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INTERVIEW

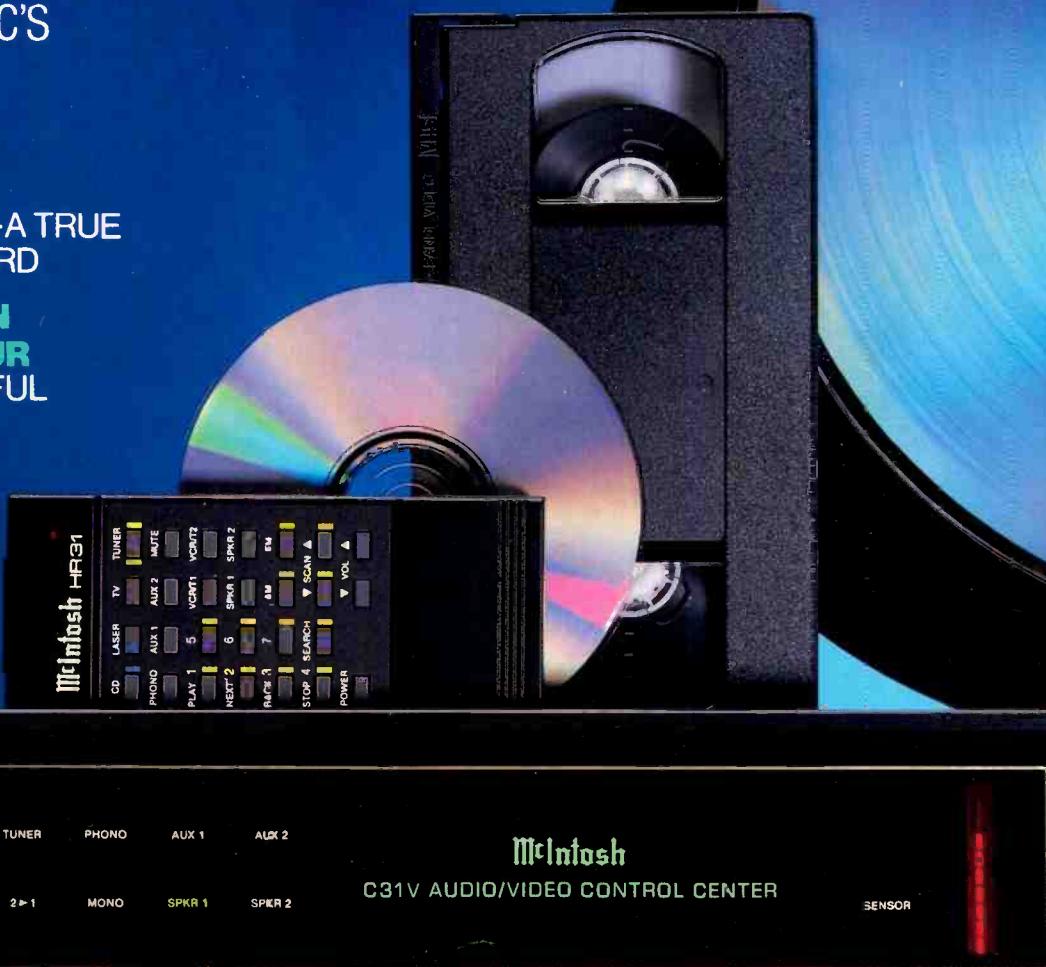
MILT GABLER

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STEADY CAPTAIN

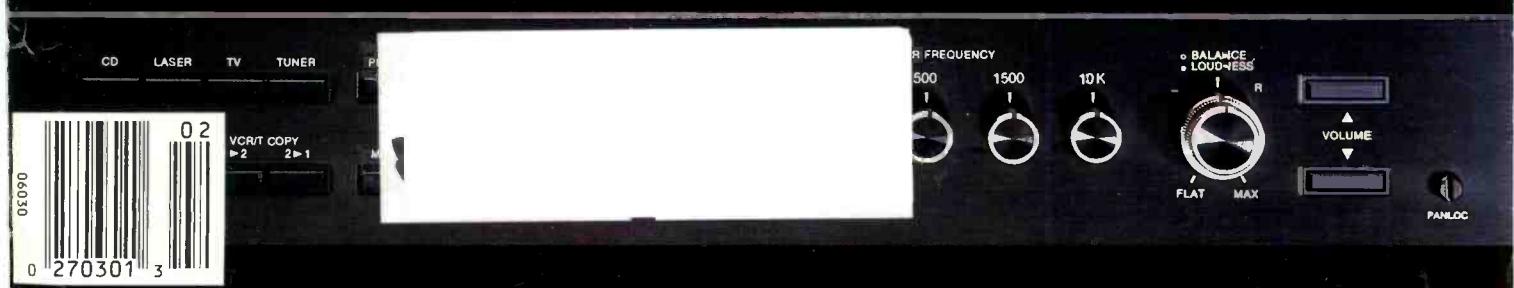
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KEF 107 SPEAKER—A TRUE
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"Polk Has Triumphed."

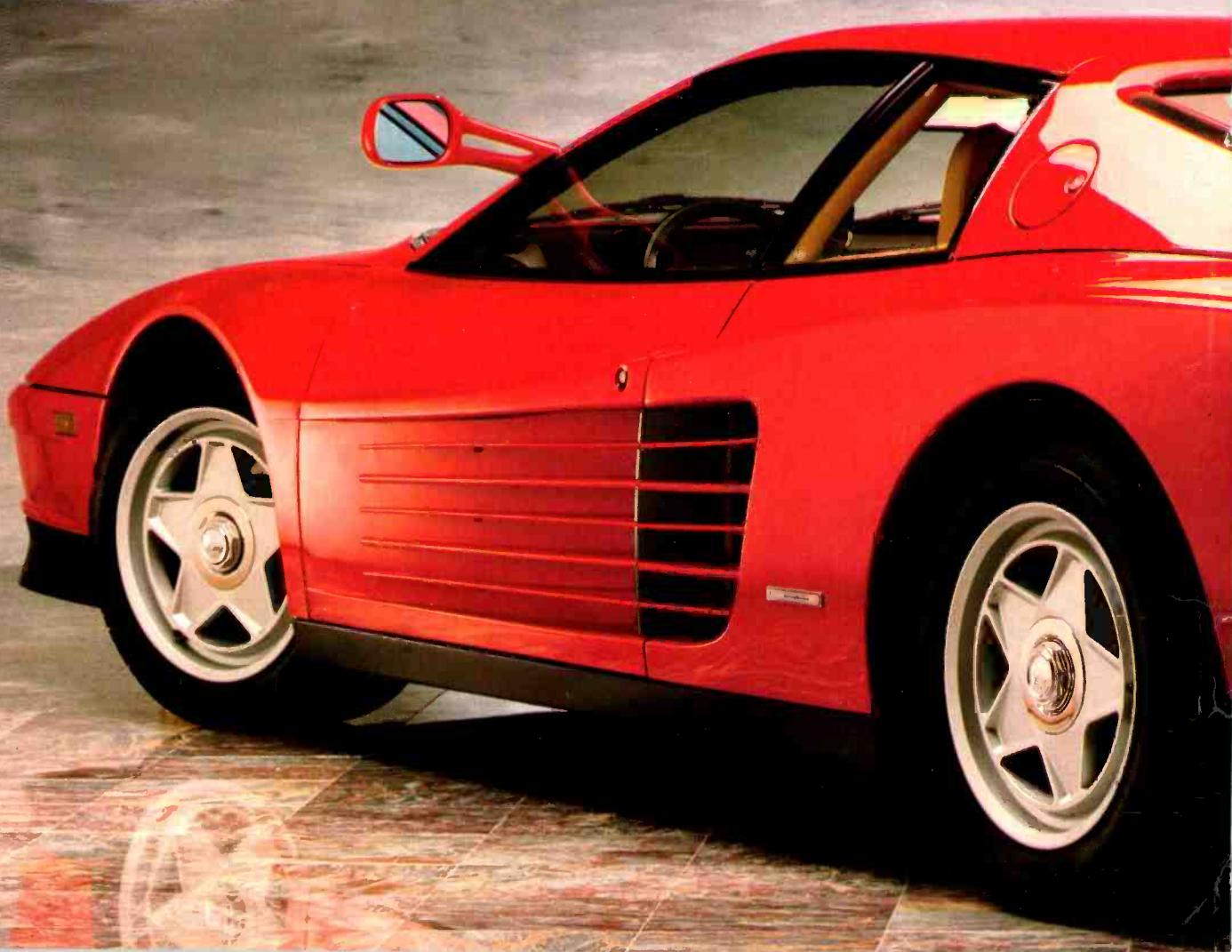
CAR STEREO REVIEW

Introducing Matthew Polk's New SDA Mobile Monitor Systems

Matthew Polk has a passion for perfection in the cars he drives, and the speakers he creates. His astonishing new SDA Mobile Monitor Speaker Systems combine the awesome sonic benefits of his revolutionary SDA True Stereo technology with the superior sound of his Grand Prix award winning Mobile Monitor loudspeakers. Car Stereo Review, the definitive authority on the state-of-the-art in autosound, raved, "It's like jumping into hyperspace."



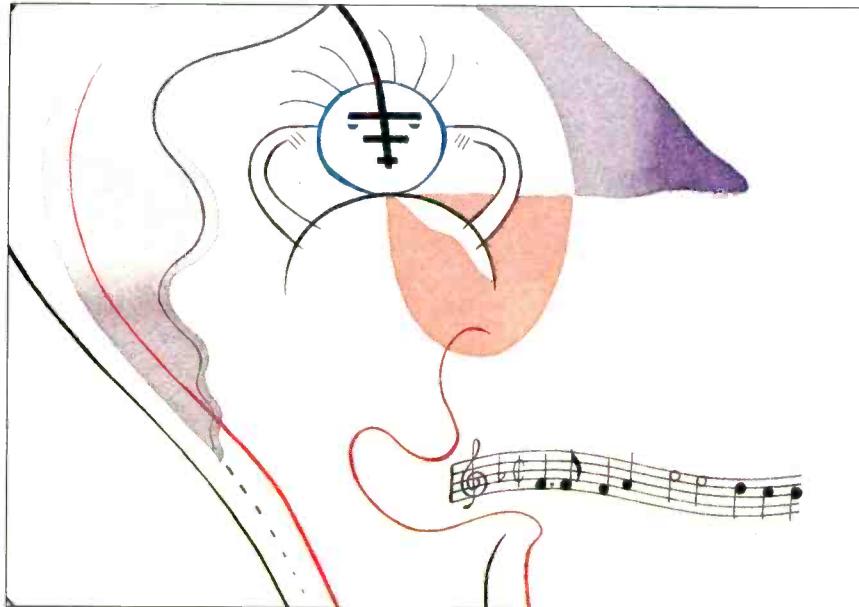
Complete systems (front and rear speakers plus an SDA Automotive Crossover Matrix) begin under \$500.



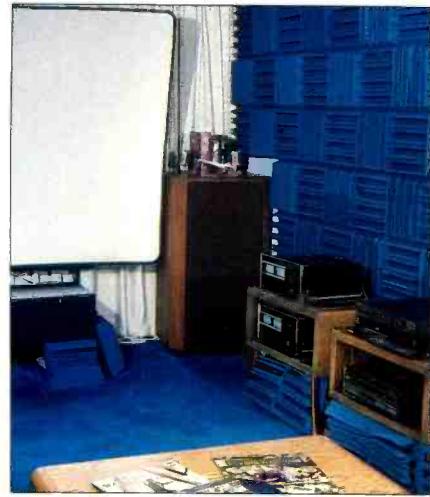


The world's finest automobiles deserve the world's finest sounding automotive loudspeakers.

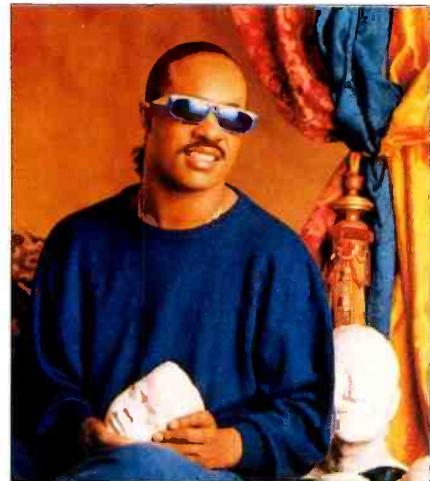
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The Cover Equipment: McIntosh C 31V preamplifier.
The Cover Photographer: ©1987, Bill Kouirinis.

Audio Publishing, Editorial, and Advertising Offices,
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THE SHAPE OF THINGS TO COME

Products recognized for their ability to reproduce music and to advance our perception of high fidelity emerge from unique companies. The community of individuals dedicated to the production of Mark Levinson components has established an unequalled tradition of excellence and accomplishment, while accepting the responsibility for refining the state of the art in music reproduction within the boundaries technology and imagination allow.

The No. 26 Dual Monaural Preamplifier introduces a new level of performance in audio system control. Until now, the most musically accurate preamplifiers have had limited control flexibility due to the sonic advantages of direct signal paths. The new generation of circuitry developed for the No. 26 provides full control flexibility, for six audio sources with two tape loops, and such refinements as absolute phase selection, all with greater sonic purity than even the minimalist preamps of the past.

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AUDIO (ISSN 0004-752X, Dewey Decimal Number 621.381 or 778.5) is published monthly by DCI at 1515 Broadway, New York, N.Y. 10036. Printed in U.S.A. at Dyersburg, Tenn. Distributed by DCI Magazine Marketing. Second class postage paid at New York, N.Y. 10001 and additional mailing offices. Subscriptions in the U.S., \$19.94 for one year, \$35.94 for two years, \$49.94 for three years; other countries add \$6.00 per year.

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Worth Every Penny

Dear Editor:

In regard to several of the letters that have appeared in recent issues, I would just like to say: Keep the reviews of high-end equipment coming. I like to read all reviews, and it does not matter to me if an amplifier costs \$200 or \$6,000; I still like to read about it. I don't have the money to buy \$6,000 equipment, but believe me, if I did, I would go out and spend it. As long as the equipment gives pure, clean sound, it's worth it to me. Besides, I would much rather spend the extra money to get metal and copper parts and oxygen-free copper wire than to buy an item that uses plastic parts and that probably would wear out in a couple of years.

I figured out how much money it would cost me to buy a complete audio/video system, and it came to about \$30,000. I'd spend that much money with no regrets. Even though I'd be in debt, I'd be happy.

John Gordon
South Lake Tahoe, Cal.

Editor's Note: Thanks for your kind words. I should also discuss one line of reasoning I use, which no one seems aware of, when I choose, say, a specific receiver to review. Most makers of such gear have lines rather than individual examples, e.g. Model 100, Model 200, Model 300, etc. My guiding thought here is that, even if the stuffing in my wallet limits me to the middle-of-the-line Model 200, I want to know what and how much I'm giving up by not going for the Model 300. I think you readers do too. Further, it has been our experience that what is pulled out of the Model 300, to make it a Model 200, is not quality but features. What we are doing, then, by reviewing the Model 300 is checking out everything that's in the Model 200—and then some. Besides, high-end gear's more fun—like blondes named Ferrari.—E.P.

A Cheer for New Orleans

Dear Editor:

This is fan mail. I loved your November 1987 issue, especially the Toussaint interview. It's great to see such a story in such a prestigious magazine. In my many travels north of the Mason-Dixon line, I've seldom found anyone

who isn't surprised to learn of the many musical contributions of the Crescent City and its artists. The Toussaint article can only help develop an awareness of New Orleans music and encourage artists there to maintain their unique sound.

I've seen Allen Toussaint in concert, and he delivers something special. I've also seen Fats Domino, Irma Thomas, Lee Dorsey, The Meters, and The Neville Brothers. Too bad I wasn't aware of the New Orleans sound in time to catch a James Booker or Professor Longhair show. They're in R&B heaven now, but judging from their LPs, they were truly something to behold.

I go to New Orleans as much for the music as for the food. It may sound strange, but I think the music and food cultures there are definitely intertwined. Take, for example, the term that has come into widespread use to describe the funkiest of New Orleans R&B—it's called "fish head."

Jim Clemons
Little Rock, Ark.

Leave the Luxuries Alone

Dear Editor:

I have been a subscriber for some 15 years now, and I felt compelled to write you. You see, I feel I match up to the average consumer in my age range. I spent two grand on a stereo system back in 1979, when I didn't have a mortgage, a car, or baby-sitting expenses. Now I no longer can afford the luxury of spending three months' income on an amplifier that can double as an arc welder.

Don't misunderstand me. I am not saying that you have to ignore the upper upper-end equipment as if it did not exist, just that you should concentrate your efforts on equipment that the average audiophile can purchase.

Audio is in the perfect position for this. Leave the mass-produced, lower end equipment to *High Fidelity* and *Stereo Review*, and the \$4,000 preamplifiers to publications that charge \$4 an issue and talk about "the inability to recapture in full the hard kernel of resonance surrounding instrumental and vocal sound propagation." Wow. Anyway, fill the void! I've cancelled my subscription to the rest.

Dan Zimmett
St. Marys, Pa.

YOU'VE BEEN MISSING!

When you hear the fidelity and accuracy of the AKG K 240DF Studio Monitor Headphones, you'll know why it's become a standard for Digital Compact Disc recording engineers and professional musicians around the world.

The K 240DF establishes a uniform sound quality, free from environmental variables. It has been created to meet a recently proposed IRT Institute for Broadcast Technology international standard. It's so smooth and flat that AKG engineers use the K 240DF as a reference headphone in developing digital products for recording studios.

Each K 240DF is tested in a diffused sound field to arrive at a headphone design with a flat frequency response ($\pm 2\text{dB}$) and matched sensitivity. This professional headphone is close to perfection — without coloration or distortion — allowing you to enjoy all the advantages of the latest in CD technology. The self-adjusting headband supports circumaural ear cups. Each contains band selected, large dynamic moving-coil transducers and acoustic filters yielding the ultimate in Digital CD reproduction. Minimum weight is well distributed for maximum comfort over longtime wear.

The AKG K 240DF Studio Monitor Headphone is a total design concept, just right for you to hear what you've been missing!



77 Selleck Street
Stamford, CT 06902

Studio-Monitor

TAPE GUIDE

HERMAN BURSTEIN

A Colleague's Amplifications

My colleague Howard A. Roberson, an *Audio* Senior Editor, writes the following:

"I'd like to comment on and amplify some topics covered in two recent 'Tape Guide' columns.

"In the October 1987 issue, Tom Whang of Glendora, Cal. complained that his tape deck's playback head had apparently been ruined by his cleaning it with 70% isopropyl alcohol. Usually, isopropyl alcohols do a fairly good job of cleaning oxides and other residues from heads and other metal parts of the tape path. It is essential, however, that only 91% alcohol be used. Versions with lower percentages may be rubbing alcohol with various skin-conditioning additives, such as lanolin, which may leave a deposit on the head surface. The alcohol itself can attack materials that would be damaged by loss of moisture, and it is damaging, over time, to rubber pinch rollers. Trichlorotrifluoroethane (TCF) solvents, sold by Geneva and others, are superior to alcohol in cleaning the metal parts of the tape path and will not damage rubber rollers or plastic parts. Intraclean S-711, a halogenated hydrocarbon, does an even better job of cleaning metal parts, and it also cleans rubber pinch rollers very well. However, it will damage some plastics, including some non-rubber rollers.

"In the November 1987 issue, Anthony Hudaverdi of Santa Monica, Cal. voiced concern that the tapes he makes on his Nakamichi deck sound muddy when played on other machines. Deck-to-deck misalignment and Dolby mistracking problems were discussed, and these are certainly possibilities. There could, however, be dulling effects from playback equalization differences, as Mr. Hudaverdi had suggested. This does not mean that Nakamichi decks don't follow the IEC tape recording and playback Standard, only that their approach to realization of the Standard is different from the ones some other makers follow. The official Standard, IEC Publication 94, gives specific formulas for ideal playback characteristics. Nakamichi's playback heads were and are very close to the ideal expressed in the formula for the cassette format; some other makers' heads, including the first

calibration heads used in generating standard alignment tapes, were much farther from the ideal. As a result, Nakamichi decks have required less high-frequency boost in record equalization than was used to make the IEC alignment tapes. In practice, however, the IEC Standard is considered to be represented by these standard alignment tapes. Tape decks designed around the tapes will therefore use more record boost than Nakamichi decks do, and the less-boosted tapes made on a Nakamichi will sound dull when played on such decks. However, recent changes have brought the IEC tapes closer to the ideal and to the Nakamichi equalization, which is now well within the tolerances of the in-practice standard. Dulling of sound will therefore be most noticeable when tapes made on a current machine are played on older decks of other brands.

"Also in the November 1987 issue, Ivo Rokovich of Hialeah, Fla. wondered about the effects of using high-bias cassettes on decks with only normal-bias settings. As was discussed, recording Type II cassettes with Type I (normal) bias will yield a large boost on high-frequency levels, with relatively little change in the level of the low and middle frequencies. In the case of Type IV tapes, on the other hand, there will be a drop in level across the entire band, including the low and middle frequencies. Depending on the tape, this drop will be perhaps 15 to 20 dB, though it will be relatively less at the highest frequencies."

Popping Caused by Static

Q. I have a problem with popping noises during tape playback, which I believe are caused by static electricity. The problem first appeared in my personal-portable tape player. Recently I bought a cassette deck that has dual transports. When I used this deck to play back a tape I'd made on it, I started to hear popping sounds about halfway through the tape. I moved the tape to the second well, but the popping continued. Thus far, commercially prerecorded tapes have not done this in my dual deck, but they have in my personal player.—Lisa Gray, Placerville, Cal.

A. Static electricity seems to be a logical explanation, perhaps due to ex-

cessively low humidity. If you have been putting a tape through fast wind or rewind after use, this might cause static buildup. See what happens if you play a tape only after it has been transported through its length at operating speed. Also try rapping the cassette sharply against your hand or a solid object, such as a book.

Parameters of High Quality

Q. I have purchased a cassette deck which I understand is a high-quality product, at a corresponding price. I would like to know the advantages of this machine over similar but lower priced decks.—Victor M. Leon, Bay Shore, N.Y.

A. A high-quality deck tends to be superior with respect to flat and extended frequency response, low distortion, accurate and steady motion, minimal electronic noise, minimal noise due to distortion in the bias waveform, and high quality of parts and construction with attendant reliability.

The Death of Type III

Q. I am curious as to whether or not there is such a thing as a Type III cassette tape. I have asked several people, including audio dealers, about this question, but no one seems to know the answer.—Justin DeCrescente, Hewlett, N.Y.

A. Until a few years ago, several tape manufacturers made Type III cassettes. This type, called ferrichrome, consisted of a layer of chromium dioxide atop a layer of ferric oxide. Whereas the bias requirement for each of the other cassette types became pretty well standardized, bias for ferrichrome tended to vary appreciably from one tape manufacturer to another. Also, ferrichrome did not appear to offer any marked advantage over the other types. For these and possibly additional reasons, Type III never acquired the popularity of the other types, and it gradually disappeared. That's just as well, because it reduces the perplexing number of choices confronting the audiophile. **A**

If you have a problem or question on tape recording, write to Mr. Herman Burstein at AUDIO, 1515 Broadway, New York, N.Y. 10036. All letters are answered. Please enclose a stamped, self-addressed envelope.

Brain vs. Bulk.

FOR UNDER \$625 YOU CAN OWN AN AMPLIFIER JUDGED TO HAVE THE EXACT SOUND CHARACTERISTICS OF AN ESOTERIC \$3000 MODEL.

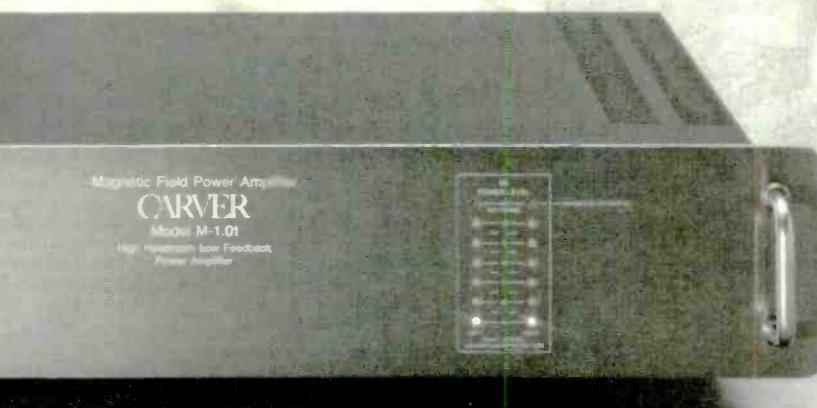
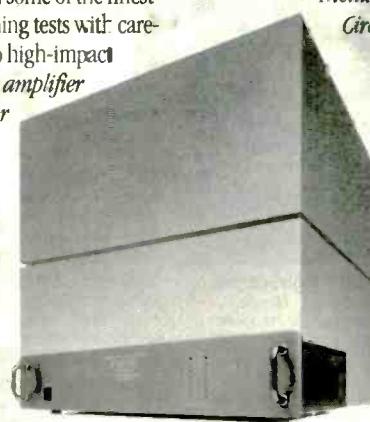
Bob Carver recently shocked the staid audiophile world by winning a challenge that no other amplifier designer could ever consider.

The new M-1.0t was judged, in extensive listening tests by one of America's most respected audiophile publications, to be the sonic equivalent of a PAIR of legendary, esoteric mono amplifiers which retail for \$3000 each!

CARVER'S GREAT AMPLIFIER CHALLENGE. Bob Carver made an audacious offer to the editors of *Stereophile Magazine*, one of America's exacting and critical audio publications. He would make his forthcoming amplifier design sound exactly like ANY high-priced, esoteric, perfectionist amplifier (or amplifiers) the editors could choose. In just 48 hours. In a hotel room near *Stereophile's* offices in New Mexico! As the magazine put it, "if it were possible, wouldn't it already have been done? Bob's claim was something we just couldn't pass up unchallenged."

What transpired is now high fidelity history. From the start, the *Stereophile* evaluation team was skeptical ("We wanted Bob to fail. We wanted to hear a difference") They drove the product of Bob's round-the-clock modifications and their nominees for "best power amplifier" with some of the finest components in the world. Ultimately, after exhaustive listening tests with carefully selected music ranging from chamber to symphonic to high-impact pop that led them to write, "...each time we'd put the other amplifier in and listen to the same musical passage again, and hear exactly the same thing. On the second day of listening to his final design, we threw in the towel and conceded Bob the bout. According to the rules...Bob had won."

BRAIN vs. BULK. Pictured is a photo of the 20-pound, cool-running M-1.0t. Above it are the outlines of the pair of legendary mono amplifiers used in the *Stereophile* challenge. Even individually, they can hardly be lifted and demand stringent ventilation requirements. And yet, according to some of the most



discerning audiophiles in the world, Bob's new design is their sonic equal.

The M-1.0t's secret is its patented Magnetic Field Coil. Instead of increasing cost, size and heat output with huge storage circuits, Magnetic Field Amplification delivers its awesome output from this small but powerful component. The result is a design with the dynamic power to reproduce the leading edge attacks of musical notes which form the keen edge of musical reality.

A DESIGN FOR THE CHALLENGES OF MODERN

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Has a continuous FTC sine-wave output conservatively rated at 200 watts per channel into 8 ohms 20 Hz to 20 kHz with no more than 0.15% THD.

Produces 350-500 watts per channel of RMS power and 800-1100 watts momentary peak power (depending on impedance).

Delivers 1000 watts continuous sine wave output at 8 ohms in bridging mode without modification.

Is capable of handling unintended 1-ohm speaker loads.

Includes elaborate safeguards including DC Offset and Short Circuit Power Interrupt protection.

SHARE THE RESULTS OF VICTORY.

We invite you to compare the new M-1.0t against any and all competition. Including the very expensive amplifiers that have been deemed the M-1.0t's sonic equivalent. You'll discover that the real winner of Bob's remarkable challenge is you. Because world class, superlative electronics are now available at reasonable prices simply by visiting your nearest Carver dealer.

Specifications: Power, 200 watts/channel into 8 ohms 20Hz to 20kHz, both channels driven with no more than 0.15% THD. Long Term Sustained RMS power, 500 watts into 4 ohms, 350 watts into 8 ohms. Bridged Mono power, 1000 watts into 8 ohms. Noise, -110dB IHF A-weighted. Weight, 20 lbs.

CARVER

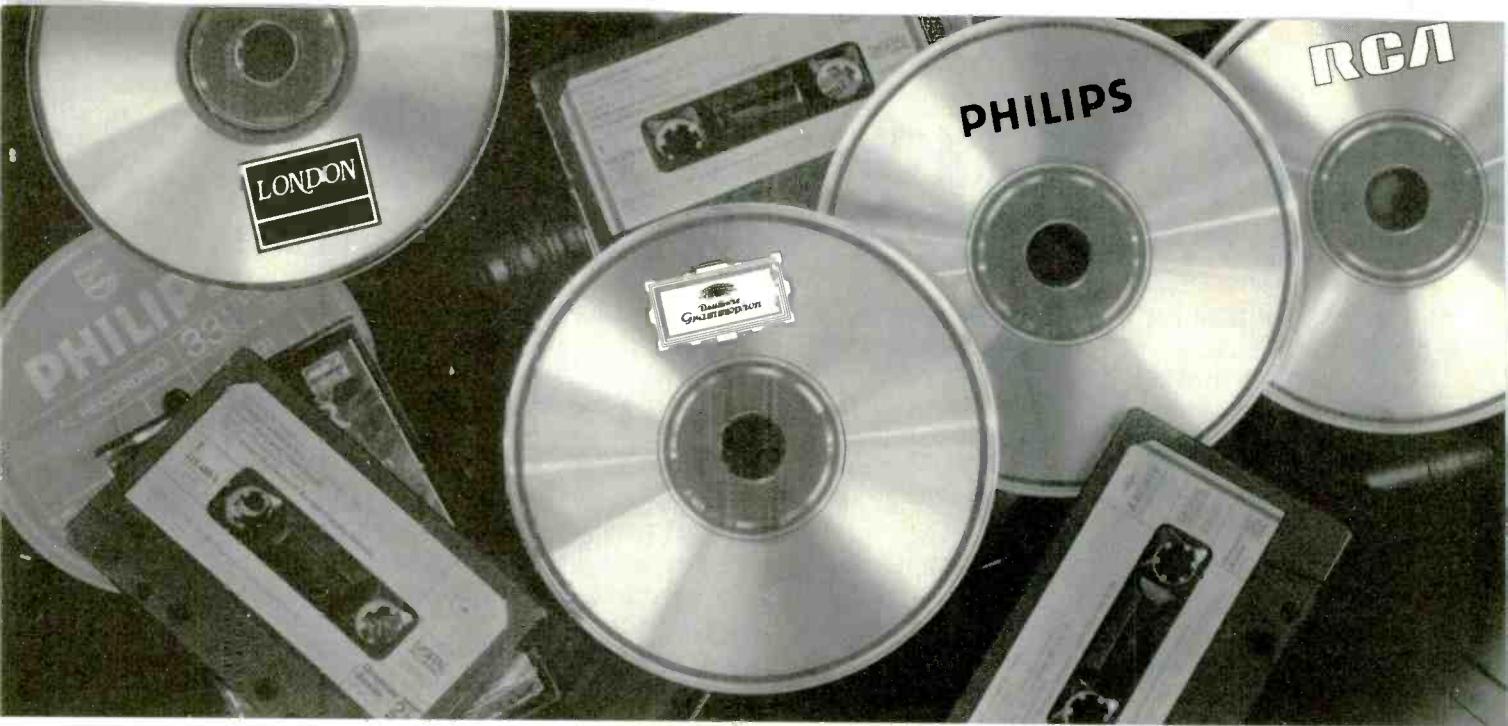
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Sir
Georg
Solti



Christian Steiner
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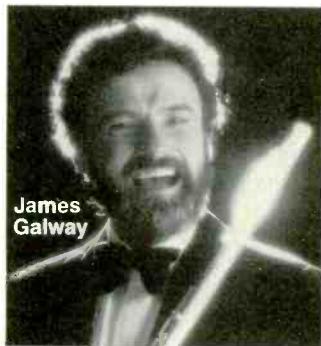
Pops In Space John Williams leads The Boston Pops in music from Star Wars, Close Encounters, Superman, more. Philips DIGITAL 105392

Pachelbel, Canon in D Also includes other works by Pachelbel & Fasch. Maurice André, trumpet; Paillard Chamber Orchestra. RCA 133877

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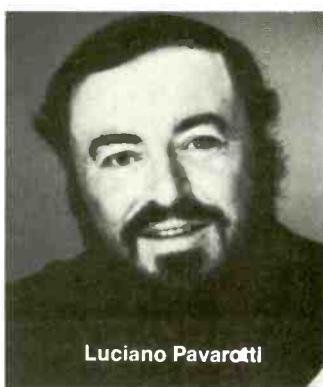
Bach, Goldberg Variations Trevor Pinnock, harpsichord. "This is a definitive performance." —Stereo Review Archiv 105318

Kathleen Battle: Salzburg Recital With James Levine, piano. Purcell, Mozart, Strauss, Handel, Fauré, & more. DG DIGITAL 115292

Mendelssohn, A Midsummer Night's Dream Ambrosian Singers. Philharmonia Orchestra/Marriner. Philips DIGITAL 115546

Artur Rubinstein: Chopin, 14 Waltzes "[His] playing is relaxed, assured, and wonderfully controlled." —American Record Guide RCA 101987

Kiri te Kanawa: Blue Skies With Nelson Riddle: Title song, Speak Low, How High The Moon, So In Love, 8 more. London DIGITAL 115035



Luciano Pavarotti

Strike Up The Band—The Canadian Brass Plays George Gershwin Title song, *The Man I Love*, *Porgy & Bess Suite*, 3 Preludes, more. RCA DIGITAL 160640

The King And I Yul Brynner, Constance Towers & revival cast. *Getting To Know You*, *Hello Young Lovers*, *Shall We Dance*, more. RCA 123742

Tchaikovsky, Symphony No. 4 Chicago Symphony Orchestra/Solti. "Eminently successful: powerful, fluent and virtuosic." —Ovation London DIGITAL 125038

Mozart, Symphonies Nos. 40 & 41 (Jupiter) James Levine conducts the Chicago Symphony Orchestra. RCA DIGITAL 104810

Beethoven, Symphony No. 3 in E-Flat (Eroica) Academy of Ancient Music/Hogwood. L'Oiseau-Lyre DIGITAL 115535

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Debussy, La Mer; Nocturnes Boston Symphony Orchestra/Davis. "The BSO is in tip-top form throughout." —Ovation Philips DIGITAL 115068

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Plácido Domingo Sings Tangos Mi Buenos Aires Querido, Alma de Bohemia, Nostalgias, El Día Que Me Quieras, 6 more. DG 105302

Kiri te Kanawa: Ave Maria Jesu, Joy Of Man's Desiring; Let The Bright Seraphim; O Divine Redeemer; more. Philips DIGITAL 115233

Perlman: Mozart, Violin Concertos Nos. 3 & 5 Vienna Philharmonic/Levine. "Radiantly sumptuous." —High Fidelity DG DIGITAL 115146

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SPL and Loudness

Q. My original speakers produced 88 dB SPL, and my new ones produce 102 dB SPL. How much louder are the new ones, given the same amount of power feeding them? Both loudspeakers are of the same impedance.—Hiram Garcia, McAllen, Tex.

A. Your new loudspeakers are far more efficient than the original ones. Assuming that the outputs of both sets of speakers are measured in the same way, the new models will produce a bit more than four times as much acoustical power as the old ones did when driven with the same electrical power.

Subjectively, I am not sure this information tells you much. Our ears don't measure quantities of sound as one would measure weight. Subjectively, however, you will definitely know that the new speakers are louder than the original pair. Keep in mind that other factors contribute to how loud a sound seems to be. Suppose the original speakers had some strong peaks in the midrange and treble. Such peaks would make the sound seem louder than if those speakers were flat. A speaker's location in the listening room can also make a difference as to loudness, as can the addition or subtraction of furniture.

X-ray Damage to CDs

Q. Is there any damage to a CD when it runs through the X-ray machine at an airport?—Carl Huff, Dallas, Tex.

A. To the best of my knowledge, no damage to CDs will occur when they are passed through airport security equipment. Certainly none of my readers have written me to that effect.

X-ray equipment can damage tape recordings, because the X-rays partially demagnetize them. No physical damage to the tape other than demagnetization takes place. Inasmuch as CDs do not in any way involve magnetic fields, I cannot conceive of a way by which X-rays would damage them.

Flickering Stereo Indicator

Q. When I tune to a certain FM station, sometimes the stereo indicator flickers. Why?—Richard Harding, Peabody, Mass.

A. The most likely explanation is that, for whatever reason, the tuner is switching to mono for brief intervals. Of

course, the light goes out during these intervals but relights when the tuner switches to stereo once again.

It is reasonable to suspect that the strength of the signal in question is weak. A passing airplane or a change in atmospheric conditions may further weaken the signal to the point where it would be too noisy for good stereo. Thus, the tuner switches to mono.

Getting a Clean Sound

I was interested to read Allen R. Meals' letter in your November 1987 issue. He traced a channel-imbalance problem to his hearing loss in one ear. I would like to relate my own experience, which may be of interest to your readers.

About six years ago, some dirt became lodged in my ear, and a trip to the doctor was necessary to remove it. Upon my return home, I noticed that my stereo system sounded like new!

Since that time I have made it my practice to cleanse my ears two or three times a year, using the Murine earwax removal system. By doing the same thing, or simply by using warm water and a syringe (following your doctor's instructions!), you too can reap the benefits of a whole new audio system.

I do not exaggerate when I tell you that this low-dollar process will produce results similar to buying a new pair of speakers. Don't think you'll notice the difference only if you work in a sawmill or in some other dusty environment. Even an office worker who commutes in city traffic will notice a remarkable improvement.—Bob Hovey, Columbus, Ga.

Equalizing Loudspeakers

Q. What effect does an equalizer have on loudspeakers? If a loudspeaker has a response dip at 30 to 40 Hz and I boost this range to restore a flat response, will the speakers really produce that flat response at low frequencies? If equalizers do work that way, why don't loudspeaker manufacturers build in electronic boosts?—Steven Di Carlo, Lanham, Md.

A. If you have a loudspeaker which is deficient in bass but whose bass frequencies can be heard to some extent, perhaps the equalizer will enhance that region. Whether or not flat

response can be brought about depends on whether the bass boost results in so much power fed to the loudspeakers at low frequencies that they are overdriven and perhaps damaged. On the other hand, if you have a speaker system in which the lows are virtually nonexistent and where we really hear harmonics of the bass frequencies rather than the fundamentals, no equalization can compensate.

Some loudspeaker manufacturers do in fact supply special equalizers, to be placed either in the tape loop or between the preamplifier and power amplifier. The purpose of such equalizers is to compensate for any dips or peaks in response—not just those in the bass.

Interfering with FM Reception

Q. Sometimes when I walk by my receiver when it is tuned to FM, I get a lot of interference. When I walk away, the signal clears up. What is the cause of this? How can I fix it?—Joseph S. Barbesa, Buffalo, N.Y.

A. This interference is the result of your body's coming between the receiving antenna and the transmitting antenna. To some extent, your body can block out the desired signal. This will happen only if you use an indoor antenna. The cure is to move the antenna to a location where your physical presence cannot affect it. Mount it near the ceiling, if possible.

As you move the antenna around, take note of the signal strength of the most desired stations. You may not only find an antenna location which will eliminate the interference caused by people walking in and out of the signal path, but you may also obtain greater overall signal strength—which will make reception better.

Static from the Volume Control

Q. I am having a problem with static electricity. When I turn on my music system, I hear static from the speakers when I adjust the volume control. I grounded my system to a water pipe, but the problem is still present. How-

If you have a problem or question about audio, write to Mr. Joseph Giovanelli at AUDIO Magazine, 1515 Broadway, New York, N.Y. 10036. All letters are answered. Please enclose a stamped, self-addressed envelope.

