Hi-Fi WORLD

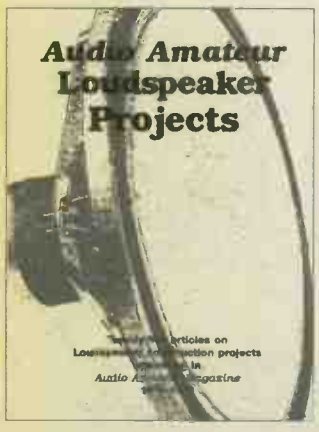
Hi-Fi WORLD

NO.39 OCTOBER 1998

SUPPLEMENT

MESSAGE IN A BOTTLE

KEL34 40watt valve integrated amplifier kit



BASS INVADER

Subwoofer for KLS10 stand mounters

BOOK REVIEWS:

Audio Amateur Loudspeaker Projects by Edward T. Dell

FREE D.I.Y. SUPPLEMENT No.39

PRICE VALIDITY TO END OCT 1998 - ASK ABOUT ANY TYPES NOT ON THIS LIST

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D.I.Y. Supplement

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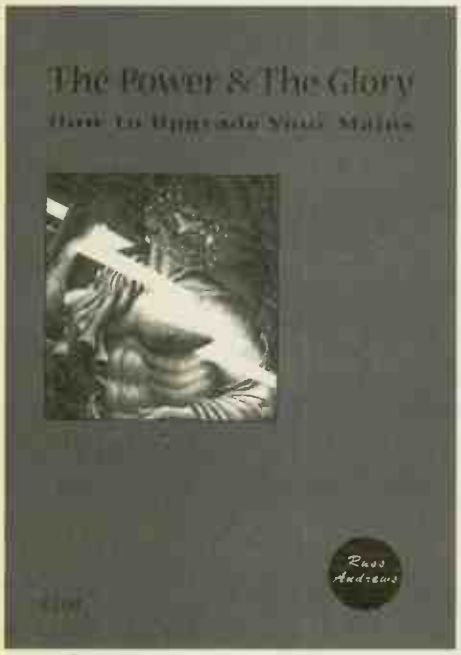
KIT NEWS



JUICE ON THE LOOSE

Russ Andrews has just published a handy little volume called The Power And The Glory - How To Upgrade Your Mains. This 26-page booklet bristles with handy hints, learned discourse and a wealth of common sense along with a delve into the realms of health and safety. The manuscript was actually checked by senior engineers from a couple of Electricity Boards, and so on the subject of 'Self: how not to electrocute', this is likely to be one of the better-vetted works to roll off the presses.

As current customers will already know, RAA prides itself on supplying a non-esoteric selection of proven mains upgrade components and The Power And The Glory usefully mentions these alongside the problems they can mitigate.

In addition to diodes and varistors, Russ has covered house wiring faults, clicks, bangs, buzzes and hums along with good, old home remedies like cleaning fuse holders, all in a concise and practical way. The diagrams are clear and well annotated and, all in all, this is as good an answer to the question 'Why bother about the mains?' as you could hope for. The booklet is free to regular patrons or can be sent to perfect strangers for £3.

Russ Andrews Accessories
Edge Bank House,
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Kendal, Cumbria
LA8 9AS
Tel: 01539 823247

GETTING CONNECTED

One of Canada's leading audiophile parts suppliers, The Parts Connection, have released the Fourth Volume of their catalogue in print and on the Internet. The number of web-site and e-mail users has grown over the past 18 months, so a secure/encrypted credit-card system for on-line orders has been set up.

The catalogue itself is almost completely new and lists Assemblage's growing kit line-up as well as a range of passive and active electronic components. Capacitors include the best from Jensen, Multicap, InfiniCap, Solen and Hovland for coupling purposes as well as Black Gates and Os-Cons for use in power supplies. The resistor contingent runs to Holcos, Caddocks and Vishays, which can also be had built up into stepped attenuators.

Kimber cabling puts in an appearance too in copper and silver forms, while UltraAnalog DACs and Analog Devices op amps make up the active section.

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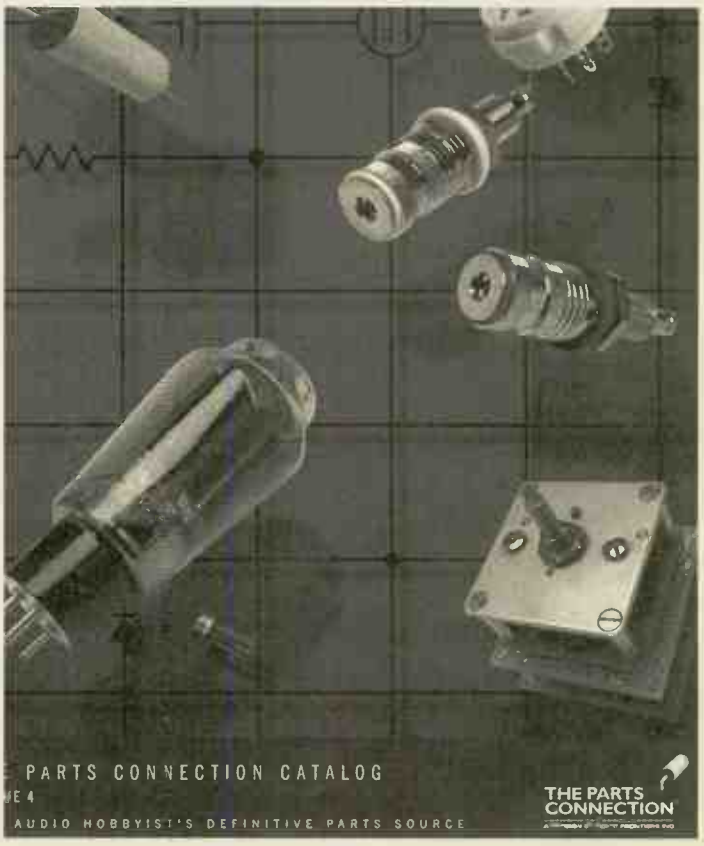
D TO A CORRECTION

In the August Supplement we published an article on how to build a budget DIY DAC. Unfortunately, one set of component values was misprinted; R13-16 should have read 3.3kohm rather than 33kohm. Also, the power supply inductors (L1-L3) were not specified - they are all 10uH parts.



KLS10 GOLD SUBWOOFER

This simple but effective subwoofer gives our compact KLS10 loudspeaker bigger bass. Noel Keywood describes its construction and operation.

KLS10 was conceived as a small, high-quality version of our KLS3 Gold floor standing loudspeaker. Readers wanted the advanced technology drivers we use in KLS3 Gold, but not its size. Trouble is, whilst small loudspeakers can do many things very well, they do not produce deep bass. To cover this drawback, from the outset we planned to design a matching subwoofer for KLS10 - and here it is.

Subwoofers take many forms, from a single drive unit in a box up to powered 'active' types with equalisation and other paraphernalia. KLS10 was meant to be fundamentally straightforward; I believe that an effective and well-balanced basic design has more to offer than technological excess. Similarly, our subwoofer comprises a single cabinet of modest 25 litre volume, with one drive unit: an Audax HM210Z2 High Definition Aerogel bass unit with twin voice coils. It's effective, inexpensive and a doddle to build.

KLS10 on its own was designed to work close to a wall, so it has well-damped bass to counteract the natural emphases a rear wall imposes. The subwoofer attenuates bass output from the KLS10s to avoid bass boom, as well as extending bass down to 20Hz - a very low frequency. And all from a relatively easy

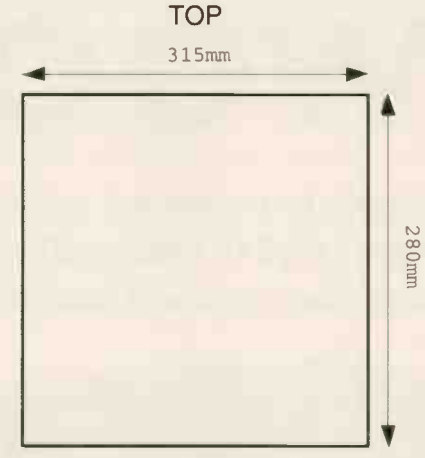
to hide cabinet, one that can even double as a small table.

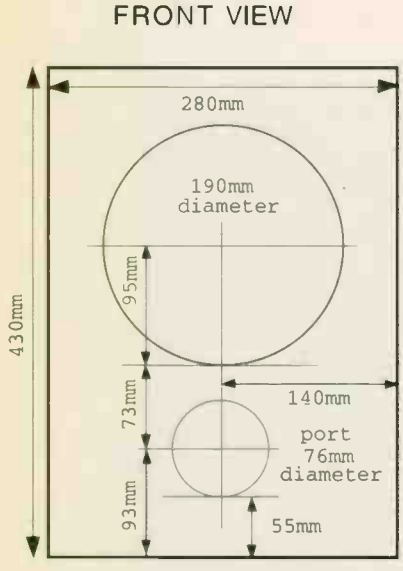
Engineered sensibly, a subwoofer like this is subjectively quite impressive. Most subwoofers deliver boomy bass; I have heard some real horrors, even from reputable companies. The boominess usually comes from poor matching to the main loudspeakers. Where outputs overlap they add, producing excessive bass over a narrow band of frequencies. As usual we have harnessed the flexibility of DIY to give you control over matching, to avoid this problem. Of course, good basic system design integrates the KLS10 'satellites' with the subwoofer properly in the first place so they don't overlap, but we cannot account for room conditions, placement or taste. That is why tunability is a useful feature, not to mention the fact that most DIYers like to experiment. It gives the builder influence over the final outcome.

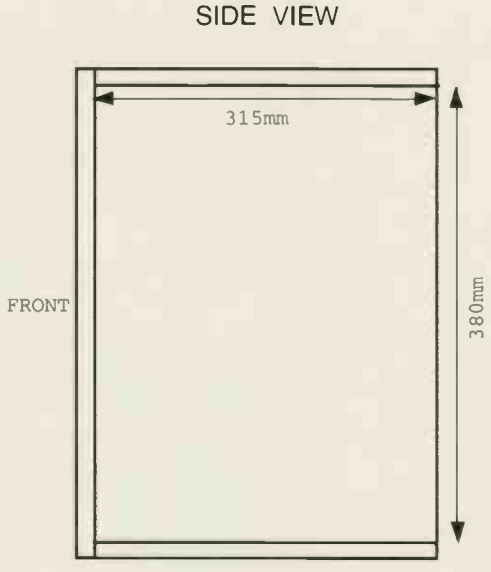
CONCEPT

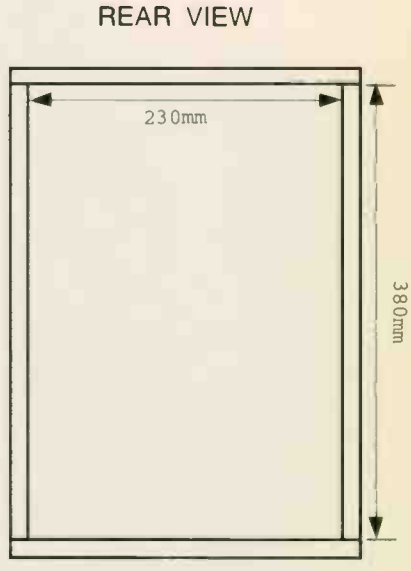
A single-box subwoofer relies on the fact that most bass is recorded equally on both stereo channels, and that in any case the ear cannot locate a low-frequency source below about 100Hz. Direction cues exist at higher frequencies, especially within transient events.

