Hi-Fi WORLD

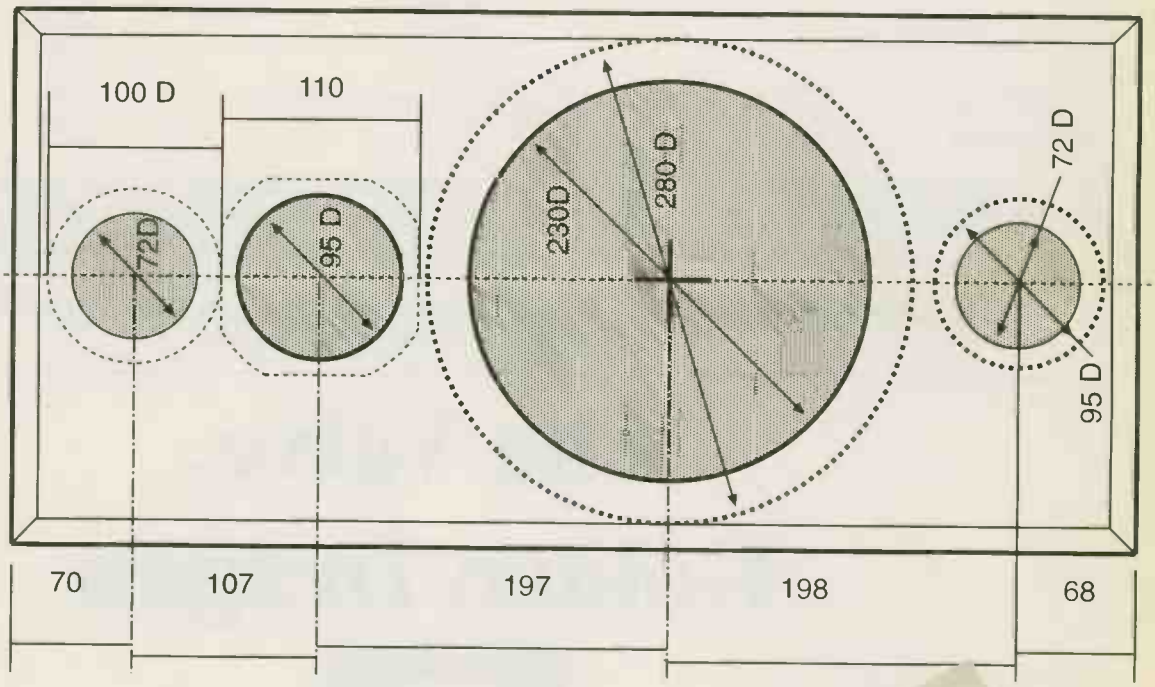
Hi-Fi WORLD

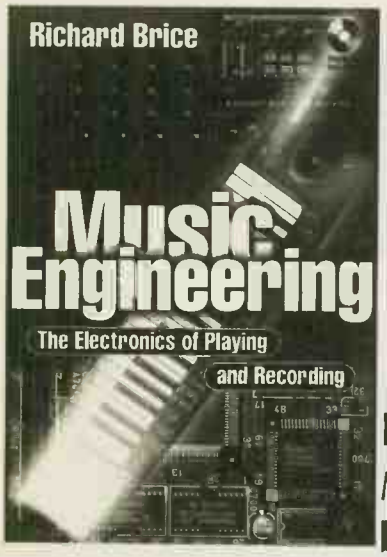
NO.43 FEBRUARY 1999 SUPPLEMENT

HD3P 640 PORT

HEAVEN ELEVEN

New KLS11 gold-dome kit loudspeaker





ABLE CABLE

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BOOK REVIEW:

Music Engineering by Richard Brice

FREE D.I.Y. SUPPLEMENT No.43

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805	£36.50	£75.00	£150.00

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Gravesend, Kent. DA11 8HD
01474 560521, fax 333762, e-mail: 101650,2424@Compuserve.com

D.I.Y. Supplement

Contents

KIT NEWS

BUY A MELLOW RIBBON. . .

The chaps at IPL Acoustics are proud to announce two additions to their varied range of loudspeaker kits which both employ ribbon tweeters.

The M3TL has a 5in. Morel mid/bass unit with a Panasonic ribbon tweeter. The second-order crossover operates at 4kHz and uses IPL polypropylene capacitors and Super Power inductors. Price without the woodwork is £207, and £282 with (plus P&P at £8.50 and £15 respectively).

Their other offering is the S3TLM which uses IPL's metal bass driver with its 104mm magnet along with the latest Legend Acoustics ribbon. Crossover is third-order at 3kHz and the non-plinth kit is £389.25 (£9 P&P). With plinth and grilles the cost rises to £492.25 (£16 P&P).

IPL Acoustics
2 Laverton Road,
Westbury,
Wiltshire BA13 3RS
Tel: 01373 823333

PIEZO CAKE

Making the piezo-electric effect truly work for its living has occupied researchers ever since the Curie brothers first discovered it. Although well entrenched at the heart of strain-gauges and the like (where movement is converted into electricity), applying the reverse process has been troublesome except on a very small scale. What should be on the face of it a heaven-sent way of converting electrical impulses directly into mechanical action has so far failed to find the means whereby science can become technology.

Now 1...Limited and the University of Birmingham's Interdisciplinary Research Centre have between them come up with a way of arranging the piezo material into structures other than the planar board which has so far stood in the way of further development. 1...Limited have patented a helical bender-cum-piston device which they intend to employ at the heart of a digital loudspeaker, once the manufacturing difficulties have been ironed out.

Since what they term the "electronic spring" has the potential for movement up to 10mm in either direction, 1 ..Limited are hoping that a cellular, full-range 'speaker comprised of up to 1000 of the basic modules will be commercially available within a year or two.

JAN SESSION

The New Sensor Corporation has acquired a small stock (10 million!) of US Military JAN sub-miniature valves. Described as "New Old Stock", these are all unused and boxed in their original packing. The tiny tubes were designed for high-density circuits which require very low heat emissions. They can be used in existing circuits without considerable re-design.

Thanks to their military background, these devices are extremely hardy and possess very low susceptibility to microphony. Tube sockets are not necessary as they can be soldered directly to the circuit because of what New Sensor describe as a "virtually limitless lifetime".

For more information, check out the real and virtual addresses below.

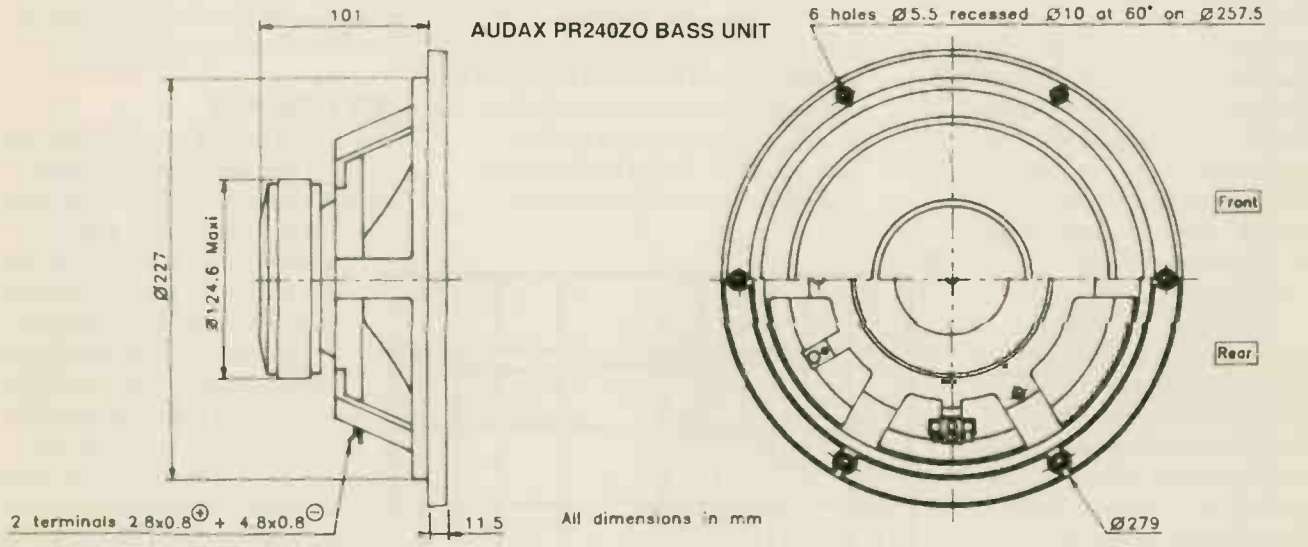
New Sensor Corporation
20 Cooper Square,
New York,
NY 10003 USA
Tel: (212) 529 0466
e-mail: info@newsensor.com

NEW KLS11 KIT LOUDSPEAKER

Our latest design is a compact loudspeaker which uses High Definition Aerogel drivers for unrivalled sound quality.

Loudspeaker designed by Gary Holland.

Feature written by Noel Keywood.



Audax recently added a large-diameter bass unit, the PR240ZO, to their range of HDA cone drivers. As large woofers go this one has been dimensioned (in terms of Thiele-Small parameters) to need a relatively small cabinet. Since bass loading most influences cabinet size, the arrival of the PR240ZO allowed us to design a compact enclosure that could reach down very low, thus giving rise to KLS11.

TOP TECHNOLOGY

High Definition Aerogel (HDA) is a light but rigid matrix of kevlar and carbon fibres baked in a gel. Light, stiff cones accelerate fast, giving clean transients. They store little energy, minimising delayed resonances and coloration. They also suffer less from internal losses, so more musical information gets through.

Low mass is not the only important factor though. A cone material must not resonate or 'ring', a problem that besets metal drivers. HDA, one of the most advanced cone materials available today, is not only light but well damped too.

One of our design rules is to ensure consistency of cone materials, in so far as possible, to help make a loudspeaker sound 'cohesive'. If drive units are consistent in their aural character, disparities are less apparent.

KLS11 combines the new Audax PR240ZO HDA bass unit with their HM100ZO HDA midrange. Since both use High Definition Aerogel cones they have similar sonic signatures.

GOLDEN PERFORMER

The HM100ZO midrange reaches high enough (6kHz) to integrate well with Audax's wonderful HD3P tweeter. This is probably the best tweeter in the world. It has no voice coil, instead using piezo-electric bending forces to make the gold-plated synthetic dome vibrate. The idea is to make a super-light assembly that can accelerate and decelerate very quickly in order to follow high-frequency signals faithfully.

Most tweeters are not so clever, which is quite apparent when listening to them. I became addicted to the Tonigen ribbon (no longer available) and then, thankfully, Audax released the HD3P.

This tweeter has the speed, clarity and incision of good ribbon devices without the slightly hard sound these often possess. Other tweeters sound harsh and muddled where the HD3P sounds clear and sweet. Needless to say, with its special crossover board and transformer it isn't cheap, which again is why you will not often see this item in commercial loudspeakers.

My loudspeakers conceptually start with the tweeter; this is an unusual starting point but it does at least ensure you get the world's best tweeter partnered with drive units matched to its abilities.

MEETING IN THE MIDDLE

This is easier said than done, because the HD3P reaches little lower than 6kHz, whereas most tweeters get down to 3kHz. So we have to use a mid/bass or a midrange able to reach high enough up the frequency range to match into the HD3P. In KLS11 that means the HM100ZO, which in itself is capable of superb results. It uses a large magnet, cast alloy chassis and soft rubber phase plug to ensure reflections across the base of the cone do not produce phase cancellations and a ragged high-frequency response.

The HM210ZO crosses over at around 800Hz to the PR240ZO. The latter has a

huge magnet on a rigid, cast-alloy chassis. It is rated at 100watts, so this is the nominal power rating of KLS11. Because KLS11 is fairly sensitive, producing 88dB Sound Pressure Level (SPL) from one watt (2.84V), there's no need for more than around 60watts to get very high volumes from it. And like all our 'speakers, this one is an easy load for an amplifier, meaning it gives consistent results when driven by different amplifiers.