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You must listen to audio equipment before buying it, but be sure you know just what to listen for.

ever, if I turn the equipment on and let it stand for a few minutes before making any volume adjustments, the static is no longer present.—Joe Pudlo, New York, N.Y.

A. The "static" that you hear when turning the volume control on your sound system is not the result of static electricity or of bad grounding practice. The offending sound results from the way in which the equipment works during startup. Capacitors associated with the volume-control circuit charge up, and this takes time. During this process, the voltage across the capacitor changes, and hence d.c. flows through the volume control. Whenever d.c. is present in such a control, adjusting it will produce a scratching noise. There is less of a tendency for this sound to be produced when the control is clean (free of oxide). What you have described may be an early sign that the control is dirty. It should be cleaned with a suitable contact cleaner. Failure to do so will ultimately result in noise every time the volume control is adjusted.

Where to Begin?

Q. When shopping for an audio system, how can I choose components in which I can be confident? Why does one choose one brand over another—reviews, reliability, recommendation? Among literally hundreds of brands, what should be important to me?—Dr. David Blank, Cleveland, Ohio

A. Most audio equipment is very good these days. In fact, I have to look in order to find really bad gear. The reliability of today's equipment has, for the most part, been surprising; I myself don't consider that aspect when I purchase a component.

To get started, one thing you can do is to look at the advertisements of high-end manufacturers. By and large, these firms have been around for some time, and they would not have remained in business had they produced consistently poor-quality goods.

Another good way to buy equipment is by recommendation, but only if the person doing the recommending has some knowledge.

Product reviews and spec sheets will tell you about the features included in any given piece of equipment. If you have a good knowledge of a particular

reviewer's likes and dislikes, you may find his opinions useful for you.

Personally, I would not want to buy something based solely on what a reviewer had to say. I would want to examine it and—most important—listen to it. An examination will tell you how easy or hard it is to operate and will help you learn about the features it contains. You may find that there are features you do not need or want but which could result in a higher price. That alone could be a reason for you not to buy a piece of equipment.

Though it is important to listen to a product before you buy it, it's difficult for me to explain how to do that, especially if you are inexperienced in auditioning audio components. An understanding can come about only by doing a great deal of listening. Even so, this listening won't have much meaning unless you have heard live music and have a reasonably good "ear memory" of what the music sounds like. Then you can listen to a system and determine how close it comes to your impression of how a given kind of music should sound.

In any event, when auditioning equipment, you may want to have with you someone whose opinion you respect. Further, you should use unflawed recordings with which you are thoroughly familiar.

Rising Cartridge Output With Rising Frequency

Q. Why does the output of a moving-coil or moving-magnet cartridge rise at the rate of 6 dB per octave?—O. O. Callaway, Carlsbad, Cal.

A. A magnetic phonograph cartridge is really a tiny electrical generator. If we move the magnet in a generator with respect to the coil, or vice versa, a voltage will be generated. As the relative motion between coil and magnet increases in velocity, the voltage rises. This is exactly what happens when a phonograph record is played using a magnetic cartridge. The stylus is coupled to the moving magnet or the moving coil. Because of the nature of disc recording, the stylus velocity increases with increasing frequency. If the stylus moves faster, so will the magnet or coil to which it is attached. This increase in speed accounts for the voltage rise of 6 dB per octave.



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WHAT'S NEW



Sherwood CD Player

The CDP-250R features a two-times oversampling digital filter, 16-selection random access programming, and an auto space mode for tape recording. The unit can be

operated by Sherwood's Digi-Link remote system, via the control supplied with the company's Model S-2770R receiver. Price: \$249.95.

For literature, circle No. 100

Concord Car Stereo

The CX70 is a removable stereo head unit with an amplifier section that delivers 12.5 watts per channel in stereo, or four channels of 4.5 watts each, at 0.08% THD. The tuner section features seek, scan and preset scan, and memories for 12 FM and six AM station presets. When travelling, the presets can be instantly reprogrammed with strong local stations.

The tape section features auto reverse, dbx plus Dolby B and C noise reduction, and automatic eject. Both the bass and treble controls offer a choice of three turnover frequencies. The unit offers switchable loudness and a preamp-level subwoofer crossover at 150 Hz, while an input terminal allows the addition of a CD player. Price: \$750.

For literature, circle No. 102



Orpheus Loudspeaker

The Orpheus 808 is a three-way system using a 1.1-inch soft-dome tweeter, an 8-inch polypropylene driver for the midrange and upper bass, and an 8-inch polypropylene subwoofer, plus a 12-inch passive radiator. The enclosure is sloped back 10° for time compensation and has a foam blanket surrounding the tweeter to reduce diffraction. Rated frequency response is 28 Hz to 22 kHz, ±3 dB. The entire speaker is wrapped in black knit, with a walnut or oak top. Dimensions are 44½ × 15½ × 8½ inches. Price: \$1,400 per pair.

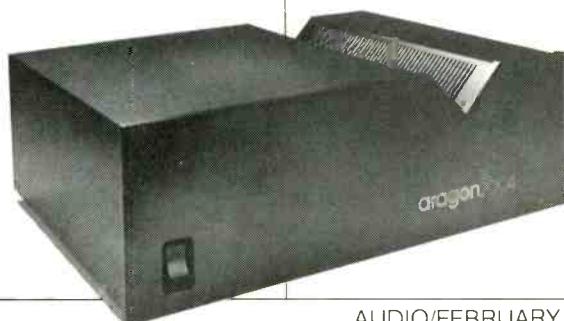
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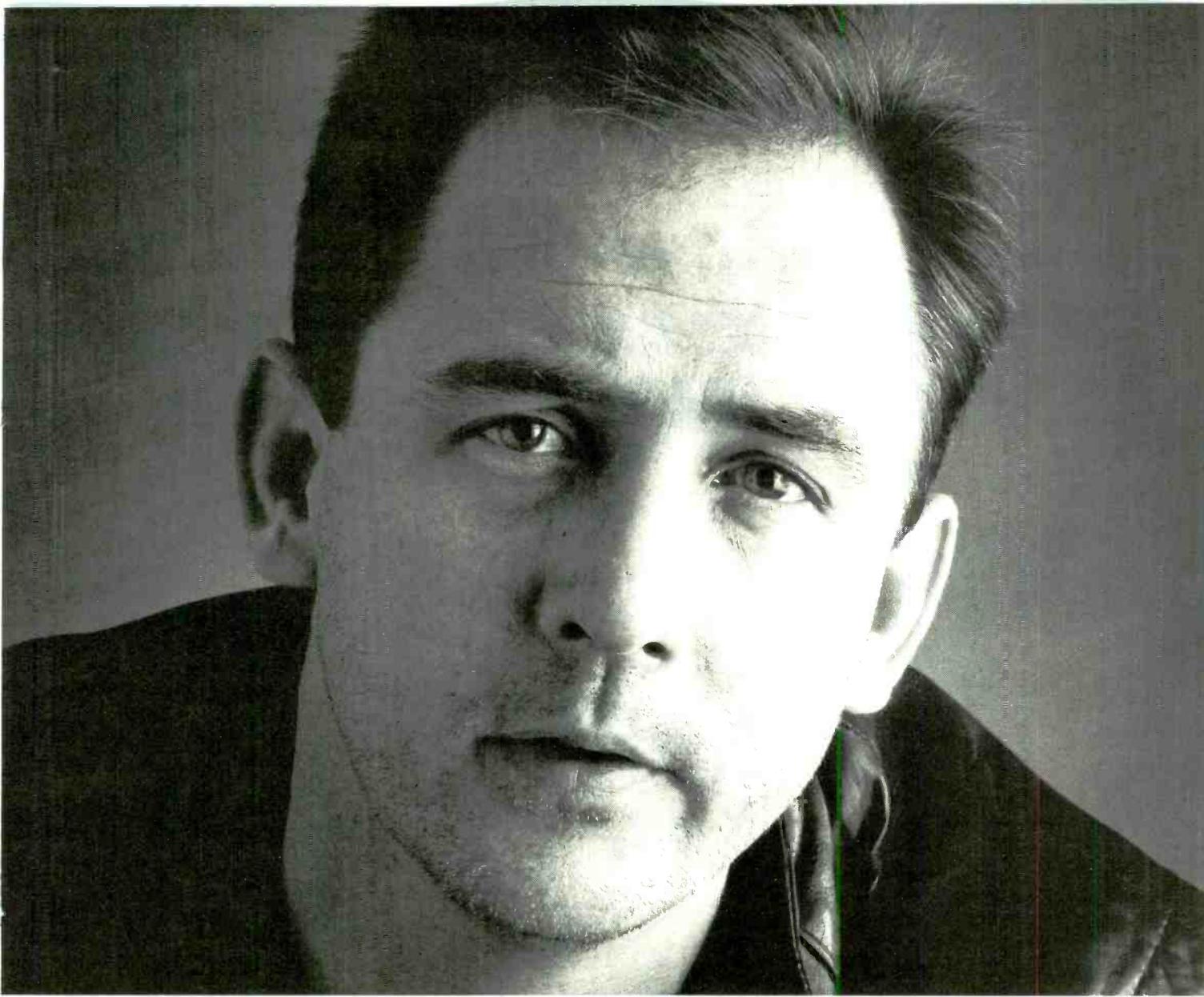
Aragon Power Amplifier

The unusual styling of the Aragon 2004 amplifier makes more than a visual point; according to the manufacturer, it also ensures adequate ventilation if the amp is right under a shelf or if a preamp or other component is stacked

above it. The amplifier, whose circuit was designed by Dan D'Agostino of Krell, delivers 100 watts per channel. It also features gold-plated Tiffany input connectors and Monster Cable output connectors. Price: \$995.

For literature, circle No. 103





"How Can Everybody's Speakers Be The Best?"

Read the various ads for speakers and you'll find many of them loaded with claims about being the best.

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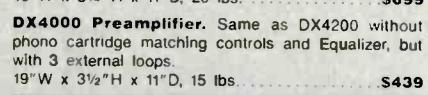
Preamplifiers



PRO-CONTROL FOUR Preamplifier, with digital CMOS switching. Ten total inputs, 5 tape monitors, 2 signal processing loops. Direct mode, Auto-Bridge circuitry, Bass and Treble Controls. 19" W x 3 1/2" H x 11" D, 15 lbs. \$699



DX4200 Preamplifier/Equalizer, with Compact Disc Player and Video/Audio inputs. Phono preamp has Variable Cartridge Loading (50-800 pF, 100/47,000 ohm); phono level controls for adjustable ± 20 dB gain; MC variable reluctance or MM cartridge inputs; 3-way Tape Dubbing: 2 external Signal-Processor Loops; conventional line outputs plus separate Autobridge Line Outputs for Mono Bridging of Most Amps; EO S/N 114 dB; Passive-Coil filters with 15 dB boost or cut for each octave, max 22 dB; Differential Comparator circuitry for True 0.1 dB Unity-Gain EQ balancing; includes Frequency Spectrum Analyzer test record and instant reset Computone Charts. 19" W x 5 1/4" H x 11" D, 20 lbs. \$699



DX4000 Preamplifier. Same as DX4200 without phono cartridge matching controls and Equalizer, but with 3 external loops. 19" W x 3 1/2" H x 11" D, 15 lbs. \$439

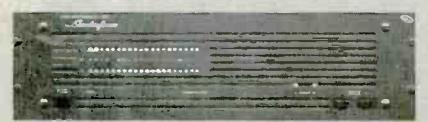


DX3000 Preamplifier, Inputs for CD player, Video/Audio, Tuner, Phono. Two Tape Decks with dubbing, Bass and Treble controls, and signal processor loop. THD - 0.01%, S/N 95 dB. 19" W x 2 3/4" H x 10" D, 10 lbs. \$329

Power Amplifiers



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PRO-POWER FOUR, MOSFET stereo power amp 300 Continuous RMS Watts per channel @ 4 ohms, 205 Continuous RMS Watts per channel @ 8 ohms, 20-20kHz, 450 Watts RMS @ 2 ohms, 900 Watts RMS @ 4 ohms Bridged. THD < 0.05%, Hum and Noise: -105 dB. Front Panel switching for 2 pair of speaker systems. 40-LED 0-1600 Watt Power Meters. 19" W x 5 1/4" H x 11" D, 30 lbs. \$799

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PM840 Power Amplifier, MOSFET stereo, features no-current-limiting power supply, 300 w/p/c RMS into 4 ohms; 450 w/p/c RMS into 2 ohms; 205 w/p/c into 8 ohms @ < 0.05% THD; Freq. resp. 20 to 20,000 Hz ± 0.1 dB; S/N > 105dB; slew rate 50 V/microsec; TIM unmeasurable; damping factor 200. 8 1/2" W x 5" H x 12" D, 22 lbs. \$549



A5002 Power Amplifier, Class-H Vari-Proportional circuitry and Autobuffer for continuous operation into 2 ohms. Features auto crowbar protection circuit for output protection without current limiting; 40-LED 0-1,000 Watt power output Meters; Front-Panel switching for 2 pairs of speakers; True Clipping indicators; Input Level controls. Output power 250 W/ch into 8 ohms, 375 W into 4 ohms continuous RMS, 20-20,000 Hz at < 0.09% THD; S/N > 105dB; slew rate > 50 V/microsec; TIM < 0.02%. 19" W x 7" H x 12" D, 50 lbs. \$949

A5001 Power Amplifier, Same as A5002 except no Meters and no Input Level controls. 50 lbs. \$799

Tuners



T6200 AM/FM Stereo Digital Tuner Digital quartz PLL tuner with 16 Station presets, 5-digit Station Readout, Auto-Scan tuning, active High Blend filter. Broad-Band AM switch, 19" rack-mount front panel, IHF sens 1.6 μ V; S/N 75 dB, distortion 0.08%. 19" W x 2 3/4" H x 12" D, 10 lbs. \$299

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DC4415 Third-Octave Equalizer, stereo with 21 controls/channel. Center frequencies 40, 50, 63, 80, 100, 125, 160, 200, 250, 315, 400, 500, 630, 800, 1,000, 1,600, 2,500, 4,000, 6,300, 10,000, 16,000 Hz; Features EO defeat; Infrasonic filter; Tape Monitor and Tape Record; Differential/Comparator® circuitry for Unity Gain setting to within 0.1dB accuracy for highest Dynamic Range capability. THD and IMD 0.01% at 2 V; S/N 114dB at full output; input imp 47,000 ohms. 19" W x 5 1/4" H x 1" D, 16 lbs. \$699

DC2215 Differential/Comparator® Equalizer, Stereo 10-band, with Differential/Comparator® True-Unity-Gain circuitry for Input-to-Output balancing accuracy to within 0.1dB. Equalizer filter circuits use precision wire-wound Passive-Coil inductors for high gain, low noise and distortion. 19" W x 5 1/4" H x 11" D, 17 lbs. \$449

DC2214 Differential Comparator Equalizer, Same as DC 2215 except equalizer filter circuits have op-amp synthesized inductors. THD and IMD < 0.01% at 2 V; S/N ratio 106 dB at 10 V; boost/cut range ± 12 19" W x 3 1/2" H x 9" D, 13 lbs. \$299

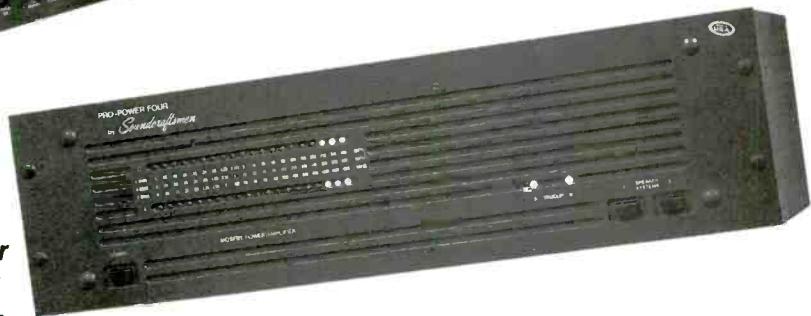
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WHAT'S NEW

Acoustat Loudspeakers

Instead of a single, full-width electrostatic panel, the Spectra 33 (shown at left in photo) and Spectra 22 use several tall, thin panels. Only one of these panels operates over the entire frequency range; the high frequencies of the others are rolled off to produce an array whose width decreases with rising frequency, thereby improving high-frequency dispersion. The transformer interface has been



designed for extended bass response with low distortion. Full-range outputs and a switchable 100-Hz passive crossover are supplied for use with optional subwoofers. Both speakers come in off-white or black fabric with dark oak as the standard finish (other finishes available at extra cost). Dimensions are 2 inches thick x 66 inches high; the Spectra 22 is 22 inches wide, and the Spectra 33 is 33 inches wide. Prices: Spectra 22, \$1,850 per pair; Spectra 33, \$2,250 per pair.

For literature, circle No. 104



Sharp CD Player/Receiver/EQ

An ultra-compact music system, Sharp's SA-CD800 "CDver" combines a CD changer, a seven-band equalizer with spectrum analyzer, and an AM/FM receiver rated at 100 watts per channel into 8 ohms at 0.5% distortion, from

40 Hz to 20 kHz. The CD section has a single-play drawer plus a five-disc magazine, and the receiver section has 24 AM/FM station preset memories. Connections are provided for a tape deck, a high-level signal source, and a pair of speakers. A wireless remote is included. Price: \$899.95.

For literature, circle No. 106



Chapman Car Alarm

The Street Fighter Series 4 alarm is actively or passively armed, and disarmed by a radio remote control. The remote has buttons for use with two different cars; if both buttons are pressed at once, the alarm system's panic siren goes off. Other features include "chirp" and LED indicators, immediate siren trigger on all openings, automatic reset, and a motion detector. Siren volume is 110 dB. Price: \$399 plus installation.

For literature, circle No. 107

JBL Car Speaker

In styling, the T75 is a departure from most plate speakers. Like other plate designs, however, it combines a woofer/midrange unit with a tweeter. The larger driver is a 5½-inch cone of mineral-

filled polypropylene with Kapton voice-coil formers; the tweeter is JBL's T05 1-inch titanium dome. The crossover's low-pass filter has a slope of 12 dB/octave, for tweeter protection, while the high-pass section has a slope of

6 dB/octave. Specifications include frequency response of 75 Hz to 26 kHz, sensitivity of 85 dB SPL (1 watt/1 meter), and a crossover at 3 kHz. Price: \$235 per pair.

For literature, circle No. 105



THE CURRENT STATE OF THE STATE OF THE ART.



Rack handles

are optional equipment.

The new NAD Monitor Series

CD player combines the latest in state-of-the-art technology with an assortment of elegantly useful features you won't find on any other machine.

To review the latest developments in compact disc technology, all you have to do is look at the new 5300 Monitor Series CD player from NAD. You'll find eleven regulated power supplies, four times oversampling, a three-beam laser pickup, 95 point digital filtering, dual 16-bit digital-to-analog converters . . . all the right numbers in all the right places.

But like many things in this non-digital world we live in, numbers are only part of the story. As with all our Monitor Series components, we've designed the 5300 to deliver the best possible audible performance under real-life circumstances. To do that we combined leading-edge technology and an assortment of "human engineering" features you won't find on any other machine. The process took over three years, and involved a thousand thoughtful, careful and (we think) correct design decisions. A very few examples . . .

■ The 5300 uses an accurate three-beam laser pickup and operates with four times oversampling and full 16-bit precision. A ninety-five point digital filtering system suppresses spurious sidebands, resulting in complete freedom from filter coloration.

■ Separate transformer windings are used to power the digital and analog sections of the 5300. Every supply is individually controlled, resulting in a total of eleven separately regulated power supplies (seven positive, four negative).

■ Two ultra high performance 16-bit digital-to-analog converters are used to completely eliminate inter-channel phase error.

■ Two disc error displays indicate the occurrence of correctable and non-correctable errors on your compact discs. This system allows users to evaluate technically flawed discs.

■ A unique processing circuit that controls the dynamic range is included for those times when you want to listen to compact discs as background music. The same circuit reduces the distortion caused by tape saturation when making cassette copies of CDs.

■ Many albums that have been re-issued on CD have a harsh, sterile sound. The 5300 has a special circuit that boosts the subdued ambience information in these recordings, thus producing a richer, easier, more three-dimensional sound.

■ Most wireless remotes control volume with an electronic system that adds audible noise to the music. The 5300's high-performance remote actually controls a small motor that changes the volume, without adding noise.

In short, what makes the 5300 CD player unique . . . is a long story. If you'd like to read it, write for our Monitor Series brochure. Or visit your authorized NAD dealer—and hear the result of a thousand design decisions, correctly made.

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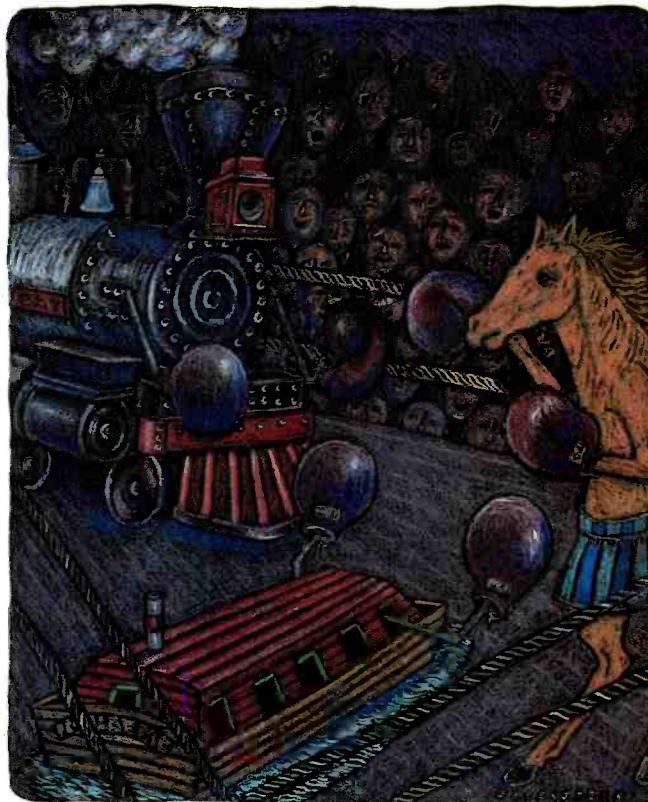
BATTLE OF THE BARGE

I have to laugh at the book I am reading, all about the first bungling attempts at railroad-building in England in the late 1820s. It ties in most oddly with the excitements of recent date concerning R-DAT cassettes. Phew, such arguments, such fights! We are still in the midst of ours today, as far as I know, with passions galore and much high-minded talk, not to mention threats of preventive action. It'll all work itself out eventually, but first, let me make the strange parallel, before it's too late.

Around 1825, the big flap was three-cornered. In one corner was the horse. In another was the almost-as-venerable (but definitely state-of-the-art) canal boat with its superbly efficient and up-to-date system of locks, up and down in discrete steps, forever flat as well as liquid. And in a third corner was the brand-new steam locomotive, that dangerously combustible and explosive small boiler on big wheels which a number of crackpots were trying to foist on the gaping public, a stinkpot brazenly occupying rails which by every right belonged to the horse. It was a fight to the death, sometimes with guns and mayhem, and at the center of it was the venerable steed, representing all that was good, traditional, fair, and reliable in transportation.

Hey, maybe I should send a copy of this book to every producer of recorded sonic entertainment. Some of them are flogging our own horse to death, all with the best of intentions in terms of the dollar.

The first railroad in England, the Stockton & Darlington, opened in 1825 as primarily a coal-hauling system. It was a public highway, equipped with that ingenious new road surface, a pair of iron rails to take flanged iron wheels, or wooden wheels with iron rims attached. Any farmer or coal driver who put the right wheels on his vehicle could drive down this highway as he pleased, and so could the owner of a



stagecoach service, all for a modest toll charge. The new steam locomotives could also use these rails, to pull coal carts. If you wished, I suppose you could fit your own private carriage with flanged wheels and take the family for a Sunday drive in the country in new and glorious comfort. No bumps, no rattles.

You could, that is, until you met up with a horse coming the other way, or even a snorting steam machine. In that case, somebody had to back up a half mile or so to the nearest turnout. That was a fatal flaw in the design—in no time there were fights breaking out up and down the highway, notably between the horse drivers and the locomotive drivers. Horse trains were left on the track while their owners caroused in a tavern. Carts derailed and blocked the line. There were no signals, no dispatchers, and not even any brakes, other than the usual crude wooden blocks on the carriage or cart wheels. (No, the locos had no brakes at all. You could not even go into reverse, at first.) Chaos? Most certainly not. There was, admittedly, room for a

few improvements, but this was the very latest in progress, just like our CD and R-DAT today.

Now, I really hate to say this, but in my fanciful analogy the forces of propriety, law, and the inalienable rights of all concerned are well represented by the horse. The horse was a principle that people believed in, the oldest and most reliable form of transport (next to one's own legs) and surely the fairest—just about everybody had a horse. Nobody could possibly object to this familiar animal, the very prop of civilized living. The horse, then, represents for me *the copyright law*. Does anybody really object to the copyright law? Of course not.

Then there was the canal-boat system. At the time we're talking about, it was at its peak in England (and in the U.S. too), an old but still modern system for the reliable transport of heavy goods, engineered by the 1820s for state-of-the-art efficiency. The canal boat could carry far more than any horse-drawn vehicle on land and with much more safety, yet it did not seriously threaten the horse, which was still its usual motive power. It had a modern, no-jolt suspension—hydraulic, like the remarkable system of locks for raising and lowering vast loads without disturbance. With land roads as they then were, you can imagine how this superb canal system was esteemed by the early industrialists. There were canals everywhere—they were essential to industry.

And so, as you might guess, the first railroad people laid out their lines exactly like so many canal systems. Quite literally! Up a steep incline, then flat for as far as possible, then down another incline, all in rigid planes. Preposterous? Maybe so, but it happened. At each inclined plane, there was a land "lock"—a stationary steam engine (in an emergency, horses) and ropes, to haul the goods wagons up or to let them down. As far as possible these inclined-plane "locks" were straight

Illustration: Susan Greenstein

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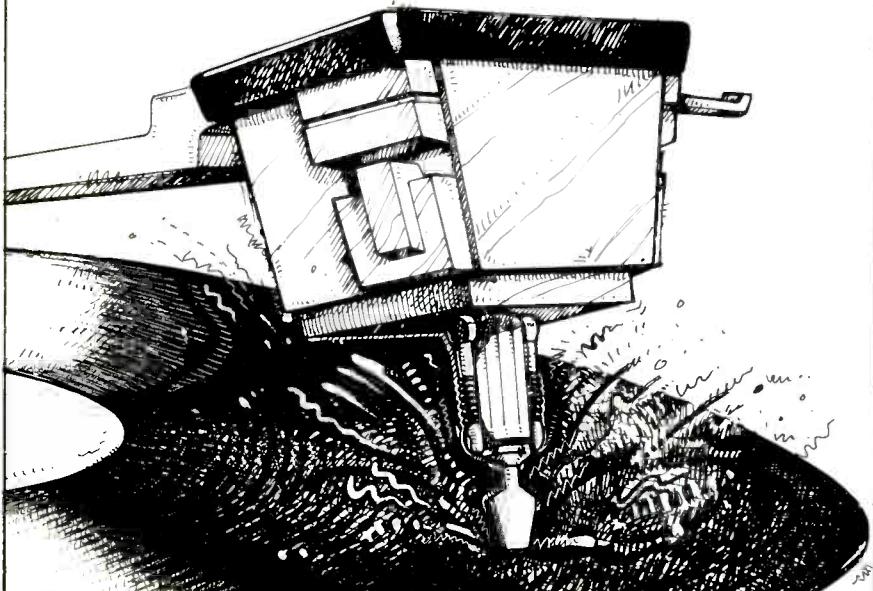


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In being an old, mature, respected system at its peak, today's analog recording is like the canal system of the 1820s.

and to an exact grade, at least at the beginning.

Let us continue my slightly zany analogy by comparing the canal system of the 1820s, an old, mature system at its very peak, with—you guessed it—the analog recording system of today and, in particular (for the moment), the old, mature *audio cassette system*, which is at its very peak right now. The analogy is close, even to the large vested interest and utter respectability of both systems.

As you may suspect, the canal-boat people quickly smelled danger in the new dry-land canal on rails, smack up against their own rights of way, and they began to fight hard—on the highest moral principles, of course. They particularly disliked that irresponsible monster, the steam locomotive, calling it evil, dangerous, filthy, and unreliable. And they were partly right. In comparison to the steady old horse, which did not explode, the locomotive was indeed a hazardous thing. And so the horse became almost the symbol of opposition. (And isn't the copyright law the center of opposition to DAT today?)

No wonder the rail people built their system as much like the canals as possible; they wanted to smooth tempers and allay fears. The railroad was just a new form of an old and acceptable mode of transport. For business reasons, the thing to do was to calm the jitters among canal proponents, and the horse, proposed as drawing power on the new rails, would maybe do it. You may be sure, the "horse power" faction among the members of the board on each of the early railroads was highly vocal and very powerful. Let me tell you, the horse very nearly won on numerous occasions—even after the bulk of a new railroad had been completed with all its tracks, bridges, tunnels, and viaducts. (But the canny engineers mostly built for steam, just in case.)

I think a much more interesting reason for the "dry canal" concept was that it was simply taken for granted. People thought in the mode of their own time—we still do today. The canal concept had momentous consequences in engineering terms. It took many years of rethinking before the out-of-date principles were put aside. Steam was considered and pushed by

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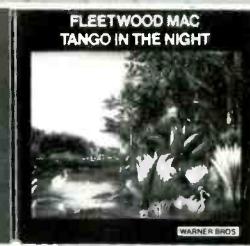
361675. Sting—...Nothing Like The Sun

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362343. Stevie Wonder—Characters



362228. George Michael—Faith



354902. Fleetwood Mac—Tango In The Night

363465. Dolly Parton—Rainbow. (Columbia)

362483. Orig. Soundtrack—Hail! Hail! Rock 'n' Roll. (MCA)

362236. Tony Bennett—Bennett/Berlin. (Columbia)

362210. Earth, Wind & Fire—Touch The World. (Columbia)

362129. Belinda Carlisle—Heaven On Earth. (MCA)

361543. Kitaro—The Light Of The Spirit. (Geffen)

361279. World's Greatest Overtures—Strauss, Suppe, more. (Digital—Pro Arte)

361147. Rodgers And Hammerstein's Carousel. Barbara Cook, Samuelli Romeo. (Digital—MCA Classics)

360974. Squeeze—Babylon And On. (A&M)

360149. Echo & The Bunnymen. (Sire)

360107. Billy Idol—Vital Idol. (Chrysalis)

359976. Bodeans—Outside Looking In. (Reprise/Slash)

359901. Mick Jagger—Primitive Cool. (Columbia)

359612. Elton John's Greatest Hits, Vol. III 1979-1987. (Geffen)

359208. Loverboy—Wildside. (Columbia)

359075. Aerosmith—Permanent Vacation. (Geffen)

359018. Pat Metheny Group—Still Life (Talking). (Geffen)

358937. Handel: Music For The Royal Fireworks—Yehudi Menuhin, Royal Philharmonic Orchestra (Digital—MCA Classics/RPO)

358663. The Art of Alfred Brendel Vol. I. (Vanguard)

358507. Who's That Girl—Orig. Soundtrack. (Sire)

358127 Kronos Quartet—White Man Sleeps. Volans, Ives, Bartok, etc. (Digital—Nonesuch)

357939. Original Soundtrack—"La Bamba". (Slash/Warner Bros.)

357889. Copland: Billy The Kid; Appalachian Spring; etc. (Bernstein, NY Phil. (Digitally Remastered—CBS Masterworks)

357871. Tchaikovsky: Waltzes—S. Comissiono and Houston Symphony (Digital—Pro Arte)

357640. Wynton Marsalis—Marsalis Standard Time. (Columbia)

357467. Sammy Hagar. (Geffen)

357350. The Duke Ellington Orchestra—Digital Duke. (Digital—GRP)

357145. Richard Goode Plays Brahms Piano Pieces, Op. 76 & 119/ Fantasies Op. 116. (Digital—Nonesuch)

357087. Grateful Dead—In The Dark. (Arista)

356741. Bach: Preludes And Fugues For Organ, Vol. I. (Digital—Newport Classic)

356667. Heart—Bad Animals. (Capitol)

356576. John Adams: The Chairman Dances—DeWaart, San Fran. Sym. (Digital—Nonesuch)

356501. Benson/Klugh—Collaboration. (Warner Bros.)

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356279. Gloria Estefan And Miami Sound Machine—Let It Loose. (Epic)

355834. David Bowie—Never Let Me Down. (EMI America)

357939. Original Soundtrack—"La Bamba". (Slash/Warner Bros.)

357889.

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355362. Whitesnake—(Geffen)

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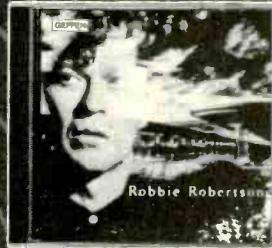
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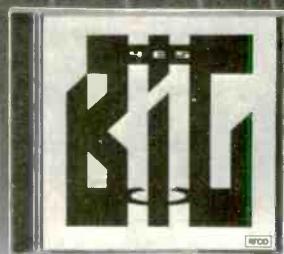
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Nobody at all questions the fairness of copyright law. The present matter is one of practicality under new conditions.

its proponents—but at first only for the flat stretches of the rail "canals." Reasonable, so long as steam engines could not haul up grades! And so the ropes were taken for granted—one proposal would have had some 30 miles of successive ropes as the main "motive" power.

This curious thinking-as-of-the-present-usage also produced railroad cars that were literally horse coaches transferred to rail wheels. What else? Sometimes there were three or four coaches in a row on one frame. The rounded coach, high and curvaceous, was considered the normal shape for

human transport. To this day, there still exist in Europe those compartment cars that evolved directly from the coach on railroad wheels—the name has persisted even where the shape has departed, as in the jet plane.

Pushing my analogy further, I note that steam railroading in 1825 was much like digital recording is today, a revolutionary new technique applied to old requirements. In particular, the steam locomotive is the R-DAT. The parallel breaks down a bit here, since the loco was indeed a shaky and hazardous engineering development whereas the R-DAT cassette system is anything but that, so far as the engineering goes. But people mistrusted railroad performance then much as they have misgivings about digital sound today.

I'm not entirely off the beam in my analogies, especially concerning the horse. I mean, of course, the 1825-model horse, not the nag of today. The equine role in civilization has changed a bit since then. I mean no disrespect to the principles of the copyright—far from it. That law does indeed present a standard of fairness and respectability that is questioned by nobody at all—in principle. The present discussions are entirely in the matter of practicality under new conditions—how to make the law work, fairly and effectively. *Adapt, adapt!* That's the only way.

It is easy to be virtuous, talking copyright. One can wax very high-minded on such matters, as one can concerning that much larger, battered entity, the Constitution. One can always defend virtue, and justice, and Basic Rights. True, true, all of it. But again, the real necessity is to *adapt*. Or else die.

We are adapting already in one sense; the people are showing how they feel, in all their millions. In technically ignoring the general idea of copyright protection, when it comes to video copying in one's home on a not-for-profit basis, the public at large is merely stating that they don't really feel that the idea applies. And I agree. Not, in any case, to the sort of fairly extensive copying covered by the so-called Betamax case. We know it, more familiarly, as Disney versus Sony. It was where the Supreme Court of these United States said that the public did have a



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If copy protection is going to put even the slightest restriction on the quality of DAT engineering, it is wrong—and shortsighted.

right to make tapes of copyrighted TV programs.

One interesting sidelight of this is that there are two readings of the Supreme Court decision. So says a lawyer friend of this magazine. The narrow reading is that the decision applies only to videotaping—as if a video re-

corder doesn't have an audio track and can't be used, as with one of Sony's PCM-F1s, for digital audio taping. The wider and (I might add) far more prevalent interpretation is that the ruling applies to *all* home recording. Which becomes even more interesting when you consider that Sony has just

reached the handshake stage of a deal of whopping proportions to purchase the CBS Records Group, which is the main progenitor of the anti-DAT Copy-code system.

I've given my thoughts on Copy-code in December; let me add only that if you think that millions of Americans are itching to set up as audio pirates when these new DAT machines get to them, you are just plain wrong. Protection, let us say, might be valuable in a literal sense if the system meant that you simply could *not* make copies—but if this protection is to be done with even the slightest restriction on R-DAT engineering quality, it is wrong. And shortsighted. Yes, I suppose a crackpot here and there, or (as in computer information) an 11-year-old genius playing games, might "crack" the protective code, whether the notch sort or the flag type—or somehow disable the whole protective system. But if we can use videotaping as an example, note this: Whether or not the wide variety of protective maskings for videotapes and programs are used, profits have soared for the owners of these copyrights—when the material has been worth copyrighting and protecting.

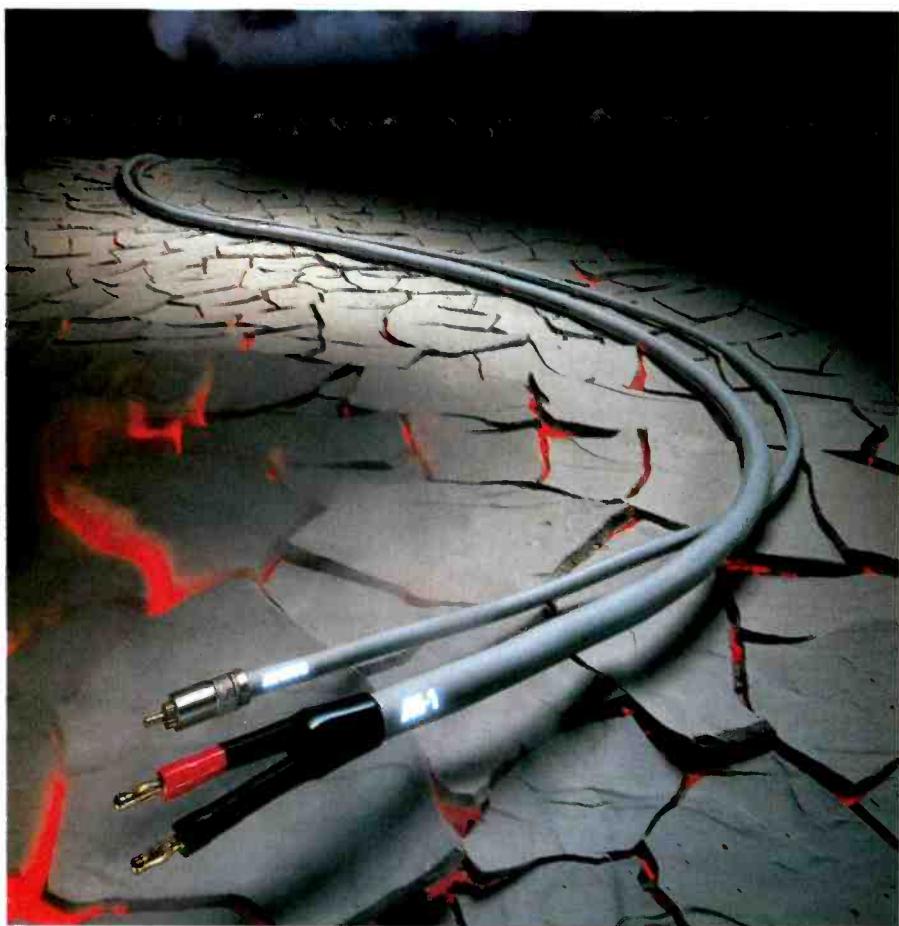
If I am wrong, I still feel that the wave of the future must continue here, and that we can indeed learn to live with an untrammeled and up-to-date form of home cassette recorder.

