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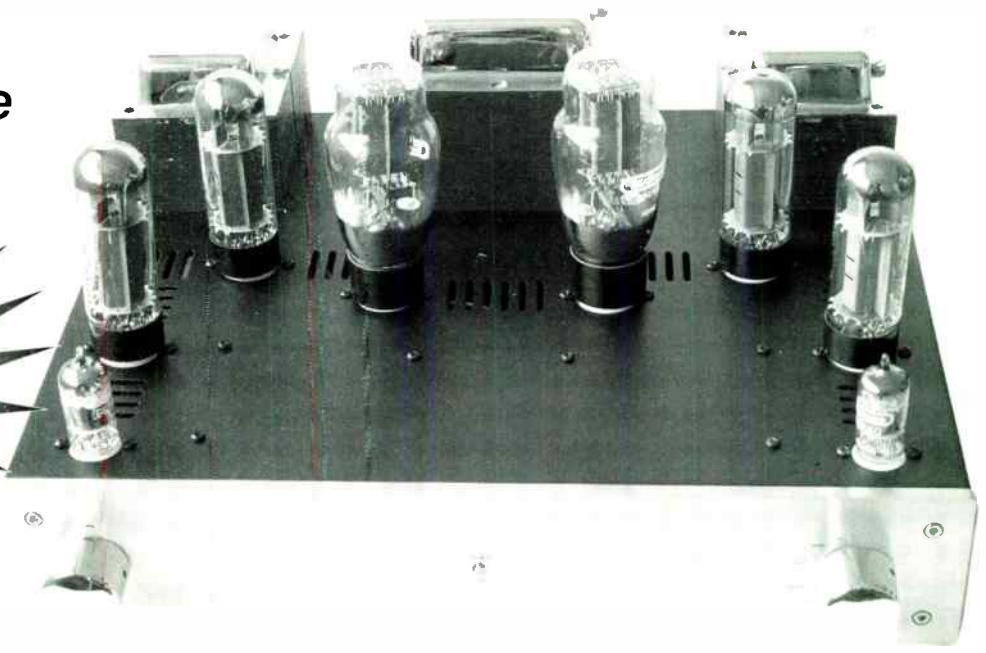


THIS MONTH'S BOOK REVIEWS:

History of H.J. Leak & Co Commercial Tube Circuits
Horn Loudspeaker design

HIGH-END TUBES

Our new 32W amplifier with tube and choke power supply



THE NORTHSTAR AUDIO DAC MODEL 3 KIT REVIEW

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EL519	EI	12.00	12AX7LPS	Sovtek	8.00

300B JJ/TESLA RAVE REVIEW

In Stereophile's November 1999 issue Peter Van Willenswaard evaluated over fifteen 300Bs using the Audionote Kit 1 and the cost no option de Jong System Amplifiers. He said of the JJ Tesla 300B - 'Worked well in both amps. very good bass - real pressure there and very involving. even euphonic - almost as if trying to make things nicer than real. It has good dynamics, reasonably fine detail, and threw a remarkably wide stage with the Audionote'. He summed up by saying in short 'The JJ electronics looks a real bargain!' We offer this great 300B at only £68 each making it an outstandingly good value upgrade.



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 +44 (0)1923 270833

Private & Trade Classified Ads
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 Fax: 020 7328 1844

Contact Numbers
 9am - 5pm Mon - Fri

Editor
 Nick Lucas
 +44 (0) 1908 218836
 nick@worldaudiodesign.co.uk

Technical Editor
 Noel Keywood
 publisher@hi-fiworld.co.uk

Design & Production
 Faiza Chunara
 020 7625 3129
 Fax: 020 7328 1844

Photography
 David Noble
 020 7625 3134

Sales and Marketing Manager
 Andrew Maynes
 020 7604 4890
 Fax: 020 7328 1844

Accounts
 Michael Ogazi
 020 7625 8032
 Fax: 020 7328 1844

Credit Control
 Louise Palfrey
 +44 (0)1923 270833
 Fax: +44 (0)1923 270833

Publisher
 Noel Keywood

WORLD AUDIO DESIGN

Technical Manager
 Nick Lucas
 Tel/Fax: +44 (0)1908 218836
 nick@worldaudiodesign.co.uk

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 Comag Magazine Marketing,
 Tavisstock Road, West Drayton,
 Middlesex UB7 7QE
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diy supplement/contents



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KIT & COMPONENT NEWS

NEW ELECTRO-HARMONIX 12AX7EH TUBE

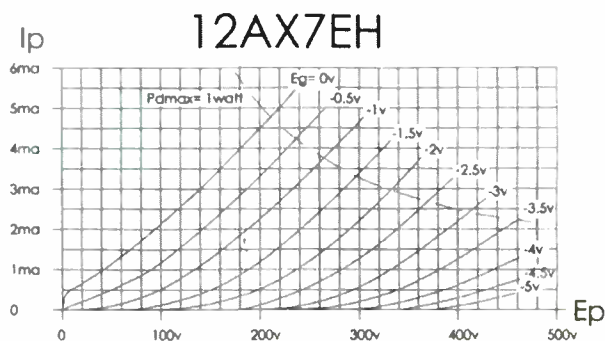


to give "soulful warmth" for guitar amplifiers. Musicians are all convinced second-harmonic distortion gives tubes their "warmth", largely because a few vociferous companies have claimed this. It isn't really true though, so the new EH tube may well be a good preamp for quality audio

work, because it has other strengths.

They state "special plate (anode) design results in super low microphonics balanced with high gain". Sounds interesting. "The unique spiral filament (heater) eliminates filament-to-cathode induced hum common to amps that use AC on the filaments". We even have a picture: better than the front cover of Loaded any day!

American company electro-harmonix have taken the 12AX7 (aka ECC83 double-triode) and added "a tad of tasteful second-harmonic" they tell us,



The 12AX7EH is a dual high mu triode with a spiral filament and special construction to minimize microphonic behavior. Ideal for replacement use in guitar amps and any place low noise and high gain is important.

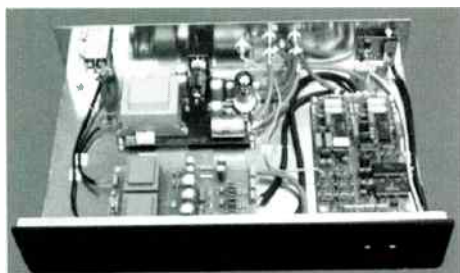


Pin #	description
1	plate 2
2	grid 2
3	cathode 2
4,5,9	heater
6	plate 1
7	grid 1
8	cathode 1

SITE NEWS

Welcome to the Audio DAC page

The information presented on this web-site reflects 5 years of work with



The following subjects can be found:

- [Project description.](#)
- [Technical overview.](#)
- [Measurement \(will be added soon\).](#)
- [Build this DAC yourself.](#)
- [Credits.](#)
- [Feedback \(will be added soon\).](#)
- [Interesting links.](#)
- [About us.](#)

D/A CONVERTORS

We are happy to announce our D/A web page, the result of some work carried on digital electronics:

<http://members.chello.nl/~m.heijligers/DAChtml/dactop.htm>

It may save your weekend, at least. Most of it looks "straightforward" though I would like to point you to:

Phase Locked Loop and Voltage Controlled Crystal Oscillator at

http://members.chello.nl/~m.heijligers/DAChtml/dig_r2c.pdf

and the Reclocking Circuit

http://members.chello.nl/~m.heijligers/DAChtml/dig_r2a.pdf

Note 1: We do not supply kits, but PCBs if there's sufficient interest .

Note 2: The design, implementation along with conceptual ideas are our properties. It may be copied for private use. Commercially interested parties must contact with me.

We wish you happy reading !

Guido Tent and DAC team

AUDIOCOM SPECIAL AMPLIFIER REGULATOR BOARD

Audiocom are pleased to release "Q-power", a discrete voltage regulator board. All of the design requirements necessary to achieve the optimum in power supply regulation are borne out in Q-power. This design starts with an ultra-low noise precision voltage reference, the output from this is RC filtered before feeding into one of the industry's lowest noise op-amps



available. The output from this op-amp controls a high current series-pass transistor. Incorporated within the feedback loop there is also additional filtering. The supply to the op-amp has an extra pole of low pass filtering. The main de-coupling capacitors chosen are the Black Gate BG-N & BG-NX type, unsurpassed in performance for low

noise, wide bandwidth and speed. Two types of Q-power are available, a standard, and reference grade. Both are built on to the same PCB design, using high quality semi-conductors, low noise resistors and Black Gate de-coupling capacitors. The reference version has been optimised by higher grade components for the ultimate performance. Prices for the standard board is £65.00 each, and £89.00 for the reference board. Audiocom can carry out the fitting of Q-power for an additional £20.00 per PCB.

Tel: +44 (0) 1646 685601
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MAPLIN UPDATES

Maplin have introduced a range of Celestion speakers nationwide through their 57 retail stores. Amateur and professional musicians alike can choose from the wide range of guitar, bass guitar and PA drivers. With 17 Celestion products there's plenty of choice, including the best selling guitar speaker of all time, the G12-T75. They are also available mail order through the company's catalogue and CD Rom, and online via www.maplin.co.uk.



the-art CD-ROM that enables users to design a customised speaker box for in-car and home use. The software can be installed on a PC in minutes and allows the user to model closed, vented and bandpass boxes to deliver the best bass response.

The software will calculate and display the expected response of a new speaker box in a matter of minutes. You can then print out cutting and layout plans for use either at home or by a commercial timber yard. You can also print out the different response graphs to provide useful reference material and impress your friends.

The software includes an online help guide, illustrated manual and tutorials on how to get the

most from your speaker set up. The Eminence CD-ROM, £49.99, order code NZ67X, can be obtained from 57 Maplin stores nationwide where specialist staff are available to help with component selection and technical enquiries.

Maplin's mail order hotline (0870 264 6000) is open 24 hours a day, 365 days a year and orders placed before 7.30pm will be despatched same day. A technical helpline for advice on installation is also available to customers.

And finally Maplin have produced a CD ROM of their catalogue which contains 15,000 products ranging from individual electrical components to state-of-the-art electronic equipment. To receive a copy of the CD-ROM catalogue, which costs £1.99, contact the Order Line on **0870 264 6000** and quote order code CQ07 or click on the icon at - www.maplin.co.uk.

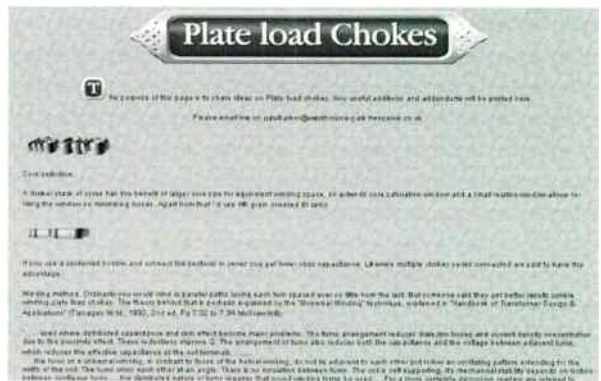
ON A PLATE

Paul Barker has put up a page titled Plate Load Chokes. Here's an esoteric subject. The anode load of a valve is usually a resistor, except in the output stage where impedance transformation is needed. An alternative is a choke. Chokes are big, heavy and expensive so they don't look like much of a substitute for a resistor, which is just the opposite.

