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**THIS MONTH'S
BOOK REVIEW:**

CHARLES HANSEN
*Joy of Audio
Electronics*



**PLUS:
KLS12
X-OVER
UPGRADE**

CLASS OF 88

KaT88 36Watt Class A Valve Power Amplifier Kit

World Radio History



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Keeping you posted with news from component suppliers and kit specialists.

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REEVES AND REVOX

REVOX POP UP THE A77

If you're one of the half-million owners and users of one of Revox's legendary A77s and your beloved reel-to-reel recorder is starting to get tired after three decades of service, help can now be found on the Internet.

Brian Reeves, officially-authorised service agent for Revox hi-fi in the UK, has taken to the Web with a site which contains exploded parts listings for many of the company's tape decks as well as some of their turntables and CD players.

www.revox.freeuk.com

Brian Reeves
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Tel: 0161 499 2349

LIFE AT THE TOP

Fans of full-range drivers normally list amongst their benefits transparency, imaging precision and an overall seamlessness which your average cone-and-dome box just can't replicate. However, single-unit loudspeakers aren't famous for their high-frequency extension, many of them getting only as far as 14-16kHz before their output starts to droop. One answer to this problem is an add-on super-tweeter, such as Visaton's TH16H, supplied in the UK by South Coast Speakers.

The TH16H consists of an aluminium/titanium diaphragm mounted on a 25mm voice-coil which sits within the field of a large strontium-ferrite magnet. Thanks to its low moving mass, the Visaton tweeter offers an efficiency of between 96dB and 100dB when used with SCS's own switched crossover/attenuation box. This allows the TH16H to be fitted to the likes of Lowthers without the need for users to design a matching crossover themselves.

Giving your loudspeaker's treble a boost will set you back £108.94 plus VAT for individual TH16Hs, or £316.88 plus VAT for a pair with crossover/attenuation boxes.

South Coast Speakers
58 Wilton Road,
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GOT A LOT ON YOUR PLATE

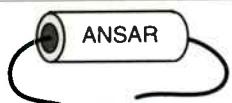
If the phrase "300B" crops up in a conversation about hi-fi and valves, you can pretty much guarantee that "2A3" won't be far behind. A smaller, lower-power member of the directly-heated triode family, the 2A3 has built up a loyal following, especially in Japan, for its linearity, tonal richness and transparency.

However, getting hold of an original in fine fettle normally involves handing over large sums of money. Cue Svetlana's new version of the 2A3. Modern manufacturing and superior materials apparently give this 21st century triode an even better sound than its predecessor, and a higher anode dissipation means that output has risen from roughly three watts to five in single-ended operation.

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CPW330N	Ansar 330nF 400V	32 x 8.0	1.60
CPW470N	Ansar 470nF 400V	32 x 9.0	1.60
CPW680N	Ansar 680nF 400V	32 x 10.5	1.80
CPW110U	Ansar 1μF 400V	32 x 12.5	1.80
CPW115U	Ansar 1.5μF 400V	32 x 14.7	1.80
CPW22U	Ansar 2.2μF 400V	43 x 14.7	1.80
CPW30U	Ansar 3.3μF 400V	43 x 17.6	2.20
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CPW80U	Ansar 8μF 400V	43 x 26.5	4.00
CPW110U	Ansar 10μF 400V	43 x 29.5	4.00
CPW115U	Ansar 15μF 400V	55 x 34.1	5.50
CPW22U	Ansar 22μF 400V	55 x 39.3	7.00
CPW25U	Ansar 25μF 400V	55 x 42.0	7.50
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CPH220P	Propax 220pF 630V	0.35
CPH330P	Propax 330pF 630V	0.35
CPH470P	Propax 470pF 630V	0.35
CPH680P	Propax 680pF 630V	0.35
CPH1N0	Propax 1nF 400V	0.45

CPP1N5	Propax 1.5nF 250V	0.45
CPP2N2	Propax 2.2nF 250V	0.45
CPP3N3	Propax 3.3nF 250V	0.45
CPP4N7	Propax 4.7nF 160V	0.50
CPP6N8	Propax 6.8nF 160V	0.50
CPP10N	Propax 10nF 63V	0.65
CPP22N	Propax 22nF 63V	0.75
CPP33N	Propax 33nF 63V	1.10
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22Y63	Lo Imp Hi Temp 22μF 63V	0.30
47Y63	Lo Imp Hi Temp 47μF 63V	0.35
100Y63	Lo Imp Hi Temp 100μF 63V	0.50
220Y50	Lo Imp Hi Temp 220μF 63V	0.75
470Y63	Lo Imp Hi Temp 470μF 63V	1.25
P100	1mH 0.40 59x19mm	£5.50
P150	1.5mH 0.50 70x30mm	£6.50
P220	2.2mH 0.60 70x30mm	£8.00
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CAB6U8	Alcap 6.8 μF	0.50
CAB8	Alcap 8 μF	0.50
CAB10	Alcap 10μF	0.50
CAB16U	Alcap 16μF	0.65
CAB20	Alcap 20μF	0.65
CAB25U	Alcap 25μF	0.65
CAB35	Alcap 33μF	0.65
CAB50U	Alcap 50μF	0.75
CAB60	Alcap 60μF	0.85
CAB80	Alcap 80μF	1.00

Part No.	Specification	Price
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F470	4.7MHz 0.250 140W	£11.00
F680	6.8MHz 0.350 120W	£12.00
F1000	10MHz 0.450 100W	£13.50

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P47	470μH 0.250 50x19mm	£3.50
P68	680μH 0.350 59x19mm	£4.50
P100	1mH 0.40 59x19mm	£5.50
P150	1.5mH 0.50 70x30mm	£6.50
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Part No.	Specification	Price
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F330	3.3MHz 0.20 330W	£9.50
F470	4.7MHz 0.250 140W	£11.00
F680	6.8MHz 0.350 120W	£12.00
F1000	10MHz 0.450 100W	£13.50

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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	£8.50
G234	RECTIFIER	£6.50
KT88	OUTPUT VALVE	£20.00

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Part No.	Specification	Price
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R100	d=110L=160-122	£5.50
R85	d=85 angled 45° for narrow cabinetL=210-310	£6.50

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KiT MEETS KaT IN 88

Nick Lucas announces the arrival of KaT88, a matching power amp for our KiT88 integrated.



Judging by the response to the release of our KiT88 integrated amplifier back in February's DIY Supplement No49, it would be an understatement to say that the KT88 tetrode is much loved amongst valve heads. To quote one fan, "I have been waiting for you guys to start using the KT88. What took you so long?" Well, we are now definitely on the case, as KiT88 is about to be joined by KaT88.

KiT and KaT are no relation to a popular piece of confectionery. Instead, one is an Integrated, the other a power Amp. Aesthetically, KaT88 has a similar look to its sibling's, though the only front-panel control is the custom-made chrome knob on the On/Off switch - KaT88 is basically the power amplifier version of KiT88.