There is one obvious point that I have yet to hear enunciated. Okay, suppose we do devise a foolproof no-copy protection scheme for digital recordings under copyright, one that "does not harm the audio quality" in any way. *Who's going to buy the digital equipment?* Would you buy a VCR if you could not ever copy anything, any time, that the copyright owner did not authorize you to copy—for any reason, good or bad? Not if I know you. Would you buy a noncopying digital cassette system to replace your present audio cassettes?

The result would be a drastically diminished market—and who would lose most? The copyright owners, natch.

Did you know that in front of every locomotive on that first railroad in England was a prancing horse and rider to lead the way? Propriety, law—but also defiance. Right?

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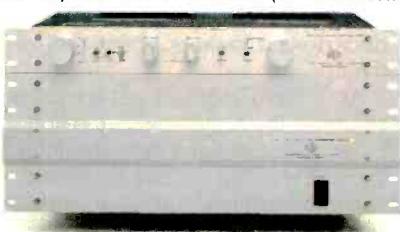
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BERT WHYTE

ROOM WITH A VIEW



While Americans have always liked movies, it wasn't until the advent of "talking pictures" in 1927 that the movies became a major entertainment medium. When television became widely available in the early 1950s, movie attendance fell off sharply, and throughout the country many movie theaters closed.

Eventually the movie industry fought back by introducing Cinemascope, which provided a giant, wide aspect-ratio screen and stereophonic sound. The original Cinemascope pictures had left, center, and right soundtracks reproduced through loudspeakers behind the perforated screen, plus a fourth track, for special effects, reproduced via speakers in the rear of the theater.

As I have pointed out in previous columns, the bona fide stereo sound of Cinemascope didn't last very long because it was too difficult to utilize it with correct audio-visual perspectives. Thus, the sound reverted to a single, center-screen mono track. It was confusing to see people at the far left or right of the wide screen with their voices coming from the center! I have told the story of how Bob Fine invented Perspectasound, which restored left, center, and right speakers to the wide Cinemascope screen, and how the pictures were "post-mixed" and panned for the desired lateral directiv-

ity and localization. Several years after Bob's invention, I recorded a six-channel surround-sound track in the Cinecitta studios in Rome for *The Scent of Mystery*, a movie starring Peter Lorre. These efforts, and the early CinemaScope and Cinerama, were the progenitors of today's Dolby Surround Sound movies. Ironically, it is TV's use of these movies on videocassettes and videodiscs that is a major source of revenue for the movie industry today.

When you go to a movie theater that shows a really good, bright, clean, sharply focused picture along with properly optimized Dolby Surround Sound, it can be a most enjoyable experience. The best Dolby Surround Sound presentation I have ever heard was in Ray Dolby's private screening room in his San Francisco headquarters. High-quality left, center, and right loudspeakers in back of the screen were augmented with a subwoofer. The rear channel was handled by a U-shaped array of speakers on the sides and back wall of the room.

To be quite frank, when I first tried one of the early consumer-type Dolby Surround Sound decoders with a 25-inch TV set, it was pretty disappointing, compared to the theater experience. There was no doubt that in the home, a larger screen was desirable for more impact and a greater sense of involvement. This meant recourse to projec-

tion TV, and I rated the performance of most of those units as pretty marginal. For the most part, the picture was too dim, color was overlaid by a blue-green cast, there was little contrast or saturation of the color, and resolution was poor.

The advent of the General Electric and other rear-projection units was a step in the right direction. Still, I avoided involvement with the concept of a home Dolby Surround setup until relatively recently. Then two parallel developments changed my attitude. At the 1986 Summer Consumer Electronics Show in Chicago, Infinity, well known for its excellent loudspeakers, showed its new Reference Standard Projection Television. I reported in my SCES round-up (October 1986) that this, at last, was a TV projector with a nice, bright picture and good resolution, color contrast, accuracy, and saturation. At the same time, there appeared Dolby Surround Sound decoders from Fosgate and Shure that were considerably more sophisticated than the simple, basic matrix units which provided only 3 dB of separation. It was the advent of the Infinity projector and these advanced decoders that made me decide to build a state-of-the-art Dolby Surround Sound entertainment center in my home.

Obviously, in this sort of home theater there are three basic elements—the room itself, the video equipment, and the audio equipment. The latter two are interrelated, of course, and this is where that audio/video "marriage" we've heard about for years is finally consummated.

The room in which I've set up my "theater" is 14 feet wide by 30 feet long. The rear wall behind the projection screen and loudspeakers is covered with Discrete Technology Soundsorber acoustic panels; these measure 12 inches square and 4 inches thick and are made of polyurethane foam. The foam on this wall is covered by decorative drapes. The side walls, out to a distance of 10 feet from the rear wall, are also covered from floor to ceiling with Soundsorber panels. With their deeply sculpted wedges, these panels afford both absorption and diffusion and greatly enhance sound-source directionality and localization, which are so important in surround

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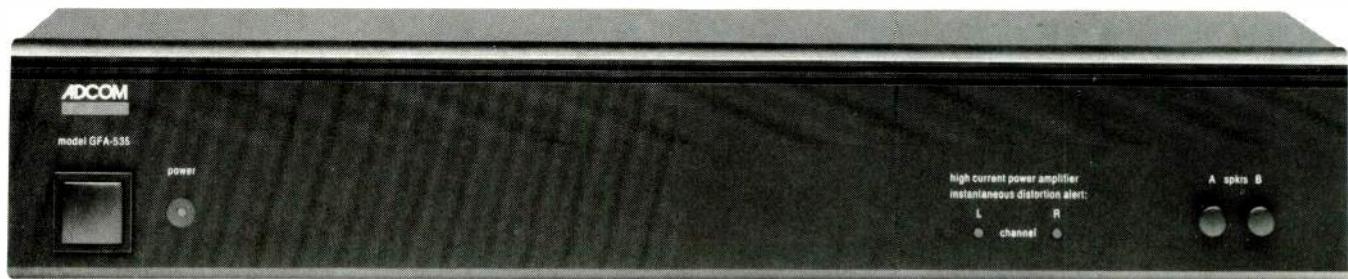
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"In its price category, the Adcom GFA-535 is not only an excellent choice; it's the only choice!"

Sam Tellig, The Audio Cheapskate

Stereophile

Vol. 10 No. 7 November 1987



Adcom GFA-535 power amplifier.

The complete report:

Sometimes products are too cheap for their own good, and people don't take them seriously: the Superphon Revelation Basic Dual Mono preamp, Rega RB300 arm, AR ES-1 turntable, Shure V15-V MR cartridge, and the B&K ST-140 power amp. They can't be any good because they cost so little, right?

Wrong, of course.

Adcom appears to be having the same problem with their \$299.95 GFA-535 amp. Credibility.

Now if this amplifier were imported from England and sold for \$599.95, then maybe it would be taken seriously. And highly praised, no doubt.

For the baby Adcom is one of the finest solid-state amps I have heard. No, not the best; I'm not sure what *is* the best. But it's an amplifier that is so good for so little money as to be practically a gift.

Actually, when Rob Ain from Adcom called, I was about as enthusiastic about the GFA-535 as you were before you finish reading this piece. But Rob insisted, "You've gotta hear this amp."

He brought it over the next day, along with the GFP-555 preamp (\$499.95), and we put both pieces into the rest of the system: a Shure Ultra 500 in a Rega RB300 arm on an AR ES-1 table, with Quad ESL-63 speakers on Arcici stands. Then we chatted for a half hour or so while the electronics warmed up.

And then, simultaneously, the two of us decided to shut up and listen.

"I've never heard the Quad ESL-63 sound better," Rob said. Of course, he was hardly an impartial observer, but the sound was extraor-

dinarily clean, detailed, and musical. If it wasn't the best sound I have ever heard from Quads, it was pretty close.

"Now if this amplifier were imported from England and sold for \$599.95, then maybe it would be taken seriously. And highly praised, no doubt."

This humble \$300 amplifier was driving a pair of very revealing \$3000 speakers and giving a very good account of itself. (We listened first to some Goran Sollscher classical guitar.)

"So how come this product isn't flying off the dealers' shelves?" I asked Rob.

"I don't know. Everyone wants the GFA-555 with 200 watts per channel. Including people who don't need it."

"Does the GFA-555 sound any better?" I asked.

"No, it's our aim to have all our amps sound pretty much the same. You pay more money, you get more power."

Rob pointed out that while the GFA-535 is rated at 60Wpc, it puts out more like 80. And while I did not do any measurements, my experience with other amps tells me Rob's right. I suppose Adcom doesn't want to steal sales from its GFA-545, rated at 100Wpc and selling for \$200 more.

After a couple of hours, Rob left, grinning from ear to ear, and I later sat down to listen alone. True, when I tried certain Telarcos and pushed hard I could get the amplifier to clip—

"...the baby Adcom is one of the finest solid-state amps I have heard...so good for so little money as to be practically a gift."

two LEDs quickly light up (very useful). But the Quads were running out of the ability to use the power anyway. My first impressions were confirmed: the GFA-535 is one of the best amplifiers around for driving Quads. Spendor SP-1s, too.

Suddenly, it hit me what this meant. Conventional wisdom had been dealt a severe blow. You know, the old saw that you should never power a good pair of speakers with a cheap amplifier. Here was a cheap amp—one of the cheapest on the market—that sounded good with Quads, Spendors, later Vandersteens. Probably Thiels, too—at least the CS1. What it means is you can stretch your speaker budget a bit and get the speakers you really want, then economize by buying an Adcom GFA-535 for \$299.95. True, you may be a little power shy, but probably not much. And to say the least, the GFA-535 would make a decent interim amp.

What does the GFA-535 sound like? (You thought I'd forget that part, right?) Well, this is one of the most neutral amps I've heard. While it doesn't sound particularly tubelike, it avoids the typical transistor nasties through the midrange and into the treble. I wouldn't call it sweet—there's no euphoric coloring—but it isn't cold or sterile. What it is, is smooth. And detailed. Far more detailed than I would

ever imagine a \$300 amplifier could be. The GFA-535 reminds me of the Eagle 2A and PS Audio 200C, amplifiers that sell, respectively, for about three and five times the price. Of course, they have more power. And they are more detailed. The point is, the Adcom comes close. Very close.

"The GFA-535 reminds me of... amplifiers that sell... for about three and five times the price."

The bass, like everything else, is neutral, certainly not fat and overdone. But it's here where you notice that this amp is not a powerhouse. You just don't get the solidity and extension you get with a very powerful (and expensive) solid-state amp. Nor do you get the breadth and depth of soundstage that you often find with a very powerful amp. The Adcom GFA-535 sounds a wee bit small, which it is.

My only criticism, and it's more of a quibble, is that the speaker connectors are non-standard and unique (so far as I know). You insert bared speaker wire into a hole and twist the connector tight a quarter turn. Most speaker cables will fit, but some will not. Certainly MIT won't. Neither will the best Kimber, the kind with eight clumps of strands. The less costly four-clump Kimber will, and proved an excellent choice. My sample amp was quiet—no hum—and ran cool. There are selectors for two sets of speakers. And the 535 looks nice.

"This amplifier is so good and so cheap that I think any CD owner who buys an integrated amp is nuts."

And talk about economy: If you're not into LPs anymore, you could buy a Mod Squad, dbx or Old Colony line-level switching box—or possibly a B&K Pro 5 preamp, with its switchable line amp section (only \$350)—and run it with a CD player. In fact, if you are into CD only (no tape, no tuner, no phono), you could buy a CD player with a variable volume output and run it directly into the Adcom. This amplifier is so good and so cheap that I think any CD owner who buys an integrated amp is nuts.

In its price category, the Adcom GFA-535 is not only an excellent choice; it's the only choice. The real question is whether you should buy one even if \$299.95 is much less than you planned to spend for an amp—if, whether you should put the money into a better CD player or pair of speakers instead.



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The three front and two rear speakers in my home theater all have protection circuits—important when playing special effects!

sound reproduction. Fortunately, the room has a concrete floor (covered by carpeting), so bass response is nice and clean, not muddled by floor resonances.

The Infinity projector is available in both ceiling-mount and floor consoles. My floor unit measures 42 inches wide by 28 inches deep by 17½ inches high and weighs 128 pounds. It is housed in an oak cabinet with a removable top.

The projector has 7-inch-diameter blue, green, and red CRT tubes, instead of the more usual 5-inch tubes, and uses fast, optically coated, f-1.4 lenses. A high-voltage circuit drives the CRT to a brightness of 250 lumens at specified resolution. Resolution is greater than 350 lines NTSC, 400 lines composite, and greater than 600 lines on RGB (red, green, blue) input. The video amplifier has a 12-MHz bandwidth with CCD comb-filtering and surface acoustic wave (SAW) filtering to eliminate audio/video intermodulation. The projector can be adjusted for either flat or curved screens with diagonals of 5 to 15 feet, and it includes a 178-channel NTSC tuner.

The projector has two audio/video inputs for direct feed from a VCR or videodisc player; there are also a composite antenna input and an RGB input. The unit has both a fixed-signal composite-mono output and stereo outputs. It is fitted with an MTS decoder for stereo and SAP broadcasts and has a Dolby Surround Sound decoder with Dolby B noise reduction, bucket-brigade delay lines, and built-in 10-watt stereo amplifiers for use with front or rear speakers.

A remote control with on-screen display capability handles 40 functions, duplicating the facilities found on the console's pull-down control panel. Individual channels can be accessed directly or by scanning, and preferred channels can be programmed into memory. Channel numbers are displayed on screen, as is time. All inputs are available at the touch of a button. One ultra-useful feature not usually found in most TV sets is remote electronic control of brightness, contrast, color intensity, and tint (hue).

The various circuit elements are in replaceable modules. Convergence controls, so vitally important on a TV projector, are unusually flexible and al-

low very precise adjustment with a cross-hatch generator.

I use a 100-inch-diagonal, curved, high-gain projection screen made by National Viewtech Corp. This screen is made of aluminum with a special, washable optical coating that eliminates oxidation. Viewtech has designed the curvature of this screen to yield a tenfold gain in reflectivity, compared to a flat screen.

In the many months I have been using the Infinity projector, it has provided superb images when using high-quality picture sources. Consistently, the best-quality TV pictures are provided from videodiscs, with their 420-line resolution, and from the new Super VHS format, which has about the same resolution. More about these shortly. My home is hooked up to a local cable service, and while generally good, it really does vary in quality from day to day. (I would be most remiss, at this point, if I did not also give credit to NBC for the number and good quality of the programs they air in stereo.)

For playback of videodiscs, I use the superb new Pioneer LD-S1, which I described in my 1987 SCES report (September 1987). With its special drive motor and laser pickup, its anti-vibration suspension, and its digital audio facility with quadruple oversampling and digital filtering, it produces the best picture and sound I have ever seen and heard from videodiscs.

For videocassettes and for off-air recording, I use the new JVC Super VHS HRS7000. With Super VHS tape from JVC, 3M, and TDK, the results have been superb, with high picture detail and color stability. I obtained a Super VHS copy of *The Return of the Jedi*, and I can tell you, it was a treat! Picture quality and the Hi-Fi sound are really superb. Of course, to get the optimum 420-line resolution and color stability of Super VHS, you have to use the special Y (luminance) and C (chrominance) outputs on your VCR and connect them to similar inputs on your TV set or monitor. The JVC HRS7000 has these outputs and I expect to use them soon, as Infinity is going to make a Y and C input module available for their projection TV.

The audio setup for my home theater includes a pair of B & W 808 studio monitors, which are capable of 120-dB

With high-quality sources, there is no doubt that Dolby Surround Sound in the home can be involving and even overwhelming.

output. These are used for the main stereo channels on each side of the screen and are driven by a 200-watt-per-channel McIntosh MC 2002 amplifier through Monster Cable M-1 speaker cable. The center-channel speaker is a B & W Matrix 3; it is mounted in a horizontal position underneath the

screen, on concrete blocks damped by Discrete Technology foam panels. The 808s and the Matrix 3 have the same 90 dB/1w/1m efficiency—important for Dolby stereo. The Matrix 3 is driven through M-1 cables from one channel of another McIntosh MC 2002 amplifier. The other channel of the

McIntosh drives a Janis W1 subwoofer for low frequencies and special effects. The rear speakers are John Bowers Active 1 units, which are three-way powered speakers of 300 watts each. It is important to note that the three front and two rear speakers all have protection circuits. For the often violent and sudden special effects, especially in movies you are seeing for the first time, these circuits are speaker-savers!

The VCR and videodisc outputs are fed into a Shure HTS 5200 Dolby Surround Sound decoder, which seems to provide accurate directional control of the stereo channel and proper center-channel integration without audible "pumping" or "breathing." I had the pleasure of meeting Bill Varney, the engineer/mixer who has done such wonderful work on such hits as *Back to the Future*, *The Empire Strikes Back*, *Young Sherlock Holmes*, and *Indiana Jones and the Temple of Doom*. We discussed specific scenes, and he described various motion and panning and special effects he had incorporated into those scenes. The effects he described coincided with what I hear from the Shure decoder. Shure uses vector cancellation techniques for steering logic to provide good directionality. The decoder also has a de-correlation circuit for the rear speaker outputs; this Acoustic Space Generator, as Shure calls it, does indeed increase the sense of spaciousness in the room, in much the same manner as the U-shaped speaker array in professional Dolby theater setups. I like the very clean, open, transparent quality of the Shure's overall sound. Some decoders give an uncomfortable compressed character to music, but the HTS 5200 does not. I also like the visual sound-field display on the unit, where LEDs indicate left, center, right, and rear signals.

The quality of the picture and sound in my dedicated home theater can be spectacular, particularly on movies like the exciting *Top Gun*, with its breathtaking scenes of fighter jets. The digital soundtrack on videodisc, played at high level, reproduces the sounds of the jets with awesome power and verisimilitude. With quality sources like that one, there's no doubt Dolby Surround Sound in the home can be involving and even overwhelming! **A**

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The first reviews for the CD 960 compact disc player (top) are in, and the verdict is unanimous: This is the new "CD reference standard." The FA 990 integrated amplifier (bottom) brings out the true potential of the CD sound—with 100 watts per channel at 8 ohms ($D \leq 0.03\%$). Its CD Direct mode eliminates every avoidable source of noise and distortion.

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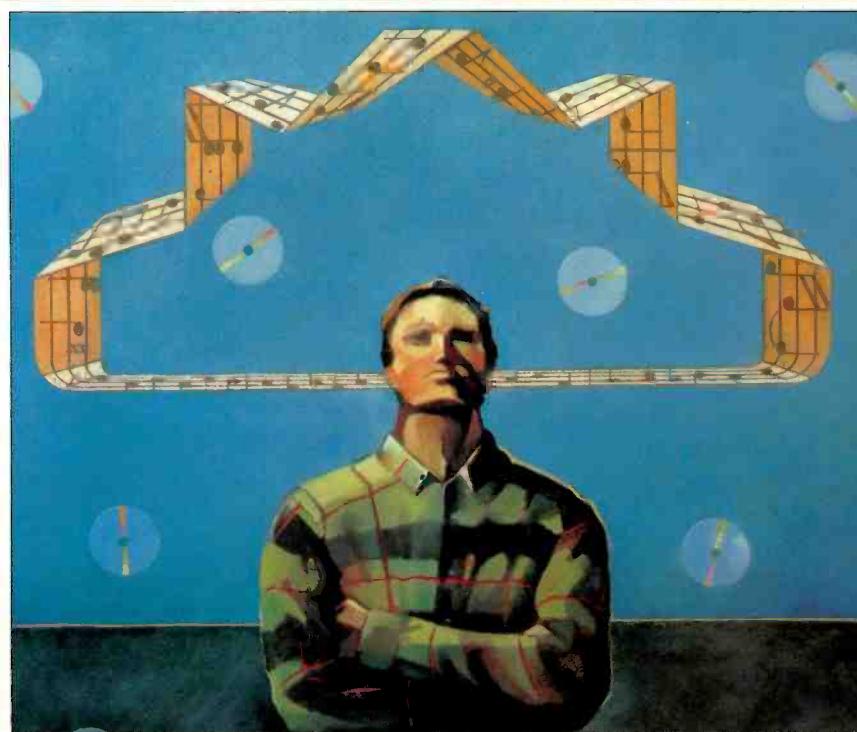


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ROUNDING THE CORNERS



You have just settled down in your plush, row-K seat in Carnegie Hall for an evening of classical music. Halfway through the Bruckner, you suddenly realize that the direct sound from the clarinets is arriving 9 mS after that of the violins, and whoa—the tympani is a good 36 mS late! Fortunately, a little quick thinking on your part restores peace of mind; since the violins are seated 10 feet in front of the clarinets and 40 feet in front of the tympani, the delay in arrival times is a natural consequence. Indeed, it is that delay which imparts depth to live (and well-recorded) music.

But this unsettling experience puts another strange notion in your head. What if, instead of time delays according to instrument placement, there were delays according to frequency? In other words, what if an orchestra were set up so that all the low notes arrived sooner than the high notes? That would sound pretty strange!

Well, it turns out that the phenomenon of delay with respect to frequency is a distinctly real one, and in fact has been given the name of group delay. Moreover, when you listen to a Compact Disc, you're most likely hearing

group delay. Fortunately, engineers are hard at work on a solution to this problem in digital recordings.

As we've discussed in the past two months, every digital audio system is preceded and followed by a low-pass filter. The input filter prevents aliasing from occurring, and the output filter removes ultrasonic images from the signal. To maximize the usable bandwidth of the system (the highest usable audio frequency is half the sampling frequency), sharp-cut filters are employed. However, such brick-wall filters introduce massive phase shift in the audio signal. One solution, as we've seen, is the use of digital oversampling output filters. The filtering is performed largely in the digital domain before the D/A converter, and phase shift is negligible. As a result, a properly designed CD player is a triumph of phase linearity, with error of perhaps 0.5° or less. That has never been achieved in the history of audio.

The problem is that phase shift is still there—not in the player, but in the discs themselves. You see, when a disc is originally recorded or transcribed from analog, it necessarily passes through an input anti-aliasing filter. And that filter is an analog brick-

wall design, with frequency-dependent phase shift measurable as group delay. Your CD library is a repository of it.

Some kinds of phase shift are perfectly tolerable. For example, when you play a 30-year-old recording, that is a lot of time delay or phase shift. However, because all of the information at all frequencies on the recording has been delayed evenly, the delay is perfectly acceptable. Indeed, a recording (at least conceptually) is only a delay; without that delay, there could be no recordings. The better the delay in terms of frequency response, noise, and distortion, the better the fidelity.

Unfortunately, recordings can also add delay that is unequal for all frequencies. Analog devices are guilty of this, and digital systems (because of their analog filters) are guilty of it too. As noted earlier, brick-wall analog filters introduce phase shift which is frequency-dependent—in other words, they introduce group delay. Specifically, the high frequencies lag behind the lower frequencies. In many cases, there is no delay up to 5 kHz, then it steadily increases to 300 µS or more by 20 kHz (in other words, a 20-kHz signal arrives 300 µS late). A CD player with oversampling is free of this delay, but the digital recorder (with analog input filter) used to record the performance is not. The discs are, unfortunately, encoded with it.

Given its presence, the foremost question concerns the audibility of group delay. It has been explored, but—like so many other questions concerning aural perception—it has not been resolved. While some researchers contend that the ear is deaf to treble phase shift, others surmise that the objections to digital's "high-frequency sound" could be attributed to high-frequency group delay. The jury is still out. However, using experience as a guide, we might propose that group delay is like other aural phenomena: Often, what is first dismissed as inaudible or inconsequential later turns out to be both clearly audible and consequential. Even if only from a purely academic standpoint, group delay in digital recordings is undesirable.

What is to be done? The problem, of course, is the analog input filter. The multiple poles used to achieve a sharp cutoff each contribute delay; when

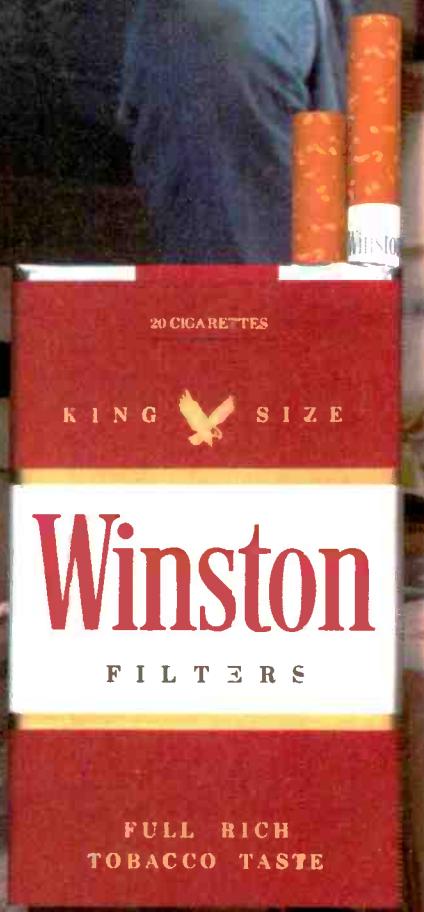
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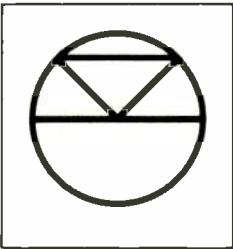
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Group delay may be like other aural phenomena:
What is first dismissed
as inaudible may turn out
to be quite consequential.

combined, the delay is considerable. Unfortunately, that result is a natural, inevitable consequence of steep analog filters. While we could obtain flat net response by introducing a compensating phase shift, an ideal approach would prevent the shift from ever occurring. If only we could use phase-perfect, digital oversampling filtering, as with the output filter. But for oversampling, you need a digital signal, and to get a digital signal you must first convert the analog signal, and to do that you must have an analog filter. It's a cart-before-the-horse problem.

Fortunately, a clever design engineer can indeed put the cart before the horse and come up with an oversampling A/D converter which outputs 16-bit samples at a 44.1-kHz rate. Only a little sleight of hand is required. The trick is the use of a very high initial sampling rate followed by a reduction to a lower sampling rate. In that way, the requirements of the Nyquist (half-sampling) theorem can be met without resorting to a brick-wall filter.

The higher the sampling rate, the gentler the required cutoff of the anti-aliasing filter, and the less severe the resulting phase shift will be. In an oversampling A/D, the initial sampling rate might be, for example, 3,175.2 kHz. Two important benefits result: Only a very gentle analog input filter (with negligible phase shift) is required, and fewer quantization bits are needed. Indeed, each sample can be represented by only one bit—a form of digitization known as delta modulation. Its advantage over PCM encoding is simplicity.

Next, the intermediate delta signal must be converted into a 16-bit PCM signal with a sampling rate of 44.1 kHz, compatible with Compact Disc standards. This is accomplished with a decimating filter, which digitally performs two functions: The low-pass filtering formerly done with an analog filter, and sampling-rate reduction. The decimating filter suppresses frequencies above the audio band; one practical choice is a transversal-filter architecture such as is used in output oversampling circuits. Samples are input to a delay line, the delayed signal is tapped off and multiplied by a coefficient, and the products are summed and output. Since the signal is only one bit and represents only +1 or -1, the

number-crunching is simple indeed. In fact, all the possible results can be precalculated, stored in a ROM, and read out using the input signal as an address for the memory location.

The architecture of the transversal filter can be designed to achieve sampling-rate reduction. The original sampling rate of 3,175.2 kHz is exactly 72 times 44.1 kHz, the desired output rate. This makes operation of the filter even easier. There is no need to generate a new output after every input bit. Rather, one output is generated for every 72 input bits by calculating the output sample in 72 steps and then adding the 72 results together successively to form the ROM address. The sampling rate is thus reduced by a factor of 72. Finally, the output samples are rounded off to 16 bits (alternatively, one could choose 18 bits, or more). The result is 16-bit samples taken at a 44.1-kHz rate, properly low-pass filtered—but digitally—so there is little phase distortion. Other methods are being explored (the one described above is a favorite of Philips), but the bottom line will be identical.

Not only have phase shift and group delay been avoided, but the resulting A/D is a better bit of technology as well. Conventional anti-aliasing filters and A/D converters are primarily analog devices; they suffer from all the frailties of analog, including difficult-to-acquire precision and higher cost. With an oversampling design, both operations are done digitally—with greater precision and lower cost. A single integrated circuit replaces a lot of analog components and yields linear phase response as well.

Additional Reading

Meyer, J., "Time Correction of Anti-Aliasing Filters Used in Digital Audio Systems," *Journal of the Audio Engineering Society (JAES)*, Vol. 32, No. 3 (March 1984), p. 132.

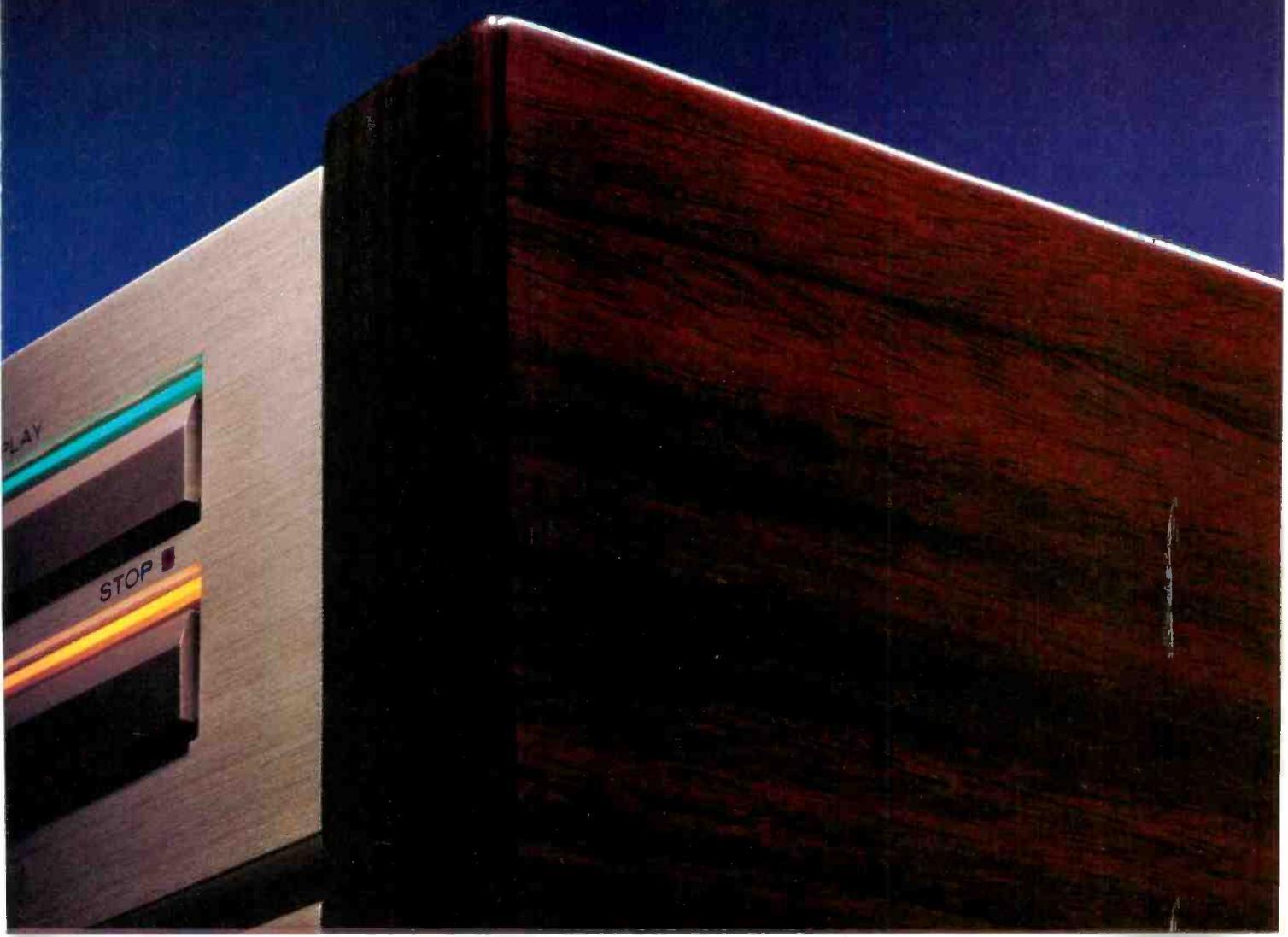
Adams, R., "Design and Implementation of an Audio 18-Bit Analog-to-Digital Converter Using Oversampling Techniques," *JAES*, Vol. 34, No. 3 (March 1986), p. 153.

Van der Kam, J. J., "A Digital 'Decimating' Filter for Analog-to-Digital Conversion of Hi-Fi Audio Signals," *Philips Technical Review* 42, No. 6/7 (April 1986).

m a r a n t z

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S e r i e s



January 1988

Dear Audio Reader,

If you're like us, you are reading this magazine to find out about new and exciting equipment. And you're probably reading it from cover to cover.

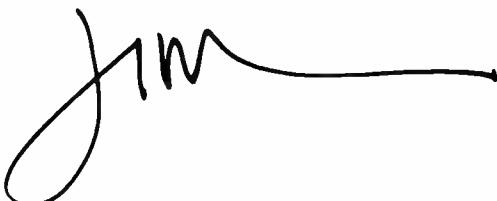
We've just returned from the Consumer Electronics Show, where the home entertainment industry first shows its most exciting products, and we thought you'd like a preview of what's coming from Marantz.

At the show we introduced our state-of-the-art 94 Series, which you'll read about over the next few pages, and two other important product lines — Century Series and Programmable Remote Controls.

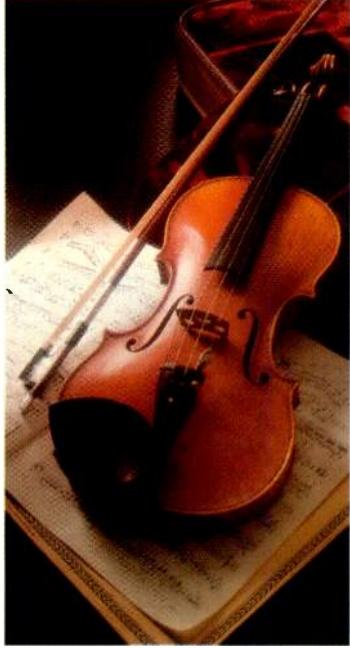
Fifteen components comprise the Century Series, including integrated amplifiers, tuners, CD players, cassette decks, and turntables — plus several stylish new speakers. Century represents an excellent balance of price and performance — a unique opportunity for the audiophile.

The easy to use RC20 Programmable Remote Control learns the commands from your audio system, TV and VCR remotes. After you try this device, you'll wonder how you ever juggled your collection of remote controls.

Thanks for your support over the years. We hope that 1988 is exciting for your eyes and ears!

A handwritten signature in black ink, appearing to read "Jim Twerdahl".

Jim Twerdahl
President



In the nineteen fifties when stereo was just beginning to establish itself, the undisputed ultimate in high fidelity componentry consisted of Marantz audio separates. In the world of high performance audio, Marantz was Rolls Royce and Ferrari rolled into one — artistry in stainless steel, incomparable sonics, painstaking hand craftsmanship, and legendary reliability. Marantz components soon became collectible classics, and their enduring appeal owed as much to their far reaching technical innovations as to their elegance in visual design.

When we conceived our 94 Series of perfectionist components we strove to maintain that Marantz legacy of innovation, and we made each one of these limited production components a showcase for demonstrating the most advanced thinking in audio playback technology. We also made them physically beautiful and absolutely impeccable in the quality of their finish and construction.

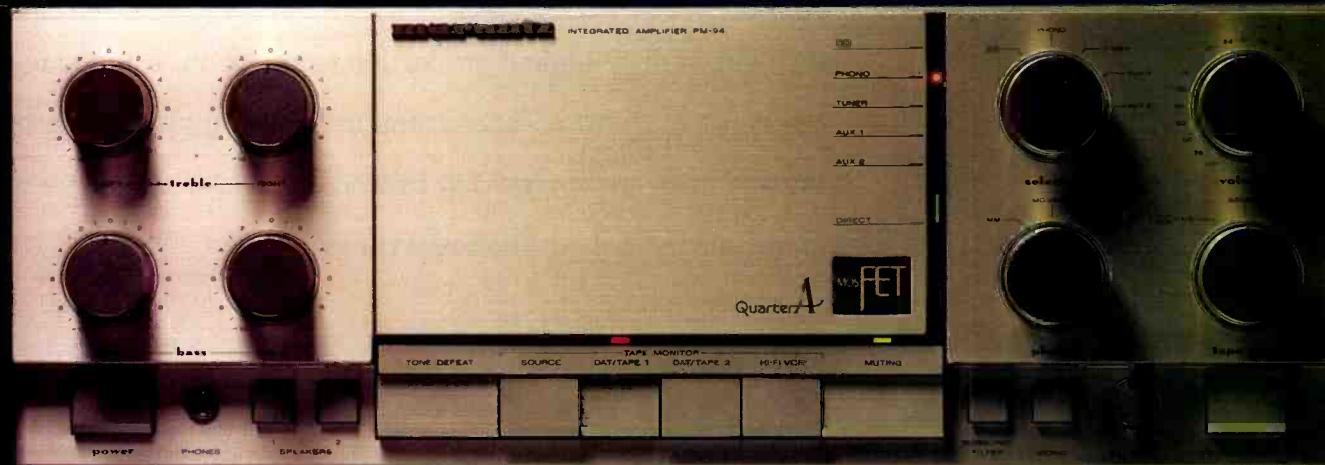
Like fine musical instruments, 94 Series components are a means to an end. Music.

The 94 Series currently includes integrated amplifiers in two power ranges, a compact disc player, a DAT (digital audio tape) tape recorder, and a component digital-to-analog converter. In combination these components make a striking visual statement and provide an unparalleled combination of musical accuracy and system versatility.

I n t e g r a t e d A m p l i f i e r s



P M - 9 4 B



P M - 9 4 G

The PM-94 and PM-84D Integrated Amplifiers

An integrated amplifier is the cornerstone of an audio system, providing a connecting point for all other components in the system, and supplying the electrical power to drive the loudspeakers.

As a power source, an amplifier must add or subtract nothing from the music signal. It must handle variations in the input impedance of a loudspeaker system with absolute composure, and it must meet demands for peak power with no audible signs of distress. Above all, it must have no sound or character of its own. A truly high performance amplifier will involve you in the musical performance by revealing even the subtlest details in today's high accuracy recordings.

The PM-94 and PM-84D attain their measure of excellence in audio amplification through intelligent design, advanced construction techniques, and the use of the finest internal parts.

Marantz Power Supplies— The Source of Musical Fidelity

The heart of any amplifier is its power supply, the reservoir of electrical energy from which the amplifier's signal circuitry draws to boost signal level. It is no exaggeration to say that proper engineering of the power supply is critical to the sound of the amplifier.

The PM-94 and PM-84D power supplies are designed to provide clean, smooth, noiseless reserves of current under all playback conditions, and to reject external electrical disturbances such as electro-motive energy from the loudspeakers and powerline voltage fluctuations. Such power supply stabilization is vitally important in musical reproduction because it allows signal circuits to operate with the greatest linearity. This results in superior bass definition and a sense of completely unstressed musical dynamics in the rendering of drums, piano, and other percussive instruments.

These amplifiers actually house four separate power supplies on one chassis. Each channel is equipped with one supply for the low level voltage amplifying circuitry, and another supply for the power output stage. Each supply is powered by a separate winding from the oversized toroidal power transformer, and each has its own dedicated, large capacity filter capacitor for storing energy. These multiple high current supplies permit the 94 Series amplifiers to supply increasing power into low impedance loads, provide for a high immunity to hum, and virtually eliminate crosstalk (the condition where signals from one circuit leak into another circuit through a single power supply feeding them both).

