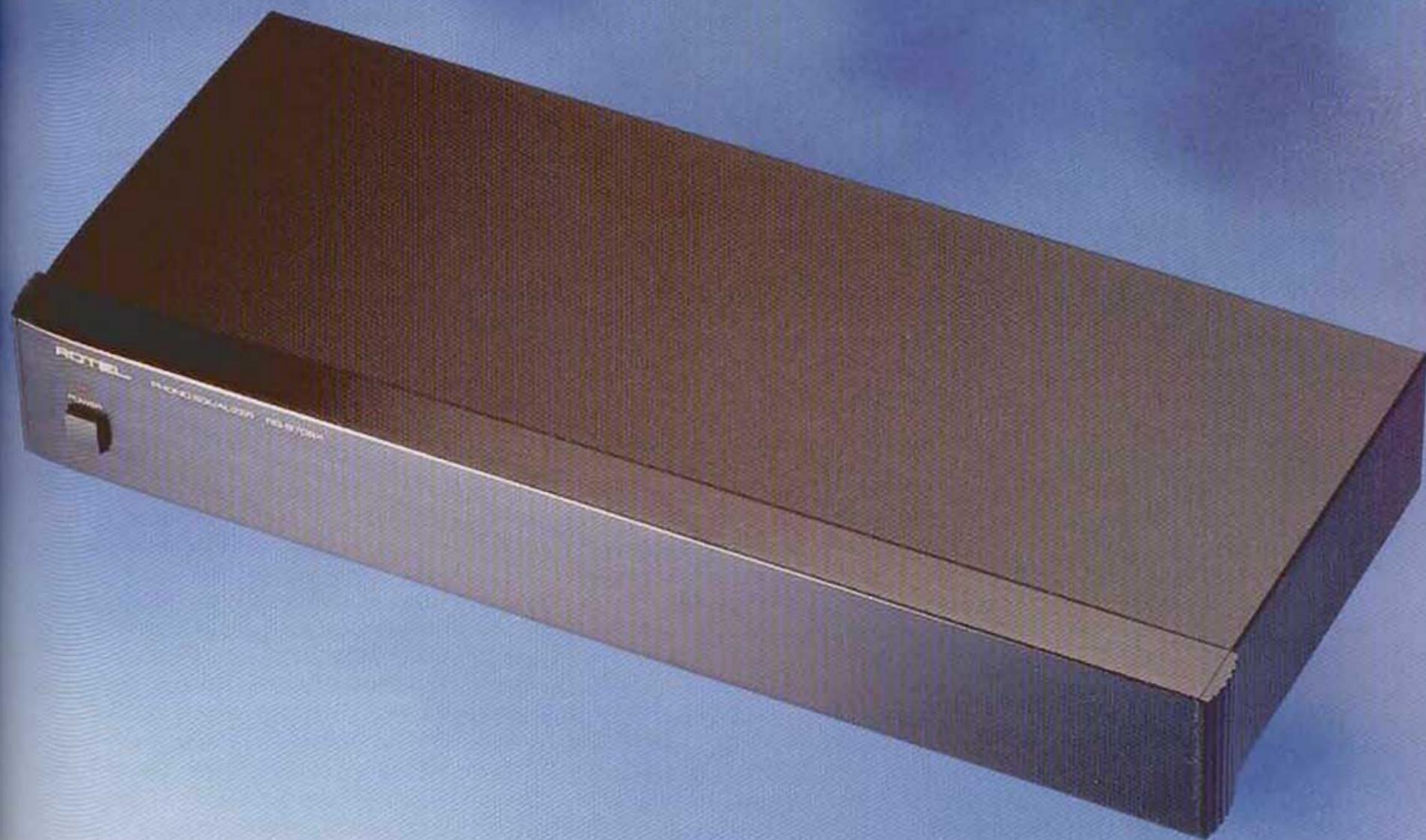


# VINYL DRIVE

review



**Rotel's new RQ-970BX phono-stage has Eric Braithwaite blowing cobwebs from his LP collection.**

Vinyl didn't exactly die, it just faded away from the display racks in the shops. But the turntable soldiers on. There are still millions of black discs around, and more and more companies are licensing the classic Decca and RCA recordings of the fifties and sixties.

Rotel, being sensible about affordable audiophile electronics, has stepped in with what is probably the most affordable mainstream company phono stage around. For a mere £130, the RQ-970BX Phono Equalizer makes vinyl replay through a line-level amplifier as accessible and as cheap as a plug-in module - and with a sound better than most.