Bypassing the selector, tape source switch and volume control that distinguish the integrated and replacing them with a single set of inputs that feeds directly into the first valve has the advantage of a less cluttered signal path and offers greater flexibility to dedicated pre-amplifier users. The circuit is basically identical to that of KiT88, but as the volume control is now unused, R28/R29 has been reduced to 100kohms to compensate. The measured performance remains the same as for the KiT88, but does it sound the same?

CONSTRUCTING THE 88 SERIES

The build sequences of KiT88 and its sister KaT88 follow the same formula that we apply to all our valve equipment:

1) FIXING THE HARDWARE TO THE CHASSIS

The initial stages are straight forward enough and revolve around fitting the front plate and associated sockets and switches before crowning them with their respective chrome knobs. As mentioned before, the KaT88 only has a power switch up front.

Next to go on are the mains and output transformers, the gold-plated phono sockets and the 4mm binding posts. Yes, I have had a change of heart on the speaker connection front as the majority of kit buyers live in the UK and already use 4mm banana plugs on their speaker leads. The alternative BFAs will be provided for our European cousins. All that remains is

the IEC mains input socket and the earth post situated to the rear.

2) POPULATING THE PCB

The KT88 and KA88 owe their ease of construction to the fact that all the valve bases and electronic components are linked together through a Printed Circuit Board rather than hard-wiring.

Additionally, all the parts are supplied in separately-labelled bags, which means less chance of putting the wrong bit in the right place. The PCB itself is double-sided, so all joints require soldering to its upper as well as lower surfaces (except for the electrolytic capacitors). Component orientation is very important when it comes to these caps, the bridge rectifiers and the octal valve bases. The high-power resistors also have to be a good 10mm off the PCB surface to avoid tarnishing it.

3) VALVE HEATERS AND INTER CONNECTIONS

Once all the components are sitting nice-

ly, the valve heaters can be wired up. Heaters, and especially those of the output tubes, carry plenty of current. To avoid over-stressing PCB tracks, we chose

now use PCB terminal pins in our kits, all 23 external connections are easy to make, though this time you may find it slightly easier to complete these connections

before fitting the PCB onto its stand-offs. This allows slightly more manoeuvrability without distressing any joints.

5) NON-PCB CONNECTIONS

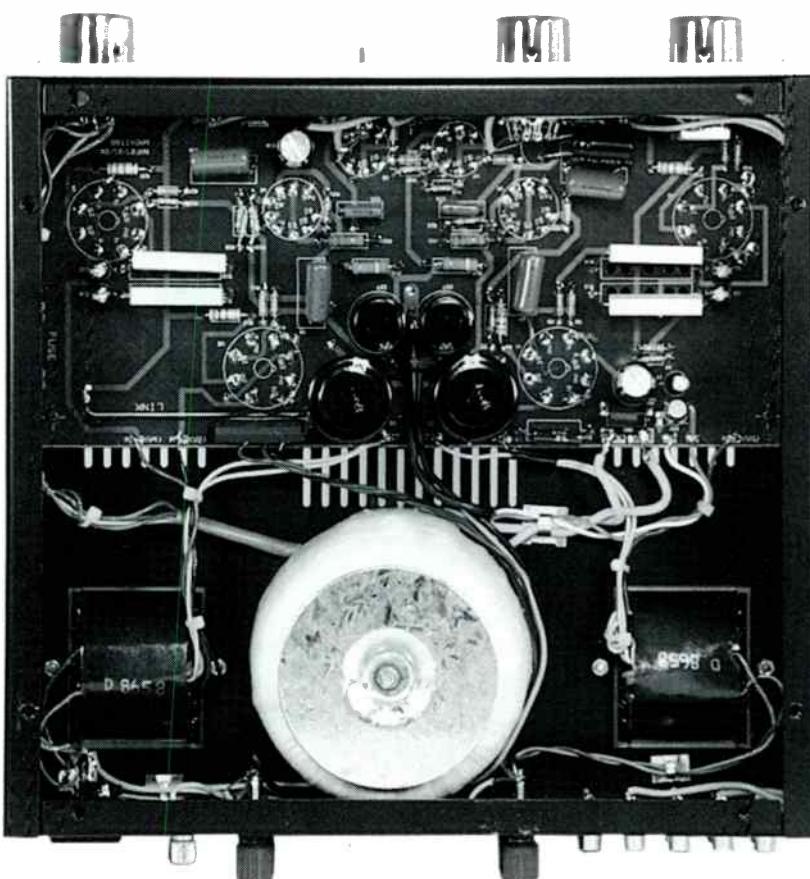
All that remains now is to hook up the IEC mains input socket to the mains switch and the output transformers to the speaker binding posts.

6) PRE-FLIGHT CHECKS

Insert all the valves, ensuring that you have the KT88s orientated correctly by checking that the 'key' on the base of each lines up. Connect a dummy load,

whether an old pair of speakers or a high-power, 7-10 ohm resistor. Bear in mind that you'll need a pre-amp for the KA88, be it active or passive, to control the signal level.

Once you've fired up the amplifier, you're ready to check the test voltages, but before you do so, remember to put on the safety gloves provided. We have included two 220kohm, 2watt dropper resistors in parallel with the large 470uF, 450V reservoir capacitors, C1 and C2, so



Internal view of Kit88

point-to-point wiring for this area. Each valve base PCB section has pin pairs, or just a single pin, to allow simple wiring direct to the board. Additionally, there are three external wire links.

4) CONNECTING UP THE PCB

The PCB fits snugly into the case, held securely in place by six stand-offs. As we

Cowboy. This has some of the subtlest, deepest, most powerful bass ever committed to disc, and the KA88 did it proud. Speed and slam were the prerogatives as the amp brought out the essential aspects of the mix and delivered them with power and control.

Whilst the above track emphasised the clout of the amplifier, a detailed and spacious recording of Stravinsky's Rite Of Spring on Reference Recordings demonstrated the warmth and sweetness of the treble. High percussion had an attractive

golden shimmer, leaving the strings and woodwind securely located within the warehouse-style sound stage the amp created. Again the speed and impact of the bass came to the fore on the deep bass drum as window-rattling thumps, although the athletic bottom-end never disturbed the clarity and transparency of the midrange on the light and airy woodwind interjections. The KA88 really did this excellent recording justice. Great stuff; I am waiting with baited breath for my reference model to arrive.