However, they allow a lower HT to be used, which may have advantages, although the output stage usually sets rail volts. Paul's page discusses winding techniques and makes reference to some U.S. books on transformer winding. Good stuff for all those interested in this balck art.

<http://www.westbourne-park.freeserve.co.uk/Page4.htm>

SITE NEWS



TUBE POWER

Purists say valve amps sound better with an all-valve power supply. There are good technical justifications. Here's a high-end design without a solid-state device in sight. Designed by Andy Grove of course, with an introduction by Noel Keywood.



Valve enthusiasts insist an all-valve power supply gives better sound quality than a solid-state design where diodes are used in a bridge rectifier. This sort of view can be easy to dismiss as the romance of valves taken to extremes, until you look a little more closely. Then the all-valve power supply starts to make some strong technical arguments in favour of itself, I have found.

With this knowledge - and demand - behind us, we decided to produce a simple, classic valve amplifier with a valve power supply. People like usable power so it gives 32W from EL34s in push-pull.

There are many questionable features in conventional power supplies, from fundamental behaviour through to the components used. It isn't just the existence of

solid-state components that is the problem! Capacitor input supplies used in today's solid-state amplifiers draw current only on mains peaks, something power supply authorities object to quite strongly. A "choke input" power supply is ideal, drawing current smoothly, but it has practical problems, I found. The choke thrums like mad, it gets hot and it produces a strong hum field. Add a capacitor in front and everything calms down. What have you got? The classic pi filter arrangement valve amplifiers have always used.

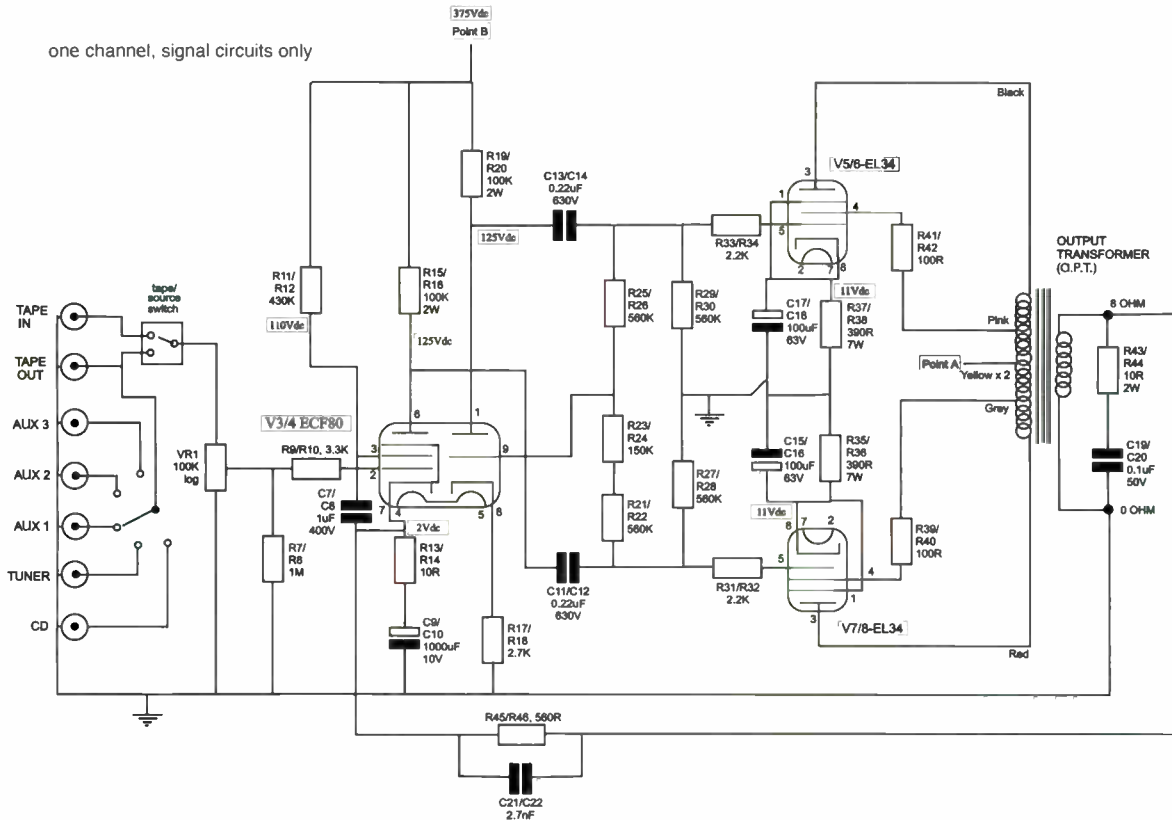
Although a pi filter might appear to be a "capacitor input" arrangement, in fact it is a compromise where some of the output energy is drawn from the choke, which stores energy, as well as the output capacitor, of course. Solid-state amplifier design-

ers were glad to get rid of the choke, but they threw out more than the pi filter and its smoother mains current draw by doing so. They also threw out a wonderful low pass filter that gave pure DC on the supply lines, free of noise.

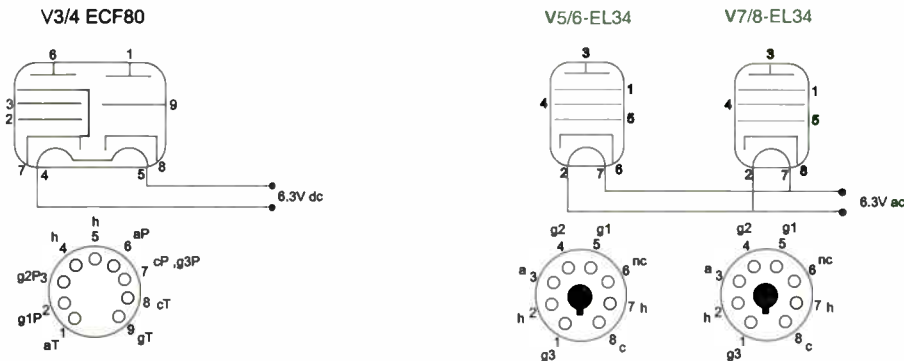
Solid-state regulators took over. They are small, cheap and have low output impedance - a great replacement for a big, expensive choke it would appear. But they produce noise that cannot be filtered out, which feeds into the amplifier.

Finally we come to the diodes themselves. They switch harder than valves, producing high frequency spikes. Slower Schottky diodes are a favourite alternative to the usual power diodes, to soften things up a bit, but there's nothing to beat a valve for smooth switching. Until now good valve

KIT34 INTEGRATED VALVE AMPLIFIER



Valve pin layout



Views are from underneath valve or valve holder
 h = heater hct = heater centre tap c = cathode a = anode g1 = grid 1 g2 = grid 2 g3 = grid 3 nc = no connection (T=triode P=pentode for V1)

rectifiers have been difficult to obtain. The 5U4 in this design is a big diode now back in regular production, making an all-valve supply a realistic proposition once again. All the same we needed two of them to handle the current demanded by a 32W per channel amplifier, plus their own heater transformer winding for isolation purposes.

You can see how impractical valve rectifiers are compared to diodes, yet they give slow switch on and great performance once aglow. Once again we find that the best solution is neither the cheapest nor the most convenient, so it is rare in com-

mercial designs. Only in a specialised DIY amplifier can such techniques be used without cost becoming excessive.

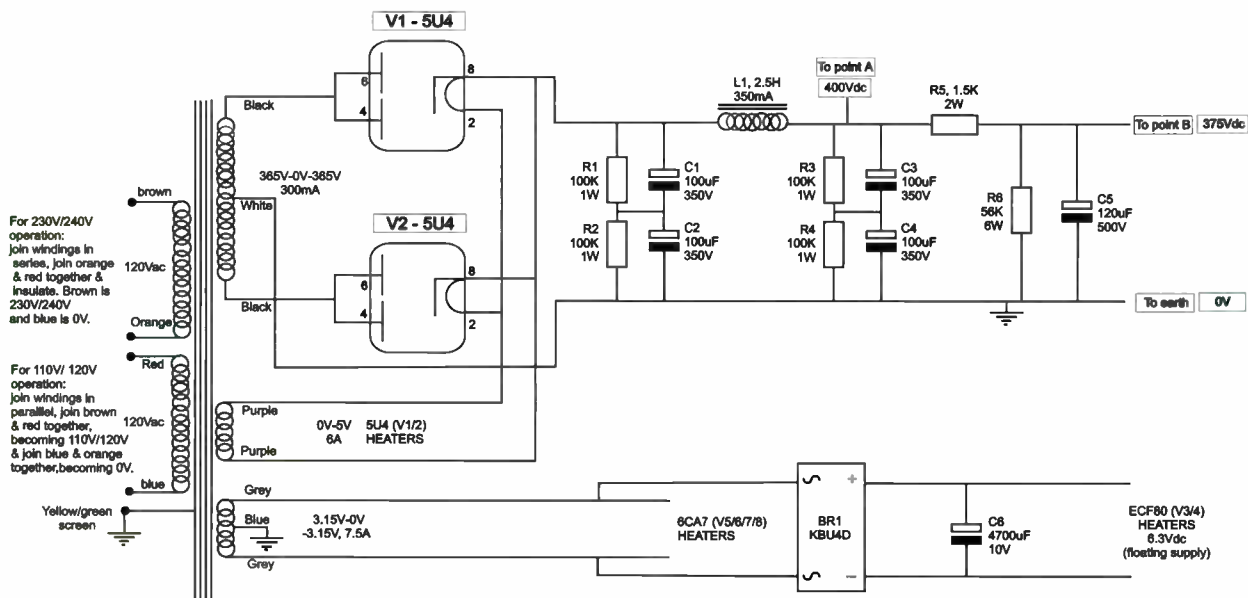
In a nutshell then, this power supply draws mains current smoothly and it feeds noise free DC out to the amplifier. You will notice we use DC heaters on the first valve to virtually eliminate hum, which otherwise upsets people used to solid-state silence!

The amplifier itself is a classic push-pull able to deliver a useful 32W per channel, enough to give good volume levels from ordinary loudspeakers. Bear in mind

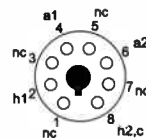
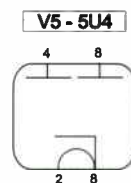
that big floostanding 'speakers are more sensitive than small bookshelf types, contrary to what you might expect, so think big if you want volume. I am currently using a 28W valve amp into KLS-9s and have plenty of volume, with room shaking bass, so lower powers don't have to mean lower volumes (but I did design KLS-9 for valve amps). **NK**

We will be finishing this article next month with a thorough appraisal of sound quality, kit construction and kit contents.

KIT34 INTEGRATED POWER AMPLIFIER - POWER SUPPLY



Valve pin layout



Views are from underneath valve or valve holder
h1, h2 = heater a1, a2 = anode c = cathode nc = no connection

Kit34 circuit description by Andy Grove

Kit34 is a simple, vintage style design using an ECF80 input valve and a pair of EL34 output valves in push-pull. The ECF80 (V3/4), a triode/ pentode combination, is connected as a "Floating Paraphase" phase inverter. With this type the pentode section is connected as a conventional voltage amplifier with a gain of approximately 150, with R15/R18 as the anode load and R11/R12 as the screen grid dropper resistor. C8 is the screen decoupling capacitor to maintain a constant screen to cathode voltage at audio frequencies.

