Hi-Fi WORLD

Hi-Fi WORLD

NO.31 OCTOBER 1997 SUPPLEMENT

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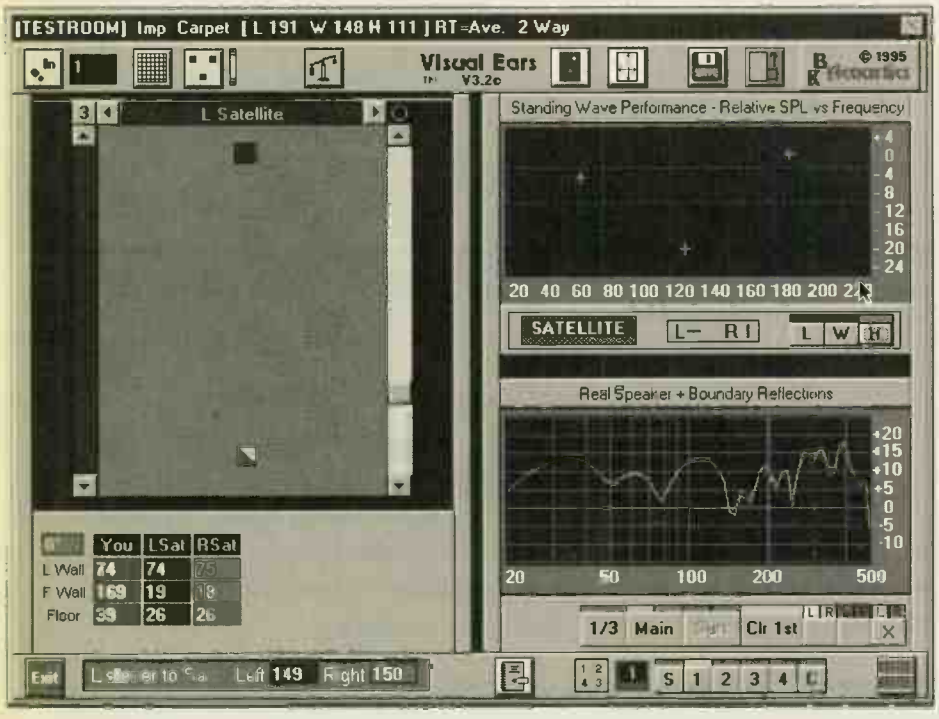
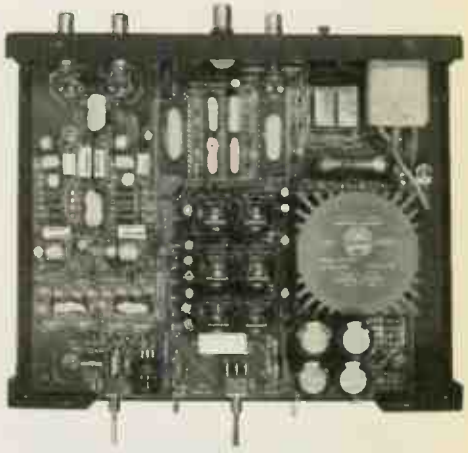
WE TEST VISUAL EARS ROOM ANALYSIS SOFTWARE



BOOKS:

HIGH PERFORMANCE LOUDSPEAKERS

by Martin Colloms



THE DAC IS BACK-

ULTIMATE UPGRADES FOR ASSEMBLAGE'S DAC-2

FREE D.I.Y. SUPPLEMENT No. 31

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D.I.Y. Supplement

Contents

KIT NEWS

SUITE LIBERTY

Liberty Audiosuite, the popular PC based audio measurement and analysis system, has been improved and is now available in version 2.2 which supports the new Turtle Beach 20-bit Fiji and Pinnacle soundcards. With the higher dynamic range of these cards, the distortion analyser can now measure Total Harmonic Distortion down to levels below 0.003%. A range of additional enhancements comes with this updated version including a redesigned example script for production testing the frequency response of 'speakers. Users of version 2.0 can obtain version 2.2 software at no extra cost by contacting Tony Seaford at Marton Music.

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Read,
Burnley,
Lancs. BB12 7PL
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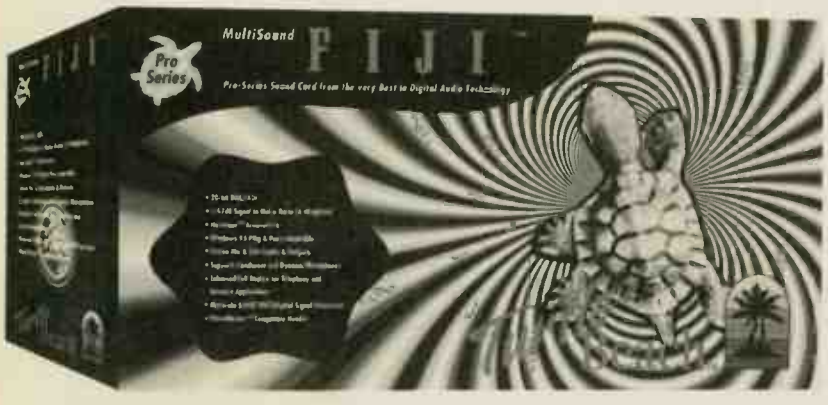


VALVE GUIDE

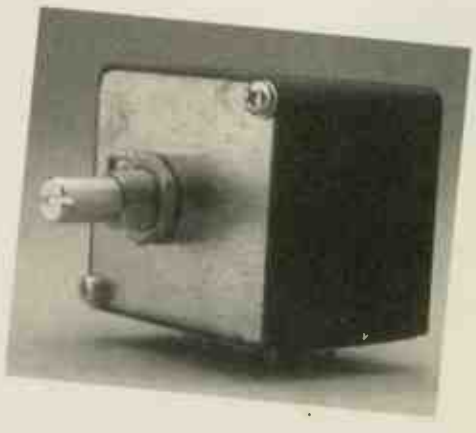
Svetlana Electron Devices, who claim to be the world's biggest valve manufacturer, has just released its 1997 Audio Tube Product Guide and Catalogue. This contains detailed technical information (including performance curves) of all of Svetlana's audio valves.

Svetlana Electron Devices Inc.
8200 S. Memorial Parkway,
Huntsville, AL 35802
Tel: (205) 882 1344

BLACK BEAUTY RIDES AGAIN

Audio-Links, the Scunthorpe based component specialist, has extended its range of Alps Black Beauty potentiometers. The additional values are 10K, 50K and 100K in logarithmic while in linear, 10K and 100K are available. Four-gang Alps Blue potentiometers designed for use in balanced amplifiers are also on sale now. Apparently, Audio-Links is the sole UK distributor for these components.

Audio-Links
7 Fairmont Crescent,
Scunthorpe,
North Lincolnshire
DN16 1EL
Tel: 01724 870432



THE GOLD LION ROARS

The Chelmer Valve Company is now able to supply valves very similar to GEC's acclaimed KT88 'Gold Lion'. Each of these valves is given individual attention during all the critical manufacturing processes in order to guarantee quality. The valves, which sell at £60 for a matched pair, are then packed with a certificate to show the results achieved in final testing.

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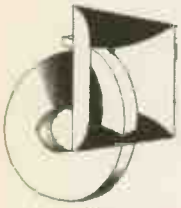
Ultra High Fidelity

DIY & VINTAGE AUDIO



Ultra High Fidelity is the new UK quarterly journal.

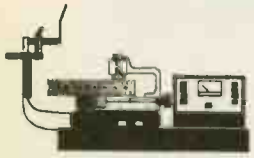
There are articles for people interested in audio, whether you are a home builder, vintage collector or into good sound reproduction.

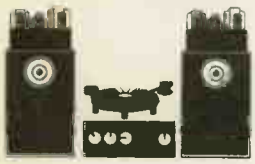
Serious indepth articles including:

- Valve related audio
- Transistor related audio
- Record Cutting
- Room Acoustics
- Record and Book Reviews
- History of Audio

It is also part of the Audio Enthusiast Society/Club which will have a Audio/Music Museum as well as Record/Audio fairs throughout the UK.

We will be at all major audio events.





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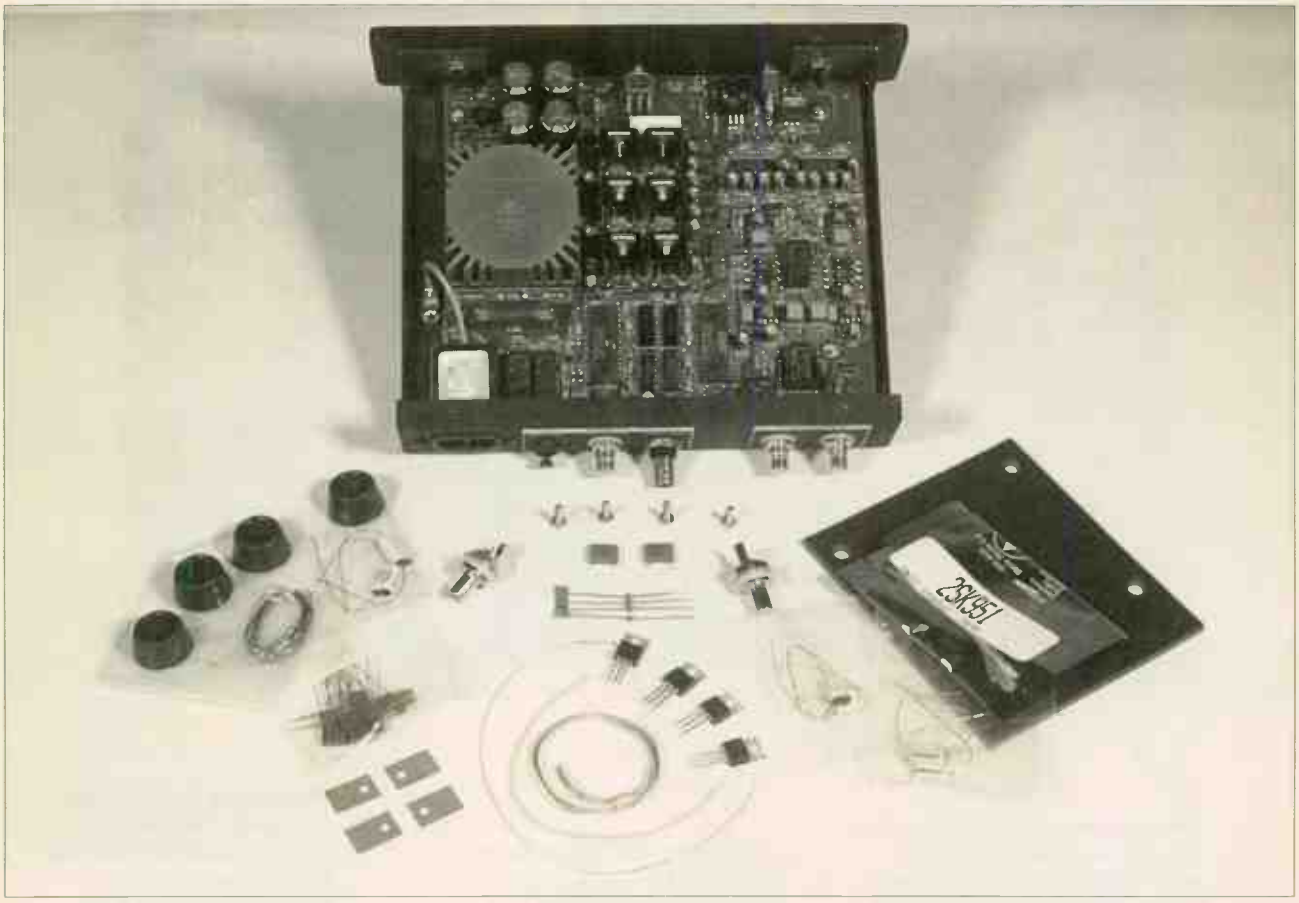
ASSEMBLAGE DAC-2 - THE RETURN

The Assemblage DAC-2 goes under the soldering iron again as Ketan Bharadia brings Assemblage's upgrade kit and some Hi-Fi World mods to bear.