Rather than using a lossy summing network, we have pressed into service a special twin-coil bass unit from Audax. The coils sum output from the stereo channels, a simple but effective method that results in high efficiency. Filters feed bass signals to this driver, removing higher frequencies. However, the rate of roll-off has been made slow, in order to







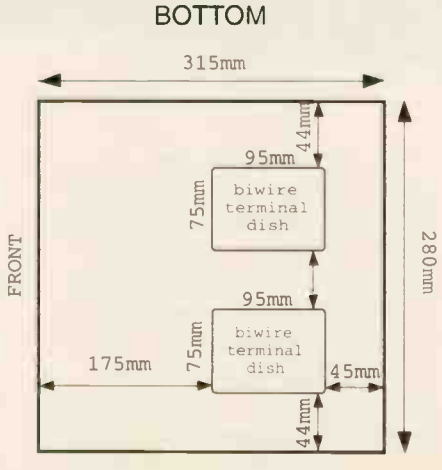


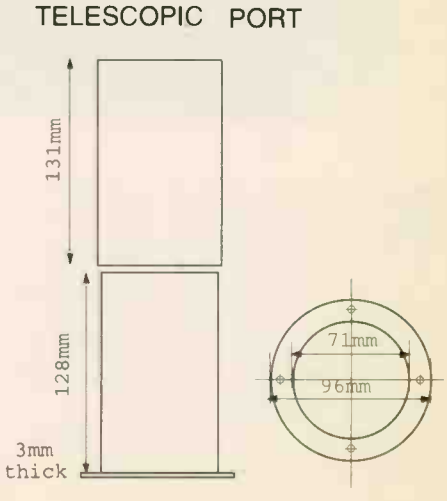
KLS10 SUBWOOFER

PANELS		25mm MDF
2 off	315 x 280	top/bottom
2 off	315 x 380	sides
1 off	430 x 280	front
1 off	230 x 380	rear

dimensions in mm

Internal volume (cc)
23w x 29d x 38h = 25346cc
(0.099cu.ft.)





provide some midrange information, which the HDA cone of the driver can reproduce faithfully. No cheap paper cone drivers here!

If the subwoofer is placed between the loudspeakers and positioned to face forward it firms up centre-stage images, making the sound stage more solid and real than is common. It's an interesting enhancement to two 'speaker stereo. This effect can be removed by making the driver and port fire either backward, or downward onto the floor (providing the cabinet is raised by a few inches on spikes).

Note that both channels of the amplifier feed the subwoofer, and a signal is then fed out to the satellites. Upper frequencies are removed from the subwoofer signal by 'low pass' filtering, and lower frequencies are removed from the satellite signal by 'high pass' filtering. These filters can be adjusted, and the port of the subwoofer can be tuned too, so there's plenty for inveterate experimenters to play with here.

THE CABINET

The most important parameter of this cabinet is its volume, since the air load in the box is tuned to suit the drive unit's mechanical Thiele-Small parameters by computer. This is an industry standard technique.

Box volume cannot be increased, but it can be decreased. This will peak up bass response, making it more one-note. An easy way of reducing volume is to put bricks inside the cabinet, since they are heavy, inert and offer a useful volume change of around 1700cc. Since our target volume figure is 25litres (25000cc) one brick changes volume by 7%. I mention this as an aside though; reducing the volume of this cabinet will rarely be of benefit. You could increase volume up to 45litres and then tune it with bricks, but the cabinet is starting to become very large, something we tried to avoid in order to keep the whole compact.

Although volume is of primary importance, box proportions must also be considered. No two internal dimensions should be the same, in order to avoid resonant boom. Proportions of 1:1.25:1.6 are commonly used, although there are other 'magic ratios'.

Use Medium Density Fibreboard (MDF) of 15mm thickness, minimum. Ideally, for a bass cabinet 25mm MDF is the best choice, to minimise panel resonance. However, we suggest you use bracing in any case.

MDF is now considered to be carcinogenic, due to the formaldehyde in it I believe. We use a face mask when cutting, like most woodworkers, and vacuum up the dust afterwards. If you feel using MDF is too risky then try using blockboard or plywood instead.

The panels should be glued together using Evode Resin W wood glue. Hold them in place with thick, sticky carpet tape whilst the glue dries overnight. Or you can panel-pin the box together after applying glue. It is usual to glue in the rear panel and put in wadding, etc through the front panel drive unit cut-out.

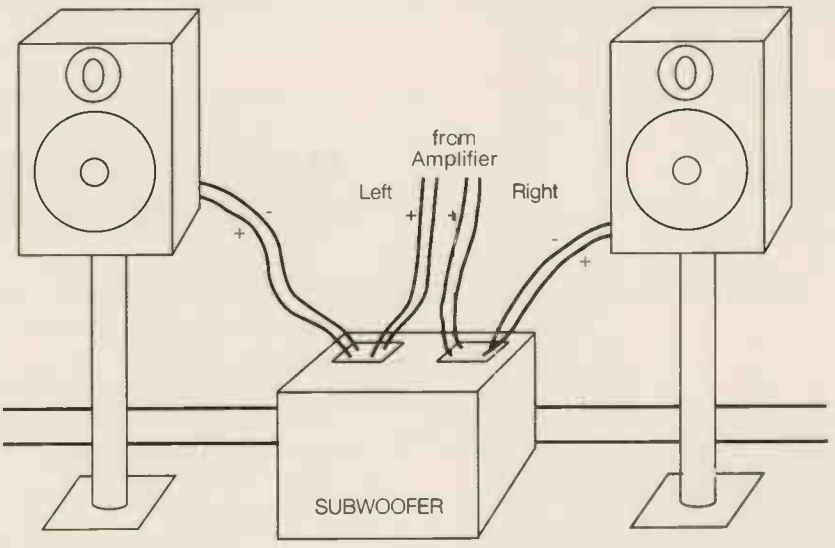
It is best to put braces across the cabinet internally, to prevent panel resonance, especially if 15mm MDF is used. Doweling of 1in diameter can be screwed and glued into place if desired.

Panel positions in our diagram relate to use of the cabinet upright, with the bass unit firing forward. The terminals then lie at the bottom of the cabinet, out of sight. Tall spikes will be needed to keep the bottom well above the floor.

A more flexible arrangement, if a less sightly one, is to lie the cabinet on its side so the terminal dishes are visible and accessible at one end. Then the cabinet can be faced forward or downward, depending on which method of operation is preferred. Facing forward fills in the centre stage, but on occasions a little box whoomph can be heard from the port. Facing downward eliminates the centre stage fill-in effect and any minor box sounds.

It is probably best to experiment first, decide which you prefer and then fix the spikes accordingly. If the drive unit faces downwards the cabinet should be raised at least 1in off the floor by the spikes. These should be fitted last, 22mm in from both edges, using an M7 drill bit.

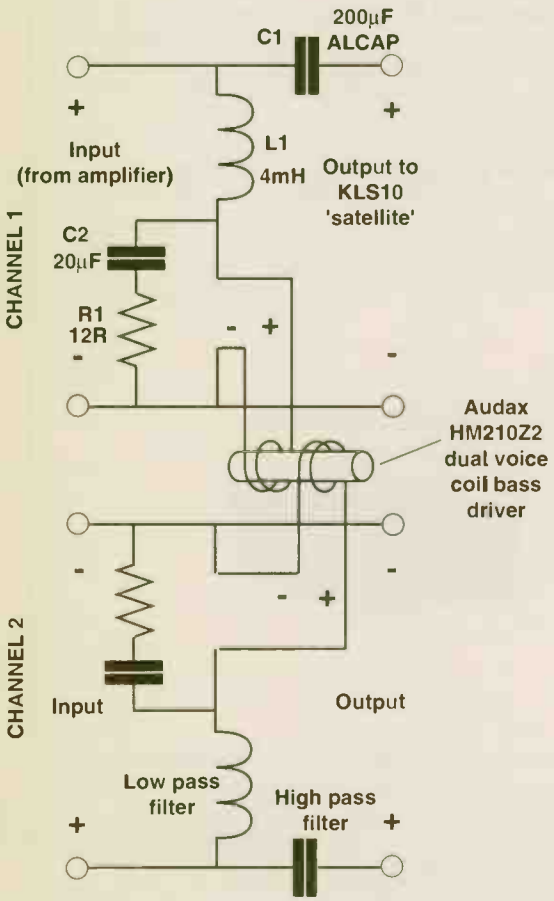
We leave choice of finish to you. Most people have their own ideas and from pictures sent in to us the preference seems to be lavish veneering with hardwood trims. Some go for piano black laquer. We knock up MDF prototypes then get a cabinet maker to build final samples for photography and use at shows. Routed-in hardwood edges, and routed driver cut-outs so the drivers sit flush, make for a professional appearance and are beneficial too. Flush mounting the drivers sharpens stereo images, and rounding edges does the same, by lessening diffraction at cabinet edges. Hardwood edges take knocks better than veneer of course and a light Ramin edge against dark Mahogany veneer looks quite attractive to most people.



The amplifier feeds the subwoofer and the subwoofer feeds the KLS10 satellites, in order to filter bass from them. Otherwise, bass overlap would create a boomy sound.

CROSSOVER

The crossover is relatively simple, comprising C1, which forms a first-order high pass filter (-6dB/octave roll-off) feeding the satellites, and L1 which forms a first-order low pass filter feeding the HM210Z2 subwoofer driver.



The crossover filters bass from the satellites through C1, and upper frequencies from the subwoofer through L1.

Capacitor C1 steadily rolls up low frequency impedance, which not only eliminates deep bass from the satellites but also raises overall impedance, to ensure the subwoofer and satellites in parallel do not draw too much current from the amplifier. Our impedance plot shows this keeps impedance of the system around 8ohms, with minima of 6ohms. Overall impedance measured 7ohms in fact, determined by applying a music-like pink-noise test signal. Components C2 and R1 provide some phase correction at higher frequencies.

Capacitor C1, set at 200µF, can be reduced in value to lessen bass input to the satellites, or increased to raise bass output. Try halving to 100µF or doubling to 400µF to check out subjective differences and whether a change might be in order. Experiment with values to find the most suitable.

The system is well balanced as it stands and should not boom. Reducing C1 in value too much may well result in boomy 'one note' bass, whilst reducing it too far will make the subwoofer sound poorly integrated with the satellites.

Distributing bass power between drive units improves power handling. The system will go loud without strain. Officially it will take 60watts, the max power rating of the drive units. But this is a very conservative continuous power rating used by Audax. In practice we found we could crank volume right up with a 200watt amplifier with little sign of strain. However, this might have been misleading because the KLS10 loudspeaker system has a very high sensitivity of 89dB, meaning it goes loud from little power. An amplifier of 100watts is the sensible maximum and 60watts will be more than enough for most rooms and tastes.

A convenient way to build the crossover is to glue the components underneath the terminal dish using a hot-melt glue gun. Note we use two bi-wire terminal dishes, one per channel. This gives a set of input and output terminals per dish. As our drawing shows, the amplifier feeds the subwoofer, and the subwoofer feeds the satellites. It is possible to re-configure this arrangement without performance being affected, if desired.