The triode section performs the actual phase inversion thus: a bridge is formed by R25/26 R29/30, R27/28, and R21/R22. The junction of R29/30 and R27/28 is taken to ground, these are the EL34 grid resistors. R25/26 and R21/22 form the other half of the bridge while R23/24 increases the resistance in one arm to provide the necessary signal to the grid of the triode, derived from the combined antiphase outputs of the two input valve sections. There is an amount of local feedback around the triode section which stabilises operation against valve ageing. R19/20 and R17/18 are the anode load and cathode resistor for the triode respectively. C13/14 and C11/12 are the AC coupling capacitors to the bridge and output valves via their grid

stoppers.

The output stage utilising EL34 output pentodes (V5/6 and V7/8), is again conventional. Here pure cathode bias is used for simplicity, rather than the compound technique used in our other kit. The EL34 screen grids are connected via screen stopper resistors R41/42 and R39/40 to ultra linear taps on the output transformer. These U.L. taps are at 14% of the total primary winding. The H.T. voltage in Kit34 is lower than that used in the Mullard 5-20 and so a lesser amount of U.L. is permissible to maintain a good power output. The experienced builder can experiment with Pure Pentode operation by connecting the screens to the H.T., Ultra Linear by using the circuit as shown or in Triode Mode by connecting the screens to the respective valve anodes. Triode operation will result in a loss of power output. Before attempting this please make sure you understand what you are doing!

There is a Zobel network connected across the output transformer secondary to ensure stability into inductive loads and the overall feedback network includes the usual L.F and H.F compensation schemes seen in our other kits. The power supply uses two Russian 5U4 rectifiers. The current requirement of

the four EL34s requires that each 5U4 is connected as a single diode with its two sections in parallel. These are then configured as a full wave rectifier of high power capability. In the filter, stacked electrolytic capacitors are used, together with balancing resistors, to ensure a wide voltage safety margin. The stacked capacitors form a pi filter with the choke L1 for superior supply smoothing. The preamp section is fed from a potential divider to ensure that C5, never experiences an overvoltage thereby ensuring reliability. **AG**

MEASURED PERFORMANCE

Power	32 watts
Frequency response	15Hz - 85KHz
Separation	60dB
Noise & noise	-90dB
Distortion	0.05%
Sensitivity	300mV

KiT34 PARTS LIST

RESISTORS

R1/R2/R3/R4	100K, 1W
R5	1.5K, 0.5W
R6	56K, 6W
R7/R8	1M, 0.5W
R9/R10	3.3K, 0.5W
R11/R12	430K, 0.5W
R13/R14	10R, 0.5W
R15/R16	100K, 2W
R17/R18	2.7K, 0.5W
R19/R20	100K, 2W
R21/R22	560K, 0.5W
R23/R24	150K, 0.5W
R25/R26	560K, 0.5W
R27/R28	560K, 0.5W
R29/R30	560K, 0.5W
R31/R32	2.2K, 0.5W
R33/R34	2.2K, 0.5W
R35/R36	390R, 7W
R37/R38	390K, 7W
R39/R40	100R, 1W
R41/R42	100R, 1W
R43/R44	10R, 2W
R45/R46	560R, 0.5W
VR1	100K dual log potentiometer

CAPACITORS & LT RECTIFIER

C1/C2/C3/C4	100uF, 350V
C5	120uF, 500V

C6	4700uF, 10V
C7/C8	1uF, 400V
C9/C10	1000uF, 10V
C11/C12	0.22uF, 630V
C13/C14	0.22uF, 630V
C15/C16	100uF, 63V
C17/C18	100uF, 63V
C19/C20	0.1uF, 50V
C21/C22	2.7nF, 63V
BR1	KBU4D

VALVES & BASES

V1/V2	5U4 (Russian)
V3/V4	ECF80 (European)
V5/V6/V7/V8	EL34 (Tesla)
B9A	chassis mount x 2
Octal	chassis mount x 6
TRANSFORMERS	
Mains	x 1
Primary	
0V - 110V/120V - 230V/240V,	
Secondary	
HT	365V - 0V - 365V, 300mA;
LT	0V - 5V, 6A; 3.15V - 0V - 3.15V,
7.5A	

Choke x 1 - 2.5 Henry, 350mA
Output x 2 - Primary 6.4K, 14% ultra-linear
taps, Secondary 8R

CHASSIS

2mm thick mild steel, black powder coat with white screen print x 1
2mm base plate, black powder coat x 1
6mm thick anodised front plate x 1
34mm diameter chrome knobs x 2
chrome finished transformer caps for mains & outputs x 3

HARDWARE

2 pole/6 position selector switch x 1
tape/source switch x 1
IEC socket & power switch combined x 1
1.6A slow blow fuse x 1
gold plated red phono sockets x 7
gold plated black phono sockets x 7
M6 fibre washers x 28
earth post x 1
gold plated banana speaker posts x 2 pairs
M4 x 12 hex. bolts x 4
M4 x 12 screws x 2
M4 nut x 6
M3 x 12 screws x 30
M3 nut x 22
self adhesive feet x 4
IEC mains lead x 1
assorted wire
instruction manual

KiT34 VALVE AMPLIFIER IS AVAILABLE AS A KIT!

	UK (inc. vat & p&p)	Overseas (exc. vat &)p&p)
KiT34-K240/120 (with valves)	£495.00	£420.00
KiT34- K240/120 (without valves)	£430.00	£365.00
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CAUGHT IN THE WEB

Bemused and befuddled by which component to buy, or how to modify your latest kit? Jon Marks went surfing for advice.

The best places to find out about hi-fi - commercial as well as DIY - are those which are, though I hate to use such an abused term, 'interactive'. There really is no substitute for being able to communicate with like-minded people who have been there, done that and learned how in the process...

WWW.AUDIOASYLUM.COM

Audio Asylum is a superb site for a range of topics, including in-depth forums dealing specifically with loudspeakers, high-resolution digital formats, vinyl, etc. If you're a fan of panel loudspeakers, and especially Magneplanars, this is the place to visit to discover how to squeeze every last ounce of performance out of them.

The tweaking side of the audio arts is catered for with a never-ending stream of questions and

AudioAsylum.com

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newsgroup for answers to just about any DIY valve question, no matter how technical.

Whether you keep an eye on the day-to-day postings, or prefer using the huge archives as a handy database, just about any query you have, no matter how technically demanding, is almost guaranteed to generate a useful response here. The whole spectrum, from jerry-built piles to no-expense-spared esoterica, gets abundant coverage.

Recurring topics are the varying sonic characters of different brands of tubes from different eras, comparisons between output transformers (including Tango and Tamura from Japan), and optimum bias points for the ultimate sound (to mention a very few).

WWW.AUDIOREVIEW.COM

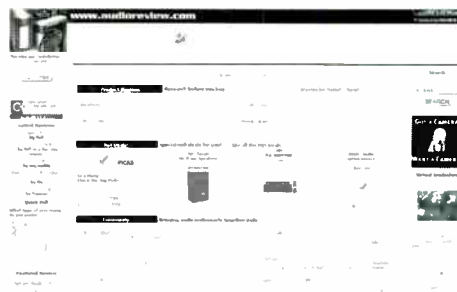
The comprehensive American site Audioreview is another useful location for researching both ready-made and home-brew hi-fi.

While the slant in this instance is more towards the commercial than the DIY, if you happen to be a fan of picking up Seventies and Eighties battleships and tweaking them, its reviews section is highly informative (although you won't find every piece of equipment ever made).

Other topics in the Tech Talk

forum include cables, tubes and vintage gear. There's a market place too, if British classifieds have failed to yield that rarity you've been hunting all these years.

Should you wish to expand your range of test equipment from a lowly multimeter to something more highly evolved (such as a first oscilloscope or signal generator), these can often be had at very rea-

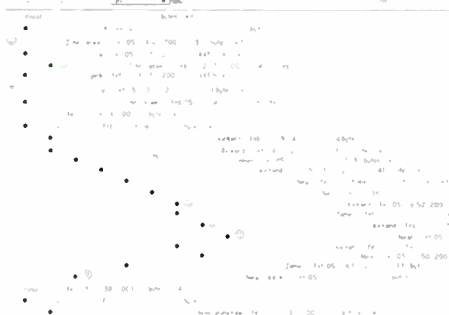


sonable prices, although it's American mains volts of course, and shipping is required. (JM)

WWW.WORLDAUDIO DESIGN.CO.UK

Closer to home is this site. Although allied to Hi-Fi World and its kits, all the same there's plenty of general discussion about valve

World Audio DIY



amplifier techniques, problems and what have you, plus loudspeakers. Ordering special parts in and from the U.K. makes it valuable for U.K. based DIYers. Some esoteric discussions take place and there's always a surprise or two. (NK)

answers, amongst which hot-rod-ding DVD players is a very popular subject. Concepts for cables and stands there are aplenty too, and the emphasis is most often on major upgrades for minor money.

If you're stuck trying to find suppliers for some of the more esoteric parts for your latest lash-up, Audio Asylum scores again, even if its bias is American.

REC.AUDIO.TUBES

Followers of the glowing bottle need look no further than this US

BOOK REVIEWS

Horns, valve circuits and the history of Leak are in this month's esoteric review bag.

Manuale Hi-Fi a valvole Schemario. Volume 2 by Macri and Gardini reviewed by Andy Grove

Don't let the Italian title put you off, this book contains virtually no text so there is no need for a translator. It is a collection of literally hundreds of audio circuit diagrams. Looking at the index, we start at



Acrosound and end up at Uesegi. Let me whet your appetite by giving a few tasters of what's in this remarkable book.

For triode fans there are circuits for the classic Audio Innovations First and second Audio amplifiers, push-pull and parallel push-pull 2A3 amps. There are the circuits for the Audio Note Neiro, single ended 2A3s, and the legendary Ongaku, single ended 211s. Audio Note will supply most of the components to build these two amps.

Equally esoteric are some of the Luxman designs using things like the 6336 double triode. How about some of the projects which have appeared in MJ, the Japanese audio magazine? There's a Loftin-White lookalike using an ECC83 and a 2A3. There are some other very esoteric Japanese circuits from Ken with push pull 2A3s, S.E. 2A3, and S.E.VT52.

For power hounds there are the complex and elegant designs from Audio Research with their unique cross coupled

phase splitter. Also take a look at the Luxman A3000 and the Michaelson and Austin M200, TVA1 and TVA10 amps.

For Mega Power there is a design from Altec using a pair of giant 813 pentodes with Xenon rectifiers for the H.T. It will seriously kick butt if you're brave enough to build it!

Fancy big classic style American amps? Take a look at Conrad Johnson, Carver and MacIntosh.

What about O.T.L.s I hear you cry? Why don't you build the MJ 40KD6 design, or the 6H13C design?

On top of all this esoterica are many of the classics like the QUAD11, the LEAK TL25 and TL50. The Bogen D30A, the Avantic Beam Echo DL7-35, the Radford STA15 and so on. Interestingly there are circuits from Loyez, using that phase splitter which had me scratching my head when a reader asked about it.