DESIGN NOTES

Bass loading is by reflex port, which results in an enclosure that's compact, easy to construct and quick to optimise using an industry-standard, computer-based programme like LMS. I verify performance by measurement, using a B&K microphone and Hewlett-Packard 3561A spectrum analyser, but this is assessment of the final prototypes.

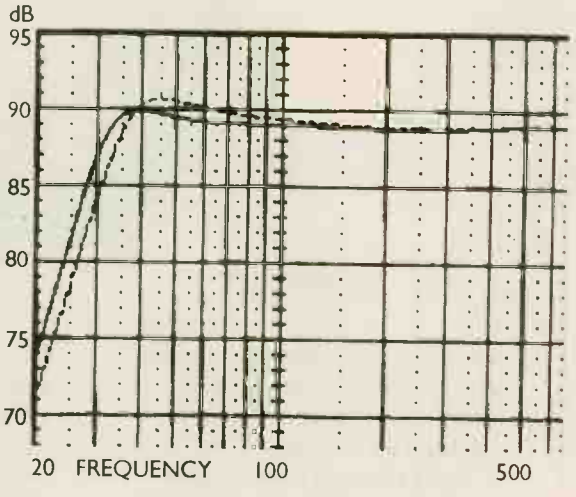
In the first instance, after deciding on the drivers, Gary Hollands had to measure the woofer's Thiele-Small parameters. We have learnt from hard experience that with Audax, who prefer to supply industry rather than the public, these can vary. So it was in this case. Their published Qts figure for the PR240ZO was quite different from what we measured. Had a cabinet been constructed from their published suggestions it would not have worked properly. As it stands the modest 45-litre cabinet of KLS11 gives a forward response from the bass unit cone that measures flat down to 50Hz and a well-damped, broad spectrum of energy from the port that extends down to below 20Hz. The port is tuned to around 35Hz.

PICKED AND MIXED

Much of the design work lies in the crossover and again this is Gary's task. Good phase matching is essential, together with a flat on-axis response and consistent off-axis radiation. It is a psycho-acoustic effect in which high-frequency energy from side walls and ceiling convinces the brain that the stereo images lie forward of the loudspeakers. Although strictly speaking this is room dependent, most rooms comply. Only those with heavy side-wall absorption would push the image back to the plane of the loudspeakers.

Good inter-drive unit phase matching and flat forward frequency response both contribute to crisp, clearly-defined imaging. In addition, you will notice that we recommend the drivers are all rebated flush with the cabinet front in KLS11, and that the front panel has bevelled edges in order to minimise diffraction. The improvements in image sharpness and tidiness these bring about are quite obvious in practice.

Having designed the crossover (no easy job with a three-way, especially when it must be a good amplifier load too), Gary then builds prototype cabinets to verify performance and make final tweaks. At this stage the cabinet is a pretty rough looking affair, having been hacked around. At Hi-Fi World we then design and build a final photographic/show model based on the design data handed to us by Gary. I will do a bit of tweaking too, in this instance adding bricks to check the affects of differing cabinet volumes to ensure the final value is optimal.



KLS11 predicted bass response.

Unfortunately I have to say that it isn't possible for even a gifted amateur with plenty of time to replicate this design procedure. We start with the best drive units available, we use sophisticated and expensive commercial test equipment and we both have a lot of experience. Loudspeaker design books go on endlessly about cabinet 'alignments'; this is but a fraction of the story. Crossover design is given little coverage and juggling forward response against amplifier load characteristics is a subject little touched upon, even though it is vital.

In my view, the end result is a sensible solution, not a definitive one. Loudspeakers are too subjective for that. I encourage all builders to experiment to suit their own tastes. It is relatively easy to tweak a loudspeaker and it can be a very worthwhile exercise. This way you get a superb basic design that exploits the latest technologies, one which can be fine-tuned to suit your preferences and, to a degree, your room.

Finally, an honest warning. If you have not built a loudspeaker before and know little about it, do not build this one! It is relatively sophisticated and is not really suitable for the inexperienced. I suggest first-timers build our popular KLS9.

THE CABINET

As far as bass loading is concerned it is the volume of the cabinet that is important. Our target volume is 45 litres (quick note: if I seem schizophrenic about measurements it is because we must work with metric French drive units using Imperial American software).

The front panel has been kept as narrow as possible and is something of a challenge woodwork-wise. It is made from 25mm MDF and must have quarter-rounds of hardwood set into routed grooves all round. Also, the drivers must be mounted flush to minimise surface reflections. This calls for a router. Note that the midrange unit has an awkward cut-out shape, just to make things even trickier, and the rebates are all different depths: 3mm for the HD3P and the port, 5mm for the HM100 and a hefty 10mm for the PR24.

The cabinet could in theory be made taller and shallower. The trouble with this is that rear-wall reflections would be strong. That is why loudspeaker cabinets are invariably made as narrow as possible and deep.

Another thing to watch for before you start is inter-driver clearances. I have placed them as close together as possible. It is especially important to keep the HD3P close to the HM100ZO. In my view, the face-plate of the HD3P is unnecessarily large. All the same, it has been electrically integrated with the HM100ZO well in this design. I insist on low phase error and Gary is a dab hand at this task. It helps give cymbals and suchlike a rock-solid sound rather than a slightly vague representation that comes about due to phase error. I have positioned the cut-outs so there is a millimetre or so clearance, but sloppy

routing may result in one driver interfering with the other.

The cabinet is small enough to be made from 18mm MDF, especially since the midrange chamber runs from the front panel right to the back. By gluing the back panel onto it, this chamber also acts as a brace. Note that this means the cabinet is fully sealed, since the back is not designed to come off. Access is through the woofer's hole.

BOX WITHIN A BOX

Since the midrange chamber is larger than critical volume (three litres) it does not act as an acoustic filter. We rely on the crossover for filtering. That does mean the chamber could be open at the rear, if a hole was cut in the back panel. Why do this? To prevent energy being reflected back off the rear wall, which in turn would lower coloration and can lead to a clearer, more open sound. It is best to add damping to the midrange chamber in the form of long-haired wool, whether the back is opened up or not. We decided to build ours closed to avoid time-consuming complication, having quite enough to worry about in or view! Just remember the bass chamber must remain air tight, except for the port.

Do not over-stuff the midrange chamber with long-haired wool or the loudspeaker will sound muffled and lifeless. Gradate the wool packing so it is most dense at the rear and relatively open at the front close to the HM100ZO. Line the walls with carpet felt. Put two carpet-felt pads on the rear wall only.

THE BASS-ICS

It is best to add long-haired wool to the bass chamber sparingly. Ideally, it should be supported on an open net (garden mesh) half way up the chamber, and not put on the bottom where it is least effective. Because of bass unit positioning, the net is probably best positioned just below the bass unit, 100mm or so up. Wool damping in a ported cabinet tends to counteract reflex operation. How much to use really depends upon your preferred bass quality, which in turn is affected by the room and loudspeaker placement. A near-wall position in a lively room will give bouncy bass and you may choose to use wool heavily to compensate for this in the loudspeaker.

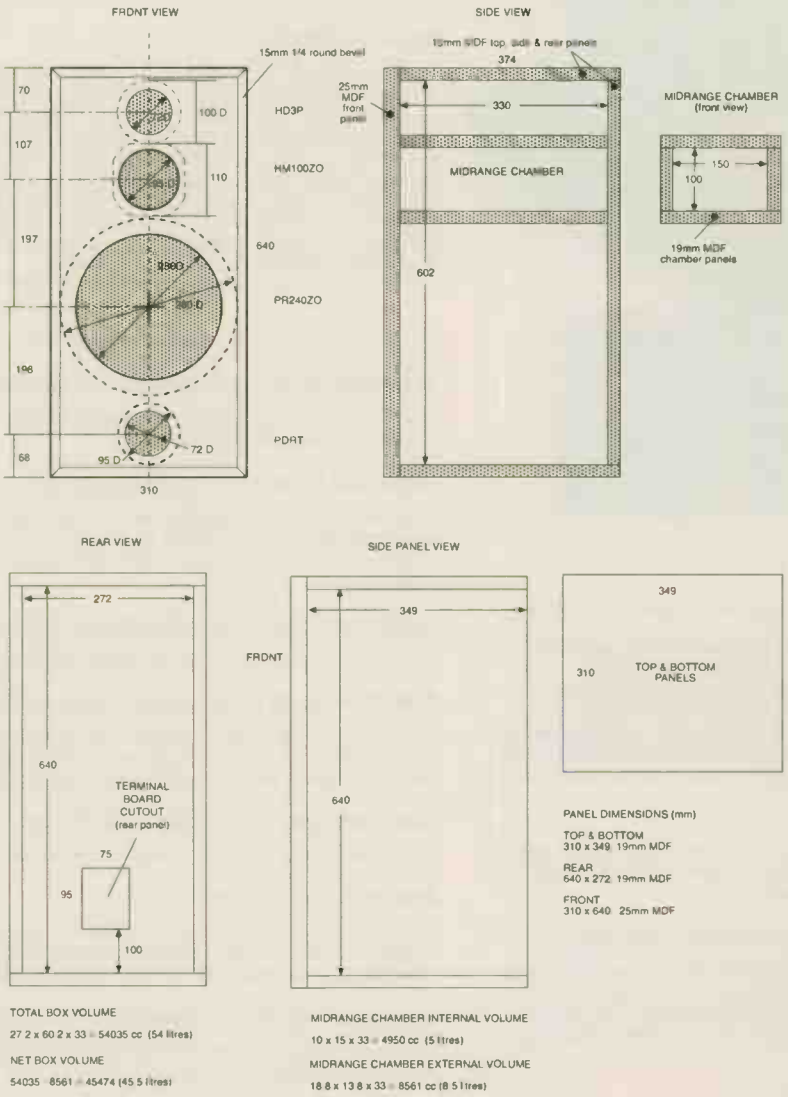
Use natural carpet felt to line the cabinet walls and damp internal reflections. An extra pad (12in. by 12in.) on the rear wall behind the bass unit is advisable. You may like to consider using one cross brace to stiffen the cabinet side walls. I use 1in. dowel screwed and glued in place.

Be very careful when soldering in the HD3P. The process must be quick to avoid damage to a very expensive tweeter. There are no reversed polarities to worry about in this loudspeaker.

Do not worry about getting an exact box volume. The 45-litre figure is not very critical - it can vary by a litre or so either way. Add bricks if you want to experiment with decreasing the volume. Around 40 litres is a minimum value. The bass will become leaner as you decrease volume.

The midrange chamber consumes 8.5 litres of internal volume when made from 18mm thick MDF. If, for example, you use a ceramic drain pipe as a rear chamber for the HM100ZO, then be aware that the net box volume will change.

The port can be varied in length. The shortest length gives a 35Hz tuning frequency, the longest decreases this to around 30Hz. Sound quality differences are not great in this case but the lower value will give the most damping and tightest bass.



INSIDES OUT

The crossover can be mounted internally or externally. The loudspeaker can be bi-wired or tri-wired too. It is best to mount the crossover externally on the rear panel, in a protective plastic case, since this minimises vibration. It should, of course, be hard-wired - no circuit boards, please. Use only the very best components too. Carbon-film resistors have a neutral sound and Solen audio-grade polypropylene capacitors are our recommendation. It is acceptable to use a bi-polar 33uF Alcap in the bass section but back-to-back 60uF Black Gates are better of course (ahem!)

The glues used in MDF are now thought to be carcinogenic, so wear a face mask when working with the stuff - do not inhale the dust. Use Evode Resin W wood glue to hold the cabinet panels together.

KLS11 needs short stands, around

Audio Note Kit Amplifiers -

Power-Amp Kit

The **Audio Note** Kit One *(illustrated)*

Based around the justly famous 300B directly heated triode, we see this kit as the introduction to *real* Audio Amplification, as it covers all the important aspects of design necessary, Single Ended, No-Feedback, Class A, Directly Heated Triode, to become a member of this exclusive club of amplifiers.

