THE B.A.S. SPEAKER

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In This Issue

This month's back-of-the-book feature is another of Ronald Johnston's annual equipment review indexes (indices?). This one has an altered and compressed format as well as a more detailed introduction, and should be easy to use; with it you can quickly find the original location of any review cited in the "In the Literature" sections of Volume 7.

Professional audio consultants and studio designers are using a variety of new electronic tools to evaluate loudspeakers and rooms. Alan Fierstein, president of Acoustilog, Inc., has designed and built an ingenious portable package that allows him to measure reverberation time, room modes, anechoic speaker response, phasing, and alignment, and more. He demonstrated this device during the April BAS meeting; the results of the tests, along with a detailed explanation of how they are done, can be found in John Schlafer's meeting summary.

We also have answers to McIntosh's advertising claims about the alleged advantages of overdamped, electronically equalized woofers from Roy Allison and Dick Greiner, a note on moving coil cartridge response from Jack Reed, reviews of courses in basic electronics from David Satz, and a review by California member Gerald Larsen of the Beocord 8000 high-end cassette deck.

Our June issue (#9) will be largely devoted to digital recording. The meeting summary will describe the visit of the men from Digital Recording Services, and the feature article will be a detailed, hands-on report of the Sony "consumer" digital adapter, the PCM-1. At the same time, a massive report on the Chicago CES is being prepared for #10, so you'll have plenty to think about during these long, hot summer days.

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For Sale

*Koss ESP-9 electrostatic headphones, excellent condition, $65. Hal Williams, 7305 S. W. 25th Avenue, Portland, OR 97219, (503) 246-1784.

*Apt Holman preamp, $350; Sherwood Micro CPU 100 FM Tuner, $900; B&O 4002 straight-line turntable, $475; dbx 117 compander, $85; Soundcraftsmen 20-12 octave equalizer, $160; Sony 3200F amp (100W x 2), $180; Allison Ones, $500/pair; all with manuals and cartons except for Allison cartons. Bob Sisk, (617) 973-7228 (days).

*Harman-Kardon Citation 11A preamp, $175; Citation 12 power amp, $175; Sherwood S-3000 III mono FM tuner, $25; Quad 405 amp, $285; two Dynaco Mk Ill amps, $175 for both; McIntosh MR-71 tuner, with case, $375; Linsley Hood harmonic distortion analyzer, as described in Wireless World, commercially built by Teleradio Electronics in England (call or write for details). Call Don at (305) 392-6716 after 7 PM EDT or write Don Konicoff, 120 W. Palmetto Park Road, Boca Raton, FL 33432.

*Ortofon M15E Super, $15; Ortofon VMS 20E, $5; Audio Technica AT 20SL, $50; set of Audio Technica AT 605 feet, $12; Absolute Sound #8-11, all four for $5; 25 TI TLO 72 op amps, $1 each; 20 Signetics NE 5532, $3 each. J. Johnston, 9305 Cedar Street, Bellflower, CA 90706.

*Revox A700 1/4-track recorder, little used, with user's and service manuals, spare fuses and lamps, other accessories, original carton; two PML EC-71 cardioid condenser mikes, with power supplies, cables, and accessories; two Norelco AKG D19/E/200 cardioid dynamic mikes with accessories and cables; all in mint condition. For details call Alex Azelickis, (714) 270-0408.

*Audio Pulse Model 1 delay, very good condition, complete with rack mount, wood side panels, cables, instructions, and box, $400; Koss Phase 2+2 quadraphones, like new, complete, $100; Lux XT50 circuit board for 5T50 digital tuner, makes tuner stop at correct point, $5; ADC LMF-1 carbon fiber tonearm, excellent condition, $125; Signet MK 10T moving-coil transformer, like new, $50; Sony turntable mat, silicone-filled, brand new, $30. All items except turntable mat include shipping costs. William Sommerwerck, C359 Radcliff House, Rosemont, PA 19010, (215) 527-4146.

*Fairchild portable record cutting lathe, 33 or 78 rpm, modified for variable pitch, currently equipped with Fairchild monaural cutter head with microgroove stylus, original electronics included but cutter has been modified to work with modern power amps, $300 or best offer. D. Griesinger, (617) 891-6790 (days).

Wanted

*Norelco full-range speakers: 12" (such as AD-5200 or AD-5277M) and the best 8" (such as AD-4877) in good condition; Grundig C-9000 automatic V. A. T. portable stereo with cassette recorder, in good condition. B. Kalish, 565 Walnut Avenue, Redlands, CA 92373 or call collect (714) 792-0220.

*Sansui CA-2000 preamp; Sansui TU-9900 tuner. John Johnson, 435 E. 70th Street, New York, NY 10021, (212) 628-2461.

*Sansui QSD-1 Variomatrix decoder. William Sommerwerck, C359 Radcliff House, Rosemont, PA 19010, (215) 527-4146.

Corrections and Amplifications

AR-9 Review

Sharp-eyed readers of Alvin Foster's AR-9 review in the March issue will have already noticed that Figures 1 and 2 were reversed. What is harder to figure out just from the text is that the values in the three figures for the frequencies above 10 kHz have been further scrambled. To unscramble them, get out your Tom Corbett decoder ring and proceed as follows:

1. Reverse the labels for Figures 1 and 2. Further instructions will refer to the new, correct numbers.

2. Redraw the data points above 10 kHz from Figure 1 onto Figure 3.
3. Redraw the data points above 10 kHz from Figure 3 onto Figure 1.

The figures and the text will now correspond. We apologize to our readers and to Al Foster for the inconvenience.

Later in the same article (p. 24), there is an editor's note about the reported distortion measurements. The coordinating editor for that issue, Henry Belot, would like our readers to know that this note was written not by him, but by Brad Meyer.

SoundAids Record Player Mods

We would like to clarify and expand the description of the SoundAids modification services described in the March Speaker (p. 6). SoundAids' principal service is the modification of existing turntable/arm combinations. They do this by cutting off the original arm tube/headshell combination and substituting a new one of lower mass. A new, lighter counterweight is also supplied, as are low capacitance arm cables. The price of this modification, performed on your turntable, is only $90. The original arm bearing assembly is retained.

If you have an AR turntable, the company will replace the entire arm assembly with a specially tweaked JH Audiolab arm for $200. If you have no turntable, they will supply a Rotel RP2300 with their standard arm mod. The price of this package is also $200.

And finally, the turntable shown in Figure 1 is a Pioneer 630, not a PL-112D. We would like to thank Dee Condon of SoundAids for the helpful clarification.

Comb Filter Intro

There is a misprint in the second line of the introduction to F. Alton Everest's article, "Acoustical Comb Filter Effects, " in the April Speaker. The proper abbreviation for the magazine Recording engineer/producer is "r-e/p."

A Suggestion for "In the Literature"

My thanks to whoever is sufficiently thoughtful to take the time and abstract the various publications in the audio field. Many times, however, I find myself in a quandary after reviewing this section. I am interested in a particular article but don't know how to go about obtaining it. Could you possibly include the appropriate addresses of the various publications where one could write to obtain a copy or even subscribe, if they desire? Such a list could be included periodically, but could also appear after each publication's name in that section. It would be helpful.

-- Gerald H. Larsen (California)

(Publishing a complete listing of this information every month would take up too much space, but the suggestion is a good one. A list of addresses and subscription information for all regularly excerpted publications will appear in the near future. -- Ed.)

Loudspeaker Q Revisited

In The Speaker's March issue Carlos Bauza questioned the McIntosh puff on their low-Q loudspeaker design. Overdamping the woofer (so that bass rolls off beginning at a fairly high frequency), and then boosting the response to flat with an equalizer, is claimed to give better "transient response" than is provided by a loudspeaker system with a naturally flat bass response.

Not so. Excessive damping certainly suppresses the Q of the speaker's mechanical resonance, but if an equalizer is used to restore the lost bass an electrical reactance is added. The net result is that, if the overall frequency response is the same, the transient response is also identical. If the overall frequency response is made reasonably flat by either means, the transient response is so good that ringing simply cannot be heard.

-- Roy Allison (Massachusetts)

In the March 1980 issue of The BAS Speaker, a reader asks several questions about woofer response. These are restated below in slightly more technical terms.

1. Do woofers with Q's greater than critical, Q = 0.5, such as those with maximally flat response, Q = 0.707, or even peaked response, Q > 1, in the frequency domain necessarily have time domain responses that show ringing?"
2. Do most woofers on the market trade less damping, higher Q, for more output at the lower band edge? And thus, do they have more "ringing" than they would if more heavily damped?
3. Is a possible solution to the problem the addition of a "peaking" electronic filter, set at the lower frequency band edge, to an otherwise heavily damped and possibly bass-deficient loudspeaker? Would this magically give the required added output in the bass without the "ringing?"
4. Is underdamping which allows "ringing" significant, or objectionable?

It is with considerable reluctance that I comment on these questions in the BAS Speaker since the issues have already been discussed in these pages almost to death. However, below is a brief summary of answers to these interesting questions. These answers are simplified, based on elementary filter theory and should be well known to any electrical engineer.

1. In general, 0 and transient response go together. That is, higher Q gives more "ringing." I know of no exceptions to this basic rule, and certainly none in the design of loudspeakers. Also, higher-order systems tend to "ring" more than low-order systems. That is, a ported box tends to ring more than a closed box.
2. Yes. Yes.
3. No. No. Electrical modification with a filter to flatten the frequency curve at the band edge, or acoustical modification, as with porting of the box, to do the same thing, have very similar consequences. A higher-order system with higher effective Q will generally have more "ringing." While the details of acoustical versus electrical modification of the response of a loudspeaker are complex, there is no "magical" solution which is a substitute for adequate speaker size, adequately low-frequency cutoff, and adequately low Q in the initial design.
4. This is largely a matter of opinion. Some loudspeaker manufacturers feel that a Q of 1 or higher is satisfactory because the room reverberation masks the consequent transient ringing of the loudspeaker. This is true for many systems. In a very dead room, one with short reverberation time, it is my own opinion that a Q of less than 0.7 is best and I personally try for a Q of 0.5 to 0.6 in a large closed-box configuration which is also of the lowest order possible. There is however no arguing about what is "objectionable" since this is a matter of taste and opinion. In fact, a system with higher Q will have impressive "punch" on kick drum bass which many listeners like. Thus, while one can argue about accuracy of reproducing a signal, one cannot come to closure on the issue of what sort of response is best, or most preferable, in a given room, for some types of programs, or particularly, for some personal tastes.

I think it is about time that many music lovers forget about some elusive "accuracy" and set up a system they like to listen to. -- R. A. Greiner (Wisconsin)

Moving Coil Pickup Damping

What has become a familiar non sequitur appears in The Speaker, Volume 8, Number 4 (January 1980) on p. 30. There it is stated that, "Moving coil cartridges rely entirely on mechanical damping to minimize the resonance problem because their source impedance is too low for electrical damping to be effective." The context of the paragraph and the reference to source impedance imply that what Mr. Farlow means by "to minimize the resonance problem" is "to flatten the treble response," and that what he has in mind where he says "electrical damping" is "electrical response correction." This interpretation being accepted, it follows that because the source impedance of an m. c. cartridge is low compared to that of some magnetic cartridges (e. g., Shure, Ortofon), the load capacitance used to correct an m. c. cartridge will be proportionately lower in impedance (higher in capacitance), not that electrical correction can never be effective.

For example, in Hi-Fi Choice Number 13, "Cartridges and Headphones," Martin Colloms reports that the Ultimo (Dynavector) 20A gave a response rising above 5 kHz to +5 dB at 25 kHz, but that adding 68 nF to the 47K load reduced this to +1 dB and improved the sound quality. The British R. T. J. line of plug-in shunt capacitors includes 68 nF and 1.5 uF.

I think the choice between mechanical damping and electrical correction to achieve flat response is a significant one. Increased mechanical damping of the stylus must spoil tracking, since it restricts the movement of the stylus; moving coil cartridges have something of a reputation for poor tracking, especially in the upper frequency range, typically requiring considerably higher tracking forces than magnetics. These forces may not deform the groove inelastically (permanently) but would result in more elastic (temporary) deformation than less damped pickups requiring lower tracking forces, not to mention the increased rate of stylus wear.