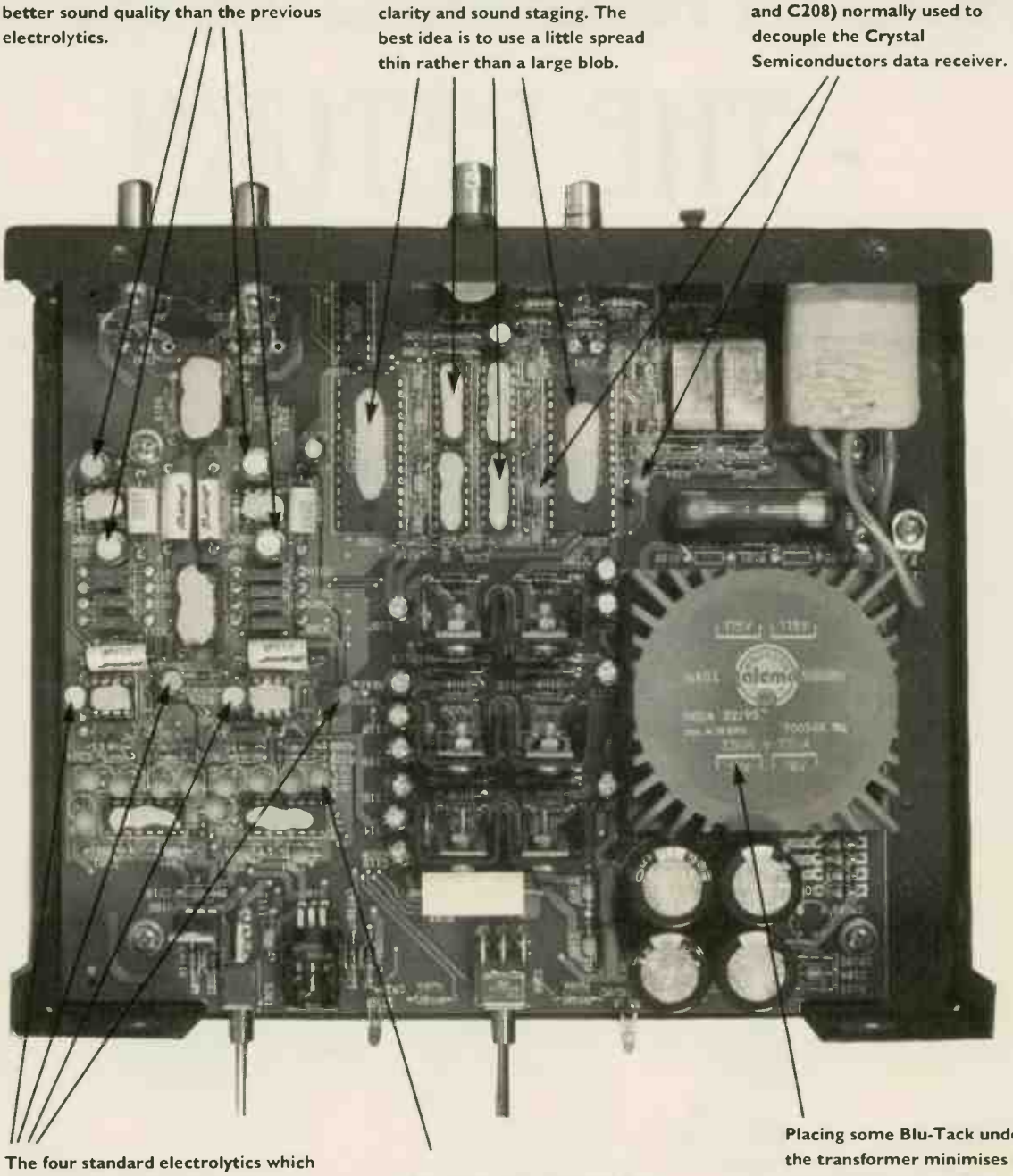


How much better can an excellent product get? That's the first question that came to mind when I found out that the Assemblage DAC-2 could be modified with an official upgrade kit. Before we get into exactly what this upgrade involves, let's just have a brief recap.

The DAC-2 is the flagship DAC kit from Assemblage, the kit division of Canadian component suppliers The Parts Connection. In the June 1997 Supplement we built the DAC-2 and were very impressed by it - the construction was easy, the instructions clear and concise, and, to top it all, the finished article sounded great.

Thus it was with great expectations that we ordered the $150 upgrade kit. This includes all sorts of goodies: better quality Kimber Ultraplate RCA sockets and cable, Caddock bulk-foil resistors, MIT Multicap and Wima capacitors, Analog Devices AD811 op amps, Linear

WHERE TO MAKE THE MODIFICATIONS



Technology regulators, Telefunken fast-recovery rectifier diodes and bigger, more compliant EAR isolation feet.

A quick word on the instructions. They are clear, concise, easy to understand and, highly unusual for any manual, also humorous. On the downside some of the photos aren't as helpful as they could be, making it hard to see exactly what they're trying to show. Overall though, high marks.

The first few steps in the instruction book outline how to take the motherboard out of the chassis. Once the board is out the serious

modification can begin.

First to go is the bridge rectifier, replaced by discrete Telefunken SF4007 fast-recovery diodes. This switch is easy enough to make as the bridge is simply cut from the board and the diodes soldered into their marked locations.

Next, power supply bypass capacitors are fitted. I encountered a bit of a problem here in that the circuit board location number given in the instructions is not printed on the board, although the place where the capacitors go is marked. The bypass capacitors are then soldered in place on the underside of the PCB.

The output filter stage also comes in for an overhaul. 12 Caddock bulk-foil resistors and six MIT Multicap capacitors replace the previously resident Holcos and Wimas.

The trickiest part of the upgrade comes when four of the six power supply regulators are changed.

The two LM337s (negative supply) are replaced by Linear Technologies' LT1033s and the two LM317s (positive) by LT1085s. The manual suggests that the easiest way of removing the regulators is first to unbolt and remove their heatsinks, then use desolder braid to soak up the solder on the regulators' pins. Once this is done, hold the regulator body with a pair of pliers and heat the legs from the top side of the PCB, gently rocking the regulator until it comes out.

I found it easier to cut the regulator legs just under the body and then desolder them individually. Once the legs had been removed I used the desolder braid to soak up the solder blocking the PCB holes, thus making replacement easy.

The next few steps are pretty straightforward. The standard output sockets are replaced with the Kimber Ultraplates, a sound-deadening pad is applied to the case lid and the basic lead-out wires removed and Kimber AGSC silver cable used instead.

The final step is swapping the Analogue Devices AD844 op amps in the DAC's current-to-voltage convertor for AD811s. This is very simple, just a case of taking one op amp out of its socket and replacing it with another. There are two things to watch out for though.

The first is that you have to make sure the orientation of the op amp matches that of the socket (indicated by an indentation at one end of the socket and chip). The second is to ensure that you aren't carrying a static charge when you handle the new op amps otherwise they could be damaged.

Once this is done, all that's left is to place the circuit board back in the case, reconnect it to the appropriate input/output sockets, fit the larger, more compliant upgrade feet and put the lid back on.

"Within a few minutes I knew that despite the fact that the standard version is excellent at its price, $150 for the upgrade kit is money very well spent."

A couple of things not mentioned in the instructions are the reconnection of the mains earth lead to the casing and putting the mains socket/filter back on the rear panel. Although it could be argued that these are obvious steps, considering how comprehensive the rest of the instructions are it seems a strange omission. So, how much better can an already top-quality DAC get?

SOUND QUALITY

The new components in the DAC-2 were given about four days to burn in. During this time the sound changed quite a lot for the better. Even at initial switch-on, however, the DAC sounded better than before. This was a good sign for two reasons. First of all it showed the DAC-2 was working, at which point I heaved a sigh of relief. It also proved the upgrade's effects were immediately obvious. So, time for some serious listening.

Stravinsky's The Sacrifice opened the proceedings. This piece ranges from a single horn to a full orchestral onslaught, with the players performing as if they're being paid by the note and how powerfully they produce it. The Assemblage handled this test with almost disdainful ease. Within a few minutes I knew that despite the fact that the standard version is excellent at its price, $150 for the upgrade kit is money very well spent.

The DAC-2 now had a transparency that made the standard version sound hazy and clouded by comparison. Even on crescendos the Assemblage kept everything well under control, timpani pounding out with great power and, more importantly, excellent definition and control.

But don't go under the impression that this was a sterile by-the-numbers crash-bang performance. The fire and emotion of the music was allowed to flow through unhindered. The only downside I could see is that where the unmodified version was relatively forgiving of poorly produced CDs, the modified version showed them for what they were, warts and all.

In the original review the DAC-2 was criticised for a touch of hardness. This had now disappeared while stereo width, depth and focus moved up a league. These abilities married to the DAC's excellent detail retrieval made it easy to pick up spatial cues and pinpoint the various sections of the orchestra in the sound stage.

Handling Michael Jackson's Thriller the DAC-2 continued to impress with its clarity and power on basslines. Vocals lead and backing were also fluidly articulate. Nobody could accuse the DAC-2 of being sterile or uninvolving - it could teach John Travolta a thing or two about boogying. And as no part of the frequency spectrum stood out, the overall sound was very even handed and balanced.

'Bad Like Jesse James' from John Lee

ANOTHER BIG HIT!

Following in the path of the original and extremely well received Assemblage DAC-1, the DAC-2 appears to be another big hit with customers and reviewers alike. The DAC-2 builds on the strengths of the original DAC-1, with its dual Burr-Brown PCM 1702 20 bit DACs, Crystal CS8412 input receiver, toroidal power transformer and Analog Devices based output stage, but adds HDCD capability with the PMD-100 digital filter chip, an extra co-ax digital input on a BNC jack, a phase invert switch, three more power supply regulation stages with greatly increased power supply capacitance, and improved parts quality in the analog output stage. The best news is that all these improvements come with a very small price, the DAC-2 digital processor kit is $499.00 U.S.! Of course, the DAC-2 also comes with our 30 day satisfaction guarantee, two year limited warranty, AND our assembly guarantee, (If you can't get it to work, we will').

For those of you with the upgrade bug, we also have a parts upgrade kit available for the DAC-2. This kit includes Caddock resistors and MultiCap capacitors for the analog output stage, Kimber silver and Illuminati hook-up wire, EAR and Sourcecoat isolation and damping materials, Linear Technology voltage regulators, and more parts that make a significant improvement in the performance of the stock DAC-2. The parts upgrade kit is available at a special package price of $149.00, which makes it even more good news!

For more information on any of our products, please call, write, Fax or E-mail us and we will be happy to assist you.

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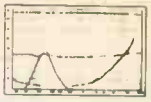

As Featured In the Hi-Fi World DIY Supplement No,s 22 & 23 (June, August 1996). Still available to Hi-Fi World readers at the Reduced price :- £89-00 Inc Plus £5-00 P&P

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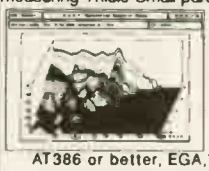

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Jason Kennedy on the Model 1 in Hi-Fi Choice Sept '97

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other locations--please call me

Hooker's Boom Boom CD followed next, electric guitar riffs sounding as low-down dirty as they should. Guitar notes had a striking sense of power and attack which, together with Hooker's gravely menacing vocals, made this song a hair-raisingly intimidating and threatening experience.

This level of performance would certainly give the best DACs in our August group test plenty to think about and is only bettered by something like Pink Triangle's Da Capo which is of course much more expensive at around £1700 (depending on filter option). Obviously this upgrade is well worth $150 extra to existing owners of the DAC-2. I would even go as far as to say that the standard version should only be seen as a stepping stone to this upgraded version, such is the level of improvement.

ONE STEP BEYOND WITH JON MARKS

Besides the official Assemblage upgrade kit, there's a few more cheap and easy modifications that can help the DAC-2 to sound even better.

The first of these is to replace the standard 0.1µF tantalum decoupling caps C207 and C208 (see picture) with larger 47µF types. These can be any voltage rating as long as it's over 5V. These two caps decouple a pair of +5V supply lines running in to the Crystal Semiconductors CS8412 input data receiver, giving it slightly cleaner power to operate from. There's no point going potty with 1000µF of capacitance here as it won't give that much more of an improvement and it'll work the regulators quite a lot harder.

