UPWARDLY MOBILE
KLPP1 PHONO PRE-AMP WITH SPECIALIST COMPONENTS

BOOK REVIEWS:

STARTING ELECTRONICS
by Keith Brindley

BUILDING KPP1 STAND-ALONE MM/MC STAGE

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<table>
<thead>
<tr>
<th>A selection of CVC PREMIUM Audio Tubes</th>
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<tr>
<td>PRE-AMP TUBES</td>
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<tr>
<td>ECC81</td>
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<td>5SN7GT</td>
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<td>6922</td>
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<td>7025</td>
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<tr>
<th>and a few “Other Brands” (inc. Scarce types).</th>
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<tr>
<td>5AR4/GZ34 MULLARD</td>
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<tr>
<td>5R4GY RCA, STC</td>
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<td>5R4WGY CHATHAM USA</td>
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<td>5U4GB RCA or GE</td>
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<tr>
<td>5Y3WGT SYLVANIA</td>
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<td>6A56G RCA or SEMIENS</td>
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<td>6AU6WVC SYLVANIA</td>
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The latest and greatest in DIY’s arrivals to warm your soldering iron over.

TWEAKED - KLPP1 VALVE
PHONO/LINE PRE-AMP
The quality of passive components can have a massive effect on sound. We pack our KLPP1 full of audiophile parts and find out how to make a good pre-amp even better.

KPP1 OUTBOARD MM/MC
PHONO STAGE PART II
Following the introduction of the KPP1 phono stage design in the December 1997 Supplement, Chris Found explains its construction.

BOOK REVIEWS:

STARTING ELECTRONICS
If you’re totally new to electronics and the average in-depth text just leaves you confused, Haider Bahrani reckons this introductory book by Keith Brindley could be exactly what you’re looking for.

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VISATON TWEETER REVISITED
South Coast Speakers have announced the immediate availability of the re-launched Visaton Ribbon Tweeter (RHT 12).

In this unit the ribbon is constructed from very thin plastic foil with a copper wire layer as the voice coil wound in a manner similar to the way a river meanders. The ribbon element is then mounted between a double cobalt-samarium magnet. The moving mass of this system is therefore minimised, resulting in a fast, accurate response. The double magnet construction causes a homogenous magnetic field within which the ribbon moves, reducing harmonic distortions which have traditionally been a problem with ribbon tweeters.

The specification of this tweeter boasts a 4kHz -30kHz response, a power handling of 200watts and 90dB sensitivity. Price for the RHT 12 is £89.99 each.

South Coast Speakers
326 Portswood Road,
Southampton,
Hampshire 5017 2TD
Tel: 01703 559312

HIGH-POWER SOVTEK
Sovtek has just announced the release of their EL34WXT valve. This features a unique grid-block construction which is claimed to allow it to operate at higher transconductance and power ratings than any other EL34. This, Sovtek say, makes it a more consistent, longer-lasting valve than its rivals. They also claim the EL34WXT is "the richest sounding, most dynamically sensitive EL34 ever produced" - a bold claim indeed!

Sovtek
New Sensor Corporation,
20 Cooper Square,
New York NY 1003,
USA
Tel: (001) 212 529 0466

NEW CLOCK ON THE BLOCK
AudioCom (UK) has announced the arrival of a new precision CD clock, 'The Superclock'. This unit has a two-stage analogue oscillator and a high-impedance buffer which feeds the digital square-wave converter. The analogue and digital sections have separate Linear Technology regulators and are built predominantly of surface-mount components. Low-noise RF transistors and high-speed digital circuitry ensure a clean clock waveform is supplied to the CD player or transport. A separate power supply is to be made available soon. The kit price of the Superclock is £145, or it can be fitted for £185 including return carriage.

AudioCom (UK)
Unit 6,
Tindle Enterprise Centre,
Warren Street,
Tenby SA70 7JY
Tel: 01834 842803
Our aim as 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 range and the component packs we supply are designed to 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 406 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 varnish cover. 4xEL34, 4xECC83, 2xECC82. A full description, including circuit diagram, is given in the 406 reference manual, £6.50. Kit £89.00, fully assembled £995.00.

Technical specification: dual mono construction, 60Hz/8kHz, 129Hz to 25kHz power bandwidth, distortion <0.1%, five line level inputs, tape output, 230v/240v mains input. Bristol amplifier circuit board: board only £45, component pack (including valve packs), add £65, populated board £80, add £45. Power supply board: board only £75.00, component pack, add £45, populated board £86. Input board: board only £15.50, component pack, add £6, populated board £63. The output transformers are configured for the McIntosh connection and have a low output transformer for minimal feedback and frequency response, and a primary inductance of 3800H. Full construction instructions provided. Price £160. The mains transformer is wound for dual mono construction and is toroidal for low leakage flux. Primary 0-230-240V. Secondaries 2x295V 0.25A (0.4A as this gives superior isolation between channels) 2x70V 0.3mA, 2x6.3V 0.5A. Price £60. Other primary voltages can be supplied to special order. These transformers are also suitable for power supplies to preamplifiers and other low level valve circuits - see data sheet for details, £7.50.

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 one of these high quality chassis for their own projects, details of the chassis are given in the 406 reference manual, £6.50.

Connection kit: twelve gold plated phono connectors, 20mm long, £3.50 each. £35.00. Magnet Weight 730g

**British Standards Inspected**

Technical specification: 47Hz-20kHz bandwidth, distortion <0.1%, 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 varnish cover. 4xEL34, 4xECC83, 2xECC82. A full description, including circuit diagram, is given in the 406 reference manual, £6.50. Kit £89.00, fully assembled £995.00.

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**British Standards Inspected**
Nick Lucas explains how to upgrade our KLPP1 valve phono pre-amp with audiophile components, while Jon Marks and Ketan Bharadia assess the benefits.

Following on from upgrading our KLPP1 line-level pre-amp and K5881 Class A 20watt power amp in previous Supplements, our next mission was to turbo-charge the KLPP1 valve phono pre-amplifier and find out just how good vinyl could sound. As there are so many types of audiophile components on the market, we simply supply good-quality standard versions in our kits. Therefore, once the kit's built and working, all you DIYers out there have a solid foundation to work on when installing those creme-de-la-creme capacitors and top-grade resistors.

The components used here were supplied by Paul Morawski at Audio-Links in Scunthorpe (tel: 01724 870432). I did a trial fitting to make sure they'd fit inside the case and then soldered them into KLPP1 and left it running for around 40 hours to get everything nicely settled into the new working environment.

The overall upgrade was broken down into five separate sections and each dealt with in turn: power supply, volume potentiometer with remote control, phono equalisation capacitors, signal coupling capacitors and finally the cathode-bypass capacitors (see circuit diagram on p13).

**A SOURCE OF POWER**

Warming my soldering iron on the power supply section (namely C14, C15, C17, C18, C19, C20 and Reg 1, the 7805) I swapped C14, a miniature 100uF 400V electrolytic capacitor, for an Ansar Supersound polypropylene reservoir cap of 100uF at 320VDC working. According to Paul, Audio-Links commissioned Ansar exclusively to construct this value which isn't generally available.

The sonic improvements polypropylene reservoir capacitors offer over their electrolytic counterparts (a crisper, more tonally colourful and open sound) are well known. This is because of their superior dissipation factor - their charge and discharge cycles are faster and quieter, making for a cleaner sound.

C20, originally a 10000uF 16V electrolytic, was replaced with two 000uF 16V Sanyo Os-Con SGs in parallel. Os-Cons are constructed of aluminium with a solid organic electrolyte made of 'Black Sak'. This means they have a very high ripple-current rating, remain uninfluenced by external vibrations and possess a high charge and discharge rate. What this adds up to is high ripple-voltage rejection and very low noise.