Kit One has one 300B per channel running at 420 volts with 75mA current giving 8-9 watts of the cleanest power you will ever hear, the input stage consists of a 6SN7GT with a 5687 double triode driver stage running in SRPP. The power supply is capacitor-choke-capacitor configuration with a 5U4G HT rectifier, the 300B's have a DC filament supply for hum-free operation whilst the other valves are AC heated. Component quality is similar to our Level 2 finished products. **Audio Note** paper in oil signal capacitors, Beyschlag 1 watt 1% metal film resistors, good quality electrolytics *(sorry NO Black Gates!)* and a simple, attractive stereo chassis in black paintwork. We have several component and cosmetic upgrades available for **Kit One**, please ask for details.

The Kit One has recently been awarded the title "The Greatest Audio Bargain of the Twentieth Century" by Dick Olsher (ex-Stereophile) in a review on the Internet - this is just one of many rave reviews, copies of which we can supply on request.

Price: £799 incl. VAT, which includes ALL parts & valves *(yes, also the 2 x 300B's needed)* but not postage/packing which to UK customers is £12.00.

KIT ONE ORDER CODE: AN-KIT-001

Audio Note is happy to provide a wide range of complete kits, output and mains transformers, chokes, paper in oil, aluminium, tin, copper or silver foil signal capacitors, Black Gate, Cerafine or standard electrolytic capacitors, tantalum, carbon and metal film resistors, silver wires, interstage and driver transformers, switches, balance controls, potentiometers, attenuators, chassis's and fittings for the quality oriented DIY'er, whether you are a beginner or hardened experimenter, male or female, we have the best *(and not always most expensive)* parts for most projects.

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Economy range Selected to ensure quality audio in a price efficient package.

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The **Audio Note** Kit Two

Kit Two features a single 6550 tetrode running in Single-Ended mode, yielding some 12 watts of pure Class A. With a valve rectified HT for the output stage, stereo chassis, and 6SN7GT input and 12AX7/ECC83 SRPP driver stage, componentry and chassis as Kit One.

Kit Two costs £599 incl. VAT, includes valves, but not postage/packing.

KIT TWO ORDER CODE: AN-KIT-002

The **Audio Note** Kit Three

Kit Three features 2 x 300B's per channel running in single-ended parallel yielding 16/17 watts in pure Class A. This kit is on two mono chassis with valve rectified HT supplies, no signal feedback, it uses a 6SN7GT double triode as input valve and a pair of 5687 double triodes running in SRPP as drivers. The **Kit Three** is essentially a mono version of the Kit One with double the power, the same component choices and on two chassis' instead of one.

The Kit Three costs £1,550 incl. VAT but excluding delivery.

KIT THREE ORDER CODE: AN-KIT-003

The **Audio Note** Kit Four

The **Kit Four** is really our introduction to valve amplifier kit building, the circuit and power supply being mounted on a single printed circuit board. The high-quality push-pull output and mains transformers are all mounted in a small aluminium chassis covering everything so nobody will be able to see that you have succumb to the lure of the valve amplifier which is sweeping the world. The circuit consists of two 6V6GT tetrodes running in Push-Pull class A, yielding about 10 watts, driven by a 6SN7GT and a 12AX7/ECC83 input stage. Easy to build, even for the beginner. Visually **Kit Four** matches the **Audio Note** Pre-amplifier shown here but with a single chrome-plated volume control. As with all **Audio Note** kits everything *(except solder)* is included.

The Kit Four costs: £279 incl. VAT but not delivery.

KIT FOUR ORDER CODE: AN-KIT-004

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Here is a product group that you do not see advertised every day! As usual we start small with the intention to grow quickly.

Audio Note Paper In Oil Signal Capacitors

These handmade signal capacitors are sonically superior to any of the plastic or other paper types we have come across. If you have never experienced the difference that a really good paper / oil capacitor can make in a valve amplifier, then you really should try.

Audio Note Paper In Oil Tin Foil Signal Capacitors

The tin foil is better than alu-foil for most applications, we recommend you try them.

Audio Note Paper In Oil Copper & Silver Foil Signal Capacitors

These copperfoil paper signal capacitors are considerably better than both the standard offerings and the tin foils. To start with there will be a few values / voltages of each available and we shall expend as fast as we can to cover all the popular values.

Audio Note Acid & Chloride Free Silver Solder

The best solder available, used in all our amplifiers from OTO to the mighty GAKU-ON.

Audio Note Cables & Wires

Audio Note manufacture a range of high quality copper and silver coax, speaker and wiring cables, which, depending on the overall price of the project, will do justice to any hifi system, regardless of price. Please call for prices and details.

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These handmade attenuators and switches are manufactured by a friend of Mr Kondo of **Audio Note**. They are the best you can buy.

Audio Note High Quality Valve Bases

All of our valve bases are of the highest possible quality materials. Ceramic, Tefion and gold and silver plated. If you want the best look no further - they are the ultimate!

Audio Note Resistors

Audio Note endeavour to stock the entire E12 range of all the different makes of resistor, since most are used in our products stock is generally available within four weeks.

BEYSCHLAG - HOLCO - SHINKOH Tantalum Film Resistors
AUDIO NOTE 1/2 Watt Tantalum Resistors
AUDIO NOTE 1 Watt Tantalum Resistors
AUDIO NOTE 2 Watt 1% Tantalum Resistors
AUDIO NOTE Precision Carbon Film Resistors
ALLEN BRADLEY 1 Watt 5% Carbon Film Resistors

Components & Valves

Pre-Amp Kit

The Audio Note Pre-Amplifier Kit *(illustrated)*

A complete kit loosely based on the **Audio Note** M7Tube pre-amplifier circuit is now available. The moving-magnet compatible phono stage consists of a cascode input, with possive RIAA equalisation and anode-follower output using the 12AX7/ECC83. Line buffer/ amplification for the four line inputs consists of an ECC82 configured in parallel anode-follower mode. For the power supply a valve rectifier and choke-input filtering are employed. All circuitry is housed in a non-magnetic aluminium chassis giving the very best sound quality.

Both phono and line stages are built on 'track-less' pcbs allowing easy construction but with the sonic benefits of hard-wiring.

The standard-quality version of the pre-amp kit includes Roederstein polyester film capacitors, Beyschlag 1 watt 1% metal film resistors, Noble open-frame style potentiometers and all pcbs, valves, wire etc. Various component upgrades are available, details upon request.

Cost of the Pre-Amplifier Kit is: £349 Incl. VAT but not delivery.

Audio Note Black Gate Electron Transfer, High Performance, Graphite Foil Capacitors

Audio Note is currently the sole source in Europe that holds any significant range of values in stock, we use literally 1000's in production, as we were the first company to realise the tremendous benefits that Black Gate capacitors offer, and we are to date the only high-end audio company in the world to incorporate Black Gate capacitors consistently in our finished products.

There are very few audio parts that promise a guaranteed improvement when replacing practically any other part, but this is what the BLACK GATE capacitors actually do. Exchanging any electrolytic capacitor anywhere in the circuit of an amplifier or in the crossover of a speaker will greatly improve sound quality. We are working on some guidelines as to where, how and which types of Black Gates to use in different circuits, the first such technical guideline is available now and is called "Improving your CD-Player" and can be obtained by sending a stamped addressed envelope to us requesting this leaflet. All AUDIO NOTE Level 2 Signature products use Black Gate Electron Transfer in critical signal / power supply junctions.

Audio Note Cerafine Powdered Ceramic Electrolytic Capacitors

We have at long last secured a reliable source for these fine power supply filter capacitors, a must in any single-ended project. The Cerafines really cover many of the Black Gates values and where the prices for the BG's are prohibitive the Cerafine is a fine sounding alternative. We have increased the range of Cerafines we stock quite recently, and strongly recommend all the Cerafines as a far superior replacement or substitute for ordinary electrolytics, and at the prices offered that should be within most budgets. All power supply Cerafines are supplied with a capacitor clamp and are upright mounting.

Audio Note Potentiometers

The best available from a sound quality / price viewpoint, made by Noble in Japan, utilising high quality conductive plastic film. However a better alternative is the KO-ON volume controls which are used in pre-amplifiers like the M7 Tube, M7Line, and in a mono version on the input in the NEIRO, KASSAI, KEISON and GAKU-ON, these are very good sounding pots by any standard.

Audio Note also carry large quantities of STANDARD TYPE SWITCHES, STANDARD ELECTROLYTIC CAPACITORS (good quality industrial types), RCA, BNC, BANANA, PLUGS, RCA SOCKETS, SPEAKER & GROUND TERMINALS & LOUDSPEAKER SPADES.

Audio Note Moving Coil, CD Line & Input Matching Transformers

Audio Note now offer moving coil, CD and input matching transformers for general sale. Common to all of these small signal transformers is that they come in a mumetal screening can with a threaded spindle with a nut for mounting.

Valves

The Audio Note AV300BSL *(illustrated)*

Audio Note has very limited stocks available of the AV300BSL and AV32BSL.

AV300BSL - 50 watt dissipation for about 12 watts class A, single ended configuration.

AV32BSL - 65 watt dissipation for about 18 watts class A, single ended configuration.

These super linear output tubes are widely regarded as the best amplification devices available.

Previously offered with a 2 year warranty at $250 and $300 respectively.

They are now available without warranty for the unbelievably low prices of $50 and $75 each.

Offer subject to availability on a first come first served basis.

Prices are exclusive of VAT.

Audio Note Selected Audio Valves

Our valves are selected from the best available sources and are tested to the same stringent standards that we apply in the production of our own amplifiers. They fall into two categories, standard production items and rare, mostly NOS *(New Old Stock)* valves which are no longer in production. We have compiled a special list of the NOS items, which is available against a stamped self addressed envelope, if you live outside the UK, send US $2. You should be aware that the valves on this list are NOT cheap, but we have stock of original GE, RCA and United Electronics 211, both standard versions and reinforced anode type for the US airforce, 845 Westinghouse, VT25/10/10Y, VT62/801A, WE300B, STC4300A, Mullard GZ34/CV1377, Tungsol 5U4G (best sounding 5U4G we have ever heard!), Chatham 5R4WGY and many others.

Audio Note Recommended Magazines

Listener
Review based music & hi-fi magazine that contains some of the best considered & well written articles in print. A very good read £4 per copy.

The Audio Adventure
Glossy, well produced publication that provides a good alternative to the established magazines. Not afraid to be controversial. £4 per copy.

A full list of available issues on request.

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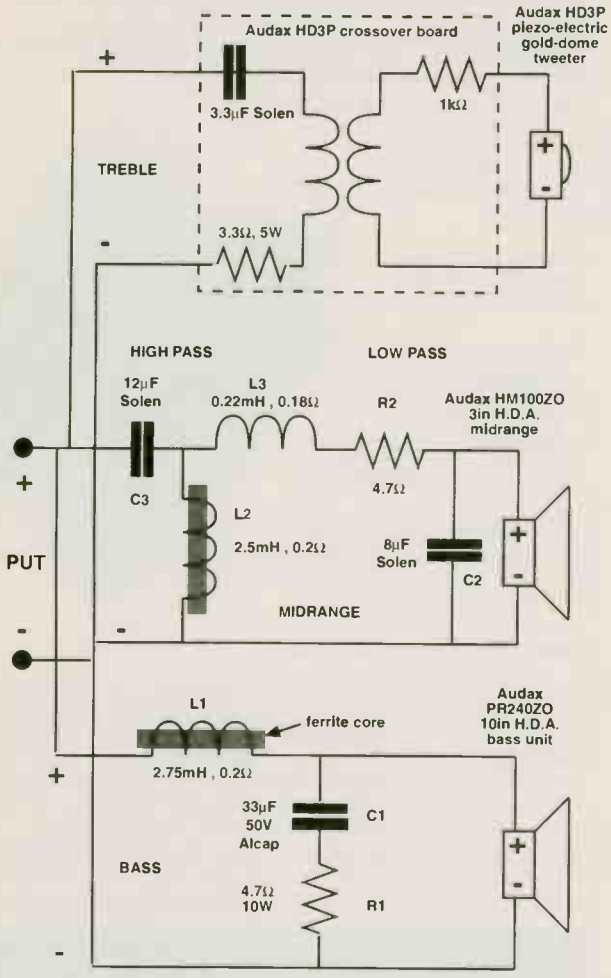
KLS11 CROSSOVER



12in.-18in. high, to raise the midrange/tweeter to ear height. You can use commercial stands or make a solid (25mm MDF) shelf unit to hold magazines and newspapers.