There's more! Preamps, tell them about the preamps! I can't see anyone building a LEAK Varislope or a QUAD 22, but how about a Conrad Johnson Premier 7A, or an Audio Research SP10? Or maybe a Luxman A2002? They're all in there.

The final pages contain some data for the 6336, 100 TH and 211 valves, including curves.

This book is a must buy. Keep it next to your bed!

FIRSTS IN HIGH FIDELITY - THE PRODUCTS AND HISTORY OF H.J. LEAK & CO. by Stephen Spicer reviewed by Noel Keywood

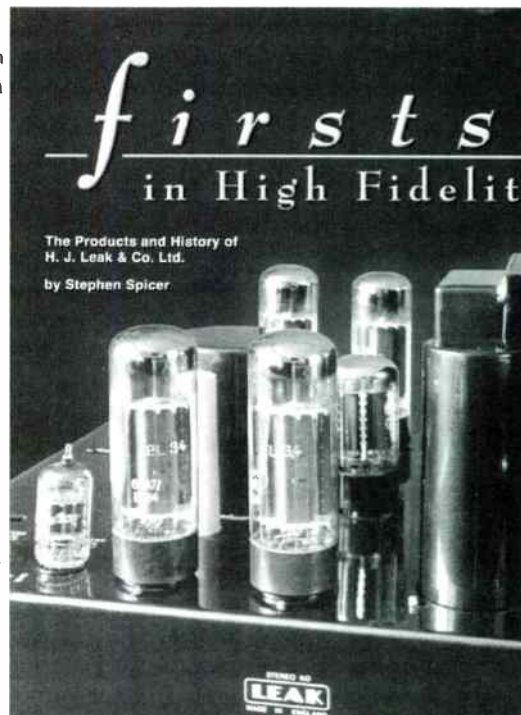
H.J. Leak & Co was a particularly interesting British hi-fi company. Amplifiers like the TL/12 are held in high regard even today and the Leak Troughline is one of my favourite tuners. I researched the company's history some years ago (Hi-Fi World, October 1996 issue) and realised in the process that Harold Leak was something of a pioneer. Stephen Spicer has put a massive amount of effort into research to come up with this definitive history of Leak. And what a great book. It was a job that needed to be done in my view.

Companies like Quad, Wharfedale and Tannoy were established at a similar time,

are alive today and better recognised, but Leak encapsulates the early spirit of high fidelity. The company produced some great products, so much so that they have better survived the passage of time than most rivals.

I kicked off my research by contacting an ex-Wharfedale employee, who put me into contact with Ted Ashley, Chief Engineer at Leak, who joined in 1944. Although retired and living in Devon Ted was very helpful. The material he sent me, notably a picture of a pre-war Leak amplifier "introduced at Olympia in 1936" also signalled that Leak were emphasising performance criteria early on. Here was a true hi-fi company, one that went on to export some wonderful products around the world.

Stephen Spicer picked up on this history and has gone to remarkable lengths to catalogue every detail, it seems, of Leak's employees, products and history. Running to 270 pages it's a sizeable work comprehensively illustrated by pictures, maps, cir-



cuits and - especially - advertisements taken from the company's history. I was surprised to see pictures of the bomb damage at Leak's Dalling Road premises. I visited the site in 1966 and took shots of the still evident damage; Stephen Spicer obtained pictures taken at the time from the Hammersmith and Fulham Archives. That's good picture research!

The Brunel Trading Estate factory had

just been demolished when I arrived. This book has original photos of the building, with the Leak name visible. No stone has been left unturned in picture research and it shows - literally. Each page carries at least one interesting picture, often many, with diversity adding interest and enriching the book.

As well as technical and commercial information, there's a strong social history too, with shots of Harold Leak and his wife, important employees like Ted Ashley and Ian Pullen, Norman Partridge (Partridge Transformers), Donald Chave (Lowther), Peter Walker (Quad) and Gilbert Briggs (Wharfedale).

By covering every aspect of H.J. Leak & Co Stephen Spicer almost moves the book into being a social and commercial history of the time. It doesn't quite match 'Setmakers' in this respect (the history of Britain's television industry), but it gets close.

Running in chronological order it even covers fully the retirement of Harold Leak and the sale of the company to Rank in 1969 for just over £1m. Gordon Provan (Rank, Celestion, TDL) was Marketing Manager at Rank at the time and contributes to this part of the book, maintaining its factual solidity.

The Leak story isn't quite over yet. Stephen brings it right up to the present day, saying the International Audio Group of Huntingdon has "plans to develop and re-launch Leak products in the near future". In brief outline, the Wharfedale and Leak brand names and businesses were acquired by Verity Group. They were sold on, along with Quad, to Sencor, a Chinese company run by the Harvard educated Chang brothers. If the Quad valve amplifier we reviewed recently finds enough of a market then the new Leak designs may well see the light of day. There is a connection back to our own valve amplifiers, through their designer, whose name appears close by..

Whether Leak will ever be revived is uncertain. In the meantime, this book offers one of the best historical accounts I have read of Leak, and of any hi-fi company. It's an absorbing read, whatever your interest might be, dealing strongly with the people involved to make this a very human story, rather than just a historical record. I hope we see more histories like it in the future.

La Progettazione Dei Diffusori A Tromba (Horn Loudspeaker Design).
by Dinsdale and Viappiani
reviewed by Andy Grove

This Italian book and "Schemario", also reviewed here, makes me wonder if I'm living in the wrong country! Obviously, these Italian guys have a true passion for Hi-Fi, and by Hi-Fi I don't mean dull, grey sounding black boxes and six-inch-woofer-plus-

dome-tweeter speakers. I think it must be the climate and food. As I sit here and look out of my window into the English winter gloom I dream of sunny Italy...

Onto the review. "Horn Loudspeaker Design" is a bilingual book written in both Italian and English, with the pages divided into two columns, Italian on the left, English on the right. Presented first is a reprint of the articles written by Jack Dinsdale for *Wireless World* in 1974, these articles cover the essential theory used in horn design culminating in two, practical domestic horn designs.

For those not familiar with the Dinsdale articles, they begin with a short history of acoustic horn design and usage, from primeval man and his conch-shell through acoustic gramophones to modern day horn speakers using electro-dynamic drivers.

From here we meet the problem of which flare contour to use, conical, exponential, tractrix and so on, and then go onto the topic of mouth area. There is a special discussion regarding the shape of the wavefront as it passes along the horn, leading Dinsdale to the special case of the tractrix horn which assumes a spherical wavefront. Also covered in the first of the articles are the loading volumes at the front and rear of the driver and their effect on frequency response. At the end of the first article is a reference section.

The second article has a more practical slant. For example, using the horn as an acoustical filter and the integration of multi-way horn systems, also the importance of horn positioning in relation to bass loading performance. There are tables giving mouth and throat dimensions for various loadings and drive unit types.

Practical advice is given as to the construction of horns, selection of materials and construction techniques.

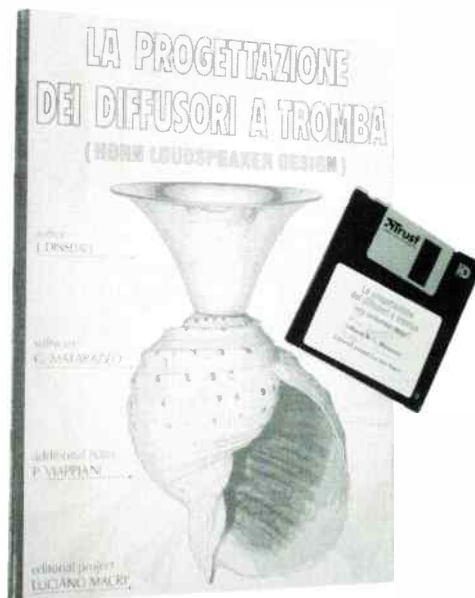
Finally, two example designs are worked through using the formulae and methods derived earlier in the article. One is a small folded horn and uses an inexpensive full-range drive unit, and the other is a large multi-way horn using drive units from the KEF Constructor series. There are drawings of both designs.

After Dinsdale's articles comes a discussion of the articles by Paolo Viappiani. This is a "question and answer" discussion of whether the articles are still relevant, given the work by modern acoustic engineers. Viappiani also gives some more reference material which came after Dinsdale's work and which may be of interest.

Towards the end of the book are plans, drawings and internal photographs of a great number of horn speakers. These designs are from University Audio, Lowther (such as the Bicolor, Classic, Accolade,

Academy, Medallion and Acousta) and Mauhorn. Using these plans you can build your own horn speaker. I'm not sure of the availability of University Audio drive units but Lowther drive units are definitely available. Some of the designs are horrendously complex and should only be attempted by the expert woodworker, but some would be fairly easy to construct at home. I suppose one could even get a local carpenter to make the enclosures for you, or at least cut and shape the panels.

Supplied with the book is a software floppy disc for those who would like to design their own horn speakers. There are two versions of the software, one English and one Italian. This software utilises the equations presented by Dinsdale and others to calculate the optimum horn for a



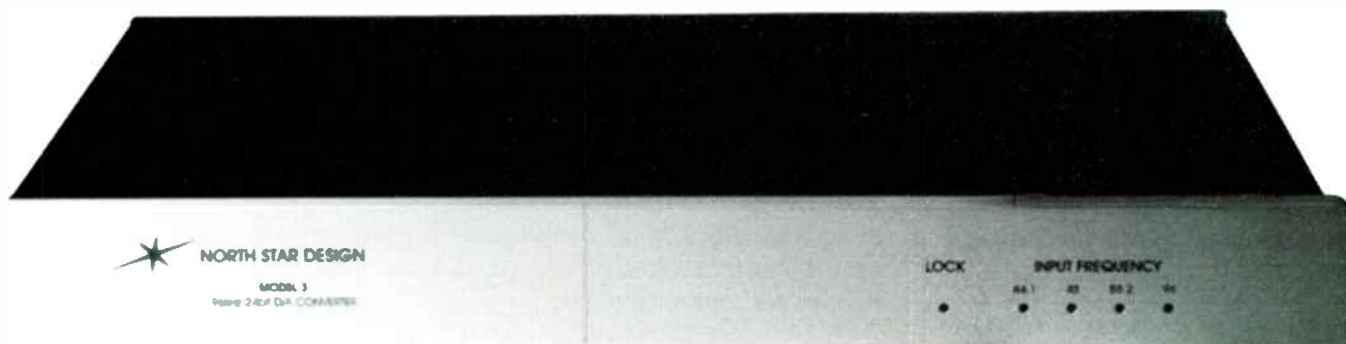
given driver. It speeds up the process enormously. It also has a handy feature whereby it will calculate the tapered conical sections of a constant width horn to assume the required flare. The package is easy to use and there are instructions in the book in case you get stuck. If you read Dinsdale's articles you will already have a pretty good idea of what's going on anyway; the software takes the pain out of it.

Overall, this book is excellent. You may already have the Dinsdale articles but I bet they are dog eared photocopies like mine. And with this book you get speaker plans and design software. There are plenty drive units around which could be used in horn systems. The craze for in-car audio has produced some great full range drivers, both twin-cone and multi-way. Or you could go the whole hog and use a mega unit from Lowther, Pioneer or Fostex, the latter two are available over the internet from Japanese suppliers.