Rather than devising complicated ways of reducing the damping in the midrange to cater for the high velocities there, while increasing it at high frequencies (see, for example, Ortofon's advertised damping system for their MC 30) where mistracking may be less obviously audible, m. c. cartridge manufacturers might well deal with the inconvenience for the average component buyer of fussing about capacitance loading by including it in the pickup cartridge body (for example, the Dynavector DV 20A Type 2; see High Fidelity, April 1980, p. 20). The capacitance values will easily overwhelm typical variations in input-circuit capacitance, and the added mass can be slight. For example, the Ortofon CAP 210 dual capacitor, intended to fit over the cartridge pins, weighs around 0. 1 gm; although a larger capacitance is needed for this application, it need not be so robust if located within the cartridge housing.

-- Jack Reed (Illinois)

Learn Electronics in Your Spare Time

Last winter I got fed up with the audiophile product fetish mentality (as I do periodically) and decided to concentrate more on developing my knowledge of electronics. I had become a fairly avid short-wave listener during the previous year, so I thought to try out amateur radio, a hobby which has a strong tradition of technical experimentation and self-training. It has turned out to be a rather gratifying hobby and I do feel that I've been learning steadily from it. My purpose in mentioning all this is not so much to tell everybody how I spent last winter, or to make propaganda for "ham" radio, but to recommend two sets of instructional materials, one fairly cheap and the other less cheap, which I have found helpful.

The first set is published by Tab Books, which are carried by Radio Shack and other hobby shops. Amateur Radio Novice Class Study Guide, by Kyle and Sessions (#873, $5.95), was one of the few clear, up-to-date books I could find on a beginner's level. The same authors have written a similar volume (#851, $7.95) for the General Class license seeker, which could also be used by a beginner although it is naturally more challenging. Further books in the series cover the higher examination levels; I have not seen these. (There are five grades of FCC Amateur Radio licenses: Novice, Technician, General, Advanced, and Amateur Extra. Each successive one grants the "ham" wider operating privileges, and is earned by passing Morse code tests and/or written examinations on radio theory and practice; some knowledge of electronics is definitely required.)

The pricier set of materials is from Heath Company (Benton Harbor, MI 49022). They sell "programmed instruction" courses on many topics in electronics, including two on amateur radio. Whereas the Tab books are meant as study materials for the written exams, the Heath courses also include good Morse code training tapes. The General Class course, at $49.95, starts at a beginner's level, so one could omit the $39.95 Novice Class course. I did take the Novice course, however, and on the first try I passed the FCC five words-per-minute code test and the written exam for the Technician Class license -- which is at the same level of difficulty as they require for a General Class license. Thus for my General ticket, I had only to go back and pass a 13 wpm code test, which took a few weeks' practice. Feeling then that I had perhaps gotten by a little too easily, I worked my way through Heath's General Class License course; to my surprise I was again promptly able to earn the next higher grade ("Advanced"), the license I still hold. All this was before I ever got "on the air" even once I If passing the FCC exams is what matters most, these courses were certainly the right stuff.

For a more thorough study of general electronics without the emphasis on amateur radio, Heath also sells a series of five self-instruction programs at $45 to $60 apiece. I have not seen the first two volumes (DC and AC electronics, which basically cover Ohm's Law in its many applications), but from the catalogue descriptions I surmise that most of their essential content is also contained in the Amateur Radio General License course. The third volume, "Semiconductor Devices," is very clear and has considerably more detail than the corresponding section of the ham course; I am working through it and expect also to take the fourth course, called simply "Electronic Circuits." Heath sells an optional "Experimenter/Trainer" unit for $75, for use in performing certain experiments along the way. I strongly question its value unless the student feels a strong need to see very basic points demonstrated with test equipment. The courses themselves are already overpriced, as good as they are; for $5 or $10 less, perhaps, Heath might have left out the dinky little phonograph records which really contribute nothing to the courses.

The FCC written examinations have just been revised, so there is some chance that either Tab Books or Heath Company will revise their texts to match. The two Tab books were already in a "2nd edition." But it is also quite possible that with their general coverage, no revision will be found necessary. In any case, the principles of electronics as contained in them will not soon become obsolete. -- David Satz, N1AWG (Massachusetts)

The B&O Beocord 8000 Cassette Deck

Ah, the wonderful people from B&O have done it again. This, their latest high-end cassette deck, exemplifies the basic beauty of all B&O designs and features a rather elaborate set of microprocessor controls, including a keyboard that looks somewhat like a calculator. I won't belabor you with too many details concerning this unit, but I suggest that you rush off to your local dealer, get a brochure, and see one for yourself. One of the more intriguing aspects of this unit is its ability to calibrate its digital elapsed time indicator to each individual tape being used. Thus, as you are recording or playing back, the large display automatically reads in minutes and seconds. This particular feature allows you to find any selection on tape once you know where it is. This can be done even on tapes which were not recorded on the B&O. The Beocord 8000 handles metal tapes for those of you so inclined. In true B&O tradition, this high-end (about $1,000) deck is a two-head machine and does not come with user-adjustable bias or Dolby record calibration controls. So if you elect to get one of these, have your dealer calibrate it for the tape you plan to use for recording. A dealer who knows what he is doing can accomplish this in only a few minutes, and the unit maintains its calibration very well. To date, I've made about a dozen recordings with the unit and in A-B comparisons with the source material its performance is excellent. In short, you'll love the human engineering aspects of the unit and its technical qualities are superb, too. Go see for yourself.

My dealer normally checks out every piece of equipment before it leaves the store. In the case of the Beocord 8000, I was present during this testing and the unit appeared to test correctly according to the dealers manual. When I got home however, I discovered that the record level controls didn't appear calibrated one to the other at my normal recording level. I brought the unit back to the dealer and we once again went through the testing procedure. We discovered that the record level controls, for the test procedure, wind up at a record level of about seven on the front scale. Under these conditions, they were balanced. When we moved the controls back down to three (where I normally record) we found that they were not in balance, one channel to the other. This indicated that the logarithmic sliding pots which control the record level were not properly matched, or that one was defective, and my dealer very quickly replaced the unit with a new one which tested properly at all record levels. My thanks go to Dimensions in Stereo of Torrance, California for another outstanding example of what a good dealer is all about, and to Bang

& Olufsen who encourage this type of dealer support with their product. I don't think manufactured products will ever be perfect. But a good manufacturer and a good dealer can make problems a painless experience. Patronize those who do.

-- Gerald H. Larsen (California)

In the Literature

Audio, May 1980

*Behind the Scenes (p. 22): High-end exotica at the Winter CES.
*Video Scenes (p. 28): News of video disc and tape gear.
*Tape Guide (p. 30): Clarifying the theory of tape recorder playback equalization.
*Headphone Crossfeed Circuit (p. 32): For people who don't like the super-wide stereo of headphones.
*Digital Techniques, Part 2 (p. 34): An attempt to explain the basic workings of digital hardware.
*Double- Barrelled Amplifier, Part 2 (p. 44): Construction details, not for the novice builder of kits.
*Equipment Profiles (p. 66): Crown FM-1 tuner (digital frequency synthesis, excellent performance). Dual 731Q turntable with Ortofon ULM 60E cartridge (anti-resonance filter works well, feedback isolation good, cartridge tracks well, system performance is very good). RG Dynamics D-3 preamplifier (intelligently designed, good infrasonic filter, tape outputs buffered, measurements excellent, sound is audibly superior to other preamps).

db, May 1980

*Letters (p. 6): The EIA standard on wiring XLR connectors (pin 2 goes positive for positive sound pressure).
*Theory & Practice (p. 14): Some historical notes on stereo.
*Reinforcing the Pope (p. 50): Brad Meyer describes the PA system which Tom Horrall and Larry Philbrick engineered for the Pope's visit to Boston.

High Fidelity, May 1980

*Equipment Reports (p. 23): Aiwa 3000U turntable (straight-line arm, relatively massive with supplied headshell but other shells can be used, resonance well damped, band-counting programmed operation works poorly, conventional operation works great). Technics SL- 10 turntable (straight-line arm mounted in cover, very compact, m. c. cartridge and head amp built in, system easy to set up and use, "an absolute joy"). Phase Linear 8000 Series 2 turntable (straight line arm, made by Pioneer, resonance is well damped, operation silky smooth). Garrard GT-350 turntable (belt drive, carbon-fiber arm, relatively low mass, resonance well controlled, fine performance as an automatic changer). Nakamichi 680ZX cassette deck (superb metering, automatic head alignment, sensitive Dolby Rec Cal adjustment, no bias trimmer, crowded controls, performance splendid at standard speed and amazing at half-speed). Crown SA2 power amp (clean and potent, 400 W/ch at 4 ohms, excellent metering, intelligent protection circuits).
*Culshaw at Large (p. 44): Asking the pertinent question, does anyone really want video recordings of symphonic performances?
*Phonographic Prescriptions (p. 47): Tests of assorted turntable aids -- vibration isolators, platter mats, disc clamps, static eliminators, indicating that some work better than others but few are miracle cures.
*How to Buy a Turntable (p. 51): Mike Riggs surveys the many variables involved; candid and informative.

Hi-Fi News & Record Review (England), April 1980

*Editorial (p. 41): A comment on James Mitchell's superb essay on A-B testing in the October-November 1979 BAS Speaker.
*A Rational Basis for Subjective Evaluation (p. 49): A thoughtful approach to classifying and characterizing some of the subjective differences between components.
*FM Radio (p. 55): On the "startling realism" of the Sony PCM-1600 digital recorder.
*Letters (p. 57): Including a couple of hilariously bad-tempered diatribes from an arrogant American with audiophile pretensions.
*Power Meter (p. 67): A good LED meter in 3 dB increments; homebrew kit reprinted from The Audio Amateur.
*Quality Monitor (p. 77): Re-assessing the sonics of the best recent discs.
*Equipment Reviews - Five Cassette Decks (p. 129): Dual 839 (tested sample overbiased but

otherwise excellent; bidirectional record/play with consistent performance in both directions; good metering). Marantz 6000 (poor playback response from test tapes; overbiased for metal; audible hum; poor headroom with high-bias tapes; performance is improved at double-speed setting). Optonica 5100 (a clear best-buy, very good overall performance at a budget price). Philips 5748 (excellent performance with CrO_2 and budget ferric tapes, underbiased for premium ferrics; excellent tape transport). Technics M63 (lousy instruction manual, performance good with premium ferrics, mediocre with other tapes).

HiFi Stereophonie (Germany), April 1980

*The Guitar: Do the Culture Machines Impede Lively Music Making? (p. 434).
*Today's Situation in Guitar Playing Education (p. 436).
*Guitar - The Omnipotent Instrument (p. 440): Remarks about a rock music symbol.
*The Inviting Guitar (p. 446).
*Small Labels: Trikont Verlag (p. 452).
*Test Reports (p. 500): The Philips 22AH180T tuner (good). The Marantz Model 300DC power amplifier (very good). The Audio Reflex EQ1 equalizer (this Canadian product is rather impressive both in its high quality and low price). The Sony Falcon GG-20 compact separates, the PS-20 turntable, the TAE-20 preamplifier, the ST-20 tuner, the TC-20 cassette recorder and the SA-20 active loudspeakers (very fine, except for the speakers). The Heco precision 400, 300, 200 and 100 loudspeakers (neutral, capable of substantial bass).
*FM Sensitivity Data in dBf (p. 502).
*The 1980 CES in Las Vegas (p. 528).