I investigated these claims by measuring the ripple content of the 10000uF 16V cap and the 2000uF combination of the Os-Cons. On my oscilloscope, the ripple of the Os-Cons was 25% less, even though their capacitance was 80% lower.

For C17, C18 and C19, normally Philips metallised polypropylenes, we used M Cap ZN™ polypropylene capacitors of 0.22uF at 250V. Even though these capacitors are dealing with the High Tension voltage of 275VDC, this is still well within the proof voltage of 375VDC which these German caps are tested to.

Regulator 1 was replaced with a Linear Technology 5V LT323AT 3A device which has the same pin-outs as the original L78S05CV. The suffix 'AT' denotes the fact that this is a high-specification IC burnt in by the manufacturer on a test rig, hence the scratch marks on the pins.

**REMOTELY READY**

Moving to the second upgrade level involves the replacement of the standard Alps 250kohm Blue potentiometer with a 100kohm motorised Panasonic For Audio potentiometer (250kohm Panasonics are not available but a 100kohm impedance causes no sonic or impedance matching problems).
Accompanying the Panasonic was Audio-Links’ Remote Volume Module, a ready-stuffed PCB with four user-selectable speeds and a 14-metre control range for even the largest lounges. The module is powered by the unregulated DC side of the valve heater supply so no external supply is necessary, although one is available for £7.60 if required.

A programmable infra-red handset was included, but for those who aren’t happy unless their coffee table is lined with a single-source version can also be had. Informative instructions come with the module to ease the installation, which is relatively straightforward anyway.

'E' IS FOR EQUALISER
Modification No3 is an upgrade to the phono equalisation capacitors, namely C4, C5, C6 and C7. We fitted new Scan-Ex polystyrenes, Swedish-built components offering very good stability, 2.5% tolerance, 160V DC working, very low dielectric absorption and extremely low losses.

SENDING SIGNALS
The fourth part of the upgrade concerns all the signal coupling capacitors, namely C2, C3, C9, C11, C12 and C13. C2, C3, C9 and C13 were substituted for M Cap ZN's. These are extremely dense capacitors made from tin foil and a high-purity polypropylene film wound in a spiral under great tension to make them much less susceptible to external vibration.

For C12 we used a PCB Swedish polypolypropylene cap of 22nF at 1kV specifically to match the hole pitch of KLPP1's PCB so it would fit in nicely. This was then bypassed with another Scan-Ex polystyrene cap to lower the PCB's impedance.

BYPASS BOOST
The fifth and final piece of the puzzle concerns the cathode-bypass capacitors, C1, C8 and C10. We used, yes you’ve guessed, Sanyo Os-Con SG 1000uF 16V electrolytics. Another important characteristic of these caps not mentioned previously is the low ESR (equivalent series resistance) and low ESL (equivalent inductance). This provides a much improved bass and treble response compared to normal industrial electrolytics.

<table>
<thead>
<tr>
<th>PART 1</th>
<th>COST (EACH)</th>
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<tbody>
<tr>
<td>5V LT323AT Regulator x1</td>
<td>£5.40</td>
</tr>
<tr>
<td>C14, Ansar Supersound 100uF 320V x1</td>
<td>£26.60</td>
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<tr>
<td>C15, 0.1uF 250V M Cap ZN™ x1</td>
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<tr>
<td>C17, 0.22uF 450V Ansar x2</td>
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<tr>
<td>C18, 0.22uF 450V Ansar x2</td>
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</tr>
<tr>
<td>C19, 0.22uF 450V Ansar x2</td>
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<tr>
<td>C20, 1000uF 16V Sanyo Os-Con SG x2 in parallel</td>
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<tr>
<td>C21, 100uF 16V Os-Con SG x1</td>
<td>£3.00</td>
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<td>TOTAL</td>
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<th>PART 2</th>
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<tr>
<td>Motorised Panasonic potentiometer 100kOhm Log, Dual Gang x 1</td>
<td>£78.70</td>
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<tr>
<td>Audio-Links remote volume control module x 1</td>
<td>£62.10</td>
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<tr>
<td>Three-source infra-red handset x 1</td>
<td>£28.20</td>
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<tr>
<td>or Single-source handset x 1</td>
<td>£12.70</td>
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<td>TOTAL (with three-source handset)</td>
<td>£153.50</td>
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<td>TOTAL (with Single-source handset)</td>
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<tr>
<th>PART 3</th>
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<tr>
<td>C4, 1.5nF 2.5% 160V Scan-Ex x 2</td>
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<td>C5, 1.5nF 2.5% 160V Scan-Ex x 2</td>
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<tr>
<td>C6, 6.8nF 2.5% 160V Scan-Ex x 2</td>
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<tr>
<td>C7, 2.2nF 2.5% 160V Scan-Ex x 2</td>
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<tr>
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<th>PART 4</th>
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<tr>
<td>C2, 1uF 250V M Cap ZN™ x2</td>
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<tr>
<td>C3, 0.22uF 250V M Cap ZN™ x2</td>
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<td>C9, 1uF 250V M Cap ZN™ x2</td>
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<tr>
<td>C11, 4.7nF Scan Ex x2</td>
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<tr>
<td>C12, 22nF 1000V Rifa Polyprop Cap x 2</td>
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<tr>
<td>C13, 1uF 250V M Cap ZN™ x2</td>
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<td>C1, 1000uF 16V Os-Con SG x2</td>
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<tr>
<td>C8, 1000uF 16V Os-Con SG x2</td>
<td>£11.40</td>
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<tr>
<td>C10, 1000uF 16V Os-Con SG x2</td>
<td>£11.40</td>
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<tr>
<td>TOTAL</td>
<td>£68.40</td>
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</table>
SOLDERING IRON AT THE READY... Due to the generally larger size of the upgrade components compared to the originals it's a good idea to do a dry run on component positioning. Bear in mind as well that it's not a good idea to have components suspended in the air on long leads. Where PCB space doesn't allow direct fixing to the board, components should be fixed down to prevent mechanical vibrations affecting the sound. You can use clamps bolted to the chassis, tie wraps threaded through the underside ventilation grids, glue or self-adhesive foam strips. We used the latter and found this technique worked well mechanically and sonically.

If component leads need extending make sure they're no longer than absolutely necessary and well isolated with some sort of sleeving to avoid the possibility of shorts.

The Panasonic potentiometer with its motor and gearbox extends approximately 8cms back into the chassis and the adjacent BUZ 78 FET which forms part of the HT regulator has to be tilted out of the way to ease positioning. Flying leads need to be soldered to the potentiometer pins before fixing as access is tricky once the pot has been attached. The control PCB was positioned on top of KLPP1's toroidal mains transformer.

The infra-red sensor for the remote control can be mounted in place of the LED power indicator on the front panel, or using extended leads passed through the vent holes, you can position it externally.

Please note that the Scan-Ex radial capacitors have different end markings. The red lead is attached to the outer foil of the capacitor and, if soldered to the lowest voltage connection, it will act as a screen to further reduce noise levels.

Now I'll pass you over to the editorial boys for the ultimate test, the listening. My thanks go to Paul Morawski for his assistance.

SOUND QUALITY It was with ready anticipation that we linked KLPP1 up to our KSW81 MkII power amp, Jamo's Concert 8 stand mounters and a Garrard 401 turntable powered by Slate Audio's Powerhouse power supply. I dropped Ortofon's MC 30 Supreme cartridge (on the end of an SME 312 tone-arm) into the lead-in groove of Ray Charles and Betty Carter with the Jack Halloran Singers.

