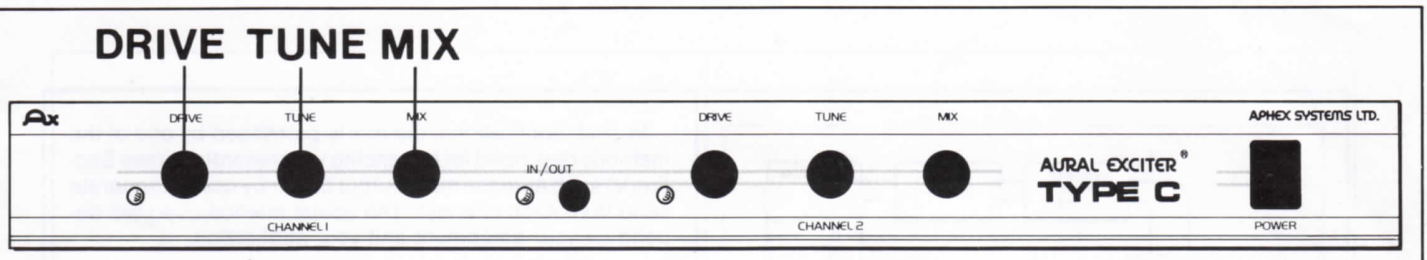

FIGURE 3. APHEX TYPE C FRONT PANEL CONTROLS

V. RECORDING APPLICATIONS

In this section we will cover some specific applications of your Type C Aural Exciter.

A. One of the easiest ways to add Aural Excitement to your recordings is to insert the unit between the stereo outputs of the mixing console and the inputs to the mastering recorder. The Aural Exciter should be placed ahead of a noise reduction system, if you use one (figure 4).

1) With the unit OUT, get a good basic mix and adjust the master gain so that the stereo output centers around 0 VU. Allow enough headroom as the material and your experience dictate.

2) Switch it IN and set the controls as discussed in the CONTROLS section and adjust to taste.

3) Remember those IN/OUT checks.

IMPORTANT — When you're just getting started with the Aural Exciter, it is easy to use too much. In setting up your processing mix we recommend that you make frequent IN/OUT comparisons, and, when recording, confirm the actual sound you are getting by monitoring the playback head of the recorder. A good rule of thumb is that Aural Excitement should be missed in its absence, not noticed by its presence. The object should be a clean, bright, natural sound.

VERY IMPORTANT — Prolonged exposure to high level sound fields (a common studio condition) causes ear fatigue and a resulting loss of high frequency sensitivity. To keep an objective ear and to avoid over-processing your sound, take periodic breaks.

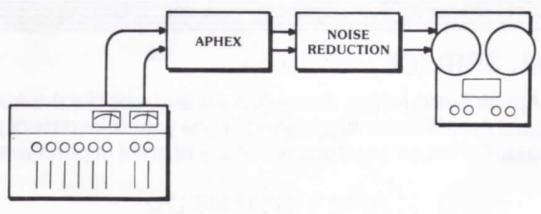

FIGURE 4. TYPICAL RECORDING CHAIN WITH NOISE REDUCTION

B. Process Grouping

You can create a processed sub-group in several ways:

1) If your console has sub-groups with a patch point at the group output you can process only those tracks in the sub-groups, leaving the others alone.

2) You can use your monitor/effects sends to create a group and mix the Exciter output back through a spare module. Send these channels "pre" fader and mute the main channel out. Your monitor/effects sends control the mix in the group which returns to the main mix through the Aural Exciter.

C. Enhancing Tape Copies

Even under the best of conditions, tape copies inevitably lose some presence, brightness and clarity, especially going to cassette and especially if they are noise reduced. And EQ doesn't seem to exactly correct the losses.

Aural Excitement can reduce or eliminate generation loss, and in some cases, actually make copies that sound better than the original. If your original tape is reasonably quiet, a little Aural Excitement can be just the ticket to "hot" copies. Just connect the Exciter between the line outputs of the playback machine and the inputs to the recording deck. For best results with a three head deck, monitor the playback head (tape position) of the recording machine to know exactly how your processed copies are coming out.

Noisy tapes present a different problem, since the Exciter works quite well in the most easily perceived "noise band."

You can use either a fixed EQ or one of the available dynamic (variable bandwidth) noise filters such as the "Dynafex™" to roll off the noisy high end (figure 5). Then, since the Aural Exciter generates new high frequency information, you can actually generate a new, musically correct "synthetic" high end free of the noise of the source tape, with full brightness and clarity. A little experimentation with the controls can give astounding, natural sounding results.

You can achieve more individual control over the amount of processing you add by enhancing individual tracks as they are being recorded instead of in the mix. This has the advantage of not processing tape hiss which falls into the same general frequency spectrum as the Exciter process (also see Enhancing Noisy Recordings). Since the Type C works at line level it is necessary to use the pre-amp in the console to boost the mike signal before it can be processed. If your board has a line level patch point before or after the equalizer, you can insert the Exciter there (if you have both, experiment, the effects are different). From the output of the Aural Exciter you can go directly to the channel input of the tape machine or return to the board. Experience will tell you how much processing will be necessary for a good sound when the processed channel is mixed.