TECHNICAL DETAILS

Measurement of PR240ZO Thiele-Small parameters gives:

Parameter	Audax	Measured
Vas (litres)	91.4	97
Fr (Hz)	25	27
Qts	0.46	0.32

Calculated bass response (LEAP) is shown in the graph on page 8. Using a 45-litre cabinet and a 65mm internal diameter Variport 13cms long for a 35Hz tune (ie, minimum length) the system peaks slightly around 45Hz. This corresponds approximately to a Chebychev/B4 alignment. Lengthening the Variport moves its frequency down to 30Hz and increases damping without internal wool damping. Adding long-haired wool will increase internal damping and reduce bass output.

The midrange chamber can be 3-5 litres in volume, preferably the latter. This minimises boxiness caused by reflections.

CROSSING OVER

The crossover points are set at 800Hz and 5.5kHz. The bass unit is fed from a damped second-order network. For the midrange there is a second-order high-pass section which results in a third-order acoustic response. For the low-pass section, a damped second-order filter once again does the job.

The HD3P comes with its own crossover board, fitted with matching transformer. Its first-order high-pass filter combined to give a fourth-order high-pass acoustic response. Treble level can be decreased a little by increasing the 3.3ohms resistor to 4.7ohms.

The third-octave frequency response analysis averaged vertically shows a flat response within 2dB limits from 63Hz up to 16kHz, with no crossover suck-outs. The tweeter runs flat to 20kHz on-axis. The port inserts a sharp dip (as always) in the near-field forward response. A separate port and driver analysis, using pseudo-random noise, shows the port delivers output from 60Hz down to 20Hz, with the -4dB point at 10Hz.

The electrical impedance of KLS11 sinks to 6ohms minimum but for the most part stays above 8ohms. Using wide-band pink noise, I found the overall impedance measures out at 8ohms, making KLS11 a relatively light load for an amplifier. It is sensitive too, producing 88dB SPL for one nominal watt (2.84V) of input, so 60-100watts is more than enough.

Power handling is not an important parameter in terms of either fidelity or loudness. An insensitive loudspeaker will, for example, need a lot of power to go moderately loud and then may hit its end stops or burn out before going very loud. Old Seventies designs, some just 82dB sensitive, would do this. This is simply bad design down to weak magnets, large motor clearances and lossy crossovers. KLS11 will handle up to 100watts thanks to the drivers' high-temperature Kapton voice-coil formers.

We pursue high efficiency together with high sensitivity, working to get the most sound from the least real power input. Then all amplifiers can be used, not just solid-state grunt machines. Signal losses are minimised too, resulting in a fast, detailed and lively presentation.

THE FINAL INSTALMENT

We will be showing you how to tweak and tune KLS11 in our April 1999 DIY Supplement.

KLS11 PARTS LIST (per loudspeaker)

Drivers

Bass — Audax PR240ZO
240mm (10in) High Definition Aerogel cone, cast chassis bass unit

Midrange

Audax HM100ZO
100mm (4in) High Definition Aerogel cone, cast chassis

Treble — Audax HD3P piezo-electric gold-dome tweeter

Crossover

L1 2.75mH, 0.2Ω DCR, 1.25mm wire ferrite cored
L2 2.5mH,0.2Ω DCR, 1.25mm wire ferrite cored
L3 0.22mH, 0.15Ω DCR, 0.71mm wire ferrite core

C1 33µF, Alcap (50V)
C2 4.7µF, Solen (400V)
C3 12µF Solen (400V)

R1 4.7Ω resistor, 10W
R2 3.3Ω resistor, 5W

Hardware

Input — bi-wire input terminal panel
Damping — a little long haired wool (0.5 lb)
Port — 65mm int. diameter, Variport
Wire — PTFE silver plated copper

W.I.Y

The World team indulges in some Wire-It-Yourself with loudspeaker cabling from Maplin.

If you drew a graph of sales of specialist hi-fi cable from 1980 up to the present day, what you'd see is a line starting almost flat on the x-axis but swiftly heading for the stratosphere. If you did the same for the maximum amount of money it was possible to spend on said cables, there wouldn't be a great deal of difference. But cabling is one of those areas of hi-fi where practical experimentation can pay off big-time.

A call to Maplin (tel: 01702 554000) secured a couple of lengths of loudspeaker cable for testing. These were plugged into two systems, one a Leak/Lowther set-up headed by a Goldring-Lenco turntable, the other a mix of DPA 50S pre, Musical Fidelity X-A200 monoblocs and Magneplanar SMGa loudspeakers downstream of a Trio L-07D direct drive.

VAN DAMME 268-544 £5.49/m

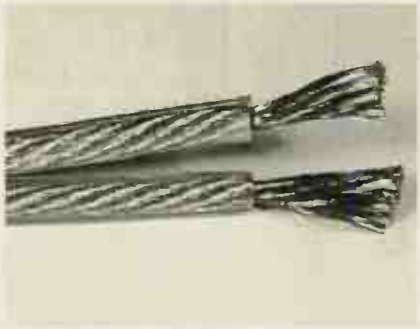
You certainly get some real diameter for your money in the Van Damme. The 19mm blue outer sheath houses four runs of LC-OFC cabling. To maintain their relative positions, a single non-conductive spacer is threaded down the cable's centre.

Since the Van Damme's conductors are individually colour-coded, there's a number of ways you can hook them up to your loudspeakers. You can use either two alone (for smaller terminals), parallel the pairs up single-wire-style (to halve resistance) or go for normal bi-wiring.

Filling the boots of DNM's Reson and QED's Profile Silver 12, the Van Damme was given a few hours to settle down before any listening. Transmitting XTC's Nonesuch LP, it proved to have a slightly brighter, more incisive treble than the others, cymbals gaining in energy and bite. This kind of balance tends to raise the profile of detail, and so it was here, the sound of plectrum on guitar strings more obvious, for instance.

Dropping down the Hertz, I had no problem picking out the beefy basslines of Claudia Brucken's 'Kiss Like Ether'. The Van Damme did a better job when it came to extension than the DNM, although it couldn't match either the quality or quantity of the QED. The DNM fought back in overall cohesion and tonal sweetness, especially in the treble, where the Van Damme could become a touch metallic at times.

The Van Damme doesn't have the finesse or transparency of pricier wire, and it would be out of place in a system that was already bright, but it's inexpensive and well-made. Considering it can be used as a minimum-spaghetti bi-wire cable, it represents fine value for money.



SHARKWIRE OFC 413 £2.39/m

This cable is configured in the popular figure-of-eight bundle with see-through insulation, a get-up which says emphatically 'not bell-wire'! Although not the heaviest cable ever (for which new records are set daily) the Sharkwire Highest (Maplin order code: XS37S) does boast 413 0.1mm sq. strands of Oxygen-Free Copper so the conducting 'skin' cross-section tots up to an equivalent circumference of about 18ins! Since one of the sleeves is discreetly but clearly marked "+++++" along its length, there should be no excuses for phase reversal, and the whole caboodle is bendable enough to negotiate the most circuitous sitting-room.

We tried the Shark with a variety of loudspeakers and found it to be a smooth performer at the price. Although its detailing will not make a bookshelf 'speaker sound like an ELS 57, the cable coped with some very acid violin sounds without adding anything of its own.

For some reason, many seem to think that the test of manhood for a cable lies in the bass but if you consider how 'simple' the low-frequency waveform is compared with, say, the prominent partials in an oboe tone, it is obvious that there is more to it than simple current capacity. From the foregoing you will guess that if we call this cable 'sweet', this is not to its detriment.

Within its limits, the Shark is a comfortably detailed bit of wire and reasonably priced into the bargain.

CANADIAN CORKERS

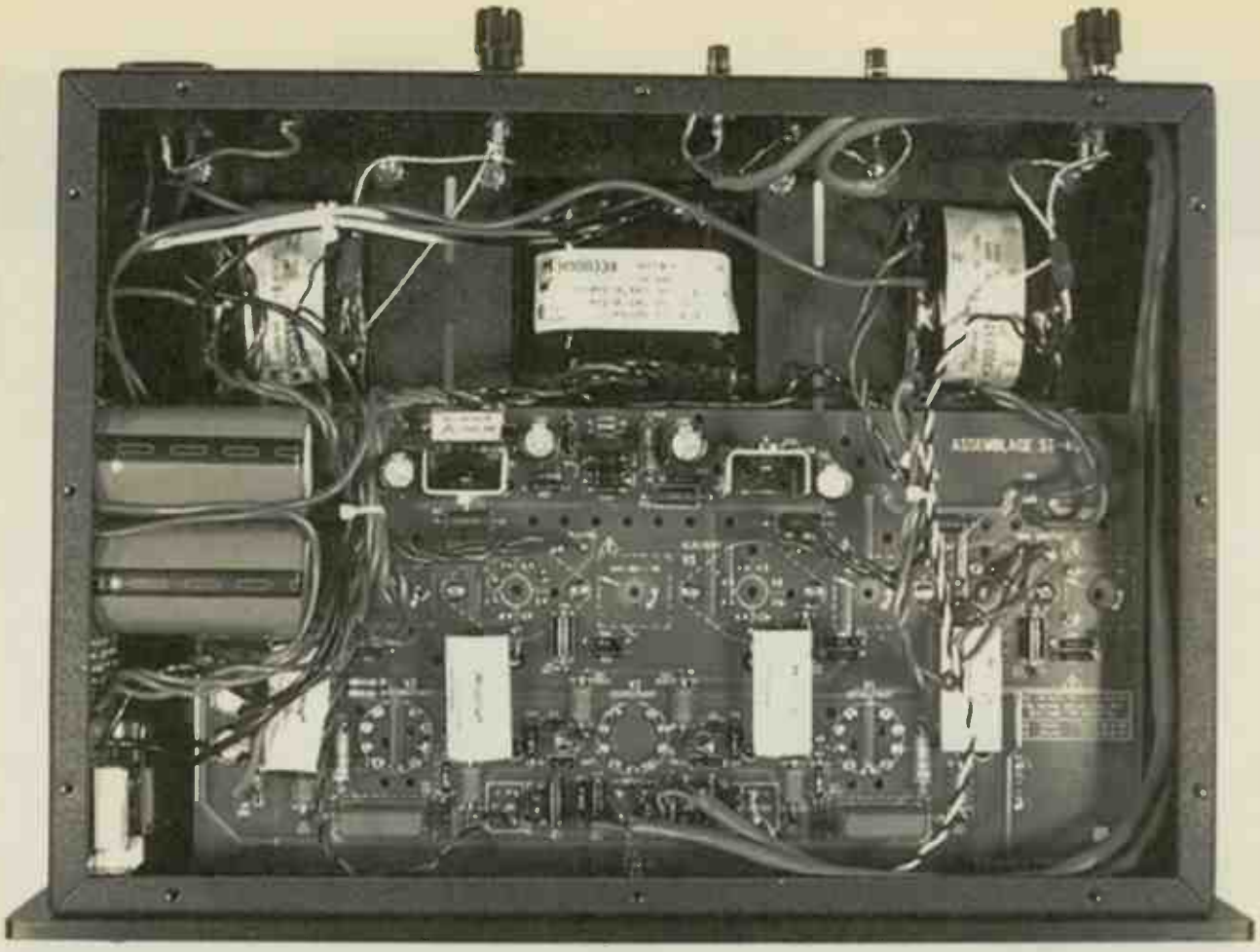
Leo Lam completes the last part of his DIY mission by upgrading Assemblage's L-1 pre and ST-40 power amplifiers.

In previous issues of the Supplement, I built the Assemblage L-1 and ST-40 amplifiers. Both of them were over-achievers at the price point, especially the L-1, which was outstanding. As usual, The Parts Connection have a set of reasonably-priced upgrades to further enhance their performance. So do these turn the L-1 and ST-40 into giant killers?

TURBO-CHARGING THE L-1

It seems that TPC is obsessed with component quality. In the original L-1 there were already Holco resistors and MultiCaps lurking on the circuit board. Honestly, I wondered, how could they do better?