HiFi Stereophonie (Germany), June 1980

*Interrelation of Pop Art and Pop Music (p. 682).
*Pop Art and Art Rock - Andy Warhol and Patti Smith (p. 690).
*Sung Pictures - The Painter and Minstrel Singer Arik Brauer (p. 696).
*Remembrances of Dada (p. 701): About the early protest art of this century.
*The German Record Award 1980 (p. 716).
*Test Reports (p. 751): The Eumig FL-1000uP and the Sharp Optonica RT-9100H cassette recorders (top class, but the law of diminishing returns is strongly evident, the High Com noise reduction of the Eumig markedly better than Dolby of the Sharp). The Braun C 301M cassette recorder (very good, especially with metal tape). A psychometric test of six vertical array tower loudspeakers: the Acoustic Research AR 9, the Braun Studiomaster 2150 (the two best of the group, neutral, capable of high volume levels, the Braun more transparent and even dry, the AR softer with more lower bass), the Epicure 3. 0 Trilogy, the Lambda M2 MkIII, the Atlantic Skyline and the Shot-Glass Signature (the worst in the group, unbalanced, colored).
*A Listening Test: Cassette Recorders of Standard, Middle and Top Classes (p. 758): These were, respectively, the Dual C 810 (Dolby, Memorex Cr tape), the Braun C 301M (Dolby, TDK MA-R tape), and the Sharp Optonica RT-9100 (Dolby, Sharp C-46 MX tape) and the Eumig FL-1000uP (High Com, TDK MA-R tape), compared in recording and replay of performances of Fidelio on Decca 6. 35492FK (digital) and RCA RVL-8502 (direct disc), using the Ortofon MC-30 phono cartridge. Even the top class models had trouble capturing the high level choir and transient sounds; only the Eumig with High Com did not impair the S/N of the records. The better sound quality of the top class recorders was discernible only on complex signals with wide dynamic range and lots of high frequency content.

International Audio Review (IAR), Issue No. 5

This book-length "periodical" appears once or twice a year; this issue is about nine months late because its intended contents were shelved and replaced by a remarkable set of cartridge tests.

*The Oracle: A rave review of an $850 Canadian turntable, judged far superior to the Linn Sondek and everything else because of its outstanding suppression and isolation of all vibrations. The record is married to the platter mat via a clamp and a vacuum pull-down system. Tone arm not included. The Oracle is not yet sold in the U. S. A.
*A Fluid that Works: A rave review of a disc-treatment fluid called LAST; unlike other materials which coat the vinyl, it apparently modifies the vinyl chemistry, thermodynamically optimizing the stylus/vinyl interface. At any rate dramatic reductions in treble IM distortion are shown.

*Cartridge Tests: The main body of the book. One test is the IAR (Instantaneous Audio Response) step test: as the stylus is dropped onto the record (or onto a piece of glass) it undergoes a square-wave step, and the signal is then Fourier-analyzed to compute the frequency response. This test doesn't include the influence of the stylus/vinyl interface, so frequency response is also measured with a pink-noise test record. Many moving-coil pickups were found to perform best with a load capacitance of 3000 pF or so (that's three thousand, not three hundred), and moving magnet pickups were generally found to give optimum response with a combination of load R and load C quite different from the maker's recommendations. IM distortion tests produced the startling discovery that as the load impedance on MC pickups is reduced toward zero ohms, the IM distortion drops dramatically; but very low load impedances (such as 5 ohms) also tend to short-circuit the cartridge's output voltage, yielding very low output and poor S/N, so compromise values are suggested. Perhaps the best result would be obtained by connecting the pickup to a current/voltage converter with near-zero input impedance, i.e., sensing the pickup's current output instead of its voltage waveform.

*Test Results: Pickups are ranked in classes. Class 1 (best): nothing qualifies. Class 2a: Dynavector Karat Diamond, Koetsu. Class 2b: Dynavector Karat Ruby, Denon 103D, JVC MC-is and MC-2E, Mark Levinson, Grado Signature III, Promethean, Fidelity Research FR1 Mk7, EMT XSD15. Class 3a: Fidelity Research FR1 Mk3F, Denon 103C, Supex SDX 1000, Signet Mk 111E, Stax CPY, Supex SD900E Super, Adcom SC-LT. Class 3b: Stanton 881S, B&O mmc20CL, Decca London, Win Labs SDT 10-2, Nagatronics 360, Denon 303, GAS Sleeping Beauty, Fulton, Sony XL-55, Ortofon Concorde 30, Goldring G900 IGC, Signet TK7, Grace F9F, Premier LME, NAD 9000, Yamaha MC-1S, Fidelity Research FR1Mk3. Class 4: Ortofon MC 30, Supex SD 900, Satin 18BX, Ortofon LM30H, Empire EDR. 9, Shure V15-IV, Nagatronics HV9100, AKG P8ES, Sonus Gold Blue, Acutex 320, Pickering XV4500Q, Osawa 300MP, Ortofon M20FL, Dynavector 20C, ADC ZLM. No recommendation: MicroAcoustics 530mp, Linn Asak, Sumo I, Sumo II, Mayware MC-2c, Mission 773.

Popular Electronics, May 1980

*Audio Reports (p. 31): Audio Control C-101 graphic equalizer/spectrum analyzer (equalizer works fine, analyzer resolution limited to 2 dB, reads about 6 dB high in SPL mode, otherwise works fine). Electro-Voice Interface 2 Series II speaker (smooth, uncolored, a good value). Nagatronics 350E phono cartridge (a decent medium-grade pickup, response curve peaks at 15 kHz).

*Scratch & Rumble Filter (p. 50): Design for simple, high-quality active filters, of 12 dB/octave slope.

Recording Engineer/Producer, April 1980

*Letters (p. 12): Temmer notes that an IEC standard says that XLR connectors are always to be wired with pin 2 plus.

*MS Microphone Technique (p. 58): A clever and easy approach to doing M-S matrix recording without transformers.

*Performance Limits in Console Design (p. 96): Some design problems in mike preamp/mixers, and a circuit in which noise and distortion are not drastically degraded as the number of channels becomes large.

Speaker Builder, 1980 No. 2

*Speaker Cables (p. 6): Measurements of 9 wires; in some cases they can make a difference.
*Three- Enclosure System (p. 12): Making satellite speakers.
*Electrostatic Speaker (p. 20): The Sanders home-made electrostatic.
*Bookwork (p. 30): Reviews of a couple of good books on speaker design.

Stereo Review, May 1980

*Audio Q&A (p. 26): Antenna couplers, un-warping discs, and impedance matching of speakers.
*Audio Basics (p. 28): Courses in audio.
*Tape Talk (p. 30): Jargon, level setting, and automation.
*Technical Talk (p. 35): All about IHF clipping headroom and dynamic headroom measurements.
*Test Reports (p. 38): Harman Kardon HK705 cassette deck (very good performance, Dolby HX

works well to alleviate high-frequency saturation). Vector Research 9000 receiver (amplifier clean and potent with good headroom and load tolerance; tuner sensitive, clean, and quiet; very good overall). Jensen System C loudspeaker (unusually wide, flat, and smooth frequency response, sounds outstandingly good). Audio Control C- 101 graphic equalizer/spectrum analyzer (included microphone is very accurate, equalizer is excellent, SPL readout is off by several dB, spectrum analyzer works well for speaker EQ and for monitoring musical spectra, a very informative tool). SAE A7 amplifier (very good performance, lots of dynamic headroom at low impedances, lots of input and control flexibility, clean and stable behavior, an excellent buy).

*Las Vegas 1980 CES (p. 62): A comprehensive summary of new products seen at the Winter CES.

-- Peter W. Mitchell (Massachusetts) and Jiri Burdych (Czechoslovakia)

April BAS Meeting

Business Meeting

Peter Mitchell opened the April meeting at GTE Labs by announcing that the BAS will be putting society information sheets and member application forms in local audio stores to stimulate enlargement of membership. A growing organization helps stabilize membership dues.

Samples of the old and the proposed new constitution, and a sheet describing the philosophy behind the revisions, were made available to members. Frank Farlow, a member of the Constitution Revision Committee, described the on-going work of the committee and asked members to read the proposed new constitution and bring suggestions for changes to the next meeting. Next month the committee will hold a panel discussion before the members to answer questions. In a subsequent meeting, the final version will then be adopted in total, and a vote taken for substitution of the proposed new constitution and by-laws for the old.

Joel Cohen, founder of Sound Concepts, was asked by Peter to describe his latest product, an acoustic image generator modeled after the Carver Sonic Hologram. He said he started playing with imaging techniques about a year ago, after learning of the Carver unit, and has developed an image enhancement accessory device which he claims has fewer detrimental effects on the central image than the Carver, as well as some useful convenience features. The control panel will be a small hand-held calculator-like pad which can be operated from the listening position for maximum precision of adjustment. Included will be controls for setting the speaker angle (10^{o} to 100^{o}), varying the level of the perimeter sound, and adjusting master volume. Joel said it would not be especially useful for pre-recording special ambient effects on records or for use by radio stations because the speaker angle could not be properly set for all listeners. He also cautioned that non-symmetrical speakers and speakers with different arrival times for different drivers may not operate optimally with this device. The best listening position is in the near field of the speakers, so the first-arrival sound is at least one millisecond ahead of the first reflections from the room. The Sound Concepts image synthesizer should be on the market by July, for about $200.

Commenting on the problems of putting these image-enhanced signals on records, Scott Kent said that the out of phase information created by the processor presents large vertical transients to the record cutter, making cutting difficult. In addition, recordings with a lot of vertical information seem to pick up more distortion and noise in the process of being cut and pressed than the typical disc, which contains mostly lateral signal.

After playing for a month with a new image processor box, the Omnisonic 801, Dave Ranada offered these comments: Like many of these devices, it brings up the noise on the record, especially in the low frequency range. The Omnisonic takes the difference between left and right channels, boosts the bass frequencies of this difference signal, and adds it to one channel while subtracting it from the other, 7 dB down from the original signal. It can sound good on some material, because it creates a sense of low frequency spaciousness which is lacking on many records.

Meeting Feature: Characterizing the Studio and Home Listening Room

Alan Fierstein, president of Acoustilog, Inc. and author of "The Equalization Myth" (reprinted in the January Speaker), demonstrated the techniques he uses to measure the important acoustic parameters of a listening room, be it home or studio. He has designed special instrumentation which simplifies and expedites the measurement of room and speaker characteristics such as:

Reverberation Time (T_{60})
Flutter Echo
Room Modes and Rattles
Speaker Direct Sound
Ambient Noise
Transmission Loss
Uniformity of Sound Field
Equalization
Speaker Polarity, Phasing, and Alignment

The equipment, consisting of an oscilloscope, microphone preamp, timing and delay circuitry, logarithmic amplifier, band pass filters, and a variety of sine, pulse, and pink noise generators, is all mounted on a single control panel which fits in a compact well-padded shipping case. An additional hand-held accessory is a 1/3-octave-band spectrum analyzer, the Ivie IE-30.

Reverberation Time

Sometimes referred to as T_{60}, the reverberation time is the number of seconds required for the sound intensity in a room to die away to 60 dB below its original value after the source is shut off. Acoustilog measures T_{60} by injecting a band-limited noise signal into the room through a speaker. The noise is picked up by a microphone and fed back to the Acoustilog unit. Upon pushing a button the noise source stops and a counter is started. The counter stops when the sound level from the microphone has dropped 30 dB, and the resultant time is multiplied by two to obtain T_{60}. This procedure is used because accuracy requires that the measured levels be at least 10 dB above the natural noise level of the room, and 60 dB below any reasonable steady-state excitation level is almost always well below the room's background level. Strictly speaking this multiplication technique yields the correct T_{60} only if the sound level decays exponentially with time, that is if the log of the sound level is linear when plotted against time. To insure that this is indeed the case, the Acoustilog unit not only provides a digital readout for T_{60}, but also displays the sound level in dB versus time on a storage oscilloscope. The plot can be examined for non-linearities, transient noises, or other artifacts which might invalidate the calculated result. One potential source of non-exponential decay behavior, said Fierstein, is the coupling of two rooms with large differences in T_{60} times.

Using a pair of small single-driver speakers to excite the room and an AKG C451-E omni mike, Mr. Fierstein measured the T_{60} of the GTE Labs auditorium. He cautioned that the mike should be placed so that it picks up predominately the reverberant field; otherwise the direct radiated sound will produce a fast initial decay and an erroneous T_{60} will result. Measurements of T_{60} using octave bands of pink noise were made at three frequencies, 500 Hz, 2 kHz, and 8 kHz, and gave values of 0.58 sec., 0.60 sec., and 0.52 sec. respectively. Plots of decay versus time for these three frequencies are shown in Figure 1. The curves are reasonably linear down to -40 dB, where they begin to level off as the reverberant sound decays below the ambient noise floor of the room.