The result is an extra smoothness, clarity and detail to the sound. It's not a sonic sea-change but it is immediately noticeable, especially on tracks like Tori Amos' 'Blood Roses' from her Boys For Pele CD. Harpsichord notes became crisper and cleaner, and the very soft, low-frequency thuds of the keys hitting their stops was lifted out of the mix.

Another set of capacitors which plays a big part in how the DAC-2 sounds are the 47µF C309-C313 around the 20-bit Burr-Brown PCM1702 in the left channel and C314-C318 in the right. As standard these are 50V electrolytic types. Swapping them over for 47µF 16V tantalums produced a much firmer sound with more controlled, powerful bass and an expanded sound stage.

Not all was sweetness and light though - there was a hardness to the upper midrange and some slight sibilance. This is characteristic of the way many tantalums can affect the sound when used as power supply rail decoupling caps.

"Comparisons with Pink Triangle's Da Capo were illuminating. The Assemblage now had a weightier, more dynamic sound with deeper, firmer bass than the Da Capo."

Approaching the tweaking conundrum from a slightly different angle - acoustical, not electrical - I tried out a little Blu-Tack. Thin sheets were pressed firmly on to the tops of the receiver chip, DAC ICs, HDCD filter, I/V convertors (AD844) and output op amps (AD817). Even relays in the signal path came in for the Tack treatment.

I was pleasantly surprised by the scale of the impact the Blu-Tack had on the sound. Bass firmed up and grew more extended, the midrange was smoother still than before and more detailed, and treble became tonally sweeter. Sound staging also expanded and the Assemblage took on a new level of involvement that found me sitting on the edge of my seat on the build-up to orchestral crescendos. Placing a 3in. square bituminous damping pad on the bottom of the case and mounting the front panel on 10 small blobs of Blu-Tack helped too.

The final pieces in the improvement puzzle consisted of four of Sanyo's Os-Con electrolytic caps (47µF 20V) replacing those that are fitted as standard (C319 and C320 decouple the rails going into the output op amp in the left channel, while C321 and C322 do the same in the right). The current-to-voltage convertors also came in for some Os-Con therapy with four 10V 16uF caps on their supply rails.

Although the Os-Cons can take at least a few days to start burning in, the sound was immediately smoother and less up-front than before. Tonal colour was better too, leaving the DAC-2 sounding extremely impressive.

Comparisons with Pink Triangle's Da Capo were illuminating. The Assemblage now had a weightier, more dynamic sound with firmer bass. Not only that but the music as a whole was more solid than I've heard from many digital sources. The DAC-2 imaged and sound staged better than the Pink Triangle too, with greater width, depth and definition.

Considering the DAC-2 itself, the official upgrade kit and our extra tweaking components add up to a total of about £600, that makes this convertor a very cheap way of getting a taste of real high-end performance ●

Assemblage DAC-2 Upgrade Kit
$149.00

Parts Connection
2790 Brighton Road,
Oakville,
Ontario,
Canada L6H 5T4
Tel: 001 905 829 5858

Os-Con capacitors are available from Audio-Links (tel: 01724 870432) and AudioCom (tel: 01834 814660).

Tantalum capacitors can be purchased from Electromail (tel: 01536 204555) and Maplin (tel: 01702 554000).

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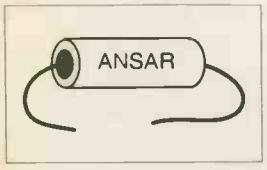

Manufactured specifically for high end audio, these polypropylene capacitors offer exceptional value for money as they use a specially imported high purity metallised polypropylene film ensuring smooth, detailed and transparent sound quality and extremely low distortion, whether they are placed directly in the sigmnal path such as in crossovers or for decoupling etc. Ideal for replacing old, stale and leaky capacitors

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CW470N	CAP PROPYL 470nF	£1.25
CW680N	CAP PROPYL 680nF	£1.25
CW1U0N	CAP PROPYL 1µF	£1.25
CW1U5N	CAP PROPYL 1.5µF	£1.50
CW2U2N	CAP PROPYL 2.2µF	£1.50
CW3U3N	CAP PROPYL 3.3µF	£1.85
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CPP220P	CAP PROPY 220pF	250V	£0.35
CPP330P	CAP PROPYL 330pF	250V	£0.35
CPP470P	CAP PROPYL 470pF	250V	£0.35
CPP1N0	CAP PROPYL 1nF	250V	£0.35
CPP1N5	CAP PROPYL 1.5nF	250V	£0.35
CPP2N2	CAP PROPYL 2.2nF	250V	£0.35
CPP4N7	CAP PROPYL 4.7nF	63V	£0.50
CPP10N	CAP PROPYL 10nF	63V	£0.65
CPP22N	CAP PROPYL 22nF	63V	£0.85
CPP47N	CAP PROPYL 47nF	63V	£1.00

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Superior electrolytics at affordable prices. This low impedance and resistance maximises signal purity, whilst the superior temperature characteristics allow the capacitor to remain very stable under the most varying conditions.

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4U7H63	LO Z HI TEMP 4.7µF	63V	£0.25
10H63	LO Z HI TEMP 10µF	63V	£0.25
22H63	LO Z HI TEMP 22µF	63V	£0.30
47H63	LO Z HI TEMP 47µF	63V	£0.35
100H63	LO Z HI TEMP 100µF	63V	£0.50
220H50	LO Z HI TEMP 220µF	50V	£0.75
470H63	LO Z HI TEMP 470µF	63V	£1.25
1000H35	LO Z HI TEMP 1000µF	35V	£1.50
2200H50	LO Z HI TEMP 2200µF	50V	£2.25
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Elna Solder Lug Reservoir Capacitor 10,000µF 80V

Choosing the right electrolytic for power supply use is very important in keeping down hum whilst allowing maximum current flow for good transient & bass response. Elna capacitors are respected the World over for their exceptional audio attributes.

Part No	µF/Voltage	Price
10000C80	CAL ELNA1000µF/80V	£11.00

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A range of professional air cored inductors for 8Ω or 4Ω crossovers/filters for use up to 300W. 1.2mm enamelled copper wire wound on air spaced plastic bobbin.

Part No	Specification	Price
P15	150µH 0.15Ω 8x19mm	£2.00
P22	220µH 0.15Ω 48x19mm	£2.50
P33	330µH 0.2Ω 8x19mm	£3.00
P47	470µH 0.25Ω 50x19mm	£3.50
P68	680µH 0.35Ω 59x19mm	£4.50
P100	1mH 0.4Ω 59x19mm	£5.50
P150	1.5mH 0.5Ω 70x30mm	£6.50
P220	2.2mH 0.6Ω 70x30mm	£8.00
P330	3.3mH 0.75Ω 70x30	£10.00

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A range of professional high efficiency ferrite cored inductors with very low ohmic losses for 8Ω or 4Ω crossovers or filters for use up to 400W.
1.4mm enamelled copper wire (1.3mm on F1000) wound on plastic bobbin.

Part No.	Specification		Price
F220	2.2mH 0.15Ω 400W	55x31mm	£6.50
F330	3.3mH 0.2Ω 330W	65x39mm	£9.50
F470	4.7mH 0.25Ω 140W	65x30mm	£11.00
F680	6.8mH 0.35Ω 120W	65x39mm	£12.00
F1000	10mH 0.45Ω 100W	65x39mm	£13.50

Quality Valves Affordable range of High Quality Valves

Part No.	Description	Price
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6SN7GT	OUTPUT VALVE	£4.50
6V6GT	OUTPUT VALVE	£3.95
ECC81	TRIODE	£4.50
ECC82	TRIODE	£4.50
ECC83	TRIODE	£4.50
EF86	LOW NOISE PENTODE	£3.50
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EL84	OUTPUT VALVE	£3.50
GZ34	RECTIFIER	£6.50
KT88	OUTPUT VALVE	£20.00

Valve Holders - High quality valve bases. Chassis mounting with screw fittings.

Part No.	Description	Price
B9AC	B9A VALVE HOLDER CERAMIC	£1.50
B9AU	B9A VALVE HOLDER CERAMIC + SCREENING CAN	£2.00 £2.25
OCTC	OCTAL VALVE HOLDER CERAMIC	£2.00
OCTP	OCTAL VALVE HOLDER PHENOL	£1.50

Fully Gold Plated Phono (RCA) Plugs with spring coil cable grip.

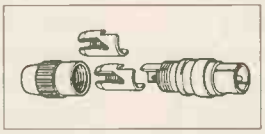
Part No	Description	Price
PPG5A2	PAIR GOLD PLUGS for up to 5mm CABLE	£1.50 pair
PPG8A2	PAIR GOLD PLUGS for up to 8mm CABLE	£1.50 pair

Very High Quality Phono (RCA) Plugs

Very high quality satin grey metal with heavy gold plated connections. Top collet cable grip & PTFE insulators. Very low noise.

Part No.	Description	Price
PPG6H2	GOLD PTFE PLUGS for up to 6mm CABLE	£3.50 pair
PPG8H2	GOLD PTFE PLUGS for up to 8mm CABLE	£3.50 pair

Neutrik Pro-Audio Super Quality Gold Plated Phono (RCA) Plugs



Superior pair of phonos each includes 2 cable grips pair 3.5-5.5mm & 5.5-7.3mm multi-way 6A/m suitable for a wide range of cables. These connectors make contact with ground first at insertion to eliminate pop.

Part No.	Description	Price
PPN2	NEUTRIK PRO AUDIO	£12.00/pair

Extra High Quality Gold Plated Phono Oxygen Free (RCA) Leads (pairs)

Available in 2 colours & 3 lengths. Highly flexible oxygen free cable with extra moulded in control / grounding wire.

Part No.	Length/Colour	Price
LPP1QG	0.8 Metres/Green	£5.50
LLP1QV	0.8 Metres/Violet	£5.50
LPP2QG	1.5 Metres/Green	£6.50
LPP2QV	1.5 Metres/Violet	£6.50
LPP5QG	5 Metres/Green	£11.00
LPP5QV	5 Metres/Violet	£11.00

Bass Reflex Tuning Ports

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R70	d=70L=128-245	£3.50
R100	d=110L=160-122	£5.50
R85	d=85 angled 45° for narrow cabinetsL=210-310	£6.50

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Sticky Situation

Jon Marks finds out how a little sticky tape can go a long way to getting the best from your loudspeakers.

Sticky tape? Loudspeakers? Does this perhaps involve taping your loudspeakers to their stands for a more solid sound? Maybe some tape on the drivers to smooth over their break-up points? No, in a word.

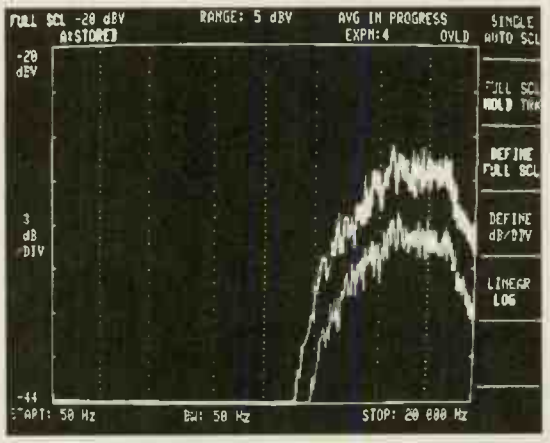
If you want to get sharper imaging and broader sound staging from your 'speaker, getting it taped starts with the tweeter.

Most loudspeakers these days have their drivers rebated into the baffle to reduce diffraction effects. These are caused by sound waves bending around the sharp edges of the front plate of an unrebated tweeter and resulting in response problems. But while rebating is better than mounting the tweeter straight on to the front of the baffle, it isn't perfect - there are still small gaps 'twixt cut-out and tweeter and often recessed mounting bolts too.

Citing surface irregularities like these might seem to be splitting some very fine hairs, but they have a very big impact on sound quality.

Taping over the holes in the face-plate of the superb SEAS Excel tweeter on Jamo's Concert 8s lifted this loudspeaker's already impressive imaging into a whole new league.

Listening to orchestral recordings I could now point to precisely where in the orchestra a particular instrument was located. The images themselves were more three-dimensional and possessed a more solid outline, making them much more realistic. Midrange and treble definition also improved, every last shimmer to a cymbal's decay revealed. As a result, even the densest of mixes was unable to phase the Jamos which dug out every last detail and presented it in an organic, unfatiguing manner.