Well, a look at the parts list supplied with the upgrade kit



As with the L-1, the ST-40 tweaks run to improved capacitors and silver wiring from Kimber.

gave me the answer. The biasing resistors have been replaced with Caddock and all the resistors in the signal path are now the renowned Vishay VTA-55 series, the latter costing around twice as much as the Holcos. The MultiCaps in the signal path have been replaced by their own better-spec'd RTX series. The power supply gets some tweaking too, a Solen polypropylene Fast Cap stepping in for the standard electrolytics in the smoothing stage. In place of the soft-recovery rectifiers come IR Hexfred diodes, capable of higher current handling and even faster recovery.

All the internal cables have been given the silver treatment. Out go the Kimber TCSS (which makes up the KC-1 and PBJ interconnects) and in comes the AGSS (Ag being the chemical symbol for silver). Other than these components, there were also Soundcoat damping panels and EAR isolation feet for the cabinet, all of which add up to $299.

IN THE FITTING ROOM

The instructions for installing the upgrade kit are fairly simple. A component reference number is given to each of the parts and, depending on the suffix, you either replace or add the part to the corresponding locations. For example, C4.1 will REPLACE C4 and LC204A will be ADDED alongside LC204. Sounds straightforward, doesn't it?

Hell, no! Implementing the upgrades was not quite as simple as building the original kit, the main problems being the removal of the circuit board from the chassis and soldering in close proximity to neighbouring components. Removing the PCB is necessary for placing the Soundcoat strip underneath the circuit boards. However, it is possible to replace all the electrical parts, except the smoothing capacitors, with the circuit board in place.

Removing the board was a bit of a nightmare. I had to take off the front panel, remove the shaft linking the knob to the selector switch and somehow figure out a way to remove the circuit board without desoldering the pot and the balance controls. In the end, I decided to press them gently backwards and bent the jumper leads so that the controllers stayed clear of the front panel of the chassis. This process was very tricky and required a lot of patience and effort.

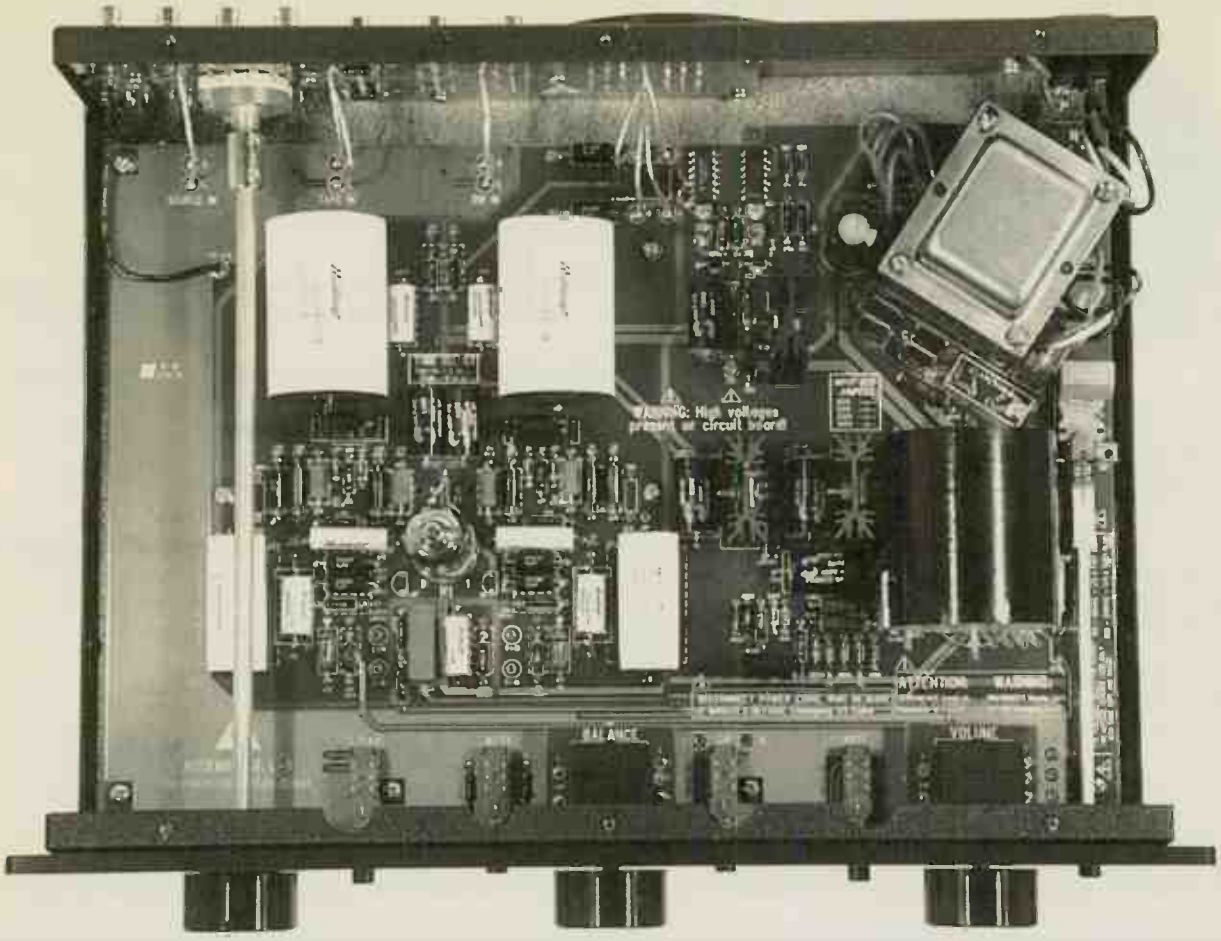
After applying the Soundcoat the rest was reasonably easy, although you must ensure that the stray lead underneath the PCB is not too long, especially when soldering from the top side of the circuit board, as I was. Lengthy leads may cause a short circuit through the chassis. The big capacitors, too, need some serious forethought. The leads from the caps are quite thick but the holes on the PCB aren't, so it was a bit fiddly pushing them through. TPC have been notified of these difficulties and have promised to rectify them in a subsequent revision of the board.

After ensuring that the jumpers on the controllers were not touching each other, the casing was put back together and it was time for power-up.

BOOM, BOOM!

Plugged in and powered up the L-1 produced some very impressive fireworks! A quick call to Glenn at TPC saw the cause resolved within five minutes.

In the original kit, the manual (which was a preliminary edition) did not mention installing the heatsink before soldering



The modifications for the L-1 pre-amp include large capacitors for signal decoupling and the power supply.

in the transistors. These heatsinks were meant to be soldered to ground but it transpired that it was fine to leave them 'floating' because there is no significant change in the electrical properties of the circuit. Therefore, I bolted on the heatsinks without soldering them to the board. However, during the upgrade I thought I would redo these parts. What a mistake!

A track carrying 250V was routed below one of the heatsinks. With the heatsink grounded, there was 250VDC across a few microns of circuit-board insulation. The result? An electrical breakdown. The lacquer became conductive and the 250V was basically shorted to ground, hence the sparks! It turned out that both of the FETs and the corresponding biasing diodes needed replacement. So, be warned; do NOT solder the heatsinks above Q201 and LQ201.

SECOND TIME LUCKY

No fireworks this time. I hooked up the L-1 to a Unison Research Power 35 and XTC Pow-2 driving a pair of ProAc Studio 150s. I listened through the 'Direct' setting, which by-passes the selector and balance switches giving a noticeably superior sound. An Assemblage DAC-2/Teac T1 formed the source and a Musical Fidelity Nu-Vista a reference.

In its original guise the L-1 was already excellent in terms of transparency, speed, tonal colour and harmonic structure. However, a hint of glassy treble and a lack of absolute focus filled in the con table. But, and it's a big BUT, the L-1 metamorphoses into something rather special after the upgrade kit.

As a whole, detail has been elevated to a much higher level, rivalling the Nu-Vista. The glassy treble has disappeared completely and all that is left is a charmingly smooth midrange.

Playing the Volodos Piano Transcription which I had used through the unmodified L-1, I discovered piano had taken on a more powerful impact and drive, with greater spatial information translating into a wholly believable sound stage. The L-1 was so fast dynamically that Volodos seemed to have got himself another pair of hands during some of the vigorous passages!

The L-1 didn't sweat over more complex material either. The opening of La Fille Mal Gardée by Herold Lanchbery was set in a stable, wide and accurate ambience, the individual instruments securely fixed in their respective locations - I could clearly hear the flute coming from 'this end' and the oboe coming from 'that end', and how far all the musicians were from me.

Accurate as it was (although not quite in Nu-Vista territory) the midrange focused more strongly on vocal and orchestral material, together with some very noticeable improvements in speed and tonal accuracy. Strictly speaking, it was not as natural as the Nu-Vista either, but the L-1 with upgrades only costs $875 (or £550 excluding import duty. Long live the strong pound!) How much you bill for your own labour is another matter.

UPGRADING THE ST-40

If I had to gauge value for money in terms of component count in the upgrade bag, the ST-40 lags behind the L-1. However, the quality is just as high and this upgrade is $50 cheaper. For that

hard-earned $250 you get some Caddock high-power resistors, Solen Fast Caps and Hexfred rectifying diodes to improve the power supply. In the signal path the capacitors are replaced by Multicap RTXs and the resistors by more Vishays. However, the more important parts, in my opinion, are not the passive components.

Unlike the L-1, the ST-40 upgrade comes with new tubes. You get two Mullard CV4003 (a military spec 12AU7, costing around US$30 each) and a gold-pin Tesla ECC83 (arguably the smoothest and sweetest sounding 12AX7 around, and also currently costing circa $30 each!) Both of these are very reputable NOS (New Old Stock) tubes which are much rarer, let alone better sounding, than the standard Philips/Golden Dragon affairs.

As with the L-1, you also get the Kimber upgrade with a KC1 interconnect cable replacing the multi-stranded standard cable at the input of the amplifier. The Kimber silver treatment was again administered, this time only to the output stage between the output transformer and the 'speaker terminals. Mechanical damping is addressed by the large-footprint EAR damping feet.

REACH FOR YOUR IRONS

The fitting procedure was much like the L-1 upgrade kit, which means that you either add or replace the parts with the designated reference number. This kit was easier to build than the L-1 because less tricky soldering was involved. The only major difficulty I encountered was getting the large MultiCaps through the holes originally occupied by the Kimber Caps. Bear in mind that subsequent changes of the board at TPC will rectify all these problems.

SOUND OFF!

So what does the upgraded ST-40 sound like? First, let's do a short recap. In the original instalment, I praised the amp's warmth, balance and sense of control but criticised a lack of transparency and detail. My intuition told me that these would be addressed, but I took the hard way anyway - I listened to the affects of the upgrade kit after individual component changes.

I swapped the bias current supply resistors with the Caddocks. The music became slightly smoother, but the effect was quite minimal. After that I changed all the resistors to Vishays in the signal path. Boy, did the sound open up! There was significantly more detail and more air, instruments starting to snap into focus.

Third, in went the Kimber and MultiCaps. In combination with the Vishays, this improved a lot on the tonality and speed of the music. Strings suddenly had more bite, more presence, without the addition of sting and sharpness. The true eye-openers were still to come, though.

With the Kimber KC1 and silver cable in place, detail increased by a substantial amount. Only then did I realise the real potential of the circuit. The lacklustre character disappeared and a sense of real involvement set in. At last, music was getting its proper drive! Small nuances were brought to the surface and that resulted in a perceptibly more 'powerful' presentation.

If I had to pinpoint the stars of this upgrade kit, it would be the valves. The Mullard took the place of the Philips and the music took on a smoother, more natural character. The tinny grain in the original was polished off, leaving behind it an engaging musical flow.