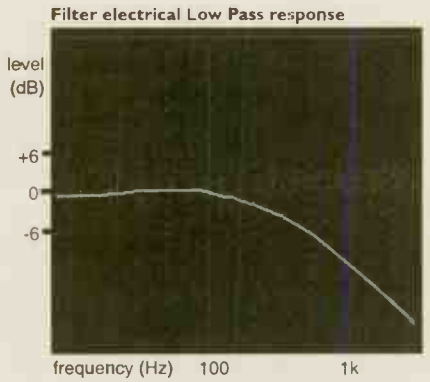


Fig 1 - The subwoofer is fed by a first-order low pass filter which rolls off energy above 100Hz.

SOUND QUALITY

After running in, the subwoofer was linked up to the KLS10s, both driven by our own amplification as well as a Creek OBH-12 passive pre-amplifier and Musical Fidelity's soowatt X-A200 monoblocs.

Obviously, the best way to find out how low a subwoofer goes is to throw at it a recording with some real bottom-end grunt; cue Joe Beard's Blues Union on a JVC XRCD disc. Compared to the '10s sans sub, this bass-enhanced trio had much more smack and weight, which put a lot of the low-down, dirty grunge back into the Blues and an extra gravelly growl into JB's vocals.

Bass isn't only about quantity, it's about quality too - the last thing you want is an octave of low-frequency sludge rumbling away regardless of what the music's doing. With Mahler's Symphony No7 (performed by the Cleveland Orchestra, Pierre Boulez conducting) inside Pink Triangle's Litaural CD player, the KLS10s and subwoofer steered clear of this pitfall. Complementing the grainless, spit-free treble of the gold-dome piezo tweeter was a lithe, extended, open bass which didn't squander detail and tonal character when handling double-bass and cellos.

If you prefer leather boots to slippers, you'll find a change of genre won't phase this sub and satellites; they Rocked along happily to Ocean Colour Scene's Moseley Shoals without sounding harsh or bloated, Aerogel, carbon fibre and gold dome marrying harmoniously. And if you're a fan of Dance, sit back, turn the volume up and enjoy beats which will put a happy, basshead smile on your face. **JM**

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MEASURED PERFORMANCE

The subwoofer uses reflex loading on an Audax HM210Z2 dual voice coil drive unit. Forward output from the drive unit

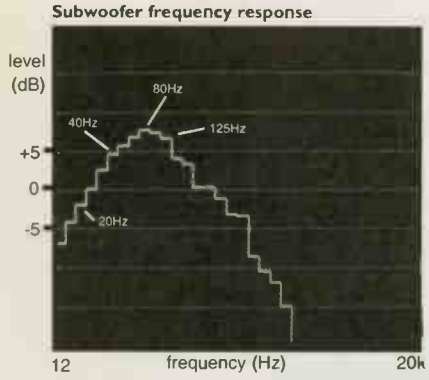


Fig 2 - Drive unit and port output add to give an overall response, as shown here. The subwoofer works from 40Hz to 125Hz.

cone combines with output from the port to form a composite response. The two outputs are shown combined in Fig 2, to give a good idea of the working range of the subwoofer. This is more accurate at low frequencies than the system response in Fig 4 which is

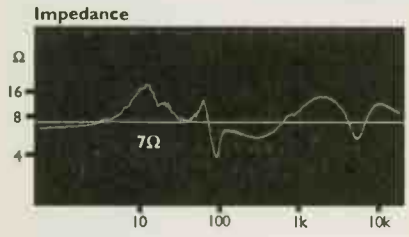


Fig 3 - Impedance stays fairly high across the audio band, making the loudspeaker an easy load to drive. Overall impedance measures 7Ω, shown by the white line.

restricted by the measuring room's dimensions.

In practice the subwoofer extends KLS10's response flat down to 63Hz, below which the port takes output down to around 40Hz. The overall response of the system in Fig 4 shows output within a few dB of flatness from 63Hz up to 16kHz, with roll-offs outside this band. This is with our usual high-resolution 5dB scale and as you can see, we have achieved the exceptional flatness we expect from our kit designs. There is some lift at lower frequencies to add a little warmth and body, and no crossover phase suckout around 3kHz. This ensures good detailing and solid sounding percussion.

KLS10 SUBWOOFER PARTS LIST

Driver	
Bass	Audax HM210Z2
	170mm High Definition Aerogel cone, cast chassis, dual voice coil.
Crossover	
L1	2 x 4mH, 0.5Ω ferrite cored,1mm wire
C1	2 x 200µF, 50V, bipolar electrolytic (ALCAP)
C2	2 x 20µF, Solen (400V)
R1	2 x12Ω resistor, 9W
Hardware	
Inputs	2 x bi-wire gold plated 'speaker terminal panel
Port	70mm diameter, 130mm long+ext.
Wire	10m PTFE silver plated copper
Spikes	8 spikes M6 (80mm)
Damping	long haired wool

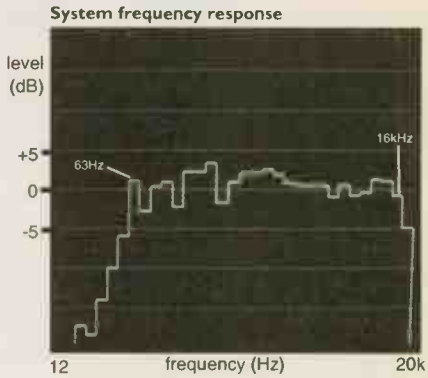


Fig 4 - The subwoofer combines with KLS10 satellite to give an overall response, shown here. The three dips are room effects, due to spacing between the subwoofer and satellite. Otherwise the response is smooth from 63Hz to 16kHz in our listening room.

One watt of input power produces 89dB sound pressure level, a high value for a small loudspeaker. Around 85dB is common. Since KLS10 with the subwoofer has an overall measured impedance of 7ohms (Fig 3) the benefit of low impedance drawing current from a constant voltage source is not inflating this figure. The drive units are simply very efficient and used optimally.

Although KLS10 is a relatively easy loudspeaker to build, having simple crossover networks for example, it easily fulfils performance criteria. It is more efficient and sensitive than most commercial designs, through the use of superior drive units, it has sweeter and smoother treble, plus an easy sounding midband that is a characteristic of carbon-fibre. It is a relatively easy load for any amplifier and offers flat frequency response without phasing problems. NK

KEL34 40W VALVE AMPLIFIER

Nick Lucas, Hi-Fi World's technician, and valve designer Gary Devon unveil our latest amplifier, KEL34

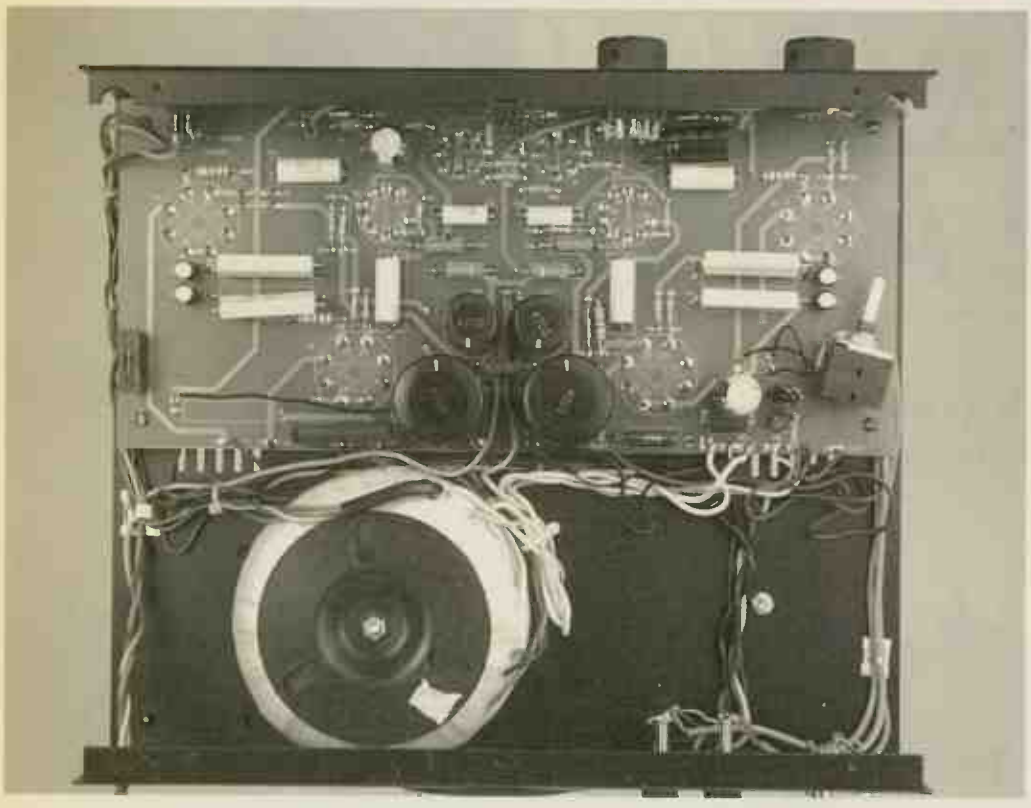
INTRODUCTION
by Nick Lucas.

KEL34 is an inexpensive stereo integrated valve amplifier capable of providing no less than 40watts into an 8ohm load. This is enough power to satisfy those who feel the usual valve power amp output of 20watts or thereabouts is insufficient for their needs.

KEL34 operates in Class AB and runs in Class A at low signal levels to ensure distortion doesn't colour music at ordinary volumes. It is possible to monobloc KEL34 by paralleling the channels as well, in which case it will deliver 72watts into a 4ohm load.

In keeping with the idea of producing a budget bargain, we have equipped this amp with four line-level inputs plus a tape output which can be chosen from the front panel where the mains switch, volume control and source selector are to be found.

The custom-designed toroidal output transformers are situated on the top panel at the rear corners. Centrally located are the output valves (four 6CA7s), while up front sit the input valves (two 6AU6s) and the phase splitters (a pair of ECC82s). All valve bases and electronic components, bar the transformers, volume potentiometer, selector, mains switch, phono sockets and 'speaker XLR sockets are mounted on the heavy-duty printed circuit board (PCB) which measures 315mm by 135mm by 2.4mm thick. The quiet 250VA toroidal mains transformer is housed internally, to the rear.



A printed circuit board makes assembly far easier than is the case with the tag strips used in many valve amps.

KEL34's external dimensions are 330mm (w) by 275mm (d) by 180mm (h) with the valves inserted. The chassis is made up of two interlocking U-shapes in 16s.w.g. steel, with a black powder-coat finish and white, silk-screened lettering. The amp is strong and durable, and its small size means it's unobtrusive.

During development we brought in all readily available EL34, ECC82 and 6AU6 valves on the market and began testing. For the EL34, our main selection criteria were sound quality, strength and reliability. Out of all the different makes and types we tried, the European-manufactured Ei 6CA7, an EL34 direct equivalent, came shining through.

Ei's EL34 is the same height as an original Philips but has a larger diameter similar to GEC's KT66 or America's beloved 6550 high-power tetrode. Housed within this bigger envelope is a beefed-up anode assembly - our tests showed the Ei 6CA7 can dissipate over 50watts on its anode, 25watts more than the maximum rating of the standard valve, with no real sign of anode melt-down. In spite of this, we decided to stick to the published limits when setting quiescent current levels, safe in the knowledge that this valve will have a long life and be able to handle anything you can throw at it musically.

The sound quality of the 6CA7 is impressive. It's slightly different from the characteristic EL34 sound, displaying smoother treble, more open midrange and tauter, deeper bass.