SOUND QUALITY

The power amp version of our KT88 integrated benefits sonically from one of the cleanest valve sounds around. Even used with a passive pre-amplifier, the bass has all the values of the venerable valve, which is a rounded sound that also manages to be tight and tuneful - it literally bounces along. This was best exemplified on an excellent remix I have of Jamiroquai's Space

that after switch-off they are bled of any residual voltage after a few minutes. This safety measure reduces the possibility of an electric shock. The build time for KaT88 is approximately eight hours. If you do encounter any problems once

the amp's assembled, turn it off and carefully check your work for any unsoldered pins or misplaced components. Believe me, 99% of all malfunctions are down to silly mistakes. However, should you encounter real difficulties, you are wel-

come to call our help line. Alternatively, for a nominal fee, we will arrange for the amplifier to be collected, fixed, thoroughly checked and returned to yourself in full working order.

Kit88 parts list

RESISTORS: POWER SUPPLY

R1	5.6K, 6W	1
R3	36K, 0.66W	1
R4	8K2, 3W	1
R5	13K, 0.66W	1
SIGNAL		
R6	100R, 1W	1
R7	36K, 1W made up of the following resistors in parallel	
	68K, 0.66W	1
	75K, 0.66W	1
R8	1K, 0.5W	1
R9	330K, 0.5W	1
R10	1K, 0.5W	1
R11	330K, 0.5W	1
R12	100R, 1W	1
R13	150R, 7W	1
R14	150R, 7W	1
R15	150R, 7W	1
R16	150R, 7W	1
R17	39K, 3W	1
R18	39K, 3W	1
R19	47K, 1W made up of the following resistors in parallel	
	91K, 0.66W	1
	100K, 0.66W	1
R20	36K, 1W made up of the following resistors in parallel	
	68K, 0.66W	1
	75K, 0.66W	1
R21	15K, 3W	1
R22	15K, 3W	1
R23	1M, 0.5W	1
R24	447K, 1W made up of the following resistors in parallel	
	91K, 0.66W	1
	100K, 0.66W	1
R25	1M, 0.5W	1
R26	330K, 0.5W	1
R27	1K, 0.5W	1
R28	1M, 0.5W	1
R29	1M, 0.5W	1
R30	330K, 0.5W	1
R31	1K, 0.5W	1
R32	100R, 1W	1
R33	100R, 1W	1
R34	6K8, 0.5W	1
R35	6K8, 0.5W	1
R36	330R, 0.5W	1
R37	330R, 0.5W	1
R38	330R, 0.5W	1
R39	330R, 0.5W	1
R40	6R8, 0.25W	1
R41	6R8, 0.25W	1
VR1	100K log dual	1

POWER SUPPLY

C1	470uF 450V	1
C2	470uF 450V	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 16V	1
C18	4700uF 16V	1
C19	3.9nF 160V	1
C20	3.9nF 160V	1

BRIDGE RECTIFIER

BR1Semikron SKBB500C3200/2200	1
BR2General Semiconductors 2KBP02M	1
BR3General Semiconductors WO2GBIAS	1

TRANSFORMERS

E/I output transformer	2
Toroidal mains transformer	1

HARDWARE

mains switch rotary	1
PCB fuse holder	1
Fuse cover	1
Fuse 1.6A slow blow	1
SELECTOR	1
BLK PHONOS	5
RED PHONOS	5
BFA sockets	2
IEC to UK plug	1
FEET	4
Octal valve base	4
B9A valve base	2
B7G valve base	2
Tape/Source Switch	1
IEC + fuse inlet socket	1
wire assorted	
Chome knobs	3
Chassis & base	1
Front panel	1
KiT PCB	1

VALVES

Tesla KT88	4
Edicron 6AU6	2
Edicron ECC82	2

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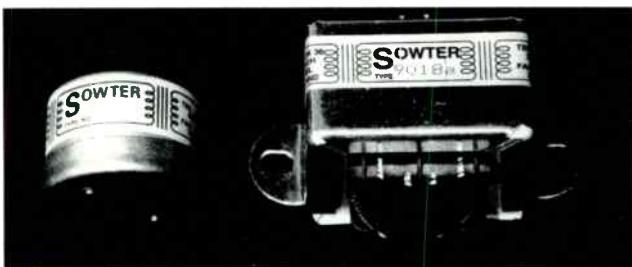
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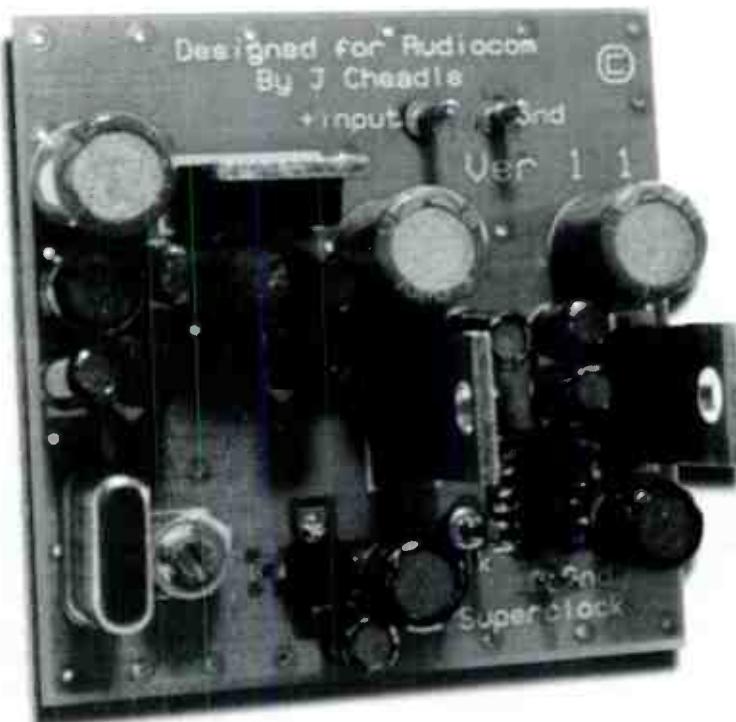
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TIMING ON TRIAL

Jon Marks goes on litter duty to clean up messy master clocks inside CD players. Helping him tidy up this month is AudioCom's SuperClock.

One of the greatest clichés in the world of hi-fi has got to be the classic, "Perfect sound forever". However, CD is taking a while to live up to this golden nugget of hype, but then the format itself is not always to blame.

One of the major problems with digital replay is that, when you're putting all those sampled bits of information from the disc back together, the timing has to be spot on - it's no use a few turning up late with excuses like, "Sorry, Miss, the cat ate my homework." You might be thinking that the master clocks inside CD players (which do, after all, synchronise all the machine's various digital circuits) would be works of quartz-regulated art, designed to exacting timing tolerances to squeeze every last ounce of performance from the small silver disc. Unfortunately, the reality is rather different - many companies seem to work to the adage that "bits is bits" and as long as they're all there, and the timing isn't miles off, then that's alright. Actually, instead of producing a clean, stable square wave whose regularly-spaced peaks and troughs tell the master clock precisely when to 'tick' and when to 'tock', the oscillators in most equipment put out saw-tooth waves that are the equivalents of 'erm, tick, no tock!' Recognising this pitfall, companies such as AudioCom, Trichord and Acoustic Precision have cooked up their own high-accuracy after-market clocks. In this Supplement, we examine AudioCom's in our two test beds, a Pioneer DV-505 DVD player and an aged but sprightly Pioneer PD-91 CD player. This pair was chosen for two main reasons, the chief being that they have a common clock frequency of 16.9344MHz. The other is that many of these clocks will be soldered into machines which are old enough to be built like tanks but fitted with particularly poor clocks.