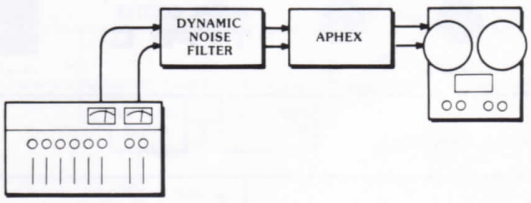

FIGURE 5. TYPICAL RECORDING CHAIN WITH DYNAMIC NOISE FILTER

D. Enhancing Reverberation

An interesting use of your Aural Exciter in both recording and P.A. applications is to use it to add that extra zing or sizzle to moderately priced reverb units.

Since the outputs from these units are quite often noisy the same noise reduction techniques discussed for making tape copies may prove useful (see Section C).

By some tricky maneuvering (requiring extra input modules) you could even include the reverb return in the mix you send to the Exciter.

VI. SOUND REINFORCEMENT AND HOME STEREO SYSTEMS

Sound reinforcement (public address and music distribution) systems can benefit considerably from Aural Excitement.

A. In music distribution and paging systems, the approach is the same as with tape duplication and basic recording, i.e., place the Exciter just ahead of the power amplifiers to enhance coverage, intelligibility and musicality. You will find the sound to be much more listenable and intelligible at lower volume levels, with an increased freedom from common acoustic problems such as varying ambient noise, room echoes, etc. In discos and clubs, for example, you won't have to keep boosting the top end as the room fills up with people, saving tweeters and the hearing of those close to the speakers. Bars and restaurants will find that background music can be heard without being loud and possibly annoying.

B. In performance use by a band in a club or concert, the Aural Exciter can benefit any P.A. system. The vocals will sound much clearer and the instruments more distinct from one another. There will be an increase in perceived loudness, meaning you can actually use lower power levels, preserving amps and drivers, and lessening the chance of feedback. If the present system is marginal, you may finally get the coverage and penetration you need without adding any other parts to the system.

C. Enhancing Stage Monitors.

One of the most useful places for Aural Excitement is in a stage monitor mix, where maximum intelligibility and definition without feedback are of prime importance. The application is similar to the house mix, being used in a monitor send bus or simply between the mixer and power amp. The settings may be quite different than the house mix, but the goal is also different.

In such applications, the mix is processed by one of the methods described for enhancing your recordings (see Section V) such as in the main output bus or by using a separate send from each channel. The actual method used will depend on your equipment and your application.

D. Home Music and Video Systems

As in the recording studio, the Aural Exciter will greatly improve sound and music at home. AM and FM stereo, records, cassettes and video tapes will all benefit by increased presence and detail from the Aural Exciter. You will find the audio more listenable at lower levels, speaker placement less critical and dialogue more intelligible.

For playback, the Exciter can go between any line level device such as a cassette deck, FM tuner, or video tape player and the amp. It can also be put in a tape monitor or processing loop of your amp or pre-amp, or between separate pre-amp and amplifier, which would allow processing of any source connected to the system.

For recording, the Aural Exciter must go ahead of the recording deck, either directly, or in another processing loop. As mentioned in Section V. C, be aware of noisy sources! You will find, though, that copies can sound better than the original.

VII. IN CASE OF DIFFICULTY

Here are a few common problems, and hopefully, the solutions.

A. Display works when IN/OUT button is OUT but no audio when IN.
Inputs and outputs reversed.

B. Distorted sound when MIX brought up.
Input level to Exciter too high.

C. Insufficient drive level, excessive noise.
Input level to Exciter too low.

D. Unit dead, no LEDs, no sound.
Check AC, AC cord, fuse, power switch.

If none of the above solves your problem, please repack in the original carton, enclose name, address, and a description of your set-up and problem, and return to Aphex Systems for a speedy repair.

VIII. SERVICE

Aphex Systems Ltd. warrants parts and labor for the Aphex Type C Aural Exciter for a period of one year from date of purchase. For repair send unit with copy of proof of purchase to:

APHEX SYSTEMS LTD.
13340 SATICOY ST.
NORTH HOLLYWOOD CA 91605

IX. SPECIFICATIONS

Frequency Response	+0, -1/2dB, 10Hz-50kHz
THD, 20Hz-20kHz, Max I/O	.02%
Noise	-100dBv (MIX at minimum setting)
Filter Tune Range	1kHz-5kHz
Operating Level	-10dBv
Max I/O	+12dBv
Input Impedance	47kOhms
Output Impedance	150 Ohms
Size	1 3/4"h x 17"w x 5"d
Weight	4.5 lbs
Power Requirements	105-130 VAC, 50-60Hz, 9 Watts (For export: 90-110 VAC and 220-240 VAC models also available)

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