If you are daring enough to take the plunge you could build yourself a speaker which will make the stuff in your local Hi-Fi shop look and sound futile.

A STAR IS BORN

Jon Marks experiences CD's silver lining with the Model 3 DAC kit from North Star Design.



Digital kits probably come alarmingly close to the top of the complex-ometer in most constructors' minds. Static-sensitivity and surface-mount parts the size of a stamp with more legs than a millipede convention loom in nightmares of unbuildability. The reality can be somewhat different though, as North Star Design's Model 3 DAC illustrates.

This converter can handle inputs from 33kHz up to 96kHz thanks to Crystal's CS8414 receiver chip and a pair of Burr-Brown PCM-1716 D-to-A chips. Yes, all three are SMD (surface mount) components with some very closely spaced leads, but all three come ready-mounted on the single PCB.

That's the hard part finished. All the other components are leaded, and anyone with a little soldering experience behind them should have no fears about attempting this kit.

MR DIGITAL AT AUDIO ANALOGUE

The name North Star Design may not ring too many bells with UK kit purchasers – it is, after all, an Italian company. On the other hand, Giuseppe Rampino might cause some slight peeling; this is the man who created Audio Analogue's respected Maestro CD player.

Hoping I might find in the Model 3 the same sort of neutral, open and musical sound manifested by Audio Analogue's offerings as a whole, I opened the sturdy packaging eagerly and checked through the contents.

The manual itself is a humble photocopied item running to 14 pages of A4. Each of these is divided into a pair of columns, the one on the left explaining

everything in what is doubtless perfect Italian, the one on the right doing the same thing in a form of 'ltanglish' which will occasionally have you grinning. Mind you, poking fun at home-spun translations is hardly fair, or politically-correct in Greater Europe.

As ever, once you've read the manual cover to cover (and discovered a couple of omissions), the next stage in readying yourself prior to soldering is to check that all the bits in the individual parts lists are actually to be found in their respective bags.

Another point to consider before populating the PCB is that it's through-hole plated – there are pads on both sides of the board. North Star recommend soldering both sets of pads to ensure the best joint quality. The disadvantage of this modus operandi is that it makes removing incorrectly-located parts more difficult than with a single-sided board, and increases the risk of component damage due to overheating.

If you're mulling over future upgrades, you might want to plan ahead and not solder all the way through the board, or put in pins to solder to, or be prepared to cut parts off the board before fitting their replacements.

BOARDING PARTY

Having bolted the four stand-offs to the PCB, I began laying out the resistors. Forming the leads is easily done with a pair of needle-nosed pliers. The full-length leads can then be slipped through their holes, bent back parallel to the underside of the board, and trimmed with a small pair of

side-cutters.

The manual suggests cutting the leads to length before fitting, but using cutters is considerably faster and allows the resistor to be held in place for easy soldering (bending back a pre-trimmed lead on a small solder pad is not fun!)

While R1-R46 were taking up residence, I spotted a cut track on the top-side of IC14's spot. Giuseppe confirmed this is a little post-production revision of the layout and not a duff board.

Unless you read the instructions first, you might also be puzzled by silk-screening for both R44 and RV1 (neither of which appear on the resistor list). A foot note explains they are one and the same (and that this variable resistor is used to trim



Parts bags with quality teflon insulated RCA sockets, resistors, etc

the crystal oscillator circuit during set-up).

Mounting and soldering the resistors was uncomplicated. The sockets for ICs 12, 13 and 14 came next, along with the three rectifier bridges.

If you know you're not going to be tweaking the Model 3 and you have no fears regarding soldering chips, I'd suggest that you leave out these sockets. Their main purpose is to allow the power supply voltages of the finished DAC to be checked without the chips inserted. These sockets

introduce extra contact resistance and, due to their height, increase the area of any current loops which might resonate and radiate at RF frequencies (see Guido Tent's article on RF layout techniques in a past Supplement, or Audio Crafter's Guild at www.galstar.com/~ntracy/ACG/).

To tweak or not to tweak will also dictate how you approach the rectifier bridges. No substitutions planned? Mount these parts flush with the PCB. On the other hand, if you feel the call to modify, give them 4mm-5mm clearance so they can be snipped off later.

Up next were more diodes in discrete form, a slew of 100nF Wima polyester caps doing duty as bypass caps on the numerous electrolytics, some tiny ceramics, and finally a sprinkling of tantalums.

MANUAL LABOUR...

While the bulk of the caps went onto the board without a fight, the markings for a couple of the tants hadn't been printed on the board, and it took some brief track-tracing to confirm the correct polarity.

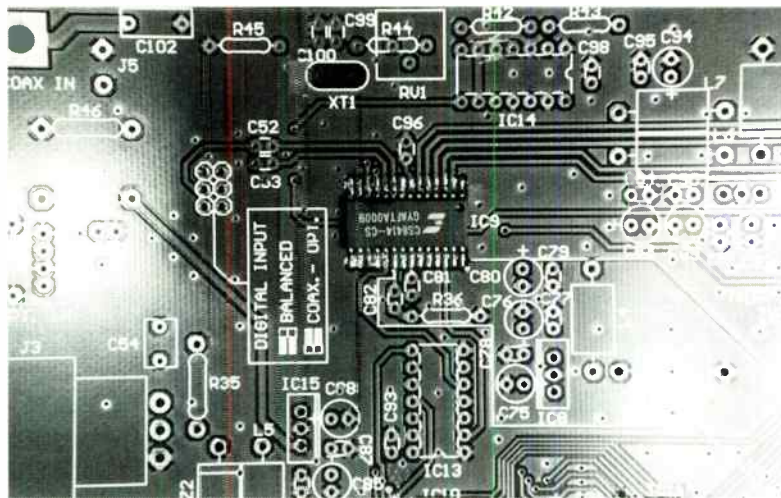
The 220uF electrolytics were also spec'd in the manual as 50volts. In fact, they turned out to be rated at 25volts, and had a smaller lead pitch than their solder pads. None of the above proved a problem, but it did detract from the otherwise slick, professional feel of the kit.

Once the ten regulator ICs had been placed, along with remaining sundries like the FETs in the discrete output stages, it was time to mate board to chassis. Or at least that was the theory. There were a pair of very unfilled markings on the PCB with C101 and C102 inscribed therein. In the parts list, these were described as 2n2 1kV polypropylenes. Mine were 1n5s. To top it off, nowhere in the assembly instructions did these caps even get a look in. Another e-mail left swiftly for Italy, and the reply confirmed these blue box caps should be soldered in with everything else.

After sorting that puzzle, I scraped away the paint around each of the four board-mounting holes on the chassis, and slipped the eye of the earth lead's tab under the left rear stand-off. The manual also urges you to insert the XLR (without soldering it in place) before PCB and chassis come together. I found this made life unnecessarily tough as the board slipped into place. It's considerably simpler to fit the XLR with the PCB already in situ, held

loosely with its four screws untightened.

The XLR socket comes with two countersunk holes to allow it to be fixed to the chassis, but in this instance, it is secured with its lower lip trapped between the rear of the chassis and the PCB. This sort of no-bolt fixing doesn't generally bode well for long-term reliability, as the



Crystal's CS1814 input receiver and, to the right, input jumpers which select input socketry

solder connections take a pounding every time an interconnect is plugged or unplugged. I would prefer to have seen the XLR properly fastened to the chassis.

The next minor but annoying hiccup involved the fascia's LEDs. They were all there, but the bi-colour one which indicates signal lock was supposed to have a kinked lead, which would tell me the correct pads to solder to. However, the three wires sticking out of mine were all straight as arrows. Seeing as the worst that could go wrong would be green instead of red showing no-lock, I just flipped a coin and soldered.

...AND MORE MANUAL LABOUR

So far, it was definitely a case of Kit: 1, Manual 0. I girded my loins for a final assault where my trusty iron would finish off the connections to the mains transformers. This boiled down to series-wiring the two dinky donuts to the rocker switch on the back panel, and then linking this (and the earth lead) to the RF filter built into the IEC socket. Piece of cake (even if the diagram shows the blades of the switch at a confusing angle).

At this point, I heaved a sigh of relief and vowed to burn the manual once the Model 3 was working properly. However, during one last run over the board before firing it up and checking some voltages, I noticed the empty spaces where the four Tranzorbs (transient absorbers) were sup-

posed to be. Hmm, I was gearing up to offer the author of these instructions a hearty breakfast, a last cigarette and a blindfold.

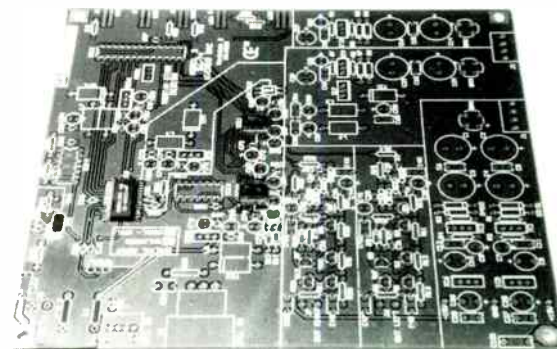
I soldered the Tranzorbs in and managed to stop myself mercilessly shredding the manual as soon as I'd finished. Instead, I carried out the requisite PSU checks, confirmed all was OK (apart from two transformers which seemed to be duetting in Hertz's most famous work, the 50th), and plugged the remaining ICs into their sockets. Another flick of the mains switch and although I was half expecting a big BANG, surprisingly there were no fireworks, just music. Success was mine.

The sole fine tuning was to persuade the Lock LED to glow green, and the appropriate frequency indicator to light up, by adjusting the potentiometer in the crystal circuit as a CD is spinning in the matching transport. This is as simple as it sounds, and I soon had the output of a modified Pioneer DV-505 flowing through the Model 3.

Now it was time to screw the lid in place, enjoy a well-deserved cup of tea, and admire the end-product of all that placing and soldering.

SQUARE ONE

Without any burn-in time under its binary belt, the Model 3 sounded as you might expect – clearer, more detailed and more realistic than the DV-505's on-board con-



The main PCB, unpopulated except for three SMD packages, input receiver and D/A converters

verter, but not by much, and rather timid and constrained with it. Giuseppe had talked in terms of a 40-60 hour run-in period, so the Pioneer and partner were left to repeat for a day or two.

Over that time, the presentation acquired more body, more liquidity, and left behind less appealing traits like a mild sibilance and a plodding way with rhythms.

As the sound filled out, the North Star's pedigree became increasingly evident on CDs such as the compilation, Bob

Marley And The Wailers – The Early Years. One of the most noticeable improvements was the clarity with which some of Mr Marley's more mumbled lyrics came through the bucket-bottom recording quality of many of the tracks. Then there was the swelling power to his voice which lent it real substance, and the lucidity of the soundstaging which meant backing vocals and instruments were far more easily picked out than on the '505.