AudioCom's SuperClock

INSIDE THE SUPERCLOCK

Designer of the SuperClock, John Cheadle, was aiming for a clock with a very fast rise time (and so a clean square wave), negligible jitter and low phase noise. Minimising the last of these involves a push-pull circuit with a series-mode oscillation quartz crystal placed at the point of lowest impedance. After travelling through a MOSFET buffer stage, the signal is fed into an IC which converts it from a sine to square wave.

GETTING IN

Gaining access to the relevant board in the DV-505 is a rather fiddly affair. Having removed the lid, undo the two screws which hold the SCART socket onto the rear panel and lift the metal clip above it which will still be holding it in

place. Next, take out all the screws remaining on the rear panel and lift it up and off.

To fit the new clock, you'll have to take out the beige PCB with the output socketry on it. This entails disconnecting CN301, which is located beside crystal 301 (not the one you should replace, by the way, as it operates at 18MHz, not 16MHz!) This leaves two ribbon cables hooking the output board to the main PCB, but these are fairly flexible and won't hamper the clock-fitting process. Once the four screws holding the board down have been removed, you can lift it gently away from the chassis.

SOLDER SURGERY

Now it's time to get down to the real modifications. Once you've warmed up your soldering iron, use it to remove R320

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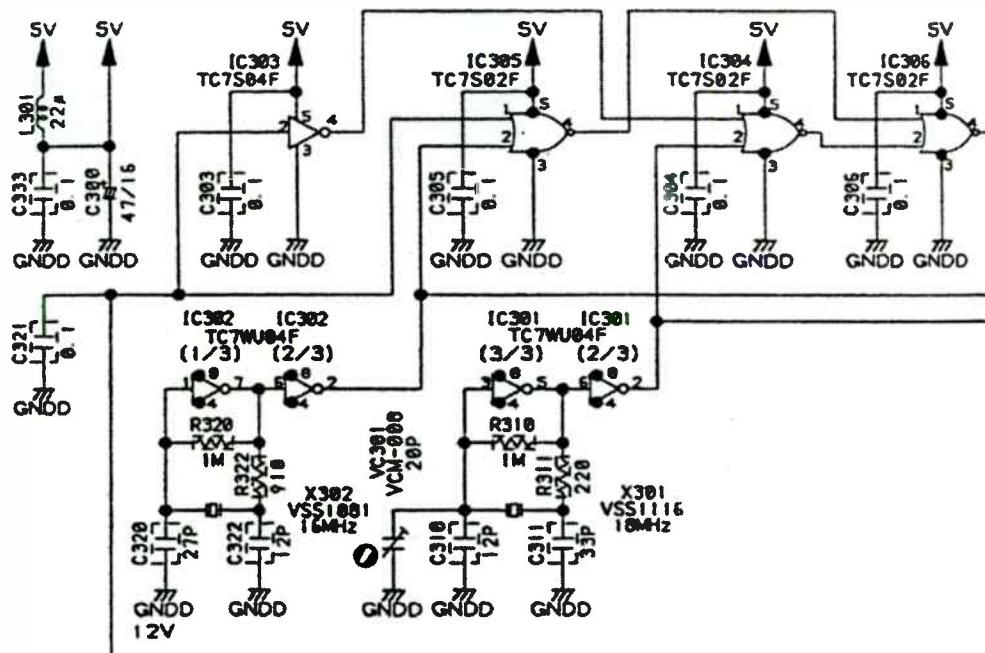
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Make sure you remove the correct crystal when working on the DV-505 - it's X302.X301 that controls the video circuitry

(1Mohm), R322 (910ohm), C320 (27pF) and C322 (12pF), all of which are located on the underside of the output board. (Beware, as these are very small surface-mount parts which are most easily removed with the appropriate bit, although a standard iron and some solder braid will also work). Crystal X302 has to go as well.

One point which clock manufacturers all agree on is that the signal leads from their devices to the relevant ICs inside the players need to be kept as short as possible. By putting a link across C322, you can simply connect the S-Clock's signal + and - wires to the pads which used to be occupied by the original crystal. The S-Clock's green (-) should go to the pad between C322 and R322, whereas the black (which is, slightly confusingly, the + output) should go to the other pad between C320 and R320.

By fitting the S-Clock in this position, you can keep its signal leads extremely short - about 12mm long, in fact. However, this does entail placing the S-Clock PCB (on the supplied double-sided adhesive foam pads) upside-down just below the back right corner of the transport as you look at the '505 from the rear (see picture).

The only other connections to make are the power supply + and -, which will

run from the S-Clock around under the edge of the output PCB. The best place to hook up in this case is the underside of connector CN191 (close to the centre of the output PCB), whose pins five or nine are where the black PSU wire should be soldered to. Pin 3 (+12V) can accommodate the red wire, although this can result in a tight squeeze, especially as the S-Clock wires are relatively thick. I ended up soldering it to the CN191 side of near-by R190 to reduce the possibility of shorts.

With the S-Clock nestling snugly inside the DV-505, all that remains is to double-check your work before firing up. I can't emphasise how important this is, as the urge to just whack the lid back on and get a CD in the drawer as swiftly as possibly can be very strong. Unfortunately, it's this classic situation which tends to lead to more barbecued equipment than any other. Check the polarity and position of all the connections from the S-Clock, and only when you're 100% satisfied that you've made no errors, reassemble the player and power it up.

SQUARE SOUNDS So what sonic differences come with a change from sloppy master clock signal to one that's a nice, clean square wave? Well, in a nutshell, every aspect of the DV-505's performance improves in a major way with the fitting of the S-Clock.

The player used for this test had already been modified to sound considerably better than the standard machine with the widespread use of tantalum decoupling caps, but the addition of the S-Clock was a vastly more effective upgrade.

The most obvious change to the sound was the extra solidity and impact on all kinds of music. Trying out something with a weighty bassline now (Moloko's I'm Not A Doctor, Asian Dub Foundation's Rafi's Revenge, Presence's All System's Gone) turned out to be a revelation. Drum machines now had greater focus, speed and slam than the '505 had previously been able to endow them with, and rhythms were crisper and enjoyed more drive. Classical

recordings benefitted in a similar fashion, Elgar's violin concerto possessing superior dynamics, involvement and overall realism. The Pioneer's level of finesse and transparency also took a leap forward with the S-Clock in place, complex passages easier to follow and the performers more clearly depicted within a larger, more convincing acoustic.