For the 6AU6 and ECC82 valves we decided to stay with Ei to ensure good matching with the output tubes. Although we made a careful choice when it came to valve selection, the amplifier will work with any EL34, 6AU6 and ECC82 (or their equivalents), and we can supply KEL34 without valves if desired.

This integrated was designed to be easy to build (most of the components are soldered onto a PCB, reducing the possibility of error, and populating the board is very straightforward). We went for a high-grade PCB too, one which uses FR4, a top-spec, fire-resistant epoxy resin. The tracks are then laid down in extra-thick 35micron copper foil, and have a green solder-mask for neatness. This improves solderability and helps prevent shorts caused by streaks of solder between tracks. The PCB is also clearly labelled to ensure correct orientation of electrolytic capacitors and octal valve bases.

There are around 25 external connections to the PCB. They involve the wiring up of the phono sockets, the selector, the volume control, the mains switch and the output transformers to their XLR sockets.

Some prospective kit builders are put off by the dangerously high-tension (HT) voltages circulating within valve amplifiers. In this amplifier we use no less than 510V DC. Therefore, we are supplying as standard with this kit a pair of size-10 electrical safety gloves rated at 650V DC to prevent any possibility of electric shock. And as far as amplifier damage sustained through mis-assembly goes, rest assured KEL34 is a rugged beast and will survive short-term distress.

The kit comes with a new style of instruction booklet with a strong emphasis on diagrammatic views to make life easier. We have also set up a helpline if you have trouble with the construction, and if the worst comes to the worst and you cannot get the amp going, for a nominal charge we will sort out any problems.

CIRCUIT DESCRIPTION
By designer Gary Devon.

The KEL34 circuit is much like the famous Mullard 5-20 circuit brewed up by Philips to demonstrate the abilities of their pentode EL34 power output valve. Our design uses a different valve line-up though - a 6AU6 pentode input valve strapped as a triode, an ECC82 phase splitter and a pair of 6CA7 output valves.

The 6AU6 becomes a good triode when grid Nos2 and 3 are connected to the anode via a resistor to stop any tendency for parasitic oscillation. This valve's mu-factor is fairly high at 41 and the anode impedance middling at 10kohm, which means there is little high-frequency phase shift while driving V5/6.

The biasing network/feedback connection is slightly different from normal. The bias voltage for V7/8 is

developed across the feedback resistor R38/R39, leaving the 4700uF capacitor, C17/18, to provide low-frequency compensation. The addition of this network gives very good bass quality. Resistor R40/41 is part of the feedback potential divider along with R38/39. Capacitor C19/20 is the customary high-frequency compensation component.

As in the Mullard circuit, the input stage is directly coupled to the phase splitter. Here you'll find an ECC82 in cathode-coupled configuration with tail resistor R21/22. As the ECC82 has a low mutual conductance (around 2.2mA/V) the anode resistors have to differ considerably in value for balanced outputs. R23/25 couples the DC voltage to the grids of V5b/6b, while the AC voltage is decoupled by C13/14. The combination of the 1Mohm resistor and 0.47uF capacitor provides a long time constant to reduce the inevitable phase shift at this position to a low-frequency turnover point.

The output stage is resistor/capacitor coupled to the phase splitter in the usual fashion, but the 6CA7s are compound biased to provide a compromise between the efficiency and low distortion of fixed biased and the ease of use of cathode bias. Some of the bias voltage is developed across the cathode resistors R13/14 and R15/16 to give a compensating action, the rest coming from a separate negative supply on grid No1 of the EL34/6CA7.

The output valves' screen grids are run at half HT potential (255V) for good reason. EL34s are susceptible to catastrophic failure at screen voltages much above 350V, especially the modern types. The lower voltage of 255V is safer, extends valve life and allows the great sounding 6CA7 to be used safely.

The PSU has a centre-tapped HT for the screen grids, which also means that lower-voltage electrolytic capacitors can be used stacked, giving a safety margin on voltage ratings. The remainder of the power supply is self-explanatory.

See page 74 of the main issue for details on how to order KEL34.

Next month's Supplement will explain how to build KEL34 (whether from the whole kit or the transformer set which will be made available) and reveal the sound quality you can expect from the amp.

KEL34 PARTS LIST

RESISTORS:

POWER SUPPLY

	Value	Quant
R1	5.6K, 6W	1
R2	prototype only, no longer fitted	
R3	36K, 0.66W	1
R4	8K2, 3W	1
R5	13K, 0.66W	1

SIGNAL

R6	100R, 1W	1
R7	36K, 1W	1
R8	1K, 0.66W	1
R9	330K, 0.66W	1
R10	1K, 0.66W	1
R11	330K, 0.66W	1
R12	100R, 1W	1
R13	180R, 7W	1
R14	180R, 7W	1
R15	180R, 7W	1
R16	180R, 7W	1
R17	39K, 3W	1
R18	39K, 3W	1
R19	47K, 1W	1
R20	36K, 1W	1
R21	15K, 3W	1
R22	15K, 3W	1
R23	1M, 0.66W	1
R24	47K, 1W	1
R25	1M, 0.66W	1
R26	330K, 0.66W	1
R27	1K, 0.66W	1
R28	1M, 0.66W	1
R29	1M, 0.66W	1
R30	330K, 0.66W	1
R31	1K, 0.66W	1
R32	100R, 1W	1
R33	100R, 1W	1
R34	1K, 0.66W	1
R35	1K, 0.66W	1
R36	330R, 0.66W	1
R37	330R, 0.66W	1
R38	330R, 0.66W	1
R39	330R, 0.66W	1
R40	3R3, 0.25W	1
R41	3R3, 0.25W	1
VR1	100K log dual	1

CAPACITORS:

POWER SUPPLY

	Value	Quant
C1	470uF, 350V	1
C2	470uF, 350V	1
C3	4700uF, 16V	1
C4	100uf, 63V	1
C5	100uF, 450V	1
C6	100uF, 450V	1

SIGNAL

C7	0.47uF, 630V	1
C8	0.47uF, 630V	1
C9	220uF, 25V	1
C10	220uF, 25V	1
C11	220uF, 25V	1
C12	220uF, 25V	1
C13	0.47uF, 250V	1
C14	0.47uF, 250V	1
C15	0.47uF, 630V	1
C16	0.47uF, 630V	1
C17	4700uF, 10V	1
C18	4700uF, 10V	1
C19	3.9nF, 160V	1
C20	3.9nF, 160V	1

BRIDGE RECTIFIERS:

	Value	Quant
BR1	HT, 1200V 1.5A	1
BR2	Bias, 200V 1.4A	1
BR3	Heater, 200V 2A	1

HARDWARE:

Type	Quant
Mains Switch	1
PCB fuse holder	1
Fuse cover	1
Fuse 1.6A, slow-blow	1
Source Selector	1
Black Phono Sockets	5
Red Phono Sockets	5
XLR Speaker Connectors	2
Octal PCB-mount valve base	4
B9A PCB-mount valve base	2
B7G PCB-mount valve base	2
Knobs	2

VALVES

Ei 6CA7	4
Ei 6AU6	2
Ei ECC82	2

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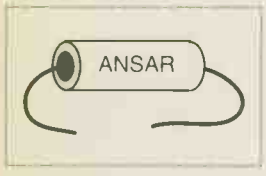

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22H63	LO Z HI TEMP 22µF	63V	£0.30
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2200H50	LO Z HI TEMP 2200µF	50V	£2.25
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Trobo Solder Lug Reservoir Capacitor 10,000µF 80V

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

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

Monacor Air Cored Inductors.

A range of professional air cored inductors for 8Ω or 4Ω crossovers filters for use up to 340W. 1.2mm enamelled copper wire wound on air spaced plastic bobbins.

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

Monacor Ferrite Inductors

A range of professional high efficiency ferrite cored inductors with very low ohmic losses for 8Ω or 4Ω crossovers or filters for use up to 1000W. 1.4mm enamelled copper wire (2.5mm on F1000) wound on plastic bobbin.

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

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Part No.	Description	Price
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6V6GT	OUTPUT VALVE	£3.95
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ECC82	TRIODE	£4.50
ECC83	TRIODE	£4.50
EF86	LOW NOISE PENTODE	£9.90
EL34	OUTPUT VALVE	£8.50
EL84	OUTPUT VALVE	£3.50
GZ34	RECTIFIER	£6.50
KT88	OUTPUT VALVE	£20.00

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

Part No.	Description	Price
B9AC	B9A VALVE HOLDER CERAMIC	£1.50
CC	SCREENING CAN	£2.25
OCTC	OCTAL VALVE HOLDER CERAMIC	£2.00
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Fully Gold Plated Phono (RCA) Plugs with spring coil cable grip.

Part No.	Description	Price
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Very High Quality Phono (RCA) Plugs