THE GOLDEN MEAN

As the days went past, the North Star proved it was perfectly capable of striking that fine balance which exists between out-and-out transparency, detail retrieval and crisp dynamics on the one hand, and natur-

ally across the land, but it has a sense of atmosphere that only the better-engineered digital gear can capture. Play this disc through mediocre machinery, and the lack of musical expression and involvement will leave the other-worldly vocals and extremely sparse arrangements sounding like random clips from the cutting room of Name That Tune. There was no such shortfall in the North Star's rendition, the plucked koto strings, shakuhachi flute and bizarre singing dovetailing neatly into a spell-binding performance.

Such a stalwart it's graduated at the school of Lift Music, Vivaldi's Four Seasons nonetheless enjoyed a freshness and vivacity which made for a truly engrossing listening session. The Model 3 accurately and

providing component upgrades (caps, resistors and a third PSU transformer). They have also noted the effect different mains cables can have on the sound (which is why none is supplied with the kit).

In addition to the substitutions published on the web site, there's a couple of others well worth sampling. The 11DQ10 is a very major upgrade over any normal discrete rectifier diode, and a rating of 1.1A at 100V means it can be used in a wide range of equipment. Then there are the regulators. The next step up from the standard types would be Linear Technology's versions with their higher spec. If you wanted to go all the way, there are bespoke devices from Audiocom, Acoustic Precision, etc. These two also

provide a range of clocks, as do Dutch firm LC Audio and Trichord Research (the Model 3's crystal runs at 6.144MHz). Finally, there's Noise Blocker visco-elastic spray from Rockford-Fosgate, available through car audio shops for about £23 for a 600ml can. Simply spray

on one or two fine coats and listen as it cures over a fortnight. The improvements are not subtle!

QUE BELLA!

Viewed as a kit, the Model 3 gets marked down for poor instructions, which really should be considerably better. Viewed as a completed DAC, the Model 3 is very good value for money. Instead of the uninspiring and frequently uninvolved sounds emitted by too much digital equipment, the Model 3 does a real 'heart and soul' job of music-making. It scores convincingly in all the 'technical' areas – imaging, sound staging, detail, etc - and then tops off this attractive package with a genuine ability to coax the full emotional content from a recording.

North Star Design Model 3

300 Euros + VAT

North Star Design

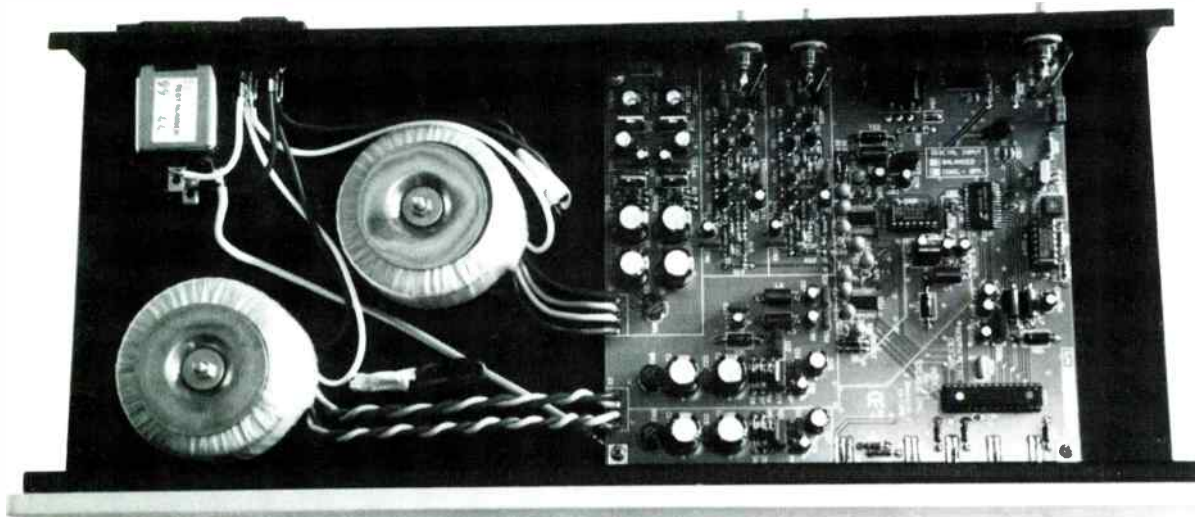
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56010 San Martino Ulmiano,

Pisa,

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www.northstar.it



The primaries of the two transformers can be wired in series or parallel for 220V or 110V, hence the taped-up flying leads

ally tonal colour, musicality and cohesion on the other. A lot of hi-fi struggles to find a workable solution to this problem, and tends to fall into one of two camps – 'fast' (used pejoratively to describe light bass and plenty of treble), hard and overtly detailed - or soft, rolled off in the treble and not very revealing.

One disc which will swiftly show if any given piece of equipment is a 'camper' is Alannis Morissette's Jagged Little Pill. Played through brighter equipment, this album can take the top of your head off, all of its plentiful rough edges exaggerated. Too much of the softly-softly approach fails just as miserably, the songs lacking the required impact and venom as their vital raw energy has been sapped. Get it just right though, and you'll have a smile on your face from track one through to the acapella tacked on after track 13. Here, Ms Morissette's vocals were incisive and suffered from no shortage of bite, but since the Model 3 wasn't adding any extra sibilance of its own, they never overstepped the line. The same went for 'You Oughta Know', where cymbals and vocals were powerful but controlled above the taut, propulsive bassline.

Koto Music Of Japan is probably not a disc monopolising transport drawers

securely placed the various sections of The English Concert within a soundstage where fine width and depth were joined by a decent sense of height, not a forte for most converters. The tonal balance was equally satisfying, with none of the smearing which blends instruments together into an amorphous lump of noise.

UP THE REVOLUTION

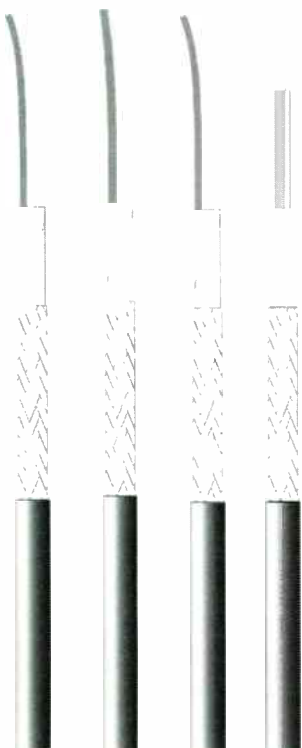
With a 24/96 disc (Red Rodney's 1957 jazz album on Classic Records) whirring inside the DV-505 at high speed, the Model 3 reacted in a very predictable manner. Basically, there were all the fundamental qualities it had shown with 44kHz recordings, but now much more obvious thanks to the higher resolution format. Transparency, detail, dynamic range and impact all benefitted massively, which only served to heighten the musical enjoyment the North Star conveyed in the conversion process.

ELECTRONIC ESCALATOR

Of course, gifted DAC that the Model 3 is, no self-respecting DIYer is likely to be able to resist the urge to tweak for long. As a starter in the right direction, North Star publish a number of suggestions for com-

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NEW DEMONSTRATION ROOM NOW OPEN AT 12A SPRING GARDENS, NEWPORT PAGNELL,

KEL84 VALVE INTEGRATED AMPLIFIER KIT

This is our brand new low cost, beginner level amplifier kit, featuring the popular a pair of EL84 valves in push pull configuration per channel, providing 15 watts into an 8 ohm load, plenty for most medium sensitivity loudspeakers. The output transformers are Ultra Linear, keeping distortion down to a minimum. Up front we have the ECF80 valve a extremely smooth pentode/triode tube. The Kel84 has an extremely low hum level, to solid state standards. The kit is based on a printed circuit board. We have given the kel84 a high class look with a 3mm anodised front panel and our famous chrome custom made knobs. The amplifier has the capacity to receive 5 line level inputs, plus one monitor input, with a tape output included, all controlled from the front panel. Both the phono sockets and 4mm banana socket speaker terminals are the gold plated. The Kel84 mains switch is, positioned at the rear of the amplifier and is

easily accessible, the mains is received via an IEC lead, an earth post is also positioned at the back.

This kit is suited to the beginner in that the instructions now include pictures as well as diagram, making them very easy to follow. At a UK price of £250.00 all inclusive you cannot ignore this kit. Simon Pope says, "The quality that can be gleaned from this amp is a fine introduction to the joys of the valve sound. The KEL84 will highlight all the intricacies and depth of detail in your favourite recordings whilst retaining a warmth and fullness. This combination of both detail and warmth is almost the exclusivity of pure valve amps and is rare at this price point." The Kel84 weighs in at 10kg, External terminals with valves are 300mm(w) x 270mm(d) x 150mm(h).

£250



KIT88 VALVE INTEGRATED AMPLIFIER KIT & KAT88 VALVE POWER AMPLIFIER KIT

Here is the amazing KIT88. The circuit is similar to that of the ever popular KEL34 with a few changes to incorporate the Tesla, JJ branded KT88 power tetrode. This is a pure Class A push-pull design providing 36 watts into an 8ohm load. Gary Devon has come up with a gem of an output transformer (E/I). Combined with the KT88 it offers a virtually unmatchable result for a valve amplifier. Frequency response measured 11Hz to 75kHz, separation 71dB, noise 98dB, sensitivity 400mV and distortion 0.03%. "As valve amplifiers go, the KIT88 is one of the best measured performances I have ever come across", says Noel Keywood. Jon Marks says, "The KIT88 pulled a series of surprisingly fast, meaty basslines out of its trickbag when dealing with Suzanne Vega's Nine Objects Of Desire album. As if

this wasn't enough, the mid and treble were nice too - cymbals had a deliciously natural, golden shimmer without sounding soft, and vocals were extremely transparent and crisply defined. KIT88 didn't hang around when it came to exploiting the virtues of its four output valves on numbers such as 'Leaves' and 'Suspect Sustain' from Cirrus' Land's End Jazz CD. Saxophone had a wonderfully smooth, realistic character, and acoustic guitar mixed speed with harmonic richness to very impressive effect. Asian Dub Foundation and Moloko showed no sign at all of the sluggish, woolly bottom-end and poorly-delineated bass beats that most valve amps are to blame for. Which makes the KIT88 an all-round, high-end bargain." Weight 16kg, external dimensions with valves are 330mm(w) x 300mm(d) x 190mm (h).



£425

KaT88 upgrade kit now available £140

KaT88 VALVE POWER AMPLIFIER KIT



£440

KIT88 upgrade kit now available £150

KIT88 VALVE INTEGRATED AMPLIFIER KIT

ALL NEW SERIES II MODULAR PRE-AMP KIT

The PRE-II is a valve pre-amplifier with six inputs, tape monitor and two sets of output sockets. It utilises a high quality line driver transformer and x5 gain. The PHONO-II is a dedicated valve phono stage that incorporates a step up transformer for MC users. Finally,

PSU-II is a power supply unit that feeds both the PRE-II and PHONO-II.