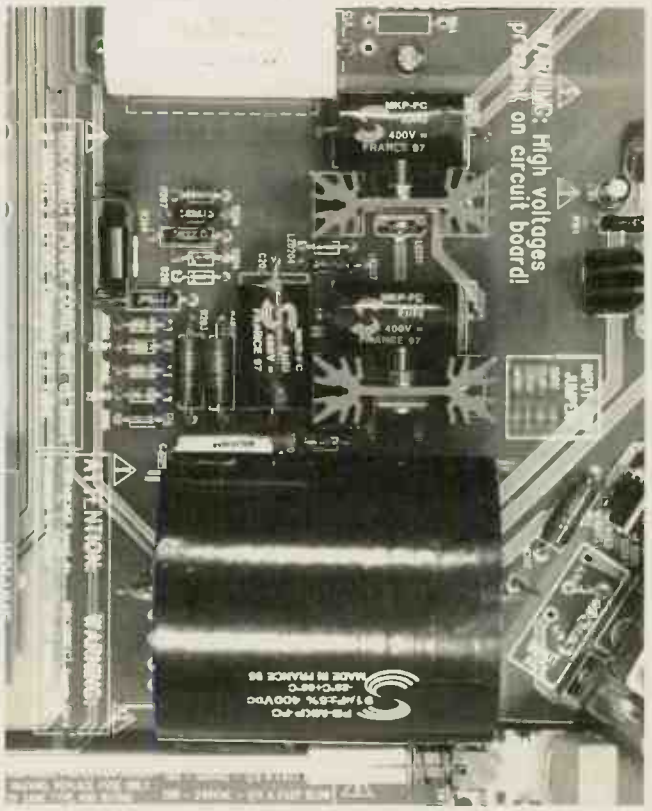
The Tesla further enhanced the quality by adding significantly more detail and lucidity to the general presentation. Those gold pins were definitely doing something right. Now the sound was warm, involving, lucid, but not sharp, perfectly balanced and without a hint of sterility. Cymbals shimmered and vocals took on a real presence. It seemed like the ST-40 had undergone a sea change from a quiet, humble performer into one that was vibrant and powerfully muscular but still every inch a gentleman.

And that bass! It certainly was not woolly like a lot of tube amps, and it was way better than most of the SETs with its clarity and punch. Recently I was given a single by Goo Goo Dolls (what a name!) The kick drum at the beginning of 'Lazy Eyes' easily rivals the power and depth of that on the Live version of 'Hotel California' on Hell Freezes Over by the Eagles. Playing this track with the Power 35 there was a lot of depth but it was a little slow in terms of speed. On the solid-state XTC it had the slam but not quite the depth of the Power 35. But with the ST-40, there was a great mix of these two aspects. The bass was fast and taut with loads of low-end grunt. And hang on, you get all this for a miserly $925 (£580), excluding import duty, etc. The upgrade kit on its own costs $249.

CONCLUSION

Well, I am happy to report that both Assemblages benefit hugely from their corresponding upgrade kits, especially the ST-40, which goes from being a good product to being an excellent one. The L-1 might be the better of the two in its original guise but after upgrading the ST-40 steps up its game to match the quality of the rest of the Assemblage system.

It has been an enjoyable experience building these kits, and since the outcome is so impressive I have no reservation in recommending them to anyone. Even those of you who have more money to spend on a system owe it to yourselves to hear (and put together) these amplifiers•



On the finned heatsinks above the large capacitor are the transistors which suffered most in the L-1 explosion.

FOUNDATIONS OF WIRELESS AND ELECTRONICS, 11 EDITION

By M.G. Scroggie (revised by S.W. and R.S. Amos)

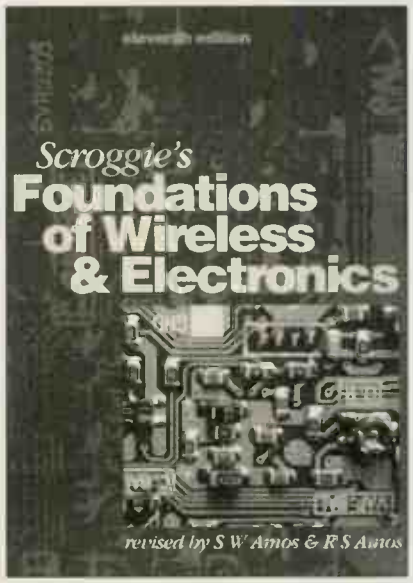
Reviewed by Noel Keywood.

I was glad to see this classic text resurface in updated form. Foundations Of Wireless And Electronics provides some of the clearest and most concise explanations of basic electronic principles I have encountered. M.G. Scroggie had a deep understanding of such matters and was able to provide his own unique explanations in magazine articles for Wireless World, plus a series of books. Other authors regurgitate time-worn explanations that can be vague, overly theoretical and even questionable in accuracy.

Foundations of Wireless And Electronics offers a refreshing alternative view, answering the questions likely to arise in a student's mind when studying basic principles. I don't know whether this was attributable to Scroggie's lecturing experience, his flexibility of viewpoint, just his breadth of view or his depth of knowledge. Whatever, Scroggie was a fluent writer with an easy, confident and erudite style that I still find engaging.

As you might guess from the title, Foundations Of Wireless And Electronics comes from another era, one where electronics extended little further than "wireless". It wasn't until the Second World War that radar and computing were to be included, with television development gathering pace later, followed by video and digital storage.

I suspect that some of the clarity and understanding displayed in the book's explanations comes from the fact that, when much of it was written, the world was technically a simpler place in which basic theory could be given more time and consideration than is possible nowadays. So there are chapters on "oscillation" and "detection", for example, both of which would be unlikely to get a whole chapter in modern textbooks. Although neither subject is as important now as it once was since chip solutions largely cut out the need for custom design, the discussion of energy transfer in an oscillatory system provides a valuable mental model that will help any engineer, even one considering the implications of oscillation in a lumped-model mechanical system where the



energy storage in mass and compliance is similar to that in capacitance and inductance.

I have always valued Scroggie's explanation of Transmission Lines, not so much because I have spent time working on RF lines as such, but because it taught me to recognise and intuitively understand the problems of lines that aren't lines, such as computer interconnects that carry high-speed digital data down a sub-optimal cable poorly or incorrectly terminated. The sort of erratic behaviour that results seems mysterious until you read Scroggie.

As Ken Ishiwata once told me, ultimately everything is analogue, and it is at the interface where digital reacts with the analogue world that most problems occur. It is also the case, he said, that digital engineers generally don't understand analogue. In some ways I don't blame them because some of the notions you come across in this book are quite 'challenging' to say the least. All the better that they are discussed in such a clear and thorough manner by someone who has thought about the subject and has a good grasp of it.

Audio enthusiasts will be interested in explanations of Class A and Class B working more than transmission lines I suspect, and there is a chapter on audio-frequency amplification. Also included are negative feedback, distortion and even loudspeaker driver behaviour. Although useful, I have seen longer and more in-depth explanations than Scroggie's when it comes to audio. This isn't where the book's real strengths lie. They are more in the very foundations of electronics, especially in subjects that are obscure, difficult to categorise and abstruse.

Scroggie extended his musings on technical matters in Second Thoughts On Radio Theory, showing that even apparently simple concerns can hide complex issues. A good example of this in Foundations Of Wireless And Electronics is a paragraph on Screening (p203). Computers, microwave ovens and suchlike make this as important a topic today as it was in Scroggie's time, yet few electrical theory books say much about it. Scroggie quickly differentiates between electric screening and magnetic screening, and then goes on to say magnetic screens work on two different principles, with explanations of each. Working designers, even of audio amplifiers, will know how important screening can be, and how little is said about it generally. Scroggie's material can provide useful insights.

The 11th edition is mainly concerned with literally 'electronic foundations', saying a lot about capacitance, inductance, reactance, impedance and what have you, which is vital stuff if you are to really understand analogue electronics. The book has, however, now been extended into Digital Techniques (Chapter 26) and Electronic Data Storage (Chapter 27), before ending on Power Supplies. Also included are Video and Principles Of Radar, plus many chapters on radio principles and techniques. This includes Sideband theory from AM and FM modulation, the Zenith/GE stereo. There are plenty of good, down-to-earth explanations of transistor and FET biasing techniques, plus quite a lot on triodes too.

Foundations Of Wireless has always been a favourite of mine. I am glad to see it re-appear and hope it will appeal to today's students, professional engineers and enthusiasts as it did to yesterday's. It's a valuable source of timeless information and a great read even, not something I can say about most books on electronic theory●

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MUSIC ENGINEERING: THE ELECTRONICS OF PLAYING AND RECORDING

By Richard Brice

Reviewed by Simon Pope.

As an erstwhile audio professional this book miraculously found its way onto my desk with an "ah, Simon, just your thing" comment. So this is probably the only book review by me that you will ever see on these hallowed pages (unless, that is, someone decides to pen a little opus entitled 'Audio and Pizza: The Definitive Guide').

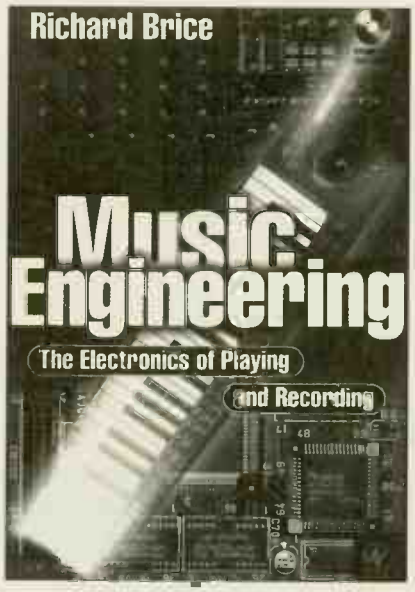
I first came into contact with Mr. Brice's musings from the pro world of recorded music in his previous existence as a contributor to Hi-Fi World. Now, a freelance consultant and engineer living in Paris, he has turned his hand to book writing. And pretty good he is at it too.

Although technically accomplished, Richard Brice has that rare knack of de-mystifying technology to enlighten the layman. As he states in the introduction to Music Engineering, a certain basic knowledge of electronics makes the going easier in a few chapters, but there's nothing impenetrable or incomprehensible here.

Despite the subtitle, the first two chapters deal with very little electronics, concentrating instead on a well-explained background to sound in the 20th century and the physics of sound such as waveforms, transients and harmonics. The section finishes off with the psychology of hearing. Heavy stuff, maybe, but the easy style makes for enjoyable reading.

The next two chapters cover microphones and valve technology. As any engineer will tell you, the importance of microphone selection and placement cannot be over-emphasised. So here you'll find a concise round-up of different types of microphone and their associated placement techniques. The valve chapter explains how glowing bottles are still relevant to microphones (many engineers prefer tube mics over solid-state), with circuits to back the whole lot up.

The following three chapters draw together electronic instruments (keyboards, guitars, etc) and electronic synthesis via effects units. Explanations of echo, flanging and reverb are present with examples from well-known



recordings quoted. In all of these sections the theory of each subject is explained and examples of equipment given, with their electronics examined in verbal and circuit form. One notable inclusion is the ground-breaking Theremin (of 'Good Vibrations' fame) and a good (if slightly 'techy') description of noise reduction theory.

Electronic synthesis is included as an appetiser ahead of the following chapter which starts to deal with the head-scratching minefield that is digital technology.

Music technology is a rapidly expanding and progressing world. Before the ink has even dried on pages covering one type of sequencer, MIDI device or sampler, you can bet it's probably been replaced or bettered. Many Pop records are processed and written via MIDI sound canvases and Digital Work Stations, so this section forms another useful part of the Music Engineering picture. Brice sensibly restricts this area to basic digital theory, again clearly elucidated with examples of popular pieces of equipment.

Sound Recording starts with a description of the physics of magnetic tape, Brice commenting rather obviously that if it didn't exist, neither would reproduced music as we know it today and thus the whole record industry! This chapter also covers digital tape formats such as DAT and multi-track. The now-common practice of hard-disc recording also gets a look-in.

One of the book's longest chapters, not surprisingly, is given over to digital audio. Again this has an excellent introduction and theoretical section which is followed by pages dealing with quite a few of the subjects included in the sound recording chapter, but in more detail.

There then follows a lengthy discussion on recording consoles (mixing desks and the like) which concentrates on the occasionally complex circuitry that makes them tick. For the uninitiated who want to learn more about what goes on over the other side of the audio fence, this is a good introduction to the working logistics of consoles.

Hi-fi related fare - amplifiers and loudspeakers - get two chapters devoted to them near the end of the book. His descriptions of amplifier operation are just as relevant to hi-fi as they are to "music engineering", and only a brief description of instrument amplifiers wanders from the domestic path.