In this narrow-band analysis, the lower response shows the treated Jamos while the upper one shows the untreated Concert 8s.

Putting tape over the gap between rebate and face-plates of both tweeter and mid/bass unit wrought a noticeable broadening of the sound stage as well. There was now about an extra six inches' spread to the left and right and the layers that build up sound stage depth could be clearly distinguished. Performance like this is usually the province of well sorted and often well expensive electrostatic loudspeakers.

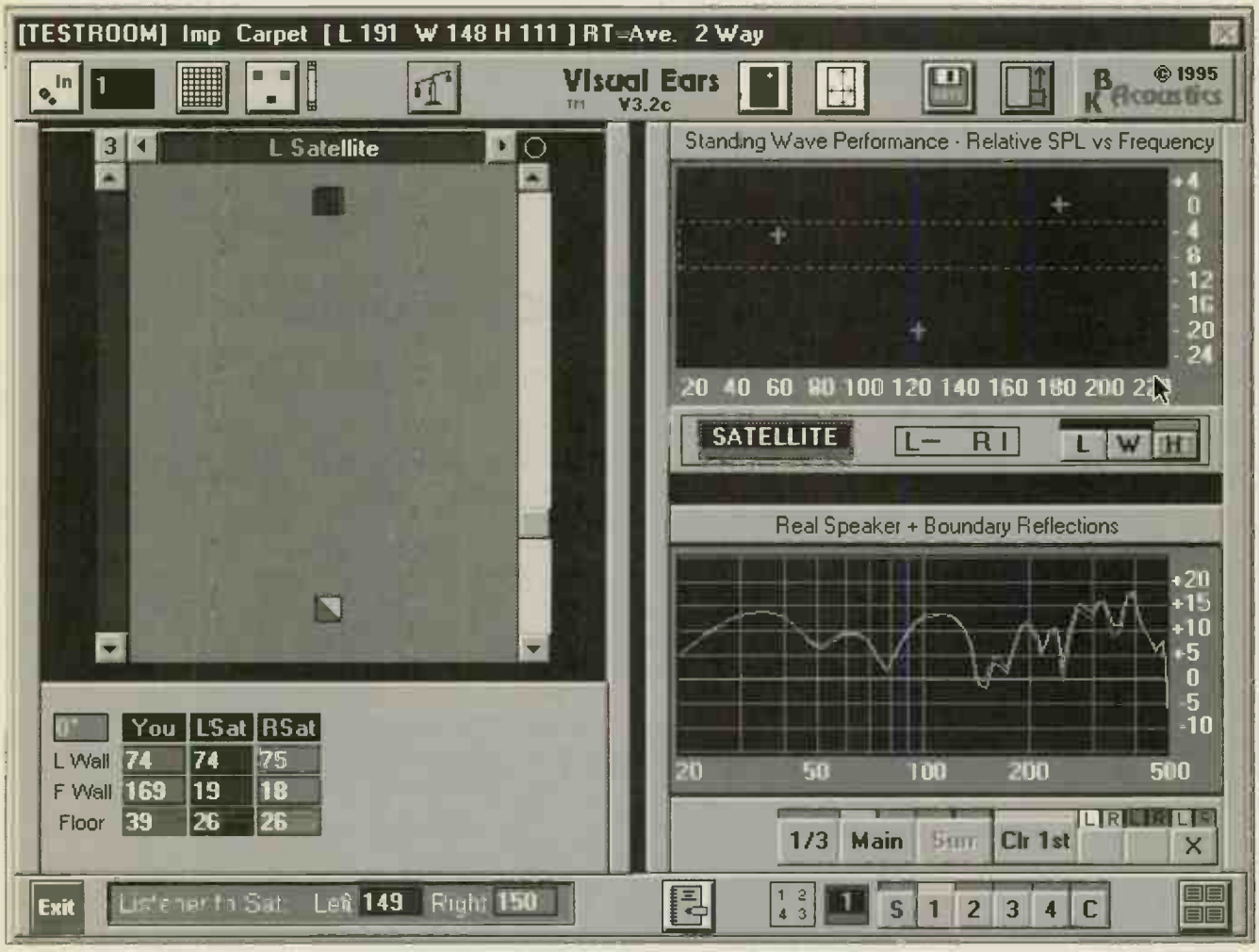
It's not only 'speakers at about the Jamo's £1300 price mark that benefit though. Tannoy's superb £140 Mercury m2s showed improvement on a similar scale to the Jamos when tape was applied in the same places.

Measurement demonstrates that there's relatively little change in terms of frequency response. Using our standard third-octave as well as narrow-band analysis (which is more revealing of small, local changes in response), the results were close to identical, although there is a slight smoothing of response with the treated Jamos. A slight hardness to the Concert 8's sound was also eliminated by the tape modification.

If you'd like to upgrade your loudspeaker's treble and midrange and boost its imaging and sound staging, all you need is some tape and a relaxed attitude to hi-fi aesthetics ●

VISUAL EARS

Can a computer tell you where to sit and place your loudspeakers? Noel Keywood reviews Visual Ears, a room analysis programme that claims it can.



The name's more catching than LSp CAD, that's for sure, and Visual Ears gives users a colourful and intriguing graphic interface. This computer programme will analyse the acoustics of your listening room and tell you where best to sit and place your loudspeakers. Or that's what it claims. There's an awful lot to room acoustics and I doubt whether many will find Visual Ears as easy to understand and interpret as its screen display and handbook would suggest. But these comments apply to any room acoustics analysis programme and, like the others, Visual Ears is not overly expensive, but nor is it cheap. KB Acoustics of Eugene, Oregon, U.S.A. ask $95.50 (overseas) for it. Is it worth it?

The programme runs under Windows 3.1 or 95 on a PC with a VGA colour monitor, mouse and maths co-processor. Being into a bit of gratuitous complexity, I ran it in Windows 95 using Insignia Solutions Soft Windows for the Mac and this works well, even if Macs do produce bizarre colours and need re-booting in protest after being asked to emulate a PC.

The screen comes up as shown above, which I'll talk about first. You are presented with a coloured rectangle that represents a room. It can be any dimension up to 43ft x 43ft x 23ft high, but not any other shape, like an L-shape room for example. Sloped and Cathedral ceilings can be accomodated, but not sideways sloping ceilings, unless the lowest side is called the front or rear of the room.

In this room you have the option of placing various types of two-way and three-way loudspeakers, or satellites and one or two woofer enclosures. The right-

hand loudspeaker is coloured green, the left one blue (our picture only shows one) and the listener takes the form of a yellow/red box. Loudspeakers and listener can be moved around with a mouse or positioned precisely by typing in co-ordinates. This includes listener and loudspeaker height. The programme does not consider the impact of furniture, treating the room as a basic hard-walled box. Carpet on the floor can be taken into account though.

Visual Ears provides two analyses. At top is Room Modes ('Standing Wave Performance'); below is the impact of Virtual Images (Boundary Reflections). Whilst you might have heard about room modes, you may not have heard about virtual images. I have provided explanations on both separately with this review. Although neither is overly complex an idea in itself, both throw up a horribly complex picture when considered in their full three-dimensional entirety. This is why a computer is needed for analysis. Unfortunately, a definitive analysis requires much more data to be input than is practicable with a consumer programme such as Visual Ears, or its competitors. The question is: are these programmes good enough to be useful, rather than misleading?

Visual Ears does not provide one integrated graph of room response, unlike LSp CAD reviewed in the August 1997 issue of Hi-Fi World. The room mode diagram gives a visual representation of the presence and strength of each mode, according to listening and loudspeaker position, but such a display is not sufficiently self-evident to be easy to understand, unlike a response plot - which it is not. If you understand room-mode diagrams you could also achieve the same end with a piece of paper, pencil and calculator, although it would be more tedious of course.

The first half-wavelength mode of a room is significant, but Visual Ears' lower limit is 20Hz, so it will show the first mode of a room up to 27ft long. Above this length and up to the programme's limit of 43ft, the first mode, which is lower than 20Hz, is not shown. It isn't much of an omission, but subsonic bass can be perceived (heard/felt) and REL subwoofers work down to 10Hz, so this region is of interest.

The upper limit of the room-mode analyser is set at 220Hz. Assuming 10ft to

VISUAL EARS & ROOM MODES

How accurately can Visual Ears chart room modes? And will you understand the information it is trying to convey?

The Visual Ears analysis places coloured markers (length =white, width=red, height=green) at the modal frequencies, as calculated from the room's dimensions. Their height on the amplitude scale at right (+4 to -24dB Sound Pressure Level) is determined by where a listener is sitting relative to the maxima and minima.

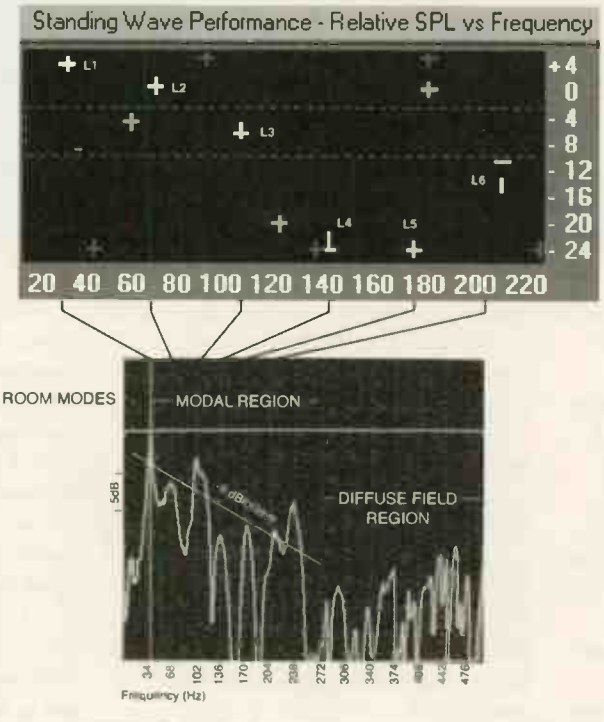
We excited the main length modes of our room with one wide-range loudspeaker (KLS9), by placing it against an end wall, approximately in the centre of height and length dimensions. Because the room has a bay window and a large chimney breast, these dimensions are not precisely defined, as is likely the case in most rooms.

At low frequencies, where wavelengths are long and room alcoves, furniture and what have you relatively small, Visual Ears correlates with our room analysis reasonably well. The markers of our analysis are at multiples of the room's length mode (34Hz, 68Hz, 102Hz etc) and it would appear that no fewer than seven modes are present, although some of these are in fact combined modes.

Visual Ears says the first three length modes (L1, L2, L3) are strong and our analysis supports this, although the amplitudes are a bit more random, probably due to absorption by furniture, and modes combining. From 110Hz up to 160Hz Visual Ears says all modes are at a minima and our analysis does show a steep dip here, but punctuated by a peak at 136Hz (3rd width mode and 4th length mode). It is difficult to say why our room has some level here; but then how long is a room with a big chimney breast, and how wide is it with a 2ft deep bay window? Such features start to take effect at about one-quarter wavelength. Since 200Hz has a 5.5ft wavelength, a 2ft deep bay is becoming acoustically significant.

As frequency rises, wavelength shortens and room topography takes ever more effect, Visual Ears corresponds ever more weakly with our analysis. Our room has a broad plateau of energy from 190Hz up to 250Hz with a very strong mode at 238Hz (7th length mode?) but Visual Ears does not agree. Its analysis predicts strong height and width modes combining at 190Hz, but little modal energy from 190Hz up to 220Hz, its display limit.

In conclusion Visual Ears is likely to offer a reasonably accurate picture of room mode behaviour up to 150Hz or so. It is better for big rooms than small ones, because more modes are shown. The modal display is difficult for the layman to comprehend I found from asking people. An approximate graph, perhaps a third-octave type bar chart, might be easier to interpret.



be a minimum for a listening room, four length modes are shown for this dimension, the fourth being at 216Hz. This is a fair number, but measurement showed our own room, which is quite heavily furnished, was exhibiting modes up higher than this. However, in our tests accuracy was increasingly lost as frequency rose and 220Hz seems like a realistic limit. How well Visual Ears can analyse a room really depends upon how well that room agrees with its basic rectangular room model, with hard walls and ceiling.