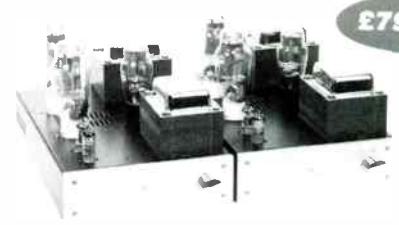
Power Supply Unit (PSU-II)	£175.00
Pre-amplifier (PRE-II)	£175.00
Phono Stage (PHONO-II)	£100.00
Moving coil step-up transformer	£70.00



300B PSE MONOBLOC KIT

Our Parallel Single Ended amplifiers offer the ultimate sound quality, featuring two of the beautifully linear 300B directly heated triode in the output stage (per monobloc) pushing out 20 watts into an 8 ohm load. At the front we have a 6AU6 pentode and the famous ECC82 as the driver valve and the kit utilises a 5U4 rectifier valve for the power supply in combination with a 10H choke, giving an extremely quiet supply. For the mains and output transformers we have used the E/I type. Feedback is

switchable for all those purist out there and the kit is totally hard-wired. For those that require valves we provide the superb Tesla 300Bs, Russian 5U4s and European 6AU6s & ECC82. Simon Pope says, "Not to put too fine point on it, the sound these monoblocs create is among the finest that can be encountered in hi-fi." Our 300B PSE kit bears an affordable price of £795.00 (UK price) excluding valves. Each monobloc weighs 23kgs., external dimensions with valves: 25cm(w) x 38cm(h) x 22cm(d) per monobloc.



£795.00

KEL80 MONOBLOC AMPLIFIER KIT

Following the success of our budget KEL34 40watt kit amplifier, we have come up with a 'bigger brother' design. The output stage utilises two pairs of TESLA EL34 pentodes in parallel-push-pull mode, allowing KEL80 to turn out 80 watts into an 8ohm load. Heading up the input stage we have the wonderfully linear Russian 6AU6 working into an American 5687 phase-splitter. KEL80's output transformers are 4ohm and 8ohm tapped. With an input sensitivity at

around 380mV for full output, it will happily partner both passive and active pre-amplifiers. It is easy to assemble. Simon Pope says, "The proof of the pudding is in the eating and the KEL80 is a feast for the ears, with solid bass attack, lightning fast reactions, that emphasises musicality as well as power, at 590.00 GBP a pair, a definite valve winner. Each monobloc weighs 12kgs., external dimensions with valves: 14cm(w) x 8cm(h) x 43.5cm(d).



£590 A pair

HD83 VALVE HEADPHONE AMPLIFIER KIT

The HD83 is our new headphone amplifier, a beautifully simple design using Mullard ECL83 valves, a triode and power pentode housed in the same envelope. It works directly from any source, be it CD, tape, tuner etc., or from an amplifier's tape out or pre-amp sockets. The circuit utilises high specification output E/I output transformers that will drive any headphone load from 16 ohms to over 300 ohms depending on how the secondaries are

wired up. The HD83 is a single-ended design with the power pentode wired up in triode configuration for that added purity and is a quiet as a mouse. For sound quality Jon Marks says, "The bass is punchy and controlled without being artificial, while treble has the crispness of the best solid-state, with the tonal purity, delicacy and speed associated with valves. External dimensions 18cm(w) x 30cm(d) x 8cm(h) weight 4kg.



£175

parts directory

mains transformers & chokes

Kel84 mains transformer
1.5 inch stack, 90mm(h) x 80mm(w) x 95mm(d) drop through fitting with zinc cap.
Secondaries: 0V-240V 300mA, 3 15V-0V-3 15V, 5 5A, suitable for 120/240V operation

KIT88/KaT88 mains toroidal transformer
120mm dia x 60mm(h)

Secondaries 195V-0V-195V, 450mA/0V-27V, 100mA/3 15V-0V-3 15V, 9A, suitable for 120/240V operation

300B PSE mains E/I transformer
130mm(h) x 95mm(w) x 115mm(d) drop through fitting with zinc cap
Secondaries 380V-0V-380V, 180mA 150-0V-150V, 25mA/0V-5V, 1 2A/0V-5V, 1 2A 0V-5V 3A, 3 15V-0V-

3 15V, 0 4A suitable for 120/240V operation

Kel80 mains toroidal transformer (encapsulated)
130mm dia. x 65mm(h)
Secondaries: 195V-0V-195V, 390mA/0V-27V 100mA/3 15V-0V-3 15V 7.5A suitable for 120/240V operation

HD83 mains toroidal transformer
80mm dia x 35mm(h)

Secondaries: 0V-165V, 75mA/3 15V-0V-3 15V, 1A, suitable for 120/240V operation

PSU-II mains toroidal transformer
80mm dia x 35mm(h)
Secondaries: 0V-270V, 60mA 0V-10V, 2A, suitable for 120 240V operation

TRANS1 mains toroidal transformer
95mm dia x 50mm(h)

Secondaries 0V-370V 150mA/0V-6.3V, 3.5A 300B E/I choke 65mm(h) x 70mm(d) x 80mm(w) open frame fitting, 10H, 180mA.

Kel84 E/I choke
0.5 inch stack, 40mm(h) x 35mm(d) x 70mm(w) clamp fitting, 1H, 250mA

PSU-II E/I
40mm(h) x 35mm(d) x 70mm(w) clamp fitting 15H 20mA

KIT34 mains transformer
2.5 inch stack, 120mm(h) x 115mm(w) x 95mm(d), drop through fitting with zinc cap. Secondaries 365V - 0V - 365V, 300mA 0V - 5V, 6A 3 15V - 0V - 3 15V, 7.5A Suitable for 120/240V operation

KIT34 choke
1.25 inch stack, 65mm(h) x 105mm(w) with fitting holes x 60mm(d), clamp fitting, 2.5 H, 350mA

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KIT34 VALVE INTEGRATED AMPLIFIER

The Kit34 is a 32 watt stereo valve integrated amplifier. Featuring a pair of EL34s, in push-pull mode, per channel, with an ECF80 pentode/triode) as input/phase splitter. The power supply is valve rectified (2 x 5U4) incorporating a heavy duty choke to achieve exceptional smoothing. The output transformers are 14% Ultra Linear tapped to keep distortion down to its lowest level and the kit is totally hard wired utilising 3 tag boards. It offers 5 line level inputs, plus, a tape in

and tape out, all controllable from the front. As you can see the Kit34 looks amazing, a true classic in the making. Simon Pope says, 'The Kit34 carries a true valve signature, it has everything you could ever want and more from a tube amp, a absolute winner. Weight 22kg. External dimensions with valves fitted - 390mm(w) x 360mm(d) x 210mm(h)



NEW KIT

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Our mini-marvel uses an Audax carbon fibre bass/midrange unit, married to the world's most advanced tweeter, the piezo-electric gold dome HD3P from Audax. KLS10 offers high performance from a small package. The main speakers are designed to work alone, or with a dedicated subwoofer to extend their bass. Alone, they are suited to near-wall mounting and can be tuned by port adjustment to suit personal taste and

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Drive units only £358.00



£394

KLS10 GOLD SUBWOOFER

Designed to compliment KLS10 Gold stand mounters by providing a deep and open bass. The subwoofer is inexpensive, easy to build, comprising a simple crossover network to a high quality 8 inch Aerogel dual voice coil unit. A must for all KLS10 Gold customers. Sens. 89dB,

volume 25 litres, external dimensions 28cm(w) x 43cm(h) x 34cm(d).
DRIVE UNIT & CROSSOVER KIT £149.95
Drive unit only £71.00



£149

KLS9 TWO WAY FLOORSTANDER

Here's a storm for you - KLS9, with its BB4 alignment bass cabinet and Audax High Definition Aerogel 8in bass/midrange unit. Designed by Noel Keywood to possess optimal bass damping and a clean step response. Aided by a teensy bit of bass lift, KLS9 really thunders: it will re-arrange your furniture. But it does not waffle, falling silent when there's no bass in the music. Aided by a high power 1in fabric dome tweeter, KLS9 is

detailed, evenly balanced and images superbly. It is an easy 12ohm load and is 88dB sensitive. For amps up to 60W. Easy to build and great for beginners. Internal volume 70Ltrs, 18m MDF external dimensions 25cm(w) x 93cm(h) x 40cm(d).
Drive units & crossover kit £230.00
Drive unit pack £160.00



£230

KLS3 Gold Mk II

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KLS3 Gold uses the latest version of Audax's innovative oval gold dome piezo electric tweeter, giving it the sweetest and most extended treble. Married to a 4in. carbon fibre cone midrange driver for neutral and clear reproduction, and a powerful 8in. bass driver for superb depth, this is our top-of-the-line reference speaker. Sensitivity

90dB at 1W/1m, 25mm MDF, internal volume 60Ltrs, external dimensions 26cm(w) x 100cm(h) x 35cm(d).
Drive Unit & Crossover kit £575.00
Drive Unit Pack £450.00



£575

Upgrade your KLS3s to Gold status. Includes latest oval gold dome piezo tweeter and all components.

£330

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- a. BLACK GATE 220uF, 50V electrolytic
- b. BLACK GATE 4700uF, 16V electrolytic
- c. JENSEN 0.47uF, 630V paper in oil capacitor
- d. LCR 22.5uF 440Vdc polypropylene capacitors (wire leadouts radial) 100mm(h) x 45mm diameter
- e. ANSAR 22.5uF 630Vdc polypropylene capacitors (wire leadouts radial) 85mm(h) x 45mm diameter

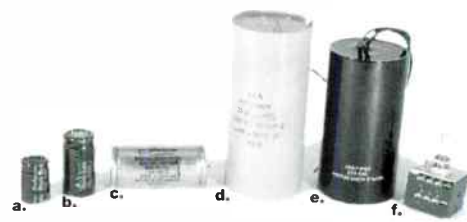
- f. ALPS blue audio grade 50K or 100K dual log potentiometer 8.5mm diameter fitting hole

Kit88 upgrade kit

- 4 x Jensen 0.47uF, 630V
- 4 x Black Gate 220uF, 50V
- 2 x Black Gate 4700uF, 16V
- 1 x 100K alps pot

KaT88 upgrade kit

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- Kit88/Kat88 E/I push-pull output transformer**

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- KIT34 E/I 14% tapped Ultra Linear push-pull output transformer**
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- output 34watts, max current 150mA, valves EL34, 6L6, 6CA7
- Kel80 E/I parallel-push-pull output transformer**
95mm(w)x115mm(l)x133mm(h) Primary-secondary 4 6K - 8 & 4ohms, max o/p-80watts, max current-250mA valves-EL34, 5881, 6L6
- HD83 E/I single ended output transformer**
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- Pre-II E/I driver transformer**
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- printed circuit boards
- Kel84 Printed Circuit Board**

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- Kel84 Printed Circuit Board**
140mm(w) x 310mm(l) x 2.4mm(d)
- Kel80 Printed Circuit Board (a pair)**
120mm(w) x 215mm(l) x 2.4mm(d)
- HD83 Printed Circuit Board**
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- 1.6mm(d)
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- Tag board**
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 Kel84 valve integrated amplifier kit (without valves)
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 PRE II pre-amplifier module
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 KiT88 Valve integrated amplifier kit (with valves)
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 KaT88 Valve integrated amplifier kit (with valves)
 KaT88 Valve integrated amplifier kit (without valves)
 KaT88 upgrade kit
 HD83 Valve Headphone amplifier kit (with valves)
 Kel80 Valve Monobloc amplifier kit (with valves)
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 Kel84-K240/K120 (without valves) L L L L
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 PRE - II L L L L L
 PHONO II L L L L L
 MC - step up (pair) L L L L L
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 KiT88 upgrade L L L L L
 KaT88-K240/120 (with valves) L L L L L
 KaT88-K240/120 (without valves) L L L L L
 KaT88 upgrade L L L L L
 HD83-K240/120 (with valves) L L L L L
 Kel80 -K240/120 (with valves) L L L L L
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 Kel80 mains toroidal transformer(encapsulated)
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 TRANS1 mains toroidal transformer
 300B PSE E/I mains transformer
 KiT34 E/I choke
 Kel84 E/I choke
 300B PSE choke
 PSU-II E/I choke
 KiT34 E/I UL push pull output transformer
 Kel84 E/I push-pull output transformer
 KiT88/KaT88 E/I push-pull output transformer
 Kel80 E/I parallel-push-pull output transformer
 HD83 E/I single ended output transformer
 Pre-II E/I driver transformer
 300B PSE E/I output transformer
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 Tag board 2 x 16 connections (hard wiring)
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 300B - choke
 PSU-choke
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 Kel84 - O/P T (pair)
 88 - O/P T(pair)
 Kel80 - O/P T(pair)
 HD83 - O/P T(pair)
 PRE-II - driver T(pair)
 300B - O/P T (each)
 Kel84 - PCB
 88 - PCB
 Kel34 - PCB
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 PRE-II - PCB
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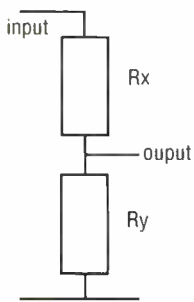
D.I.Y. LETTERS

Neville Roberts shows us how to build a quality attenuator and even offers formulas on a special website. Mick Tracey has an overheating 5881 and wonders why - Dr John to the rescue!