Switchable between moving magnet and moving coil, its performance on both was very respectable, not in the least cheap-sounding. Unadulterated, for this review covers Hi-Fi World's modifications as well, its showing with a Goldring

1042GX was very vivid. On both MM and MC, the Rotel displays a very fleet-footed turn of speed, rhythmically adept and controlled. Common to both was a top-rank degree of depth definition, albeit on MC with a tinge more hollowness in the mid-range which tended to make second violins a spot more laid-back than is really correct.

Less distinguishable on jazz or rock recordings, this actually produced a concomitant benefit, with the studio echoes of a drumkit neatly defined so that a listener could enjoy that rare detail of spotting where the baffles were placed; usually the province of much more expensive phono stages.

Only two traits say that the Rotel was built to be affordable rather than cost-no-object. On MC, the RQ-970BX lacked that ability to flow into and fill out the upper registers of the treble clef that the

top-ranking stages have. There was a feeling of dynamic restraint there. And while the breadth of the soundstage is creditable, it couldn't quite find the extra bit of distance between brass instruments or cellos and double basses at its further extremes, on MM particularly putting a boundary within the outer edges of the speakers. But the Rotel is as far ahead in sound quality of the average amplifier phono stage as a Williams is in advance of a Fraser Nash.

## **WORLD UPGRADED RQ-970BX**

The Hi-Fi World-modified Rotel made a noticeable improvement, especially on MC. My Morch da Capo tended to push the original a little too hard dynamically, but this, you will note, was also true of more expensive stages. On the revised



Inside the RQ-970BX is a wealth of high quality components, including polystyrene and Rubycon Black Gate capacitors.

combination will surprise you with how good vinyl can be. Like going from a mid-system deck to a Systemdek.

### UPGRADING THE RQ-970BX by Andy Grove

The modifications to the Rotel RQ-970BX turned out to be simple but effective. The most straightforward modifications are the component substitutions, although the component quality is already excellent with Rubycon Black Gate power supply bypass capacitors and 1% polystyrenes in the EQ network.

The first mod is to **remove** the two **NE5534** (yuk!) op-amps and **replace** them with the **AD744s** which are currently being used at the front end. **Fill** the gaps left by the AD744s with AD743s (available from Electromail), a rather costly op-amp, but one of excellent sound quality. Be sure to remove and replace these very carefully. A solder sucker and good quality temperature controlled soldering iron are absolutely essential.

When you remove the AD744 and NE5534 op-amps you may like to fit IC sockets in their place which makes it easier to change the op-amps around or experiment with different types. Be very careful to make sure, whether you use sockets or solder the op-amps directly to the board, that they are the right way around. One end of the chip is marked either with an indent or small dot.

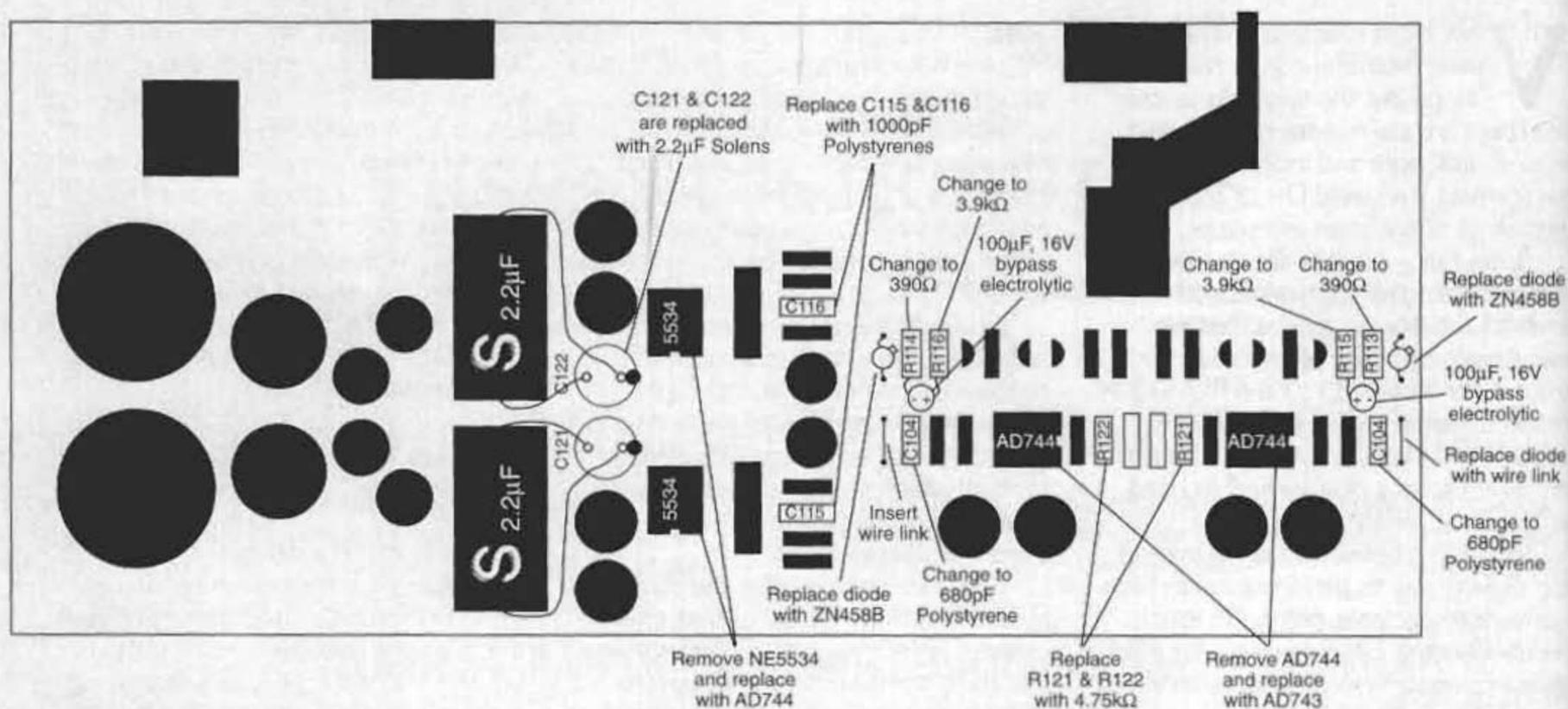
C121 and C122 are the output decoupling capacitors (10µF, 50V), these are Black Gate electrolytic types as standard. In my view, even though the Black Gates are excellent, they aren't really suitable here because of the lack of DC polarization voltage across them. A high

