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conrad-johnson



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Audio Research (ARC) Reference 3

MARTIN COLLOMS SCRUTINISES ARC'S NEW £9,000 TRIODE LINE PRE-AMPLIFIER

MARTIN COLLOMS

This is my first review of a high end ARC product for a few years. It began somewhat inauspiciously, for although the sound showed promise, it was spoilt by a continual low pitched rumbling that was independent of either the selected input or the volume setting and audible in both speakers. It was almost certainly a flaw in the regulated power supply – some component or tube clearly in partial breakdown.

Problems are not unknown where high end audio equipment is concerned. For example, my first conrad-johnson *ART* was dead on arrival, with a short-circuited output capacitor. More recently I experienced a faulty input on a Krell *402* power amplifier and a fused digital power line on a Krell *202*. But all of these problems were quickly addressed: the *Reference 3* was repaired within a day or so.

ARC provides a certificate of compliance, including ROHS which specifies a complete absence of lead in soldered joints. I have some misgivings about the removal of all lead from components and soldered joints with respect to sound quality and reliability, and some experience with 'before' and 'after' audio components in this regard has tended to reinforce my concern. The ability of ARC to succeed in using the new soldering technology is a key part of this test.

The £8,995 *Reference 3* is a moderate gain, line-level only preamplifier distinguished by fully balanced topology. A full range of balanced (XLR) and single-ended (phono) inputs and outputs ensure broad compatibility with a wide range of sources and power amps. Obvious partners are either ARC's *Reference 110* stereo or a pair of *210* monoblock power amps. The utilitarian, plastic wand remote control handset has a surprisingly large array of useful features and tells us much about the product.

There is no mains switch as such: the *Reference 3* has a low-power auxiliary standby supply that enables the handset to activate the preamplifier. Labelled inputs are provided for CD, tuner, video, phono (line-level, so requires the use of an external RIAA equaliser), Aux 1 (= tape) and Aux 2. Each input may be balanced or single-ended, but not both. When the input type is selected the assigned setting is stored in memory. The last input is for an external loop (eg for an AV processor), disabling the volume facility and providing the usual unity gain. There are three outputs: record-out and pairs of main outputs (e.g. for bi-amping).

The *Reference 3* has a huge bright green matrix type fluorescent display. Fortunately, the handset can dim it in steps, finally turning it off altogether for best sound quality (operation of other buttons momentarily illuminate it again). Left/right buttons adjust channel balance, and up/down the 104-step electronic volume control. 'Invert' reverses the absolute phase (polarity) of the output, a mono button is useful in setting up, speaker placement and replaying mono vinyl discs (where it will reduce the audibility of surface noise). Finally, a button marked 'hours' advises how long the valve set has been working, and indicates when a re-valve would be worthwhile to maintain performance. A new set won't cost an arm and a leg: ARC suggests 4,000 hours – say 20 hours listening a week for five years, but audiophiles may well fuss earlier than this.

The *Reference 3* is presented in classic ARC livery, with satin anodised fascia, decorative 'rack' handles, and black enamelled case. The usual horizontal row of control knobs has been supplanted by that huge display, which attracted praise and criticism in equal measure from all who saw it. Fully bright it is rather an eyeful, but is rather less 'in your face' when appropriately dimmed. One plus is that input, balance and level can be read at some distance, but even its best friend would be hard pushed to describe the styling as attractive. The unit comes fitted with special vibration absorbing visco-elastic polymer feet. It is also available in an all black finish.

Tech Talk

A glance inside the cabinet reveals a relatively short signal-path construction with fewer active devices than before – slimmed down compared with previous ARC models. Two audio-related power transformers are present. One is for general duty, including the regulated heater supplies. The other is a smaller ring-core type; this affords superior noise isolation and is used for the critical high voltage anode/plate supply, which includes low-noise, fast-recovery rectifier diodes. A generously specified high-current power 6550 valve regulates the high voltage supply which is further enhanced by a newly tuned version of ARC's progressive-bandwidth capacitor decoupling. Here, instead of just picking up different sizes and types of supply decoupling capacitor, each capacitor is low-pass filtered so that the optimum part of its operative frequency range is active. The capacitors no

longer fight each other for charge, but act as a consonant array for low coloration. Potentially, clarity, transparency and high frequency precision will all benefit.

ARC founder Bill Johnson was back in harness to create this design and has chosen not to use loop negative feedback. His simple differential circuits use modern, wide bandwidth triodes, the only feedback comprising local differential cathode 'degeneration'. Thus two pairs of 6H30 triodes operate in long-tailed pairs (with FET constant current sources), and provide line gain, single-ended-to-balanced conversion, and the usefully low 300 ohms (single-ended) output impedance. The well crafted signal attenuator uses both Dallas and Maxim ICs in a novel configuration, and still delivers a respectably high 60 kohms input impedance (120 kohms balanced).