Visual Ears has some difficulties for users. It asks for highly specialised technical data about three-way loudspeakers to be entered, such as crossover frequency between bass and midrange (assuming this is below 500Hz), crossover rates and, for all loudspeaker types, low frequency roll-off point (-3dB) and rate. Most manufacturers will baulk at supplying such specialised data because of the time and effort involved; I wouldn't bet on getting a reply to any request. It would be sufficient to generalise I believe. For example, most reflex loaded two-way stand mounters of 2cu ft (56litres) or thereabouts have a similar bass limit of 40Hz, and a roll-off rate of 24dB/octave. Since this data only affects the accuracy of the first octave (20-40Hz) of the analyses a rough approximation is good enough in my view.

Much the same observation applies to the crossover data requested for three-way loudspeakers. It's probably sufficient in most cases for users to assume their loudspeakers are two-way boxes and so dispense with crossover data. Drive unit phase is important when the loudspeaker is not treated as a simple point source but one has to assume that drivers are in phase below 500Hz. Drive unit phase cannot be determined from crossover rates in any case, because driver mechanical dimensions and displacement must also be taken into account.

If there's a criticism to be made of Visual Ears it lies primarily in its handbook. It does not discuss trade-offs in any fashion helpful to a user, for example what size of object in the sound path might be acoustically significant and what might not; a chart of wavelength versus frequency would help here.

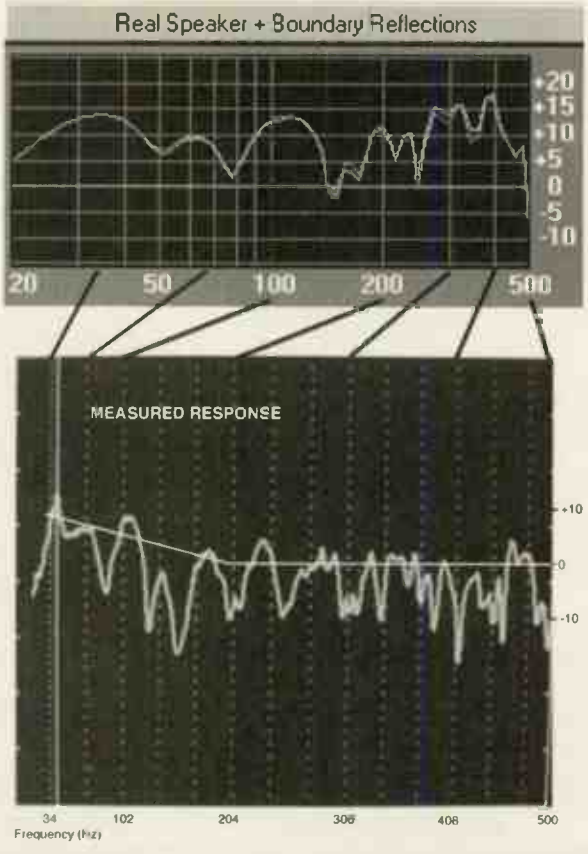
It does not list or chart 'speaker low frequency roll-off rates. Generalisations would be more than adequate. Users trying to get this data from manufacturers may well end up frustrated.

VISUAL EARS & DIFFUSE FIELD

How accurately does Visual Ears chart the Diffuse Field, which is a function of the room's many images, and images of these images?

The diffuse field contributes to the direct sound from the loudspeaker that we hear. Visual Ears claims to give the combination of the two (direct and reflected/diffuse) and it shows a progressively smoother result as listener and loudspeakers are moved closer together and away from the room's boundaries, as it should for the direct component becomes stronger and the influence of reflections weaker. All the same, in our assessment correlation between Visual Ears and actual room measured response was reasonable at lower frequencies but poor higher up. Yet again, as wavelength shortens so many influences come into play in a real room (furniture, windows, chimney breasts, etc) that the likelihood of correlation with a model that assumes a perfect rectangle with hard, flat boundaries is remote.

Even though Visual Ears' Boundary Reflection graph does not include modal phenomena it appears to correlate well with measurement at low frequencies. Our room peaks at 34Hz, and so does Visual Ears. Then there's a dip down and another small peak at 68Hz, then a sharp dip at 80Hz and a big peak after that at 105Hz or so, in both Visual Ears' and our room measurement. If we ignore a small, sharp dip at 120Hz in our measurement that is not shown by Visual Ears, it continues up the frequency scale accurately, showing a dip at 150Hz.



Above this frequency, however, correlation starts to weaken. Our measurement shows a dip at 200Hz, but Visual Ears has a peak here. Above this point Visual Ears predicts an overall rise in energy of +5dB from 200Hz up to 400Hz, then a fall from 400Hz up to 500Hz. Our room was flat (with suckouts) out to 400Hz then a rise above 450Hz. We used one loudspeaker and one microphone for this assessment; a stereo system and two ears should average out the dips to produce a smoother result.

So again my conclusion is that Visual Ears gets it about right up to 150Hz, but above this frequency correlation weakens. This is perhaps to be expected in a room with a chimney breast, bay window, two settees and an armchair, which goes to show just how difficult it is to come up with a useful working acoustic model of an everyday room.

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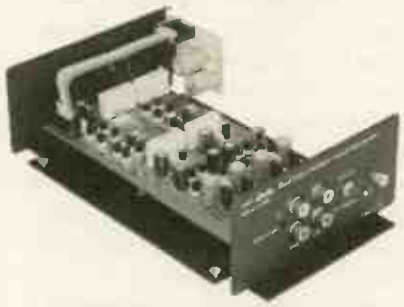

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Some of the diagrams are misleading or difficult to comprehend; one on p32 omits the direct wave and presents a confusing picture; observations such as "a high wing-back chair as your listening seat . . . this programme will not be for you" overstate the case. Standing modes and direct sound would not be affected, only the diffuse field. But the diffuse field is affected quite significantly by every feature that departs from the programme's hard walled, no-furniture image model. It might be more helpful to tell a potential user to sit in the open, as it were, then in a wing-back chair and note the difference.

The handbook suggests the only trade-off in not having furniture in the programme is processing time. Processing time is more computer dependent. Sophisticated acoustics programmes require an amount of data entry few domestic users would ever want to contemplate and a price that reflects their complexity.

Finally, KB Acoustics claim their programme is KEF approved, but KEF told me this is not so. Their previous U.S. distributor approved it without their authority. That isn't to say they disapprove of course.

CONCLUSION

As computer programmes go Visual Ears is easy enough to use. It has a lot of helpful features, like a layout grid, four room set-ups, a symmetrical mode that moves the second loudspeaker in response to the first to maintain symmetry, and so on. It does ask users to supply some difficult-to-obtain technical data about loudspeakers, notably bass roll-off frequency and rate and, for three-ways, satellites and subwoofers, crossover frequencies and rates. In many cases this will be impossible to obtain. Little advice is offered about how to overcome such a problem.

The accuracy of the programme's two analyses depends primarily upon the closeness of matching between the room being analysed and the room model used in the programme. People with lightly furnished hard walled, rectangular rooms should get a meaningful result and be able to find the best listening position.

Our own room, with alcove, chimney breast and furniture was a poor match. It matched Visual Ears' analysis only up to 150Hz or so. Above this frequency correlation was poor. This lack of correlation is just about impossible to avoid though. It is enormously difficult to model a complex room.

Probably the weakest feature of Visual Ears is its handbook. It makes unhelpfully contentious statements and offers users little useful guidance in using the programme or improving a room's acoustics. If it more clearly explained the programme's workings, how to interpret the displays, what to do if required information is unavailable and what to do to control predicted problems other than just move the furniture and/or loudspeakers, it would greatly improve the practical value of the programme to users. As it stands, Visual Ears represents an impressive amount of acoustic theory and programming, whose potential is not fully realised.

Visual Ears **$95.50**
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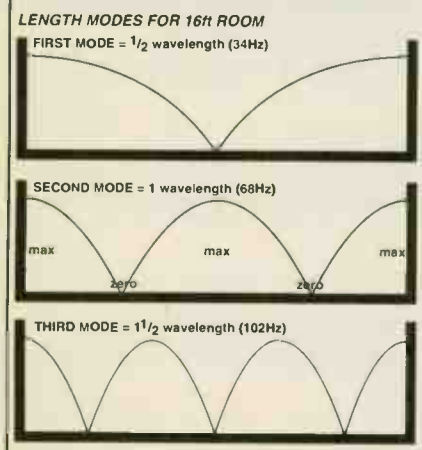
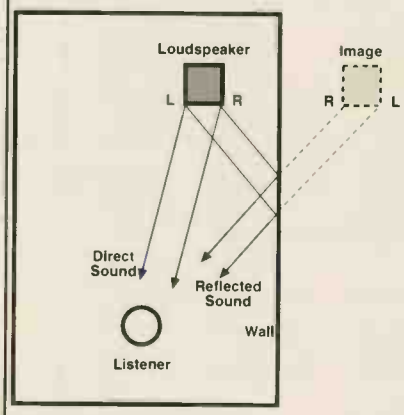
ROOM MODES



Rooms act as organ pipes at low frequencies: the air inside them vibrates at certain frequencies when excited by the bass energy from a loudspeaker. These vibrations are known as Room Modes and are determined by a room's length, width and height dimensions. A pattern of static or 'standing' waves will exist between these parallel surfaces. Their static nature alters perceived bass balance around the room and decay times are longer at the modal frequencies, producing 'boomy' bass.

The condition can occur at half a wavelength and multiples of a half wavelength. Sit at a peak and bass at this modal frequency will be loudest. Sit at a zero and it will be non-existant at this modal frequency. This does not mean there will be no bass of course, only absence of bass at one particular frequency.

IMAGES



Sound from your loudspeakers reaches your ears directly, and indirectly as reflections off walls and ceiling. The direct sound from your loudspeaker is well defined high-quality audio. The reflected sound is "dirty" and time delayed, causing it to interfere with the direct sound.

Although the reflected sound is unwanted, removing it produces an unnaturally dead acoustic. A proportion of reflected energy is needed, but not too much. Visual Ears uses complex acoustic image modelling to give a resultant response at the listening position.

Sound from the reflected image travels further than the direct sound. Where the path length difference amounts to one half a wavelength at a particular frequency, phase will be reversed and a suckout in response at that frequency will occur at the listening position. If the sound arrives in-phase then it will reinforce the sound at the listening position. Since there are many images doing this, the overall impact upon sound quality can be significant.

Riverside Audio

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Our aim at Riverside Audio is to enable the home constructor to build valve amplifiers which combine superb sound quality with the professional finish of the best high-end products - at a low price. Our rigorous and conservative designs ensure that you get long and trouble free service from your amplifier. We offer our amplifiers in various forms, from circuit designs, through printed circuit boards, to full kits and even fully assembled amplifiers for those who cannot wait to listen to them.

The Riverside 4040 is our integrated amplifier. It features dual mono construction and has five line level inputs and both 4Ω and 8Ω outputs. The output stage is configured in the classic McIntosh connection, which gives stable, wide-band operation even with difficult loudspeaker loads. The stainless steel chassis and transformer cover are hand polished to a mirror finish, and come with a semi-matt black valve cover. 4xEL34, 4xECC83, 2xECC82. A full description, including circuit diagram, is given in the 4040 reference manual, £6.50. Kit £780, fully assembled £995.

Technical specification: dual mono construction, 40W/channel, 12Hz to 25kHz power bandwidth, distortion <0.1%, five line level inputs, tape output, 230/240V mains input.

Stereo amplifier circuit board : board only £49.50; component pack (including valve bases), add £63; populated board £125; full valve set, add £45. Power supply board : board only £20.50; component pack, add £44; populated board £66. Input board : board only £15.50; component pack, add £16; populated board £33.

The output transformers are configured for the McIntosh connection and have excellent low frequency response and a primary reflected impedance of 3800Ω. Full connection instructions provided. Price £70. The mains transformer is wound for dual mono construction, as this gives superior isolation between channels which sharpens imaging and eliminates inter-channel ground loops in the amplifier. Primary 0-230-240V. Secondaries 2x295V@0.25A (0.4A int.), 2x70V@30mA, 2x6.3V@5A. Price £60. Other primary voltages can be supplied to special order. Data sheets giving connection diagrams, specifications, as well as circuits for using each transformer, £2.50 each.