Marantz 94 Series power supplies also feature an AVSS (Automatic Voltage Shift Supply) circuit that instantaneously adjusts power supply voltages to meet signal demands. AVSS, when utilized in power supplies with such massive electrical storage capabilities, endows the amplifier with enormous headroom for responding to musical peaks, while at the same time increasing electrical efficiency and minimizing heat generation.

Such overengineering of the 94 Series power supplies gives these amplifiers a remarkable sense of clarity. Musical details seem more in focus, and even the most dynamic compact discs are reproduced with a notable lack of stress.

Quarter A Operation for Warm, Musical Reproduction

Both the PM-94 and the PM-84D boast pure class A operation up to one quarter of their rated outputs. Class A operation involves sending a high idling current through the output transistors at all times. This keeps their internal temperatures stable, and prevents transistors from switching on and off during playback and generating notch distortion in the process. Class A operation permits a transistor to track a signal more accurately than in typical class AB operation, resulting in extremely smooth, natural sounding musical reproduction, with a notable lack of edginess or harshness even at very loud playback levels.

We have found that by operating our amplifiers in class A mode up to a quarter of their rated outputs, the full sonic benefits of class A are obtained without the necessity of brute force engineering strategies. (Pure class A operation up to full rated power would require great bulk and weight.) And in Quarter A, the transistors change to AB mode only at high signal levels (where distortion is effectively masked), so the amplifier is essentially class A in operation.

Perfection in Every Detail

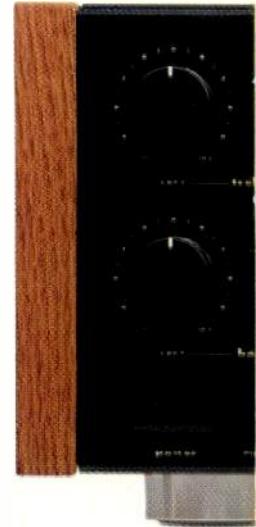
The PM-94 and PM-84D are constructed with meticulously selected circuit components to ensure consistent operation over many years and to provide the most refined sonics available. Special Cerafine capacitors have been manufactured for these amplifiers by the Elna Corporation, and other circuit elements, including transistors, resistors and even internal wiring have been chosen only after the most exhaustive listening comparisons. The internal chassis of both amplifiers are heavily plated with high purity copper to provide a low impedance grounding plane and high immunity to low level electrical noise. Special oxygen-free copper wiring is used for all critical signal handling connections.

Superior Flexibility and User Convenience

The 94 Series amplifiers are designed to provide maximum flexibility and convenience as well as no compromise sonic performance. Separate bass and treble controls are provided for both channels, and each has inputs for up to seven signal sources, including hi-fi video and the new DAT (digital audio tape) decks. For absolute lowest noise and distortion, both the compact disc and phono inputs may be routed directly to the amplifying circuits, bypassing the tape dubbing and tone control circuitry.

Three separate phono cartridge input levels are provided, and a high quality transformer is included in the PM-94 for moving coil cartridges. Both amplifiers have outputs for two speaker systems, and both are capable of driving two pairs of speakers simultaneously.

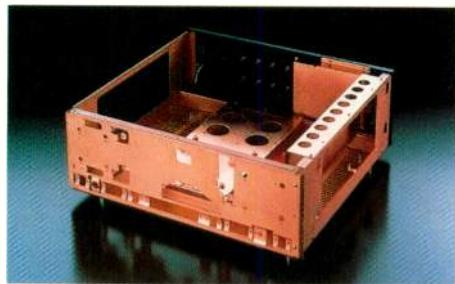
The PM-94 is available in satin black with oak side panels or in rose gold with rosewood panels.



I n t e g r a t e d A m p l i f i e r s



P M - 8 4 D



Copper plating the entire chassis provides a high immunity to low level electrical noise.

C o m p a c t D i s c P l a y e r s



C D - 9 4 G



C D - 9 4 B

CD-94 Compact Disc Player

The compact disc medium offers extremely impressive specifications in terms of dynamic range, absence of noise and distortion, and general musical fidelity. But extracting all of the information encoded on a disc requires a thoroughly engineered and exactingly constructed player.



Precise Mechanical Construction

Performance engineering begins with the mechanical transport system that spins the disc and operates the laser. Since the audio track is only two microns wide, even the smallest unwanted movement of the disc will adversely affect playback.

Disc stability is ensured by the CD-94's high quality motors and anti-resonance chassis construction. The transport mechanism is provided with an elastic suspension system that isolates the spinning disc from external shocks and airborne vibrations, while the outer chassis improves isolation still further by means of a heavy resonance-suppressing aluminum top-plate and specially damped, cast metal heatsinks. A magnetic clamp holds the disc firmly in place during playback and all mechanical parts are fabricated from die cast aluminum for mechanical reliability and the last measure of acoustical isolation.

All of this mechanical sophistication has a definite purpose — the extraction of every bit of musical information contained in the signal track. When this is successfully picked up and conveyed into the analog circuits of the player, the unique tonal qualities of various instruments and voices will be clearly defined, even in densely orchestrated passages.

Advanced Digital Circuitry for Superior Digital Sound

The CD-94 uses the latest and most sophisticated decoding and output filtering circuitry to interpret the digital information on the disc. It is a true sixteen bit, four times oversampling design.

Sixteen bits of information represents the full 96dB of dynamic range on a compact disc — in other words, all of the information that relates to every sound on a recording. Many compact disc players only decode fourteen of those sixteen bits, resulting in reduced clarity and loss of subtle musical details.

Four times oversampling is a means of moving up the frequency of the digital pulse train or "clock" frequency which carries the audio information. The pulse train itself is only a code for conveying this information, and the digital pulses must be removed in the decoding process. Speeding up the "clock" allows the digital pulses to be removed more easily without contaminating the music signal.

The CD-94 uses two filters to remove high frequency energy unrelated to the music signal. The first is a digital filter that performs mathematical analyses of the signal in the digital domain and subtracts false data representing unwanted high frequency content. The second filter is a gentle analog filter that removes the actual clock frequency of the oversampled digital signal. Neither filter imparts significant phase shift to the audio signal and all of the information on a recording relating to the placement of performers is preserved.

Favorite Track Selection

The CD-94 provides for extreme flexibility in programming. The unique FTS (favorite track selection) feature allows you to permanently program up to 1600 track selections. This enables you to store indefinitely, in any order, your favorite tracks from hundreds of separate discs.

Absolute Signal Integrity

The CD-94 shares the same sophisticated power supply engineering as the 94 Series amplifiers. A large toroidal transformer and large capacity filter capacitors are employed. Separate power supplies are allotted to the transport, front panel display, digital circuitry, and finally to the analog output circuitry. The separate supplies greatly reduce the "gritty" sound quality that results from electrical interference among the separate circuits.

For ultimate fidelity and freedom from residual noise, the CD-94 includes a pair of digital outputs, one electrical and the other involving a fiber optical connection and a laser transmitted signal.

The CD-94 is available in black satin finish with oak side panels, or rose gold with rosewood sidepanels, and includes a full function remote control. We believe that no other compact disc player has been made with such absolute attention to detail.

D i g i t a l A u d i o T a p e R e c o r d e r s



D T - 9 4



D T - 8 4

DT-94/84

DAT (digital audio tape) is the newest and most accurate recordable audio format available to the consumer, and the Marantz DT-94 and DT-84 represent the vanguard of this technology. Like the other components in the 94 Series, these recorders are built to the highest standards and incorporate the most sophisticated mechanical and electronic subsystems. For the first time, the home recordist has access to a studio quality medium.

A Medium for the Perfectionist

DAT bears a strong family resemblance to the professional multi-track rotary head digital tape recorders that have been used in recording studios for many years. The technology is similar to that utilized in compact discs, but instead of physical depressions on a disc, DAT uses magnetized sections of recording tape to represent the digital pulses.

The pulses themselves constitute an intricate code that represents intensity measurements of individual sound waves. Each wave cycle in the enormous succession of sound waves comprising a musical performance is assigned a number in the digital code, and the numbers are stored on the recording tape just as numbers are recorded on a computer's magnetic hard or floppy disc.

Because the data on the tape is numeric rather than a direct analog audio signal, tape hiss, tape distortion, and even slight variations in tape speed cannot contaminate the sound. During playback, signals are created by a digital-to-analog converter reading the numbers on the tape and selecting corresponding signal voltage intensities. The result is a pure representation of the musical waveform as it appeared at the input.

Sophisticated Digital Circuitry

The basic specifications of DAT are similar to those of the compact disc, but the DT-94/84 goes beyond standard specifications in its performance. These recorders use dual 16 bit oversampling D/A converters, a 96 pole digital filter, and a 3 pole minimum phase, anti-aliasing output filter. True 16 bit A/D (analog-to-digital) converters are used in the record section.

Unparalleled Fidelity and Versatility

Sixteen bit resolution, and its resulting 96dB of dynamic range, virtually eliminates background noise and permits you to record the most explosive musical crescendi without fear of overload or distortion. You can make perfect copies of prized old phonograph records or reel-to-reel tapes, you can make live recordings comparable to those made with digital mastering tape recorders, and you can make virtually perfect recordings from modern vinyl records and compact discs.

The convenient DAT cassette is a little over half the size of a standard analog cassette, yet it can hold two hours of continuous music. It can store so much information because of its advanced metal tape formulation and a high effective tape speed, or "writing-speed," of over nine feet per second — a speed made possible by the rapidly spinning head.

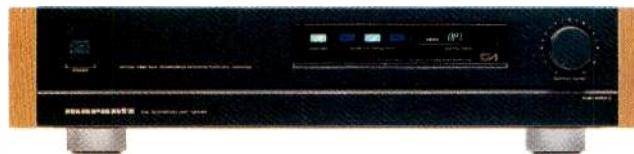
The DT-94/84 will record a live microphone feed at a sampling rate of 48kHz, the same frequency used in professional recording. It will also permit perfect dubs of a tape made on another consumer DAT machine — a direct digital data stream can be transmitted from one machine to another via a standard electrical connection or a fiber optical digital port.

Convenience and Programmability

With DAT, individual tracks are much easier to access than on conventional tape decks, and the DT-94 can execute complex programming commands. DAT requires no bias adjustments, no azimuth calibration, no setting of recording level during direct digital recording, and tape type can be disregarded since all DAT cassettes use essentially the same tape formulation.

With the introduction of the DT-94/84, the music lover finally possesses a recording medium that performs to the standards of the digital age, while incorporating the styling and remote control functions expected in an advanced consumer component. These are simply the most impressive recording devices ever offered to the public.

Digital-to-Analog Converters



C D A - 9 4 B

C D A - 9 4 G



The CDA-94 Digital-to-Analog Converter

The CDA-94 is a component digital-to-analog converter — a device intended purely for the converting of the digitized data on a compact disc into an analog music signal that can be routed to an audio amplifier. All compact disc players include D/A converters as part of their decoding electronics, but making this circuitry separate has several advantages. First, the circuits are protected with the greatest possible electrical shielding; and second, they are provided with a degree of power supply capacity and stability impossible to achieve in a conventional CD player where all circuits share a common chassis and a common ground.

The Marantz CDA-94 also shares the same general circuit topology as the integral D/A converter in the CD-94, but it has selectable digital clock frequencies of 44.1kHz, 48kHz, and 32kHz, permitting the decod-

ing of compact discs, DAT (digital audio tape), and digital satellite radio broadcasts respectively. (Digital satellite audio transmissions have been approved in Japan and in some European nations.) The correct clock frequency is selected automatically so you never have to worry about matching the source to the appropriate frequency.

This component D/A converter uses the same advanced four times oversampling digital filter D/A conversion technology featured in the CD-94. But here the safeguarding of signal integrity is taken even further by the provision of separate circuit boards, separate power supplies, and even separate power transformers for the digital input section, the D/A converters themselves, and finally for the analog output amplifiers.

The CDA-94 will mate only with CD players such as the CD-94 that have direct digital outputs. It will accept either electrical or fiber optical inputs, and is equipped with line level outputs for linkage with preamplifiers, integrated amplifiers, and signal processors. Output connectors

include both standard RCA jacks and balanced line connectors.

An absolute phase inverter is also provided, which can reverse the positive and negative halves of the wave cycles comprising the audio signal. Phase is often reversed during the recording process, and restoring correct absolute phase can bring about a real improvement in stereo imaging.

When used with top quality loudspeakers and amplification, the CDA-94 will bring about subtle but significant improvements in depth and spaciousness and will provide a superior rendering of the soundstage.

The CDA-94 has a nonresonant aluminum chassis anodized in either satin black or rose gold. Black finish comes with oak side panels, and gold with rosewood.

Specifications

PM-94

Power Output per Channel FTC 4 ohms (20Hz-20kHz)	200 watts
FTC 8 ohms (20Hz-20kHz)	140 watts
Total Harmonic Distortion at Rated Power 4 ohms	0.03%
8 ohms	0.02%
I.M. at Rated Power 4 ohms	0.005%
8 ohms	0.006%
IHF Dynamic Power 4 ohms	300 watts
8 ohms	180 watts
Damping Factor	200
Slew Rate	70 V/ μ s
Frequency Response (+ 1 dB)	10Hz-200kHz
Signal-to-noise Ratio, (A weighted) at 1 W Output	97dB
Dimensions H x W x D	6 1/2" x 18 1/8" x 17"
Weight	51 lbs

PM-84D

Power Output per Channel FTC 4 ohms (20Hz-20kHz)	125 watts
FTC 8 ohms (20Hz-20kHz)	105 watts
Total Harmonic Distortion at Rated Power 4 ohms	0.06%
8 ohms	0.03%
I.M. at Rated Power 4 ohms	0.06%
8 ohms	0.03%
IHF Dynamic Power 4 ohms	210 watts
8 ohms	130 watts
Damping Factor	110
Slew Rate	30 V/ μ s
Frequency Response (+ 2 dB)	10Hz-100kHz
Signal-to-noise Ratio, (A weighted) at 1 W Output	90dB
Dimensions H x W x D	6 1/2" x 18 1/8" x 17"
Weight	40 lbs

CD-94

Frequency Response	4Hz-20kHz ± 0.5dB
Dynamic Range	Greater than 96dB
Signal-to-noise Ratio	96dB
Total Harmonic Distortion (incl. noise)	0.003% (at 1kHz)
D/A Conversion	16 bit 4 times oversampling
Dimensions H x W x D	4 1/8" x 18 1/8" x 13 1/8"
Weight	28 lbs



CDA-94

Frequency Response (with a 44.1 kHz input signal)	2Hz-20kHz ± 0.1dB
Signal-to-noise Ratio	More than 101dB
Dynamic Range	More than 96dB
Channel Separation	More than 90dB
Total Harmonic Distortion	0.003% (at 1kHz)
Headphone Output Terminal	Output level @ 8 ohms, 14 mW (THD: 0.1%)
Dimensions H x W x D	4 1/8" x 18 1/8" x 13 1/8"
Weight	25 lbs



DT-94/84

Frequency Response	2Hz-22kHz ± 0.5dB
S/N	93dB
Dynamic Range	95dB playback 90dB record/playback
Harmonic Distortion	0.003%
Separation	90dB
Wow/Flutter	± 0.001%
Input:	Analog + Digital Optical
Output:	Analog + Digital Optical
Dimensions H x W x D	4 1/8" x 18 1/8" x 13 1/8"
Weight	25 lbs



Note: Prerecorded digital audio tapes and compact discs cannot be copied directly via the digital ports. Both are recorded at a 44.1kHz sampling frequency, and no consumer DAT machine copies digital data at that frequency.

However, existing consumer DAT machines can accept the analog output signal from either a CD player or a DAT recorder and make a virtually perfect recording from it. DAT pictures are of prototypes and specifications are preliminary.

The 94 Series of components offers a level of performance and workmanship that will establish them as classics in their own right — worthy heirs to the great Marantz tradition of the past. Because they were designed by engineers who are also music lovers, they will provide you with a depth of musical experience that is simply unobtainable with lesser componentry. The proof is in the listening.



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Post Office Box 2577
Chatsworth, CA 91313-2577
Phone: 818-998-9333
Fax: 818-998-5475

EDISONICS



CICCOLINI, the Italian Tenor, a great favorite of Milan and Paris who has just completed a triumphant tour of America. Signor Ciccolini has already achieved a brilliant career, and seems destined to win the highest laurels in the world of opera.

The Test of Tests

The only true measure of a sound system's accuracy is how it re-creates reality. So the best test should be a direct comparison between a reproducing system and the live sound source that it hopes to reproduce, right?

Well, maybe. I heard a number of such live-versus-recorded tests in the '60s, under the aegis of Acoustic Research. Even without the advancements that have been made in the past 20-odd years, the results sounded very nearly like reality to my newly professional ears, and exactly like reality to many listeners. But I gather that audiences were similarly fooled at the similar demonstrations mounted by Wharfedale's Gilbert Briggs back in the '50s (and in mono, I believe!). And I'm told that they were also fooled by the demonstrations put on even earlier, by Edison.

The ad shown here, which appeared in the April 1917 issue of *The Ladies' Home Journal*, proves only that the demonstrations took place, not that the audiences were fooled by them. Portions of the text read as follows:

The illustration on this page is from an actual photograph of Signor Ciccolini *actually* singing in direct comparison with the New Edison's Re-Creation of his voice, thus adding to the already overwhelming proof that the New Edison Re-Creates the voice or instrumental performance of any and all artists with such literal fidelity, that the original cannot be distinguished from the Re-Creation.... The NEW EDISON, "the Phonograph with a Soul," is conceded by the music critics of more than three hundred of America's principal newspapers to be incomparably superior to all other devices for the reproduction of sound. This remarkable new musical invention brings into your home a literally true presentation of the art of the world's great musical artists. After you have heard the New Edison you could scarcely be contented with a talking machine....

There's more truth than hype in this ad. Little hype is needed, because the audiences at such events—or at any demonstration of a real sonic advance—provide the hype for themselves. As listeners, we are so impressed by the rollback of former unrealities that we temporarily fail to notice the unrealities that remain. The live-versus-recorded comparison is still a good test, and maybe even the best one—but it won't be a perfect test until we become perfect listeners. And that won't happen soon.

Putting a Lid on a Mystery

Several accessory suppliers sell replacement CD jewel boxes, but most of us need only jewel-box lids. In the five years since I got my first CD, I've never broken a box itself (though I have cracked one or two), but I must have more than half a dozen boxes with their lids broken. Somehow, whatever forces break the lids of Compact Disc boxes leave the

rest of the box alone. So why must we buy a whole box to get the part we need—and the smaller part, at that? "Because," says Edward Griffin of The Geneva Group, "manufacturers don't make boxes and lids separately." The molds are designed so that both box and lid are made together; selling lids separately would leave the manufacturer with a warehouse full of lidless boxes.

Inaudible Distortion

I keep looking for correlations between what I hear when listening to components and the way those components measure on the bench. So I was pleased to see what seemed to be some correlation between distortion levels and sound quality among the 10 car stereo units I've road-tested for this magazine: The unit with the lowest distortion (0.08%) on FM stereo was also one of only two I'd singled out for their clear sound. For a moment there, I thought I was onto something.

The only problem was, the distortion of the other units wasn't all that much higher—just 0.22% to 0.85%, with an average of 0.47%. Looking at it one way, the clearest-sounding unit had only a bit more than one-sixth as much distortion as the average of the others, which should be significant. But looking at it another way, the average difference amounted to a mere 0.39%.

Could this tiny difference in distortion account for the differences I clearly heard? I asked Dr. Richard Small, who is probably best known for his part in establishing the Thiele-Small parameters for speaker enclosures, and who's now head of research at KEF. "We cannot hear distortion," he replied.

Huh? Then why have we been measuring and specifying THD and IM all these years? Because, Small said, distortion is caused by nonlinearity, which is audible. Distortion, in other words, is not the disease but just an accompanying symptom. We measure it because it's easy to measure, not because it's what we hear. The difference in circuit linearity probably accounted for my perception of sonic clarity.

Sure enough, when I reread my reviews, I discovered that the distortion level of the one other unit I'd acclaimed for its sound was, at 0.32%, right in with the units I had not acclaimed. In fact, the one unit whose sound I'd specifically demurred about (I said it had a high-frequency "edge") had virtually the same level of distortion (0.33%).

To cite THD as the reason for the differences I heard can only be considered a distortion.

The magical power of radio stemmed from its staging dramatics behind our eyes, not in front of them.

Pied Prophecies

Prophets live in hope that people will forget their prophecies. Any prophet will remind you of the ones he called correctly but will leave the rest unmentioned, thank you.

I'm not in the prophecy business as a regular thing, so I don't have to hope as hard for an amnesiac audience. My one real attempt at foreseeing the future came on the threshold of the '80s, when I wrote a piece predicting electronic developments for the decade. How did I do? Well

On the positive side, I predicted that the FCC would approve stereo broadcasting for AM and TV, that the French would start substituting computer terminals for printed phone books, and that digital audio systems using optical discs would arrive in '82. I also foretold that flat-tube TV would arrive, but would stay small and expensive for a while, and that video camcorders would be here by '85. Probably my best hit was saying we'd get home ambience systems by 1986 that could simulate specific concert halls; indeed, Yamaha's DSP-1, which at least lets you select the type of hall, appeared that very year. I also foresaw the growth of specialized cable TV channels, though not that some would become less specialized as they matured.

Most of my other prophecies were less accurate. Among other things, I guessed that home appliances, including stereos, would include built-

in decoders for remote-control pulses sent over house wiring and that they'd also accept vocal commands by 1985. I thought FM stations would discover quadraphonic sound. (It could yet happen, but don't hold your breath.) In video, I said two-way cable systems would become widespread. I overestimated the computer too: We don't have a national mania for interactive computer games, electronic mail competing strongly with the Post Office, or data banks supplanting reference books. However, the number of people working at home via computer link is growing.

In some cases, I was at least half right. I predicted four incompatible videodisc systems, and we briefly did have two; I surmised that videotext and teletext broadcasting would come but not that they'd go away again. Wall-size TV screens are here—but do you know anyone who actually owns one?

In some cases, the jury is still out. Hi-fi systems that could recognize a tune did not come in 1987. Systems that let you alter recorded performances by waving a baton have not been introduced, but at least we have the potential capability to alter pitch and tempo independently. Flat speakers are not yet hanging on our walls. High-resolution video is definitely coming, and 3-D video could appear.

What do I predict for the '90s? Ask me in '89—or better yet, in '98.



Radio Reminiscences

I'm just old enough to have grown into television rather than growing up with it. Mortimer Goldberg's article in our December 1987 issue ("A Life in Radio Broadcasting") reminded me of the days when programs were staged behind our eyes rather than in front of them.

It also reminded me of a long nostalgia session I had with a woman I was dating, some years back. We were about five years apart in age and discovered we'd both enjoyed the same shows when we were kids: *Captain Midnight*, *Sergeant Preston of the Yukon*, *Sky King*, and so on. But after the discussion had gone on a while, I realized her reminiscences did not quite jibe with mine: "Hey, wait a minute," I said. "You're talking about television programs!"

"Why, of course," she said. "What are you talking about?"

"Radio."

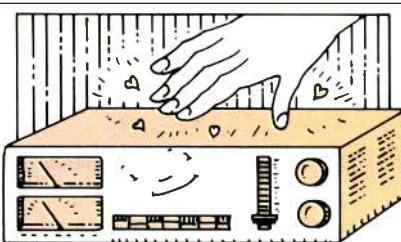
"Radio?? How on earth could they do all those things on radio?"

Actually, they did them very well, using only sound effects, a few scene-setting lines ("Gee it's lonely up here at the lake . . . Wait! Put that gun away!"), and the listener's eager imagination. That kind of induced creativity is still used on radio but mostly just for a few ads (and not too many of them, either). A few years back, comedian Stan Freberg demonstrated to radio ad people how creative the medium could be: With a few sound effects, he filled Lake Superior with Jello, covered it with whipped cream, and topped it all off with a 10-ton maraschino cherry dropped from a bomber. On TV, you might be able to do that too, but the budget would be considerably higher.

Drawing the Blind

Back in the all-analog '70s, and before, components had controls that worked by feel. Switching was done by buttons that popped in and out with a snap or by multiple-click rotary controls. Variable functions such as volume were handled by knobs or sliders whose position you could figure out by touch. Even meters could be read by touch if you took off their cover plates. To the blind, it was a boon.

Now, what with soft-touch switches and flat-panel volume controls whose settings can only be determined from a display, audio equipment is not as



friendly to blind users as it used to be. Digital technology has brought them some helpful conveniences, such as automatic tuning aids and circuits that set recording levels. But in the main, judging from some calls I've gotten from blind audiophiles, it's taken away more than it's given them.

FIFTEEN YEARS AGO BRITAIN THOUGHT THIS MAN WAS CRAZY.

Fascination with the way things work led Ivor Tiefenbrun astray from a very young age. But in the early seventies, the dark ages of hi-fi, things really took a turn for the worse.

It was a grim time all round. Cordless phones were hard to come by. People wore flares. And even the experts still believed that the hi-fi chain started with the speakers and worked down to the turntable.

This understanding dominated the way the industry as a whole designed new systems.

And it drove Ivor to distraction.

Because it was diametrically opposed to his own opinion. He believed that the turntable was the most important element.

As crazy as it seemed at the time – his reasoning was pretty straightforward. Commonsense really.

To pick up the music the needle follows the record grooves for information stored in the groove walls. What most people don't realise is how intricate an operation this is. Movements so minute, they are measured in microns.

Take a few minutes to watch closely while a record is playing. The process is hypnotic. Because you live in a world where things are measured in inches.

It's when you scale the 'groove world' up to inches that things start to get pretty hair-raising.

Suddenly you are in a deep crevice. The walls are undulated. Approaching at an alarming speed is a bobsled. As it hurtles through the passage it has to pick up tiny pieces of information.

The bobsled is, of course, the needle. And to pick up a deep organ note it has to swerve 10 feet 6 inches. For a high violin note it's less than an inch. A difference which may not seem staggering in itself. Until you stop to consider that the needle is travelling 6 miles per second. And that the pivot point of the lever controlling it is four miles away.

In these terms you can see how easy it is to miss out on critical information.

And how even the slightest, imperceptible movement can cause the needle to miss out on the more delicate notes.

Ironically, that which gives a piece its musicality.

No speakers in the world can bring back lost music. It must be dealt with at its source. The turntable.

A painfully obvious idea. Yet the entire industry ridiculed it. Because it pointed out they were wrong.

Ivor would have had more luck arguing that the world was round or man would fly.

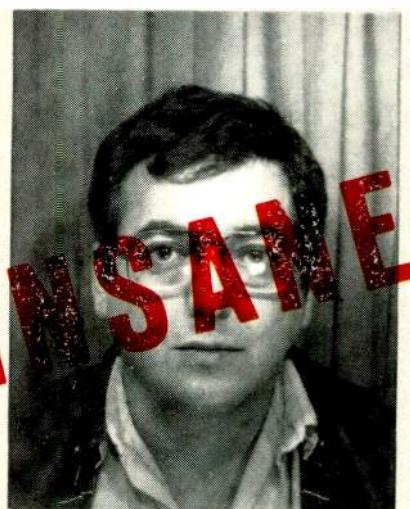
So he did what Ivor always does when people tell him he's wrong. He ignored them. And quietly set about building a turntable.

The fruit of his labor, was the Linn LP12. And with it he proved categorically that the signal

source is the most important component in the hi-fi chain. Apart from revolutionizing the hi-fi industry as a whole, the LP12 has served history well.

As a shining example of the time honoured truth

Ivor Tiefenbrun



that sometimes things are too simple for people to understand.

Because not only was it the undoubtedly industry leader in technical terms: it also sounded demonstrably better than any other turntable.

TODAY AMERICA THINKS HE'S CRAZY.

But for some mysterious reason the concept that one turntable might sound better than another was too much for some people to cope with.

Such was Ivor Tiefenbrun's dilemma. He was just a guy who wanted people to calm down and listen to the music.

And when they were too uptight to try it, he behaved in a slightly deranged manner. He called hi-fi reviewers who refused to listen 'cloth ears'. They called him a heretic. The score remained fairly even.

But the press love vocal crazies and Ivor was forever giving interviews.

Interviews in which he issued challenges to the hi-fi aficionados, calling on them to explain what the speakers can do about restoring music the needle has failed to pick up.

Their answers spoke volumes about their understanding of hi-fi. The industry leaders told Ivor he was certifiable. Out to lunch. Looney tunes. Living in Gagaland. Not to mention rather rude. This upset Ivor. He doesn't like to be thought of as rude.

Alas these Board Room diagnoses came too late. Ivor's insanity had proved infectious. The industry

was in turmoil. Music lovers everywhere, long tired of worshipping false gods, listened to Ivor's turntable and were converted.

Up and down the country naive listeners began to confess. A Vicar here, a Member of Parliament there, even somebody's mother in Shropshire, all heard the difference. Because the Linn proposition is so simple to prove.

Anyone can hear the difference between good and bad hi-fi. All you have to do is listen.

This fundamental belief is at the root of everything we do. And it governs our retailing philosophy. Comparisons, using a single set of speakers, are a matter of course at all our dealers. And have been ever since the dawn of Linn. No gimmicks. No obligations. Just a straightforward listen.

And whether you compare Linn to a similarly priced system, or one at ten times the price, the results are the same: Time and time again, Linn's superiority rings true.

By the late seventies, the LP12 reigned supreme, yet Ivor still would not rest. Having proved that the turntable was the critical component, he then applied his fanatical attention to detail to the problem of the hierarchy itself.

He tweaked and tested, designed and refined. And established that the correct order of the hi-fi chain is, turntable, tonearm, cartridge, amplifier, and speakers.

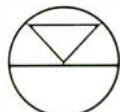
The rest is, as they say, history.

Now music lovers can choose between a variety of Linn components in the hi-fi chain. And with the recent introduction of the Axis turntable, starting to build-up a Linn system is more affordable than ever before.

Today Linn products are sold in thirty countries. In America Linn are the recognised leaders in

specialist hi-fi. And worldwide Ivor is the undisputed protector of the faith.

While the problem of the hi-fi chain has been happily resolved, the larger question of Ivor Tiefenbrun's mental status still looms. What's your opinion? Just clip the coupon and send it to your nearest Linn dealer (p. 40). YOU'VE NEVER HEARD IT SO GOOD.



LINN

HIGH FIDELITY

SO GOOD.

Yes, this guy is crazy.

He's probably crazy, but I'm reserving judgement until I get more information.

If you promise he won't be there I'll come in for a listening comparison.

He seems perfectly sane to me. (hee hee ho ho ha ha.)

Name _____

Address _____

UNDERSTANDING COMMON-MODE SIGNALS

R. X. MARSH

"If the nature
of a problem
is not recog-
nized, a useful
solution will not
be available."

—Ralph Morrison,
Grounding and
Shielding Techniques
in Instrumentation

Amplifier performance suffers from more signal contaminants than just the amplifier's noise, frequency response problems, and nonlinear transfer characteristics. How the amplifier handles certain types of signals, called differential- and common-mode signals, can determine the ultimate performance level of a system. Common-mode signals, which are undesirable, can get converted to differential mode and then be amplified along with the desired signal. Insufficient rejection of common-mode signals can cause audible problems. Unfortunately, the way signals are typically handled in audio equipment makes it likely that these unwanted signals will contaminate the desired music signal.

All signals exist as differences of potential. The difference can be between a zero-reference conductor and a signal conductor or between two signal conductors. Signals referenced to a zero-reference conductor, called "single-ended" signals, are most common in consumer audio equipment. Signal differences between two points removed from the zero-reference conductor, called difference or differential signals, are common in professional equipment. In Fig. 1, e_1 and e_2 are single-ended voltage differences between signal conductors and the zero-reference conductor, and e_3 is a differential signal voltage.

A differential amplifier, the configuration used in professional studios, has

three terminals at both input and output, with one terminal of each group grounded (Fig. 2). The input terminals of such circuits are "floating." Whenever there is a difference between the voltages applied to the two ungrounded input terminals (e_{11} and e_{12}), the amplified response appears as a difference between the voltages (e_{o1} and e_{o2}) at the ungrounded output terminals. Difference signals of this type are known as differential-mode (DM) signals, whereas signals common to both terminals are called common-mode (CM). The common-mode signal is the

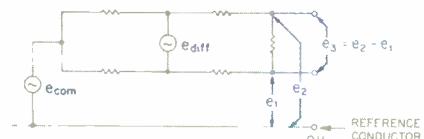
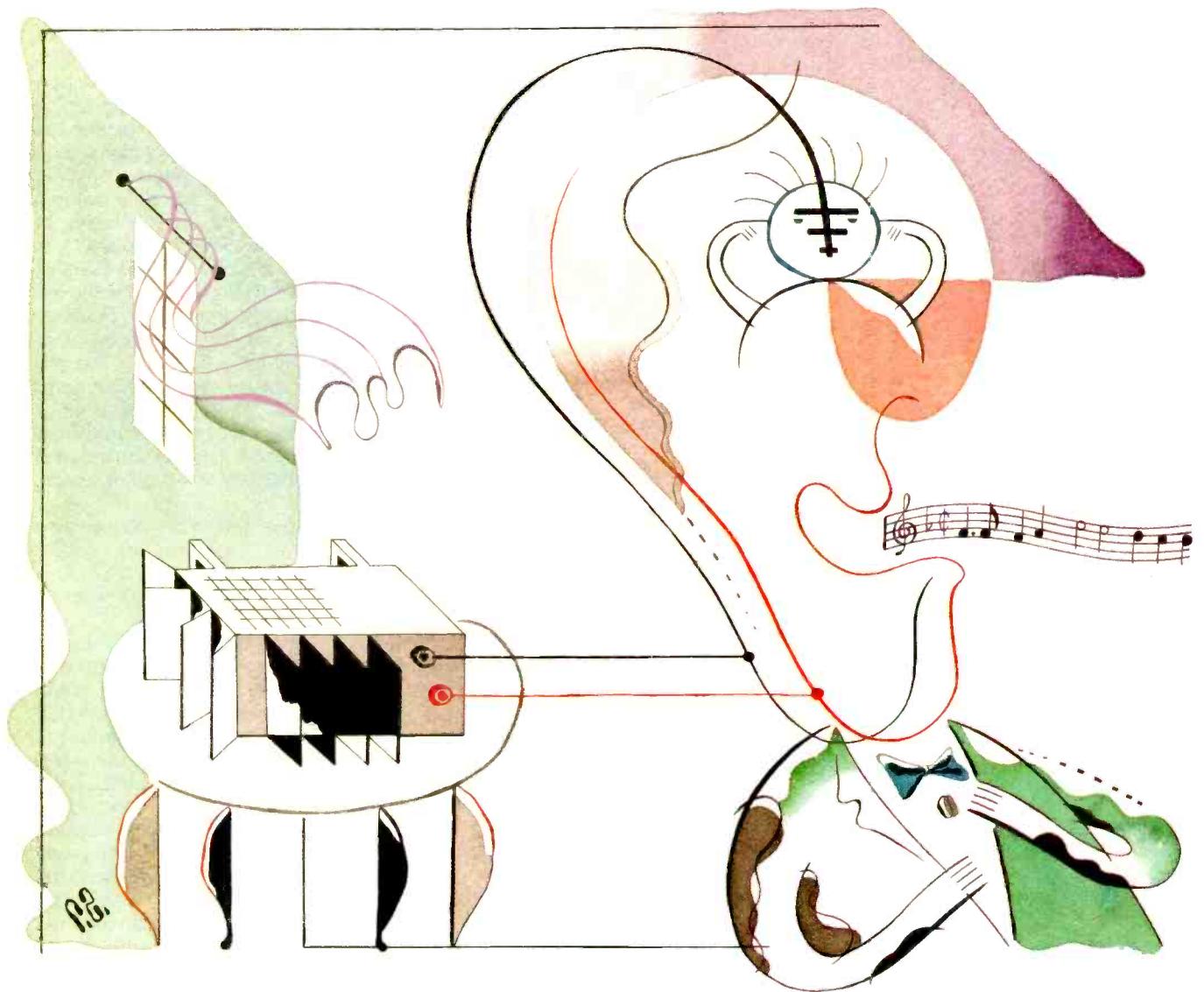


Fig. 1—Single-ended signals (e_{com} , e_1 , and e_2) and differential signals (e_{diff} and e_3).

average of two signals; $\frac{1}{2}(e_{11} + e_{12})$ or $\frac{1}{2}(e_{o1} + e_{o2})$. The desired difference signal, sometimes called the "normal-mode" signal, contains the original information to be amplified. A significant advantage of the differential amplifier is its ability to distinguish common-mode input signals from differential input signals.

In an ideal differential amplifier, a common-mode voltage would cause no differential output voltage. The amplifier's output would be a function only



of the differential input, and any common-mode signal would be rejected. In practice, no differential amplifier is perfect, because non-ideal conditions exist. A useful measure of performance, or figure of merit, is the common-mode rejection ratio (CMRR). This is defined as the ratio of the common-mode input to the differential-mode input that would produce the same differential-mode output. The higher the CMRR at a given frequency, the better the amplifier.

Common-mode rejection must be preserved in the input stage since common-mode error voltages, once added to the amplified signal output, cannot be separated from it. Single-ended input circuits (Fig. 3A), in which one terminal is grounded and the signal is applied to the other (typical of home audio equipment), have lower CMRRs than do completely balanced amplifiers with floating inputs (Fig. 3B).

For a differential input and a single-ended output, both the differential and the common-mode output error voltages add to the output signal. With differential loading, only the differential output error signal directly adds to the amplified signal.

In practice, the common-mode rejection of a balanced amplifier stage is never infinite. It is, however, considerably greater when constant-current (high-impedance) sources are substituted for resistor R_E in Fig. 2. Imbalances in the differential amplifier stage reduce the rejection of the average or common-mode signal. One common cause of imbalance in audio amplifier designs is device mismatching. If the two devices used in a balanced amplifier do not have identical characteristics, the transfer conductance of that amplifier's two sides will not be equal. Therefore, there will be a differential-mode component of the output current

in response to a common-mode input voltage; this is called common-mode to differential-mode conversion and is the source of the differential error voltages referred to previously.

Inequality of load impedances (R_{L1} and R_{L2} in Fig. 2) also causes differential-mode conversion, even if the two sides have equal transfer conductance. Unequal input impedances from each input (e_{11} and e_{12} in Fig. 2) to the output common create differential errors too.

The greater the imbalance, the greater the unwanted differential error pickup will be. Imbalances between the two sides of a differential amplifier mismatch the gain presented to the common-mode signal at the two input terminals. This creates a differential error signal which the following stage amplifies.

Then there is the question of ground-signal reference regions, containing

DIFFERENTIAL AMPLIFIERS CAN DISTINGUISH COMMON-MODE NOISE FROM INPUT SIGNALS, A SIGNIFICANT ADVANTAGE.

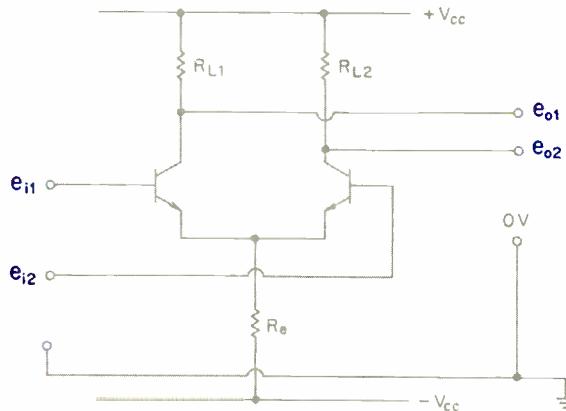


Fig. 2—A commonly used differential amplifier configuration, often known as a long-tailed pair.