KLPP1 with its audiophile component contingent sounded far more transparent, solid and rhythmic than the unmodified version with its standard components, which is no slouch in these areas anyway. The most obvious benefactor was sound staging, which swelled to fill our listening room. Images were crystal clear, three-dimensional and truly solid whether centre stage or out in the wings to the left and right. A firm, weighty bottom end underpinned all this, but what really impressed was the combination of gorgeous vocal smoothness and superb projection. Completely free of grain, the modded KLPP1 caught the album's mellow feel perfectly.

The extra bass control meant LPs like The Stone Roses' Second Coming had far more drive and funk without ever sounding aggressive. Cymbals, for example, were as smooth as silk but still crashed with real energy, their decay tantalisingly prolonged and full of the subtle harmonics which give them their golden shimmer. This tonal range came through with every slab of the stuff which hit the Garrard's platter.

A Decca pressing of highlights from Puccini's Turandot showed just what bass depth and power KLPP1 was now capable of, with the timpani of Act 1 almost shaking the room, while the sound stage's new-found size had us setting the Concert B8 further apart to take full advantage. The result was a presentation of cinematic scale without any of the bass waffle and blurred imaging you often get in film houses. And the music's emotional impact made it hard to drag ourselves away, especially when Joan Sutherland's singing was so pure and sweet.

If you aren't operatically inclined, try a bass-laden 12 inch and you'll find the Os-Con SGs, M Caps™ et al will pin you to the back wall with brutally hard, deep bass. This switch, from the kind of delicacy you need for Classical music to the slam and punch which gets Dance going, is a measure of the transparency of KLPP1.

The line stages showed the same leap in performance, with our Teac P-30/Pink Triangle Da Capo transport and DAC now sounding far more open, spacious and involving than before. The Da Capo's characteristic smoothness was more obvious too.

Soldering a wealth of audiophile components into any hi-fi equipment is likely to improve quality, but for it to be sonically worthwhile as well as cost effective you need to know which components are making what changes to the sound. So we decided to remove the various new parts stage by stage and replace them with the originals.

STAGE ONE - THE BYPASS CAPS Putting back the standard components (C1, C8 and C10) we found KLPP1 lost some stage depth and imaging clarity. On Classical recordings in particular, the orchestra appeared flatter and less three-dimensional, with individual sections less distinct.

On choral and operatic works, the most noticeable change was a loss of that lush tonal colour and treble smoothness which had made voices hauntingly realistic with the audiophile goodies in circuit. The music was still a pleasure to listen to but it was missing that last iota of subtlety, nuance and richness which had made it captivating.

When it came to music with more beats per minute, we discovered Sanyo's Os-Con SGs had taken with them some extra bass extension, power and speed. The Stone Roses were less punchy and rhythmic than before, although tweaked KLPP1 remained taut, focused and dynamic.

STAGE TWO - THE SIGNAL CAPS Now it was time to say goodbye to C2, C3, C9, C11, C12 and C13. Without the M Cap ZNs™, the Rifa and the Scan-Ex, the sound stage shrank back towards the Jamo Concert B8's cabinets and became flatter. On the Ray Charles and Betty Carter LP the rich tonal colours had faded somewhat, Ray's vocals possessing a slight but previously unheard greyness.

My feet were telling me the rhythm department was now taking a less active part in the proceedings because of the looser bass. Musical tempos slowed a touch, with fewer rhythmic and timing expressions apparent.

What the audiophile components really revealed, which the standard ones didn't, was how the tonal richness and smoothness of a capable valve phono stage leaves solid-state offerings sounding hard and artificial.
Hart Audio Kits and factory assembled units use the unique combination of circuit designs by the renowned John Linsley Hood, the very best audiophile components, and our own engineering expertise, to give you unbeatable performance and an unbelievable value for money.

We can help you with your easy home construction to professional standards, even in the sixteen we were using easily assembled kits. Instructions to assist you were still using telexboard. Many years of experience and innovation are going back to the early Daley and Bailey classics gives us incomparable design and background in the need of the home constructor. This simply means that building a Hart kit is a real pleasure, resulting in a place of equipment that not only saves you money but you will be proud to own.

Why not just order a construction manual for the kit you are interested in to see how easy it is to build your own equipment the Hart way. The FULL cost can be credited against your subsequent kit purchase.

‘AUDI0 DESIGN’ 60 WATT POWER AMPLIFIER.

Our John Linsley Hood designed 60 watt Power Amplifier continues to amaze all who listen to it, and is now finding new Hart audiophile manufacturer who uses it to show their own products to their best advantage. Its flawless performance is the result of a combination of inspired circuit design and the very best components, specified by the designer. Such innovations as the intelligent rail fully stabilised power supply make great contributions to the overall reproduction quality and are not found on even the most expensive run-of-the-mill designs in the high Hi-Fi shop window.

We have long know that the delicacy and transparency of sound from this amplifier placed it in the world class and safe from some comparisons with amplifiers costing five times as much still show small performance advantages which suggests that among similar expensive amplifiers will only equal rather than exceed, its sound quality. All amplifiers in the range have the same basic quality and the decision about whether to use a preamplifier is governed by the listener's need. The STAGELINE amplifier has switching for up to three inputs, if you need more than this then a preamplifier feeding a SLAVE power amplifier will give up to seven inputs.

If you would like to hear this incredible amplifier in action then arrange a visit to Winmale Audio's new premises at Broughton Ashby, near Leicester. Their phone number is 01455 286003, to Shaw or Terry. All amplifiers are available in kit or factory assembled form.

<table>
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<tr>
<th>Model</th>
<th>Price</th>
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<tr>
<td>K1100 Complete STANDARD Amplifier Kit</td>
<td>£145.21</td>
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<tr>
<td>A1100 Factory Assembled version</td>
<td>£155.21</td>
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<tr>
<td>K1100S Complete stereo SLAVE Kit</td>
<td>£350.62</td>
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<tr>
<td>A1100S Factory Assembled</td>
<td>£362.22</td>
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<tr>
<td>K1100M MONOBloc Amplifier Kit</td>
<td>£271.20</td>
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<tr>
<td>A1100M Factory Assembled</td>
<td>£351.20</td>
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Super Audiophile (SA) Versions of all the above kits with selected audiophile components at an extra cost of only £15.95 per channel. All SA kits are designed for easy home construction to the highest standards, and can be built by anyone of average manual ability. If you are not still convinced how easy it is to build it yourself with a Hart kit you can order the Instruction Manual to read for yourself and we will refund the cost when you buy your kit.

JOHN LINSLEY HOOD 15W SINGLE ENDED CLASS A’ POWER AMPLIFIER.

A design for the experimenter who wants to try and re-create the warmth and purity of sound given by valve amplifiers from the days of long ago. It is a design that can be constructed at home by anyone to give a sound that is indistinguishable from the famous "Williamson" design, the unparalleled leader of the field, with its triode connected KT66s and KT88s.

This magnificent kit, comes complete with all parts ready to assemble into the fully finished 228 x 134 x 63mm case. Comes with full, easy to follow, instructions as well as the Hart Guide to PCB Construction, we even throw in enough Hart Audiograde Silver Solder to start your construction.

K1450 Complete Kit | £116.56
K1450S Audiphile Kit | £138.94
A1450SA Factory assembled Audiphile unit | £180.94

"Andante" Linear Technology

AUDIOPHILE POWER SUPPLIES

A higher quality, purpose designed, "single ended" class 'A' headphone amplifier for "stand alone" use or to supplement those many powerful amplifiers that do not have a headphone facility. Easy installation with special signal link-through feature, the unit uses our 'Andante' Ultra High Quality Power supply.