A T_{60} time of 0.6 sec. would be considered very live for a small room, according to Mr. Fierstein. But in large rooms, like the GTE Labs auditorium, sound must travel farther between reflections from room boundaries, where most of the absorption takes place, yielding longer decay times. An ideal room would have a T_{60} time which was the same at all frequencies; however, a number of elements can produce deviations from this ideal. Air absorption can reduce reverberation time at high frequencies. Solid room walls are poor low frequency absorbers and will increase low frequency T_{60}. Sharp peaks or dips in T_{60} can be produced at certain frequencies by poorly damped or well damped (absorbing) resonances of items in the room such as console panels, ducts, paneled walls, etc. These peaks and dips can sometimes be controlled by adding or reducing absorbing material at strategic points. Some dips in T_{60} at high frequencies can be very sharp and deep. These are usually due to phase cancellation effects, which may look rather drastic on an oscilloscope, but cannot normally be heard since they are too narrow.

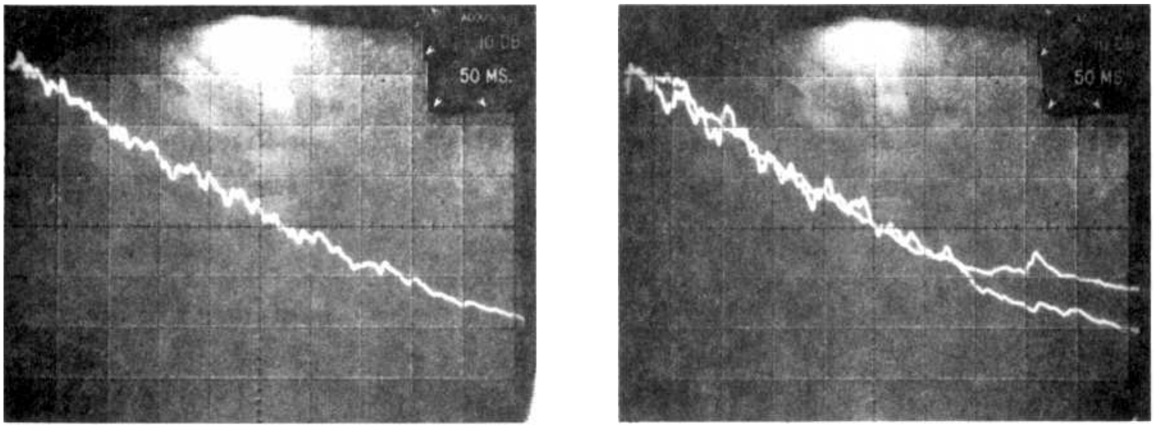

Figure 1. Plots of room reverberant sound level in the GTE Labs auditorium as a function of time after the sound source is shut off show a nearly linear decay with time for the first 40 dB. Each major vertical division is 10 dB and each major horizontal division is 50 msec. Three measurements were made using one octave band of pink noise centered at 2 kHz (a), 500 Hz (b, lower curve), and 8 kHz (b, upper curve).

Flutter Echo

When a transient sound bounces back and forth between two parallel walls with little absorption, a condition known as flutter echo is created. It can be detected by listening for distinct multiple echoes from a sharp hand clap, and is most evident when all but two parallel surfaces in the room are good sound absorbers.

A flutter echo measurement is made to determine two things: does the room have a flutter echo and, if so, which surfaces are causing it? The microphone is set up at some position in the room and the oscilloscope is adjusted to trigger when the first transient hits the microphone. An initial measurement is made with a hand clap close to the microphone. The oscilloscope trace begins and records each echo as it returns from being reflected at a wall or ceiling and passes the mike. It also traces the overall decay of sound level in the room. By examining the position of the peaks as they occur in time along the trace, an estimate can be made of which surfaces are contributing the major reflections.

As an example, Figure 2 shows the results of a flutter echo measurement made in the auditorium by Mr. Fierstein. The mike was placed about nine feet from the front of the room and centered between the side walls. In the lower trace a peak is seen about 15 milliseconds after the start at the left edge. At a velocity of 1140 ft. /sec. sound will travel 17 ft. in 15 msec. That is, the hand clap traveled 8.5 ft. from the mike to a reflecting surface (front wall) and 8.5 ft. back to the mike (17 ft. total) to register the first echo peak. The second peak occurs at 95 msec. This corresponds to a round-trip distance of 108 ft. or 54 ft. to the reflecting surface, which targets the rear wall as the source of this echo. A third peak at 110 msec. is the front wall reflection traveling to the rear wall and back, past the mike. Other peaks can be correlated with further multiple reflections from the front and rear walls and with reflections from the side walls.

From the trace in Figure 2 it is obvious that overlapping reflections from a number of surfaces can be confusing. To emphasize only two surfaces at a time, Mr. Fierstein puts the mike midway between those two only, and off center with respect to all others. With this arrangement the clap transient arrives at the mike simultaneously from both walls, producing peaks that are twice as strong and spaced evenly along the time axis. These characteristics make them more easily identified among the other echo peaks. A second measurement made with the mike located at one surface will give similar results, but with a doubling of the time between peaks. A comparison of the two measurements should allow a positive identification of those surfaces' reflections.

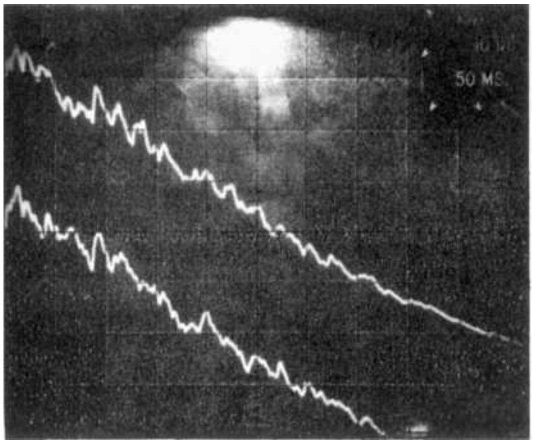

Figure 2. The oscilloscope trace, triggered by a hand clap transient, records room echoes as peaks superimposed on the ambient decay. The horizontal time axis is 50 msec per major division.

Mr. Fierstein commented that echo suppression is not the only reason it is desirable to reduce reflections. Early reflections, by which he means those that arrive within 3 to 8 msec. after the direct sound, tend to combine with the direct sound to produce frequency response aberrations due to phase cancellation effects.

Fierstein mentioned two techniques for reducing reflections. The first involves hanging a curtain of absorbing material near the reflecting surface at a distance of one-quarter of the sound wavelength to be absorbed (e.g., the absorber-to-surface spacing should be about 3.4 inches to most effectively absorb sound frequencies around 1 kHz). The second method uses diffusing elements to break up the reflected wave and scatter its energy incoherently about the room. A combination of these two methods, e.g., the application of spaced strips of absorbing material, can sometimes produce results that are esthetically as well as acoustically pleasing, according to Mr. Fierstein.

Time Delay Spectrometry (TDS)

Swept frequency response measurements can be useful for checking a room for poorly damped room modes (resonances) and rattles, and for determining the detailed frequency response characteristics of speakers. Unfortunately, the straightforward technique of driving a speaker with a signal which sweeps in frequency, and plotting the response picked up at a microphone, gives the sum of all of these effects and more. Separating them so that they can be identified and analyzed individually requires a much more sophisticated approach. One way of achieving this separation makes use of the different arrival times at the mike of each of the individual components which affect the total sound (direct sound from the speaker, early reflections, room resonances, etc.). We can build a gating circuit which will turn on the mike for just a moment, some time after the sound leaves the speaker, and measure only those sounds which arrive during that on time or "time window." The amount of delay before turning on the mike corresponds to the distance the sound has traveled from the source. The shortest time delay or distance which gives useful information is usually that between speaker and microphone. Setting the time window for the first arrival of a brief pulse from the speaker will produce the anechoic frequency response of the speaker, un-muddied by room reflections. By adjusting both the initial delay and the width of the window, frequency response information can be obtained for selected elements or combinations of elements in the room. This technique is referred to as time delay spectrometry (TDS).

The TDS instrumentation used by Mr. Fierstein consists of a sine wave generator and a band pass filter, both of whose frequencies are swept from 1 kHz to 10 kHz. The filter follows the sine wave frequency, but with a time delay which is adjustable. This time delay is in effect the time the system waits before listening to the sweep. The filter width is the size of the time window, or range of distances (and frequencies), over which the system listens. In operation the swept sine generator drives a speaker; a mike picks up the signal, which is passed through the delayed filter, and displayed on an oscilloscope as amplitude versus frequency.

Mr. Fierstein explained that TDS is a fine-detail analysis technique, revealing minute peaks and dips in the frequency response which can be attributed to specific features of the speaker or room, e. g., reflections from room boundaries or furniture, early reflections from the speaker edge, or speaker phasing problems. TDS gives so much detail that it is not the best method for determining the overall balance of a sound system. To illustrate the effect of phase cancellation between speakers, Mr. Fierstein placed two identical speakers next to each other with the microphone about 5 feet in front of them, and drove the speakers simultaneously with the sweep generator. One frequency sweep was recorded with the fronts of the speakers in the same plane. He compared this with a second sweep in which one speaker was moved back about two inches. These sweeps, shown in Figure 3, have dips where cancellation at the microphone has occurred because the sound from the two speakers was out of phase. The phase differences occur because the drivers are at different distances from the microphone. The first curve has a dip at 7.5 kHz. This is the frequency at which cancellation would occur if the difference in path lengths from each speaker to the microphone was 0.9 inches. Since the speakers were flush for this measurement, the indicated path-length difference is probably due to the microphone being off center by a few inches. In the second curve, dips occur at 2. 4 kHz and 7. 2 kHz, corresponding to a path-length difference of 2.9 inches, i.e., the built-in 0.9 inches plus the 2.0 inch speaker offset.

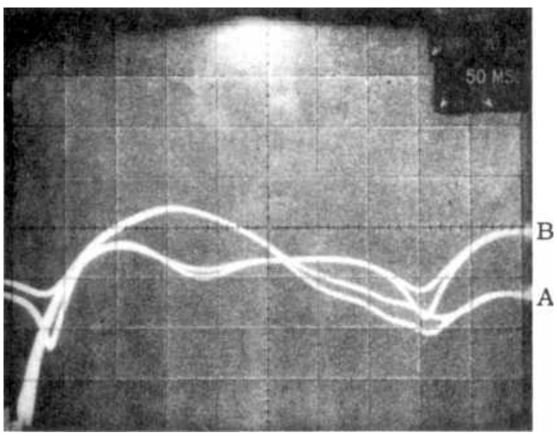

Figure 3. Two TDS measurements of a pair of speakers which have their fronts flush (a) and with one speaker moved back 2 inches (b). Two frequency sweeps (producing two traces) were made for each condition. Scales are 1 kHz/division horizontal and 10 dB/division vertical. The first two horizontal divisions do not contain valid information and should be ignored.

As a comparison, Mr. Fierstein also made frequency response measurements of the same speakers, first aligned and then offset 2 inches, using an Ivie 1/3-octave spectrum analyzer and pink noise source. It was possible to hear the change in character of the pink noise as the speaker was moved. The measurement was made about 5 feet from the speakers by moving the Ivie in a small circle, while integrating the reading to average out differences which might be caused by small variations in microphone position. Figure 4 shows the reading obtained for the two conditions. Because this type of measurement includes the room's reverberant field as well as the direct radiated sound, and because the sound is averaged over an area in front of the speaker, the results will not be exactly the same as for the TDS measurements. A large dip can be seen at 3.15 kHz, and a much smaller dip at 8 kHz for the offset condition, corresponding to the TDS measurement. The TDS dip at 7.5 kHz in the aligned condition is not seen on the Ivie display, probably because instrument movement during measurement averaged out small phase differences about the on-axis position.

<u>Transmission Loss</u>

Sound traveling from one room to another can be disturbing to recording engineers, neighbors or other family members. Transmission paths for extraneous sounds include conduction through walls and windows, and direct radiation through openings beneath doors and over partial walls. A measurement of transmission loss can be made using the TDS system with the speaker in one room and the microphone in the other.

Fierstein described several ways of dealing with transmitted sound. Placing absorbing material such as fiberglass directly on a wall usually does little good. The absorber is most effective in a location of maximum air velocity, i.e., one-quarter of the acoustic wavelength away from the wall. Similarly, acoustic tile for absorbing the reverberant energy of transmitted sound should be suspended below the ceiling. Absorbing material placed inside a hollow wall may help by reducing the reverberation time between the wall panels. Double glazing, heavy glass, and setting the panes in rubber molding can reduce transmission through windows. All direct paths through the air should be blocked.