ATTENUATED

Following the recent successful upgrades to various resistors and capacitors in my WAD K5881 Mk II power amp and WAD Series II Modular Pre-Amp, I decided to turn my attention to the volume control. Although there is a quality Alps Blue supplied with the Series II kit, a friend of mind achieved significant improvement by replacing the Alps Blue in his KLPP1 pre-amp with a stepped attenuator.

The first step along the track was to locate a supplier of a suitable switch. I found one UK based supplier who could provide a 23-way, 2 pole, make-before-break



(or 'shorting') rotary wafer switch with end stop for just over £55. This constitutes the bulk of the cost, as decent quality metal film resistors cost 7p +VAT from Maplin, so the cost of the finished unit will still be less than half the cost of a commercial product.

The next stage was to calculate the value of the resistors for each step. In Mr. White's original article, he stated that the attenuation for a given pair of resistors comprising the potential divider (above) could be calculated from:

$$A = -20 \log \left(\frac{R_y}{R_x + R_y} \right)$$

where $R_x + R_y$ is the total value of the equivalent potentiometer, R_y is the sum of all the resistors in the chain to give the attenuation at a given point and R_x is the remainder of the resistor chain. What we actually want to calculate is the value of each individual resistor in the chain to give us the range of attenuations required. Rearranging the above equation, we get:

$$R_y = A \cdot R_t \quad (R_t = R_x + R_y)$$

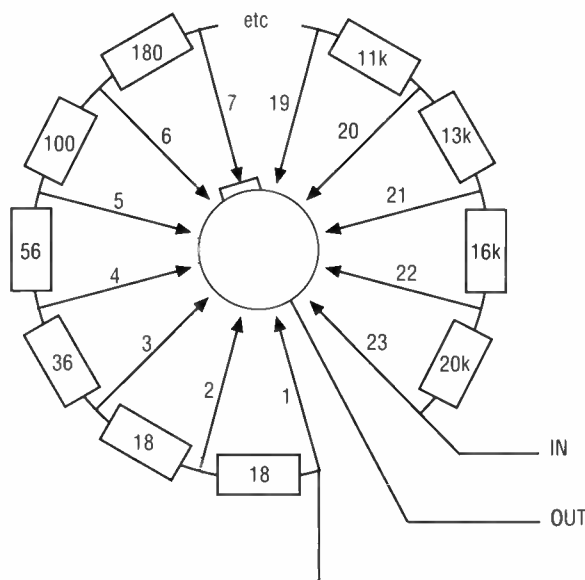
where R_t is the total value of the attenuator ($R_x + R_y$) and A is the attenuation, shown simply as a ratio for clarity. Where A is in dB it must be divided by 20 and the anti-log found.

For the Series II pre-amp, a total value R_t of 100kohms is required. You, of course, may require a different value to suit your amplifier.

I decided that it would be worth writing a simple program in Javascript to allow the calculation of each resistor for a given value of R_t , number of steps and required attenuation at each step. It can be found on my Web site at

<http://homepages.tcp.co.uk/~nroberts/atten.html>.

To use the program, change the 'total value of attenuator', 'number of steps' and 'attenuation required for each step' to the required values, then click the 'Calculate Resistor Values' button. The program suggests some default values for a 24-step, 100KW attenu-



How the rotary attenuator is wired. Position 23 offers full volume (no attenuation), whilst Position 1 goes to ground to give no signal transfer. Position 2 gives a low -75dB signal. We do not show all 23 positions here.

Step	Atten. (dB)	Resistor
1	∞	0
2	75	18
3	69	18
4	63	36
5	58	56
6	53	100
7	48	180
8	43	300
9	39	430
10	35	620
11	31	1K1
12	27	1K6
13	23	2K4
14	20	3K3
15	17	3K9
16	14	5K1
17	12	5K6
18	10	6K2
19	8	8K2
20	6	11K
21	4	13K
22	2	16K
23	0	20K

ator. Obviously, you will have to select the nearest 'preferred value' for each step. The exact value is not critical, but if you wish to see the exact attenuation you will get for a given R_y , there is another calculation area at the bottom of the screen that does this.

If you are particularly fussy (like me!) you can use this to recalculate the attenuation for each step using preferred values and build up the entire table with preferred values and the exact attenuation at each step. Incidentally, you can save the Web page locally and run it from your hard disk so you don't need to be on-line while you are experimenting with the program.

For my 23-way switch, I calculated the approximate attenuation and resistor values shown in the following table:

Total value: 99.2kohms

I had to drill a hole in the front panel to accommodate the locating pin to the side of the spindle as this was in a different position from that in the Alps Blue. It is easier to make such mechanical changes before wiring up the resistors.

Wiring up the switch (Figure 2), make sure you have the following available before starting:

* Two sets of all the resistors (one for each channel) appropriately labelled and laid out in order (those coloured bands start to look all the same after a while!);

* Soldering iron, cutters and pliers;

Remember that the switch is, in all probability, somewhat larger than the potentiometer it is replacing so it is worth getting the resistors to lie as flat as possible.

I wired up a temporary unit with the attenuator feeding into the existing volume control via one of the inputs. I was then able to switch between the attenuator and the volume control by turning the attenuator to maximum and using the volume control, and vice versa. This was worthwhile as I discovered the first step was too loud for a minimum setting. I originally used 60dB attenuation, but it wasn't enough. My loudspeakers (Chris Rogers' PRO9-TL transmission lines) are not very sensitive so the effect would have been worse with more sensitive speakers.

I decided on 75dB and returned to my program to recalculate all the other resistor values for a new range of attenuations shown in the above table. This necessitated replacement of about half of the resistors. My solder-sucker came in very handy at this point! All that then remained was to install the attenuator permanently in the amplifier.

Was it worth it? Well, yes, definitely. The sound was noticeably

more detailed and the sound sources more accurately placed between (and indeed, behind) the speakers. If anything, the sound was slightly brighter than with the Alps Blue. This was not surprising as metal film resistors typically have a bright sound. There was certainly greater clarity to the sound with individual instruments within an orchestra being more clearly identifiable.

Finally, it is worth mentioning that, apart from saving money and the satisfaction of having built an attenuator yourself, another advantage of the do-it-yourself approach is that it allows for experimentation. Not only can you change the attenuation of any step to suit personal preferences, but also use different qualities of resistors in the chain, although I haven't experimented with that yet. Maybe I can add a list of Shinkoh resistors to my next year's Christmas present list!

A 23-way, 2 pole, shorting switch (part number OPZS1201-2) can be obtained from:

**Blore Edwards Limited,
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Tel: 01443 742202**

Neville Roberts
Metal resistors do give a bright sound. Cheap ones can sound nasty, so care is needed here. Vishays are well known as a good choice, but are expensive. Carbon film resistors give a neutral sound and represent an alternative.

With a two-pole, multi-way switch it is possible to switch between twin-resistor attenuator pads, rather than down a long chain of resistors. It uses more resistors, but there are just

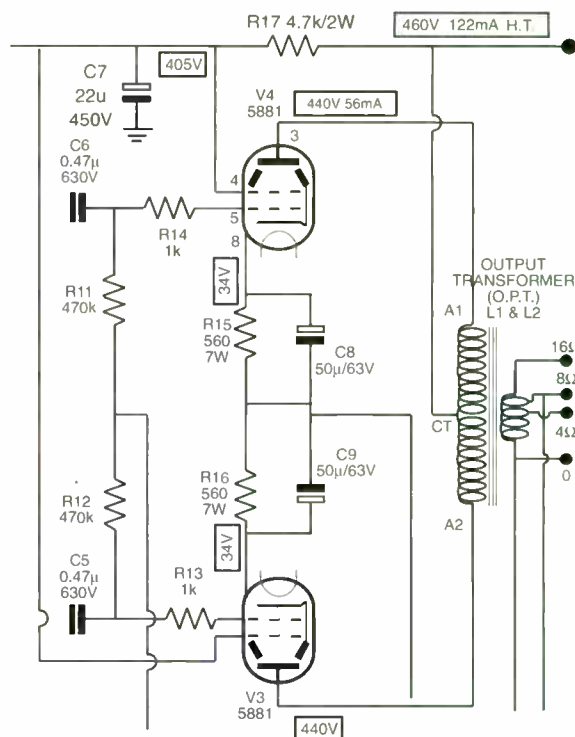
two in the signal path, instead of twenty two. NK

HOT 5881

I have a problem with an overheating resistor (R17) on the LH channel only of my K5881 MkII. I have checked and re-checked the wiring to both board and valves and this looks ok. I have changed the offending resistor and C3 and C7 and also swapped output transistors to see if the fault changes channel, however the fault stays with the resistor. HT voltage measures correctly 460v.

I am at the point of changing all components on the board to

of this amp but looking at the circuit diagram would tend to make me think you possibly have a faulty 5881 valve, as there is nothing after this resistor that would draw sufficient current to cause R17 to overheat except the G2 grids of the 5881s. I suggest you measure the voltages around the 5881, especially the G2 (pin4) volts approx 420v, the G1 (pin5) volts approx 0v and the cathode (pin8) volts approx 34V, which should be within +/- 10% of the norm.



see if this cures the fault, but maybe somebody out there has had a similar problem.

Mick Tracey (from the World Audio Design Bulletin Board)

Hi Mick,
I assume that the K5881 Mk2 is the one with the SRPP input stage. I regret I don't have any experience

It is also possible that you have a leaky/shorted capacitor C6/7 which will show up as positive volts on the 5881 G1 (pin5), and another option is a shorted/leaky cathode bypass capacitor C8/9 which will show up as low volts on the cathodes.
Regards, Dr John

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