The chassis, comprising main chassis and transformer cover, is hand polished, welded 1/16" stainless steel - NC machine tooled for a perfect fit and clean finish. Each kit also includes a mesh valve cover and baseplate, finished in semi matt black. Price £310. Also available in mild steel finished in black, £195. For those who wish to use one of these high quality chassis for their own projects, details of the chassis are given in the 4040 reference manual, £6.50.

Connector kit: twelve gold plated phono connectors, two sets of loudspeaker terminals, an IEC mains socket with integral fuse and switch, and an IEC mains lead with fitted 13A plug. £51.50. Cable kit: all cables required for the 4040, £6.

The Riverside P2 phono preamplifier is designed to partner the Riverside 4040 for those who enjoy the vinyl sound. Equalization is provided for moving magnet output to line level. The P2 features a high accuracy feedback RIAA equalization circuit, ensuring a natural tonality, a regulated high voltage supply per channel and cathode follower outputs. 3xECC83, 1xECC81, 2xECF80. Full details and circuit diagram in the P2 reference manual, £6.50. Kit £225, fully assembled £275.

Technical specification: 47kΩ input impedance, 1kΩ impedance output for driving long interconnects.

Stereo circuit board: board only £25; component pack, add £37.50; populated board £70; full valve set £20.

The mains transformer is wound for dual mono construction and is toroidal for low leakage flux. Primary 0-230-240V. Secondaries 2x295V@20mA, 2x6.3V@0.45A, 16V@1A. Price £30. Other primary voltages can be supplied to special order. These transformers are also suitable for power supplies in preamplifiers and other line level valve circuits - see data sheet for details, £2.50.

The chassis (main chassis and transformer cover) is made from mild steel. Each kit comes complete with a mesh valve cover and baseplate, finished in black. Price £110. For those who wish to use a high quality chassis for their own projects, details of the chassis are given in the P2 manual, £6.50.

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1000V	0 022mF	28mm	9 5mm	£0 92
1000V	0 047mF	28mm	12mm	£1.09
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1000V	0 47mF	46mm	24mm	£6.88
1500V	0 01mF	28mm	10mm	£0.72
1500V	0 022mF	28mm	13mm	£0.84
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HIGH PERFORMANCE LOUDSPEAKERS

by Martin Colloms

Reviewed by Noel Keywood.

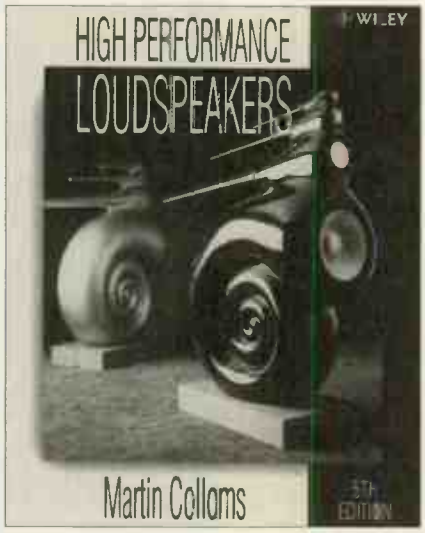
This book is no new kid on the block. Martin Colloms has chosen to substantially add to the content of High Performance Loudspeakers, now in its fifth edition, rather than start anew, resulting in a sizeable tome of some 475 pages. But then loudspeakers need it.

High Performance Loudspeakers seeks to be a comprehensive and up-to-date reference book and, because Martin either works for or closely with most British loudspeaker manufacturers, he benefits from access to the latest research information. As a magazine reviewer he is also conversant with all recent debates, fads and fashions. So is this book of interest to you?

Martin seems to have asked the same question, declaring in his preface that the book has been expanded significantly and reduced in price, making it accessible to more people. This is a welcome move in my view; the original was a bit abstruse for anyone with a practical interest. With plenty of design experience and test equipment Martin has the ability to write a good bridging work between the theoretical and the practical.

High Performance Loudspeakers moves in this direction, but remains primarily a broad and current summary of loudspeaker technologies, ideal for the student or professional more than the DIYer. I was intrigued by Appendix B, Design Tips, which could have been hot for budding designers and students, but this proved perfunctory. Much the same can be said about Appendix A, titled CAD Software. Both need strengthening up or moving to another book.

I detected the need for further updating in discussions of cone materials, where paper, Bextrene and polypropylene are talked about, due to the book's 1978 genesis. If anything has changed greatly since 1978 it is materials technologies. Today's understanding of materials and our advances in modern synthetics may not be highly visible, but they are highly significant. We are now into carbon fibre, Kevlar, High Definition



Aerogel, various ceramics and such like.

A similar problem exists with Ribbon Loudspeakers. The diagram used is an old fave from Gilbert Briggs' book, Loudspeakers, and there's a discussion on Celestion's defunct ribbon, for which the tooling is unavailable I am told (pity, I would like to have used it!) The famous Tonigen ribbon tweeter is not mentioned, nor are Fostex, Magnestat or the widely publicised Newform Research ribbons from Canada.

There has been a good overall updating of views on sensitivity, load characteristics and what have you. The further constraints upon system design imposed by the need to load-match could have been better discussed, but then Martin does make some valuable observations about the dangers of relying upon heavy current draw and flow, and it is in this respect that High Performance Loudspeakers shows its mettle. It digs deep in narrow but important areas. Furthermore, every chapter has a good bibliography, allowing readers to pursue a subject. In probably no other book out today will you find so much theoretical and practical discussion of the NXT distributed mode panel loudspeaker. But should the more conventional NCT panel have been included, for people who might wonder about differences between the two in light of their claims?

High Performance Loudspeakers remains strong in its coverage of basic principles and, in fact, finds science in areas too often dismissed as mumbo-jumbo by engineers with less experience and commitment than Martin Colloms.

Here's a list of chapter contents to help give some idea of how the book is pitched. It starts with a General Review followed by Theoretical Aspects of Diaphragm Radiators. Chapter Three is on Transducers, Diaphragms and Technology and Four on Low Frequency System Analysis: Room Environments and 2π Theory. Chapter Five covers Moving Coil Direct Radiator Drivers and Six Systems and Crossovers. Then comes The Enclosure followed by Home Theatre and Surround Sound. Martin then covers Loudspeaker Assessment before embarking on the Appendices on Computer Design Software and General Design Considerations.

High Performance Loudspeakers is very readable and there's lots of good diagramming but the mono scanning is appalling, especially the amusing picture of a Yeti in a lab coat engaged in acoustic research on page 391.

Either High Performance Loudspeakers moves up to the stature of The Radio Designers Handbook in future or it needs to split into three or four comprehensive volumes. But for now, the fifth edition is a cornucopia of loudspeaker information at a very good price and, like the fourth edition, I strongly recommend it.

High Performance Loudspeakers
£24.95
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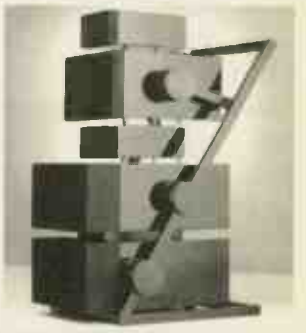

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Oscilloscopes - How To Use Them And How They Work (4th Edition)

By Ian Hickman

Reviewed by Haider Bahrani.

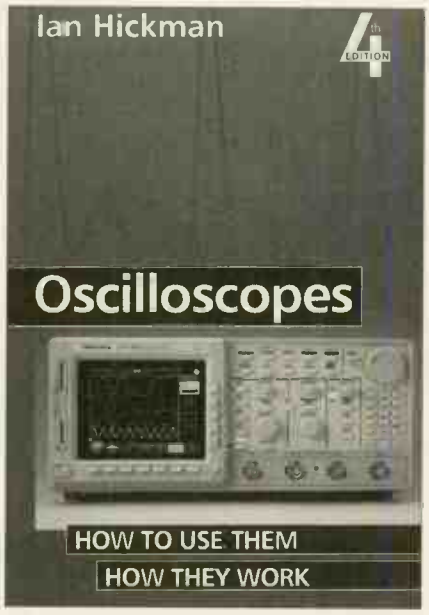
The oscilloscope, be it in its common cathode-ray form or other varieties such as the more recent LCD (Liquid Crystal Display) types has become almost as important to the electronics engineer and designer as a paint brush is to a painter. In terms of audio electronics it is almost a prerequisite lagging only slightly behind the forever-handy multimeter.

Now to the matter at hand. On first sight an oscilloscope, even the most basic of models, can seem like a daunting tool to use. A quick read of the manual clarifies matters slightly and getting started becomes less of a problem. Realising the immense potential of a 'scope can take more than a while though.

For the past 16 years there has been a publication that gives a thorough insight into the workings and operation of this tool and it's now in its forth edition. Ian Hickman's book is by no means a step by step tutorial guide to the use of oscilloscopes, but it certainly leaves very few areas untouched.

The first chapter introduces the reader to the basic concepts of the oscilloscope, tracing the name back to its Greek and Roman origins followed by a brief summary of what the instrument does. The next couple of chapters focus more closely on functions, with Chapter Two detailing the knobs and twiddles of the basic, no-frills cathode-ray machine. Most basic 'scopes are limited to 20MHz bandwidth, more than plenty for us audio freaks.

Chapter Three cries out for the attention of the more serious user, one who has been confronted with an even vaster array of buttons and gizmos. Oscilloscopes bristling with these more complex features will normally have a bandwidth in excess of 100MHz. The example at this juncture is Technics' 2465B which has a 400MHz bandwidth



and boasts just about every feature an oscilloscope can offer. The author is certainly comprehensive in his approach here.

The book doesn't get to grips with actual use of the 'scope until Chapter Five which follows a chapter on fiddly extras, such as probes, calibrators and cameras. This is a long and winding section that takes the reader through the use of the aforementioned probes, dual trace 'scopes, putting the instrument through its paces in component testing, etc. All these details are accompanied by true-to-life examples in a tutorial-type fashion.

The kind of oscilloscope referred to so far has been working in real time which allows the user to observe a continuous signal only. Chapters Six and Seven introduce the reader to the sampling oscilloscope and its successor, the DSO (Digital Storage Oscilloscope). This is where the book starts to tackle areas aimed at the serious professional user. Many engineers would read a book like this to inform rather than to brush up, or even as a cure for insomnia. Yes, it is heavy going rather than difficult, but to a certain extent it needs to be.

Sampling 'scopes, although no longer in production, are covered as a lead up to DSOs and because many are still in use. The former instrument preceded the DSO by at least 20 years with the latter carrying forward many of the sampling oscilloscope's attributes. The advent of the storage 'scope in the early Seventies has lead to immense development in the field, much due to the improvements in digital sampling and storage techniques and the author readily admits this is a subject area which could be covered in a text of its own.

Chapter Eight runs through a list of oscilloscopes designed for special purposes such as portability, education, recording, etc., and expands the theme into spectrum analyser and logic analyser territory with some brief explanations of their use.

And the lesson has only just begun! Chapters Nine, Ten and Eleven see out the text in three parts on how oscilloscopes work, covering the cathode ray tube, the oscilloscope circuitry (transistors and what have you) and finally storage ray tubes as used in analogue storage 'scopes.

Phew! Oscilloscopes - How To Use Them And How They Work is the kind of book I would have hated as a student but would love when I needed it in the real world. It is heavy going but very clear and thoroughly deserves shelf space ●

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D.I.Y. Letters

REVIEW RETORT

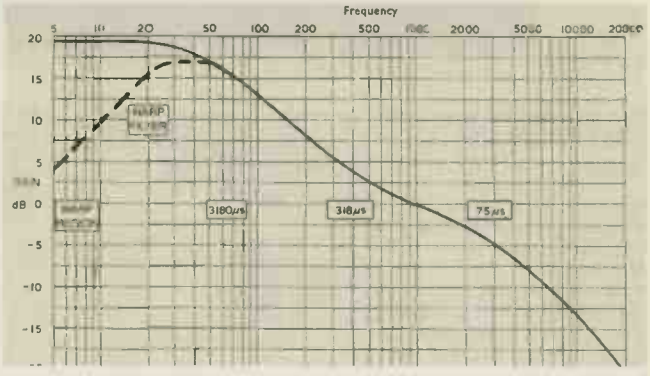
Thank you for reviewing our HMC 100 phono stage. There are a number of subjective opinions given in the technical report that are arguable and we would like to address these.