Moving on to Bonnie Raitt, Suzanne Vega and the Jazz of Tois' *Forbidden Fruit* confirmed tonal colour and expression had nipped a rung or two up the evolutionary ladder along with everything else. Not that the '505 has ever scored on the listenability scale anywhere near paint drying, but now it really went with the musical flow, whatever its speed. The player was all bump and grind on BR's 'Tangled And Dark', while still maximising the tear-jerk balladeering of 'One Part Be My Lover'. 505 DOWN, 91 TO GO After the major rise in sound quality I'd heard with the SuperClock in the 505, I had high hopes for the PD-91. Actually reaching the listening stage took a little longer than anticipated though. Getting inside the PD-91 to remove the relevant components isn't particularly tough, but grafting on the SuperClock takes some planning.

Having unscrewed the Urushi side cheeks and lid to expose the upper surface of the PCB, you'll need to flip the

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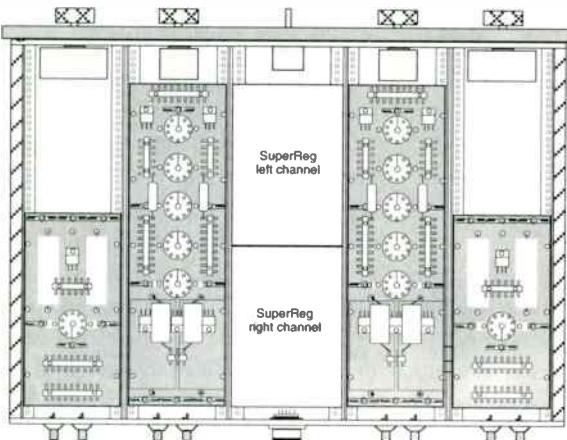
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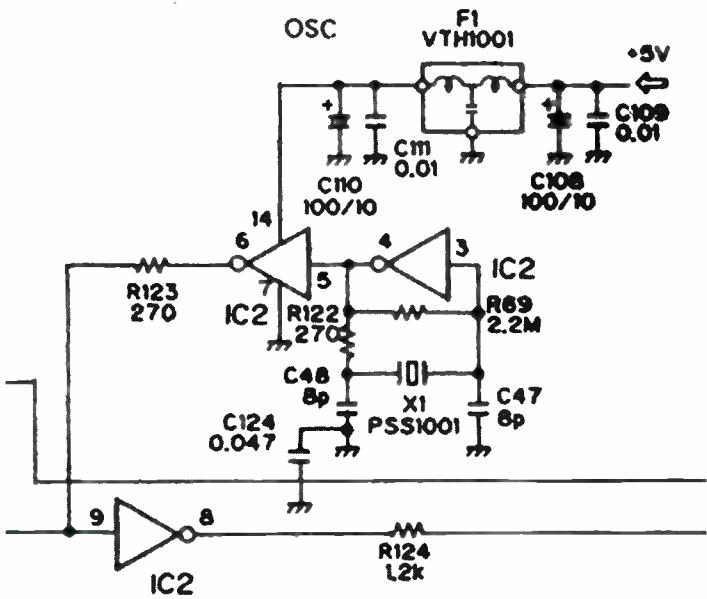
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IC2 : TC74HCU04P



The PD-91's master clock is built around IC2 and X1

Pioneer over and remove the baseplate too. Be careful with the laser sled while you're doing this - it's best to lock it in place with the plastic 'switch' on the transport's underside to stop it sliding up and down along its guide rails.

The next parts to come out are the large, copper-plated metal screen that runs down the centre of the player, and the copper-covered plastic skirt that sits to its right (looking from the front of the PD-91). Beneath the latter you'll find the crystal X1, resistors R69, R122 and R123, and

two small, ceramic caps, C47 and C48. Desolder all of these and place a wire link across C47's position on the PCB. The link to the player's power supply should be made at C85, one of the four 3300uF, 25V electrolytics towards the rear left corner of the case.

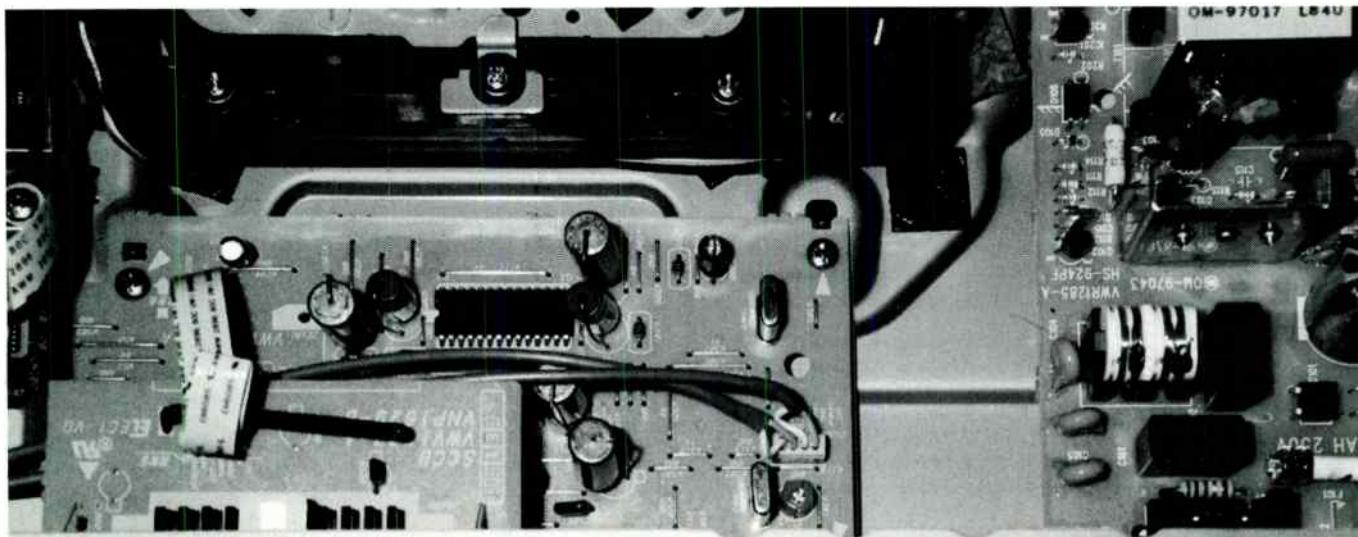
TAKE COVER

Now the job becomes slightly trickier. The SuperClock's signal output has to be taken to pin 9 of IC2, the matching signal

ground to pin 7 of the same chip. Based on my experience with the DV-505, I chopped down some solid-core copper wire (whose sound AudioCom prefer to that of coax), used self-adhesive foam pads to mount the clock board vertically with its front edge stuck to the top of IC2, and soldered in a pair of short clock leads (less than 15mm each). This approach meant leaving off the copper-covered plastic skirt, but if the '505 hadn't needed shielding, I reasoned the '91 might not either. Wrong!