Highest quality, purpose designed, "single ended" class 'A' headphones amplifier for "stand alone" use or to supplement those many powerful amplifiers that do not have a headphone facility. Easy installation with special signal link-through feature, the unit uses our ‘Andante’ Ultra High Quality Power supply.

Now you can throw out those noisy ill-matched carbon pots and replace them with the famous Hart exclusive ALPS ‘Blue Velvet’ range of component components only used selectively in the very top flight of World class amplifiers. The ALPS ‘Blue Velvet’ range of component components only used selectively in the very top flight of World class amplifiers.

MANSION POTENTIOMETERS

- 2-Gang 70k, 50k or 10k Log
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- 2-Gang 10k 10K Special Balance, zero cross-talk and less than 1% loss in centre position

ALPS PRECISION SWITCHES

At long last, switches to match the quality of our Alps pots. These switches not only solve the quality gap but also have features facilitating their use in real audio applications. The "flexi" version having a panel mounting control to a rear switch mount up to a 150mm Flax Plug. Also an Amp is a matter of opinion which, like the pots, can also be operated with its control knob.

HCS51B 4P 6W Switch | £17.95
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The size of modern components makes the need for soldering equipment essential for good results. Everything that you need for your soldering project. See our Lists for the full range.

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HCS51B 4P 6W Switch | £17.95
HCS50B 5P 6W Switch | £29.80
HCS560 4P 6W Motorised Switch | £99.60

PRINTED CIRCUIT BOARD SOLDERING PRACTICE KIT

Unsure whether you can construct a HART kit, this is your chance to have your Hart printed Circuit Board Soldering Practice Kit comes with a range of modern components, a typical Hart quality PCB, a tool of the correct grade of solder and full instructions. It enables the enthusiast who is uncertain of his, or indeed her, ability to put together and solder a printed circuit to try his hand at minimum cost. The instructions explain the right technique and guide even an absolute beginner through the seemingly daunting, but in fact very simple, art of making a good soldered joint. Excellent value for money.

Super Version with Hart Silver Solder | £5.95

LINSLEY-HOOD 400 SERIES SUPER HIGH QUALITY FM TUNER.

This high quality analogue tuner system is the ideal companion to the Hart Audio Design Kit amplifier in any audio hifi setup, with case size, front plate layout and even control pitches unified for ease of use.

K210D Complete Standard Kit | £112.50
CM20 Construction Manual | £2.50

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All Prices include UK/EC VAT.
This attractive module consists of a low pass filter and power amplifier ready for you to mount in a suitable subwoofer cabinet. The combined unit can then be combined with any new or existing hi-fi or home cinema speaker system to add in the real bass punch missing from most rooms.

The ASM 100 module comes as a ready-to-mount unit on a solid extruded aluminum heat sink. Input signal may be at line or front panel control. The ‘Green’ power supply switches the unit to provide them with strong bass support.

Crossover frequency can be set all inputs to add bass to any signal. The speaker level inputs are stereo inputs at line level and the unit will use any signal presented or the ASM 100 Module comes as a ready-to-mount unit on a solid extruded aluminum heat sink.

20,000Hz and a power rating of 200W.

Decay that does not look out of place, even in a smaller room. A

A speaker kit from the VISATION range that really fits the modern
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EXPERIENCE V20

A real heavyweight performer with a
to these speakers and two 20cm long throw drivers.

The excellent performance of modern cassette recorders depends
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Super High Quality stereo phono to phono audio lead featuring gold plated stereo connectors plus split outer skin to ensure positive connection to phono sockets. Plugs have red and black polar bands. Sky blue multistrand oxygen free copper cables with independent braided shielding, controlled signal loss and crossover with maximum musicality at a sensible price. Directional arrows indicated on connector signal direction.

An excellent high quality lead ideal for interconnection between professional audio equipment or for use in high end domestic systems.

A practical book that does exactly what its title says and combines the maximum loudness of the speaker/box combination. It modelling the maximum loudness of the speaker/box combination. It calculates dimensions for a catenoid, exponential or hyperbolic bass horn and prints out in less than a minute. Provides mouth and throat area, 20cm long throw drivers.

Loudspeakers, the Why and How of Good

Step down transformer plus computer disk that requires Lotus 120, or equivalent spreadsheet software on your microcomputer for all sub-woofer modeling.

This practical program allows you to model the size of bass enclosures by allowing you to adjust the curve in a variety of boxes and then modeling the maximum loudness of the speaker/box combination. It then helps to calculate the dimensions of the box and port, if needed. Needs Windows 3.1+, DOS 4.0, 386 or better, 4MB RAM and 4MB hard disk space.

Full Version (3") £ 45.51

Full Version (2") £ 44.51
STAGE THREE - THE EQUALISER CAPS
Considering this change amounted to a mere four capacitors I was quite taken aback by the scale of the difference. It wasn't a sea-change, but it was still very noticeable. What it boiled down to was a continuation of what had happened when the other audiophile components were replaced with the originals.

The low-level detail and spaciousness that KLPP I can rustle up with the top-notch caps was masked by the more industrial-grade offerings. The decay of individual notes, whether it was in the lower bass or the upper treble, was curtailed and basslines and melodies came across as rather perfunctory and uninvolving.

Sound staging diminished once more, vocals lacking the gorgeously smooth projection of yore, while imaging was shallower and more diffuse and the tonal palette restricted.

STAGE FOUR - THE VOLUME POTENTIOMETER
Replacing the Panasonic pot with an Alps Blue Velvet (fitted to the standard KLPP I) proved interesting. Although the Alps Blue is a high-quality audiophile pot in its own right, returning to it showed just how much better the Panasonic laser-trimmed version actually is.

Individual voices in a choir were harder to identify and were reduced in presence and weight. Tonal things became greyer, and lacked the expressive nature of the Panasonic-potted KLPP I. Rhythmically the sound suffered due to a bass end which was now less taut and precise. Subtle acoustic clues which were previously highlighted were now less apparent, leading to a reduction in image depth and scale.

STAGE FIVE - THE POWER SUPPLY
The final step in the listening test concentrated on the KLPP I with its original power supply capacitors and regulator. High frequency detail was now fuzzier, and cymbals which previously sparkled sounded slightly blurred and thin, lacking both bite and power. The biggest change caused by the removal of the upgraded power supply components was the loss of fine detail. This most significantly affected tonal colour and consequently made instruments and vocals less natural. Sound staging also suffered, the depth plane flattening into a more two-dimensional image. Listening to John Lee Hooker the bass end had reduced attack and definition, leaving the music slower and less involving.

Splash out on audiophile components is guaranteed to soup up your sound, but taking the mods one component at a time will spread the cost and familiarise you with individual sonic signatures, as well as giving parts time to burn in and achieve their optimum performance. True, it takes longer than soldering in an entire bag of components in one sitting, but it will save you loads of time removing caps and resistors that haven't been used in the correct circuit location. It also means that when it comes to future upgrades, you'll know what will work best where and how to tune your hi-fi to get exactly the balance you're after. As they say, you can't buy experience...
KLPP-1 (one channel)

All valves type 6922

Regulated Power Supplies

DIY feature
Falcon Acoustics Ltd

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Chris Found explains how to build the KPP1 phono stage introduced in the December 1997 Supplement.

In the last Supplement we dealt with the basic concept of the KPP1 phono stage and its design. In this article we show you how to build the unit. As with all designs that employ high overall gain plus a lot of boost at low frequencies, important matters such as keeping background hum and noise to a low level are a major problem - and this design is of no exception.

The main problem with hum in a pre-amplifier comes from the radiating fields of the mains transformer and the mains input wires. Although this can be reduced to a low level you can never really remove it completely, at least while the mains transformer is in the same case as the pre-amplifier.