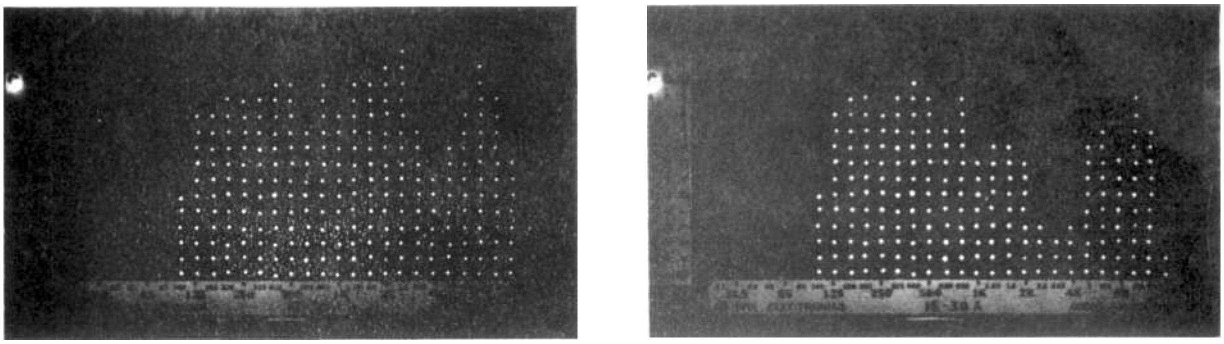

Figure 4. The 1/3-octave pink noise spectrum of two speakers displayed on an Ivie IE-30A show the response when the speakers are aligned (a) and when the speakers are offset 2 inches (b). The vertical calibration is 1 dB per dot.

Speaker Polarity and Phasing

While simple listening tests may be adequate for detecting polarity reversals in speaker terminal connections, more sophisticated test methods are required to ferret out phase reversals in one driver of a multi-driver speaker system. For polarity and phase determinations, Mr. Fierstein uses a half-sine pulse to drive each speaker, in turn, and displays the microphone signal on the storage oscilloscope. A half-sine rather than rectangular pulse is chosen because the latter is a broad band signal which tends to excite all of the drivers of a speaker, making individual polarity or phasing determinations difficult. Although the half-sine does have a harmonic spectrum, its fundamental frequency is more dominant, and if properly chosen can effectively excite predominantly one driver at a time. An example of the waveform produced by a speaker fed the half-sine pulse is shown in Figure 5, where a comparison is made between two waveforms, one of them phase reversed.

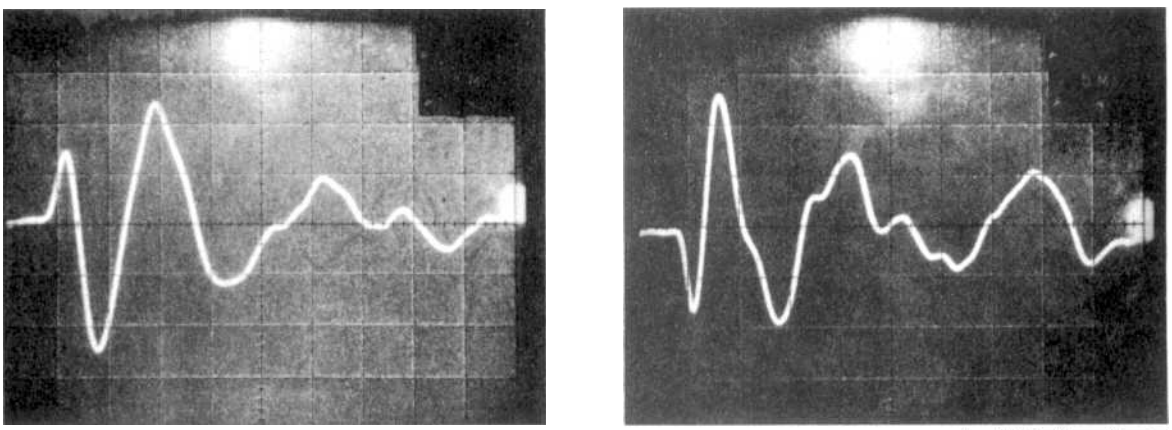

Figure 5. Speaker polarity can be determined by comparing the response to a half-sine drive signal for one polarity connection (a) and the reverse (b).

By pulsing the woofer and then the tweeter, using half-sine pulses with fundamentals in their respective frequency ranges, phase differences or time delays between the two drivers can be measured. Mr. Fierstein pointed out that in some speakers phase differences between drivers are purposely built in as part of the acoustic design. One example is the Altec 604, which has an 8 msec. time delay between the low and high frequency drivers.

-- John Schlafer

Equipment Review Index
for
The BAS Speaker, Volume 7

Ronald L. Johnston

The following is an index of equipment reviews from the "In the Literature" sections of The BAS Speaker, Volume 7. The index may be used to locate a review in any of the regularly excerpted publications, which are listed below along with the abbreviations used in the tables. Note that this is not necessarily a complete list of the contents of each magazine, but only of those reviews which were selected by the authors of "In the Literature." As was the case in the index for Volume 6 (which can be found in Volume 7, Nos. 11 and 12 -- Ed.), some equipment articles and reviews from other parts of The Speaker have been included.

The list is organized into component categories, and within each category by manufacturer and model number. The abbreviation for the magazine comes next, followed by the issue number. Finally, in parentheses, is the number of the issue of The Speaker in which the review was cited. Thus, if the Threshold Model 4000 power amp is reviewed in The Absolute Sound, No. 14, and this review is mentioned in the March issue of The Speaker, then (remember, our subscription year begins in October) the entry would be: Threshold 4000: AS #14 (6).

I apologize in advance for any errors or misclassifications. If any readers have ideas to improve the format, I'm open to suggestions.

Due to the prodigious number of reviews contained in each issue of the Hi-Fi Choice series, these publications have been omitted from this index. The following editions were mentioned in Volume 7:

Hi-Fi Choice: Tuners	BAS pp. 4, 5	(1)
Loudspeakers	BAS p. 5	(3)
Turntables and Tonearms	BAS p. 3	(12)
Cartridges and Headphones	BAS p. 3	(12)

Abbreviation	Publication
A	Audio
AA	Audio Amateur
AC	Audio Critic
AF	Audio Forum
AH	Audio Horizons
AS	The Absolute Sound
ASC	AudioScene Canada
BAS	The BAS Speaker
BP	Boston Phoenix
db	db
G	Gramophone
HF	High Fidelity
HFN	Hi-Fi News and Record Review
HFS	HiFi Stereophonie (Germany)
Mr. A	Mr. Audio's Bimonthly
MR	Modern Recording

Abbreviation	Publication
PE	Popular Electronics
RE	Radio Electronics
S	Stereo
SA	Sound Advice
SO	StereOpus
SP	Stereophile
SQ	Stereo Quarterly
SR	Stereo Review
SS	Studio Sound
T$S	The $ensible Sound

Power Amps

Amber Series 70: BAS User's Report (12)
Audio Research D-52: AS #14 (6)
Audio Research D-52B: AS #15 (12)
Audio Research D-110: AS #14 (6)
Audio Research D-110B: AS #15 (12)
Audionics CC-2: AS #15 (12)
Audionics PZ3-II: AC Vol. 1 #6 (4)
BGW 210: SR 1/79 (4)
Bryston 4B: SO Vol. 4 #3 (1); MR 10/78 (2); AS #14 (6)
Cambridge P80: G 8/78 (2)
Cerwin Vega A-400: MR 8/79 (12)
Crest Audio P-3500: MR 6/79 (9)
DB Systems DB-6: SA Vol. 2 #5 (1); SO Vol. 4 #3 (1); AS #14 (6)
DB Systems DB-6M: AS #14 (6)
Dynaco ST-150: PE 6/79 (9)
Dynaco ST-416: S Fall '78 (1)
Dynavector: SA Vol. 2 #5 (1)
EM Acoustics 600A: AC Vol. 1 #6 (4)
Futterman H-3aa: AC Vol. 1 #6 (4)
GAS Grandson: AS #14 (6)
Hafler DH-200: AS #15 (12); AC Vol. 2 #1 (12)
Harman-Kardon Citation 19: HFN 10/78 (2); HFS 2/79 (6)
Heathkit AA-1600: MR 2/79 (5)
Hitachi HMA 7500: HFN 10/78 (2); PE 2/79 (5); HF 3/79 (6)
Hitachi HMA 8300: MR 5/79 (8)
Infinity HCA: SP Vol. 4 #4 (10); AS #15 (12)
Kenwood L-07M: AC Vol. 1 #6 (4)
Kenwood L-07MII: HFS 9/78 (1)
Leach: AS #13 (3)
Levinson ML-2: AS #14 (6)
Mitsubishi DA-A15DC: HFS 9/78 (1)
Mitsubishi mini: HFS 5/79 (8)
NAD 3020: SR 7/79 (10)
Paragon E-5: Mr. A Vol. 1 #3 (1)
Phase Linear Dual 500: AS #13 (3)
Phase Linear 700: HFS 10/79 (12)
Phase Linear 700/R: SR 4/79 (7)
Pioneer M-22: HFS 10/78 (1)
PSE Studio: A 4/79 (7)
Quad 405: A 4/79 (7)
Quatre 250C: AS #13 (3)
Rappaport AMP-1: AC Vol. 1 #6 (4); AC Vol. 2 #1 (12)
Rotel 2030: HF 7/79 (10)
SAE C3A: PE 1/79 (4)
Sansui AU-919: SR 3/79 (6)
Sansui BA-Fl: HFS 10/79 (12)
Series Twenty M-22: AC Vol. 1 #6 (4)
Sony TA-N7: HFS 10/78 (1)
Sony TA-N86B: HFS 10/79 (12)
Sony TA-N88 PWM: HFS 9/78 (1)
Sony mini: HFS 5/79 (8)
Soundcraftsmen 5002: AS #13 (3)
Stax DA-80: SA Vol. 2 #5 (1); AC Vol. 1 #6 (4)
Technics 9021: G 4/79 (8)
Technics 9060: HFN 10/78 (2)
Technics SE-Al: HFS 1/79 (5)
Technics SE-CO1: HFS 5/79 (8); HF 6/79 (9)
Thiel 01: SA Vol. 2 #5 (1)
Thiel 02: SQ Winter '79 (3)
Thiel 03: AS #15 (12)
Threshold 400A: SA Vol. 2 #5 (1); AS #13 (3)
Threshold CAS-1: SR 2/79 (5)
Threshold 4000: AS #14 (6)
Uher mini: HFS 5/79 (8)
Uni-Sync 50: HF 5/79 (8)
Van Alstine Model 2: AS #14 (6)
Yamaha B-2: SA Vol. 2 #5 (1)
Yamaha M-4: MR 7/79 (10)

Preamps

Ace 3000: SO Vol. 4 #3 (1)
Apt/Holman: BAS p. 8-9 (1); S Fall '78 (1); AC Vol. 1 #6 (4); AS #14 (6); BP 4/3/79 (7)
Audio International CM 301: HF 2/79 (5); AC Vol. 2 #1 (12)
Audionics BT-2: AS #14 (6)
Audionics BT-2 Series U: AC Vol. 2 #1 (12)
Audio Research AR SP-6: Mr. A Vol. 1 #3 (1); AS #13 (3); AC Vol. 1 #6 (4); AS #14 (6)
Audio Research AR SP-6a: AS #15 (12)
Audio Research AR SP-5: AS #14 (6)
Berning: SP Vol. 4 #4 (10)
Bryston CM 612: SO Vol. 4 #3 (1)
Carver 4000: PE 5/79 (8); SR 5/79 (8); BAS Publication (8)
Conrad-Johnson tube: AS #13 (3)
Conrad-Johnson tube, Improved: AS #15 (12)