Having completed my 'Go over it five times or watch it go up in smoke' checklist, I turned the Pioneer on and loaded it with a disc. Barely a second after pressing Play, it was obvious something wasn't right - accompanying the music was a kind of 'crackling' which definitely wasn't in the recording. A swift call to AudioCom provided an explanation: without the shield in place, RF radiation emitted by the SuperClock was interfering with the Pioneer's digital circuitry. The solution consisted of replacing the skirt, having punched a hole in it to allow a short length of coaxial cable through from the clock to IC2. This hole should be approximately 80mm in from the rear of the PD-91, and 20mm in from the side of the plastic shield.

AudioCom recommend XXXX coax, even if it is delicate. I chose a strip about 40mm long and soldered it to the underside of the clock board, which was fixed at an angle to one edge of the large metal shield. Powering up proved less disappointing on this occasion, as the PD-91 worked perfectly and was in fine form.



Internal view of DV-505 prior to fitting of SuperClock

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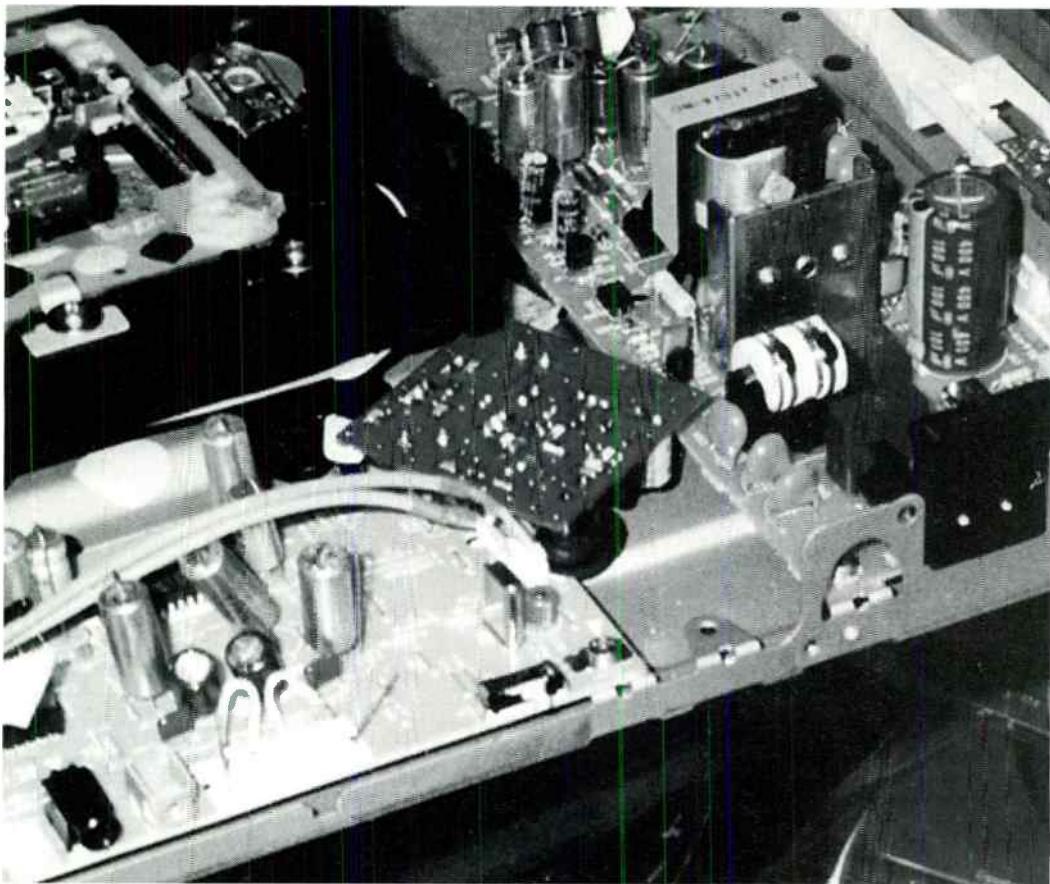
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Internal view of DV-505 after fitting of Superclock

SWEET SOUNDS

Bolted back together, the transformation to the presentation of this older machine proved that the SuperClock was once again an effective modification. In this instance the upgrade might not have been such a leap forwards as it was with the DV-505, but it was still very noticeable.

On Natacha Atlas' Halim album, all the Arabic rhythms picked up extra drive and speed courtesy of a faster, more controlled bass. Sound staging and imaging were both more holographic too, and the overall level of detail was considerably higher.

One CD where the greater grip in the lower frequencies was really appreciated was Bob Marley And The Wailers' Early Years compilation. Where the original PD-

91 had been rather too laid-back and mellow on some of the skankier tracks, now it handled all of them convincingly, putting the necessary bounce into basslines. The differences in production quality between songs was much more evident as well, as certain numbers had that authentic 'recorded in a shed by stoned musicians' feel to them.

In spite of the Pioneer's 18-bit Burr-Brown DACs lacking the sort of dynamics and low-level subtlety that more up-to-date designs are capable of, it still had a very musical, involving way with any of the discs that I fed it. In fact, John Cheadle, the SuperClock's designer, swears by a heavily tweaked PD-91 as a transport, although the changes there include a huge number of component substitutions and a replacement digital

output board amongst other things. However, we hope to be covering other mods for the PD-91 in future issues.

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CUE THE COMPETITION

In the next Supplement, we'll be putting Acoustic Precision's master clock through its paces as well as introducing superior power supplies for both it and the AudioCom. We'll also discover how DIY clocking can sound with Daniel Esplly's circuit, which was published in the previous Supplement.

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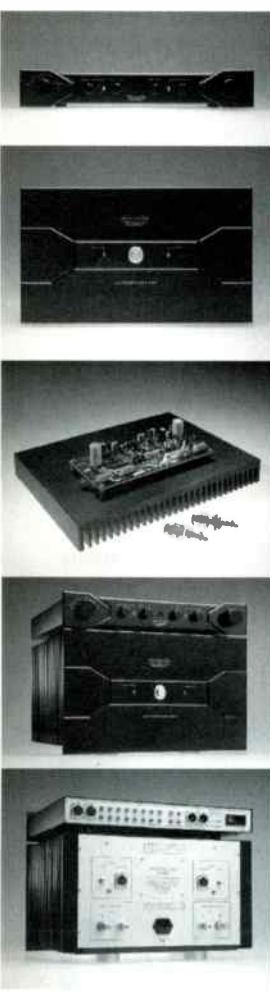
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MODIFICATION SITUATION

Nick Lucas dons his tweaking cap to test out hot-rod parts in our KLS12C loudspeaker.