The larger 20A type IEC connector is used for the power cable. Build quality and finish are very high, RCA sockets included, while the internal component selection includes custom 10µF polypropylene output capacitors bypassed by 24nF polystyrenes, plus a selection of Rel-cap and Multi-cap polypropylenes for supply decoupling. Electrolytic reservoirs were by Nichicon. For this kind of money a more impressive looking handset might have been nice, but we've been saying that for years. [Some of us actually prefer unpretentious, compact, lightweight handsets – Ed!]

I have assessed many ARC designs over the years, but the brand has not been faring as well recently. There've been some stars, such the *Reference Phono* and *Reference 1*, but in my opinion the *Reference 2* represented more of a lateral than an upwards shift in sound quality.

In view of the 'removal of lead' issue, I really had no idea what to expect from *Reference 3*. Traditional ARC designs had high feedback, skilfully delivering an exceptional and reliable technical performance, while the sound of these amplifiers was never short of resolution and precision. More recent products using simpler circuits and reduced feedback have led to a more relaxed sound, often accompanied by a subtle gain in dynamic expression, rhythm and listener involvement.



Sound quality

Initially ignorant of the internals of the *Reference 3*, from the moment it was powered it up, I knew that there had been a design revolution at ARC. I had come to expect a particular kind of sound, not quite brittle but somehow hyper-real – the photographic equivalent of 'solarisation', with a perceptible 'zing' around the edge of notes. This gives the impression of increased definition, but is very different from the richer, calmer results found in products from such as conrad-johnson or Audio Note.

The first moment of the first CD told me that ARC's mission for purely technical perfection had been abandoned, and what a difference it has made! The *Reference 3* rockets the brand up the ratings. It is so fundamentally musical, so committed to the performance qualities of a track that sometimes laborious, though crucial, exploration of measured parameters that qualify the listening experience seemed certain to be redundant.

At first hearing, this preamplifier's accomplishment was so complete that it appeared to hold every musical ace. No shade of fault or bias could be discerned. Moreover it displayed that frustrating, yet ultimately rewarding, behaviour common to excellence: a potential that is mightily dependent on the quality of the overall system, the interfaces and the cleanliness of the power line.

"The first moment of the first CD told me that ARC's mission for purely technical perfection had been abandoned, and what a difference it has made! The Reference 3 rockets the brand up the ratings."

LISTENING SYSTEM

The system used for the listening tests, and as comparative references, included the following pre-amps: the conrad-johnson *ACT-2*, the ARC *Reference 2* and *3*, the Krell *EVO 202* and *Evolution One*, the XTC *PRE-2* and that trusty Audio Synthesis *Vishay Passion* passive. Power amplification included the ARC *Reference 110*, the conrad-johnson *Premier 350SA*, the Krell *FPB700cc* and Krell *EVO 402*. I also had a conrad-johnson *CA200* integrated amplifier on test at the time. Loudspeakers included the Avalon *Eidolon Diamond*, the Wilson *System 8*, the Quad *2805* and a 15 ohms *LS3/5a*. Cables were Transparent *XL Reference* and Cardas *Golden Cross*. Equipment stands were Finite Elemente *Pagode*.

This is an expensive line preamplifier, but it delivers good stereo in spades. The mildly uptight, almost 'trying too hard' sound of the previous series is completely absent, and has been replaced by an open-hearted, flowing drive which carries you along without ever seeming contrived. Good rhythm and focused timing have never been ARC's strongest virtues, despite clean transient definition, but this is now overturned. The *Reference 3* has great rhythm. It's a pleasure on both classical and rock material, and seems well able to rejuvenate an otherwise over-relaxed system.

It achieves 'very good' to 'excellent' on most of the major subjective characteristics, including bass reach, uniformity, tune playing and attack, as well as slam. Timbre is first rate, with the broad midrange beautifully balanced, in fact almost creamy compared with the brighter offerings from competitors. There is no perceptible glare in the upper mid, and inner balance is also first class. The treble is sweet and clear, delicate and well focused, with only the merest hint of that Aeolian harp type 'tinkle' that is characteristic of line-level tube amplification (due to subtle vibration of the grid wires). Vocals are excellent; female singers do not screech and are outstandingly articulate, with perfectly controlled sibilants. Despite the absence of any detectable forwardness or false projection and brightness, voices are strongly holographic, so good is the focus. Lyrics are conveyed with feeling and abundant expression, and the wide, deep soundstage has very consistent perspectives. Dynamics sound just right: lifelike, and neither hardened nor exaggerated.