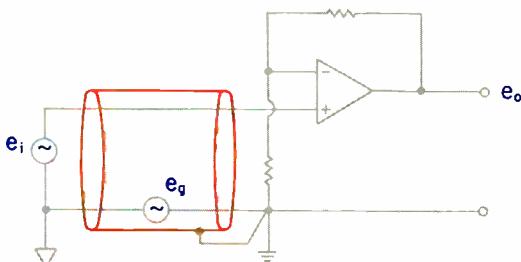


Fig. 3A—An op-amp used as a single-ended amplifier. The distinguishing feature of the single-ended configuration is the through connection of the zero-signal reference conductor, which means that ground-line signals (e_g) will be amplified. As a result, the output voltage for the single-ended amp equals the gain, A , multiplied by the sum of the input and ground voltages:

$$e_o = A(e_i + e_g).$$

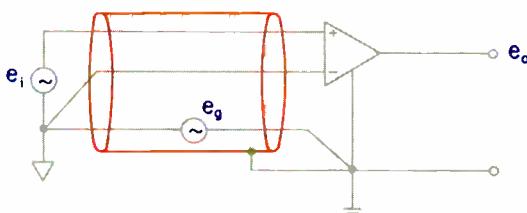


Fig. 3B—An op-amp used as a differential amplifier. In this configuration, ground-line signals are attenuated by common-mode rejection, and output voltage is as follows:

$$e_o = A(e_i + e_g/CMRR).$$

points which are supposedly, but not actually, at the same potential. Consider a signal potential that is developed in one ground-signal reference region and must be observed in a second such region. For the output signal e_o in Fig. 4, the zero-signal reference is taken as the zero-reference potential (e_1) for the input signal. The potential at point B, as measured from point C, is e_1 (assuming no current flows in R_1 or R_2 , which would signify a potential difference between B and e_1). Potential e_1 is just the zero-reference potential of the signal measured from C. The potential at point A (again referenced to C) is $e_{sig} + e_1$. Therefore, the potential difference e_{sig} can be measured from point C by subtracting the voltage at B from the voltage at A—in other words, $e_{sig} = e_A - e_B$.

The average (common-mode) value of the input $e_A + e_B$ is:

$$(e_{sig} + e_1 + e_1)/2 = e_{sig}/2 + e_1.$$

Since the unwanted term e_1 is present, the amplifier in Fig. 4 must reject and not amplify this average value. Here, we can say that the common-mode signal is simply the difference of ground potential between ground-signal reference points. This points up the important fact that all conductive paths, reactive and resistive, must be considered—the amplifier is only one area of concern. For that reason, the common-mode rejection (CMR) demands on the amplifier can be met only by understanding the basic shielding and grounding processes involved.

In the design of amplifiers, single-ended topologies offer no rejection of these unwanted signals, while the differential family of circuits does. Unfortunately, it is too often assumed that the topology will take care of matters, so efforts to improve or optimize the circuit for CMR are rarely seen. Even when an active current source is used to bias the differential input stage, one cannot necessarily assume the matter is taken care of.

The basic method for measuring CMR is to apply a common (mode) signal to both inputs (plus and minus) of the differential stage; the resulting residual output signal indicates the degree of rejection. Note that the input should be terminated with the output of the actual expected driving unit so that the measured CMR will be whatever the system produces. This system CMR could be much different if the amplifier had a short or specific resistor value terminating its input. For example, if a power amplifier were measured for CMR, the amount of rejection

could vary significantly depending on the output impedance of the preamplifier. This is because the output impedance is added to the power amplifier input impedance, as seen by the power amp's input transistor. This transistor's impedance will then be out of balance relative to the other transistor of the input pair. It might help if terminating impedances for audio equipment were standardized. With a standard impedance (where appropriate), various components could be combined with minimal CMR degradation; perhaps the communications industry standard of 600 ohms should be adopted. Taking its cue from communications equipment, recording studio equipment uses a balanced, 600-ohm impedance for the very purpose of crosstalk and CM rejection. A CMR ratio of at least 60 dB (and preferably 80 dB) at frequencies up to 20 kHz should be a minimum for the highest quality equipment.

In many cases, a single op-amp configuration used as a differential amplifier (Fig. 5A) to accept a balanced cable from a balanced source is insufficient to achieve good common-mode rejection. For improved CMR, a three-amplifier circuit known as an instrumentation amplifier (Fig. 5B) can be used. This consists of two noninverting amplifiers having a common gain-setting resistor, followed by a difference amplifier. Input signal e_i is duplicated across gain-setting resistor R_g via feedback that forces the differential input voltages on A1 and A2 to be zero. This is accomplished with current supplied through the R1 feedback resistors. The outputs of A1 and A2, however, are amplified replicas of e_i . Note that these outputs are of opposite phase. Also present at the A1 and A2 outputs is the common-mode voltage of the inputs. The difference amplifier, A3, nulls this common-mode voltage while the opposing-phase e_i signal components are combined; the result is a ground-referenced, amplified version of the differential input signal.

Common-mode rejection is important because CM error signals are unwanted signals that are not a part of the original. In addition to the imbalances already discussed, the ways in which signals enter the amplifier have a lot to do with CM rejection. Common-mode voltage is produced when a signal's electric or magnetic field is coupled to other circuit conductors such that currents flow in-phase on all wires. Such field strength is converted to an open-circuited, available voltage. This voltage coupling can occur via a shared, common-ground impedance (conductive coupling). It can also occur

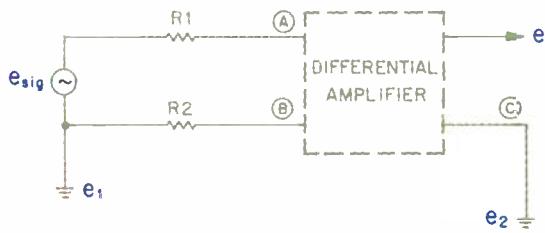


Fig. 4—Two zero-signal reference regions; see text.

ONCE ADDED TO THE SIGNAL, COMMON-MODE NOISE CANNOT BE SEPARATED OUT AGAIN; IT MUST BE REJECTED AT OR BEFORE THE INPUT STAGE.

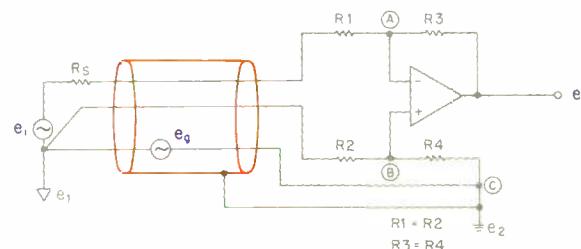


Fig. 5A—An op-amp connected as a differential amplifier can reduce sensitivity to ground-line signals. However, common-mode rejection is seriously degraded by signal-source resistance (R_s). Output voltage in this setup is:

$$e_o = e_i(-R3/R1) + (e_g/\text{CMRR}), \text{ where } \text{CMRR} \leq (R1 + R3)/R_s.$$

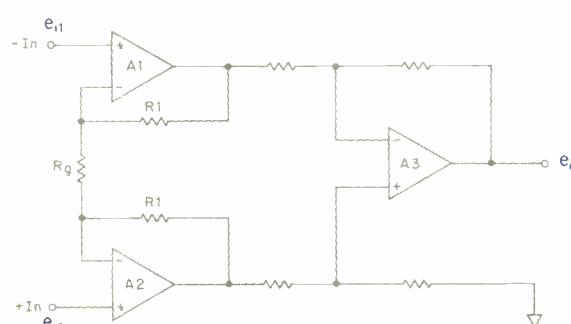


Fig. 5B—The topology of an instrumentation amplifier offers high accuracy and a common-mode rejection ratio exceeding 100 dB. Here, output voltage is:

$$e_o = [1 + 2(R1/R_g)](e_{i2} - e_{i1}).$$

B

ECause MOST
HOME AUDIO COMPO-
NENTS USE UNBALANCED
CONNECTIONS, THEY
DON'T REJECT COMMON-
MODE NOISE WELL.

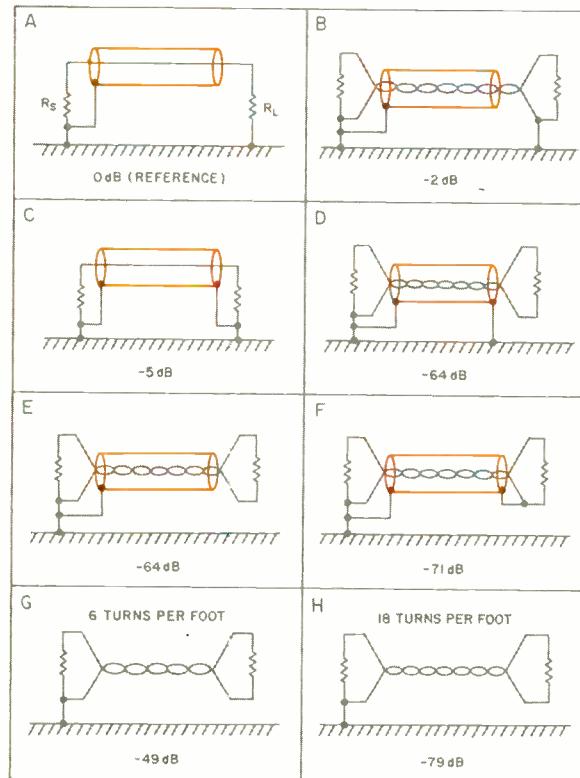


Fig. 6—Relative susceptibility of common cabling circuits to electric-field and magnetic-field coupling.

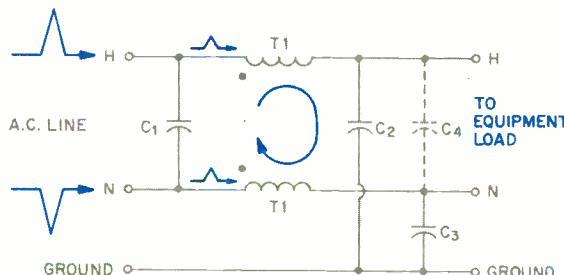


Fig. 7—An a.c. power-line filter used to remove common-mode (CM) and differential-mode (DM) noise. Capacitor C1 converts DM to CM, which is then cancelled by common-mode choke T1. Capacitors C2 and C3 filter DM components only; C4 is sometimes added between filter output's hot and neutral lines to keep load-generated noise from being reflected back into the a.c. line.

cur when electrical or magnetic fields travel via nonconductive paths (field coupling). Examples of field coupling include wire-to-wire and cable-to-cable coupling (especially when the wires or cables are bundled together). Other examples are emissions from fluorescent lamps and other appliances.

Part of the cure, as discussed above, is in the amplifier topologies used. If both the amplifier and the system it is used in are optimized, the differential family of amplifiers (push-pull, paraphase, and differential) are best for the rejection of these unwanted induced signals. However, we can do more than just use this family of topologies in our search for more cleanly reproduced signals.

When using wire pairs for balanced transmission of the low frequencies (below about 100 kHz), either magnetic-field or electric-field coupling will predominate, depending on both the wiring geometry and the impedance levels. Below about 100 kHz, we can make the following generalizations: When the circuit impedance products (both source and load impedance) are less than 300 ohms, the principal coupling mechanism is magnetic-field. However, when the circuit impedance products are more than 10 kilohms, the principal coupling mechanism is electric-field.

Figure 6 shows some of the many possible cable constructions and their relative susceptibility to both magnetic- and electric-field coupling. Consumer amplifier inputs are usually configured to accept single-ended input cables such as those shown in Figs. 6A, 6B, and 6C. In coaxial cables (Figs. 6A and 6C), both an inner wire and an outer cylindrical conductor carry the signal currents (source to load and return). Inasmuch as the outer conductor is usually grounded at the source, load, and other intermediate points (Fig. 6C), ground-current loops and common-mode currents caused by coupling of external noise sources are also carried on the outer coaxial conductor. Since both the desired signal and the undesired signal are carried on the same outer conductor simultaneously, some level of electrical interference certainly will be introduced into the system.

With differential amplifiers, we are able to use the other wiring methods of Fig. 6 for improved rejection. However, in the presence of severe electromagnetic interference (EMI), more complex configurations may be necessary. One such configuration would be triaxial cable, in which one signal conductor surrounds the other as a shield while an additional, grounded shield pro-

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KENTUCKY

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MARYLAND

MASSACHUSETTS

LOUISIANA

MISSOURI

The volume control is an electronically switched ladder attenuator—a type that won't become noisy or intermittent over time.

"Panloc" buttons permit you to slide the unit out, should you want to remove it from the cabinet at any time.

Control Layout

The upper half of the front panel is a display which shows what source, volume setting, operating mode, and tape facilities are in use, along with the settings of the speaker switches. The volume indicator is a vertical row of LEDs at the right side of the display.

The lower left half of the black-anodized aluminum panel contains pushbuttons for program-source selection, muting, audio and video tape monitoring, tape dubbing, stereo/mono selection, and speaker selection, as well as the a.c. power switch. The "Speaker" buttons not only operate the SCR-3 speaker control relay, but also turn two extra line outputs on and off. A stereo headphone jack is near the center of the panel; to its right are five rotary knobs to adjust boost or cut of the five equalizer bands. Concentrically mounted balance and loudness-contour controls and a pair of volume-control pushbuttons complete the front-panel layout. When rotated fully counterclockwise, the loudness control provides flat response; when rotated fully clockwise, it offers maximum loudness compensation.

On the rear panel are nine pairs of input jacks (including those for the two tape/VCR loops), the tape/VCR outputs, two external-processor loops, and three pairs of output jacks (the "Main" jacks plus the two pairs controlled by the front-panel "Speaker" switches). One processor loop affects signals going to the tape outputs, and the other affects main output signals. With an encode/decode noise-reduction unit, the encoding connections are made to the "Tape" processor loop and the decoding connections are made to the "Main" loop. The processor-loop jacks are the switching type; they automatically bypass the loop inputs if there is no cable connected to them. As a result, the C 31V needs no front-panel switches to select the processed signals; the processors' own switches would be used instead.

A total of eight convenience a.c. receptacles are also found on the rear panel; only one of them is unswitched. A chassis ground terminal is located next to the phono inputs. Multi-pin connectors identified as "SCR," "Tuner," and "Video Selector" are intended for connection of cables from the optional McIntosh accessories mentioned earlier and to link McIntosh's MR 7082 tuner (which has no remote control of its own) to the infrared and multi-room remote-control systems of the C 31V. A DIN jack provides similar control connection for McIntosh's MCD 7000 and MCD 7005 CD players. Another DIN jack allows hookup of the McIntosh Area Controller described above. Finally, two coaxial connectors are provided on the rear panel for use with remote sensors that enable the remote control of the C 31V to be used in listening areas where a direct line of sight to the main front panel does not exist.

Measurements

Frequency response of the C 31V, measured from the high-level inputs to the main output, was flat within 0.2 dB from below 20 Hz to well above 20 kHz. As shown for one channel in Fig. 1, response was down only 0.8 dB at 40 kHz. The -3 dB points occurred at 12 Hz and 100 kHz. The

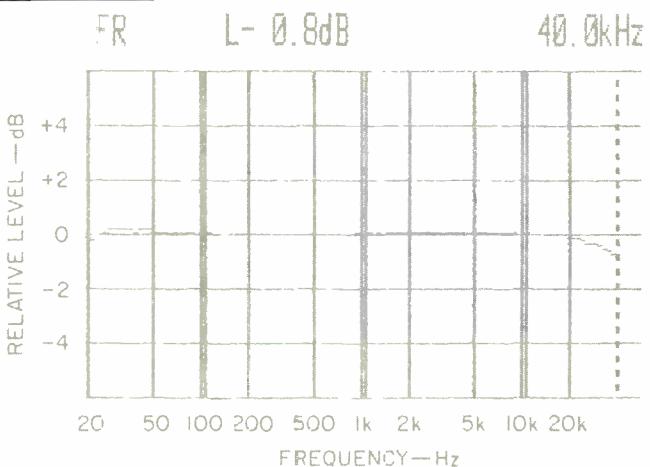


Fig. 1—Frequency response.

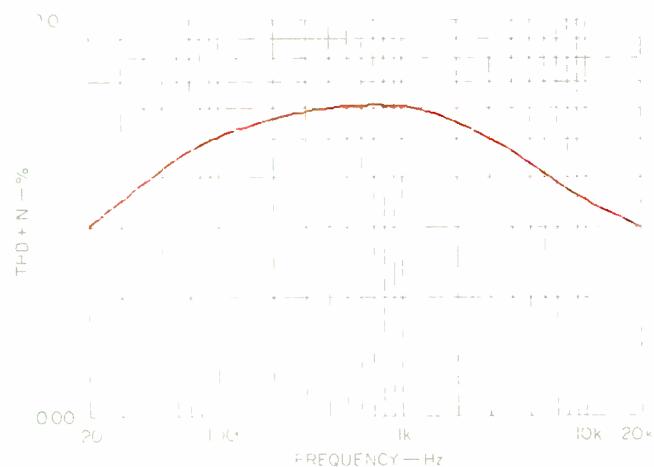


Fig. 2—THD + N vs. frequency.

sample that I tested had moderately less high-level gain than specified by the manufacturer (high-level input sensitivity was 90 mV), while gain via the phono inputs was a bit greater than the nominal value specified (0.56 mV input for 0.5 V output). Phono overload measured 100 mV at 1 kHz, a bit higher than the 90 mV specified by McIntosh.

Figure 2 is a plot of harmonic distortion plus noise versus frequency. McIntosh has always been noted for its conservative specifications, and the specs listed for the C 31V are no exception. At rated output level (1.5 V), THD + N measured only 0.006% at mid-frequencies and actually decreased at the frequency extremes. SMPTE-IM distortion, not specified by the manufacturer, was 0.025% for rated output. Maximum output level before the onset of significantly higher levels of distortion measured 8 V, as claimed by McIntosh.

I was impressed by the absence of switching noise and background hum, and by the accurate and totally transparent sonic quality.

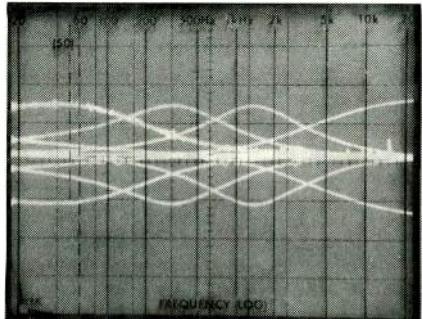


Fig. 3—Boost and cut range of equalizer controls. Sweep is logarithmic, from 20 Hz to 20 kHz. Vertical scale: 10 dB/div.

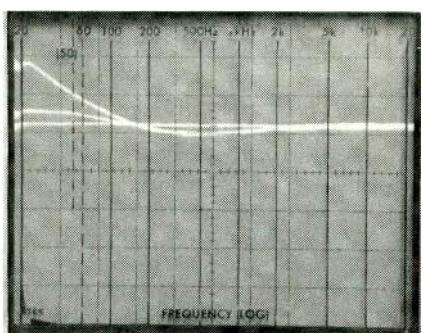


Fig. 4—Loudness-contour characteristics for three settings of independent loudness control; see text.

Signal-to-noise ratio for the high-level inputs was 88 dB (A-weighted) referred to 0.5 V output, exactly as specified, while phono S/N, at 85 dB referred to 5 mV input and 0.5 V output, was slightly better than claimed. With the volume control adjusted to its minimum setting, a further increase of high-level S/N to 90 dB (again, referred to 0.5 V output) was noted. These S/N figures are among the best I have ever obtained for any preamplifier or integrated amplifier. Bear in mind that most power amplifiers require an input of 1 V or more in order to be driven to their rated output. Also, consider the fact that most CD players these days put out about 2.0 V at maximum recorded level, 12 dB more than the 0.5 V used in making the standard IHF/EIA signal-to-noise measurement. Assuming, therefore, that you would have to turn down the gain by at least 6 dB below unity when listening to a CD player (so as not to overdrive your power amplifier), you could expect at least 6 dB better S/N

than the 88 dB I measured (or 94 dB) and possibly even more than this. So, with the C 31V, you can certainly avail yourself of the full dynamic range claimed for CDs (more than 90 dB from input to speaker outputs). I know of few preamplifiers that can deliver this kind of dynamic range. It's clear that the designers of this control unit were very much aware of the requirements of digital program material when they finalized its performance capabilities.

RIAA equalization conformed to the specified playback curve within ± 0.3 dB. Figure 3 shows the boost and cut range of the five equalization controls, whose center frequencies were very close to those specified by McIntosh.

I am always delighted when I run into a loudness control that is completely independent of the master volume control. Such loudness compensation is especially important these days, when we are dealing with a wide range of program source levels (as little as 100 to 150 mV for the outputs of some tuners and as much as 2 V, or more, for CD players). Obviously, a loudness circuit which changes compensation only in response to volume-control settings cannot properly apply Fletcher-Munson compensation to all of these program sources, since the volume control must end up at widely different settings to cover this broad range of input levels. By separating the loudness-contour function from the volume control, as McIntosh has done, it becomes possible to adjust loudness compensation as needed, regardless of the setting of the master volume control. Figure 4 illustrates three compensation curves achieved by setting the loudness control to its minimum and maximum settings and to an arbitrary mid-setting. The point to keep in mind is that this range of compensation is available regardless of the volume-control setting. As far as I am concerned, this is the only kind of loudness control that makes any sense, and the only kind whose use is ever justified.

Use and Listening Tests

There's no denying that the McIntosh C 31V is expensive. Still, dozens of control preamplifiers from other manufacturers cost as much as or more than this one.

After hooking up the C 31V to my reference power amplifier and loudspeakers, I was impressed by the total absence of any switching noise, the inaudible background noise and hum level—even when no program material was present to mask it—and the accurate and totally transparent musical qualities of this preamp. I listened to a variety of program sources, but frankly, the majority of my listening was done using some of my newer CDs, such as *The Symphonic Sound Stage* (Delos D/CD 3502), which features selections from recordings engineered by my good friend John Eargle. To be sure, both hardware designers and software producers have had to relearn some tricks of their trade. If there is anyone who understands how a CD should be recorded and mastered, it is Mr. Eargle, who learned quickly and effectively how best to handle the digital medium. McIntosh, too, has adapted itself perfectly to the requirements of the new, digital program sources. Even a brief listening session with the C 31V will convince you, as it did me, that there's nothing behind the times about the good folks who turn out those magnificent McIntosh components, year after year, for all of us to enjoy.

Leonard Feldman



Exactly how easy is the Revox B203/205 Control System . . . ?

Press the "CD" button on the B205 Wireless Remote Control. The B203 Timer Controller turns on all the required components, and your Revox B226 Compact Disc player fills the room with music.

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EQUIPMENT PROFILE

2

KEF 107 LOUDSPEAKER

Manufacturer's Specifications

System Type: Floor-standing, three-way, with coupled cavity woofer enclosure and external equalizer.

Drivers: Two 10-in. (250-mm) woofers, 5-in. (127-mm) midrange, and 1-in. (25-mm) dome tweeter.

Frequency Range: 20 Hz to 20 kHz, ±2 dB (equalized).

Sensitivity: 90 dB SPL at 1 meter for 2.83 V rms input.

Maximum Output: 112 dB SPL on program peaks under typical listening conditions.

Crossover Frequencies: Not specified.

Impedance: 4 ohms, resistive, 20 Hz to 20 kHz.

Recommended Amplifier Power: 50 to 300 watts into 4-ohm resistive load.

Dimensions: 45.9 in. H × 13 in. W × 17.6 in. D (116.5 cm × 33 cm × 44.8 cm).

Weight: 99 lbs. (45 kg).

Price: \$4,500 per matched pair with KUBE equalizer.

Company Address: 14120-K Sullyfield Circle, Chantilly, Va. 22021.

For literature, circle No. 91

The KEF 107, the flagship model from KEF's "Reference Series" of loudspeakers, is primarily a high-end audiophile system. However, with its very high power-handling capacity, extended low-frequency response, and high maximum acoustic output capabilities, it will do justice to any type of program material from chamber music to hard rock. It represents the end result of many years of research and development and the pioneering use of computer-aided design and testing in the manufacture of loudspeakers and systems.

In early 1983, I had the pleasure of visiting the KEF plant in England, where I talked extensively with Laurie Fincham, KEF's technical director, and with KEF's founder and man-

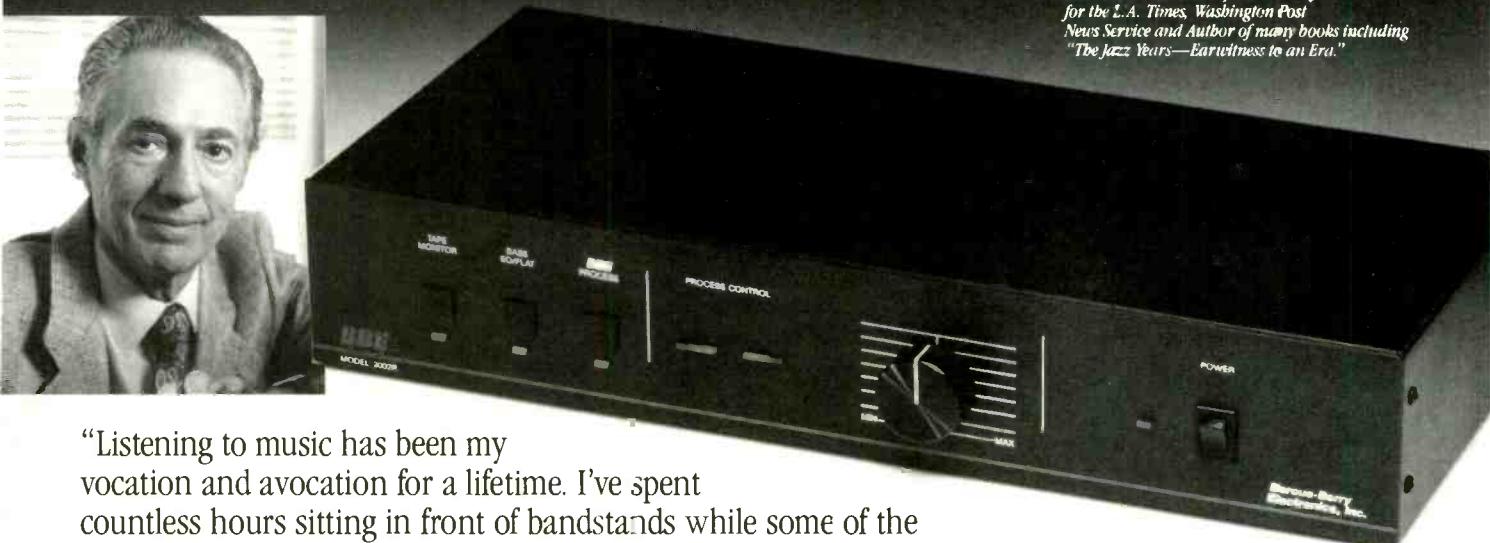
aging director, Raymond Cooke (whose position is equivalent to that of president of an American firm). I came back very impressed with the company, its philosophy, and its products. When given the opportunity to review one of KEF's high-end speaker systems, I jumped at the chance.

The KEF 107 is a three-way, modified direct-radiator system supplied with a line-level equalizer. The equalizer, called the KUBE (which stands for KEF User-variable Bass Equalizer), is used primarily to adjust the low-frequency characteristics of the system to the listening environment and also to equalize a moderate upper-midrange peak exhibited by the unequalized system. The equalizer is an



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*Leonard Feather, Celebrated Jazz Critic
for the L.A. Times, Washington Post
News Service and Author of many books including
"The Jazz Years—Earwitness to an Era."*



"Listening to music has been my vocation and avocation for a lifetime. I've spent countless hours sitting in front of bandstands while some of the world's greatest musicians mesmerized me with their artistry.

At home, I listen to and review new recordings, searching for tomorrow's major talent or simply enjoying the magic of great music.

Listening to recorded music, of course, falls short of the delights of listening to a live performance. I was therefore skeptical when told that BBE could make a dramatic improvement to virtually all audio systems and I had to hear for myself.

I was amazed at how much better the BBE 2002 made my music system sound! There was a presence, a *being there* sense of excitement. The rich textures of instrumental sounds, the subtle nuances and details in the music come through with clarity and authenticity.

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—*Radio World*

"There was no doubt the BBE processor added more spatial quality, more transients and more clean highs. This is the first black box that actually helped make my music sound the way that I knew it should. The effect is shattering!"

—*Music Technology*

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The bass equalizer is an integral part of the 107's overall design, not just an after-the-fact addition for extra sales appeal.

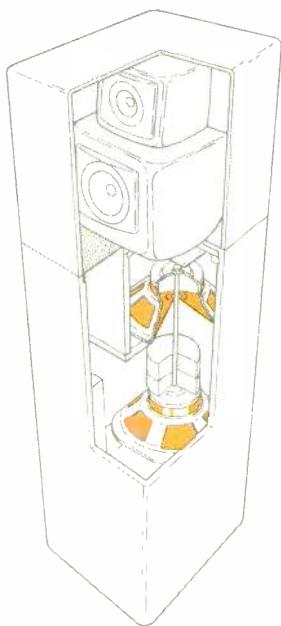


Fig. 1—Cutaway view of the KEF 107. Note the dual woofers, each firing from a sealed enclosure into a shared, ducted cavity, and the rod connecting the two woofer magnets. (See text.)

integral part of the system design and not just an after-the-fact addition to add some extra sales appeal.

The two low-frequency drivers are mounted in a modified version of the vented-box enclosure, called a "coupled cavity configuration" by KEF. This type of cabinet provides a band-pass type of frequency response because the acoustic output from the enclosure comes only from the vent.

The mid and high frequencies are radiated from a separate high-frequency enclosure or head assembly that is mounted on top of the low-frequency enclosure. This separate enclosure, which also contains the midrange/tweeter crossover, is shaped to minimize mid- and high-frequency diffraction effects; this ensures smooth on- and off-axis frequency response. The head, which is detachable, is connected to the bass cabinet with a gold-plated XLR connector. The head assembly can be rotated roughly $\pm 30^\circ$ to optimize coverage of the listening area. This method of handling the mid and high frequencies continues a successful approach first offered in 1976 by KEF in the Model 105.

KEF uses "conjugate load matching" in the crossover so that the system's input impedance, over the range of 20 Hz to 20 kHz, is essentially resistive, with a value of about 4 ohms. This load is very easy for any amplifier to drive. The lower value of impedance essentially doubles the voltage sensitivity of the system and raises the acoustic output, as compared to an 8-ohm system.

While KEF does not specify crossover frequencies, measurements revealed that the system is crossed over at about 160 Hz and 3 kHz and that the respective drivers' acoustic outputs are essentially in phase at crossover, thus minimizing lobing error.

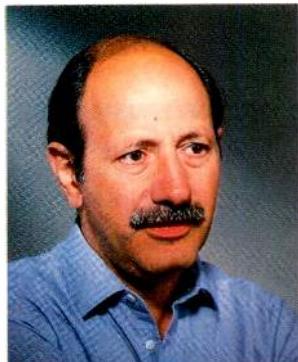
The highs are radiated by a ferrofluid-cooled dome tweeter. The tweeter is a refined version of KEF's T33 high-frequency unit, which is also used in other KEF systems.

The mid-frequencies are radiated by a polypropylene-cone midrange driver with an effective radiating diameter of about 4 inches (100 mm). This driver is an improved version of KEF's very fine B110 midrange unit, with higher sensitivity and power handling. The mid-frequency driver is used down to the relatively low frequency of 160 Hz, because the band-pass vented-box low-frequency system will not easily go any higher in frequency. The wide range covered by the midrange driver (160 Hz to 3 kHz, over four octaves!) opens up the possibility of intermodulation of the upper-midrange frequencies by high-amplitude signals in the 150- to 300-Hz range.

The low frequencies, below 160 Hz, are generated by a special form of vented box called a band-pass vented-box enclosure. This modified form of vented-box cabinet differs from the standard vented box because all the sound generated is radiated from the vent only. No sound comes directly from the drivers because they are contained within the sealed-box enclosure. This enclosure has a band-pass type of frequency response that, unassisted, covers only a response of roughly one to two octaves. KEF's technical director, Laurie Fincham, completely described this type of system at the May 1979 Audio Engineering Society Convention in Los Angeles (Preprint 1512, D-4, "A Bandpass Loudspeaker Enclosure"). Additional information can be found in a more recent paper by E. Geddes and D. Fawcett, "Bandpass Loudspeaker Enclosures," which was presented at the November 1986 AES Convention in Los Angeles (Preprint 2383, D-3).

The band-pass vented-box enclosure offers several advantages and one major disadvantage. The major disadvantage is that its frequency response is limited to a relatively narrow range, about one to two octaves. This response range can be extended, of course, by the use of equalization, and this is what is done in the KEF 107. With the full amount of equalization, the effective range of the 107's low end extends from 20 to 150 Hz, a three-octave range.

The advantages of the band-pass style of vented-box enclosure include the following: First, because the sound is radiated only from the port, and not directly from the cone, all forms of distortion are potentially lower. This is due to the high linearity of the acoustic resonance system as compared to the mechanical resonance system of the cone driver. Second, the acoustic resonant system acts as an acoustic low-pass filter which attenuates any extraneous noises, such as distortion generated by the low-frequency driver. Third, the low-frequency response of the system rolls off at only 12 dB per octave, the same as a closed-box system, rather than the faster roll-off of a standard vented box, which is 24 dB per octave. This greatly increases the low-frequency energy below the system's 3-dB down point and also much improves the system's low-frequency transient response. Fourth, the sealed box loading one side of the cone adds additional stiffness to the driver and thus increases the system's subsonic power-handling capability. This overcomes one of the major disadvantages of the standard vented-box enclosure, which essentially unloads the driver at frequencies below the vented-box resonance frequency.



"It's no trick to make a great speaker when price is no object."

Andy Petite, chief designer, Boston Acoustics

The 3-way T830 Tower System.

It needs only 10 x 9½" of floor space, only 32" in height. Suggested retail: \$480 a pair.



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"However, that kind of quality doesn't always filter down through their product line. At Boston Acoustics, we take pride in designing every system to measure up to the highest standards. To show you what I mean, let's look at our newest model, the T830 tower system."

"We designed the T830 to deliver exceptional performance at a very reasonable price, and did it by making knowledgeable and intelligent choices. We custom-designed all three of its drivers: an 8" high-compliance woofer, 3½" midrange and 1" dome tweeter. No compromises here."

"The midrange and tweeter are ferrofluid cooled for greater power handling capacity. The diaphragms of all three drivers are made of copolymer. Although it is more costly than conventional materials, we used copolymer because of its structural uniformity and immunity to atmospheric changes."

"We make all these drivers under our own roof, using specialized machinery and jigs that we've designed or adapted ourselves. This helps us maintain consistent high quality, and save through efficiency."

"For the enclosure, we used the same dense, non-resonant structural material as in our highest-priced system. To keep the cost down we used wood-grain vinyl instead of costly wood veneer. It looks rich, and makes absolutely no difference in sound quality."

"More important than what we put into our systems is the quality of sound that comes out—and how that matches your expectations."

"From our very first product to our latest, audio critics have appreciated what we've accomplished—delivering demonstrably high performance at truly affordable prices. Here's what Julian Hirsch said about the T830 in *Stereo Review*:

'In all measurable respects, the Boston Acoustics T830 delivered outstanding performance. Few speakers we have tested have had such a flat frequency response or such low distortion, for example, and most of those were considerably more expensive... we were enormously impressed.'

"When you compare the T830 against similarly-priced systems, you'll also find it sounds better in a number of ways. More musical, smoother, its imaging more precise. And it can play louder without distortion."

"What we've accomplished is no trick. It's knowing what to do, then doing it."

"If you'd like to know more about the T830 and other Boston Acoustics speakers, please write or call. We promise to reply promptly."

Boston Acoustics

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Even without its equalizer, the 107 has commendable frequency response, but the equalizer flattens and extends it further.

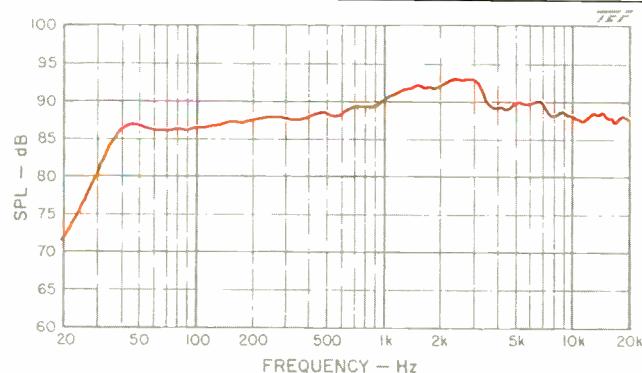


Fig. 2—On-axis frequency response without KUBE equalizer. (0 dB = 20 μ Pa.)

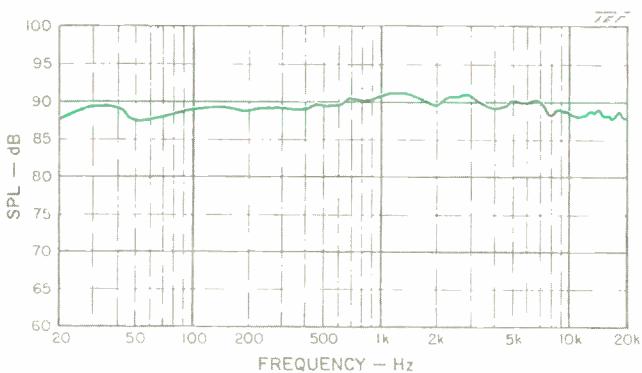


Fig. 3—On-axis frequency response with KUBE equalizer at factory-recommended settings. Note extended bass and flattened midrange.

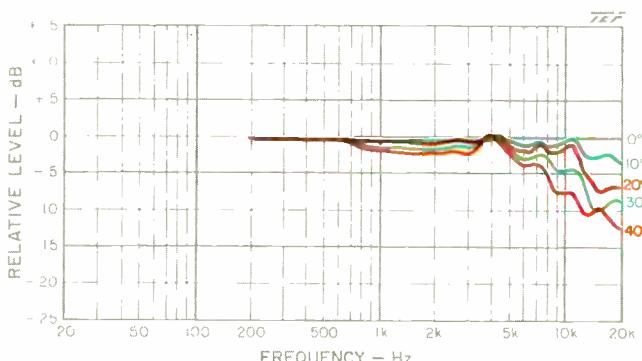


Fig. 4—Horizontal off-axis response, normalized to show deviations from on-axis response.

The KEF 107 actually implements the band-pass vented-box enclosure, using two low-frequency cone drivers. This configuration is shown in Fig. 1. The two drivers feed into a common cavity with a single duct exiting to the outside air. Each driver is loaded by a separate sealed enclosure. The magnet assemblies of the two drivers are connected solidly together with a metal rod; this essentially cancels any inertial forces which could vibrate the cabinet. Additional distortion is cancelled due to the push-pull configuration of the drivers (one driver moves toward its frame while the other moves away).

The duct exit is actually on the top of the low-frequency enclosure, which places it in close proximity to the mid- and high-frequency drivers. Because the duct exit is significantly smaller than an equivalent direct-radiating cone assembly, the total radiating sound area for the whole 107 system is significantly smaller than for an equivalent system with the same acoustic output. The close proximity of low-, mid-, and high-frequency radiating elements in this system ensures more even coverage of the listening area. The frontal area of the system is quite close to that of a typical two-way mini-monitor, but with a vastly higher acoustic output capability that goes down into the response regions of some subwoofers.

The KUBE equalizer is an active, line-level equalizer providing two types of equalization, one fixed, the other variable. The fixed equalization compensates for mid- and high-frequency response errors of the unequalized system and also provides a means for matching the left and right speakers of the stereo pair. The variable equalization allows control of the system's low-frequency output and response shape. Three parameters of the low-frequency response can be controlled: "Extension," which allows setting of the lower cutoff of the system to 50, 35, 25, and 18 Hz; "Q," which allows setting of the low-frequency response shape continuously in the range from 0.3 (overdamped) to 0.7 (maximally flat), and "Contour," which allows setting of the overall low-frequency level below 500 Hz in the range of ± 3 dB. These three controls allow a wide adjustment range of the system's low-frequency behavior so that response can be optimized for many different listening environments and types of program material.