Something I have failed to mention so far is that this book comes with a CD. Its tracks mirror the order of the chapters with relevant examples of frequencies, microphone placement techniques, effects, samples and a MIDI-generated tune for the Rainforest Foundation.

I get the impression this book is not targeted at working or trained audio engineers since the information it contains is fairly fundamental, introductory stuff. However, this means it would work well as a preliminary text book for sound recording students and audiophiles wanting to learn more about where the CDs and LPs in their collection come from.

The impression given by the title - that the book is centred around the electronics of sound engineering - is actually a bit misleading. It doesn't venture into techno-babble or diagram overload; it's more of an informative general introduction to the science of sound and how it is recorded.

Music Engineering: The Electronics Of Playing And Recording
£19.99
ISBN: 07506 39032

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DIY Letters

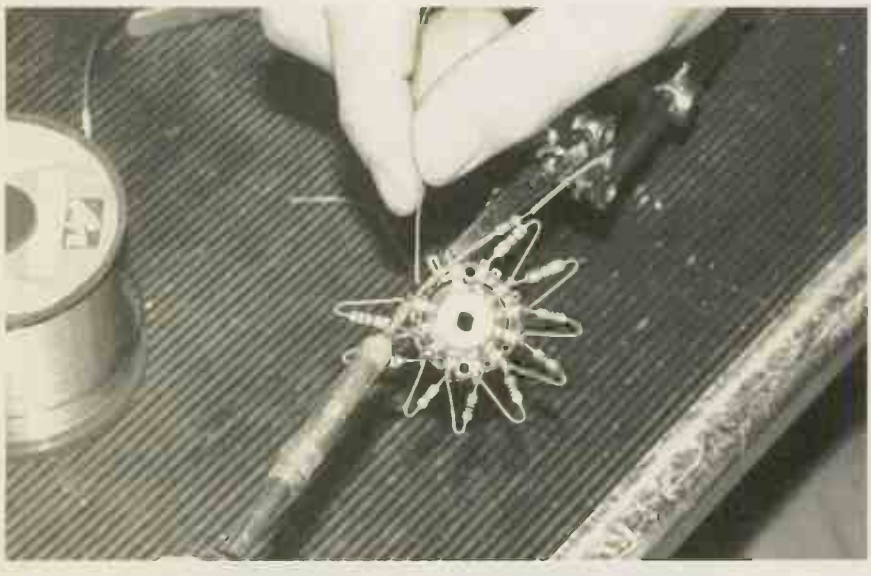
STEPPING ON THE WEB

To simplify calculations for the stepped attenuator article published in December's issue I have produced a java applet at:

http://margo.student.utwente.nl/klaas/audio_step.htm

www.audio-nl.con is a presentation of a dutch audio magazine which came up with this one.

Klaas Hoekstra
margo.student.utwente.nl/klaas/audio_step.htm



Save calculator wear when designing a stepped attenuator with a handy programme for working out resistor values.

This is effective if rather basic - I am still working to make it a bit more sophisticated. I also have plans to make another which calculates the achieved attenuation with chosen resistance values.

If you care to view the other audio tips and tweaks pages, you'll find a great deal is focussed on removing muting resistors (CD players), a very nice tweak. On

GETTING HORNY

I wish to build a pair of horn-loaded loudspeakers to use with a modern valve amplifier. I haven't decided which one yet as I'm still auditioning, but it will probably be a fairly low-powered, single-ended design such as a Unison Simply 4 or a Gamma Rhythm. I have good cabinet-making skills and access to a well-equipped workshop, so it seems silly paying for ready-built 'speakers that I could make myself.

Some years ago (about eight, I think) your magazine sold a small horn-loaded kit which my brother and I built and my brother still uses. I am looking for a kit perhaps a little larger than that, with a more sophisticated design and superior drive units. Do you have any suggestions for where I can find such a design or kit? As I want to build something which I know will work well, I would prefer a tried and tested design that includes information on which drive units to use.

Mark Southworth
Mark.Southworth@nl.abnamro.com

As you know, horns tend to be very expensive when someone else builds them for you, so it's a good idea to have a squint at the recipes which are about, as you say. As regards "tried and tested" this is difficult to pronounce upon. With loudspeaker building you can spend a lot of effort making something which you then find you don't like. A horn design is no guarantee of satisfaction because, let's face it once again, all our aural tastes are different and all designs will sound different, else why have them in the first place?

One possibly fruitful branch for you to climb is to give Lowther a ring (0181 300 9166) or visit their web-site on: http://www.lowtherloudspeakers.co.uk.

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quality anyway, you would be able to encompass your desire for a driver upgrade at the same time. All of the designs are properly prototyped and are intended to offer optimum loading for a high sensitivity driver.

As an alternative route, you might like to peruse volumes of When Audio Was Young, available at £14.95 + P&P from our World Library. There are horns a-plenty in these old articles which, although they may not have the finesse of later designs, are certainly much easier for doing-it-yourself than some of the more modern ones.

Horn profiles seem to be very forgiving things in the nether regions and below 500Hz are quite tolerant of folds and bends; at least this has obviously been the view taken by practically all commercial designers of the things - look at the tortuous course of the Klipsch bass horn, for example.

Above this midrange mark, the sound-

Horn systems don't have to use full-range drivers. Multi-cell midrange horns, for example, can sound superb if they're properly built.

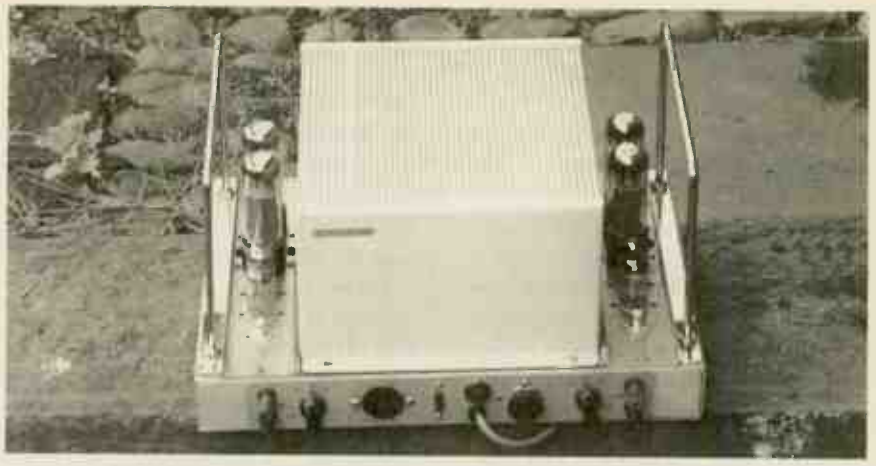
waves should be given as straight a route as possible. In short, if you come across a design which does not follow these bench marks, I would leave it alone. ***RMW***

RADFORD RELOCATION

I am trying to find any information I can relating to Radford Audio. I have one of their pre-amps which I am trying to restore. I know that the STA 25 power amp was reissued a couple of years ago but I cannot locate any references to Radford on the Internet. Any information, links, etc would be welcomed.

Mike Baker
mnmrb@worldnet.att.net

This might be one occasion where the Net isn't going to help. The people you need to speak to are Woodside Sound Engineering (tel: 01994 448271). They're based in Wales: Arfryn, Llanboidy, Whitland SA34 0EY. They can carry out a range of revamps on Radford gear, from minor servicing to complete strip-downs and rebuilds. ***JM***



Radford amplifiers, like the STA 25 above, are well worth the money spent on a service.

SOLDERING ON

Having been a hi-fi buff for well over 20 years now I take a special interest in articles on vintage stuff, tweaking and upgrading. A hi-fi, to me, is an on-going project and a soldering iron should always stand next to it. For example, my loudspeakers are Quad ELS 57 stacked pairs much modified, especially the EHT supply pictured which is completely re-designed with a custom-made PCB. If anyone is interested in information on this, drop me a line.

Keeping back issues of hi-fi mags can pay off well sometimes (although the Wife Approval Factor of huge piles of old mags is very low). Some six months ago I and a friend decided to invest in an Assemblage DAC-2 after reading the rave reviews in Hi-Fi World and some other hi-fi magazines. So we got the kit including the upgrades and put it together. The idea was, since we had not had the opportunity to listen to it, we would share the cost and, if things came out right, buy a second.

Assembling the kit was a piece of cake. Then came the moment of truth. Sadly, the DAC-2 didn't overwhelm us. Admittedly, it possessed a very sweet treble but apart from that, things were slightly disappointing. Everything came out clear but anemic and lacking body and life. We found both my Audiomeca Elixir and my friend's Sentec DiAna superior. Indeed, the built-in D-to-A convertor of a humble Pioneer PD-S901 had a more substantial sound, although it was a bit coarse compared to the DAC-2.

The DAC-2 was gathering dust on a shelf until the other day, when browsing through some old Hi-Fi Worlds, in the October '97 issue I fell over an article on the Assemblage upgrade kit plus a few extras of your own.

Off I went to obtain the Os-Con caps et cetera and (with a little difficulty) they went into the circuit along with some blobs of Blu-Tack as icing on the cake. The DAC-2 was connected, well warmed up and the auditioning began. In short, it was now converted into a jaw-dropper. All in all I cannot recall hearing a more 'analogue' sound from CD before (including some experience with Accuphase and Wadia players). As we built the DAC-2 with Assemblage's upgrades right away, I wasn't able to gauge the magnitude of improvement offered by your upgrades over SF's own compared to the standard DAC-2 but I find it difficult to believe it can be any greater.

One word of caution to anyone who wants to try the changes out. Be careful to check the polarity of C207 and C208. Neither of the caps (in our edition of the kit at least) is labelled with "+" or "-" on the PCB. With the DAC-2 running you should have a reading of 5V DC, which enables you to determine their polarity. All the other components in for an upgrade have a polarity marking either on the component or the PCB.

Another thing we considered would be to use Os-Con caps for the decoupling of the Burr-Brown DACs too. Was it for cost reasons that you didn't try this, or do tantalums really sound better there? Got any more ideas on how to improve the DAC-2 further? The next thing to do is open up my trusty old Elixir DAC to see if any of your tricks are applicable to it as well.

One final question: do DVD players really do such a great job of reproducing

CDs? On the admittedly few occasions I have listened to one the sound reminded me more of budget CD players.

Anders Enquist
anders.enquist@mailbox.swipnet.se

Any other suggestions? Well, take a look back to the October 1998 Supplement's Letters section where you'll find details on how to wire up the DAC-2 to run from a battery power supply. We didn't actually have a chance to try this mod out ourselves, but I've yet to discover a piece of equipment which hasn't benefited from batteries.

The tantalums used to decouple the DACs in our upgrade article were relatively cheap. What we wanted to do was test out a couple of different types of caps to find out what their affect on the sound would be. Yes, 47uF 16V Os-Cons would probably sound better (and cost rather more!)

As a general rule, replacing non-audiophile decoupling caps in almost any equipment produces an improvement. However, each brand of capacitor sounds different. It may be extremely (and I do mean extremely!) time-consuming, but the only way to get components sounding exactly as you want is to learn the sonic signatures of individual parts by substituting them one at a time and allowing them to burn in for a minimum of 50 hours. Nichicon's top-grade Muses, for instance, have a wooden, artificial character until they've clocked up about 45 hours, at which point their sound changes quite suddenly and becomes much more natural.