version, there was a more dynamic top end, albeit still somewhat restrained.

The most marked alteration was the now more discernible separation between instruments both physically and in tonal colour. Cellos and basses close to the same note on the staff were now clearly distinct, brass instruments and strings now more laterally separated. Vocals - this is either a change in the plus or minus side entirely dependent on taste - now projected forward, having been more on a plane with the 'speakers' before. The Rotel's already fast subjective speed was marginally even tighter, with the lower resonances of

instruments that bit more defined. Individual images, too, had just that bit more of a perceptible outline than before. While the modifications still don't put the Rotel into the £400 league, and I don't expect that was anticipated, they do turn a very good disc stage into a worthy one. If they put it into the £200-ish bracket, it's worth every penny and more. Meanwhile, all those people with LP collections and a good quality cartridge in the £40-£200 range, need look no further than a Rotel RQ-970BX to blow the cobwebs off their discs. Buy a good £250 line-level amp to go with it and even that minimalistic

## Schematic of Modifications.



quality polypropylene such as a Solen or Ansar (available from Falcon Acoustics) will give a clearer, less grainy sound, 2.2 $\mu$ F is plenty. The physical size of these is an order of magnitude greater than the original so you need to use your dexterity and imagination to get them in. C115 and C116 (1000pF) are polypropylene in the original circuit, which although good, can be replaced with 1% polystyrene capacitors for better sound quality.

The gain of the original was too low on both MM and MC for many preamps. I changed R121 and R122 from 2.74k to 4.75k, which reduces the feedback and increases the gain to a more useable level.

The final modification is the most comprehensive. It reduces the noise at the input stage and allows the input op-amp to operate more optimally by reducing the DC common mode input voltage. The main change is to increase the current through the input Long Tailed Pair. As standard it is about 2.5mA total, 1.25mA per transistor. I have increased this to 4.5mA total, 2.25mA per transistor. The two 1N4148 diodes which provide the

1.4V reference voltage for the current source are replaced by a precision bandgap reference IC of 2.45V (type ZN458B from Electromail). This increased voltage also improves the performance of the current source. So D101, D102, D103, D104 all go, R113 and R114 change from 274R to 390R, R115 and R116 change from 22.1k to 3.9k. For some reason the original diodes were left unbypassed, injecting noise into the Long Tailed Pair. 100 $\mu$ F, 16V capacitors are added to bypass the voltage references, soldered to the legs of R113/115 and R114/116 (note polarity). These changes to the input pair increase its transconductance and extend its frequency response. To keep the stage stable C103 and C104 should be changed from 330pF to 680pF 1% polystyrene ●