The construction and finish of the 107 are of the very best quality. Much attention has been paid to detail, even in normally inaccessible areas. The system can be used without the mid/high-frequency grille assembly without any apologies. The low-frequency and mid/high-frequency enclosures are very solid and essentially inert due to very effective internal bracing and the special configuration of the cabinets. I was not aware of any cabinet wall vibration of any kind during my tests. Connections to the 107 are made via heavy-duty, gold-plated, knurled knob terminals designed to accept large-diameter wire, 4-mm plugs, or spade connectors.

Measurements

Most of the measurements for this review were made with the Techron TEF System 12 analyzer, which uses the technique of Time Delay Spectrometry (TDS) invented by the late Richard Heyser. Mr. Heyser was the senior loudspeaker

A U T O E A R D I C A



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The frequency response of the 107 actually achieves the 20 Hz to 20 kHz, ± 2 dB, listed in its specs. This is very flat indeed!

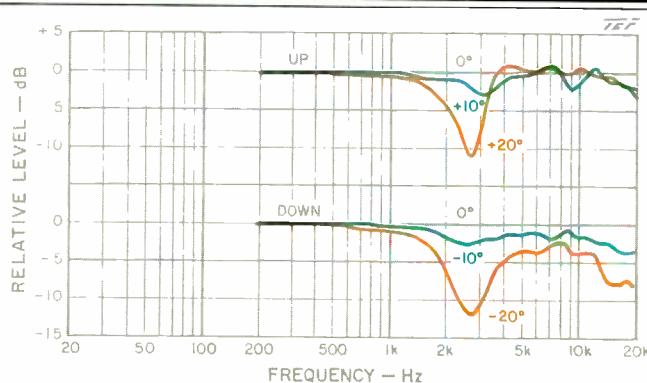


Fig. 5—Normalized vertical off-axis response (normalized) for angles above the axis (upper curves) and below it (lower curves).

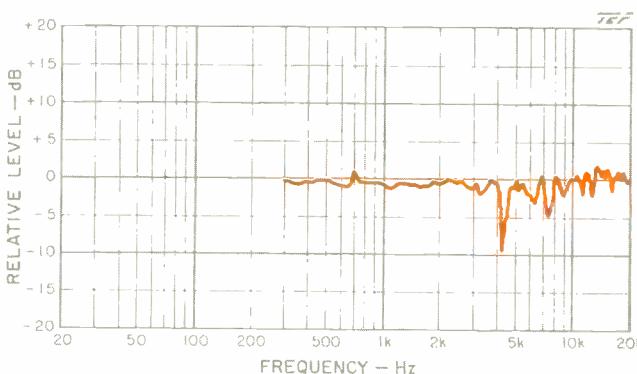


Fig. 6—Effect of grille on on-axis frequency response (normalized).

reviewer for *Audio* for more than a dozen years and used the TDS test technique extensively in his reviews.

TDS allows anechoic chamber-like, reflection-free measurements of parameters such as frequency response, phase response, and time response to be made under decidedly non-anechoic conditions. TDS measurements can be made under high noise-level conditions due to the inherent noise-rejection capabilities of the TDS technique.

The measurements in this review were generally done outdoors, with a combination of elevated free-field measurements, ground-plane measurements, and near-field measurements. Information on the ground-plane technique can be had in Mark Gander's paper in the *Journal of the Audio Engineering Society* ("Ground-Plane Acoustic Measurement of Loudspeaker Systems," Vol. 30, No. 10, p. 723, October 1982). My article on the near-field technique appeared in the April 1974 issue of the same journal ("Low-Frequency Loudspeaker Assessment by Nearfield Sound-Pressure Measurement," Vol. 22, No. 3, p. 154).

The system on-axis frequency response was measured at a distance of 2 meters directly on-axis of the tweeter. The input level was 2.83 V rms, which corresponds to a level of 1

watt into 8 ohms (the system is actually 4 ohms). The on-axis response was corrected to the standard distance of 1 meter for display of the data. The measurement parameters were set so that the data was essentially smoothed with a tenth-octave filter.

Figures 2 and 3, respectively, show the unequalized and equalized response curves of the system. The unequalized response is commendably smooth, exhibiting a lower 3-dB down point at about 35 Hz and actually extending beyond 20 kHz—out to 23 kHz—before dropping rapidly. An upper-midrange peak of about 3 dB, extending from 1 kHz to 3.5 kHz, is also noted. The sensitivity of the system appears to be roughly 89 dB for 2.83 V rms input. Remember that this is a measurement of boundary-free response similar to that measured in an anechoic chamber; the low-to-high frequency balance will change when the system is placed near reflective boundaries in an actual listening situation.

The equalized response curve was run with the factory-recommended equalizer settings of full "Extension" (4), maximum Q (0.7), and a slight "Contour" boost (+1). With these equalizer settings, the response actually meets KEF's rating of 20 Hz to 20 kHz, ± 2 dB! This is very flat indeed. Note that the equalizer also nicely minimizes the upper-midrange response peak.

The off-axis frequency response was measured and is illustrated in Figs. 4 and 5. Figure 4 shows the normalized horizontal off-axis response plotted on a log frequency scale, but only for angles out to 40° off-axis. Normalization is equivalent to precisely equalizing the on-axis response flat and then measuring the off-axis response. The response does exhibit some high-frequency roll-off above 10 kHz at angles beyond 20°. Figure 5 shows the normalized vertical off-axis response for angles of 10° and 20° above and below the axis. An off-axis crossover dip is evident at about 3 kHz both for 20° up and for 20° down.

For critical listening, the listener should be within a 40° horizontal window centered on the axis of the system, and preferably within a 20° window, for accurate high-frequency response. Fortunately, the mid/high-frequency head module can be freely rotated horizontally to aim it at the preferred listening location.

Figure 6 shows the effect of the grille on the on-axis frequency response. The grille caused some narrow high-Q peaks and dips due to internal reflections in the grille framework. I suggest leaving it off for serious listening; the system does look quite handsome without it.

The on-axis response match between left and right was so close that it approached the repeatability limits of my test setup. The only significant difference occurred in the 9- to 14-kHz range, where the left speaker was slightly louder than the right speaker, about 1.5 dB. I judge this level of right/left matching to be extremely good. Subsequent measurements of the equalizer revealed no differences between its channels.

Figure 7 shows the phase response of the system (equalized) with the delay adjusted for the tweeter. Figure 8 shows the corresponding group-delay measurement. The group delay indicates that the midrange and tweeter arrival times differ by about 0.24 mS (240 μ S), with the midrange lagging the tweeter. The increase in delay below 500 Hz reflects the

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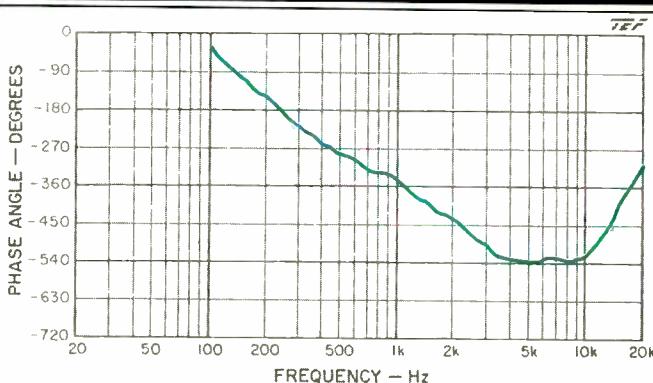


Fig. 7—On-axis phase response of the equalized system, with delay adjusted for the tweeter.

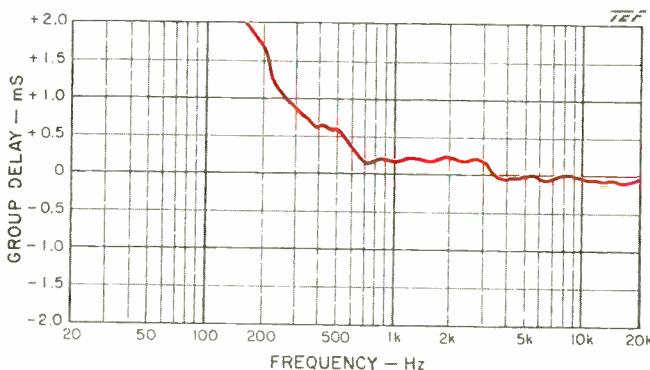


Fig. 8—Group delay corresponding to phase response of Fig. 7.

normal minimum-phase delay caused by the high-pass characteristic of the speaker's response. Most available research indicates that this amount of mid/high-frequency all-pass (flat frequency response) delay is inaudible.

The on-axis energy-time response curve (ETC) of Fig. 9 is shown for a test signal swept over the range from 200 Hz to 10 kHz. In general, the ETC is very well behaved except for a broadening of the response at levels well down from the peak.

The measured impedance between 20 Hz and 20 kHz was so flat and well behaved that no test results need be displayed here. The impedance magnitude varied from a minimum of 3.8 ohms to a maximum of 4.6 ohms. The phase angle was less than 10° for all frequencies below 10 kHz and smoothly rose to roughly +35° at 20 kHz. This means that the load can be considered as a resistor of about 4 ohms, which should be extremely easy for any amplifier to drive. Due to the constant nature of the load, no excessively high transient currents will be required by the load due to reactive effects. For speakers that have widely varying impedance, research has shown that with some program material, drive currents can sometimes reach values two to

five times the values computed on the basis of minimum impedance alone. KEF points out that the 107 can actually be considered a typical 8-ohm system insofar as sensitivity and load are concerned.

Figures 10 through 13 show distortion measurements taken on the system. All measurements were made without the equalizer, using near-field techniques. Figure 10 shows harmonic distortion for the single frequency E_1 (41.7 Hz) at increasing power levels. Virtually no higher order harmonics are evident at higher powers. Figure 11 shows the intermodulation data for 250 Hz and 2 kHz. Moderate distortion is shown here because both frequencies are handled by the same driver. Figures 12 and 13 show swept second- and third-harmonic distortion at power levels corresponding to midband levels of 90 and 100 dB SPL at 1 meter. At an axial level of 100 dB in the bass range from 40 to 150 Hz, the distortion was essentially less than 1%. This is commendably low distortion at these levels. For the lower frequencies, the third harmonic predominated, while at higher frequencies, the second harmonic was greater.

To evaluate the maximum peak input and output capabilities of the loudspeaker, I used a peak-power test method similar to that used by KEF to evaluate their professional line of loudspeakers. These tests are very revealing in that they indicate, at each frequency, a system's short-term power-handling capacity and maximum acoustic output capabilities. The method, which uses a shaped tone-burst test signal, is discussed by S. Linkwitz in his JAES article in April 1980 (Vol. 28, No. 4, p. 250). This method allows the dynamic peak input and output power capabilities of the system to be evaluated over the complete audio range. The shaped tone burst restricts the energy of the burst to a relatively narrow $\frac{1}{3}$ -octave bandwidth. The burst lasts for 6.5 cycles and is shaped using the Hanning raised-cosine envelope. This test signal has a good combination of characteristics that include short time duration, restricted frequency range, relatively high peak energy, and a waveform somewhat similar to actual musical waveforms.

The burst is presented at such a low duty cycle that the long-term thermal characteristics of the speaker under test are not exercised at all. In testing the 107, the tone burst was generated at 4 bursts per second, except at lower frequencies, where the repetition rate was lowered so as to maintain a crest factor (ratio of peak to average power) no lower than 20 dB. Note that typical crest factors of music, as recorded on Compact Discs, range from 15 to 25 dB.

The test method consists of evaluating the maximum peak input power-handling capacity and maximum output peak sound pressure levels at all the $\frac{1}{3}$ -octave center frequencies in the range from 20 Hz to 20 kHz. An extremely powerful amplifier, one which can generate 5,000 peak watts (141 V into a 4-ohm load), was used to drive the loudspeaker under test. (When I first started this project, I thought this amplifier would be plenty powerful enough for any test I would care to make. The measurements that follow showed me how wrong I was!)

The test sequence consisted of determining how much of the special test signal could be handled by the speaker at each frequency before either the output sounded audibly distorted or distressed, or the acoustic output waveform



Photography by Ken Wynn

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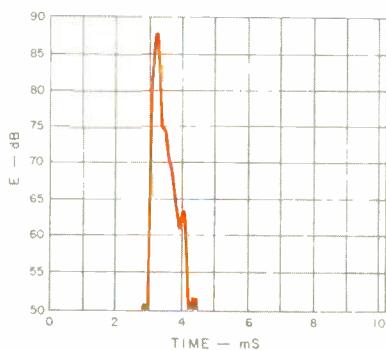


Fig. 9—One-meter on-axis ETC.

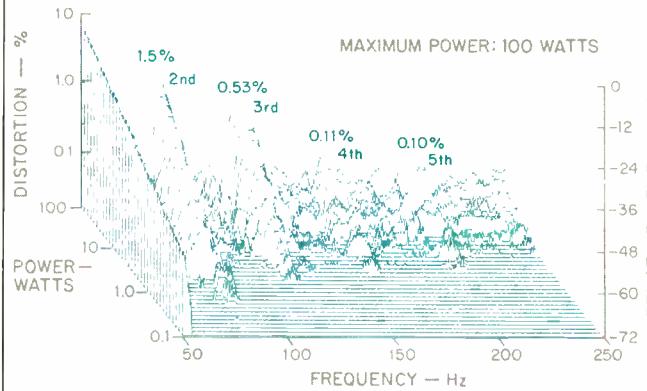


Fig. 10—Harmonic distortion products for a 41.7-Hz tone.

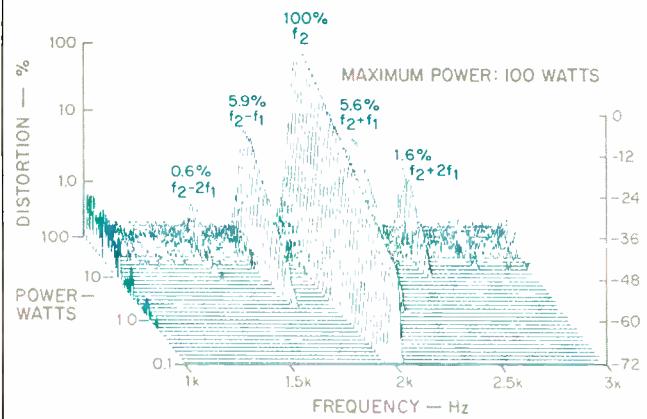


Fig. 11—Intermodulation distortion products for 250-Hz (f_1) and 2-kHz (f_2) tones, mixed 1:1.

appeared distorted on an oscilloscope monitoring the signal coming from a high-intensity microphone (whichever occurred first). At each frequency, the maximum peak input voltage and the corresponding generated peak output sound pressure level at 1 meter were recorded.

Figure 14 shows the maximum peak electrical input power-handling capacity of the loudspeaker. Except for a 2-dB limitation (625 watts) at 300 Hz, the system could handle peak power of 1 kilowatt and greater in the range from 50 Hz to 20 kHz. Above 5 kHz, the system could handle the full 5-kilowatt output of the amplifier (141 V peak)! In this range, amplifier clipping limited testing at higher power. Please realize that, during these tests, the system was producing some very loud sounds! After all this seemingly brutal power testing, the system did not seem to be affected in any way, as far as I could determine.

I found that at low frequencies, the 'scope waveform defined the power limit, while at higher frequencies, the audible effects defined the limits. I found that I was quite tolerant of rather high distortion levels (primarily second- and third-harmonic distortion) at low frequencies but was very critical of any slight audible distortion at mid or high frequencies. Note that the 107's band-pass vented-box enclosure, fortunately, filters out most higher order low-frequency harmonics.

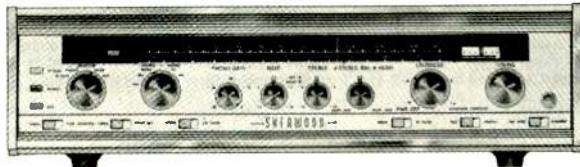
Figure 15 illustrates the maximum peak sound pressure levels the system generated at a distance of 1 meter, on axis, for the input levels shown in Fig. 14. Except for a limitation at and near 300 Hz, the system can generate peaks in excess of 115 dB SPL above 50 Hz. Above 1 kHz, the peak levels rise above 120 dB SPL! These levels are loud—hearing protection required!

Also shown in Fig. 15 (dashed curve) are the maximum peak SPLs generated by a pair of 107s in my listening room, as measured at the listening location. The systems could generate peaks in excess of 110 dB SPL at frequencies above 30 Hz (100-dB peaks at 20 Hz). These are wall-shaking levels! The room provides some 5 to 10 dB of low-frequency gain, while a pair of speakers increases the level some 3 to 6 dB.

Please don't interpret this maximum input and output test data to mean that you should run right out and purchase a 2.5-kilowatt power amplifier with a peak power rating of 5 kilowatts to use with your KEF 107s. An amplifier of this size has the capability of blowing up any domestic loudspeaker if continuous long-term power in this range is presented to the system. What I am suggesting is that maybe we need an amplifier with an honest continuous rating of 100 to 200 watts and a peak power rating of 1 to 5 kilowatts (a dynamic headroom rating of 10 to 20 dB). This would allow you to play CDs with typical crest factors of 15 to 20 dB, without clipping, and to exercise the peak sound levels the system is capable of generating—your ears willing!

I measured a wide variety of equalizer frequency responses at different control settings but have elected not to show them here because of space considerations as well as the complex nature of their interactions. Figure 16 shows the maximum boost and cut capabilities of the equalizer from 2 Hz to 1 kHz. Note the very high gain (20 to 25 dB) in the infrasonic range from 2 to 15 Hz. This could potentially

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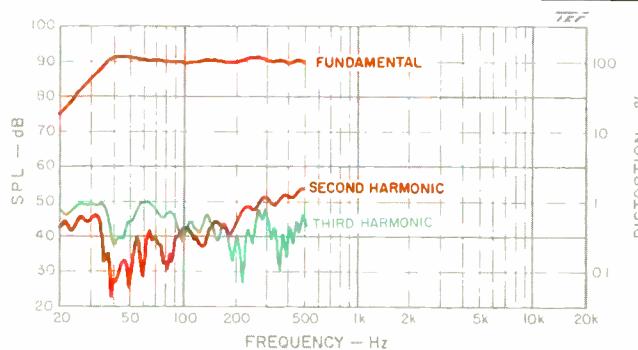


Fig. 12—Second- and third-harmonic distortion level vs. frequency for 90 dB SPL output at

1 meter on axis; input signal is 3.2 V rms (2.5 watts).

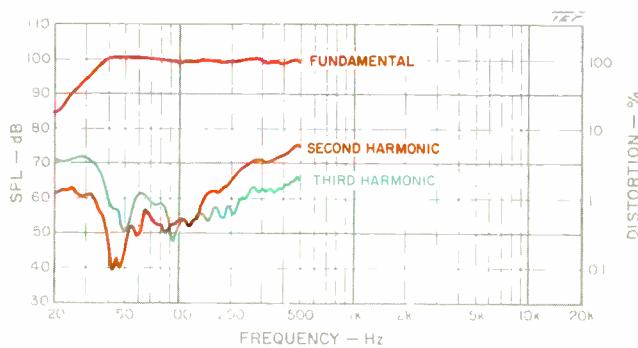


Fig. 13—Same as Fig. 12 but for 100 dB SPL at 1 meter on axis, using

input signal of 10 V rms (25 watts).

cause amplifier-speaker overload problems and decreased headroom if any significant infrasonic program energy exists. Lower frequency measurements indicate a first-order roll-off of 6 dB per octave below about 1 Hz. The first production release of the KUBE was actually d.c.-coupled and exhibited problems with some power amplifiers. The current version is a.c.-coupled to minimize these problems.

One source of potential infrasonic energy is from turntable rumble, where tonearm resonances may generate frequencies in the 5- to 8-Hz range. This problem is compounded by the fact that previous measurements showed the speaker's maximum input level below 20 Hz to be only about 6 V rms before excessive distortion is generated. Since I have designed speaker systems, I can sympathize with some of the design goals that led to this high amount of gain, but at least an optional high-pass filter with a high roll-off rate could have been provided to roll off the subsonic frequencies when needed.

I measured the equalizer's maximum input and output voltage capabilities when its controls were set to their maximum boost settings ("Extension" = 4, Q = 0.7, "Contour" = +3). A standard 10-kilohm load was used for these

measurements. Maximum voltage was considered to be the point where distortion of the output waveform became visible on an oscilloscope. The measurement (not shown) indicates that the lowest pass-band maximum output voltage was 3.5 V rms at about 2.5 kHz. Make sure you have your power-amplifier gain set high enough so that this limit is not reached by the equalizer. The measurement of maximum input voltage (also not shown) indicates a very low input limit of roughly 0.5 V rms for frequencies below about 15 Hz. This low level is due to the high gain of the equalizer in this frequency range. If you use the maximum gain settings, be aware that you risk overloading the equalizer (and the speaker!) if levels above these limits are sent to the unit. A typical Compact Disc player can generate levels of 2 V rms down to below 2 Hz, so watch out!

Use and Listening Tests

Listening tests were conducted primarily in my basement listening room. The room is somewhat small, with a volume of about 1,500 cubic feet (43 cubic meters). The walls are all non-parallel (by accident, not by design). The systems were placed 20 inches (0.5 meter) away from the wall and separated by about 8 feet (2.5 meters). The upper-frequency modules were aimed at the listening position on the couch along the opposite wall. My ears were at the same height as the tweeters when I was seated on the couch.

A good portion of the listening tests was actually done without the equalizer, not because I have an aversion to equalizers but only because the system sounded quite good without it. The upper-midrange peak at 2 kHz is quite moderate and was audible only when the program material contained energy in its range. I had to listen critically to the midrange frequencies to hear the effect of the equalizer being switched in and out.

It is always a good exercise to listen to a specific amount of spectral aberration being switched in and out of a signal path, to calibrate your ears to the audible effects of certain spectral shifts. The KEF equalizer is quite good for providing specific low-frequency adjustments to allow you to listen to the effects. It's quite easy, for example, to change the Q of the low-frequency roll-off from 0.3 to 0.7 to see how audible the change is. In most situations, the effect is quite subtle.

Several times, I found myself going up to the equalizer and twisting the controls back and forth to see if it was operating, and then doing a double take because it didn't seem to make much difference. The program material must have frequency content in the equalizer's adjustment range for you to hear the equalizer's effect.

Most of my equalizer-in-the-circuit listening was done with the factory-recommended settings of "Extension" = 4 (flat to 20 Hz), Q = 0.7, and "Contour" = +1. With the equalizer in the signal path, the system provided a very neutral listening environment, with no emphasis or de-emphasis of any part of the frequency range. Imaging was very stable and consistent. Reproduction of male singing voice with acoustic guitar was very accurate and realistic. Female vocals showed no hint of spectral imbalance. Because of the very close right/left matching of the speakers, there was absolutely no lateral shift of image with changing frequency. I was aware of some moderate roll-off of the extreme high



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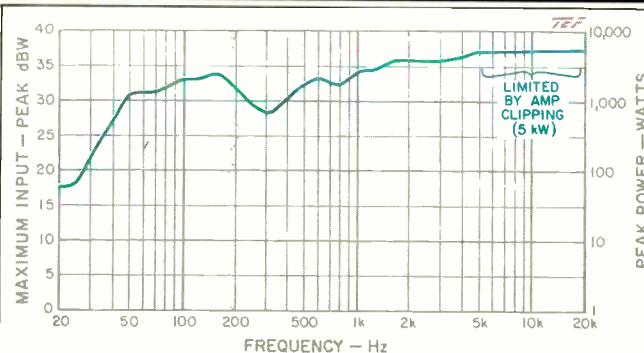


Fig. 14—Maximum peak input power for moderately clean output (see text). Above about 5 kHz, note that

limitations are imposed by clipping of a 5-kilowatt amplifier, not by the speaker.

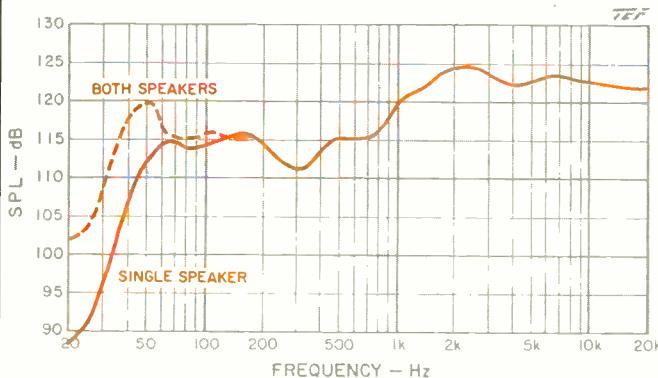


Fig. 15—Solid curve: Maximum peak SPL output at 1 meter, on axis, for input levels shown in Fig. 14. Dashed curve: Combined output of

two 107s measured at the listening position, including low-frequency gain from room interactions.

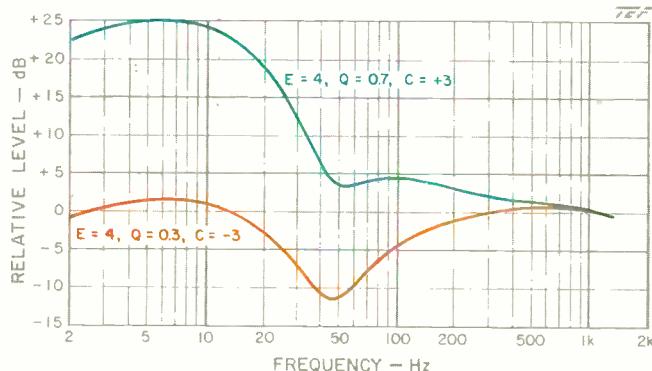


Fig. 16—Maximum boost and cut capabilities of KUBE equalizer supplied with the 107. Note the

high gain in the infrasonic region, below 15 Hz (see text).

frequencies at relatively large off-axis angles. Make sure that the high-frequency modules are aimed at the listening position to minimize this effect.

I initially was somewhat apprehensive about using the equalizer at settings near full boost, because of the amount of boost I knew it could provide. Subsequent listening proved that my worries were unfounded, however. At only one time was I aware of any overload problems I could attribute directly to the equalizer: The cannon shots on Telarc's CD of Tchaikovsky's "1812 Overture."

I suggest you make sure your power amp's input gain settings are set high so that the drive level to the equalizer is kept low. If you use the equalizer in the tape loop of a receiver, you could be in trouble because the full signal at the AUX input is typically fed through to the tape out, with no attenuation. This means that the full 2 V rms output (at 0-dB record level) of your CD player may be applied directly to the equalizer. If your player has adjustable outputs, use them to reduce the drive level to the equalizer.

The low-frequency response was always quite solid and very much in evidence when the program material demanded it. Pipe-organ pedal notes were reproduced with much authority. The low frequencies could get up to very impressive sound levels without any audible stress whatsoever. On transient bass passages, such as rock kick drum, the lows were very tight and could be turned up to levels that would make a professional drummer happy. The extended low-frequency response of the system unearthed some very low-frequency rumble, of which I was previously not aware, on a couple of my classical Compact Discs.

With three teenagers in my house, our listening system is subjected to many varied types of program material, from Mozart and Dave Grusin to ZZ Top and Run-D.M.C. The KEFs proved themselves very versatile in realistically reproducing everything from the subtleties of chamber music and delicate female vocals, played at low to moderate levels, to heavy-metal rock music, played at gut-thumping levels that only my teenage son could appreciate.

There are not too many systems that can do justice to such extremes in program material and not come out as a middle-of-the-road compromise. The KEFs did an extremely good job on all types of program material. The 107s are a fine example of a system that provides a good combination of physical size, high maximum output capability, very smooth response, and high power-handling capacity. In the true sense of the term, the KEF 107s can be considered a reference standard.

D. B. Keele, Jr.

D. B. Keele, Jr. is Manager of Software Development for the Technion Industrial Products Division of Crown International, Inc., makers of TEF measurement equipment on which the tests for this review were performed. Don Keele is a Fellow of the Audio Engineering Society, so honored for his work on vented box design, and helped develop the near-field woofer measurement technique. He has also worked at Electro-Voice, Klipsch, and JBL. He says that he is most proud of his design work on constant-directivity horns, an area where he holds three patents.

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EQUIPMENT PROFILE

3

SOUNDCRAFTSMEN PRO-CONTROL FOUR PREAMPLIFIER

Manufacturer's Specifications

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Input Sensitivity (For 0.5 V Output): Phono, 1.75 mV; high level, 120 mV.

S/N (A-Weighted, re: 2 V Output): Phono, 85 dB; high level, 105 dB.

Maximum Output: 8.5 V.

THD + Noise: High level, less than 0.005%.

SMPTE IM: Less than 0.005%.

Tone-Control Range: Bass, ± 10 dB at 60 Hz; treble, ± 10 dB at 10 kHz.

Output Impedance: 180 ohms.

Crosstalk: 90 dB.

Dimensions: 19 in. W \times 3½ in. H \times 10½ in. D (48.3 cm \times 8.9 cm \times 26.7 cm).

Weight: 9½ lbs. (4.3 kg).

Price: \$699.

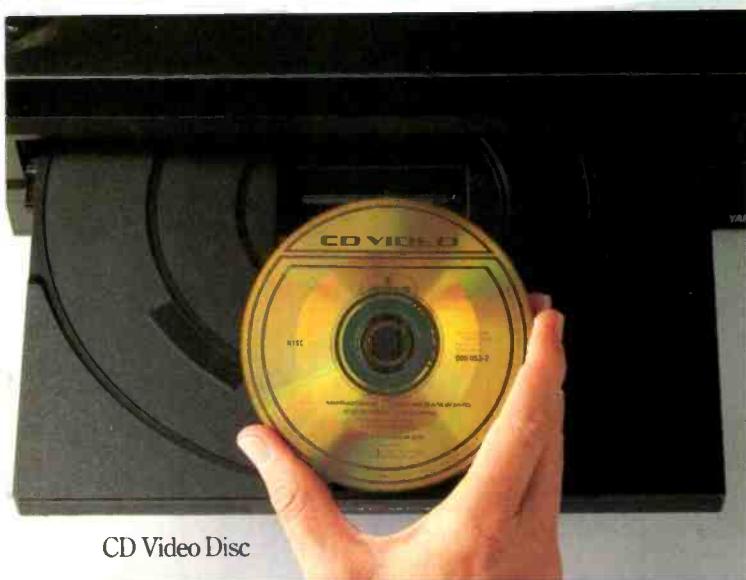
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Something I've always admired about Soundcraftsmen products is their ability to provide a great deal of flexibility and control without sacrificing the simplicity and direct signal paths of true "high-end" components. Soundcraftsmen may have a lower profile in the audio marketplace than do some of the more flamboyant West Coast audio firms, but if you check the U.S. Patent Office, you'll find that this company's engineers have contributed more than a modest number of circuit innovations over the years. A classic example is the so-called "Class-H" circuit, which utilizes a two-level output-stage power supply for improved efficiency in Class-AB and Class-B power amplifiers.

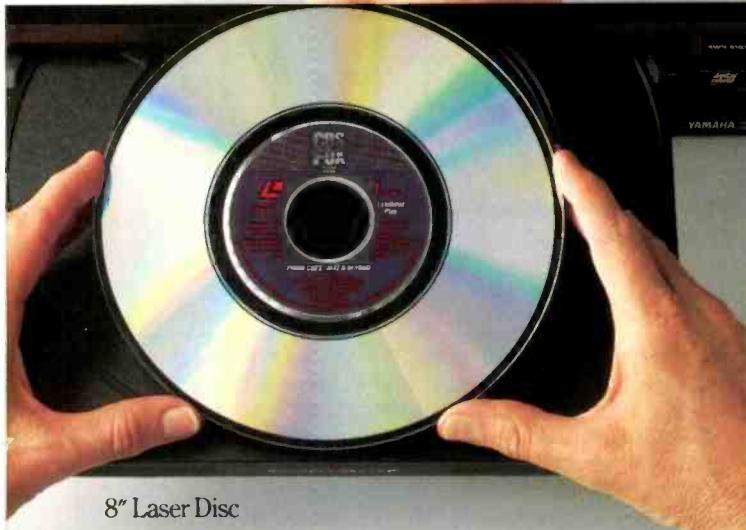
The Pro-Control Four preamplifier is another example of Soundcraftsmen's superb engineering and dedication to user convenience and product flexibility. It serves as a true control center without adding complications for the user. The preamp employs an independent solid-state switching technique designed by Paul Rolfs, the company's chief engineer. This switching system lets you route any input to the line outputs while independently routing that signal, or any other, to the five tape-recorder outputs (two nominally for audio decks, three nominally for the audio tracks of video recorders). Front-panel LEDs make it easy to keep track of system status; green LEDs show which inputs and proce-



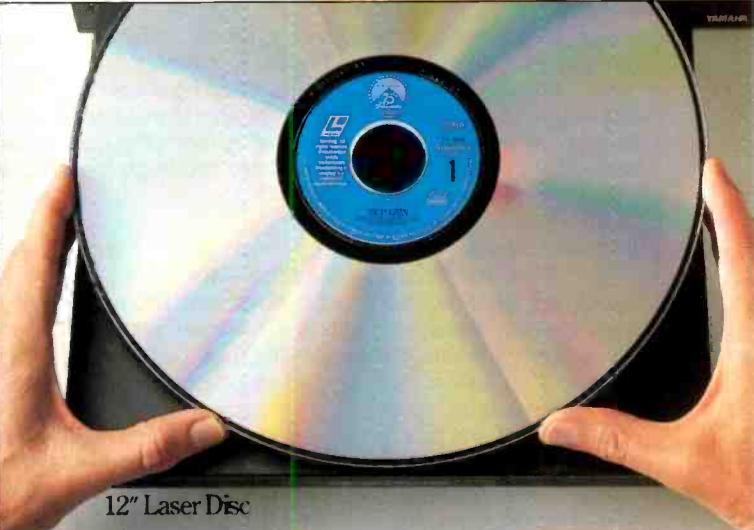
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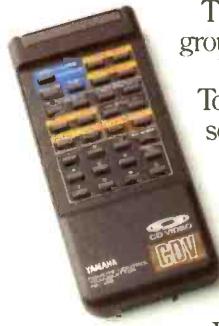


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The Pro-Control Four offers lots of flexibility without sacrificing high-end simplicity and direct signal paths.

sor loops have been selected for listening, and red ones tell you which have been selected for recording.

In addition to the multiple tape recorder loops, two more external signal-processor loops connect such components as equalizers, surround-sound processors, and ambience-recovery devices. These two loops can also be switched to function in either the "Listen" (line output) or the "Record" (tape output) mode. This flexibility allows you to conveniently and quickly apply an externally connected processor to the signal to which you are listening and another to the signal being recorded.

Subsonic filtering is available too, for either the listening or recording mode or for both at once. Conventional bass and treble controls are available in the listening mode only. For those who object to the presence of any signal-processing circuitry in a "pure audiophile-type" preamplifier, all such controls can be eliminated in the listen mode by touching a front-panel button labelled "Direct."

Control Layout

The Pro-Control Four's all-black, rack-mountable front panel has white control designations that I found easy to read even in subdued lighting. The rack-mounting holes come fitted with unobtrusive black plugs that eliminate this preamp's "industrial" look should you choose not to mount it in a "professional" rack.

A stereo phone jack is located above the "Power" button at the left end of the front panel. Nearby are buttons labelled "Listen" and "Record." Successive pushes of the "Listen" button cause the solid-state switching circuitry to connect CD, tuner, phono, or any of the five tape inputs to the signal path leading to line output; doing the same with the "Record" button makes connections to the five tape outputs. Designations for the program sources and the tape inputs/outputs are given in a horizontal row to the right of "Listen" and "Record"; the green LEDs mentioned earlier are located above the designations, and the red LEDs are below.

Just to the right of the front panel's center are two buttons for introducing the external signal-processing loops, plus a

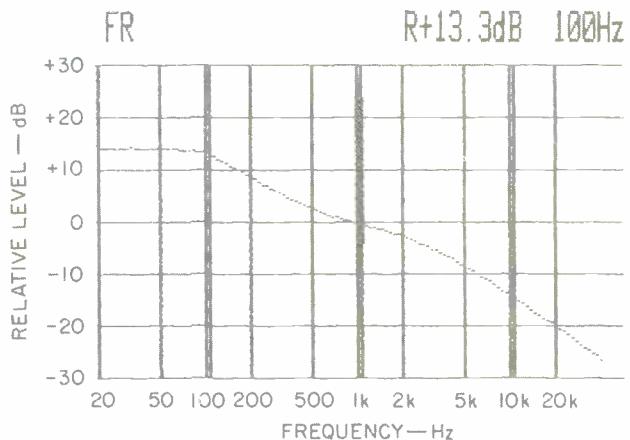


Fig. 1—RIAA playback characteristics.

subsonic filter button and the "Direct" button which allows bypassing of all control circuitry. Pushing either of the signal-processing buttons once will introduce an external processor into the "Listen" (line output) path, and pushing it again will introduce that processor into the "Record" path instead; however, the same processor cannot be applied to both paths simultaneously. The "Subsonic" button inserts a subsonic filter into either or both paths.

Small rotary knobs farther to the right adjust bass and treble. Completing the layout, at the far right of the front panel, are a large master volume-control knob, with a green LED that acts as a calibration pointer, and a small rotary channel-balance control.

The rear panel has 19 pairs of input and output jacks arranged neatly across nearly its entire width. Here, too, labelling is legible; even more important, it's easy to understand. All inputs except those for external processors are grouped at the left, with a ground terminal near the gold-plated phono inputs. The "In" and "Out" jacks for the two external loops are at mid-panel, and the five sets of tape output jacks are farther to the right. After these come two sets of line output jacks—normal and inverted. Some power amplifiers invert polarity from input to output; the availability of the inverted-polarity output jacks on this preamp makes it possible to re-invert the signal, if such an amp is used, so that correct polarity can be maintained from the preamp input to the speaker terminals. However, according to Soundcraftsmen, the main purpose of the inverted output is to allow the user to bridge two standard stereo power amps for greater power capability without using external adaptors, which could degrade the signal.

A pair of a.c. receptacles, one switched and the other unswitched, is at the extreme right edge of the rear panel. Although such receptacles are quite commonly found on the rear panels of audio equipment, those on the Pro-Control Four have enough power-handling capacity to be of practical use. The switched receptacle can handle up to





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A frequency response plot for this preamp would just be a straight line; it varied by less than 0.1 dB across the audio band.

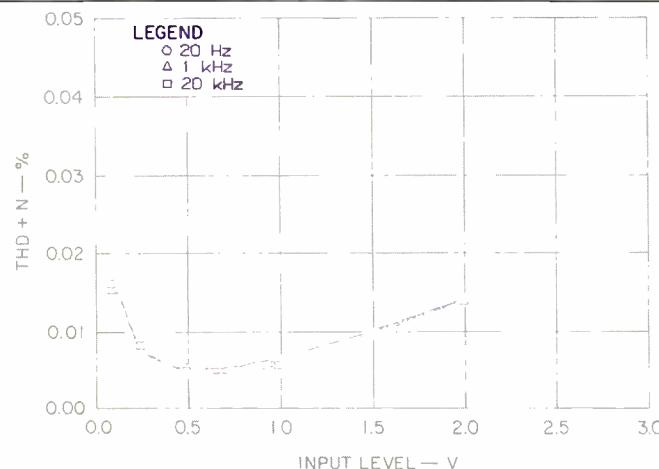


Fig. 2—THD + N vs. input level.