To mitigate this problem with some certainty in a DIY project we decided to distance the mains transformer from the main electronics as far as possible. This meant mounting the transformer in its own dedicated case, not a new idea. In fact, in many high quality pre-amplifiers that sell for three figures it is virtually mandatory to have a remote transformer and when you think about just how much gain exists at 50Hz because of RIAA equalisation, it makes the most sense. High impedance valve circuits are also more susceptible than low impedance transistor circuits, because they load the radiation source less.

Using a remote supply does, however, pose another potential problem: long wires can cause earthing problems through raised impedance. This can be minimised by using thicker wires for the earth returns than normal.

POWER SUPPLY
As with all commercial designs, the first prototype is designed for top performance but inevitably some changes are required. In the earlier phono stage I found that the heater power supply was not as well optimised as I would like, so I decided to change the wiring of the heaters of the valves from parallel to series connection. This changed the main operating voltage from 6V to 12V and allowed a single high-current regulator (heatsinked) to be used in place of the three regulators of the original.

This has the additional benefit of removing the centre tap requirement on the mains transformer, allowing the unit to be built with standard parts. The valves still see a split supply rail but it is configured differently and has the extra benefit of reducing the current to the regulator, producing less heat. A split rail automatically cancels noise, reducing hum, hiss and random interferences.

To simplify the wiring of the heaters even further, I decided to group the valves into three pairs, where each left and right heater supply for that section has its own dedicated heater wires. Each pair of valves is now fed from the power supply board and is connected by three wires. Two of these are for the main supply voltage to the valve heaters and a third provides the series connection that is connected to the ground return.

This arrangement is more effective than the original proposal and provides the best results, with no negative aspects. With the valves grouped in this way, it is easier to fault-find, if one set of valves does not light up.

CONSTRUCTION
There is a construction routine for building this phono stage. It allows you to check each individual stage, as it would be quite difficult to remove a component once the
The power supply features a high-voltage regulator to improve sound quality.

PCB is fixed into the chassis.

After building up the printed circuit board (PCB), the first set of wires for connection are the feeds to the heaters. I suggest that different colour wires be used for each pair of valves. This removes any problems later in trying to find the correct wire for each of the three positions. In the prototype, I used the following colours.

The first YELLOW wire connects to Pin 5 of the right channel input valve. The GREEN wire links between Pin 4 of the right channel valve and Pin 5 of the left channel valve. This wire also runs back to the power supply board. The second YELLOW wire connects to Pin 4 of the left channel valve to finish off this first group. The end result should be 3 groups of 3 wires (YELLOW, GREEN, YELLOW).

To separate each group of heater wires I recommend each triplet be tied together with a small piece of insulating tape or a cable tie. This removes the error factor when connecting these wires to the power supply board.

After the heaters have been wired up, we can connect the HT (high tension) wires. These are coloured RED for HT and GREEN for the ground connection. Following the HT wires, we can now fit the two screened wires that feed to the output sockets. These are placed to one side of the chassis to minimise hum pickup from the power supply.

If you have decided not to use the PCB-mount input RCA socket, you can connect the PCB to the input sockets via three solid-core wires. Make sure that these wires are as short as possible to reduce any noise pickup when using the pre-amplifier in MC mode.

With the main PCB inside the case, we can now wire up the power supply board. The coloured wires that have been run to the board to connect up the heaters and HT can now be soldered to the power supply PCB.

For the heater supply, there are 9 holes grouped into three sets of three holes labelled H1, H2 and H3. These are the heater connections for each individual group of valve pairs, and correspond to the group of three wires that have been connected to the phono stage PCB. H1 connects to the YELLOW wires, H2 connects to the GREEN wires, with a final connection to the last of the YELLOW wires at H3. Do the same for each of the three groups and you have wired up the heaters.

Now that all the power supply output wires have been fitted to their respective holes on the board, all that is required is to connect up the multicore cable that feeds from the external mains transformer case and you are almost ready to power up the unit.

CHECKING

Now comes the checking. I do hope you have checked the heater wires before the phono PCB was installed, as this is where you find out if they are wired up correctly. Double check each wire from the multicore cable to power supply board, checking each goes where it should. One final check of the Phono board and power supply connections, and off we go.

Without the valves in place or anything connected to the phono unit other than the mains plug, plug in the mains and switch on. Look for any burning or signs of distress from a relative distance (just in case). If all seems to be OK, switch off and let the power rails discharge (10-15 minutes).

Still with no valves in place, switch back on. With a multimeter set to 400V or higher check the power from the power supply board. You should have around 280V DC on the HT output positive connection and 12V between H1 & H3 pins of the heater output wires. If the
voltages are about right, switch off and put in the valves after the same discharge time.

Switch back on and look for any problems. You may smell a small amount of heat from certain components as they get accustomed to their new job, but nothing more.

Recheck the HT and heater voltages.

The HT should have dropped slightly to 250V but the heaters should be the same voltage. Look at each valve in turn for the heaters lighting up. Some valves glow a little brighter when powered up but settle to the same brightness after a minute or so. If after 2 minutes one valve glows a lot brighter than the rest, switch off and recheck its heater connection. Look for excess voltages on input and output with a multimeter. The inputs should read zero voltage and the outputs should have no more than a few millivolts on their pins. If all is well, switch off and connect up to the rest of your Hi-Fi.
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## Resistors (all 0.66W carbon film)
- R1: 47k
- R2: 100
- R3: 1k
- R4: 1k
- R5: 1k
- R6: 33k
- R7: 33k
- R8: 22k, 1W carbon film/metal oxide
- R9: 100k
- R10: 10k
- R11: 270k
- R12: 100k
- R13: 1k
- R14: 1k
- R15: 1k
- R16: 56k
- R17: 100k
- R18: 820
- R19: 100k

## Capacitors
- C1: 100\(\mu\)F, 25V electrolytic
- C2: 100\(\mu\)F, 25V electrolytic
- C3: 100\(\mu\)F, 25V electrolytic
- C4: 47\(\mu\)F, 250V polyester
- C5: 33\(\mu\)F, 350V electrolytic
- C6: 0.47\(\mu\), 250V polyester
- C7: 0.1\(\mu\), 400V, polypropylene
- C8: 33\(\mu\), 350V electrolytic
- C9: 10\(\mu\)F, 1% polystyrene 160V
- C10: 2n7\(\mu\), 1% polystyrene 160V
- C11: 100\(\mu\), 250V electrolytic
- C12: 33\(\mu\), 250V electrolytic
- C13: 1\(\mu\), 400V polypropylene Solen

## Transistors
- Q1: TIP50

## PSU PCB Parts List

### Diodes
- RDI-4: IN5402
- DI-4: IN4007

### Capacitors
- C1: 100\(\mu\), 400V
- C2: 33\(\mu\), 350V
- C3: 33\(\mu\), 350V
- C4: 4700\(\mu\), 16V
- C5: 470\(\mu\), 16V

### ICS
- Reg 1: 78S12 (on heatsink)

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- R1: 56k

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- Q1: TIP50
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STARTING ELECTRONICS

by Keith Brindley

Reviewed by Haider Bahrani.

One of the hardest things about learning electronics from scratch is finding a starting point. Many books begin by claiming they assume the reader has no prior knowledge of the subject, then spend a couple of paragraphs formally introducing the resistor before swiftly pushing students in at the deep end without armbands by bombarding them with complex circuit analyses. Starting Electronics in principle takes a step back from all that and tries to lead the reader through the basics, holding their hand at every step of the journey.

Chapter One sets out the stall by getting to grips with the necessary tools that hobbyist wannabes need to stock their toolboxes with. Wire cutters, snipe nose pliers and the soldering iron all make an appearance. At this point the first of many ‘hint’ boxes raises its head, telling us not to blunt the wire cutters on thick wire. Now we’ve been told!