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

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

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

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

Part No.	Length/Colour	Price
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LLP1QV	0.8 Metres/Violet	£5.50
LPP2QG	1.5 Metres/Green	£6.50
LPP2QV	1.5 Metres/Violet	£6.50
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R100	ø=110L=160-122	£5.50
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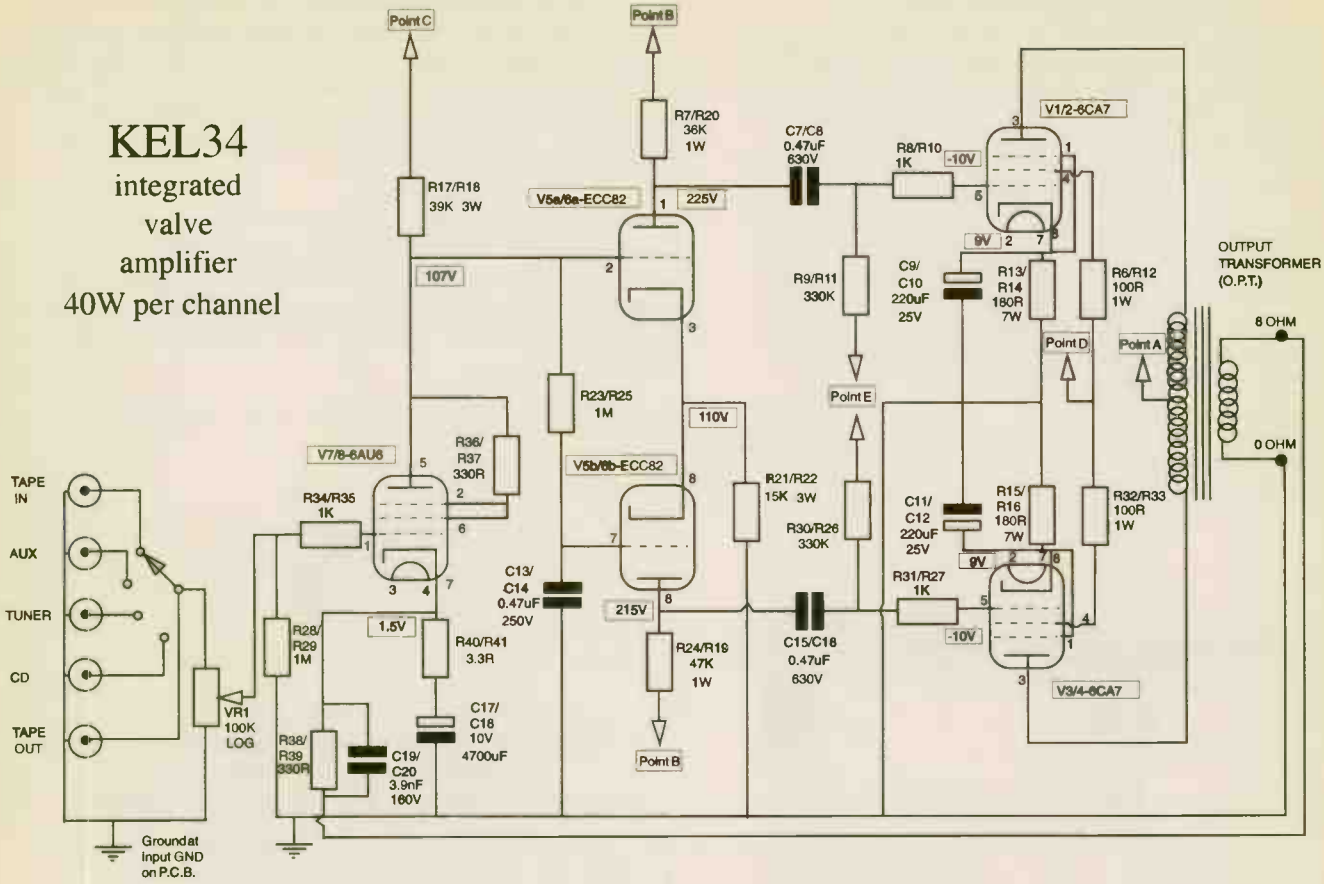
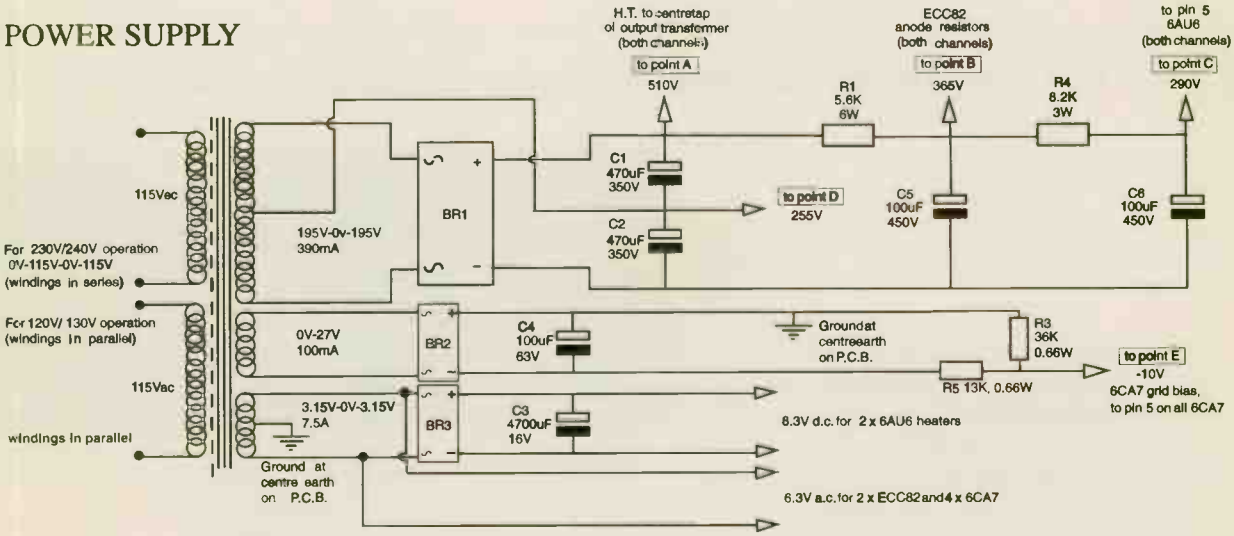
KEL34

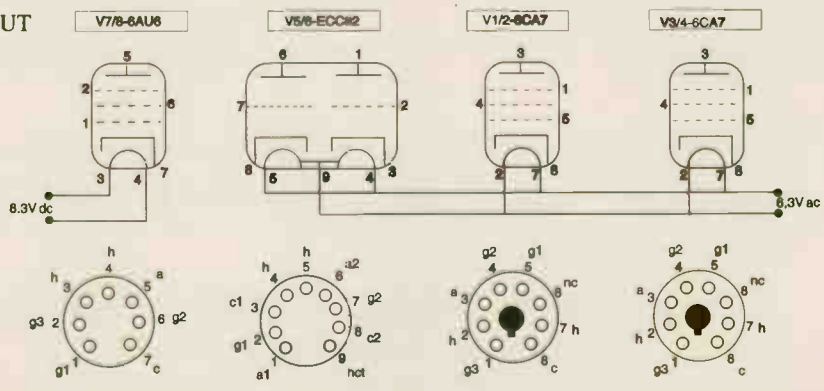
integrated valve amplifier 40W per channel



POWER SUPPLY



VALVE PIN LAYOUT



Views are from underneath valve or valve holder

h = heater hct = heater centre tap c = cathode a = anode nc = no connection

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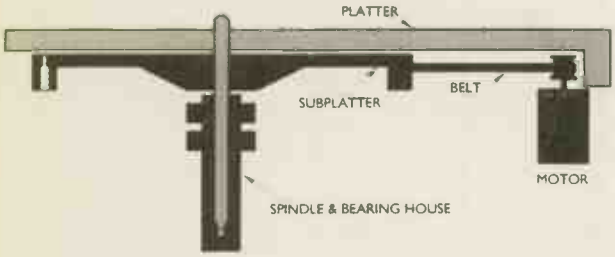
HI-FI WORLD SUPPLEMENT NOV 97

"is exceptionally easy to build and professional in both sound quality and appearance"
HI FI NEWS SUPPLEMENT NOV 97



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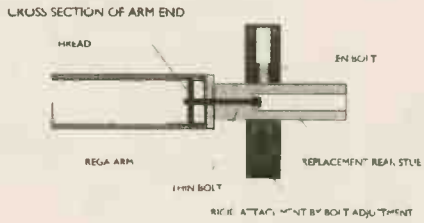

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web site: http://www.originlive.com/index.htm

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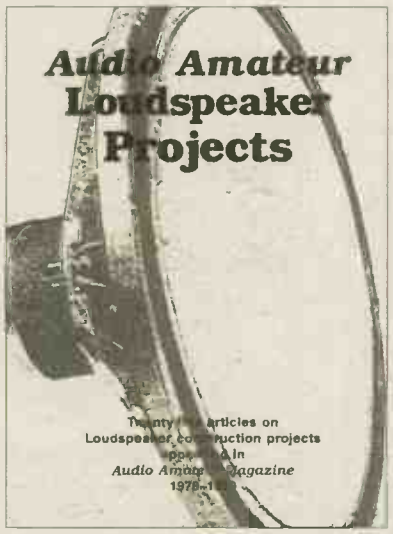
AUDIO AMATEUR LOUDSPEAKER PROJECTS

By Edward T. Dell

Reviewed by Richard White.



The 1970s were a bit of a dicey era for hi-fi enthusiasts. The period saw the final, seemingly irreversible triumph of solid-state over valves, the virtual disappearance of reel-to-reel in domestic circles and (hooray!) the 'music' centre replacing the radiogram as the item of choice for the unwary.

In many ways, hi-fi of a sort had never been so popular; the technological advances which had swept hot cathodes into oblivion made self-proclaimed low-distortion amplifiers available at prices undreamt of in the Sixties, and kit building was reaching a wider public thanks largely to simpler methods using PCBs.

Into this context, the American publication Audio Amateur Magazine slots quite nicely. This collection of published gems has been gleaned from the years 1969-1979, before Speaker Builder split off as a companion paper in its own right. Although many of the loudspeaker articles included herein have dated inasmuch as they share the Seventies' common assumptions and delusions, there is still gold to be dug, not least in the incandescent enthusiasm of the DIYers who contributed these pieces in the first place.

The book kicks off with a contribution by Peter Baxandall, he of the famous tone-control circuit. One surprise lurking in his contribution is the way he writes of the "uncritical" nature of the low bass before charging on to say that "any old 12in. unit" will do! To be fair, his L-C/H-Q enclosure is intended to be Low-Cost, but you're left wondering how High-Quality it could have been with design precepts as wobbly as that.

The interest in Baxandall's design lies mainly in the attempt to use an (admittedly peaky) elliptical driver and to correct its worst faults by a passive tapped-choke filter. Then there's the suggested use of a shared driver, what would now be called a sub-woofer, to fill in below 100Hz.

The lion's share of space in this collection goes to some ambitious electrostatic designs for home-constructors. This is a fertile field which most general 'speaker building books simply haven't space for, owing no doubt to the finicky nature of the beast - anyone can glue a few slabs of chipboard together, but it takes real dedication to make your own electrostatic diaphragms by rubbing powdered graphite into mylar film. American DIYers are obviously made of stern stuff!

The intriguing idea of using a charged capacitor as a midget spot-welder is another of those little dodges which this book offers the enthusiast. Having welded multimeter probes to HT rails by a similar process I can vouch for its effectiveness, so long as you don't weld yourself to the Hereafter in the process.

A technique which was arousing renewed interest then was the transmission line. All those featured here incorporate some sort of taper, and most writers stress the naturalness of the bass response (which is hardly surprising considering the home-made reflex 'speakers of the time). As one design uses a 24in. woofer in an enclosure of about 30 cubic feet, how could you lose!? We might be more used to compact designs today, but these dedicated DIYers seem to ignore any such constrictions, unless 30 cubic feet is compact by American standards.

The space-challenged bass horn isn't forgotten either, with a cardboard-and-string assembly which had me reaching for my scissors, until I realised that several coats of polymer resin were required after the easy bits to prevent resonances taking over. As always, the common laws of acoustic physics cannot be circumvented.

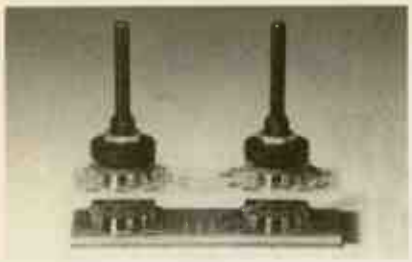
This leads on to one of the more obvious points concerning these articles; to achieve results of this standard takes time, tools and application, but chiefly time. This is not a volume for the five-minute knocker-upper; I would be the last person to indulge in 'chronological snobbery', but perhaps a prospective constructor should read an up-to-date text before embarking on some of these projects. To spend a good deal of time and effort making something which a cheap bookshelf 'speaker nowadays could beat hollow doesn't make a lot of sense.

On the subject of production, the majority of the photographs are of the 'black cat in a coal cellar at midnight' type, and just to keep you on your toes, there's the odd 'continued on p48' lay-out and unconcluded paragraph. When all's said and done though, Loudspeaker Projects is a solid, entertaining read perfect for long winter evenings●

Audio Amateur Loudspeaker Projects
Available from our World Library (see p50 for order form. Book code 1570)
£16.99 + £2.50 post and packing
ISBN: 0-8338-0193-7

Rothwell

THE ULTIMATE VOLUME CONTROL



The Rothwell Stepped Attenuator is truly the ultimate volume control. Two 12 way dual gang (stereo) devices are used, one for coarse control, the other for fine. The combination gives 132 volume settings with steps of less than 1dB, and channel balance better than 0.1dB. No pot can come close to the performance of this unit. The sound quality of the attenuator can be staggering when compared to a pot - even the expensive "audiophile" pots using plastic film or cermet tracks pale in comparison. Space, imaging and sheer detail are unsurpassed. This unit may look like an overkill solution to the problem of poor pots, but hearing it proves that it *is* justified.
And using two 12 way devices instead of one 24 or 36 way device not only results in more volume settings - it keeps the price realistic. Instead of the three figure price tag normally associated with stepped attenuators (if you can find one at all), the Rothwell attenuators cost just £79 inc. VAT and postage. Both 10k (ideal for passive pre-amps) and 100k (ideal for valve pre amps) are available, and each unit comes with free application notes giving suggested circuits for various pre amp configurations.