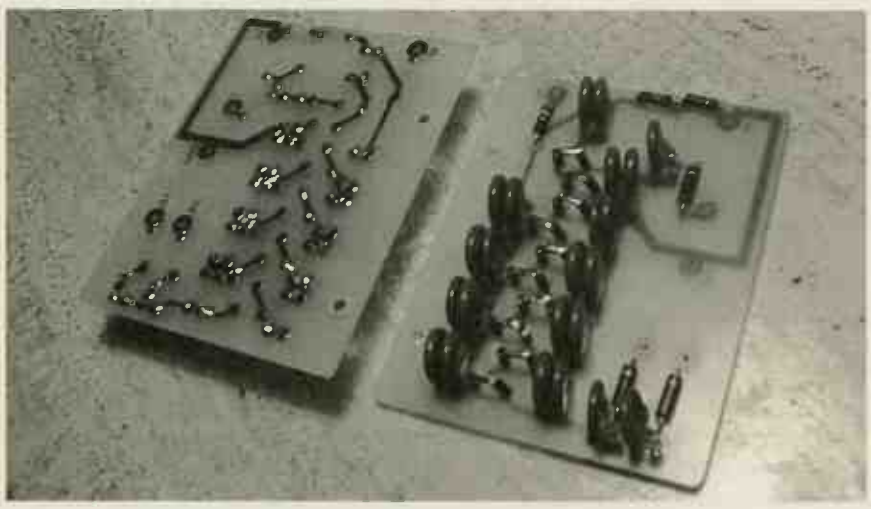
DVD players are still the subject of heated debate. Not all of them make a good job of CD, but those that do (Pioneer DV-505, Denon DVD-3000, Panasonic DVD-A350) work very well indeed in my opinion. Check out this month's main-issue letters for another verdict on their performance. JM

HI-FI ACTIVITY

Having been interested in the benefits of active operation for some time, I have finally taken the plunge and modified my KEF Coda 9s to run in semi-active operation using the Maplin DR66 crossover.

Initially I had a small problem as I appeared to 'frazzle' my Marantz CD-67 MkII CD player in testing by plugging this directly into the crossover. Upon reading the manual I noticed that the output impedance on the Marantz was 200ohms whereas the input impedance of the crossover was greater than 10kohms. The affect on the CD player was to lose all bass and impact. Was the mis-matched impedance the cause? The only other reason I can think of is that initially I had been using a 15V power supply on the crossover. Although the rating for the crossover is 10V-16V, would this have caused any damage?

A replacement CD player has subsequently been acquired (Marantz CD-63 KI-Sig) and my Rotel RC-970 pre-amp now feeds the crossover. As the KEFs are three-way 'speakers I am still using two passive components in the subwoofer roll-off at about 85Hz. I have replaced the original dust-core inductor with an air-core of 7.5mH and have an electrolytic cap for the high-pass filter on the mid/bass unit, value 450uF. Although three-way active would have been preferable, I decided that these components were not in the critical audio frequency band.



One Quad mod is a wholly new PCB for the EHT supply, as mentioned above.

After much huffing and puffing, the moment of truth arrived and I was duly impressed with my handiwork. The extra detail was immediately obvious, as was the new-found lack of coloration. The bass also improved, with added drive, but I'm sure that the kick-drum will annoy the neighbours soon!

That was two days ago though. I now seem to have something missing in the upper bass/lower midrange region, noticeable because of the way different tracks are reproduced. Anything with low bass rocks the sofa, but some tracks sound 'lean' where there are no kick drums in the track. Vocals can sound a bit nasal and strings lack substance. I initially thought that I might be suffering from over-exposure to testing, but my girlfriend notices it too.

I am running the crossover from dry batteries now (12V), as I was during the initial listening, but did change briefly to a plug-top PSU, rated at 12V (although my multi-meter rated the output nearer 15V), after which the change seemed to appear.

The loudspeakers are cabled inside with silver-plated OFC cable (from Maplin) and the internal components are hard-wired.

The system is currently: Marantz CD-63 KI-Sig, Rotel RC-970 MkII pre-amp, Rotel RB-970 MkII and RB-971 power amps. Transparent Straightwire Chorus 2 and QED Qnect3 interconnects and CableTalk Talk 4 'speaker cable complete the bill.

My room is the fairly standard 5m. by 3m. with the KEFs positioned half way along the long wall, about 1m. from the back wall either side of a chimney breast. As I am quite close to the 'speakers they are slightly toed-in. My music is generally contemporary, with Madonna (Ray Of Light) providing many of the test tracks.

I seem to remember a previous Supplement mentioning that a test-frequency CD was available, I think from Sony, and that basic response measurement can be carried out using this and a level meter from Tandy. If this is correct, could you please supply me with the details.

Graham Willard
Graham.Willard@Catalyst-Solutions.com

Quite what caused your first CD player to go belly up is a mystery to us here; we've never experienced any problems with the Maplin, even after plugging a player straight into it and controlling overall volume levels by tweaking the two pots for channel matching.

When it comes to impedances, it's basically a case of low output, high input. A lot of solid-state sources have output impedances of a few hundred ohms and inputs usually of 10kohms plus, so there was no mismatch there. And the voltage from the PSU fell within acceptable limits too.

From the missing frequencies you talk of, it sounds as if the midrange and bass

One candidate for an active loudspeaker conversion - KEF's Coda 9s.

aren't overlapping properly. If you've changed from one inductor to another of the same value, you might well find that the DC resistance has changed, which could alter the way the crossover works. You could try taking the woofer's output up a touch or running the midrange unit a little lower to fill in the missing bits by increasing the value of the high-pass capacitor.

There's really no such thing as a component in a non-critical position, especially where loudspeakers are concerned. If the suggestions above don't point you in the direction of a sonic solution, the best thing would be to go completely active, as you say. This might involve shelling out on another amp and a new crossover, but the results and extreme tuning flexibility would be very much worth it. ***JM***

BOARDED!

In reply to Haden Boardman's article on the Thorens 150 and 160: has he completely lost it? I have had several TD150s over the years and I've modified most of them, so I consider my knowledge and experience to be pretty good.

The first thing I'd like to correct is the use of Linn springs on the suspension. Linn springs are not compliant enough to achieve the correct bounce on a TD150 (due to the deck's platter being lighter than a Sondek's). Haden also mentions various arms which in his opinion are suitable for a TD150 - Linn arms, etc, - but anyone who has taken the time to replace the original arm will know that any arm which is too heavy will play havoc with the suspension, making it almost impossible to achieve an even bounce.

In my experience the most suitable arms are the Grace 707, Hadcock and Mayware Formula IV. An indicator of this is the fact that most dealers fitted either Maywares or Hadcocks on TD160s.

The last point I'd like to make is about replacing the original plinth as suggested by HB. Swapping the original chipboard plinth for something more substantial and heavier only takes away the transparency and produces a heavier, more compressed sound. I agree it is necessary to increase the size of the plinth to accommodate replacing it with a more modern alternative, but using material such as hardwood (ie, Linn Sondek) or 15mm MDF just doesn't work. My advice is to use 10mm chipboard as in the original, with veneer to finish.

I hope your readers will benefit from these points of view because HB has got one thing right: the TD150s are brilliant little decks!

A. Johnson
Yorkshire.

Haden replies:
Most of Mr Johnson's points are related to one thing: the suspension. From his letter we can gather he is very much in favour of a light-weight approach - a different view from my own.

I disagree that LP12 springs are unsuitable for a TD150. I was fully Linn trained and have set up more LP12s than I care to think of. The actual compliance of the springs varies wildly from one batch to another and within batches. It is true that the 'average' Linn spring will stiffen the 150's suspension a little but I do not consider this to be a bad thing. Adding a heavier mat or mass-loading the sub-chassis is no bad thing either.

As for achieving the 'correct bounce', this is purely subjective depending very much on your own personal view. The comments on the arm choice echo what I put in the original article and are applicable to both Linn and Thorens units. An arm that works well on an LP12 will usually work well on a Thorens and vice versa.

I understand Mr Johnson's view on the light-weight plinth but I disagree with it; the majority of the TD150 plinths were nasty and vibrated badly. These vibrations will be fed back into the deck giving a slightly more 'lively' but less accurate sound. In hi-fi I have always sought the truth, the whole truth and nothing but the truth.

There's many a different way to get more from Thorens' TD150 turntables.

Within the thousand or so words of the Vintage Virtues column I can only fit in so much. There must be 1001 different tweaks for a TD150 with 1001 different views on the result. On Linn springs and lightweight plinths, Mr Johnson and I will have to agree to disagree. ***HB***

STANDS THAT DELIVER

I recently constructed the KLS9 kit 'speaker. A cabinet-maker friend made a superb job on the enclosures so they look good too. I must say that the sound is tremendous - the 'speakers have certainly

Stands and loudspeaker cabinets (like those of Celestion's SL600s) need rigidity rather than mass for optimum sound quality.

breathed a new lease of life into my system. This is made up of a Roksan Xerxes turntable, Rega RB300 arm and AT-OC5 MC for the shiny black stuff. A Marantz CD-63 KI-S handles the shiny silver stuff, an Arcam T21 the etherworld stuff, a Nakamichi LX3 the thin brown stuff. An Onyx OA21S makes sense of everything. All this is supported on various stands I have constructed over the years.

Typically I am a tinkerer and I can not leave well enough alone. I have found that supports for equipment have a large affect on the quality of sound from a hi-fi system. To this end, and to add to all my other stands, I fabricated some for my KLS9s. These consist of 25mm by 25mm square tube with a wall thickness of 2mm. I welded the tubes together in a double 'H' pattern. The M6 spikes supplied with the kit were then bolted to the stands' underside and the stands themselves to the threaded inserts installed in the enclosures' bases. The stands were finished in a satin black powder coating.

The stands made a huge improvement to the KLS9s' sound. The bottom-end, which was good to start with, is much cleaner and deeper. Imaging also improved. The KLS9 as standard has fine stability front to back, but because they are so narrow, sideways stability is not so good. The KLS9s with stands are now as solid as a rock. To say I was over the moon with the improved sound would be an understatement. I hated it when I had to remove the stands and send them to the powder coaters to be finished.

Keep up the good work with your Supplements. I, along with many others, feel a lot closer to our gear when we have a direct input in its construction.

Bill Redward
New Zealand.

As we discovered with Black Box's Monitor loudspeaker stands in November 1998's issue, getting the most from your favourite transducers needn't be all about mass. After all, mass has an annoying habit of storing energy and letting it out slowly to smear transients and blur imaging (amongst other nasty side-affects).

Celestion proved with their SL600s that good cabinets, like stands, are about rigidity rather than weight. The Aerolam aluminium sandwich used in the enclosures of these stand mounters is very light but also ultra-rigid. The result? Very clean, uncoloured and transparent sound reproduction.

I have a sneaking suspicion that Aerolam would make superb 'speaker-stand material too, even if it isn't exactly cheap! I'd love to hear a pair of Aerolam-cabinetted 'speakers screwed to Aerolam stands which were themselves screwed into a (preferably concrete) floor. JM

TUNING IN

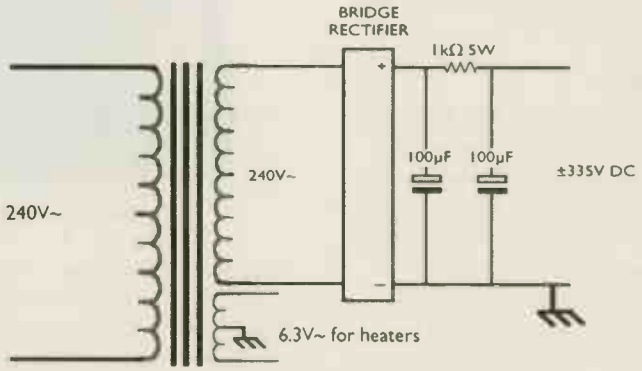
Here is my problem. I've just picked up a Quad FM tuner from Audiofair 98 and I want to use it with non-Quad equipment. Does anyone know if there is a power supply kit or circuit out there?

I spoke to an engineer at Quad and he said I needed 330V HT and 6.3V for the heater. I'm new to the DIY hi-fi scene and, although I know what this means, getting it out of the socket and into the tuner is a different matter.

From the number of Quad tuners at Audiofair I think there might be a few people in the same boat as me. Any help would be much appreciated.

John Wright
wright@dcs.kcl.ac.uk

We ran an article on firing up Quad tuners as stand-alone units back in November 1996's Supplement. Building a PSU is actually very simple. 330V DC can be obtained by rectifying 240V AC mains, so all you need is a transformer (never hook equipment up directly to the mains), a bridge rectifier, some smoothing caps (say a pair of 100uF at 450V) and a heater PSU. JM



If you want to use a Quad tuner but don't have an amplifier to power it from, an uncomplicated PSU can easily be constructed.

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