The good old analogy comparing the flow of electricity to that of water is given an airing next. A briefing on resistance then follows; that’s the electrical type as opposed to the French. ‘On The Boards’ is Chapter Two, which gets you breadboarding. Not nearly as exciting as snow boarding, this entails the use of a breadboard-look-alike block purpose-built for connecting components together in experimental circuits. A selection of simple circuits introduces the use of a multimeter and the practical application of the resistor along with plenty more hints.

The third chapter starts to investigate measurements and puts the multimeter to more serious use. Resistors come together in parallel and serial combinations, they even get variable, but that’s not the biggest shock. We find out that the water analogy was wrong all along, for electricity (as in electrons) flows backwards, from negative to positive. It was all a historical mistake and so by convention going backwards is actually going forwards. Confused? The book makes sure you won’t be.

Charge storage in the form of capacitors is the mainstay of Chapter Four, practical implementation being more the order of the day than theory. The important topic of measurements comes to the fore again, in the form of recording results, alongside the physical behaviour of the capacitor in the circuit.

Chapter Five is where the fun really starts. A 555 IC is used to build an astable multi-vibrator, which is a square-wave oscillator. This chapter consolidates everything that has been learnt in the earlier sections and brings them together in a real application. It then warms down with some basic first-order filter theory showing how to calculate roll-off frequencies and plot graphical results as proof.

The sixth chapter finds the text entering more complex active-component territory with the humble diode. Again real circuits are employed to show off the component’s uses and behaviour, and measurement techniques are elucidated, leading to a little graph plotting. Zener diodes are given a hearing too, and the characteristics (both forward and reverse bias) are examined.

The next chapter attempts to shine a stronger light on the applied advantages of the diode’s operation discussed earlier. The book does take a small sideways step into the mathematical arena at this stage and reveals the diode equation, having shown that the relationship between current and voltage in a diode is clearly non-ohmic (i.e., it doesn’t obey Ohm’s Law) over its entire range. This is followed by a discussion on the use of the diode in power supply rectification and regulation.

Transistors and integrated circuits are covered in the final two sections of the book. Transistor-wise the author concentrates on the bipolar junction type and leaves other forms for another book. The text does start to get a little more theoretical at this stage, although the general format is maintained with handy hints and guidance.

The integrated circuit section is much the same, with the focus, not surprisingly, on the ever-popular 741 operational amplifier. At this point you’re encouraged to build one or two circuits including an inverting amplifier and a non-inverting version of same. A glossary of electronic terminology is added at the back to help you get acquainted with the jargon.

Certainly a welcome addition to a poorly-served sector of the book market, Starting Electronics is thankfully basic and will be a less daunting introduction to the keen pupil of the science than many a heavy-handed text I’ve come across. Those come into their own when it’s time to blow up a few transistors!

Starting Electronics £9.99

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| 12BY7A         | GE                    | 12BY7A         |
| 5687WB         | ECG                   | 5687WB         |
| 6072A          | GE                    | 6072A          |
| 6146B          | GE                    | 6146B          |
| 6366A          | RCA                   | 6366A          |
| 6550A          | JAN GE                | 6550A          |
| 7027A          | GE                    | 7027A          |
| 7581A          | SYL                   | 7581A          |
| 5Z4G           | BRIMAR                | 5Z4G           |
| 6V6GT          | BRIMAR                | 6V6GT          |
| 12E1           | STC                   | 12E1           |
| 13E1           | STC                   | 13E1           |
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| 6072A          | GE                    | 6072A          |
| 6146B          | GE                    | 6146B          |
| 6366A          | RCA                   | 6366A          |
| 6550A          | JAN GE                | 6550A          |
| 7027A          | GE                    | 7027A          |
| 7581A          | SYL                   | 7581A          |
| 5Z4G           | BRIMAR                | 5Z4G           |
| 6V6GT          | BRIMAR                | 6V6GT          |
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**World Radio History**

HI-FI WORLD SUPPLEMENT
MULTIMEDIA & VIRTUAL REALITY ENGINEERING

by Richard Brice

Reviewed by Noel Keywood.

This book covers an amazing amount of ground in an easily readable, original and fascinating manner. I went from being sceptical to becoming hooked as I read it. But whilst much of it is intriguing, equally a lot is highly specialised - more so than author Richard Brice realises, I suspect. All the same, Multimedia & Virtual Reality Engineering is an important book for many compelling reasons.

Is it the title, which uses two overworked terms, "Multimedia" and "Virtual Reality", the final chapter on "Cyberspace" or Richard's rather flimsy intro that made me initially sceptical? It got worse before it got better.

By p11 of this 300-page book, readers are introduced to the Fourier Transform. I tried to explain this to a computer expert recently. The incomprehension it caused reminded me of my own difficulties with this topic. An explanation demands careful writing and diagramming, but Richard dispenses with it in fourteen lines and no diagram. It is deservedly given an Appendix but this is no clearer.

Richard scores a bullseye on p13 though with some original and cogent observations about the enormous ability of the human hearing mechanism, pointing out that it has a wider range than Compact Disc. The popular perception that CD is perfect has only evaporated recently.

The appearance of circuit diagrams by p19 may be enough to convince the faint-hearted that this book is a hardcore engineering treatise. There are perceptive comments about the relative merits of valve and solid-state power amps, as well as Class A versus Class B, but this will go over the heads of most bar engineers.

Chapter 4, simply entitled 'Image', has broader appeal, at least in its opening stages. Then it dives into engineering again, with topics like genlocking, video switching with DC component restoration and transmission lines. It's all very technical. The book takes quick but informed peeks at certain critical areas which may suit boffs but will baffle newcomers. Richard Brice has perhaps been in the multimedia engineering world too long to realise that it is heavy stuff for the average mortal. Having said that, I found the book getting progressively more absorbing.

The book is split into three parts and Part I continues discussing engineering aspects of analogue video through to digital audio and video, ending with 'Computers' (Chapter 7). On this vast subject Richard is unusually brief: 'Computers' occupies 14 pages.

The second part of the book is entitled Media Production And Hardware. Superficially less technical, it is meant to deal with production techniques. Circuit diagrams soon start to appear though; I was taken aback to see nine consecutive pages of them devoted to a complete vision mixer. 'Multimedia Authoring' runs through current production techniques and, although I am deeply involved in HTML as a user, author and what have you, my interest wasn't especially gripped.

The book finds its second wind in Part III, Virtual Reality. The first chapter, 'Realistic Auditory Stimulation', was informed to the limits of our knowledge, fluently written and gripping to read. With references and discussions of all research into the creation of realistic sound through stereo and other methods reaching back into the 19th century and including the likes of Blumlein, Richard doesn't miss a trick.

When William A. Yost makes an appearance this section really starts motoring. Yost brings a rigour and insight to the subject traditional engineers completely fail to grasp, and by locking into this rich vein of cognitive research the book profits immeasurably. Chapter 12 alone justifies the cost of the book and should be required reading for everyone in audio. Until we understand the extraordinary non-linear schemes and complexities of the human auditory process we really possess no useful foundation on which to base all other knowledge of the subject. Richard has carried out a lot of original work in this area and it shows in his writing. But then again this is a book written from the top to engineers lower down the audio food chain.

With its CD ROM containing both data and surround-sound music attached, Multimedia & Virtual Reality Engineering is a tour de force of this subject, written by someone with unique research and practical experience. I can only be severely impressed, but I do doubt whether non-technical readers will get much further than p11 and the FFT before deciding tiddly winks is an altogether more amenable pastime.
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I read with great interest the devices to reduce the noise.