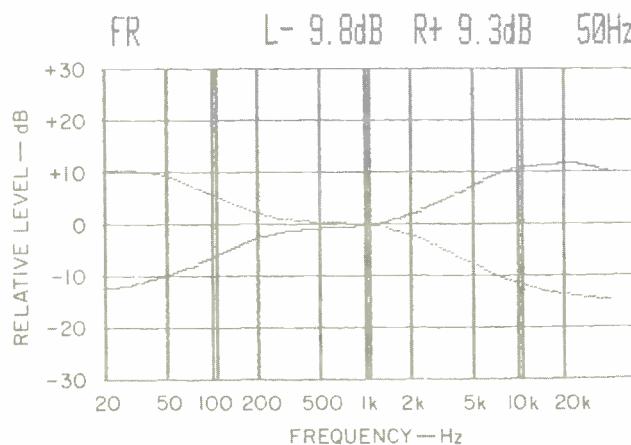


Fig. 3—Tone-control characteristics.

600 watts of power—more than enough to allow connection of most power amplifiers—and the unswitched receptacle can handle up to 550 watts. These receptacles are of the grounded type to accept the three-prong power cords now commonly supplied with many audio components. I'm sure many of you, like me, have sometimes wanted to connect a component to the power line via a convenience receptacle on another component only to discover that the receptacle was a two-slot type, while the line cord had a three-prong plug. Many people either cut off the third prong of the plug or install a "cheater" adaptor, without bothering to connect the green ground wire to a suitable ground point. Either course of action defeats the safety aspect of the three-prong plug. There's no such concern with the a.c. receptacles on this Soundcraftsmen preamp—a small point, per-

haps, but indicative of the good thinking that went into the Pro-Control Four.

Measurements

Frequency response for all of the high-level inputs was so flat throughout the audio range that any response curve I might plot would simply be a straight line, no matter how much I expanded the vertical scale. There wasn't so much as 0.1 dB of variation in amplitude from 20 Hz to 20 kHz. The -1.0 dB points were reached at 5 Hz and 165 kHz. As for RIAA equalization, it was accurate to within 0.2 dB at 100 Hz and within 0.4 dB at 10 kHz. The preamp's RIAA playback curve is shown in Fig. 1; the actual bass boost at 100 Hz was 13.3 dB, as shown, and the actual treble cut at 10 kHz was 14.1 dB.

Harmonic distortion plus noise via the high-level inputs, for 0.5 V input and with the volume control set at maximum, measured 0.0045% at 1 kHz, 0.005% at 20 Hz, and 0.0047% at 20 kHz. I should point out, however, that for other input levels, THD + N increased slightly, as depicted in the curves of Fig. 2.

Distortion decreased when the "Direct" or bypass mode was used. For example, with 0.5 V applied and the volume control set at maximum, high-level THD + N was only 0.0028% at 1 kHz, 0.003% at 20 kHz, and 0.0035% at 20 Hz. When switching from the normal to the "Direct" mode, I noted a very slight change in gain—no more than 0.1 dB—for any setting of the master volume control.

SMPTE-IM distortion measured 0.006% with 1 V input and the volume control adjusted for 2 V output. With 0.5 V in, IM increased slightly, to 0.009%, and with 2 V input, IM increased a bit further, to a still insignificant 0.011%.

Input sensitivity via the high-level inputs was 125 mV for 0.5 V output. I was somewhat surprised to find that although Soundcraftsmen quotes input sensitivity in accordance with the IHF/EIA Standard (which calls for a reference output of 0.5 V), they do not follow the same practice when specifying signal-to-noise ratio. Here, the IHF/EIA Standard calls for a 0.5-V signal for high-level inputs and a 5-mV signal for moving-magnet phono inputs. In each case, the volume control is then adjusted to produce an output of 0.5 V. Soundcraftsmen chose to reference an output level of 2 V, thereby coming up with a somewhat higher S/N figure than I did. Even so, my signal-to-noise reading for the high-level inputs was an outstanding 95 dB, A-weighted. I can't remember any other audio amplifier, preamplifier, or receiver that yielded such a high value for S/N. Since 0.5 V is approximately 12 dB lower than 2.0 V, I would have come up with a figure of 107 dB—actually 2 dB better than claimed—if I had conducted the test as Soundcraftsmen's engineers did.

THD + N via the phono inputs measured 0.015% for a 1-kHz, 5-mV input with 1.5 V appearing at the output. At 100 Hz, THD + N rose to 0.02%, and at 10 kHz it decreased to 0.01%. Phono sensitivity for 0.5 V output (the standard EIA reference level) measured 1.8 mV. Phono overload was the only even mildly disappointing measurement. I usually expect phono overload of such a carefully designed preamplifier stage to be at least 100 mV for a 1-kHz signal, but for this preamp it measured 90 mV.

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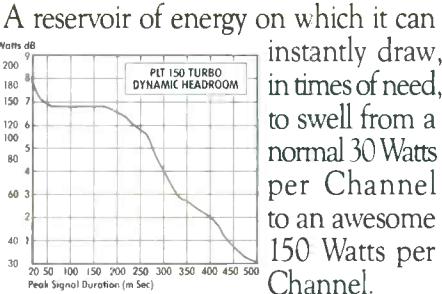
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My chief delight was with the versatile switching logic. What a joy not to hear any noise or clicks!

Signal-to-noise ratio in phono, referred to 5 mV input and 0.5 V output, was 84 dB. When I used the Soundcraftsmen's volume control to raise the reference level to 2 V output, the S/N ratio increased somewhat, to 87 dB. At this level, the relationship between S/N and output is no longer a linear one, since the limiting noise factor is produced by the preamplifier stages and is therefore nearly independent of volume-control settings.

Maximum output level before clipping was 9.3 V, and crosstalk between different sets of inputs was 92 dB. The bass control yielded 9.3 dB of boost and 9.8 dB of cut at 50 Hz, and the treble control yielded 10.9 dB of boost and 11.2 dB of cut at 10 kHz. The tone-control curves are shown in Fig. 3.

Use and Listening Tests

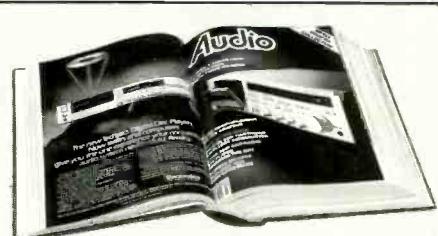
Although all of the measurements I made of the Pro-Control Four were certainly beyond criticism, my full appreciation for this well-designed component came only when I began to use it and to listen to different program sources through it. With the tone controls set to their flat positions (easily accomplished, thanks to well-defined detents at the controls' midpoints of rotation), I could not honestly detect any difference in sound quality between the normal mode and the "Direct" mode. Perhaps listeners more critical than I will be able to hear some improvement when switching to

the "Direct" mode; if they do, fine. For my ears, both settings yielded absolutely clean, uncolored sound that was no different from what I heard when the same high-level program sources were connected directly to a power amplifier. (This is a good test for any preamplifier, whose main purpose should be control rather than signal modification.)

My chief delight with the Pro-Control Four was its solid-state switching logic. What a joy to be able to switch a program source to a tape-out jack without hearing any switching noise or click in the program I was listening to at the time. Operation of this preamp/control unit is so neatly arranged that I was even inspired to pull out some of my old, long-abandoned LPs and play them on my almost totally abandoned turntable. You will probably be a bit surprised at the absence of moving-coil cartridge inputs on this preamplifier, but I reason it this way: Most audiophiles who are astute enough to appreciate a control unit like this one, and who also want to use an MC cartridge, are more than likely going to want a separate pre-preamp, or perhaps even a step-up transformer, to go with it. That being the case, Soundcraftsmen was wise in not penalizing those of us who prefer moving-magnet cartridges by adding a feature that would have raised the price of this preamp. As I think about it, Soundcraftsmen has exhibited audio wisdom in all aspects of the Pro-Control Four's design. To Paul Rolfes and his crew, my sincere congratulations! Leonard Feldman



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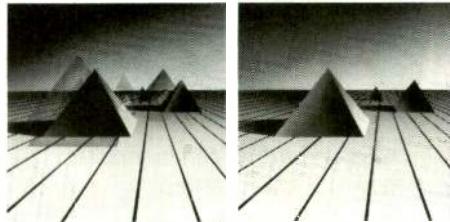
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NEW RECORDING ARTISTS

Paul Mahr and Andrew Gordon Share Some Musical Views

This month, our publisher's presentation spotlights cellist Paul Mahr and pianist Andrew Gordon, whose first recording of the two Brahms cello sonatas is scheduled for February release on Compact Disc. It was produced by Christopher Greenleaf for Classic Masters. Mahr, who has been studying his instrument since the age of 10, is just 24 years old yet has been principal cellist of the Richmond [Virginia] Symphony since the spring of 1986. He studied with cello virtuoso Stephen Kates at the Peabody Conservatory in Baltimore, spent a year at the Liszt Academy in his parents' native Hungary and earned a Bachelor's degree from the Juilliard School in Manhattan. Gordon, a native Bostonian who turns 29 this month, earned his Master's degree from Juilliard after studying at the New England Conservatory.

Since both musicians would like to pursue careers in chamber music, it isn't surprising that, for their debut recording, cellist Paul Mahr and pianist Andrew Gordon chose to play a pair of Brahms sonatas. While he feels the composer's solo piano works are "probably the least successful that he wrote," Gordon has an extremely high opinion of Brahms' chamber repertoire. "It's all fabulous," he enthuses. "It always seems to me there's a degree of spontaneity that isn't there in the piano music."

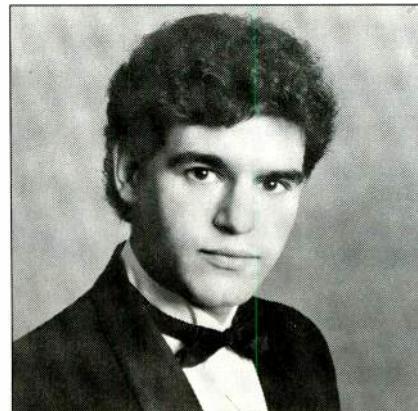
Mahr calls the first work on this new recording, Sonata #1 in E-minor, Op. 38, "very much a classical sonata, almost in the style of Haydn." Yet the young cellist finds a good deal of "repressed emotionalism" in it as well. The second composition on the disc, Sonata #2 in F-major, Op. 99, is, in Mahr's words, "more exuberant, outwardly." Dated 1886, the F-major sonata was written some 20 years after the E-minor piece. "It seemed to be a much more carefree time for Brahms," comments Mahr, "and I think that's reflected there."



Cellist Paul Mahr

Classical forms combine with emotion more characteristic of the Romantic composers in these Brahms works, leaving them open to a wide range of interpretation. This performance by Mahr and Gordon tilts toward the romance; the artists choose to savor certain passages rather than emphasize structure. This reading was arrived at through a great deal of work, according to Gordon, who notes that the duo spent a full month together rehearsing the sonatas prior to recording.

Rather than a studio, producer Christopher Greenleaf of Classic Masters suggested St. George's church in New York City as the venue for recording. In addition to its acoustical advantages, the church houses a



Pianist Andrew Gordon

nine-foot Steinway piano built a century ago, the same year, in fact, that Brahms wrote the F-major sonata.

These factors helped provide "optimum conditions" for the two-day session, says Gordon, and helped create the "sense of occasion" he personally finds necessary for an inspired performance. Consequently, "a number of things happened that didn't when we rehearsed but just occurred spontaneously at the time."

Performing and recording can be radically different experiences, of course. For Paul Mahr the latter provided the luxury of being able to do something a second time when necessary. "In this particular case we were able to experiment a bit with things," he states.

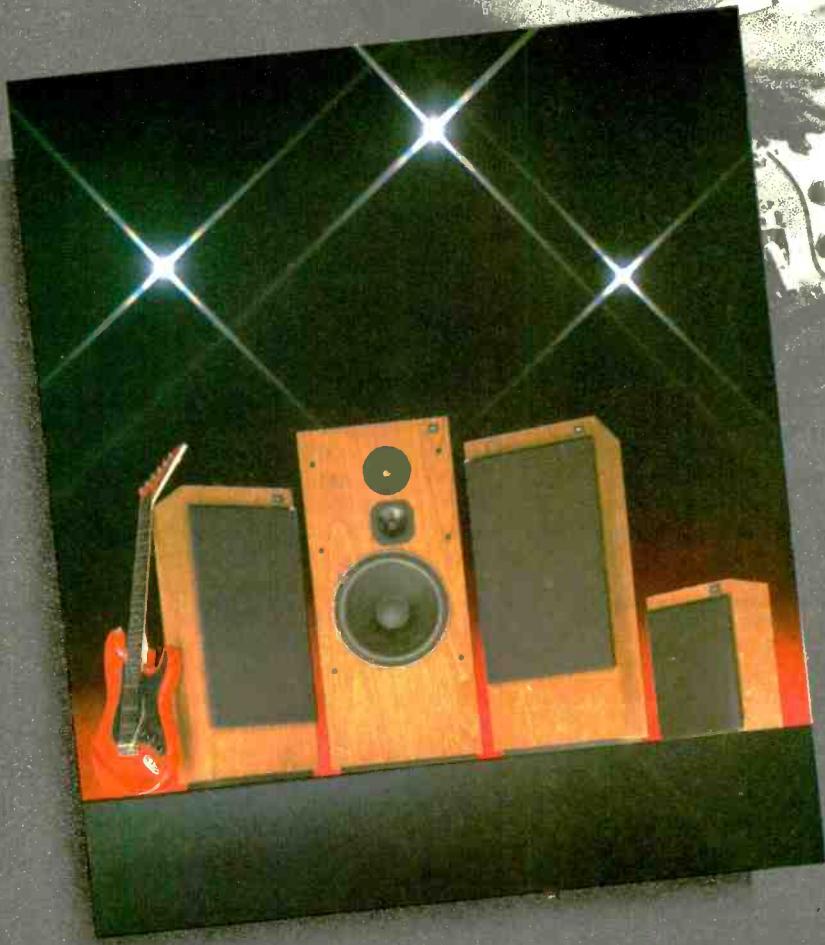
While Mahr dismisses many recordings as "all technology—piece of tape, piece of tape, piece of tape"—both musicians feel theirs preserves the continuity of a live concert since it consists largely of a single performance with only small splices to compensate for problems.

Because taping took place in summer in the heart of New York City, ambient noise caused many difficulties. The musicians, producer Greenleaf tells *Audio*, patiently worked their way through more than 100 takes of varying length and also took part in grueling editing sessions that tended to last into early morning.

While concertgoers, even musicians who are capable of recognizing wrong notes, display what Gordon calls a "threshold of tolerance" during live performances, both he and Mahr feel we expect more, often too much more, from recordings. "With the ability to cut and splice, the engineer has the capacity to create perfection that just doesn't conform to reality."

"The kind of perfection people want [from recordings] now is superhuman," the pianist concludes. "Yet perfection isn't supposed to be what you listen for. Communication is."

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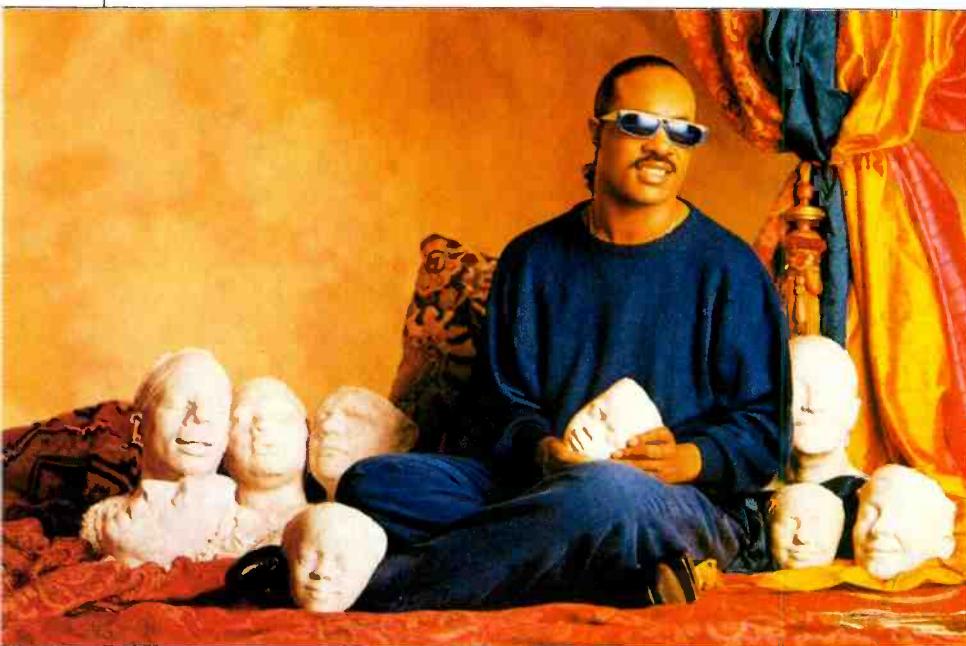
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POETRY IN MOTOWN



Characters: Stevie Wonder
Motown 6248ML, LP: 6248MD, CD.

Sound: A- Performance: A-

Stevie Wonder has had a very peculiar career. He recorded smash after smash during his teens, blossomed as a major singer/songwriter in his early twenties, and then reached a plateau on which his records were embraced by middle-of-the-road audiences while being dismissed by critics as fluff. This most recent recording seems to be at least a partial attempt by Wonder to make an earthier record, one with more edge than his last few efforts, while recognizing the realities of a competitive marketplace. It's not an easy task, but if anyone is equipped for it, Stevie Wonder is.

Characters may not be *Innervisions II*, but it's as powerful a record as Wonder's made this decade. Riff-oriented funk like "Skeletons" and solid songs like "Free" are welcome additions to the Stevie Wonder catalog, and "Get It" (a duet with Michael Jackson) comes on stronger than anything on *Bad*.

Wonder has made one small mistake: Almost without exception, all of the instruments on the record come from his synthesizer, and the result is a sameness of sound at times. This flaw doesn't diminish the record drastically,

but if Wonder had corrected it the recording might have had a little more depth. The occasional guitar from Ben Bridges is welcome, and the one LP track which features additional players ("Free") stands above the rest. B. B. King and Stevie Ray Vaughan do contribute to a CD-only track, "Come Let Me Make Your Love Come Down," but vinyl addicts are denied the pleasure. Gone are the days when a Stevie Wonder record brought us not only Stevie but the likes of Jeff Beck, Ray Parker, Jr., and David Sanborn. We are in the 80s, and this, apparently, is the new Wonder method.

Still, *Characters* is truly the best work in many years from one of the few pop geniuses around. Buy it in either format, but note that Compact Disc listeners get two additional songs for their money.

Jon & Sally Tiven

Big Generator: Yes
ATCO 2-90522, CD.

Sound: A- Performance: B+

"Big" describes the sound of *Big Generator*, the long awaited follow-up to the highly successful *90125*, as Yes continues to define state-of-the-art, late-'80s, high-gloss "art" pop.

Big Generator continues in the creative musical direction set when Trevor Rabin infused new ideas into the band:

Slightly obscure, poetical love lyrics are surrounded by a lush, heavily produced "orchestral" setting with enough hooks to give the material plenty of commerciality.

The title track sounds very like "Owner of a Lonely Heart." Other songs contain clever tributes to other artists: Beach Boys vocals in "Rhythm of Love"; orchestra tune-ups à la *Sgt. Pepper* in "Shoot High Aim Low"; a Booker T R&B beginning to "Almost Like Love"; and a chamber ensemble similar to the one found on The Beatles' *White Album* on "Love Will Find a Way." All these details are woven into a tapestry of constantly shifting instrumental sounds and effects, very hot licks, and intellectually stimulating structures.

Sound-wise, the music seems to be coming from inside a cavernous open space with a slightly distant presence, as if you're in an Escher labyrinth or, well, a big generator. This takes some getting used to.

Big Generator doesn't really break new ground, but neither is it a disappointment after such a long wait.

Michael Wright

Crest of a Knave: Jethro Tull
Chrysalis OV 41590, LP.

Sound: B+ Performance: A-

For a while there, it looked like Ian Anderson and company were all played out—musically, they had grown fainter and fainter until at last they'd become mere phantoms of their former selves. So it comes as a very pleasant surprise, after the band's last four or five ectoplasmic endeavors, to find that Jethro Tull's peculiar, patchwork muse has revived.

The strength's in the music, not the lyrics, which are poor to middling, at worst betraying an adolescent, sexist mentality pathetic in a grown man. The

Editor's Note: This month we continue our new policy, begun in the January issue, of presenting both LP and CD reviews in each of our three music departments ("Rock/Pop Recordings," "Jazz & Blues," and "Classical Recordings"). The separate "Compact Disc" department will no longer run.—E.M.

best is "Farm on the Freeway," which successfully conveys a worthy sentiment—that money is a pretty poor compensation for the loss of a family farm.

The music, on the other hand, is Tull in full flower. Perhaps some of Anderson's fans enjoyed his recent sojourn amongst the heaths and hedgerows of English folk music. Those who didn't will be glad to hear that he's back to what he does best: Pop, rock, blues, and even baroque.

Though there have sometimes been as many as five in the band, Jethro Tull is now down to a core of three: Anderson on vocals, guitars, keyboards, and flute; Martin Barre on guitars, and Dave Pegg on bass. Thanks to Anderson's return to the flute after several albums' abstinence, and Barre's mastery of a wide range of classical and pop techniques, to which he has recently added a sinuous and flowery country style reminiscent of Mark Knopfler's, the level of instrumental proficiency on the album is very high. Add to that Tull's typically imaginative and flexible arranging, a surprisingly good recording (it was made in Anderson's home studio), and a full, clear mix. With all of this working in the service of strong compositions, *Crest of a Knave* is consistently enjoyable and often thrilling.

Susan Borey

Document: R.E.M.
I.R.S. 42059, LP.

Sound: B Performance: B

The gloomy R.E.M. continues its slightly surreal assault on the status quo with *Document*, perhaps the group's best work since their debut EP.

The most notable change is Michael Stipe's singing, which has moved from his nose down to his chest, where it belongs. He now delivers lyrics that are well articulated and understandable—not that their meaning is any easier to figure out, though. R.E.M. remains masterful at the almost stream-of-consciousness juxtaposition of images—check out the wordplay on "It's the End of the World as We Know It (And I Feel Fine)." You'll feel like you've heard something profound but aren't sure what. Still, despite the impenetrability, this sure beats the slam-bam simplicity of much of pop music.

R.E.M.'s narrow, descending melodies ride over fairly simple (and usually distorted) garage-band accompaniments, greatly enhanced by Stipe's new voice. You don't listen to R.E.M. for hooks. Structurally, however, the songs are often interestingly complex; note the changes on "Exhuming McCarthy" and "Fireplace," for instance.

R.E.M.'s *Document* isn't the kind of record that will brighten your day; in



Robbie Robertson

fact, it may leave you feeling a bit uneasy. Not a bad achievement.

Michael Wright

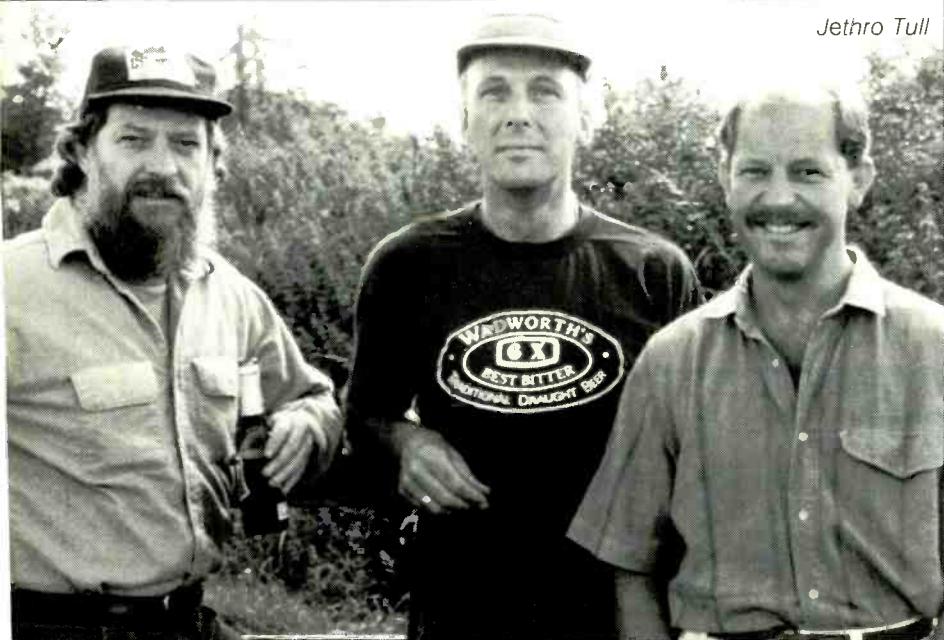
Robbie Robertson
Geffen GHS 24160, LP.

Sound: B Performance: B+

The rest of the album you can measure however you like, but there are three songs on this solo disc from Robbie Robertson for which only exclamation points are appropriate. These are songs so good they're shocking, songs that are passionate, precise, subtle, considered, surprising, important—and hot.

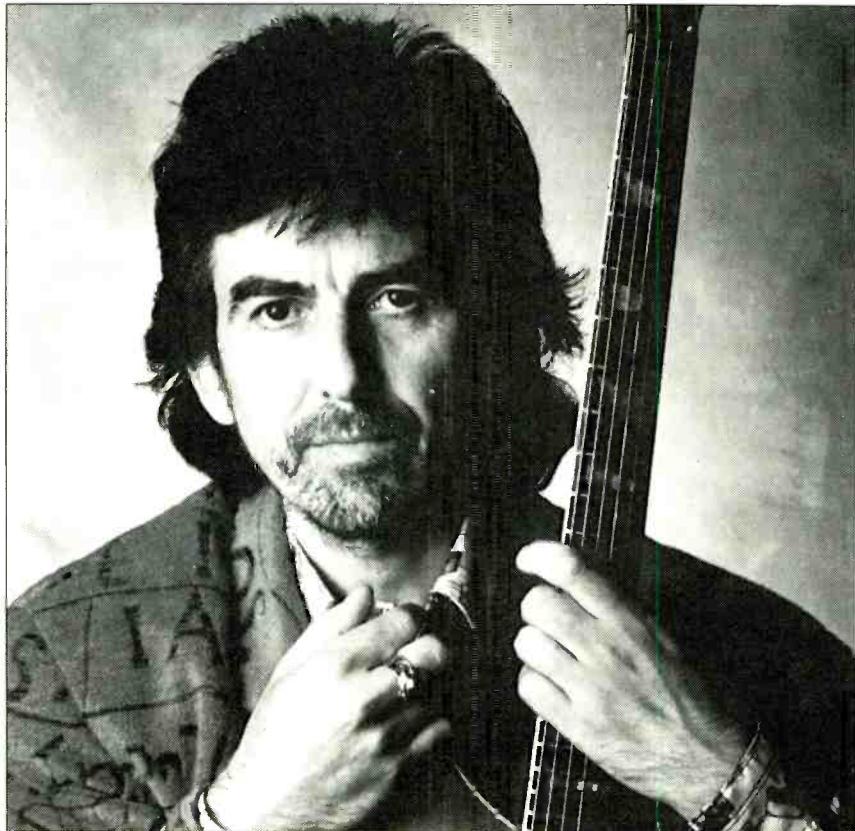
"Showdown at Big Sky" is a raunchy, minor-blues jump tune complete with rollicking bass and drums and understated pentatonic guitar fills that add an air of suspense. Over this, Robertson's voice is big and baaad as he delivers a bible-thumping sermon on the weapons race and the fulfillment of biblical prophecy. He pleads with man to be wise and with God to "Give us the strength, give us the wisdom, and give us tomorrow." What's especially nice is that Robertson had the wit to name the whole thing as though impending Armageddon were some kind of gunfight at the OK Corral.

For those whose appetite for the spine-tingling isn't quite so easily satis-



Jethro Tull

George Harrison's new LP shows a deeper level of reflection than his other solo efforts, along with a pleasant nostalgia.



fied, there's "American Roulette." Set to similarly dramatic, ominous, and rhythmically compelling (and danceable) music, the tale this time is of how James Dean and Marilyn Monroe gambled that fame and fortune would make them happy—and lost. It's very clever and very true; also haunting, sad, and moving.

In a related vein, we also have "Somewhere Down the Crazy River." Manu Katché's wonderful lurching drums, the deeply breathing music, the vast spaciousness of the sound provide the setting for a funny, moody monolog that's part Raymond Chandler and part voodoo. The way in which the lead vocal is treated in this song is typical of the excellent and attentive (but unobtrusive) recording throughout. There is very close, essentially untreated mixing for the deep, gruff, spoken verses, and a bit of distance and compression for the choruses, which make them sound like someone is singing into cupped hands or a seashell. Daryl Hall had better watch out, because Robertson soul-croons

just as beautifully, and he has true grit, real credibility, and a dash of mystery to boot.

These are the outstanding numbers on an album that is otherwise very good. The best tracks after those already mentioned are "Fallen Angel," which features Peter Gabriel, "Broken Arrow," also with Gabriel, and the U2 collaboration "Sweet Fire of Love." But in the end, these very good songs only serve, by contrast, to reveal how unusually excellent those inspired three are, and as a reminder of how many things must go right for creative work to turn out this good. Susan Borey

Crazy Nights: Kiss
Mercury 832 626-1, LP.

Sound: B+ Performance: A-

The formerly masked ones have unleashed a powerful new record that's more than competitive with the heavy-metal/glamrock offerings currently selling massive amounts of vinyl. Unlike some of their successors, this group comes up with real songs (drop your

needle immediately on "Hell or High Water"), plays exceedingly well (ace guitarist Bruce Kulick wails with the best of them), and brings us a blistering LP (with Ron Nevison producing) that actually sounds good.

Kiss has retained their patented noisy drum sound, dramatic entrances and exits, and unrelenting wash of distorted guitars. But they've also grown, to compete with slightly more adult-oriented hard-rock bands like Heart. Bravo.

Jon & Sally Tiven

Cloud Nine: George Harrison
Dark Horse 25643-1, LP.

Sound: B+ Performance: B+

Nearly 20 years ago today, George Harrison began making gently rocking pop records strongly informed by mysticism. On the surface, this continues with *Cloud Nine*. However, this first release from Harrison since 1982 contains a deeper level of reflection and a pleasant nostalgia in its conscious hearkening back to The Beatles' versatile sound.

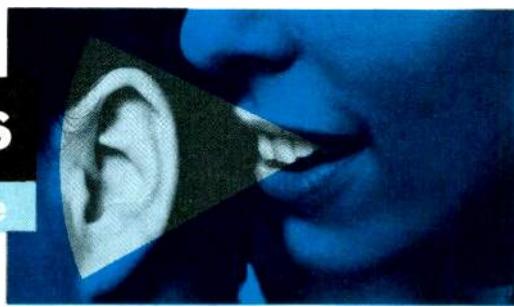
More interesting here than the nicely crafted pop melodies ("This Is Love") are the songs which show a seminal figure in rock 'n' roll coming to grips with middle age in a medium many feel is the province of teenagers. For example, "Wreck of the Hesperus" is a clever assertion of well-being as age advances. In "That's What It Takes" changing the world is still a goal, but somehow it's held with less energy. "Cloud 9" is a dialog between idealism and reality. "When We Was Fab" is Harrison's reminiscence of heady youth (Beatles fans will have fun picking out the musical quotes packed into this number). Even the love songs have the sensibility of a more mature person, someone who can appreciate both the burning flame and the warm, glowing coals ("Someplace Else," "Breath Away from Heaven").

Jeff Lynne's coproduction (with Harrison) gives the album a bright, airy, contemporary sound with a generous sprinkling of subtle effects such as phrase-end echo and reverb. Guest appearances by Eric Clapton and Ringo Starr add a welcome dimension.

Cloud Nine is good George Harrison. Listening to it is not unlike sitting around and having thoughtful conver-

COMPACT DISCLOSURES

February CDs of Note

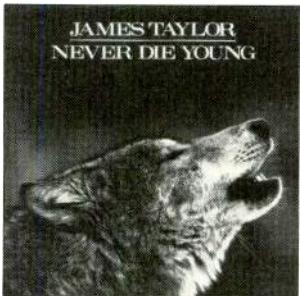


Still full of surprises after all these years, recent Rock & Roll Hall Of Fame inductee, BOB DYLAN, remains very much "Down In The Groove." In the new recording of that title,

he pays Dylanesque tribute to classics like "Shenandoah" and more recent hits like "Let's Stick Together." He then moves forward with new creations like "The Usual" and "Silvio." "Down In The Groove" spins onto CD this month.

LESS THAN ZERO

Too much time and too much money add up to "Less Than Zero" for a group of jaded young Southern Californians in the recent film. Too much talent, however, amounts to one of the most original and exciting movie soundtracks of recent years. Featured artists include AEROSMITH*, L.L. COOL J, ROY ORBISON and ORAN "JUICE" JONES, not to mention the BANGLES performing their hit, "Hazy Shade Of Winter." "Less Than Zero" premieres on CD this month.

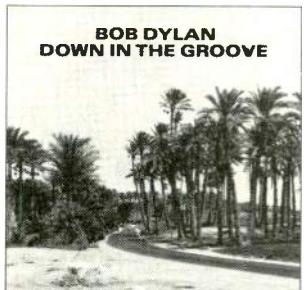


DYLAN GETS DOWN IN THE GROOVE

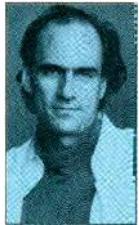
JAMES TAYLOR OPTS FOR THE LONG HAUL

LESS THAN ZERO = 11 HOT NUMBERS

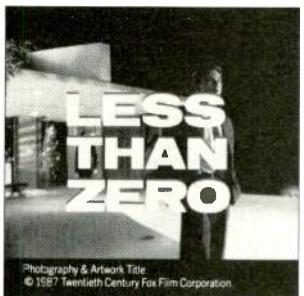
CTI MASTERS OF JAZZ GET REMASTERED



Old news is good news for jazz aficionados this month as CBS debuts the third wave of releases featuring the incredible roster of jazz greats that recorded for the CTI label. In total there are more than forty titles now available from the likes of George Benson, Deodato, Hubert Laws and Freddie Hubbard, including three samplers entitled "Fire Into Music." All digitally remastered, most of the new releases have been embellished with rare additional tracks that couldn't fit on the original records.



Yet another music legend offers living proof that a star should "Never Die Young." JAMES TAYLOR's latest, his first LP in over two years, builds on the distinctive musical style that has earned Taylor the undying support of fans young and old. The new recording features some of the music you heard if you caught Taylor on his concert tour late last year, including the title song. (If you didn't get to hear him live, make sure you tune in to the PBS Broadcast of the concert next month.) "Never Die Young" is born on CD this month.



OTHER FEBRUARY CD RELEASES! RYUICHI SAKAMOTO "Neo Geo"/SANCTUARY "Refuge Denied"/CHRIS JASPER "Superbad"/CHARLIE SINGLETON & MODERN MAN "Nothing Ventured, Nothing Gained"/THE BYRDS "Greatest Hits"/PUBLIC ENEMY "Yo! Bum Rush The Show" THE BYRDS "The Original Singles/Volume 1"

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Many blues-based styles converge on Supertramp's latest, including gospel and soulful, melodically sophisticated ballads.

sation with old friends. It's a very interesting alternative to artists who continue to pretend they're still 18 or, worse, give up rocking for anemic balladry.

Michael Wright

Hearts of Fire: Various Artists
Columbia SC 40870, LP.

Sound: B— Performance: B

Less Than Zero: Various Artists
Columbia SC 44042, LP.

Sound: C— Performance: D

The movie business and the record business have been having a lot of bastard children lately. They're called soundtracks. They are rarely great and occasionally good, but mostly they're stuff churned out to fit a scene and please some stogie-smoking honcho who wants to wring every drop of profit out of a project.

Hearts of Fire gives Bob Dylan some good material to sing, and if the whole record were as listenable as his ver-



sion of John Hiatt's "The Usual," it'd be fine. Unfortunately, Fiona, a fine young singer in her own right, is matched with B-grade material which is, for the most part, way beneath her. No matter how hard she tries, she can't breathe life into these songs. Rupert Everett, one of the other principals in the movie, has a hard time finding his voice, and we sure can't.

Less Than Zero features a snappy version of Simon and Garfunkel's "Hazy Shade of Winter" by The Bangles and a rocking contribution from Joan Jett, but the rest of the album consists of flaccid remakes of songs which were far better in their previous incarnations. Sound is mudlike, as if it matters. But gracious, this record was meant to be enjoyed in the theater, not at home!

Jon & Sally Tiven

Free as a Bird: Supertramp
A & M SP 5181, LP.

Sound: B Performance: B

Hai Hai: Roger Hodgson
A & M SP 5112, LP.

Sound: B Performance: B

In 1983, after a fruitful 14-year partnership with Rick Davies, Roger Hodgson split in half the songwriting nucleus of Supertramp to pursue a solo career. Left at the helm of Supertramp with all the songwriting duties, Davies steered the group away from the direction that used to be called "progressive"—intricate, sometimes whimsical arrangements carrying complex, often convoluted messages. Davies gravitated towards a grittier, harder hitting sound that epitomizes the upper-class Englishman's concept of R&B, and he has developed this even further on *Free as a Bird*.

Many blues-based styles converge on the album, including call-and-re-





Starship's *No Protection* has a big problem: All the songs are well intentioned, but they're heartless.

sponse gospel, growling staccato blues, and luscious ballads that are as soulful and as melodically sophisticated as anything Michael McDonald might put out. Equally diverse are the arrangements, which sport everything from a six-piece horn section to baroque-sounding strings.

By comparison, Hodgson's second post-Supertramp album, *Hai Hai*, has a smoother continuity of styles and arrangements, which makes it sound like the product of a band that's been together for years. Perhaps it's because Hodgson plays so many of the instruments on the album (though he does get contributions from Omar Hakim, Lee Sklar, and Toto alumni Jeff Porcaro and David Paich). Or perhaps it's because Hodgson chooses to explore a narrower musical range than does Supertramp, leaning towards simpler, groove-oriented songs whose hooks are more rhythmic than melodic. But though his songs are musically simple, their lyrics are not: While Supertramp

seems to eschew anything more complex than basic boy-girl themes, listening to *Hai Hai* is like walking through a maze whose walls are the pressures of life.

Both Hodgson and Davies recorded these latest efforts in home studios; the very high production quality achieved by both is characterized by sparkling separation and a sound so bright that it seems to jump off the record.

Susan Borey

No Protection: Starship
Grunt 6413-1-G, LP.

Sound: B Performance: C

After listening recently to the extensive Jefferson Airplane retrospective (*2400 Fulton Street*), auditioning *No Protection*, the latest by Jefferson Air-

plane's descendant, Starship, is pretty depressing. There's no adventure whatsoever in the music. It does have a relentless earnestness and a shimmering, modern '80s sound, full of synths and sequencers, but there's no fun in it at all. It is, as they say in the music biz, mere product.

The 11-song program is the work of three producers. The one song produced by Narada Michael Walden, "Nothing's Gonna Stop Us Now," has already been a hit. Keith Olsen helmed four cuts, and Peter Wolf produced the rest. Wolf's six are full digital recordings, as evidenced by a drum sound that's snappier than that of the analog tracks.

Yeah, Grace Slick and Mickey Thomas do sing very well here, and Craig Chaquico's guitar leads are ear-catching. However, the songs sound like Journey retreads, well intentioned but heartless. And that's the big problem with *No Protection*.

Michael Tearson

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CLASSICAL RECORDINGS

MORE THAN MINIMAL

Daniel Lentz: The Crack in the Bell
Angel/EMI CDC-7 49180 2, CD.

Sound: B+ Performance: B

John Adams: The Chairman Dances.
The San Francisco Symphony; Edo De Waart.

Nonesuch 79144-2, CD.

Sound: A- Performance: A-

Steve Reich: Drumming

Nonesuch 79170-2, CD.