Compared to other state-of-the-art pre-amps, the *Reference 3* has a very slightly darkened character. Although the effect is not at all unpleasant, it's like a painting that shows a hint of the canvas texture overlaid with a touch of varnish. The *Reference 3* does not throw detail at you; rather it is highly resolved. It encourages the listener to hear more in the music. Like the extraordinary midrange of the Quad *2805* (*HIFICRITIC* No1), this new ARC digs deep into recordings, providing instrumentalists with a more naturally balanced sound.

I was surprised how well this pre-amplifier performed. With shared listening, much head scratching and careful comparison with our reference designs, we arrived at a class-leading sound quality score of 130 under optimum, stripped down system conditions, listening via unbalanced input to balanced output. Final audition with a fully balanced set-up indicated that perhaps another 5 points was attainable.

Achieving this in your home will depend on many factors. Most of my listening was via a conrad-johnson

PREMIER 350SA power amplifier, which has kind input loading. Because the *Reference 3* is so neutral, and provided the system quality is high enough, differences in cable 'character' seem to have less effect on the final result. We found both Cardas *Golden Cross* and Transparent *XL Reference* highly satisfactory interconnects. We also found that the phase inversion facility worked best in fully balanced mode. Single-ended connections showed a small lowering of quality in phase-inverted mode.

However, the *Reference 3* does not have entirely silent backgrounds. With the *PREMIER 350SA*/Eidolon Diamond pairing, background noise was barely apparent, but with the 5dB higher sensitivity Wilson *8* connected it was clearly audible at the listening location with moderately quiet room noise levels. The higher than usual input sensitivity of the conrad-johnson power amp was a major factor here, and when a Krell *402* or ARC *Reference 110* was substituted, peace was restored even with the Wilsons (see lab report).

Test Results

The faulty first sample was fine in every respect save for one insuperable problem – a poor 45dB to 50dB unweighted signal-to-noise ratio. When repaired, the IHF 0.5V-to-0.5V figure increased to 71dB. For IHF 0.5V and unity gain, the balanced S/N figure improves to 95dB unweighted. When 'A' weighted it achieves -83dB single-ended (SE) and -99dB balanced. These are fine results, especially the latter. Like the noise level, distortion is also better in balanced mode, agreeing with the listening tests, although subjectively the margin is small. With distortion at typically -65dB (0.06%) over the frequency range under single-ended conditions, the balanced results were -85 dB (0.006%) of pure second harmonic. Channel separation was fine overall: 79dB midband and a still fine 62dB at 20kHz. Very good high frequency intermodulation figures of -71dB single-ended, -88dB balanced were recorded.

Very good channel balance was evident over the whole operating range of the volume control. With a minimal 0.25dB channel imbalance, it tracked within better than 0.2dB over 60dB of the range. However, the volume control steps themselves are a little quirky. It has the usual smaller step resolution below setting 10, and was a sensible 0.7dB/step across most of the range, but strangely this increased to an altogether too fine 0.1dB/step between 34 and 44 on the display, for no obvious good reason. It must be something to do with the control codes. The overall range covers 65dB, with the zero setting providing full muting.

The input impedance is usefully high, 56 kohm single-

ended, 122 kohm balanced, which helps preserve source dynamics and bandwidth. Output impedance was fine at 300 ohms single-ended and 600 ohms balanced. Into 100 ohms it could provide 7.7V single-ended, 15V balanced – enough for any amplifier, although low loads will reduce the dynamics a little and marginally curtail the low bass. Otherwise the *Reference 3* has a wide, flat frequency response. Gain is moderate at just over 6dB single-ended, 12dB balanced – ie a measured sensitivity of 289mV IHF single-ended.

Conclusions

Bill Johnson is back in town, and his contribution to the new *Reference 3* has been striking, with its sonic characteristics of simplicity and clarity, its natural dynamics, pure timbre and great rhythm – maybe the best yet for an audiophile pre-amp – and terrific soundstaging.

Technically accomplished, there is nothing in the lab performance to cause concern, save a caution that a very low power amplifier input impedance could reduce subjective dynamics a little and dry up the low bass very slightly, and that a combination of high sensitivity power amplifiers and loudspeakers could result in some audible hiss.

For the very best results the *Reference 3* should be used with >20 kohm loads for single-ended working and 2 x 20 kohm loads for balanced use. Otherwise the distortion, noise, bandwidth matching and channel separation result are all very good.