I have been hoping to build a MM/MC cartridge pre-amp. I have been looking at valve designs for a valve ET81 valve phono stage. One question bothers me - is the choice of valve. Is the RF application where the valves were used in a Mullard design. He built one around 1955 and the other around 1958 to make a matching stereo pair. Misunderstanding my enquiry about their sound. I feel the 6922 has a more detailed, open sound than the competition.

I see that these are identical to E88CCs which I have used in pre-amps before and experienced a lot of microphony problems with.

The selection of valves was not purely down to its sound quality. I feel that the 6922 has a more detailed, open sound than the competition - ECC83 and others. It comes in several guises: 1) Standard 6922 (silver pins). These are the most open sounding valves of the 6922 variety but they suffer from higher noise levels and some can have a grainy edge to their sound. 2) Special 6922 (gold pins). These are the best 6922 valves around. The sound is very smooth but extremely detailed and I prefer these over any other type, but they are hard to get. CF

TRANSFORMER TRANSPLANT

I've acquired a pair of homemade vintage valve monoblocs, each of which has two EL84s, an ECC83 and an EZ81. They were made by a man called Dennis and based on a modification of a Mullard design. He built one around 1955 and the other around 1958 to make a matching stereo pair. Misunderstanding my enquiry about their power output as a vulgar modern consideration, Dennis told me, a touch defensively, that he had built the amps for sound quality.

Through an early Brenell pre-amp he was unable to achieve a true stereo split and from his expression this was a big disappointment such, it is clear, was the anticipation for stereo. From there he went on to a Rogers HG88.

I took the amps to a valve radio enthusiast (boy, what a collection!), who checked them over for me and awoke them from a great sleep by means of a variac.

Dave, who had made amps himself at the time, confirmed Dennis' claim about having built the amps for sound quality. They were, he informed me, made from the absolute best components available to home constructors: "Only the guys who didn't drink and smoke and were 100% committed to their hi-fi made amps like these", he told me. Teaming them up with my Audio Innovations Series 800 pre-amp, Cambridge 200 CD player and a pair of Mission 760SE 'speakers I was compelled to step back into the room (I was about to make a cup of tea) as 'Have I Told You Lately' by Van Morrison was playing. The piano solo had just begun.

Each note was as vivid as life and I could hear the great care the soloist was taking in the execution and selection of these notes.

For the first time I could hear how hard Earl Klugh worked to sustain the movement of a piece called 'The Highway Song' and how graceful a dance was his piece 'Winter Rain'.

The downside was that the bass seemed cut-off and at best stodgy. Which brings me to my question about impedance matching. I was using these amps set at 15ohms (only one output transformer has taps - 3ohms, 7.5ohms and 15ohms, which is the rub) with the Missions which are 6ohms.

Now some people say I will simply lose a couple of watts of power. The pre-amp has high gain in any case. However, I have read that impedance matching is about maximising audio frequency power and that pentodes are very exacting in their
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**KIT & COMPONENT SUPPLIERS**
If your output transformer has more than three wires on its output, it's likely to be an Ultra-Linear type connected in the way above (Mullard's S-20 design) to give low distortion from high levels of feedback.

requirement of a correct match whereas triodes are less so (this in an old hi-fi book). So I am still wondering if the impedance mismatch is responsible for the bass not being able to get down, as it were.

It seems, output transformer transplant notwithstanding, I'm stuck with 15ohm. Can you suggest a small 'speaker (my listening room is a bit of a shoebox) that might be suitable; nothing too expensive, I'm a house daddy. Finally, the second amp is not earthed. Dave says it will be through the pre-amp. Is this good practice?

Gilbert Akingele
Wallington,
Surrey.

From your letter it would seem that Dennis was an avid home constructor with a purist touch. The combination of valves suggested was, and still is, very acceptable in terms of sound performance, but the matching between output transformer and 'speaker is critical.

My best recommendation for a 'house daddy' is to get the output transformers replaced with something that would work to an acceptable level with the 'speakers that you have. You can always replace one transformer first and the second when more funds are available. These units should not break the bank in cost terms but expect to pay around £50-£75 for one.

The anode-to-anode impedance of a transformer for a pair of EL84s is 8kOhm. If the primary winding has more than three primary wires, it is fairly safe to assume that the amplifier is connected in Ultra-Linear mode and you will require 43% taps on the new transformer primary to suit. Please check this before committing any cash.

Some transformer manufacturers have the ability to copy a ready-made unit, so the choice is up to you. And all power amplifiers, especially of the valve variety, must be earthed. CF

FOLLOWING UP A LEAD
I have been trying to improve on the rather cheap looking tone-arm lead that came with my turntable, with variable results. Cables which work well with a CD player seem to reduce the treble, and deaden the overall sound when used with a tone-arm.

Having done what research I can it seems that the capacitance and resistance of the cable may be the key factors in producing this result, with both needing to be as low as possible for a tone-arm given the nature of the signal from the cartridge (MC in my case). Unfortunately cable manufacturers do not give figures for these characteristics on their packaging, so it becomes a question of trial and error.

My conclusion is that I am unlikely to better the lead supplied unless I invest in a silver-wired cable. Am I on the right track, or have I misunderstood the technical information I have read?

Having become interested in the subject I have also considered a separate phono stage as an upgrade to my Audiolab 8000A. There seem to be two types of equalisation, R.I.A.A. and shunt feedback, and a need to balance the impedance of the cartridge, but I am beginning to suffer from information overload. Can you supply a simple explanation?

Paul Beever
100522.737@compuserve.com

Cables can be such a terrifying thing - you can spend obscene amounts of money in this direction and every manufacturer states theirs is the best.

Moving-Coil cartridges require a certain load impedance and capacitance, so the cables carrying these signals must be of a different construction from normal interconnects. The
standard input impedance for a moving-coil pre-amplifier is around 100ohms with a capacitance of around 100pF.

My own preference on cables of this nature is for silver-plated or oxygen-free types. These provide good sound but may not be to everyone’s taste.

I would recommend that you look through either a Maplin, RS Components or Farnell catalogue and choose a double-lap screened cable (microphone cable) with a low to medium impedance (about 100ohms) and a capacitance of about a hundred pF, then adjust the loading capacitance on the MC input according to the manufacturer’s figures minus the cable’s capacitance. Bear in mind that the specification for the cable is for a particular length and this has to be taken into account to get the final value.

You seem a little confused technically. R.I.A.A stands for Recording Industry Association of America and their curve is a group of parameters that were set for the equalisation of records.

The R.I.A.A. curve was specified initially in 1955 to standardise the recording industry, who at that time used many different curves which depended on the manufacturer of the record. This standard allowed a full frequency response (20Hz-20kHz) and the reduction of surface noise to an acceptable level. The way it works is as follows: the record is equalised in the cutting room with an attenuation in the low frequencies and a boost applied to the high frequencies. The equalisation network in the phono stage applies the inverse of the R.I.A.A. curve to the cartridge’s signal to give a net flat response. Although some of the specifications were changed a few years later, the basic characteristic of the original exists to this day.

Shunt feedback and Series feedback are two types of feedback used in phono stages. Early Cambridge Audio amplifiers used the shunt variety in their designs to achieve to what Stan Curtis described as a ‘perfect curve’, or one which very closely mimics the R.I.A.A. equalisation curves, while Audiolab use Series feedback in their phono stage. The choice is purely down to the designer, though in theory Shunt feedback is best.

**POWER IN SHORT SUPPLY**

I have built the IC power amplifier featured in the February 1997 Supplement and have added extra line sources and LM317T voltage regulators in the PSU. I also used a transformer with 18V AC secondaries to compensate for the voltage drop through the regulators. The problem is that the amplifier produces a lot of treble distortion at high volumes and I can’t pin-point the problem. I’ve tried reducing feedback by replacing feedback resistor 3 (22kOhm) with one of 27kOhm but this didn’t help much. Your advice would be much appreciated.