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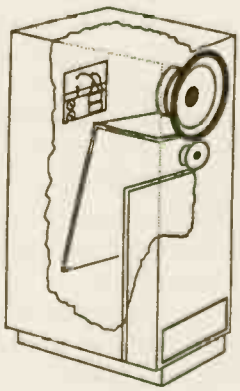

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AUDIO AND HI-FI HANDBOOK

Edited by Ian R Sinclair.

Reviewed by Noel Keywood.

The Audio And Hi-Fi Handbook covers most aspects of high fidelity in good detail. With no fewer than 23 chapters, each written by an expert in the field, there's a good depth and breadth of knowledge and opinion.

I found some of the opinion pretty contentious, from the editor's assertion that, "the record deck and pickup had contributed to the degradation of music" through to Allen Mornington-West's strongly-held view that, "technology has been supplemented by what amounts to superstition". But that is all you would expect from the pot-pouri of knowledge and opinion found here.

Is there something in the book that might interest you? Probably. Here is a list of the subjects covered, chapter by chapter.

1) Sound Waves - Dr W. Tempest
This is a fairly brief chapter covering the nature of sound and characteristics of the human ear. Some common aspects of hearing are included like masking.

2) Microphones - John Borwick
Microphone types and theory of operation.

3) Studio And Control Room Acoustics - Peter Mapp
Room modal behaviour, "Golden Ratios", absorbers, little of diffusion and the home. A bit too 'pro'.

4) Principles Of Digital Audio - Allen Mornington-West
A technical view, but highly detailed and thorough. Good for students.

5) Compact Disc Technology - Ken Clements
The delights of eight-to-fourteen modulation, pit size and other such wonders. Nothing on blue lasers, smaller pits and the future; DVD - whassat?

6) Digital Audio Recording John Watkinson
Needs updating to lessen coverage on defunct DCC and to include CD-RW, which is not even mentioned.

7) Tape Recording - John Linsley Hood
The analogue tape recorder, in much useful detail.

8) Noise Reduction Systems - David Fisher
A dying subject, like analogue recording and tape hiss. We now have MD and CD-RW.

9) The Vinyl Disc - Alvin Gold and Donald Aldous
Somewhat condensed from two original chapters. The editor doesn't rate LP.

10) Valve Amplifiers - Morgan Jones
A delightfully idiosyncratic chapter describing The Beast, an 845-based amp with 1kV HT supplies. Yow! Includes World Audio KLP-1 pre-amp (he said proudly).

11) Tuners And Radio Receivers - John Linsley Hood
JLH at it again with long but thorough and comprehensible explanations. Nothing on DAB receivers, and NICAM comes later, with just a passing mention of DAB technology.

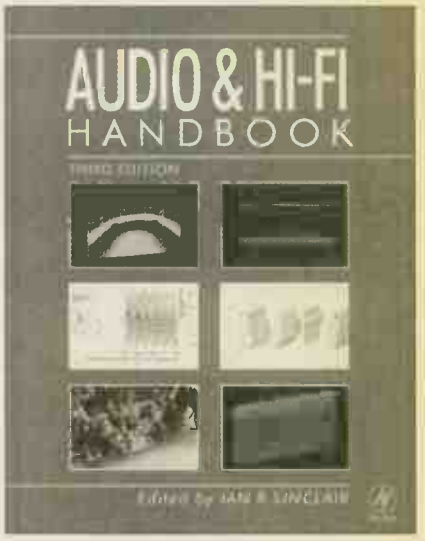
12) Pre-amps And Inputs - John Linsley Hood
Plenty of good, solid stuff on phono stages, plugs, etc.

13) Voltage Amplifiers And Controls - John Linsley Hood
Small-signal voltage amps, with plenty of circuits.

14) Power Output Stages - John Linsley Hood
Again, lots of detail, practical experience and invaluable insights, such as Class S, Blomley non-switching, feed-forward, etc.

15) Loudspeakers - Stan Kelly
Basic theory only.

16) Loudspeaker Enclosures - Stan Kelly
More theory than practice.



17) Headphones - Dave Berriman
A brief round-up.

18) Public Address And Sound Reinforcement - Peter Mapp
A good overview of the basic problems.

19) In-Car Audio - Dave Berriman
Basic arrangements with some interesting detail on car electrical systems.

20) Sound Synthesis - Mark Jenkins
Lots of info on synthesisers and such like.

21) Interconnections - Allen Mornington-West
Theory, theory, theory, partially presented. No attempt to correlate subjective with objective. An engineer's view: not for cable buffs.

22) NICAM Stereo And Satellite Radio Systems - Geoff Lewis
NICAM stereo, which is obsolete with the coming of DAB.

23) Modern Audio And Hi-Fi Servicing - Nick Beer.
Very short and not much detail. But then, with servicing it is all or nothing.

One fact stands out after perusing this Third Edition and comparing it with the Second. It needs updating! A lot of the info is becoming dated and many new developments are missing: most obvious are DVD, CD-RW, DAB and new music coding schemes such as Sony's DSD. It is still a necessary addition to the bookshelf, but the edifice needs building and tidying.

Audio And Hi-Fi Handbook
Available from our World library. See p50 of the main issue for order form (book code 1570)
Cost: £50 + £5 post and packing
ISBN 0-7506-3636-X

DIY Letters

BATTERED

A while ago you reviewed the Parts Connection DAC-2 with component upgrades and thought very highly of it, both before and after your own modifications. However, you also promised a future article on how to adapt the DAC-2 to run on battery power, and I wonder if this project is still gestating or if it has been abandoned.

I am particularly keen to do such a conversion as the mains power supply here in Azerbaijan has so many problems (spikes, brown-outs, etc) that I already have to run most of my hi-fi through a servo-controlled voltage stabiliser, but it would be better to abandon the mains as far as possible. I would even be willing to run my CD transport from a battery if it were viable, though I guess this would need a car battery rather than the smaller Yaesu types.

The system I'm trying to run out here is: Micromega T-Drive and Parts Connection DAC-2, Sony WM-D6C Pro Walkman, Sony IC-SW100E, EAR 859 integrated amp into Quad ESL 57s, and Krell KSA50S into Gradient subwoofer.

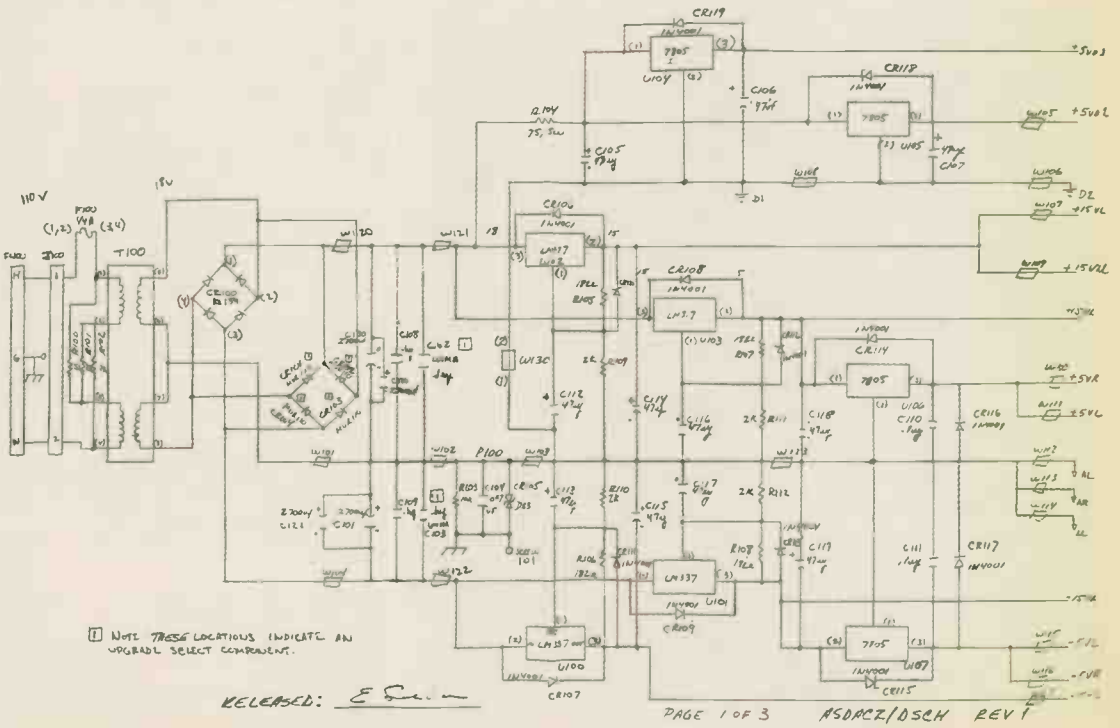
Phil Naylor
naylorpd@bp.com

Yes, as you've noticed, that one ended up on the back-burners. A basic battery-power conversion (where the entire DAC runs from one set of cells) is not especially difficult to implement, though, as long as you're careful to check your wiring before switch-on.

The DAC-2 is easy to work with when it comes to an external PSU. As you'll see in the circuit diagram, three wire links (W121, W103 and W122) separate the regulation stages from the transformer, rectifiers and reservoir capacitors. These links carry +18V, 0V and -18V respectively. Before any tweaking, remove the positive and negative links one at a time and check how much current your DAC-2 draws, so you can add an appropriate fuse in the leads from the batteries.

All you then have to do is lash out on six 6V lead/acids (each of around 10Amp-hours' capacity). You'll need to wire three batteries a side in series to reach roughly 18V. The two sets of batteries can then be wired together as shown to provide a split-rail PSU.

The DAC-2's PSU (shown below) is easy to convert to battery power.



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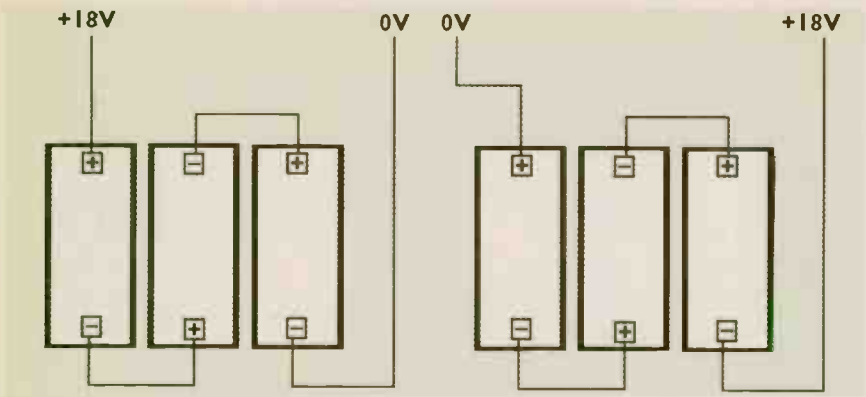


Wiring up a split-rail battery power supply for Assemblage's DAC-2 is surprisingly simple.

While you're making these modifications, it would also be a good idea to change some of the regulators' capacitors for Os-Cons (which can be bought from Audio-Links, tel: 01724 870432).