Cotter PSC-2: AC Vol. 2 #1 (12)
Cotter CU-2: AC Vol. 2 #1 (12)
Crown DL-2 Digilogic: HF 12/78 (3); PE 12/78 (3); SR 12/78 (3); A 3/79 (6)
DB Systems DB-1A: AC Vol. 1 #6 (4)
Dayton-Wright SPA: AS #14 (6)
Dynavector: SA Vol. 2 #5 (1)
Hafler DH-101: AA 3/78 (1); HFN 11/78 (4); BAS p. 8-10 (6); AS #14 (6); G 3/79 (7); AC Vol. 2 #1 (12)
Harman-Kardon Citation 17: HFS 2/79 (6)
Harman-Kardon Citation 17S: HFN 10/78 (2)
Hegeman HAPI One: AS #13 (3); AS #14 (6)
Hegeman HPR/CU: AC Vol. 1 #6 (4); AC Vol. 2 #1 (12)
Hitachi 7500: HFN 10/78 (2); AC Vol. 2 #1 (12)
JVC P-3030: G 4/79 (8)
Kenwood L-07 CII: HFS 9/78 (1)
Leach "Low-TIM" RIAA preamp module: BAS p. 11-12 (2)
Levinson LN P-2: AC Vol. 2 #1 (12)
Levinson ML-1: AS #15 (12)
Mitsubishi DA-C20: HF 3/79 (6)
Mitsubishi DA-P20: HFS 9/78 (1)
Mitsubishi mini: HFS 5/79 (8)
PSE Studio: A 4/79 (7)
Paoli SP-3a-1 Mod 2: AS #14 (6)
Paragon 12: Mr. A Vol. 1 #3 (1)
Phase Linear 3000: HFS 10/79 (12)
Pioneer C-21: HFS 10/78 (1)
Precision Fidelity C-4: AC Vol. 1 #6 (4)
Precision Fidelity C-4 Improved: AC Vol. 2 #1 (12)
Quantum Electronics CP-1: BAS p. 9-11 (2); AS #14 (6)
Rappaport Pre-2: AC Vol. 1 #6 (4)
Rappaport Pre-3 prototype: AC Vol. 1 #6 (4)
Rappaport Pre-3: AC Vol. 2 #1 (12)
SAE 2100L: HFS 2/79 (6)
SAE 2900: HF 1/79 (4)
Sansui CA-Fl: HFS 10/79 (12)
Series Twenty C-21: AC Vol. 1 #6 (4)
Sony TA-E7: HFS 10/78 (1)
Sony TA-E88: HFS 9/78 (1)
Sony TA-E86B: HFS 10/79 (12)
Sony mini: HFS 5/79 (8)
Soundcraftsmen 4002: SR 6/79 (9)
Source Engineering "Specialist": HF 3/79 (6)
Spatial TVA-1: AS #13 (3); AC Vol. 2 #1 (12)
Technics 9070: HFN 10/78 (2)
Technics SU-A2: HFS 1/79 (5)
Technics 9011: G 4/79 (8)
Technics SU-CO1: HFS 5/79 (8); HF 6/79 (9)
Threshold CAS-2: AS #13 (3)
Threshold NS-10: AS #15 (12)
Trevor Lees (mod): Mr. A Vol. 1 #3 (1)
Uher mini: HFS 5/79 (8)
Van Alstine SP-3a-1 Mod 2: AS #14 (6)
Van Alstine FET-5 Mk. V: AC Vol. 2 #1 (12)

Integrated Amps

Aiwa AA-8700E: HFS 4/79 (7)
Hitachi HA-5300: HFS 11/78 (3)
Kenwood KA-9100: HFS 11/78 (3); HFN 12/78 (4)
Lux CA 810: HFN 12/78 (4)
Lux SL-15: HF 4/79 (7)
Marantz 1122-DC: HFN 12/78 (4)
Nikko TRM 750: HFN 12/78 (4)
Onkyo A-10: HFS 11/78 (3)
Onkyo A-7070: HFS 10/79 (12); SR 8/79 (12)
Pioneer 9800: HF 9/79 (12)
Revox B750 Mk. II: HFS 10/79 (12)
SAE 2922: A 3/79 (6); HFS 2/79 (6)
Sansui 717: HFN 12/78 (4)
Sansui 317: G 5/79 (10)
H. H. Scott 480: PE 3/79 (6)
H. H. Scott 480A: HF 5/79 (8)
Visonik VSA-1000: HFS 4/79 (7)
Yamaha CA 810: HFN 12/78 (4)

Receivers

Akai AA-1150: HFS 3/79 (6)
Fisher RS-2007: HF 7/79 (10)
Grundig X55a: HFS 1/79 (5)
Harman-Kardon 670: SR 4/79 (7); HFN 5/79 (9)
Hitachi SR-2004: A 11/78 (2); HF 12/78 (3)
JVS JR-S301: HFS 3/79 (6)
Kenwood 7050: A 7/79 (10)
Kenwood 8050: SR 9/79 (12)
Kirksaeter Moderator 100-150: HFS 12/78 (4)
Lafayette 120 Db: PE 12/78 (3)
Lux 1120: PE 11/78 (2)
Lux R-1050: HFS 12/78 (4)
MacIntosh 4100: HF 2/79 (5)
Marantz 2285B: S Fall '78 (1)
Marantz 2265B: RE 10/78 (2)
Marantz 2238B: HFS 3/79 (6)
Metz Studio 4730: HFS 12/78 (4)
Nakamichi 730: A 12/78 (3); HF 4/79 (7)
Onkyo TX-2500/II: A 2/79 (5)
Onkyo TX-4500/II: HF 5/79 (8)
J. C. Penney 3275: SR 1/79 (4); HF 9/79 (12)
JVC JRS 501: RE 6/79 (9)
Pioneer SX-1980: SR 12/78 (3)
Pioneer 790: HFN 5/79 (9)
Radio Shack Realistic STA-7: HF 8/79 (12)
Sansui G-9000: RE 12/78 (3)
Scott 390R: A 8/79 (12)
Setton RS660: RE 9/79 (12)
Sherwood 7650: SR 5/79 (8)
Sherwood 7450CP: HF 7/79 (10)
Sony STR-V5: HFN 5/79 (9)
Sony STR-V7: RE 8/79 (10)
Thorens AT 410: HFS 12/78 (4)
Yamaha CR-420: A 11/78 (2); RE 2/79 (5)
Yamaha 2040: A 6/79 (9)
Yamaha 640: HF 6/79 (9)
Yamaha 840: SR 6/79 (9)

Cassette Decks

ASC AS-6002/38: HFS 4/79 (8)
Advent 201A: AS #13 (3)
Advent 201: BAS p. 9-11 (4)
Aiwa AD-6800: ASC 5/78 (1); G 9/78 (2)
Aiwa 6550: A 12/78 (3)
Aiwa 6900: HF 3/79 (6)
Aiwa 6700: HFS 9/79 (12)
Akai GXC-730D: ASC 5/78 (1)
Akai GXC-709D: SQ Winter '79 (3)
BASF D-3055: HFS 10/78 (1)
B. I. C. T-2: SQ Winter '79 (3); PE 1/79 (4)
B. I. C. T-3: MR 2/79 (5); HF 8/79 (12); HFS 8/79 (12)
Denon 750: MR 5/79 (8)
Dual C-819: PE 12/78 (3); SR 12/78 (3)
Dual C-839RC: HFS 9/79 (12)
Eumig CCD: MR 12/78 (3)
Eumig CCS: PE 5/79 (8)
Fisher CR-4025: SR 5/79 (8)
Harman-Kardon HK-3500: MR 6/79 (9); HF 7/79 (10)
Hitachi D-720: SQ Winter '79 (3)
Hitachi D-900: HFN 11/78 (4)
Hitachi D-7500: HF 3/79 (8)
Hitachi 5500: SR 7/79 (10)
JVC KD-85: A 11/78 (2); HF 12/78 (3)
Kenwood KX-1030: ASC 5/78 (1)
Lenco C2003: A 11/78 (2)
Marantz 5030: MR 10/78 (2); A 12/78 (3)
Marantz 5030B: HF 1/79 (4)
Mitsubishi DT30: MR 8/79 (12)
Mitsubishi T01: HF 6/79 (3)
Nakamichi 1000/II: SQ Winter '79 (3)
Nakamichi 582: A 8/79 (12); HF 8/79 (12); SR 8/79 (12)
Optonica RT-3535: HFN 11/78 (4)
Pioneer CTF-900: PE 11/78 (2); BAS p. 9-12 (4); BAS p. 3-5 (9)
Pioneer CTF-1000: HFN 11/78 (4)
Pioneer CTF-4242: ASC 5/78 (1)
Pioneer CTF-800: MR 7979 (10)
Realistic SCT-30: SR 1/79 (4); PE 4/79 (7); RE 4/79 (7); A 6/79 (9)
Revox B77: HFS 4/79 (8)
Sansui 100G: SQ Winter '79 (3)
Sanyo 5350: A 2/79 (5)
Sanyo 5370: HF 8/79 (12)
Sony TC-K8B: MR 11/78 (2)
Tandberg TCD-340AM: RE 3/79 (7)
Teac C-1: SQ Winter '79 (3)
Teac 124 Syncaset: SR 9/79 (12)
Technics 616: A 2/79 (5)
Technics M85: HF 4/79 (7); A 6/79 (9)
Toshiba 5460: SR 2/79 (5)
Uher CG-362: ASC 5/78 (1)
Uher CR240: HFS 11/78 (3)

Reel Decks

Akai Pro-1000: MR 2/79 (5); PE 2/79 (5); HF 5/79 (8)
Akai 267D: A 6/79 (9)
Otari 5050-B: MR 6/79 (9)
Technics RS-1500US: HFS 9/78 (1)
Tandberg TD-20A: MR 10/78 (2); RE 1/79 (4); A 3/79 (6)

Tuners

Aiwa 9700: HFN 2/79 (7)
Aiwa 9700E: HFS 4/79 (7)
JVC JT-V77: PE 10/78 (1)
JVC T-3030: HF 2/79 (5); HFN 2/79 (7)
Kenwood KT-917: SR 3/79 (6); PE 4/79 (7)
Kenwood 615: SQ Summer '79 (9)
Marantz 21300: HFS 8/79 (12)
Mitsubishi DA-C20: HF 3/79 (6)
Mitsubishi mini: HFS 5/79 (8); HF 6/79 (9)
Mitsubishi F20: SR 8/79 (12)
Nakamichi 430: HFN 2/79 (7)
Nikko Gamma 1: A 5/79 (8)
Optonica ST-3636: A 12/78 (3)
Pioneer TVX-9500 (TV tuner): A 11/78 (2); HF 12/78 (3); RE 1/79 (4); PE 5/79 (8)
Revox B760: HFN 2/79 (7)
Rotel 2100: A 9/79 (12)
SAE T3U: PE 1/79 (4)
Scott 530-T: RE 6/79 (9)
Sony ST-A7B: HFN 2/79 (7)
Sony mini: HFS 5/79 (8)
Technics ST-9038: HFN 2/79 (7)
Technics 9031: G 4/79 (8)
Technics mini: HFS 5/79 (8)
Toshiba mini: HFS 5/79 (8)
Uher mini: HFS 5/79 (8)
Visonik VST-1000: HFS 4/79 (7)
Wega 42T: HFS 1/79 (5)
Wega Lab Zero: HFS 8/79 (12)
Yamaha T-2: HFS 8/79 (12)

Turntables

ADC LMF-1: AC Vol. 1 #6 (4)
ADC 1700DD: HF 7/79 (10); HFN 8/79 (12)
Acoustic Research XA: BAS p. 11 (1)
Acoustic Research 77XB: G 9/78 (2)
B&O 1500: HFN 6/79 (10)
Denon DP-2500: HF 2/79 (5); PE 4/79 (7)
Dual CS731Q: HFS 6/79 (9)
EMT 950: SS 5/79 (9)
Fisher MT-6225: HF 1/79 (4)
Garrard GT25P: G 8/78 (2)
Garrard DD-130: HF 1/79 (4)
Garrard DD-132: SR 9/79 (12)
Hitachi HT-353: HFN 8/79 (12)
JVC QL-7: A 12/78 (3)
JVC QL-47: G 4/79 (8)
Kenwood KD-5070: HF 1/79 (4)