The rest of my system consists of Mordaunt-Short MS10i ‘speakers and a Kenwood DP-3080 CD player.

Gareth Ogden
jlo2@student.open.ac.uk

Your modifications to the 30watt chip amplifier are worthy in concept but have fallen down in practice. The chip amplifier draws up to 2.5A of current from each rail of the power supply. The exact amount is dependent upon the 'speaker impedance and the regulator used - the LM317T/LM337T voltage regulators you’ve used are only rated at 1.5A max.

What you are hearing is the regulators being pushed beyond their limits and there is nothing that you can do with them to overcome this problem. If you really want to regulate the power supply, you must have regulators that are capable of handling the maximum current demanded by the amplifier and the only way to solve this problem is to go discrete.

**MEASUREMENT BLUES**

I have recently started customising my loudspeakers (a two-way stand mounted design). First the crossovers came out of the cabinet, then the throwaway internal wiring was replaced, and finally those crossover components which had clearly marked values were swapped (capacitors were upgraded to polypropylenes,
resistors to high-power metal films).

Each change resulted in a small improvement in the sound, the most noticeable change being the capacitors and resistors. Unfortunately, the inductors in the crossover (two air-core, one ferrite-bobbin) have no values indicated and there is, I think, a small electrolytic capacitor also with no value printed on it. I contacted the manufacturer who, despite the fact that the model is discontinued, was reluctant to give the values of the components.

How can I find the values of the remaining components if I have a multimeter?

Alan Zoric
Alan.ZORIC@BXL.DG5 .cec.be

Easier than fiddling with a volts/ohms multimeter which won’t directly measure these values is to buy one of the low-cost LCR (inductance, capacitance, resistance) meters on the market that will measure these parts. You can get them from Maplin or RS Components (Maplin’s cheaper LCR, order code YB82D, costs £45.89 and will measure up to 10H, 100uF and 1MOhm).

Please note that some components used in speakers are sometimes adjusted for the specific drive unit tolerances and therefore close-to-exact replacement values are very important. CF

WIREY ENQUIRY

My system includes a Rotel RCD-965BX, Naim 32.5/Snaps/160 (32.5 is 72 spec with CD boards), Wilmislow Studio Monitor II loudspeakers and two 7.5m runs of Cable Talk Talk 3 bi-wire. (I also have two sets of 4 metres of Naim NAC4 cable, a bit of Veetuec bi-wire solid core and quite a lot of QED 79-strand lying about not in use right now). The music I listen to is mainly Pop/Rock/Motown.

I have recently made a change to my system and have gained a considerable improvement in so doing. The change was from Epos ES14s to the Studio Monitor IIIs. Having taken the plunge into building my own loudspeakers (inspired by your feature on KLS9 in April 1997’s Supplement), I am looking to carry out some fine tuning. This is where I would appreciate your advice.

A couple of months ago, as an experiment, I removed the crossovers from the loudspeakers and put them into a bit of a lash-up container as a temporary home. The improvement was staggering! I have now decided to do a proper job on this tweak by buying decent binding posts and building a nice looking box.

Having made a couple of phone calls I established that Naim advise at least 3.75m of cable from the amplifier to the crossover, whereas Wilmislow recommend placing the crossover close to the amplifier if removed from the enclosure. Naim do not recommend bi-wiring, although I am currently ignoring that because I perceive a clear improvement in sound quality by doing so.

What I would like is an impartial opinion on types of cable for doing different parts of this job. The loudspeakers are positioned 7m away from the power amplifier and I do not want to change this.

1) Where do you recommend I put the crossover?

2) What cable do you recommend from the amplifier to the crossover?

3) What cable do you recommend from the crossover to the loudspeaker?

4) What cable do you recommend for internal wiring of the loudspeaker (currently 79-strand)?

Thank you for an enjoyable read.

Name and address withheld by request.

Ideally, you want to put the crossover as close to the amplifier as is practical. Passive crossovers are easier to drive for an amplifier when there isn’t a long length of speaker cable making the job even more difficult.

For the cabling between amp, crossover and loudspeaker, that comes down to a matter of taste and the consideration that Naim amps can be a bit fussy over what cable they’re driving. Cost obviously enters into the equation as well. We’ve had good results from DNM’s Reson (£6.96/m) and Pentacone’s loudspeaker cable (£243 for a 7m bi-wire set).

While 79-strand is a bargain cheap cable, you’re better off lashing out on something superior. The easiest option is to use your chosen speaker cable inside the cabinet as well as out. If you fancy mixing and matching brands there’s no reason not to,

The idea of outboard crossovers for loudspeakers has been around a while but is not widely used. B&W and QLN have gone this route though, with their Signature loudspeakers.
and it should allow you to strike exactly the sonic balance you're after. JM

DIY IN DEPTH
As a long-standing Thorens TD125 owner (over 18 years) and self-confessed tweaker, I was very interested to read Haden Boardman's feature article on this turntable in your September 1997 issue. I have spent quite some time modifying and improving mine and I thought your readers might be interested in further modifications to really get the most out of this excellent machine.

First, as Haden suggests, throw away the mat and tone-arm. I have tried a glass mat with good results, but have found an acrylic mat to be MUCH better. The spindle on the 125 protrudes only 10mm above the platter, and with my 10mm thick acrylic mat I have had an extension piece turned up which is a sliding fit over the existing spindle and a very tight press-fit into the acrylic. The mat is fixed to the platter using a number of very small blobs of Blu-Tack, which also help to damp out any resonances.

A very useful improvement can be had with a record clamp - mine's a GB clamp, which grips the spindle and screws down onto the record forcing it to bend slightly over a 1mm thick shim placed over the spindle. This brings the record into contact with the mat.

It is important for the suspension to move freely, and I believe it is worth spending some time to ensure that it only moves in the vertical plane. Any sideways skewing will be detrimental to the sound. With the added mass of the acrylic mat, I actually had a spring maker manufacture three new springs - total cost $8, and money well spent. Removing any mechanical grounding of the tone-arm wires also improves the performance. I have found that the low-mass Mission 774 arm is a very good match for the turntable.

Another remarkable improvement can be made by modifying the plinth. These two alternative tweaks are very worthwhile:

1) Remove the hardboard bottom from the plinth and throw it away. Make a new stage too adding space in all three dimensions.
2) Remove the turntable from the plinth and make a new two-piece plinth from something solid (I have used 25mm thick nylon sheet, which has good vibration-absorption properties). A template can be drawn from the existing metal base. The new plinth should be made in two pieces, one to support the turntable on its springs, with locator pins, and the other to support the motor only. These two pieces should be fitted with three spikes each which will allow adjustment of their relative heights and levelling of the turntable.

A sub-plinth is also necessary. I have used a concrete paving slab. The motor wires need to be extended back to the speed control PCB which is now remote from the turntable and still mounted in the old plinth. A cosmetic wooden surround can be made if you want to hide the guts, but ensure that it does not come into contact with the new plinth or turntable.

The improvements are staggering; an extra octave of bass, infinitely more detail, wider and deeper sound staging and quieter silences are just some of the gains.

I have been very well rewarded for my efforts and have spent little money in achieving these results.

The rest of my system comprises Benz Micro Glider cartridge, Plinius Jarrah phono stage, Naim NAC 102/Hi-Cap/NAP140 and Mordaunt-Short Performance 860 'speakers, with Chord Solid and Naim interconnect and Naim NACS 'speaker cable.

Scott Roberts
scott.roberts@clear.net.nz
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