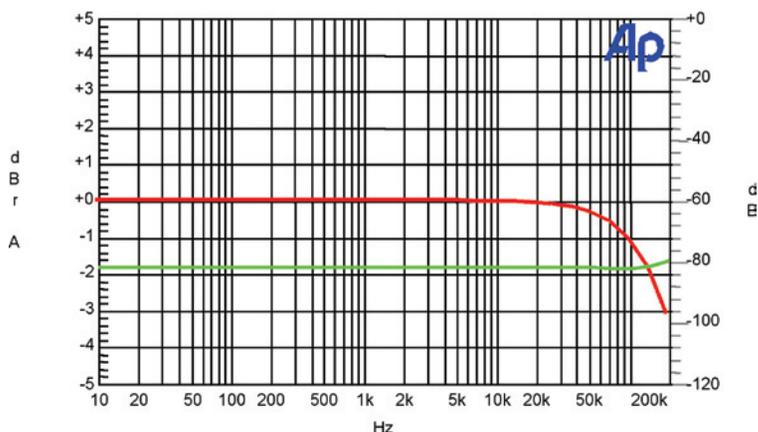
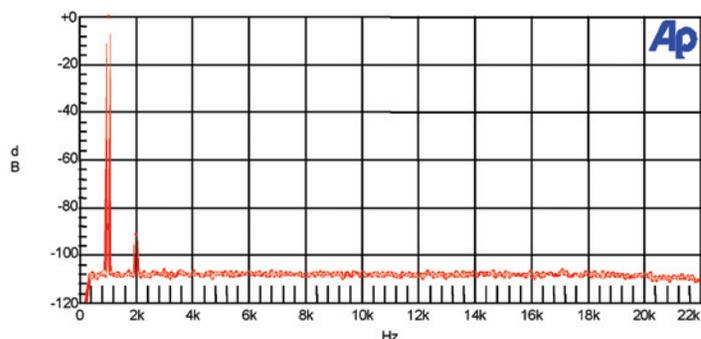
Leaping to the top of the class, this design manages to combine the best of two sometimes divergent audio worlds: the sector that favours rhythm, dynamics and involvement and that occupied by aesthetes who love purity, transparency, depth and low coloration. It is manifestly a winner and highly recommended, especially as its £8,995 pricetag is much lower than many ‘high end’ competitors.

HIFICRITIC PREAMPLIFIER TEST RESULTS

Make: Audio Research		Date: 14/1/07	
Model: Reference 3			
Distortion , THD inc. noise		20Hz	1kHz
At IHF 0.5V out, 0.5V line in		-69 dB	-64 dB
At IHF 2.0V out, 2.0V line in		-63 dB	-64 dB
At IHF 0.5V out, 0.5V line in		-87 dB	-84 dB
Channel Separation IHF, 0.5V		Aux SE	62 dB
Frequency Response IHF, 0.5V		Aux SE	-0.01 dB
IHF 0.5V		Aux Bal	-0.275 dB
Intermodulation Distortion			
19.5kHz/20.5kHz 1:1		0.5V output	1kHz difference tone
		Aux SE	-71 dB
		Aux Bal	-88 dB
Signal to noise ratio		CCIR Weighted	20Hz-22kHz
IHF 0.5V		Aux SE	-81 dB
		Aux Bal	-96 dB
Channel Balance over volume range			
Rch is reference		at 0 dB	+0.27 dB
		at -20 dB	+0.30 dB
		at -40 dB	+0.36 dB
		at -60 dB	+0.21 dB
Maximum output level (1% clip)			
100k Ohm load		7.4 V SE	15 V Bal
600 Ohm load		1.5 V SE	n/a V Bal
Output Impedance SE			300 Ohms
Balanced			600 Ohms Loading
Input Data		Socket	Sensitivity
Aux input balanced		XLR	141 mV
Aux input single ended		Phono	289 mV
DC offset		Left 0 mV	Right 0 mV
Size (W x H x D)		480x178 x394 mm	
Price		£8,995	

Audio Research Reference 3 Frequency Response and distortion (green) balanced in/out

Colloms Electroacoustics Audio Research Reference 3 FFT SPECTRUM of THD Residual @ 1kHz - 4 averages balanced in/out 01/14/07 17:49:29



HIFICRITIC

AUDIO AND MUSIC JOURNAL

WE'VE CALLED THIS MAGAZINE HIFICRITIC, BECAUSE THAT'S PRECISELY WHAT IT'S INTENDED TO BE.

Because HIFICRITIC will be entirely funded by its readers, the subscription cost will necessarily be higher than magazines subsidised by advertising revenue. But we'll keep this as low as possible, by operating entirely with freelancers (and choosing the very best of these), and by concentrating our resources on the researching and writing. Our independence from product advertising will allow us to criticise and comment without fear or favour. Our intention is to scrutinise internationally important equipment in depth and detail, technically and subjectively, and to provide comprehensive investigations into the key issues and developments that are facing hi-fi today.

Paul Messenger, Editor

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