Firstly the maximum output swing is criticised for being low at only 3V before clipping. This is deliberate so as not to damage the input stage of following pre-amplifiers, if the input of the phono stage is accidentally connected to a line-level source. A 3V swing is still more than that from most other audio sources.

Secondly the input impedance is said to be 'high, for no good reason'. As stated in the main article, these phono stages are available to order with any input impedance along with gain settings to suit any cartridge. The review model (standard) was optimised for high-end Ortofon cartridges such as the Rohmann which benefits from seeing a high impedance as a low impedance applies too much inertial damping (caused by the flux-braking effect of a low resistance across its coils) restricting dynamics and bass response. Other cartridges need the damping and optimised noise performance that impedance matching brings.

The unit was also criticised for having a 5V DC offset on the output. This is not the case in use, but the observation is easily explained. The HMC 100 is direct coupled and uses a DC servo to zero any offset with reference to the input ground. As this was the high impedance model and it was measured without a cartridge connected to the input, the servo did not have a reference point to input ground so drifted to -5v. This phenomenon is explained in the instructions along with a warning to connect the cartridge first.

Finally, low-frequency roll-off, to prevent excessive cone excursions when playing warped records, is always a controversial subject when designing a phono stage as you have to trade playability off against fidelity. I chose 17Hz and 6dB/octave as the best compromise - a higher-order filter gives poorer phase linearity leading to a less coherent bass, and a higher turnover frequency compromises bass response.



A warp filter reduces the high +20dB gain of RIAA equalisation at low frequencies, rolling off response below 40Hz and introducing around -10dB attenuation at 10Hz, below which warp signals become a problem.

Henley's HMC 100 phono stage was originally reviewed in our July issue where it produced some unusual measured results.

Perhaps our records are less warped than Mr Keywood's?

Colin Toogood
Henley Designs Ltd.

The usual maximum output of chip based audio pre-amplifiers is 10V or so. This is because chip maximum rail voltages are commonly +/-18V, with which +/-15V line regulators are used. The maximum available output swing is therefore 15V peak, or 10.5V rms. Most designers find this a sensible headroom figure and it too is something of an ad hoc standard.

The output of a pre-amp feeds a volume control in 99% of amplifiers and the volume control is often set between 10 o'clock and 12 o'clock, so quite a lot of attenuation is applied to the incoming signal. The first device is unlikely to see 10V even if the pre-amp is, by some peculiar accident, caused to deliver full output swing. Voltages like this are very unlikely to cause damage in any case. Your presumption that people will be plugging "line level" devices like tuners or cassette decks into a phono stage is a little fantastic. The usual reason for low output swing is because

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the designer has been trying to save pennies in the power supply.

Ortofons have traditionally demanded a very low input impedance of 10ohms or so. High impedance in Moving Coil terms is usually 100ohms, not the 47kohms figure of your pre-amp, which is suited to MMs.

I doubt very much whether a load of 50ohms-100ohms or so would impose any damping effect upon the very low impedance of a Moving Coil generator. If you have evidence that the Rohmann is upset by normal MC loading then we will be happy to verify the fact through measurement and publish the data. Users need to know that this cartridge requires 47kohm loading if it is so.

The phono stage was measured with its input short-circuited. For obvious reasons most designers feel it is wise to ensure their products cannot develop DC output offsets by any means, since there are quite a few all-direct coupled amps around. The simple but safe solution usually adopted is to use an output blocking capacitor, especially when the output is likely to develop an offset, as it is with your phono stage when a cartridge is disconnected. The normal reason for leaving out such components is to save money of course.

Nowadays a large majority of loudspeakers are reflex designs. They possess no acoustic damping at low frequencies, with the consequence that cone flap occurs with LP. Complicating factors are arm mass and cartridge compliance, which set the arm's subsonic resonant frequency and the peak in output that accompanies it. Whilst the usual IEC filter at 40Hz does perceptibly remove deep bass, some type of filter, perhaps switchable, to significantly reduce output at 10Hz or thereabouts is required.

The records you are meant to be considering are those of your customers. I'm sure that if you bore their needs more in mind your phono stage would be better suited to its task. NK

SERVO SAVVY

There has been increasing interest in DC servos over the last few years, but my colleague's copy of Horowitz and Hill's The Art Of Electronics seems to make no mention of them. Could you provide an overview of what they do and how they go about it? Does the increased component count really improve on a well specified decoupling capacitor?

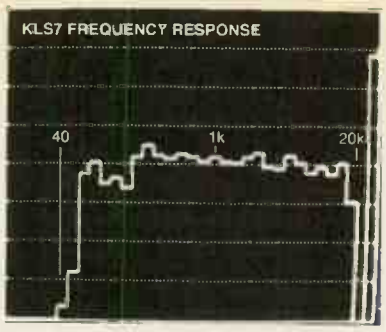
On a different note, is it possible to put a few more markers on your 'speaker frequency response charts - for instance the frequency at which it hits -5dB? I'm trying to work this out for your KLS7. I'm thinking of having a go at them but am still a little apprehensive of their low frequency performance.

At the moment I have a pair of Ruark Sabres. These have a lovely forward sound and voices are particularly enjoyable. But because they have a problem going low I have to keep them close to the wall which makes the bass somewhat flabby. Will I have the same problem with the 7s?

I assume that your tweak to the tweeters on the KLS7 is an in-house secret. What sort of trouble would it be to use one of the Audax Fabric Domes like the TWO25MO instead?

Ian Medland
ian@pdd.pioneer.co.uk

I am not acquainted with any books on DC servos.



There are 33 level 'blocks' in our third-octave analyses. They run from 12Hz up to 20kHz, a wide range able to give a full picture of loudspeaker frequency response.

As a quick explanation to readers, servo feedback puts gain in the feedback loop, rather than the forward path. DC servo amplifiers are concerned solely with maintaining DC stability and low output offset in all direct coupled amplifiers. In effect they roll off gain to unity at low frequencies, determining the low frequency -3dB point.

In my experience, sources feeding an amplifier quite often have DC output; DPA's 50S disc stage for example has 2V output offset as standard. It is meant to be used with their own amps, which have an input blocking capacitor. Similarly, Audiolab amps have an input blocker for safety. Here's what Mike Martindell, Senior Design Engineer at Arcam, told us on this little discussed topic:

"I doubt that there are any good books about DC servos. Maybe there was something about it in Wireless World during the '70s and '80s. We usually put the -3dB point at 2Hz to 5Hz. This is a compromise between getting a sensibly short switch-on settling time and good low frequency audio performance.

All blocking capacitors affect the sound. Really they should be disposed of completely, but in a real world you don't know what someone is going to plug into their amplifier. It could be a source with a large DC offset which the servo might not be able to correct for, and/or it might produce a nasty DC bang. So prudence indicates that adding one blocking capacitor in the signal path is a sensible thing.

DC gain in the feedback loop is difficult to define for the best; too much and you limit the range over which you can correct circuit offsets, too little and the circuit can take a long time to settle down from switch-on."
Mike Martindell
mikem@arcam.co.uk

The KLS7s are meant to be used close to a wall, but the bass does not get flabby. They were designed to fit small rooms and match small budgets. The response is printed in more detail here. Different drivers cannot be substituted into our loudspeakers because our crossovers frequency-equalise the drivers, working in conjunction with their own particular load characteristics.

The sort of response flatness we expect to achieve is demonstrated by KLS7. Both system response and load characteristics would change for the worse if another unit was substituted. NK

THE INCREDIBLE HULK

From looking at Hi-fi World it seems to me that there are quite a number of home constructors building amplifiers with wimpy valves (like the EL34) running on sissy voltages. I would be interested in hearing from other people like myself who put together amplifiers using

In a single-ended amp like yours with 211 triodes, a quality power supply is essential. Replacing electolytic reservoir caps with polypropylenes is one way to upgrade.

serious valves like the 211 or DA100.

On a more serious note, I have built an amplifier that uses a pair of 211s in parallel single-ended Class A on some 1200 volts of HT. I was interested to read your advice on the matter of power supplies in the April issue of the DIY supplement.

My power supply uses U19 rectifiers with paper-in-oil capacitors and chokes. There is 2µF of capacitance before the choke. However, I am using three 330µF capacitors in series for the final post-choke reservoir and am advised that using a large polypropylene capacitor such as the 200µF 1200V item offered by the Vintage Audio Co. would improve the sound quality, which is already impressive.

Is a capacitor like this a worthwhile investment? In my circuit it would be the only capacitor in the signal path.

A final question. In view of the heavy demands this type of circuit puts on the power supply is it worth using a more elaborate stabilised supply?

I have not seen any commercial amplifiers of this kind using stabilised power supplies (most seem even to use solid-state rectification). Thanks for an interesting magazine.

Paul Preston
paulpaula@intonet.co.uk

The polyprop cap could make a real improvement to the amp, but your 2µF input cap is a bit small. If you want to experience true bass and definition you must use a choke input filter. The input cap on a π filter defines the DC regulation, and the DC regulation must be good to get away from that bouncy, amorphous 'boing' sound that most valve amps make. This way is better and cheaper than using a stabilised supply. These can sound good but it's difficult as shunt regulators sound the best and they are extremely inefficient. Don't consider using a solid-state supply, or even solid-state diodes as rectifiers. AG

PERPLEXED BY PRE-AMPS

I'm looking to replace my Sugden C28 pre-amp which is a bit hummy on one channel and has some low-level, low-frequency grunge to the sound. The rest of the system is a Garrard 401/Akito 2/MC 25FL, Michell ISO, Sugden P28 (lusting after Symetras!) and KLS4s.

I've tried several pre-amps:

1) LFD's LS1 was very clear and quiet with good control but to my ears the sound was rather sterile.

2) Michell's Argo/Hera was again clear and quiet with good control and it had a more involving sound than the LFD. It seems to put an unwelcome sheen over the music though - eg, the attack of bow on 'cello string has no bite to it but rather a beautiful but glassy and wholly unrealistic sound.

3) Two Sugden AU51 pre-amps (the old two-box with poor phono stage and the new one-box), both of which had an engrossing if overly warm sound. They also seemed to lose detail and control in the bass.

Various dealers have been very patient with me through all of this and suggest that perhaps a valve pre-amp might be what I'm looking for (essentially an Argo without the sheen). Do you think your KLP1 might fit the bill?

Dr. Jonathan Iggo
iggo@liv.ac.uk

I think KLP1 would fit in very well with the rest of your system. As David Price mentioned in his September column, valve and solid-state can work together to produce very good results. We've been trying an old Sony TA-E88B transistor pre-amp with our K5881 MkII power amp recently and have gotten some extremely listenable results.

I suspect you'll find KLP1 completely free of that "glassiness" you talk about which tends to afflict transistors. And if you opt for the Panasonic For Audio potentiometer (£65 from Audio-Links, tel: 01724 870432) you'll get a deliciously open, detailed sound from your system. JM

For a smooth, natural sound one worthy option is a KLP1 valve pre-amp.

GETTING DECKED OUT

The reason I'm writing is to put forward a suggestion for an article. I'm considering an upgrade to my ageing Systemdek IIX/RB250. Funds being limited I'm considering looking to the second-hand market. Any chance of an article about buying second-hand decks - what to look for beyond general condition? And also some kind of price guide?

I have a Cyrus II/PSX and a pair of Ruark Templars and am considering upgrading to a PT. Should I consider any other kind of deck?

Bob Barton
Bob777992@aol.com

The IIX is a very decent deck in its own right, and, dare I say it, very amenable to tweaking. One option very worth trying is to get hold of a Linn Valhalla power supply. These can be picked up second-hand for around £30-£40. The motors used in the Linn LP12 and Systemdek IIX are both 24-pole AC synchronous devices from Airpax, so the Valhalla should work with the IIX, although I haven't tried it myself. The result should be a much crisper, cleaner and more powerful sound.