You could try operating your transport from batteries too, but you'll need a circuit diagram to make sure you're not about to barbecue it with any modifications. JM

PLANAR SAILING

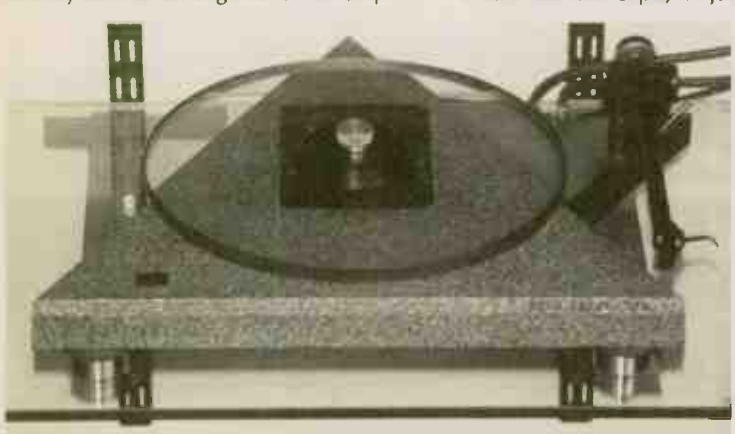
Two years ago I bought a second-hand Rega Planar 3 for the princely sum of £15, the low price due to the fact that the plinth had been subjected to someone's stomach contents! However, the shop owner - my best mate, in fact - had done a pretty good job of cleaning it up, saving me the hassle.

Having hooked it up to my system, which comprises a Naim NAC 32.5 pre with a NAP 110 power amp and B&W DM601 'speakers linked with Cabletalk 3, I was very impressed and didn't switch my NAD 502 CD player on for months.

The only down-side to the system in my view was the appearance of the Planar 3 - its earlier cleaning had left it looking very sorry for itself. So I decided to use my skills as an engineer to re-vamp the plinth, as the arm, platter and motor had escaped unharmed.

Working in a machine shop as a Milling Machine Setter/Operator for a company with its own iron foundry, cast iron was the obvious plinth choice. However, a rectangular chunk of cast iron that size would put quite a strain on the shelf, so to make things lighter I hit on Pink Triangle's idea of a triangular plinth with one point at the front.

The Tarantella in my opinion looks odd, as with a straight edge at the front there is nowhere to mount the arm. Solution: another triangle, this time made from aluminium, bolted to the main plinth's side. Although it is still pretty heavy (as you can see from the photograph by the very squashed Blue Spot squash balls which sit in stainless steel cups), it's just below the hernia limit.



Like Pink Triangle's Tarantella, Nick Daker's heavily-modified Rega Planar 3 uses a triangular base, in this case supported on squash balls.

I finished the plinth by painting it in Fleck Stone to give a granite effect.

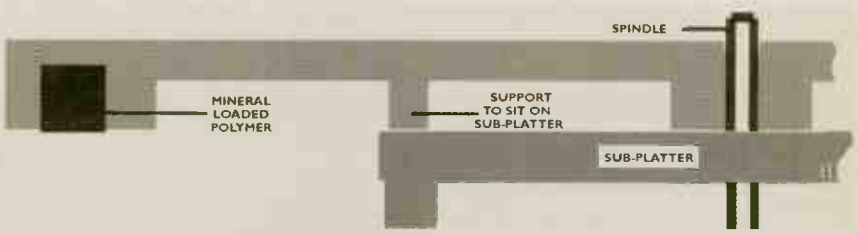
I am more than pleased with the end result - the sound quality has improved greatly and the strange æsthetics make the deck a novel talking point.

I am keen to make further improvements and this is where I am calling on you for help. Whenever Planar 2s and 3s are reviewed, speed stability always crops up. Could you please furnish me with a motor power supply diagram for the original Airpax motor, or make other suggestions on speed stability.

Finally, thanks to Nigel Purdy who prompted me to write; we were probably coincidentally building our turntables at the same time.

Nick Daker
Wolverhampton.

There's a couple of ways to improve speed stability. The first is with a specialist external power supply. Now if you could only get a Lingo which had suffered the same kind of 'party damage' as your Rega. . . Otherwise,



A platter with most of its mass concentrated around the outer edge will aid speed stability in a turntable.

there's the Valhalla and a range of other PSUs to choose from.

The second method is to replace the Planar 3's glass platter with something superior. My personal favourite material is acrylic which, with the equipment you've got access to, should be very easy to work with.

For maximum speed stability, you want the platter to have a large moment of inertia. You can achieve this either by keeping the platter diameter the same and transferring mass to its outer edge, or you can go for a larger platter. Whichever, make sure you don't massively increase the load on the bearing - putting a heavy platter on a bearing only designed to handle low masses is a recipe for swift bearing wear.

For my money, adding mass around the outer edge of a same-size platter is preferable. This means cutting away acrylic towards the centre of the platter, where extra mass adds almost nothing in terms of the moment of inertia. Just make sure you leave a

circle of full-thickness acrylic whose diameter is slightly smaller than the sub-platter's, otherwise you'll end up with a very low-slung platter which could cause problems with arm height.

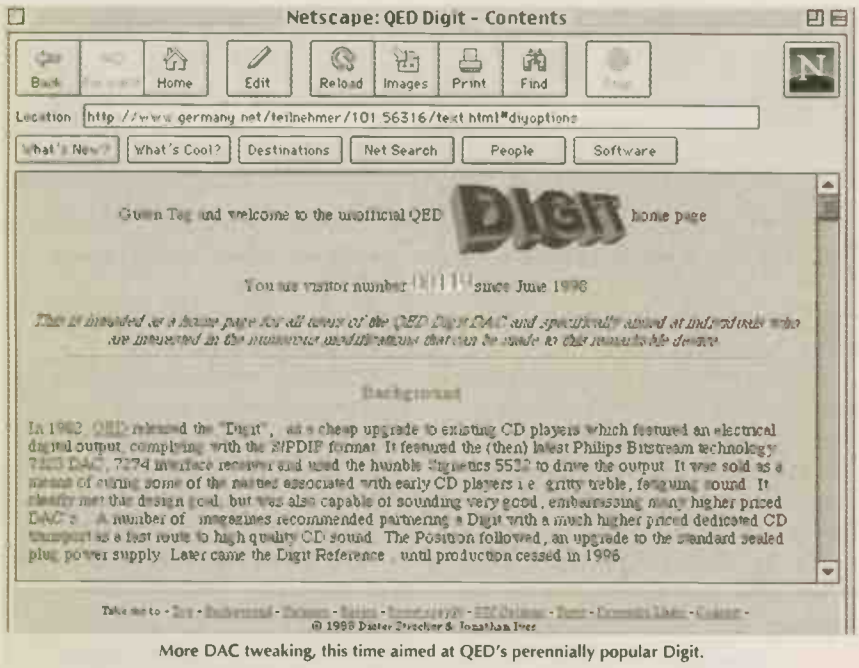
You can then leave a band around the edge which can be loaded with, perhaps, mineral-loaded polymer. VPI do something similar with a platter upgrade for their Junior turntable, where a lead ring is cast into the circumference of an acrylic platter. JM

THE DIGIT LIVES ON

Dieter and I have built a web site dedicated to the QED Digit DAC, which features many modifications and tweaks to improve its performance. Some of these are also appropriate for other DAC designs.

We were inspired by your original article on modifying the QED Digit for operation with two power supplies, and subsequent Digit-related correspondence in your letters section.

The URL for our site is:



More DAC tweaking, this time aimed at QED's perennially popular Digit.

http://www.germany.net/teilnehmer/101.56316/digit.html

Jonathan Ives and Dieter Strecker
Germany.

A QUESTION OF IMAGE

I have been interested in the development of both the KLS3 MkII and KLS10 in the Hi-Fi World Supplements because of the hi-tech drivers that are employed and because I believe that your views about the importance of driver quality, phase relationships, simplicity of crossover, impedance, etc are spot-on. I am contemplating building a KLS3 MkII, and yet one comment that you made about the HM130CO driver caught my attention. I would be grateful if you could clarify a couple of things for me.

First, here's what caught my attention. You said, "there's no doubt that a loudspeaker able to project clean, cohesive and strongly-embodied images of singers and instruments into the room, a few feet in front of the loudspeaker, is captivating to listen to. The superb carbon-fibre-cone Audax HM130CO midrange unit achieves this with some ease. . ."

This implies to me that the image will be forward of the loudspeakers irrespective of whether the music contains this image relationship. When buying my power amps, I asked for part of the demo to be with top-quality ancillaries so I could see what the amps would be capable of when funds allowed.

The loudspeakers were Wilson System Vs and these produced a truly 3-D sound stage. Somehow the singer was projected into a 'virtual room space' that was larger than the actual room, with the vocalist placed clearly behind the 'speaker plane yet with other instruments in front of and behind her. This sounded very realistic - much as one would experience in a Jazz club. I am concerned that a loudspeaker which consistently projects a forward image (KLS3 MkII?) will sound claustrophobic in the sense of being too close to the music, and, therefore, in the case of Classical music, unrealistic.

Question 1: Does the HM130CO in the KLS3 MkII always produce imaging forward of the 'speakers?

Question 2: If so, as such imaging is surely a function of how the crossover shapes (and attenuates?) the midrange frequency response and not solely a property of the driver, can KLS3 be tuned to provide sound staging to one's own taste?

Or. . . Have I just misunderstood what you said, subjectivity being difficult to put precisely into words and then easily misconstrued! My preference is for a sound stage level with or slightly behind the plane of the loudspeakers which allows the mix positioning to become clearly apparent (à la Wilson System V), and I would welcome the obvious benefits of the HM130CO in this type of presentation.

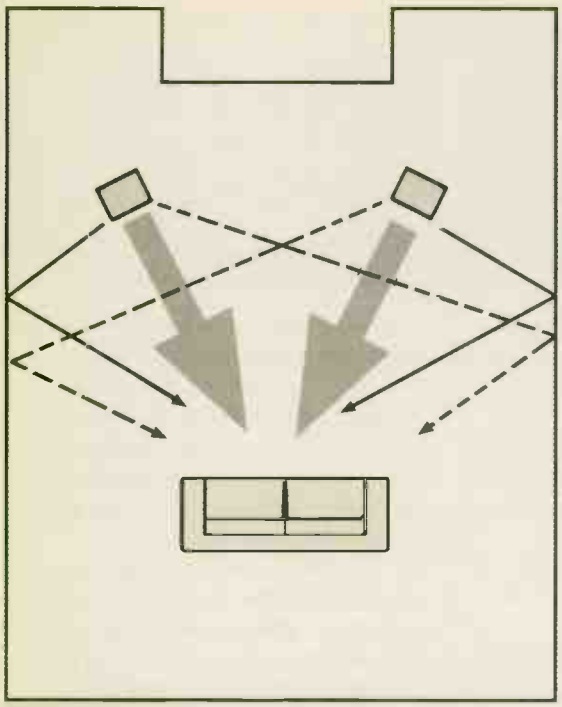
Any clarification you can provide would be much appreciated before I proceed. Please don't shirk from telling me I'm talking complete rubbish (if I am!) - I don't offend easily, have an open mind and wish to learn.

Brian Hammond

You are reading too much into what I said, but I know that I will read and re-read something that is important to me and can make too much of it. Perhaps what I should have said was the sound is not 'box bound', for that is all I meant. How the sound stage constructs itself really depends very much upon the recording, providing the loudspeaker does not stifle the imaging process.