### Component List.

Capacitors:  
2 x 680pF 1% Polystyrene  
2 x 1000pF 1% Polystyrene  
2 x 2.2 $\mu$ F Polypropylene  
2 x 100 $\mu$ F 16V Electrolytic

Resistors:  
2 x 390R 1%1/4W  
2 x 3.9k 1%1/4W  
2 x 4.75k 1%1/4W  
Semiconductors:  
2 x AD743JN  
2 x ZN458B

Hardware:  
4 x 8-pin IC sockets

### SUPPLIERS

**Electromail**  
P.O. Box 33, Corby,  
Northants. NN17 9EL  
Tel: 0536 204555

**Falcon Acoustics,**  
Tabor House, Norwich Road,  
Mulbarton, Norwich. NR14 8JT  
Tel: 0602 578272

**RQ-970BX** £130  
**Gamepath,**  
25 Heathfields, Stacey Bushes,  
Milton Keynes, Bucks. MK12 6HR  
Tel: 0908 317707

## MEASURED PERFORMANCE

Relying on silicon chips, like most disc stages, the RQ-970BX has a maximum output of 11V. Most competitors give 9V-11V or so and this largely determines most other parameters. If a designer wants good overload figures - and it looks like Rotel have placed a priority on this - then overall gain must be kept down. The RQ-970BX has very low gain values of x67 for moving magnet (MM) cartridges and x700 for moving coil (MC) cartridges. That's just enough for amplifiers with sensitive line inputs.

For example, with a 300mV line (i.e. Tuner/Aux/Tape) input sensitivity this pre-amp offers 4.4mV input sensitivity for MM and 0.42mV for MC. Most disc stages have twice as much gain (x150 MM/ x 1500MC) but less overload headroom. Anyone considering the RQ-970BX will need a good modern amplifier and they must expect to turn the volume up. It cannot be used to drive most power amps through a passive volume control, except those that are very sensitive (like our own or Leak TL12, for example).

Interestingly, Rotel have omitted the IEC recommended warp filter, so there's plenty of gain right down to 10Hz. Equalisation was accurate, giving a measured response on both MM and MC of 10Hz-100kHz (-1dB). Those with compliant moving magnet cartridges, heavy-ish arms, warped records and reflex loudspeakers should beware of cone flap.

Input hiss values - the only valid way of specifying noise - were good at 0.5 $\mu$ V and 0.086 $\mu$ V (CCIR) for MM/MC respectively. It is possible to get -6dB quieter MC stages from Audiolab, EAR, so for this reason and low gain the Rotel is best off paired with

high-ish output moving coil cartridges, not the very best low output types. **NK**

### TEST RESULTS

Frequency response	10Hz-100kHz
Separation	90dB
Noise (MM/MC)	0.5/0.08 $\mu$ V
Distortion	0.003%
Sensitivity (MM/MC)	4/0.4mV
Overload (MM/MC)	164/16mV

### MODIFIED VERSION

The biggest change Andy made to this phono stage lies in its increased gain, which improves sensitivity and general application. Moving magnet gain has increased from x77 up to x100 and moving coil gain has increased from x700 up to x1100. When feeding an amplifier with a line input of 300mV sensitivity - about average these days - the RQ970BX then has effective sensitivities of 3mV for MM and 0.27mV for MC. This is far more appropriate for high quality, low output cartridges - especially quality moving coils. For example, an Ortofon MC15 Super II produces 0.53mV at 5cms/sec rms, typical average music level from LP, so the amp system has enough gain to reach full output.

Andy changed the feedback compensation capacitors to ensure a good stability margin at the new higher gain, bringing bandwidth down to 50kHz - there's no need to reach 100kHz in our view. His increase in current into the long tail pair causes noise to decrease by -1.5dB from 0.5 $\mu$ V to 0.42 $\mu$ V (CCIR weighted

equivalent input noise) on MM, and -1.2dB from 0.08 $\mu$ V to 0.07 $\mu$ V on MC. (Note for engineers: this noise improvement has nothing to do with bandwidth reduction, since CCIR weighting concentrates on noise around 7kHz only).

Distortion remained very low, measuring just 0.004% at 1kHz (MC), second harmonic only - as our analysis shows.

So there you are. Courtesy of a very tolerant Rotel, Dennis the Menace Dominic and Amplifier Andy, you can buy a straight RQ-970BX and apply tweaks when you feel ready. **NK**

### TEST RESULTS

Frequency response	10Hz-50kHz
Separation	90dB
Noise, MM/MC (CCIR)	0.4/0.07 $\mu$ V
Distortion	0.003%
Sensitivity (MM/MC)	3/0.27mV
Overload (MM/MC)	110/10mV

### Distortion