Sound: A- Performance: B+

Daniel Lentz, John Adams, and Steve Reich would seem to have a good deal in common: All three are contemporary American composers, all are strongly associated with minimalism, and all have recent releases on CD. However, minimalism is a term whose meaning has become diffuse since it was coined 20 years ago. Today, it can be argued that only Reich adheres to the genre's original precepts, and that Adams and Lentz represent a post-minimal development.

Certainly there is nothing minimal about Adams' collaborations with Edo De Waart and the San Francisco Symphony Orchestra, nor Lentz's diverse use of multi-tracked instrumentation and echo systems or his melodic approach to composition. Sure, the pulse throbs on, but the textures of the music have become more richly complex. "Less is more" has given way in many instances to "more is more," and a form once noted for its linearity has become increasingly parabolic. At least in the hands of Lentz and Adams, minimalism is becoming maximalism.



Daniel Lentz reveals in his work a definite "pop" sensibility which, in concert, would not be out of place with Talking Heads or Fleetwood Mac. His compositions contain a mellifluousness that is not present in other works of the genre, as he creates motifs that have a melodic identity as well as a rhythmic one. While much of Lentz's music is written for keyboards and synthesizers, he also writes specifically for the voice, and words are an integral part of his compositions. Though oblique, the song pieces on *The Crack in the Bell* are more listenable, in my opinion, than those to be found on Philip Glass' *Songs from Liquid Days*.

The Crack in the Bell features five pieces, four of which are termed "songs." The title cut sets an e.e. cummings text, "next to of course god," into an interaction of live and electronic sounds for which The Daniel Lentz Group is joined by members of the Los Angeles Philharmonic New Music Group, with John Harbison conducting. It opens with a heavy chord which flares from organ into brass before transforming into a panoply of vibrant instrumental colors: Pianos, clavichords, dulcimers, and flutes; what sound like steel drums, marimbas, and vibraphones, and an assortment of bells, cymbals, and percussion. The acoustic and electronic instrumentation—three Yamaha KX-88s and two synthesized mallets—is enhanced by studio techniques utilizing various ech-

oes and multi-track layers of sound, to heighten the effective stereo imaging. "The Crack in the Bell" demands of its singer a singular dexterity, one which Jessica Lowe almost manages; an occasionally errant sense of pitch and a certain stridency of tone, however, diminish its consideration as a vocal tour de force. Nonetheless, Lowe's performance is still impressive.

Other cuts include "Wild Turkeys," a conundrum of rhythmic interpolation with 350 keyboard figures performed by three synthesizer players; "The Dream King," which draws from two speeches by Martin Luther King, Jr., with two processed voices plus 128 keyboard figures; the very pretty, dreamy "Lullaby," in which the singers' voices are multi-tracked to create a choral effect across which a lovely harp spirals, and "Adieu," which is scored for six voice parts and eight keyboards. On this last piece, Lentz essentially subverts the elemental triteness of clichéd lyrics like "baby come back, please don't leave me" into a rondelet of self-involvement and then juxtaposes quasi-medieval choral sounds and Jessica Lowe's vocals against the percussive movement of the synthesizers to create an intriguing collage.

While Daniel Lentz continues his evolution, there can be little doubt that John Adams is already established as one of the most important composers of this decade (and probably of the next as well). Following the success of Adams' *Harmonielehre*, Nonesuch has released a new all-digital recording of



Illustrations: Rick Tulk

five pieces written between 1973 and 1985. The title work, "The Chairman Dances," is Adams' most beguiling and fanciful to date. The composer paints his Chairman Mao with a spectacular sonic palette which brings to mind the grandiose cinematic eloquence of Bernard Herrmann or Bronislau Kaper. Subtitled "Foxtrot for Orchestra," "The Chairman Dances" has a modern-jazz balletic feel and a sense of stylized theatricality. There is, too, a certain portentous surrealism as Chairman Mao and Madame Mao dance out their destiny together. Adams energetically propels huge blocks of sound, permeated by strobe-like percussive effects, into enormous climaxes and then suspends brief contrapuntal phrases above the main pulse before driving them off with immense cadences. Then gradually the dancers dissolve and fade. The stereo, incidentally, is luxuriant.

The second piece, "Christian Zeal and Activity" has a sober, hymnlike quality which is in sharp contrast to the exultant mood created by the first. It serves as a sort of preamble for "Two Fanfares for Orchestra," the first of which, "Tromba lontana," conveys the same luminous mysticism as Ives' "The Unanswered Question." The second fanfare, "A Short Ride in a Fast Machine," is a more delirious piece, with the orchestra and synthesizers steadily pounded along by the sound of wood blocks before resolving into a brief, almost traditional fanfare for four trumpets. The last piece, entitled "Common Tones in Simple Time," reveals Adams' link with minimalism. It has an ethereal quality, with violins and violas that shimmer and vibrate as two pianos echo out of phase. Strings, oboes, flutes, and finger cymbals resonate in long, sustained notes as the pulse swells and condenses in a prism of tonal diffusion, the sounds rippling and cascading against each other. What is at first perceived as something diminutive is gradually revealed to be more prodigious. Thus, "Common Tones in Simple Time" becomes an entrancing journey of revelation and awe.

The Chairman Dances is superlative composition, performed by the San Francisco Symphony with exuberance and precision under the flair of conductor Edo De Waart. This recording



illuminates just how far the minimalist movement has developed over the past decade, and it can be recommended to anyone with even a cursory interest in modern music.

Minimalism cannot be discussed without mention of Steve Reich, who, more than any other composer, deserves credit for the music's popularity. All of Reich's major works are available on CD, and now *Drumming*, a 1987 recording of a seminal work composed between 1970 and '71, has just been released. *Drumming* is not "conventional" Western music. The influence is heavily African, and at first there is no discernible melodic tone to attract casual ears. Therein lies the wonder of the piece, because imperceptibly the timbral resonance of the four pairs of tuned bongoes invokes a subtle musicality. Gradually, a percussive vortex begins to form, and the harmonics and echo create a dimension of their own. From the hypnotic repetition of the beat emerge patterns that rise and fall, insistent and incessant, fluid in their tension.

Drumming comprises four parts. The first sets the basic pattern, the second merges three marimbas (played by nine players) with two women's voices, the third introduces three glockenspiels along with whistling and piccolo, and the fourth combines all the instruments and voices. There is only one basic rhythm pattern, but by shifting its phase and by fading the various instru-

ments in and out, considerable rhythmic variations develop, and the piece's timbre is gradually altered. Its inherent simplicity becomes elaborately sophisticated.

Drumming is a true artifact of minimalist composition, and there is a lode to be uncovered in its subliminal convolutions. Whether you have experienced other Reich works or not, you may find that once you get into *Drumming*, it may well get into you. It represents minimalism to the max.

Michael Aldred

Classic Gershwin: Various Artists Columbia MK 42516, CD.

George Gershwin died 50 years ago, and there have been the predictable concerts, homages, recitals, even a new biography. Columbia has added this freshly produced Compact Disc of *Classic Gershwin*, and it is a worthy addition to the collection. Here's Gershwin himself on the 1925 piano-roll version of "Rhapsody in Blue," with today's Columbia Jazz Band and Michael Tilson Thomas added by the magic of modern technology. And what a glorious beginning this is, with the harmonies unusually clear and with the flapper-era frenzy in all its glory. You hear the triangle in the *Largo* section, the celeste a moment later—and you have a fresh appreciation for Gershwin's wondrously apposite orchestrations. Tilson Thomas has rever-

Classic Gershwin offers a variety of performers on one shimmeringly produced, exquisitely transferred, first-rate Compact Disc.

ence for the composer's unexpected changes in tempi, and that's all to the good.

"An American in Paris," with Leonard Bernstein and the New York Philharmonic, has a freshness too. Bernstein takes his time conducting the jaunty trumpet solo about one-third of

the way through, and so the percussion that follows becomes a swaggy counterpoint. The syncopation, never gratuitous, highlights the string section immediately following.

Michael Tilson Thomas plays the "Three Preludes for Piano" with attention and evident affection. The second

is arguably the single loveliest solo-piano piece Gershwin wrote and one of the glories in the instrument's modern library; Tilson Thomas offers it with all the work's tentative poignancy and limpidity. Only the preludes, the Jean-Pierre Rampal rendition of "Liza," and John Williams' guitar performance of "A Foggy Day" are digital originals, but there's a seamless clarity, and only the churlish, golden-eared expert will detect a difference.

Assuring variety, the disc includes Cleo Laine singing "Embraceable You" (lyrics by Ira Gershwin), but her low voice is perhaps a bit too smoky, a mite too self-conscious here. Rampal's flute solo for "Liza" gives us all the vitality and clarity of the instrument's little sunbursts, and what an experience on this silvery Compact Disc! But John Williams' cut of "A Foggy Day" has been overorchestrated and over-accompanied. Also curious is Zubin Mehta leading the New York Philharmonic in a spiritless rush of what is fatuously called a "Medley from the Woody Allen Film Manhattan," as if Allen justified Gershwin.

The disc concludes with the "Overture to Porgy and Bess" and a medley from the same sung by Sarah Vaughan (and evidently recorded live under Tilson Thomas and the Los Angeles Philharmonic). There are disruptive bursts of applause, and Vaughan's interpolations are, typically, somewhat exaggerated tinsel to my ears. Why the italicized consonants? Why the extended vowels and idiosyncratic diphthongs? Well, Vaughan fans will adore it.

These hesitations aside, this is a first-rate Gershwin disc, shimmeringly well produced, exquisitely transferred. I'd have liked more comments in the notes (any comments would have done) and a somewhat more judicious selection of sung solo pieces, but what's here is superb. Donald Spoto

Piano-Theatre: Martha Anne Verbit, piano.
Spectrum SR 322, LP.

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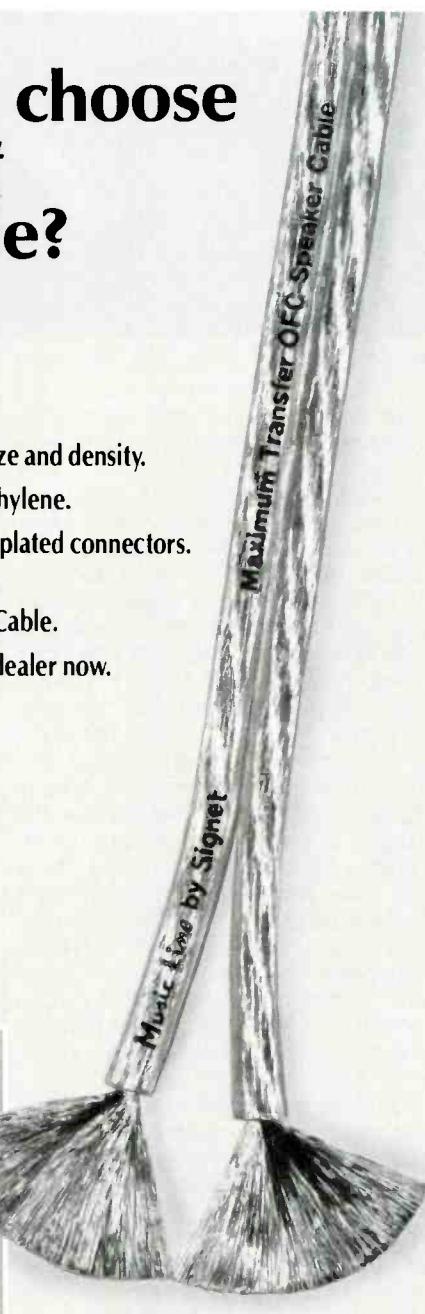
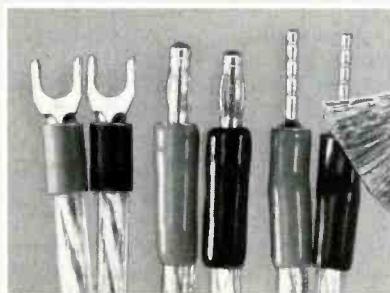
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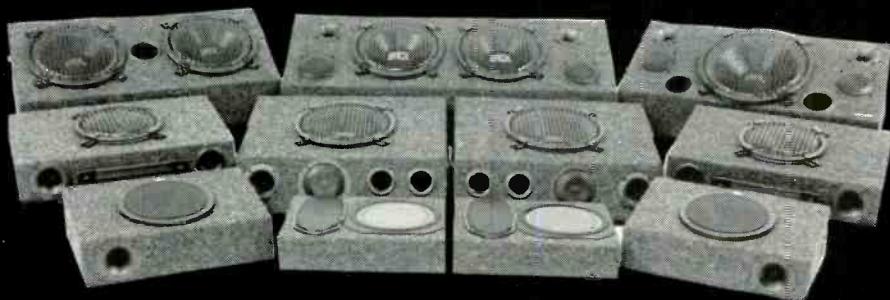
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In light passages, Verbit's touch is feathery; in loud segments, she is hard-toned but uses a lot of pedal. Interesting contrast.

hear how pop, theater, and classical idioms have intermingled and developed together in this century, you'll find this LP fascinating—beginning with Gershwin and ending with Ravel, poles apart in background, who met and influenced each other to an astonishing degree.

Verbit has an intriguing piano style, basically neo-Romantic, with lots of hesitations (more than the older pianists) and an almost exaggerated sentiment. Verbit's playing is classical-sounding, yet she has an ear for pop and especially for the tricky "sour note" harmonies that flourished all

over, from old Satie through Poulenc. In her lighter passages she has a feathery touch, very feminine (if I do say so); in the louder, brassier segments she is hard-toned but uses a lot of pedal. Interesting contrasts. Within this styling, her ear is faultless, as too many pianists' are not. She catches every quirk of harmonic change, every vinegar bit of melody in the "wrong key." You could not do better for making history into audible music of the liveliest sort.

Verbit's playing passes on one extra lesson—probably unintentionally—via the big Joseph Fennimore piece included here. Fennimore is ostensibly writing in the style of a 1930s Hollywood glamour movie. What you will actually hear is an evocation of all the rest of the composers on this disc, in an expertly mishmash style that reminds me of a cocktail lounge. It may be a set of vignette variations, but if you want the real thing, go listen to Edward Elgar's "Enigma Variations." Coming after this fulsome piece, the music of Satie is refreshingly tight and clever, ragtime and all. Good lesson.

A fine digitally recorded LP here, mostly as silent as the grave in the S/N. Does everybody notice how superbly improved most recent LPs are—now that they are hopelessly out of date?

Edward Tatnall Canby

John Duffy: Heritage—Symphonic Suite with Narration. Israel Philharmonic Orchestra, Zubin Mehta; Abba Eban, narrator.

CBS Masterworks M42566, LP.

John Adams, Charles Wuorinen, Jacob Druckman, and Joan Tower are among the many American composers whose residencies with major U.S. orchestras have been facilitated by an organization called Meet the Composer. As MTC's founder and president, John Duffy is widely recognized as a vital catalyst in disseminating the work of living American composers.

As it turns out, Duffy is also a composer himself. Unlike most of his colleagues, he does not mine the minimalist or the avant-garde vein; rather, he specializes in the traditional, lushly orchestrated film score. He has apparently written over 100 of these, mostly for network television. *Heritage—Sym-*

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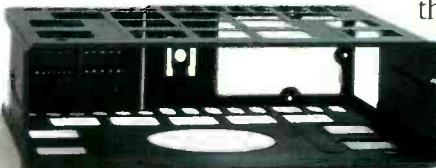
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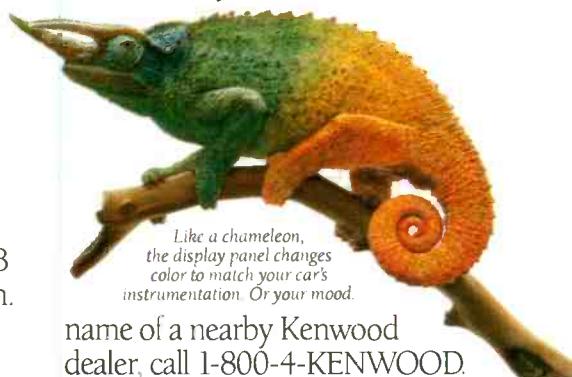
theft prevention makes perfectly good sense in light of the number of very desirable features Kenwood's KRC-858 and KRC-757 offer. Like the improved Automatic Noise Reduction Circuitry that adds to the clarity, and the reputation, of our quartz synthesized tuner. And our programmable Scan/Seek function that allows you to sample from a previously selected number of preset stations entered into the unit's memory.

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John Duffy's *Heritage* is straight-ahead program music that serves its narrative context well.

phonic Suite with Narration is a distillation of his Emmy-winning score for *Heritage: Civilization and the Jews*, a nine-hour WNET series that first aired on PBS in 1984. The recording features narration by Israeli statesman Abba Eban, author of the book from which the series was derived and also the

show's host. Text is by Marc Siegel, the series coproducer.

Duffy states in his liner commentary that his music is based on the shofar (a ram's horn used in Jewish observances), which is capable of two notes, usually a fifth apart. As such, his theme is a fifth-based fanfare reminis-

cent of Copland's "Fanfare for the Common Man." It is a grand, heralding statement dominated by brass and thundering percussion. This is straight-ahead program music, tailor-made to plot line and text: shimmering strings underlie such phrases as "the promise of hope"; wild, 7/8 rhythms dominate the "Dance Before the Golden Calf"; a plaintive solo viola mourns the Holocaust; menacing percussion and low strings punctuate the reading of those Commandments that deal with murder and adultery. Throughout, traditional-sounding melodies abound, rendered by muted brass and talking, laughing upper winds.

Heritage serves its context well; with Siegel's text and Duffy's skillfully orchestrated aural allusions, visual images come easily to mind. Eban weaves a good story, his British inflection lending an air of genteel academia to the proceedings. The Israel Philharmonic is also in good voice, with Duffy apparently having been on hand to guide Zubin Mehta's interpretation. Recording is quite clean and has plenty of depth; the shofar sounds appropriately distant, as if played from a mountaintop. The wind machine, which is heard several times on side one, woefully sounds like a wind machine; otherwise, this is a convincingly cinematic presentation, full of skillfully created images.

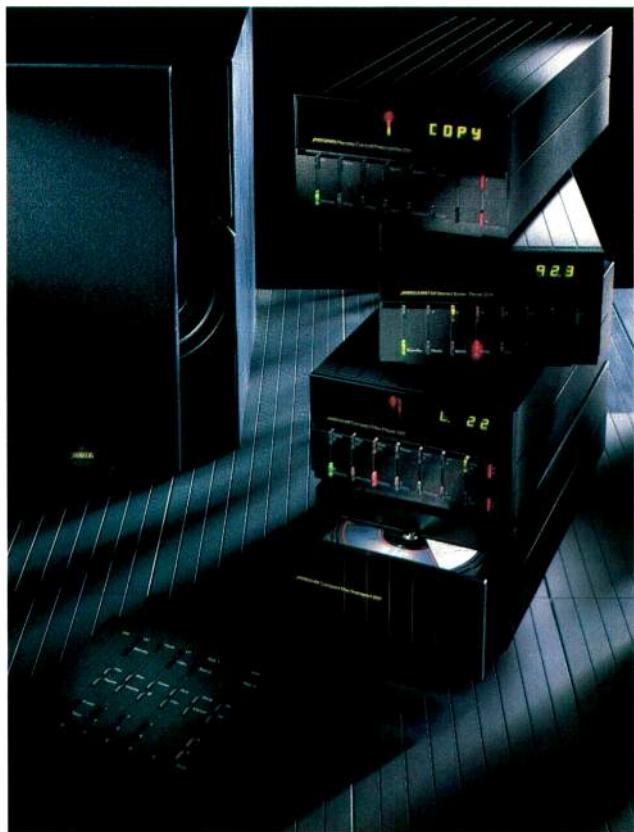
Susan Elliott

Bruckner: Ave Maria. The Dresdner Kreuzchor, Martin Flamig. **Capriccio 10 081, CD.**

Bruckner was a devoutly religious man, and it is reflected in a large body of his music. On this CD, we hear a collection of two Bruckner "Ave Marias" and 12 of his choral motets. For mixed male and female voices in a choir, they are sung mostly a cappella; a few are accompanied by trombones and organ. The Dresdner Kreuzchor is a finely trained group with beautiful intonation and clean, articulate phrasing.

This digital recording is very well done. Recorded in Dresden's Lucas Church, the voices soar exultantly in the warm vaulted acoustics and have good articulation. The reverberation time is just under 3 seconds, giving a lovely "bloom" to the sound.

Bert Whyte



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**The Quintessential Billie Holiday,
Volume 1, 1933-1935
Columbia CK 40646, CD.**

Sound: C+ Performance: A

Lady in Satin: Billie Holiday
Columbia CK 40247, CD.

Sound: B- Performance: A

Over the past year or so, Columbia has been reissuing a worthy group of jazz recordings under the title "Columbia Jazz Masterpieces." Spanning five decades, the series contains previously released material, new compilations, and previously unreleased individual tracks. As might be expected from a label with as deep a stock of great

music as Columbia's, the collection contains many classic artists and titles, including Miles Davis (*Sketches of Spain* and *In a Silent Way*), Benny Goodman (*Sextet*, a new compilation of music from 1950-52), Louis Armstrong & His All-Stars (*Satch Plays Fats*), and Duke Ellington (*At Newport*). As of this writing, 20 titles have been released, and more are planned.

The CD versions of the series (which is also available on LP and cassette) have all been digitally remastered from the original analog tapes by series producer Michael Brooks and recording engineer Larry Keyes. Listeners will find obvious differences in sonic quality within the series; some CDs suffer

from mild distortion and tape hiss, while others come closer to filling the potential of the digital medium. The differences exist because the collection spans many years—from the 1930s through the 1970s—and recording techniques and equipment, as we all know, have improved with each year. The original analog tapes and metal and shellac master parts used for disc mastering contain numerous faults due to age and the quality of the original equipment, and many of these faults cannot be eradicated by even the most meticulous and modern digital processing. Given these realities, Brooks and Keyes have done a very good job. (Wisely, they have left the earliest recordings in mono.)

Two of the most musically impressive CDs in the gathering are reissues from Billie Holiday. Originally produced—as were many of these recordings—by John Hammond, the releases cover two completely different periods in Holiday's life. The first period is represented by *The Quintessential Billie Holiday, Volume 1, 1933-1935* (mono), the second by *Lady in Satin*, from 1958. These two compilations, while featuring the same vocalist, are otherwise totally different, both musically and emotionally.

The Quintessential presents Holiday in a youthful, exuberant mood; her voice is clear and strong. The selections are mostly up-tempo and feature some of the era's best jazz musicians: Teddy Wilson and Buck Washington, piano; Benny Goodman, clarinet; Roy Eldridge and Charlie Teagarden, trumpet; Cozy Cole and Gene Krupa, drums, and Chu Berry, tenor saxophone. The musical arrangements are loosely played and the band swings. The weak point of the album—as many have noted over the years—is the selection of songs. All except three or four are mediocre pop songs of the period. (Music publishers of the time were not in the habit of providing young black singers with the finest material.) What is amazing—and proves why Billie Holiday remains unsurpassed as the finest jazz vocalist of any era—is that she manages to "sell" these songs, making them sound interesting and potent. She takes a tune like "What a Little Moonlight Can Do" and makes it totally believable. In fact,

she makes all the tunes believable, combining an awesome sense of swing with an incomparable phrasing ability.

Lady in Satin is a very different recording. By 1958, Billie Holiday's life was running out. Drugs, alcohol, and constant government harassment had taken their toll, and her voice tells it all. It is husky and dark, not quite able to complete certain phrases or reach certain notes. The voice is like an open wound, yet it carries the lyrics into your heart. The emotion is real.

Lady in Satin features the Ray Ellis Orchestra (which included Milt Hinton, bass; Mel Davis and Billy Butterfield, trumpets; Hank Jones and Mel Waldron, piano, and J. J. Johnson and Urbie Green, trombones). The tempos are slow, with prominent string arrangements by Ellis.

The material on *Lady in Satin* is better than on *The Quintessential*, with two numbers from Rodgers and Hart—"It's Easy to Remember" and "Glad to be Unhappy"—among the 12 tracks. Ellis' string arrangements are supportive and musically interesting, but it is difficult to listen to Holiday in such a setting. The strings were arranged to dominate the rhythm and horn sections; thus, there is little interaction between Holiday and the soloists, something she seemed to thrive on. But strings were *de rigueur* in pop music in the '50s, and this album was an attempt to bring Billie Holiday to the attention of a bigger audience.

Recorded in stereo, *Lady in Satin* is sonically superior to *The Quintessential*. There is an interesting story about the final track of *Lady*, "The End of a Love Affair." According to the liner notes, the original LP was simultaneously released in mono and stereo. However, the stereo version was missing "The End of a Love Affair." While compiling this collection, Brooks and Keyes found out why: No original stereo recording of that cut had ever been made. So, in order to include a stereo version of the song in this collection, Keyes took an unmixed music track along with a vocal-and-rhythm-section tape and simultaneously mixed them down to a digital cassette—in effect, making one recording from two. But a problem arose: "The original tape machine used to record Billie was running

a fraction faster than the [machine used to record the] music," resulting in timing differences between the two tracks. Consequently, engineer Keyes had to edit the tape (and, I imagine, hand-sync the tape machines) to create one complete work. This is a very tough task to perform well because it requires cutting sections of the tape to match beats, vocal phrases, etc., some of which hang over into the next beat or measure. Poor editing will create an out-of-sync, jerky effect rather than smooth musical transitions. I made a point of listening very carefully for the edits in "The End of a Love Affair" and could hear (I think) only two. This is great work by engineer Keyes to maintain musical integrity and continuity. The effort provides us with the first stereo version of "The End of a Love Affair," 28 years after the original session.

Columbia will, I hope, soon be releasing more of Billie Holiday's music. Issuing music from her sessions during

the '40s would help to chronologically tie together the two compilations reviewed here. Until then, I am going to sit back and enjoy these two Compact Discs for quite some time. This is beautiful music. *Hector G. La Torre*

The Genius of the Electric Guitar:

Charlie Christian

Columbia CK 40846, CD.

Sound: A-

Performance: A

It's been nearly 50 years since young Charlie Christian's newly electrified guitar cut through the shellac with hot solo statements that established him as *The Genius of the Electric Guitar*. His trailblazing work had implications which have spread far beyond the boundaries of jazz.

These historically significant performances from 1939, 1940, and 1941 (the year of Christian's untimely death) include contributions from the Benny Goodman Sextet and a veritable who's who of jazz: Lionel Hampton, Fletcher



This Zoot Sims recording was made at a time when soft, laid-back playing was in vogue; the result is warm and smoothly swinging.

Henderson, Nick Fatool, Count Basie, Cootie Williams. The music goes beyond swing to encompass stride, boogie-woogie, Memphis and New Orleans blues, and even proto-bop.

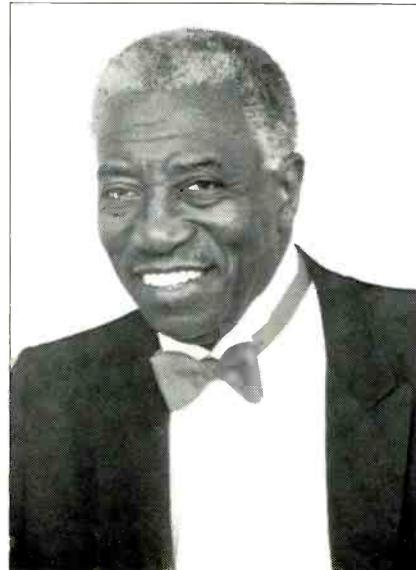
Essentially, this CD is a digitally remastered rerelease of material, produced by the late John Hammond, which was included in a 1972 double-LP called *Solo Flight*. While not perfect, the new format is a vast sonic improvement. Given the ancient sources, there is still some slight background pop and hiss, but Columbia has done a great job of cleaning up these cuts. The frequency and dynamic ranges are still somewhat compressed—after all, you can't add what ain't there—but as often happens, the voices have opened up, bringing the listener closer to the music.

Like a time machine, *The Genius of the Electric Guitar* provides a remarkable glimpse of an instrument coming into its own in the hands of a giant. With playing that remains as vital as it was the day it was laid down, this CD is an excellent tribute to Mr. Hammond's considerable contributions to American music.

Michael Wright

Every Night: Live at Vine Street: Joe Williams
Verve 833-236-2, CD.

Joe Williams' voice clings to the contours of a song like velvet Saran Wrap. Whether he's dealing with a lowdown



blues, a tender ballad, or a rip-roaring rocker, Williams embraces every nuance and makes each song his own.

His is an urbane and easy-going voice, exuding experience and affability. It suggests untapped reserves of power and a limitless range, loping along at an easy, muscular pace like a great cat at leisure. Williams is totally in command of it, both in the studio and on stage; *Every Night: Live at Vine Street* captures him in action on two California nights in May 1987.

The program is a mixture of blues and ballads, with a slightly heavier emphasis on the former. Although the album is named after Williams' own classic, "Every Night," the pivotal cut of the 11 on this Compact Disc is the nine-minute-long "Everyday (I Have the Blues)," which here is merged with Miles Davis' "All Blues." Williams is splendid, in full control of his marvelous vocal instrument. On "Every Night" he easily slips back and forth from a high falsetto to a brief basso profundo with no sense of strain or strangeness. His phrasing is impeccable, his diction faultless, his tone conversational. He takes a chestnut like "Too Marvelous for Words" and refashions it in his inimitable style. He tenderly embraces the

lesser-known "A Dollar for a Dime" by Eubie Blake and Andy Razaf and wrings every ounce of unsentimental sweetness from its lyrics and melody. Somehow, with the same apparent effortlessness, he rocks the dickens out of "Shake, Rattle and Roll."

Wonderful as this album is, it falls short of Williams' best. It concentrates a bit too heavily on the blues for my taste, and I prefer the CD of an earlier recording, *A Man Ain't Supposed to Cry* on Roulette, despite its obvious audio problems. *Every Night* was recorded digitally, and though the sound is sparklingly clean and clear, there is an almost subliminal flatness to it. It's a very minor quibble, and not enough to detract from the overall excellence of this superior Compact Disc.

Paulette Weiss

Zoot Sims in Paris
Swing SW 8417, LP.

Sound: B+ Performance: A to B

This is one of many outstanding productions which Hugh Fordin has released on his DRG and Swing labels. Under a long-term license from EMI, which owns the famed French Swing label's entire output, Fordin has pro-

Though the playing is fine, *The Spice of Life* could have used a bit more of Kazumi Watanabe's fertile, cross-cultural fusions.

duced consistently interesting reissues of material by Coleman Hawkins, Benny Carter, Bill Coleman, and others over the past several years.

This very interesting session was recorded for the Ducretet-Thompson label in Paris in 1956, when Zoot Sims and trumpeter Jon Eardley were both in Paris working with Gerry Mulligan's band. Pianist Henri Renaud, one of France's best jazz men and for many years the head of jazz at CBS Records there, organized the date. He plays beautifully throughout, accompanied by the fine bassist Benoit Quersin and drummer Charles Saudrais.

If Zoot Sims ever made a bad record, at least I don't know of it. An original talent inspired by Lester Young and Ben Webster, among others, he was equally fine at any tempo. This recording was made at a time when the soft, laid-back style established by Mulligan and trumpeter Chet Baker was very much in vogue, and Eardley, who replaced Baker in Mulligan's group, plays in the same understated style. Listen to Zoot on "My Old Flame" and on Quincy Jones' fine ballad, "Evening in Paris." Only a man who had listened carefully to the ballad masters of an earlier generation could have played like this. The highlight of this fine new release may be "Nuzzolese Blues," a seven-minute slow blues that finds Zoot and his companions very much at home.

This warm and smoothly swinging date should be better known. I highly recommend it.

Frank Driggs

The Spice of Life: Kazumi Watanabe Gramavision 18 8706-4A, LP.

Sound: B+ Performance: A-

The power trio is back—in a fusion context—as fretmeister Kazumi Watanabe wails with luminaries Bill Bruford and Jeff Berlin on *The Spice of Life*.

Watanabe's nonstop liquid guitar lines lead the way as the group cruises from the bluesy scales of "Hiper K" to the wild improvisation of "Period" and the straight-ahead fusion of "J.F.K." Watanabe's usual penchant for funky rhythms makes itself felt only on "City," which also contains a good bass solo by Berlin. "Lim-Poo" is, alas, the only overtly Japanese-tinged tune this time out. The award for "most exotic" goes

to "Na Starovia," which begins with synthesized Andean guitar and then takes off into outer space. This is the most layered cut, the rest featuring fairly sparse, straightforward production. Throughout, the playing is fine.

The Spice of Life is Watanabe's most mainstream work to date. This also

makes it one of his least distinctive recordings, which is too bad, considering how crowded the genre is. Perhaps it could have used a bit more of Watanabe's fertile, cross-cultural fusions, which on past albums have created a special niche for this artist.

Michael Wright

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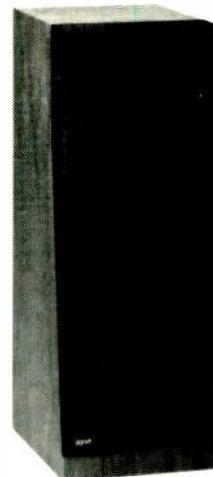
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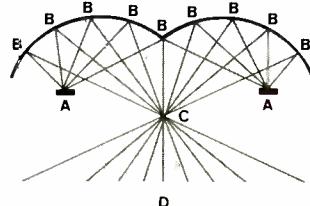
• Julian Hirsch, Hirsch-Houck Laboratories, Stereo Review, July 1987

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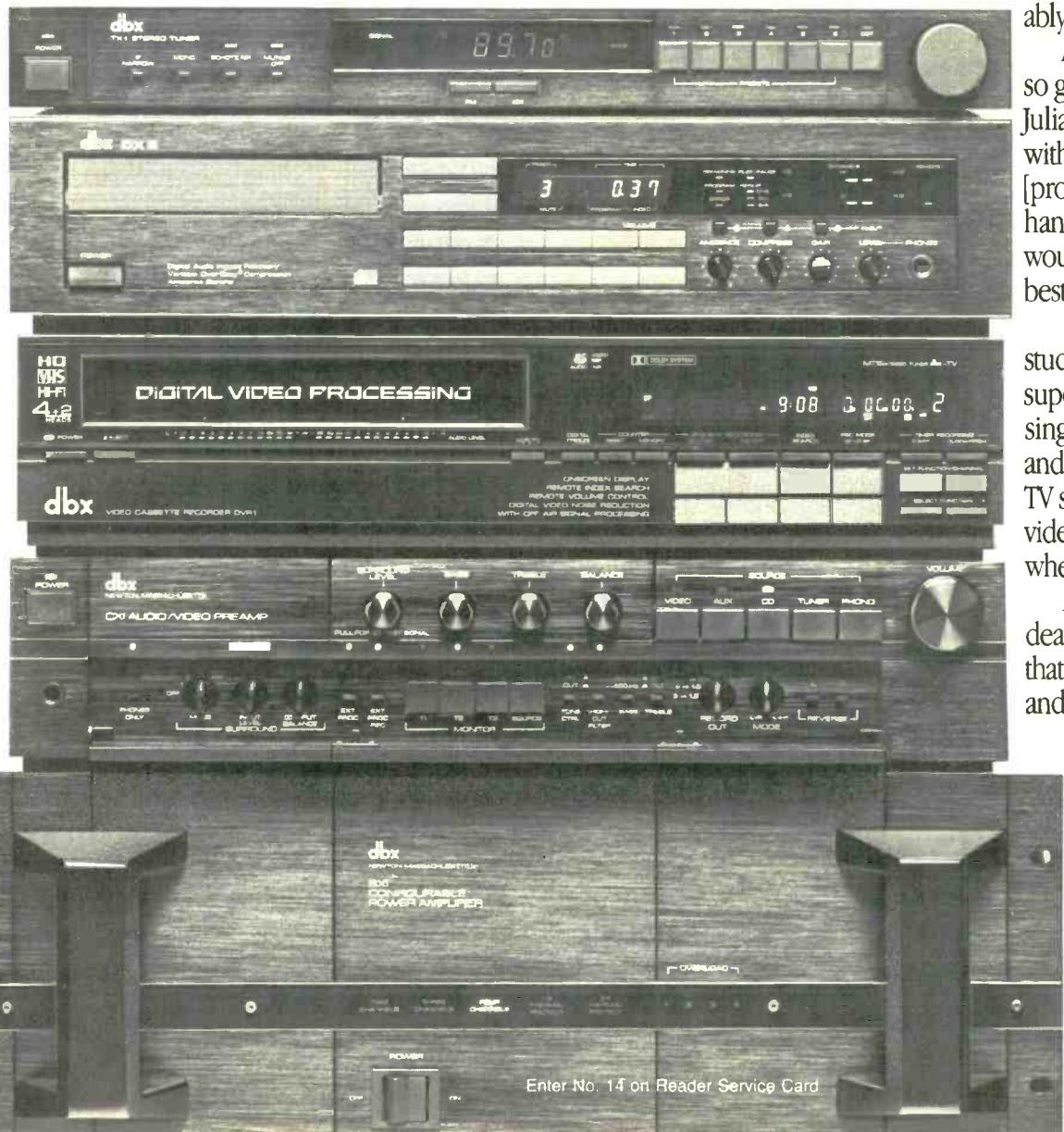
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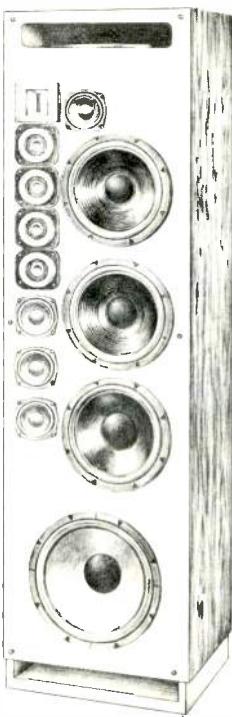


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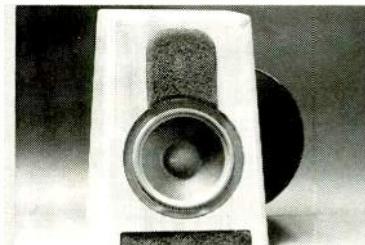
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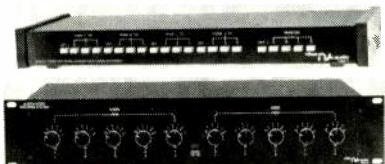
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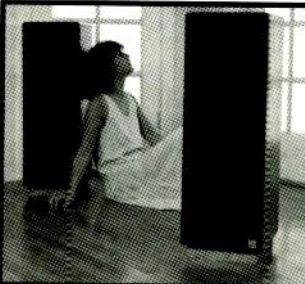
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Digital Audio, on the DCD-3300

For example, the digital-to-analog converter found in every

But Denon occupies an unusual position in the digital audio world. They (Nippon Columbia, in Business-Speak) are one of the few companies to engage in all three industries that bring digitally mastered recording (tapes), digital post production (their own label), digital disc pressing (Hi-Fi), and CD player manufacturing (hi-fi). While other companies own sub-sidiaries that function similarly, none achieves quite as finely forged integration as does Denon. When you're hearing exactly what Denon intended.

they've variously hailed our CD players as "a winner on every count," "the player I recommend most highly," "superlatives have to be used," and "in several respects, the best I've ever heard."

Reactions which simply demonstrate one point. It's a lot easier to make audio sound like music



THE NEW DCD-1500II. ITS SUPER LINEAR CONVERTER COMES STRAIGHT OUT OF DENON STUDIO RECORDERS.

Denon CD player comes directly from Denon studio recorders. Unlike conventional designs, Denon's Super Linear Converter detects and corrects D/A transfer distortion.

Perhaps that's why each succeeding generation of Denon CD players is eagerly anticipated by the world's audio critics. And why

"A look into the interior of this player reveals that Denon engineers were not taking any shortcuts whatsoever."

Germany's Hi-Fi Vision,
on the DCD-1500

when you really know what music sounds like.

DENON
DESIGN INTEGRITY

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