A topic which we have rarely touched upon in the DIY Supplement is upgrade components for that most easily modifiable of all hi-fi components, the loudspeaker. As any manufacturer attempting to balance cost against profit understands, the all-important bottom-line dictates that the majority of commercial loudspeakers use caps and inductors that were sourced with price rather than absolute performance in mind. But with most crossovers just a screwdriver and a bit of elbow grease away, changing this situation needn't be a DIY nightmare.

Unless the components inside your loudspeakers are custom made, you're unlikely to require a circuit diagram to understand what's going on as the parts values should all be clearly marked. Getting to the crossover normally entails either removing the mid/bass or bass unit and unscrewing a PCB from whichever panel it's mounted on, or, if you're lucky, merely taking off the terminal plate where simple filters are often to be found.

To illustrate the upgrade power of crossover revamps, we dusted down a pair of our budget KLS12 two-ways in floor-standing guise, and faxed over a circuit diagram to Audio-Links in Scunthorpe with a price limit of £100 for the most effective mods possible.

IRONS AT THE READY

The most obvious upgrade in a complex crossover like the KLS12's is any part that lies directly in the signal path. For L1 and L2 we plumped for M CAPfusion Air Core Inductors (1% tolerance, wound on a large diameter former, with a low ESR). These hefty beasts are constructed from 99.998% oxygen-free copper wire and, after production, each inductor undergoes a special process, resulting in the winding bonding to itself and the spool. This process creates an inductor that is a single mass with near-zero microphony.

Sonically, the improvements are claimed to include greater clarity, tonal realism and spaciousness. When it came to C4 and C5, we settled on Ansar's smooth but affordable polypropylene capacitors. These were then bypassed with M CAPzN polypropylenes, C4 with a 0.1uF and C5 with a 0.47uF. The zns are very tightly wound from solid tin foil and high-purity polypropylene film to give an extremely dense and thus low-microphony capacitor. Audio-Links informed us that they have a beautifully clear sound with a tone that is very even-handed across the audio bandwidth. The final substitution consist-

ed of R4, where a Caddock MP930 non-magnetic, non-inductive power resistor with copper leads and 1% tolerance replaced the standard fare. After 100 hours' burn-in, Jon Marks sampled the sound of the hot-rodded KLS12Cs.

SOUND QUALITY

For £100 you'd be entitled to expect a fairly radical lift to sound quality, and the Caddocks, Ansars and M CAP parts didn't disappoint. Rather than a subtle enhancement of the KLS12s, what I heard was immediately obvious. However, where many upgrades that stick out like a sore thumb on the first listen can become wearing as the hours roll by, these were welcome to stay.

Nusrat Fateh Ali Khan's chanting can verge on the painful through loudspeakers where there are more rough edges than smooth, but his voice dipped and soared in a natural, dynamically unrestricted way as it emerged from the high-spec KLS12Cs. His Shahen Shah album has a crystal clarity to the recording of the venue, and this was much more vivid than it had been previously, as if a layer of gunge that had previously obscured a wealth of fine detail had been peeled off the music. Evidently, M CAP's low-microphony construction techniques were paying their way.

Shifting from the wholly acoustic to the wholly electronic, I cued up Presence's All Systems Gone CD. Again a disc which can go wrong if played via transducers which suffer from too cold or clinical a character, ASG sounded well at home here. The fact that the vocals were far clearer and crisper than before without there being any sibilance counted heavily in the upgrade's favour, as did the firmer, faster and more controlled basslines. In spite of the synthetic nature of this recording, it had a sweetness you only hear through electronics and speakers which don't dirty its surprisingly high standard of



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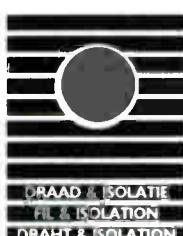
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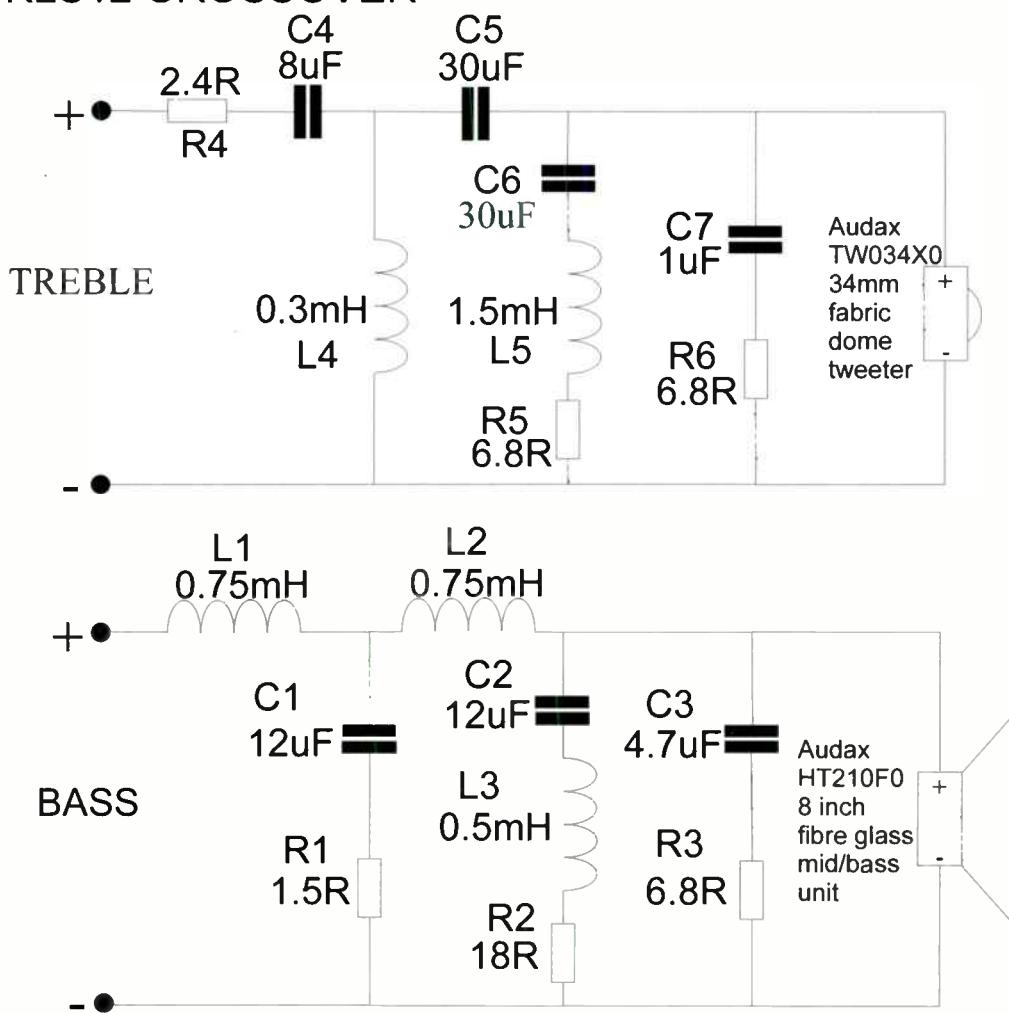
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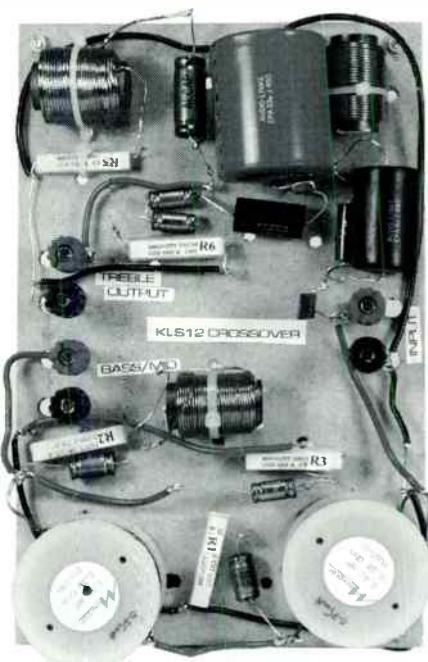
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KLS12 CROSSOVER



