

# HIFICRITIC



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# Criterion + Copperhead

MARTIN COLLOMS EXAMINES A RADICAL UPMARKET VINYL SPINNER FROM AUSTRALIA

MARTIN COLLOMS

In an era when £10,000 is considered a very hefty price for a high end analogue turntable, the idea of spending £50,000 on one made in Australia might seem pure fiction, never mind the £100,000 asked for some putative reference players, including Continuum's own *Caliburn/Cobra* (£115,000 including its dedicated *Castellon* stand). Indeed, a little web research will reveal a surprisingly large number of elaborate and seriously expensive turntables ostensibly on the market, though it's likely that only a modest percentage are real world products.

It was with some trepidation that we awaited the arrival of Criterion's £50,063 *Criterion/Copperhead* turntable/tonerarm combination, which weighs some 100kg when packed and crated: the player alone weighs 75kg! It took the first hour to get the primary components unpacked and brought up to my first floor listening room, and another five hours to install and calibrate. My heartfelt thanks to Brian and Allison Rivas of Pinewood Music, who journeyed up from Somerset in good time and then expertly assembled and aligned the player. They also lent a special Finite Elemente *Pagode Master Reference* stand, customised with an oversize top support to allow easy placement of this turntable with its inboard, baseboard located motor. This platform is a later version of my own and very satisfactory Finite Elemente *Pagode* stands. All were harmoniously installed together, and this synergy was to prove useful at a later stage of the auditioning. With the *Criterion* player on top, the electronic control unit was next down, and with the combined main power supply and vacuum unit placed on the lowest shelf. On my hardwood floor, matching Finite Elemente *Cerabase* supports were installed under the *Master Reference*.

In my view a customer will need to learn some set up skills, to avoid requiring the services of the local agent if, for example, the magnetically retained bias thread is accidentally displaced, or the alignment in its two curved, right angled paths is perturbed. To reset this assembly requires a delicate touch, good lighting and keen eyesight.

The layered counterweight requires a tray of matched weights to be used in carefully judged combinations for a given cartridge mass and desired downforce. The arm height may be also adjusted 'on the fly' via a calibrated micro-threaded rotating collar, but will need careful relocking thereafter. Continuum offers a 5 year guarantee, welcome in view of the complexity and potential performance of the design.



At its heart is a very powerful three-phase motor with 17kg of continuous torque and very low cogging. The 24V DC motor has internal sinewave electronics, and is almost silent electrically and mechanically, driving the platter via a rubber cord of modified, long life polyurethane (Pyrathene). (Two cords are supplied.) The motor is built into a massive machined housing, free standing on isolating feet and employs optical sensing feedback to the electronics to maintain the required speeds. The speed may also be offset in precise 0.1rpm increments, readily stored as required. Inherent speed stability is claimed to be 0.006%.

The self-lubricating main bearing is counter-bored to facilitate the vacuum that holds down the disc, and is carefully designed silently to maintain negative air pressure below the LP. The massive 30mm diameter bearing of special alloy runs in hardened tool steel bushings, with nitride and tungsten bi-sulphide nano-tech lubricants. This supports a huge 28kg two-part non-resonant platter assembly machined from precision castings of acoustically selected magnesium alloy. It employs a computer controlled vacuum pump with pulse and echo acoustic filtering. Not only is the air feed silent, the pump itself is inaudible in use/play mode. The very heavy composite and alloy plinth is singularly non-resonant, and features a version of the very stiff, magnetically-tensioned, Kevlar-cord-suspended armboard first seen on the *Caliburn*. While anti-resonance measures are contained within the die-cast plinth, control of external vibration is down to the point-contact machined feet, the overall mass and rigidity and the performance of the audio frame on which it is placed.

In danger of being overlooked in the face of the heroic *Criterion* turntable, Continuum's visually understated *Copperhead* tonearm (named after a venomous Australian snake!) also deserves close attention, and could well deserve a place on other



Brian and Alison ready to unload the *Criterion*



Magnetically suspended arm board, the Kevlar cords

platforms. Available individually at £ 6,079, it's the most costly arm I have yet evaluated, and despite a degree of natural scepticism, the results go some considerable way to justifying the cost.