When a loudspeaker images strongly 'out of the box', as good modern designs do, then in a typical modern, close-mic'd Rock recording with a lead vocal, the singer can step out in dramatic fashion, and it is this sort of thing I had in mind. When other perspectives are recorded, and Classical mixes can be very different, then a good loudspeaker will again reflect the recording engineer's intentions. This is what KLS3 MkII will do.

My only qualification to the above statement is to note that on-axis frequency response shape, off-axis dispersion and - little mentioned - room behaviour all affect quality of imaging. A good demo room with balanced left/right sidewall dispersion will confuse the direct sound component less, maintaining image sharpness whilst at the same time giving the impression of a wide and airy sound stage. Similarly, the ceiling



For best results, loudspeakers should be placed symmetrically within a regularly-shaped room. This ensures reflections from side and rear walls, as well as the ceiling, have the same impact on the frequency response of both channels at the listening position.

reflection provides a sense of height; it can sound quite weird, but instructive, to suppress the ceiling reflection!

I mention these things so you can get a handle on the parameters which influence sound staging, since it is obviously important to you. Slight midrange lift in the frequency response characteristic also helps throw vocals forward, but we try to avoid such artificiality. NK

SETTING BIAS

I love your new KLS10 design using the Audax drive units. I was about to start my own 'speaker based around the ScanSpeak Revelator tweeter and Dynaudio 15W75 midrange, but now I'm pondering whether to go for the oval gold-dome Audax tweeter and carbon midranges (it's a three-way system - I haven't mentioned the ScanSpeak 21Ws for the bottom end). I'd be really interested in your opinions on the comparison between these drivers.

I was very impressed by the ScanSpeak units, but should I ditch them and go with the Audax units instead? The situation has been complicated by a listen to the Lumley Reference 2.5s which rely on the same 4in. carbon midrange and 9in. woofer. I am very puzzled now as to which way to go.

You are obviously biased towards the Audax units you sell, which I accept, and I have to admit they are very good value for money. However, could you not do a large drive-unit group test covering the main makes (Audax, Dynaudio, ScanSpeak, Volt, etc) giving marks for good and bad, and maybe even a top ten for tweeters, midranges and woofers. It would be very handy for those of us who don't have the access to the drive units which you do.

Also, surely when you reduce the internal volume of an enclosure, you tend to make the bass response more peaky. Your article seems to suggest the opposite. I'm not being picky, but it might confuse a few people who are starting out. Keep up the great work.

Phil Boakes
boakesp@kben.co.uk

Hmmm! This raises a number of points of commerce on which, by definition, I can only give a partial reply. Others might retort, "he would say that". Well, they can - I'm saying it! We are not biassed toward Audax units because we sell them; we sell them because we are biassed toward them. Thankfully, Audax are happy we do, in effect, provide them with good, free, 'advance' publicity. It's an interesting little relationship that has arisen fortuitously, but with super benefits for our readers. Let me describe what lies behind it.

Audax are a French company owned by Harman Audio, a major US technology company founded by once-senator Sydney Harman. They actually specialise in high-volume production of car and audio drivers. Our supply of top-end hi-fi units is small - almost too small for them to bother with. Luckily, they are prepared to supply us.

Thank heaven, because this makes available some of the best loudspeaker drive units, which dovetails neatly with my belief that you cannot build a good loudspeaker around cheap drivers. So we started using High Definition Aerogel (HDA) before it appeared in UK loudspeakers, and the unique HD3P piezo-electric gold-dome tweeter too. That suits me, it suits our readers (who get the most advanced technologies first), and it also happens to suit Audax. In effect, we showcase their technologies early. This helps publicise them, which often leads to UK manufacturers employing their drivers in high-volume, custom form. (Bear in mind that most UK loudspeaker manufacturers source their drive units from specialist sub-contractors and that this sourcing is confidential and little talked about).

One manufacturer takes HDA from Audax, for example, and has a dye added to disguise it. Perhaps I should mention too that Audax make hundreds of drivers of all sorts, and we only use their very best.

Why don't we use other makes of drive unit? Largely because most still use coated-paper/plastic cones and what have you, which is a trifle Neanderthal technologically speaking. The HDAs may not be cheap, but that isn't us. We are not trying to mimic everyone else by attempting to coerce passable results from cheap drivers. Our desire is to move the whole argument forward a little. Hence our bias toward Audax and our

Driver technology and quality have a huge affect on loudspeaker sound quality, which is why we use Audax's High Definition Aerogel.

consistently high sensitivities coupled with easy load characteristics from simple crossovers.

At present we do not know enough about alternative makes of drive unit to be able to make valid comparisons for you. Let me explain it like this. We started out using Dynaudio and Morel and we are now happy with Audax. And if we were to test other makes, would our tests and conclusions be seen as impartial?

Finally, reducing box volume does not guarantee peaking will occur; try running an analysis programme on an Audax HM170CO.

I hope you and other readers don't mind my blatant partiality, but I am a little pleased that we can make top Audax drive units available to readers in effective designs. I feel we have something special to offer. NK

GETTING DAMP

I am keen to build my first pair of loudspeakers (KLS9) so I have been doing some research over the last few months. However, since it's going to be some time before I'm confident about 'speaker design and theory, I would appreciate it if you could clarify a couple of points on how 'speakers work (KLS9s in particular).

1) The KLS9 instructions I downloaded say, "Glue damping pads. . . onto every internal panel." Other 'speaker designs indicate no damping material on the front baffle, and some use a different material for the front baffle. So I guess the front baffle has an important influence on the sound. I assume it's not supposed to be acoustically transparent and so allow internal reflections to pass through it, but it doesn't seem likely it could emit sound in sympathy with the drive unit (it would move in the opposite direction and inhibit the driver). I would be grateful if you could clarify this function.

2) It seems to be accepted that it's not desirable to have reflected noise from inside the cabinet coming back out through the hole where the driver is mounted (or through the front baffle itself). This would seem to suggest that damping on the rear baffle is more critical than on the sides (since any sound travelling in that direction must have reflected off the back at some point). I've not come across any confirmation of this idea, though. Have I missed something?

As this picture of a KLS3 under construction from D.F. Moore of Cardiff illustrates, thick MDF panels and extensive bracing can both be used to cut down on cabinet coloration.

Donald Anderson
etl.etlddan@mesmtpse.ericsson.se

There are different types of damping to consider, each with its own function. I suspect you need to differentiate between them clearly.

Cabinet panels can resonate at their own natural frequency, creating 'woody' colorations. This problem most affects larger panel areas. It can be suppressed by gluing bituminous or Deflex panels to the surface, by using extra bracing, or just fitting thicker MDF.

Bituminous panels in particular affect internal sound absorption little; that is not their purpose. KLS9 has big panels, which is why we suggest they are damped a little. Alternatively, braces could be added.

Internal reflections need to be absorbed and/or dispersed. Deflex pads will disperse higher-frequency reflections, above 1kHz. Thick felt is needed to absorb lower frequencies effectively - see the KLS10 tune-up in the August Supplement. KLS9 needs some thick felt on the cabinet wall directly behind the HM170ZO mid/bass driver. The most transparent exit point from the cabinet for sound is the loudspeaker cone, not the cabinet panels, and thick felt on the rear wall best copes with absorbing the rear wave that you so rightly presume will otherwise reflect back out through the cone.

The other approach is to disperse this wave so the energy loses its coherence. This requires a (pseudo) randomly-contoured internal surface, but the contours need to be large at lower frequencies.

Another idea is to use a 45degree panel behind the cone to deflect sound, usually downward. With KLS9 the cabinet is sufficiently deep for this to be barely necessary. However, HDA cones are more transparent to sound than heavy plastic types, so internal treatment of the rear wall is important, more so than the side walls. Then, of course, you can use Dr Bailey's famous long-haired wool, the produce of rare Hippy sheep. We supply this with our kits. It too absorbs internal energy, reducing the effect of standing waves.

There are two factors to bear in mind with long haired wool. It adds acoustic resistance to the cabinet and this degrades reflex behaviour, so use it lightly in a bass-reflex enclosure. Long-haired wool is also used to best effect where wave excursion is large, which is at or around the centre of a cabinet, not on the walls. I hope this answers your specific questions and defines the various types of damping available. NK

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VISION OF SOUND

VISATON , who have been a sustaining member of the Audio Engineering Society for many years offer a vast range of speaker kits that give unrivalled sound quality & performance. From all round loudspeakers that are suitable for enthusiasts of any experience., to the top class high-end systems that require some advanced woodworking skills, the vast range of kits on offer means that there is something for everyone, whatever your tastes.

All kits are supplied with straightforward instructions & cabinet dimensions. No soldering is required for the "Alto" series as the crossovers come ready wired & fixed to gold plated connection terminals. The more advanced kits in the range do require some soldering.

Visaton Drive Units

Visaton have set a goal for their loudspeakers, and that is : "The completely natural reproduction of music, including the emotions that the artist tries to express". Loudspeakers therefore have to perform with much more than just high power levels. A balanced frequency response as well as maximum transparency will give the optimum reproduction of all types of music from pop bands to symphonic orchestras.

Latest High-End Drive Units :

RHT 12 - High End Ribbon Tweeter (outstanding performance, must be heard)
AL 130/170 - 5.5" & 6.5" aluminium cone, cast chassis, bass/mid drivers
GF 200/250 - 8"&10" glass fibre cone, cast chassis, dual-coil bass drivers

Help with your own Ideas

At ***South Coast Speakers*** we want to help you realise your own ideas. We offer a full after-sales service to help with any construction problems & general queries. We can also cater for spacific needs with custom designs & projects.

Design Services

1) ***Crossover Design*** :
You must send us your drive units. We will then design & optimise a crossover network specifically for those units.

2) ***Cabinet Design*** :
In order to achieve optimum performance from the bass driver the cabinet must be the correct volume for that driver. Given the parameters of the unit we will supply cabinet dimensions together with port tube length & diameter if required .

3) ***Full Test Service*** :
We use a sophisticated computerised measurement system to fully test your loudspeaker with regard to frequency response, phase and impedance. We can also test driver units & supply you with the actual Thiele/Small parameters values. This will insure that you have the correct values for your calculations

Up-grade & Repair service

We can repair or up-grade your existing loudspeakers, bringing them up to 1998 specs. Up-grades include : Replacement drivers, OFC internal cable & new crossover components. Estimates are provided free of charge and without obligation.

Listening Room

Our Showroom has a comfortable listening area modled on the average family living room, giving you, the customer, a realistic idea of how your kit speaker will sound when you have completed construction & plug them in at home. There are 15 kits on demonstration ±2 from time to time.

We are here to help you, offering informed & friendly advice so please ask.

FREE Loudspeaker Kit & Drive Unit catalogue & price list (including some useful hint and tips)
Telephone / Fax : 01703 - 559312

PM Components Ltd

SALE SALE SALE

VALVE SECONDS

These valves have been tested and are electrically to the same standard as Golden Dragon premium quality valves. However, during testing some discolouration of the glass envelope has occurred which means we cannot offer them as first quality.

The following are available until stocks are sold (few of each only, matched pairs available (subject to stock):

300B, KT90LX, EL156LX, KT66, 4.300B, KT90, 4.300B LX, 2A3, KT88, 300B Super, KT88M, EL34

Valve seconds for sale at 40 % discount off normal retail.
All guaranteed NEW, and unused.
Guaranteed for six months

Selectron House, Springhead Enterprise Park, Gravesend, Kent. England. DA11 8HD

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