production.

More digital ditties were supplied by Unkle's Psyence Fiction. Talking of dirty, this CD is about as rough as a builder's behind, and any 'speaker that makes a decent stab of it has to be spacious, transparent and devoid of any midrange or treble nasties. Although a sock over the tweeter is probably the best way to get the most from Psyence Fiction, the post-upgrade KLS12Cs managed to strike the right balance without resorting to woolly high frequencies. Removing the esoteric additions and going back to the common-or-garden KLS12Cs proved just how much more listenable this album was for £100 spent on the crossover. Reverting to the more basic bits brought it a grainy, fuzzy edge to the midrange and treble, while the bass put on weight and loosened its belt, sapping a lot of its drive and impact. JM



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THE JOY OF AUDIO ELECTRONICS

By Charles Hansen

Reviewed by Richard White

Many years ago, when I was a boy there were not many books on electrical matters suitable for the enquiring mind. There was a number of reasons for this. For a start, in those days everything educational seemed to begin with first principles and work up gradually. As an example, if a practical demonstration of audio amplification were to be given, it seemed impossible to commence without the phenomena of current, voltage, resistance, capacitance and inductance being first explained. Unfortunately, there was a risk that enquirers would too easily fall by the wayside, felled by the cumulative effect of too many algebraic expressions and the continual postponement of the plans for a working Tardis.

Times change; Science had been trodden underfoot by Technology and it doesn't seem to matter if you know how it works as long as you can buy it. Ohm's law has been sent 'ome, and comparatively simple word-processor programmes will manipulate algebraic expressions to A-level and beyond.

The Joy of Audio Electronics squeezes in somewhere between these two extremes. The author's aim seems to be to lead people into the hobby, teaching along the way. Two specific projects are described, the first of which is a loudspeaker 'peak power indicator', which lights an LED when a voltage determined by the builder is exceeded. A pair of circuit boards (one for each channel) is provided free with the book, rather in the way that the Dandy Thunderbang or Beano Fizzer were 'presented free' with comics. These little gadgets derive their operating power from the loudspeaker signal and so require no external supplies.

The other project is The Quadpod, a powered device intended for extracting 'hidden information' from standard stereo signals. In essence, the idea is to disentangle L-R and R-L leftovers from recordings made with the well-known 'Blumlein pair'

microphone configuration. These gleanings can then be played (through a suitable amplifier and loudspeakers) to give two rear ambience channels from an ordinary stereo record. Not very many modern Rock & Pop mixes are recorded with a Blumlein pair, although it is still a 'classic' for Classical

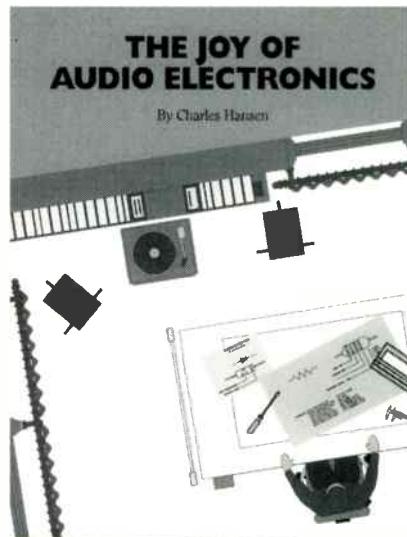
Making these projects is described in very fine detail, including a little theoretical digressing and entirely practical hints such as the best way to bend wires to fit a PCB. While this approach may irritate the more experienced builder, for the beginner any time spent inculcating good habits is well spent and will go a long way towards avoiding the 'solder sculpture' results of a first PCB project.

The remainder of the book is devoted to, in its own words, 'Where do we go from here?' Advice is given on the modification of published projects and the techniques used for making PCBs at home. Breadboard and hard-wire techniques are also discussed. A chapter is given on the design and furnishing of a home electronics workshop or testing station.

Elementary theory, including a glossary, has an informative chapter to itself. In addition to pencil-and-paper formulæ, Excel computer programmes for theoretical modelling are identified alongside their applications.

A few cautionary words will not be out of place. First, this is an American publication and the author has done his absolute utmost to smooth the path of the reader, provided that the said reader resides in the USA. Chapter Five, which deals with suppliers suffers much from this export limitation. Similarly, estimated costs for the projects are given in dollars which may not correspond elsewhere.

Second warning: the United States is not a metricated country. This doesn't bother me in the slightest, but if you are uneasy around 'three-sixteenths' and other such homely phrases, better have your conversion tables handy. In one instance,



the author designates drills by Morse Gauge numbers, an engineering standard with 106 sizes between roughly quarter-inch and minuscule! You won't get much help with these at B&Q.

Notwithstanding these caveats, the Joy of Audio Electronics is above all a friendly book. The author rightly understands that not everyone knows everything before they're told, and sets about leading the way to an increased appreciation of the chief points of the hobby with a companionable air. Whether or not the specific projects appeal to you, there is a mine of handy information here, presented in a very readable form. After all, studying a book on motor mechanics does not necessarily make you Herbert Austin, but it might help you when it comes to changing the oil filter. In the same way, the little tit-bits of knowledge in this book may seem to have no immediate application - until you find yourself wishing that someone had told you to make a good joint before applying the soldering iron. When all the insulation has melted and the thing still won't stick, it is usually too late!

RMW

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