Kenwood KD-750: HFS 2/79 (6)
Kenwood KD-500: AS #15 (12)
Linn Sondek LP-12: SA Vol. 2 #5 (1); G 12/78 (5); AS #14 (i)
Marantz 62700: HFN 8/79 (12)
Philips AF 777: HFS 12/78 (4)
Philips AF 877: HFS 12/78 (4); PE 3/79 (6); SR 3/79 (6)
Philips 977: HFS 12/78 (4)
Pickering FA-330A: HFS 2/79 (6); G 3/79 (7)
Pioneer PL-540: HFN 8/79 (12)
Revox B-790: HFS 9/78 (1); AS #13 (3); HF 3/79 (6); SR 4/79 (7); A 6/79 (9)
Sansui 838: A 2/79 (5)
Sansui 222: HFN 6/79 (10)
Sanyo TP 1030: PE 7/79 (10)
Series Twenty PLC-590: AC Vol. 1 #6 (4)
Sony PS-X7: HF 12/78 (3); BAS p. 16 (6)
Sony PS-X60: G 7/79 (12)
Stanton 8005M: HF 1/79 (4)
Technics SP10-Mk. II: SA Vol. 2 #5 (1); AC Vol. 2 #1 (12)
Thorens TD-115C: SR 7/79 (10)
Thorens TD-110: HFN 8/79 (12)
Visonik DD-8200: HF 1/79 (4); A 5/79 (8)
Win Labs SDC-10: AS #15 (12); AC Vol. 2 #1 (12)
Yamaha YP-211: BAS p. 8 (3)

Tonearms

ADC LMF-2: A 1/79 (4)
Audiocraft AC-400 Mk. II: HFS 3/79 (6)
Breuer Dynamic: SA Vol. 2 #5 (1)
Decca London: A 8/79 (12)
Denon DA-307: SA Vol. 2 #5 (1)
Dynavector DV-505: SA Vol. 2 #5 (1)
Fidelity Research FR-64s: AC Vol. 1 #6 (4)
Fidelity Research FR-66s: AC Vol. 1 #6 (4)
Infinity Black Widow: SA Vol. 2 #5 (1); A 3/79 (6)
Infinity Black Widow H: AS #15 (12)
J. H. Audiolab: AS #14 (6)
Macinnes 5220: SS 5/79 (9)
Mayware Formula 4 Mk. II: SA Vol. 2 #5 (1)
Mayware Formula 4 Mk. III: G 2/79 (6)
Series Twenty PA-1000: AC Vol. 1 #6 (4)
Sliski "Frictionless": BAS p. 15-16 (6)
SME 3009-III: PE 10/78 (1); RE 10/78 (2); AS #14 (6); SR 5/79 (8); SS 5/79 (9)

Cartridges

16 cartridges from Audio Technica, Elac, Empire, Glanz, Ortofon, Philips, Technics and Yamaha: HFS 8/79 (12)
Number of moving coil cartridges: Mr. A Vol. 1 #3 (1)
ADC-ZLM: T$S Vol. 2 #5 (1); A 1/79 (4); A 3/79 (6)
AKG P8ES: A 12/78 (3)
B&O MMC-20L: HF 4/79 (7); SQ Summer '79 (9); SR 6/79 (9)
B&O MMC-20CL: G 7/79 (12)
Decca London Gold: HFN 4/79 (9); A 8/79 (12)
Denon DL-103D: AS #13 (3); HF 12/78 (3); HFS 3/79 (6); HFN 4/79 (9)
Denon DL-103: HFS 3/79 (6)
Denon DL-103S: HFS 3/79 (6)
EMT TSD-15: SS 5/79 (9)
Elite 500: G 2/79 (6)
Elite EEI MC555: HFN 4/79 (9)
Empire 2000E-HI: BAS p. 8 (3)
Empire BC1: SS 5/79 (9)
Empire EDR. 9: PE 7/79 (10); A 9/79 (12); SR 9/79 (12)
Fidelity Research FR-1 Mk. 3F: AC Vol. 1 #6 (4)
Fidelity Research FR-7: AC Vol. 2 #1 (12)
Grado Signature III: AS #13 (2); AS #14 (6); AS #15 (12)
Iverson Electro Kinetic System: SA Vol. 2 #5 (1)
JVC MC-2e: G 4/79 (8): HFN 4/79 (9)
JWS AT-1001 Super E: HFS 3/79 (6)
Koetsu: AC Vol. 2 #1 (12)
Mayware MC-2C: HFN 4/79 (9)
Nagaoka OS-100MP: HFS 3/79 (6)
Nagaoka OS-200MP: HFS 3/79 (6)
Nagaoka OS-300MP: HFS 3/79 (6)
Nagatron HV-9100: SR 12/78 (3); HF 1/79 (4); A 5/79 (8)
Ortofon MC-10: HF 2/79 (5); HFS 3/79 (6)
Ortofon MC-30: HFS 3/79 (6); G 3/79 (7); HFN 4/79 (9)
Ortofon Concorde 30: SR 8/79 (12)
Promethean: AS #13 (3)
Satin M-18BX: A 12/78 (3)
Satin M117G: G 12/78 (5)
Shure V15IV: ASC 4/78 (1); T$S Vol. 2 #5 (1); BAS Publication (3); A 2/79 (5); BAS p. 4-7; 9 (7); BAS p. 20-25 (7); SS 6/79 (9); SP Vol. 4 #4 (10)
Shure SC35C: SS 5/79 (9)
Shure M95HE: HF 9/79 (12); PE 8/79 (12)
Signet TK7E: T$S Vol. 2 #5 (1); PE 11/78 (2); SR 2/79 (5)
Signet Mk 111E: AC Vol. 1 #6 (4)
Signet MC: AS #15 (12)
Sonus Blue: T$S Vol. 2 #5 (1); S Fall '78 (1)
Sonus Gold: S Fall '78 (1)
Sonus Gold II w/ Blue Stylus: A 7/79 (10); HF 8/79 (12)
Sony XL-55: G 6/79 (10)
Stanton 881S: ASC 4/78 (1); BAS p. 20-23 (1); A 11/78 (2); G 8/78 (2); AS #13 (3); BAS Publication (3); BAS p. 4-9 (7); BAS p. 10 (8)
Stanton 500 AL: SS 5/79 (9)
Stanton 680 EL: SS 5/79 (9)
Stax CP-Y: AS #15 (12)
Sumo: AS #13 (3); AS #14 (6)

Toshiba C-400: HFS 3/79 (6)
Van Alstine/Sonus Es-AnsM: AS #13 (3)
Win Labs SDT-10 Mk. 2: BAS p. 7-8 (2); AC Vol. 1 #6 (4)

Headphones

Test of 36 headphones by Aiwa, AKG, Braun, Canton, Dero, Grundig, Jeklin, JWS, Koss, Micro, Peerless, Saba, Sansui, Sennheiser, Stax and Vivanco: HFS 7/79 (10)
AKG K141: HFN 1/79 (5)
Audio-Technica ATH-7: HF 1/79 (4)
Beyer ET 1000: HFN 1/79 (5)
B&O U70: HFN 1/79 (5)
Howland-West 1750: HFN 1/79 (5)
Infinity ES-1: SA Vol. 2 #5 (1); AC Vol. 1 #6 (4)
Jeklin: SA Vol. 2 #5 (1)
Koss ESP/10: SA Vol. 2 #5 (1); HFN 1/79 (5)
Koss Pro/4AAA: SR 1/79 (4)
Koss HV/1A: BAS p. 10-11 (5)
Leak 3000: HFN 1/79 (5)
PWB: HFN 1/79 (5)
Revox RH-310: HFN 1/79 (5)
Sennheiser HD 420: HFN 1/79 (5)
Signet TK-33: AC Vol. 1 #6 (4)
Stanton Dynaphase 35: HFN 1/79 (5); PE 6/79 (9)
Stax SRD Sigma: HFN 1/79 (5)
Stax SR-X Mk. 3: SA Vol. 2 #5 (1)
Superex PEP-81: SA Vol. 2 #5 (1)
Toshiba HR 811: HFN 1/79 (5); G 7/79 (12)

Speakers

Tests of seven mini speakers: BP 10/3/78 (2)
AAL Micro 100: SR 8/79 (12)
ADS 300: SR 8/79 (12)
AEI Evolution One: T$S Vol. 2 #5 (1)
AR-9: PE 10/78 (1); HFN 12/78 (4); HFN 3/79 (7); AS #15 (12)
AR-90: SQ Summer '79 (9)
Acoustat X: SO Vol. 4 #3 (1)
Acoustat Monitor: AS #13 (3); AS #14 (6); AS #15 (12)
Acron 3000: HFS 10/79 (12)
Acutex MTS1: SR 8/79 (12)
Advent Powered: S Fall '78 (1); PE 1/79 (4)
Advent New: AS #14 (6)
Advent 400: BAS p. 5-6 (9)
Akai SW-7: SR 8/79 (12)
Allison Three: HFN 12/78 (4); G 4/79 (8)
Allison Four: HFN 6/79 (10)
Altec Lansing 19: HFS 10/79 (12)
Audioanalyst M2: SR 8/79 (12)
Audiomaster MLS4: HFN 6/79 (10)
Audiomaster MSL1: G 8/79 (12)
AudioPro B2-50: HFN 7/79 (12)
Avid 230: SR 2/79 (5)
Avid 330: HF 3/79 (6)
B&W DM2/II: G 12/78 (5); HFN 6/79 (10); SR 8/79 (12)
Backes & Muller Monitor 6: HFS 10/78 (1)
Bang & Olufsen C40: SR 8/79 (12)
Bass Mint 10/24: AC Vol. 1 #6 (4)
Beveridge 2SW/II: AS #14 (6); SP Vol. 4 #4 (10); AC Vol. 2 #1 (12)
Bose 901/III: HFS 3/79 (6)
Bozak LS-300: HF 4/79 (7)
Braun LW1/L530S: HFS 3/79 (6)
Braun SM 1002: HFS 10/79 (12)
Braun L-200: SR 8/79 (12)
Cabasse Brigantin 3VTA: HFS 10/78 (1)
Canton Gamma 800L: AC Vol. 1 #6 (4)
Canton Gamma GLE 70: HFS 3/79 (6)
Canton Gamma GLE 50: HFS 10/79 (12)
Canton Gamma GLE 40: HFS 8/79 (12)
Celestion Ditton 22: HFS 6/79 (9)
Celestion Ditton 551: G 5/79 (10)
Celestion Ditton 662: HF 9/79 (12)
Cerwin Vega R12: HFN 6/79 (10)
Chartwell PM110: G 8/79 (12)
Cizek MG-27: AC Vol. 1 #6 (4)
Cizek KA-1: BAS p. 6-7 (9)
Cybele: AS #15 (12)
Dahlquist ALS-3: SR 8/79 (12)
Dansk Prof 100/140: HFS 8/79 (12)
Dansk Prof 80/100: HFS 8/79 (12)
Dansk Prof 50/70: HFS 8/79 (12)
Dennesen electrostatic: BP 10/3/78 (2)
Dennesen SW-II: AC Vol. 2 #1 (12)
Design Acoustics D- 12A: AR 3/79 (6)
Dual CL470: HFS 6/79 (9)
Dual CL241: HFS 10/79 (12)
Dynaco A-30XL: AS #13 (3)
ESS amt 1b: HFS 10/78 (1)
ESS amt Monitor: HFS 7/79 (10)
Electro-Voice Interface B-II: S Fall '78 (1)
Elton Serie els 1000: HFS 12/78 (4)
Fisher STE-1200: HFS 10/78 (1); HFS 4/79 (7)
Fisher STE-1150: HFS 4/79 (7)
Fisher STE-1110: HFS 4/79 (7)
Fisher ST-460: PE 8/79 (12)
Fried B/2: AC Vol. 1 #6 (4)
Fried T: AC Vol. 1 #6 (4)
Fried W: AC Vol. 2 #1 (12)
Fried C: AC Vol. 2 #1 (12)
Gale GS401A: SR 4/79 (7); AS #15 (12)
General Sound Micron 500: SR 8/79 (12)
Goodmans Achromat: G 2/79 (6)
Goodmans Sigma: HFN 6/79 (10)
Grafyx SP-10: HF 4/79 (7)
Grundig Professional Series: HFS 1/79 (5); HFS 3/79 (6)
Harbeth HL Mk. II: G 8/79 (12)
Heco Professional 650: HFS 6/79 (9)
Heco 450: HFS 10/79 (12)
Hill Plasmatronics Type I: SP Vol. 4 #4 (10)
Hitachi HS-1: SR 8/79 (12)
ITT 8073: HFN 6/79 (10)