You could also line the sub-chassis and plinth with some damping material like the self-adhesive bituminous pads used to damp vibration in car body panels. These are available from car accessory shops. Going this route would increase the weight of the sub-chassis so you might have to invest in a set of stiffer springs for the IIX.

If you decide to go for another deck bought second-hand, above all else you need to check that the main bearing is in good condition. Grasp the spindle (which goes through the hole in the

The most important part of a record deck is the main bearing. If there's a lot of play when you gently pull side-to-side on the spindle, then it's best to steer clear of that particular deck.

and dab it on to one end of the cut belt. Then lay the belt on a piece of clean glass, butted up against a straight edge like a metal ruler. Use the ruler to make sure that the ends of the belt are correctly aligned as you press them gently together.

centre of the record) with your fingers and try gently rocking it side-to-side. If there's quite a lot of play, then the bearing is probably worn and the deck should be avoided. Do bear in mind, however, that there is generally a small amount of play in the bearings of turntables costing less than about £700. Precision bearings are costly to produce and so tend to crop up on pricier decks.

If the bearing is OK, the next thing to check is the motor. You can do this in the same way as for the bearing. If the motor is worn, it will put out a lot of vibration as it turns, smearing the sound and raising background noise levels. Speed stability can suffer as well.

You don't need to worry unduly about the condition of the drive belt. Most belts are flat, rectangular-section types and replacements can be bought from Maplin, etc. If you can't find a belt of the right length, buy one that's too long and cut it to length. The cuts themselves both need to be made at 90degrees to the length of the belt to ensure a clean join when they're glued together. The same procedure works for round-section belts.

Superglue is the best bet as an adhesive. Put a tiny drop on the end of a pin

If your bargain hunt extends to second-hand direct drive turntables, then there's one rule of thumb to bear in mind - Quartz locked decks usually sound better than their non-Quartz peers. As before, the bearing condition needs to be confirmed, but most of the higher quality direct drive motors have bearings which should last a life-time.

Keep an eye on our Olde Worlde section for a guide to the price of second-hand decks. You shouldn't really pay any more than half of what the turntable originally cost when it was brand new though. JM

A QUESTION OF CLASS

I have four original 805 valves. I had hoped that they were similar to RCA 845 except for the topcap. I thought of using them in a power amp circuit designed for 845s, either SE or PSE.

However, I recently got hold of the RCA 805 data sheet which indicates that they are very different to the 845. These valves do not seem to have been designed for Class A operation and I haven't been able to deduce possible Class A operation characteristics. Are you able to throw any light on this?

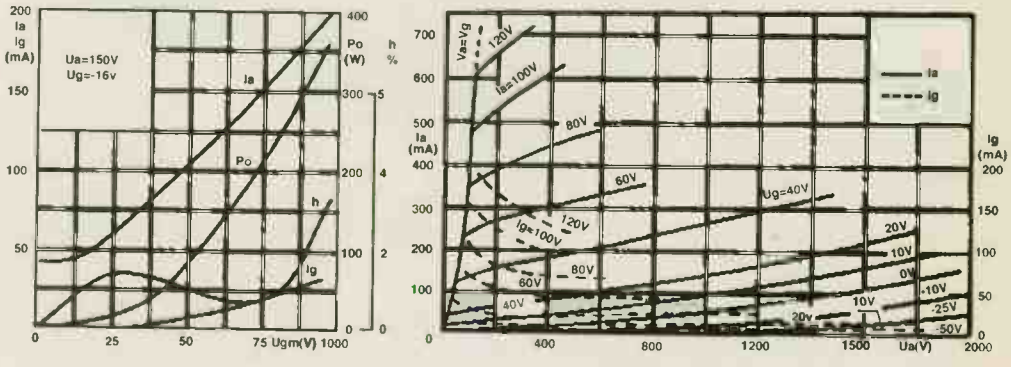
Continuing undaunted, I have heard that there is a Japanese design for a single-ended 805 amp published in a circuits' book. Do you have any idea as to whether this book is available in the UK, or of any other sources of a PSE/SE 805 design?

Thanks for a great magazine.

Andrew Slater
ASlater313@aol.com

The 805 valve is similar in construction to the 845 but has very different electrical characteristics as you have found. The 845 was designed as an audio valve with a low anode impedance which gives it good power efficiency before having to drive the grid positive, which requires power from the driver stage.

The 805 has a much



805 Power Triode

U_f V	I_f A	Cl.	U_a V	U_g V	I_a mA	I_g mA	U_{gpo} V	P_{dr} W	$R_{a/a}$ kΩ	P_o W	P_{in} W	P_a W
10	3,25	C-Ter	1000	— 95	200	40	225	8,5		130		
			1250	—100	200	40	230	8,5		170		
			1500	—105	200	40	235	8,5		215		
			1500	—500	210	70	maximum				315	125
		C-TH A-Mod	1000	—155	160	60	295	16		110		
			1250	—160	160	60	300	16		140		
			1250	—500	175	70	maximum				220	85
		B-TH	1250	0	135	15	75	11		55		
			1500	— 10	115	15	70	7,5		57,5		
			1500		150		maximum				185	125
		B (≈) Mod	1250	0	148÷400		235	6	6,7	300		
			1500	— 16	84÷400		280	7	8,2	370		
			1500		210		maximum (x2)				315	125
		stat	1500		S = 4,8 mA/V; μ = 30; $f_{(max)}$ = 30 MHz							

RCA's 805 valve was designed specifically for use in Class B amps, so fitting it to a single-ended amp may not work too well.

tighter grid pitch and larger electrode spacings. This gives it a high impedance, which was done to create a Class B zero-bias valve. There are many such types around, like the 811A, 572B, 833A and so on. These were (and still are) used as transmitter and modulator valves. They have very high anode efficiency but require substantial power to drive them, whereas an 845 requires only drive voltage.

The high anode impedance of the 805 and its friends makes the output transformer design much more critical and it will never give such good bandwidth as the lower impedance types. But there are quite a few original valves of this type around so they have become interesting.

Nobu Shishido of WAVAC uses this kind of valve in his amplifiers, and when I spoke to him at C.E.S. in Las Vegas this year he told me that the 805 was his favourite valve, so you may still want to experiment with them.

I have designed a special driver transformer which uses a 300B to drive the 805. The 805 is set with zero bias on its grid and the grid swings positive and negative. The transformer has a 5:1 step-down ratio and a 100kHz bandwidth (-3dB). This is available from AudioNote UK.

There are two points that need considering though:
1) The 805 is deliberately non-linear. The transconductance above and below the 0V grid line is different, higher above than below. This reduces crossover distortion when it is used in its intended push-pull Class B mode. When used in a single-ended circuit it makes for quite a lot of second harmonic distortion.
2) I recommend you build an amp possibly similar to the Ankoru but only using one 805 per channel - it will sound better. Unless you want megawatts, use single tubes. AG

MORE CHIPS AND SOURCE

Having built a K5881 MkII some weeks ago I want to thank you for this wonderful amplifier kit. It gave me a lot of fun and it sounded very good from the first time I switched it on.

In the meantime I did your Black Gate tweak which further improved the sound (why don't you deliver them with the original kit?) Some AudioNote paper-in-oil capacitors followed. I prefer tweaking step by step with a lot of listening between the steps because this stops you getting confused.

The amp drives a pair of Revelation 1 two-way loudspeakers (17cm Görlich mid/bass, Corona ionostatic HT, 91dB sensitivity, first-order crossover) and is fed by a highly modified battery powered QED Digit getting its signal from a battery powered Audio Alchemy DTI Plus. Volume control is by an Audio Synthesis Passion. A modified Marantz CD-80 (Trichord Clock 2) rotates the CDs.

The SRPP input stage of the K5881 MkII seems to work extremely well with the passive pre-amp.

The output op amp of the Digit was changed several times: from NE5532 (original, poor sound) to OPA2604 (good sound, good value for money) to OPA627 (very good sound, expensive) and finally AD744/AD811 pairs (excellent sound, very expensive).

Recently I also swapped my REL Stentor 1, which was too big for my room, for an Audiodata Soutien 2 which is a German subwoofer that works with motional feedback and delivers a tighter and faster bass than the REL.

Dieter Strecker
Augustin,
Germany.

To go beyond the benefits of bi-amping you need to make your loudspeakers active. You can do this with an active crossover like this one available from Maplins.

We don't offer as standard the capacitor upgrades you mention because we prefer to leave tweaking to people's own tastes.

I'm getting the impression there's a legion of QED Digit owners out there running their DACs off batteries judging from the number of letters we receive mentioning them. Apparently the results are rather impressive, which is why we hope to battery power our Assemblage DAC-2 soon.

Analog Devices' AD811 and AD744 op amps (the DAC-2 uses the AD811 as an I/V converter) are also building up a sizeable following thanks to their seductive sound quality.

The Audiodata Soutien subwoofer is new to me, but, like you say, if it uses motional feedback successfully I'm sure it does sound very crisp and controlled.

The easiest way to go active is to use a buffered active filter. Maplins offer a two-way device (order code: DR66, price £30) with a 12dB/octave crossover point that can be set between 50Hz and 5kHz and a level control to integrate a mid/bass and tweeter of different sensitivities. It's designed for in-car use and can be operated from a 12V battery, as are many of your other components. JM

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At **South Coast Speakers** we now have our own range of hand-made loudspeaker systems available. Individuality is our stronghold! All our loudspeakers are hand-made which means that we can offer you, the customer, a wide variety of beautiful real-wood finishes, including: Cherry, Pine, Walnut, Rosewood, Oak, Ash, Teak.

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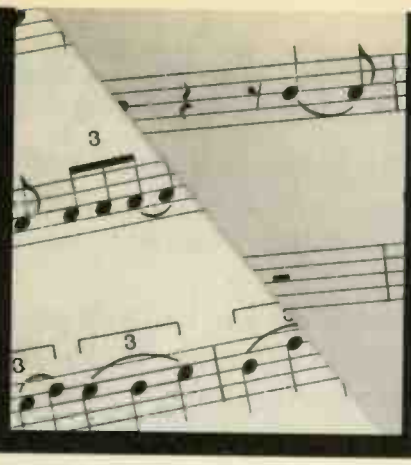

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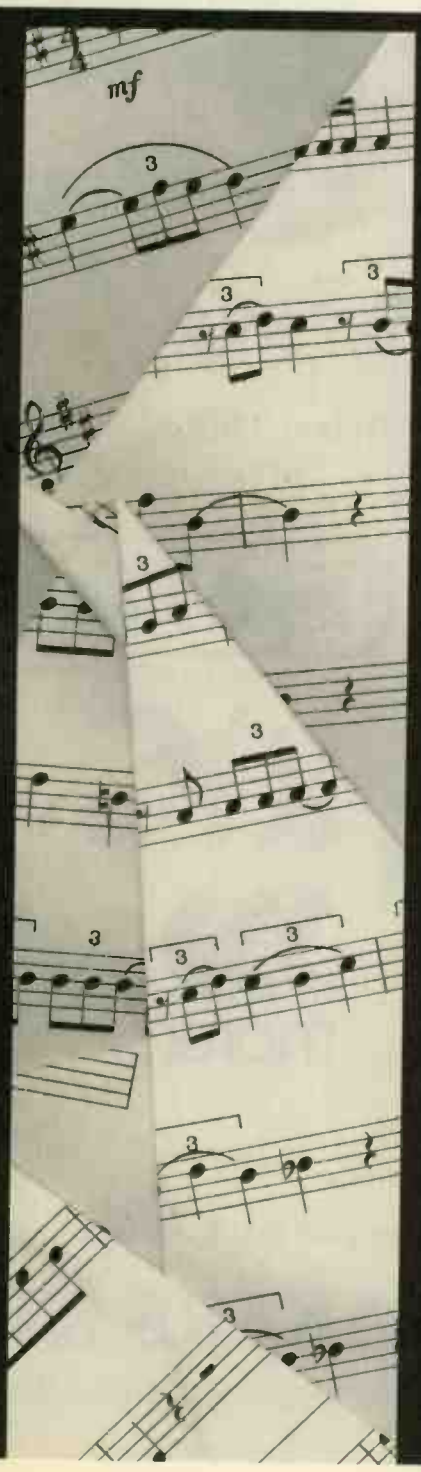

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