Infinity QRS: HFS 9/78 (1)
Infinity Qe: S Fall '78 (1); AS #13 (3)
Infinity Infinitesimal: HF 6/79 (9)
Infinity 4. 5: SP Vol. 4 #4 (10); HFS 8/79 (12)
Isophon HPS-90: HFS 3/79 (6); HFS 4/79 (7)
Isophon HPS-140: HFS 4/79 (7)
JBL L-110: HFN 10/78 (2); HFS 6/79 (9); HF 7/79 (10)
JR 150: G 8/79 (12)
JVC s-M3: SR 8/79 (12)
Jim Rogers JR149: BAS (1)
Jordanow 80/130A: HFS 6/79 (9)
KEF 105: G 9/78 (2); HFN 10/78 (2); HFS 3/79 (6); SR 6/79 (9); HF 7/79 (10)
KEF Celeste: G 3/79 (7)
KEF Concord III: HFN 6/79 (10)
KEF 101: G 8/79 (12)
Kinetic Audio (Kustom Acoustics) Stat 400: AS #15 (12)
Koss CM/1020: S Fall '78 (1); SR 8/79 (12)
Koss CM 530: PE 6/79 (9); HF 9/79 (12)
LTC 100: AS #13 (3)
Lafayette Pipsqueak: BAS p. 5-6 (9); SR 8/79 (12)
Lentek S4: HFN 6/79 (10)
Magneplanar Tympani 1-D: AC Vol. 1 #6 (4)
Marantz HD-880: BAS Publication (7)
Mark Levinson HQD: SP Vol. 4 #4 (10)
Mission 770: HFN 3/79 (7)
Mitsubishi MC-7500: HFS 2/79 (6)
Monitor Audio MA4/II: HFN 10/78 (2)
Mordaunt-Short Signifier: HFN 10/78 (2)
Mordaunt-Short Pageant II: AS #13 (3); AS #15 (12)
NAD 8080: HFN 6/79 (10)
Ohm L: SA Vol. 2 #5 (1)
Philips RH545 MFB: HFS 10/78 (1)
Pohler PS5503: HFS 2/79 (6)
Pohler PS4302: HFS 2/79 (6)
Polk Mini-Monitor: SR 8/79 (12)
Precedent M. S. Mod. III: AS #13 (3); AC Vol. 1 #6 (4)
Pyramid Metronome: AS #13 (3)
Pyramid T-1 ribbon tweeter: AC Vol. 1 #6 (4); AC Vol. 2 #1 (12)
Qysonic Array: HF 8/79 (12)
RTR PS/1 compact: SR 7/79 (10)
RTR DAC/1 subwoofer: SR 7/79 (10)
Radford T90: HFN 6/79 (10); G 8/79 (12)
Realistic Minimus 7: SR 8/79 (12)
Revox BR430: HFS 2/79 (6)
Rogers LS3/5A: HF 7/79 (10)
SMC AL50: HFN 3/79 (7)
Sansui J11: SR 8/79 (12)
Scott 188T: SQ Winter '79 (3)
Snell A: SO Vol. 4 #3 (1); AS #15 (12)
Sony SS-G7: HFS 10/78 (1)
Sony SS-G1: HFS 4/79 (7); HFN 6/79 (10)
Sony SS-5GX: SR 8/79 (12)
Speakerlab S3: S Fall '78 (1)
Speakerlab 30: HF 7/79 (10)
Spendor BC-1: SO Vol. 4 #3 (1)
Spendor BC-la: AS #13 (3)
Symdex Sigma: AC Vol. 1 #6 (4); AC Vol. 2 #1 (12)
Synergistics S-92: SR 12/78 (3)
T&A elektroakustic Delta: HFS 11/78 (3)
TSM Puris 62: HFS 10/79 (12)
Tannoy 125: HFN 6/79 (10)
Technics EAS-10 TH 1000 ribbon tweeter: HFS 1/79 (5)
Technics SB-F1: G 8/79 (12)
Telefunken TLX-Professional Series, TLX-3, 2/4 and 1: HFS 7/79 (10)
Thiel 03: AC Vol. 2 #1 (12)
Thorens Sound Wall HP-380: HF'S 4/79 (7)
Ultralinear 228: SR 1/79 (4); HF 5/79 (8)
Ultralinear M16: SR 8/79 (12)
Vandersteen Model U: AC Vol. 2 #1 (12)
Visonik David 803: HFS 12/78 (4)
Visonik David 702: HFS 12/78 (4)
Visonik Expuls 1: HFS 4/79 (7)
Visonik Expuls 2: HFS 6/79 (9)
Visonik 502 w/ Sub-1 woofer: AS #13 (3); SQ Winter '79 (3)
Visonik Euro 7: HF 7/79 (10)
Visonik D-6000: SR 8/79 (12)
Watson 10-H: AC Vol. 1 #6 (4)
Wega Direct 1 and 11: HFS 1/79 (5)
Wega Concept 51K: HFS 2/79 (6)
Wharfedale SP2: HFN 6/79 (10)
Wharfedale Shelton XP2: G 8/79 (12)
Yamaha NS-1000: A 1/79 (4)
Zachry EM12: HFS 12/78 (4)

Miscellaneous

Automobile Equipment

General articles: BAS p. 10-11 (1)
Blaupunkt speaker: HFS 1/79 (5)
Canton HC100 speaker: HFS 1/79 (5)
Grundig L/U 200 speaker: HFS 1/79 (5)
Jensen R430 receiver/cassette deck: A 1/79 (4)

Analyzers, Scopes, Test Equipment

Crown RTA-2 real time audio spectrum analyzer: MR 2/79 (5)
Heath audio load and sweep generator: AA 1979 #2 (8)
Inovonics 500 third-octave LED spectrum analyzer: SS 5/79 (9)
Ivie 10A spectrum analyzer: SO Vol. 4 #3 (1); BP 4/3/79 (7)
Ivie 30A 1/3-octave real time analyzer: MR 11/78 (2)
Nakamichi T-100 audio analyzer: A 11/78 (2); SQ Summer '79 (9); PE 7/79 (10)
Realistic (Radio Shack) sound level meter: A 11/78 (2); BAS p. 13-14 (2); BAS p. 3 (4); SQ Summer '79 (9)

Sabtronics 2000 digital multimeter kit: BAS p. 12-13 (2); RE 6/79 (9)
Sabtronics 8100 frequency counter kit: PE 5/79 (8)
Scott 830Z octave-band LED spectrum analyzer: SQ Summer '79 (9); SR 6/79 (9); MR 7/79 (10)
West Side Electronics pink-noise generator: AA 1978 #4 (4)

Cleaners, Demagnetizers, Maintenance

Bib 115-AE tape head cleaning kit: G 5/79 (10)
Empire Disco Film record cleaning system: A 4/79 (7); SQ Summer '79 (9)
Keith Monk's Record Cleaning Machine: db 10/78 (3); AS #14 (6); SP Vol. 4 #4 (10)
Knowin 3000 Disco-Antistat record cleaner: G 9/78 (2)
Nortronics videocassette maintenance kit: SQ Summer '79 (9)
Robins universal demagnetizer: SQ Summer '79 (9)
Sonic Research Pixoff record cleaner: SQ Summer '79 (9)
Sound Guard: BAS p. 21-27 (5); BAS p. 4 (8)
Stanton Permostat record cleaner: A 5/79 (8)
TDK HD-01 in-cassette head demagnetizer: A 3/79 (6); SQ Summer '79 (9)

Equalizers

ADC Sound Shaper Two: SR 2/79 (5); HFN 7/79 (12)
Dyna SE-10: AA 1978 #4 (4)
MXR 15 band: MR 11/78 (2); HFN 7/79 (12)
Rotel 2000: HFN 7/79 (12)
SAE 1800: HFS 2/79 (6); SR 5/79 (8)
SAE 2800: HFS 2/79 (6)
Soundcraftsmen 2215-R: A 7/79 (10)
Soundcraftsmen 3044: MR 8/79 (12)
Spectra Sound 1000B: MR 5/79 (8)
Technics SH-9010: S Fall '78 (1); AC Vol. 1 #6 (4)
White 4100: A 11/78 (2)
White 4300: MR 12/78 (3)

Mikes

Nakamichi 700: BAS p. 3-5 (4)
Neumann KM-83: BP 10/24/78 (2)
Sony ECM 56: A 1/79 (4)

Noise Suppressors

Burwen THE 7000: PE 11/78 (2); A 1/79 (4); HF 2/79 (5); BAS User's Report (10)
Garrard: PE 11/78 (2)
Nakamichi "Hi-Com": RE 3/79 (7)
SAE: PE 11/78 (2)

Speaker Cables

Miscellaneous reviewed: BAS Publication (3); BAS p. 6-7 (6)
Tocord Sound Cable: G 12/78 (5)

Step Up Devices

10 moving coil devices: AH Fall '78 (1)
Audio Standards MX- 10A head amp: AC Vol. 2 #1 (12)
Denon HA- 1000 pre-preamp: AS #13 (3)
Fidelity Research FRT-5 transformer: AC Vol. 2 #1 (12)
Hafler DH-102 pre-preamp: G 8/79 (12)
Leach pre-preamp: BAS p. 6 (12)
Marcof PPA-1 head amp: AC Vol. 2 #1 (12)
Nagatron 9000: SR 12/78 (3)
Ortofon T-30 transformer: G 3/79 (7)
PS Audio PS-II phono stage: AC Vol. 1 #6 (4); A 2/79 (5)
Sony HA-55 head amp: G 6/79 (10)
Trevor Lees (mod) pre-preamp: Mr. A Vol. 1 #3 (1)

Time Delay/Ambience Recovery Systems

ADS 10 digital time-delay: SR 4/79 (7); A 6/79 (9)
Advent 500 Soundspace time-delay: HF 1/79 (4); A 5/79 (8); SQ Summer '79 (9)
Neutrik AD4 analog delay: MR 5/79 (8)
SAE 4100 time-delay: MR 12/78 (3); RE 2/79 (5)
Schrieber 360° Spatial Decoder: AS #14 (6)
Sound Concepts SD-550 delay line: S Fall '78 (1)

Turntable Equipment/Phono Equalizers

Berkshire Audio Matchmakers: A 3/79 (6)
Berkshire Audio CCM Capacitance meter: A 3/79 (6)
Cotter B-1 turntable isolation base: AC Vol. 1 #6 (4)
Cotter B-2 isolation platform: AC Vol. 1 #6 (4)
Cotter PSC-2 phono stage (prototype): AC Vol. 1 #6 (4)
Cotter Mk-2 transformer: A 3/79 (6)
DB Systems DBP-6 phono "equalization" kit: A 3/79 (6); SQ Summer '79 (9); SP Vol. 4 #4 (10)
DiscTraker: BAS p. 5 (2)
Osawa SE-22 Platter Pad: AS #13 (3)

Miscellaneous by Manufacturer

Ace 4000 infrasonic filter: SQ Summer '79 (9); PE 7/79 (10)
Allison electronic subwoofer: BP 10/3/78 (2)

Audio Technology 510 LED peak level display: A 5/79 (8); SQ Summer '79 (9)
B. I. C. FM-8 Beam Box: SR 3/79 (6); SQ Summer '79 (9)
Braun RS1 synthesizer: HFS 1/79 (5)
Cotter NFB-2 audio bandpass filter: AC Vol. 1 #6 (4)
dbx 2BX dynamic expander: MR 6/79 (9); RE 8/79 (10)
dbx 1BX dynamic expander: SR 7/79 (10)
Denon Phono Crosstalk canceller: AS #15 (12) .
Electronics Specialists RFI filters: BP 4/3/79 (7)
Integrex Dolby B decoder: HF 9/79 (12)
Integrex Dolby kit: SQ Winter '79 (3)
Lectrotech PPI-400 LED power meter: RE 12/78 (3); PE 8/79 (12)
McKay Dymek DR33 communications receiver: A 9/79 (12)
Panasonic 1500 omnivision IV VHS videocassette deck: SQ Summer '79 (9)
Pioneer D-23 electronic crossover and U-24 Control Center: HFS 10/78 (1)
Sony Betamax MCR: SP Vol. 4 #4 (10)
Sony PCM-1 digital recording adapter for video cassettes: SP Vol. 4 #4 (10)
Tascam 15 mixer: MR 12/78 (3)