This low mass unipivot arm is 239mm long and has a complex, almost organic composite structure of stiff fibres and resin. Its predominantly thin walls are reinforced at vital locations like the cartridge mount and around the pivot. Overhang is 17.3mm, offset angle 23 degrees, and spindle-to-pillar is 221.7mm. It will balance cartridges weighing up to 20g mass, while effective mass is close to 9g. Height (for VTA) and azimuth are both adjustable, and the natural resonant frequencies when balanced are quoted as 8-10Hz in both planes. It has a singularly 'quick' yet vibrationally inert structural 'feel'.

A unipivot was chosen for its simplicity and effectiveness, using a hardened stainless steel point to a sapphire 'V' bearing. Such a bearing cannot go slack or bind, as can occur with gimbal type bearings. However, the main counterbalance is held below the centre of gravity, and laterally offset to stabilise tonearm azimuth. The latter is achieved via a hardened point contact to a sapphire ring, this partly load-bearing using a precision AEBC grade 9 ball-race to the ring.

That novel and perhaps counter-intuitive arm shape was modelled by co-designer Dr Neil McLachlan using *ReShape* structural analysis software from Advea, to obtain an optimum combination of low mass, controlled natural vibration modes, and high stiffness. Ironically, he is also credited with the design of the world first harmonic bell, a new type which is clean-pitched and dominant in consonant agreeable harmonics. For the *Copperhead* the opposite was intended, *ie* to deliver the least bell-like sound possible.

The electrical connection is unbroken from the cartridge pins to the output cable and phono sockets, and no attempt has been made to feed the lead out through the bearing assembly where it can become crimped or add unwanted side torque.

The external output cable enables the arm to be lifted out for easy cartridge installation, and also exchanged for an alternative arm top and cartridge. As installed the fine lead out wire was wrapped a few turns around a supporting aluminium alloy loop, positioned over the pivot point for a neutral bias effect.

The intrinsic clarity delivered was so high on test that deleting the alloy loop entirely and using a simple nearby Bluetack hold point for the wire led to a further increase in transparency and detail (something to try if you like!) (In fact Continuum shows only one or two turns around the loop in its own illustration.)

There is a ground lead but connecting it to the Audio Research *Reference 2 Phono* produced a substantial and unaccountable noise, still more so when the accompanying *Reference 5* display was powered up. I have never experienced a clearer demonstration of the small but audible change in noise floor generated by a cold cathode electronic display (an ionised gas discharge device). The ground connection worked fine with the Naim *Superline/Supercap* phono stage, but sound quality was actually slightly better with it left off. The manufacturer had reported occasional set-up difficulties with some ancillaries and an alternative output cable can be supplied. I tried a Linn *Uphorik* and it simply did not work at all; this phono stage produced unaccountable broadband noise, causing me to imagine it was faulty, but it proved merely to be incompatible with this design of arm cable.

### The Sound

At first the LP sound was so different to my previous experience that mental confusion reigned. How could it be so different? Certainly there were different tonearms, disc supports and drive systems to consider. Direct comparisons with the fully upgraded Linn *LP12* revealed much about the *Criterion*, but also initially showed up some loss of attack and dynamic power in the mid-treble. This was rapidly sorted by slightly increasing the cartridge bolt torque (taking care not to over-tighten to avoid fracturing the arm).

While the latest Linn is a star and sits very well in its sector, it manifestly could not keep up with the *Criterion*. In fact nothing I have heard for some time, even above £30,000, gets close, though the AudioNote *TT3* (assessed in pre-production guise in Vol2 No4) was a notable flyer at around £35,000.

Several more recent costly turntables, both suspended and solid designs, have set respectable standards overall, though most seem to miss out a little on dynamic contrast, rhythm and timing, often sounding elegant, informative and well founded in the bass, but not quite as involving as I could wish. Disconcertingly, the *Criterion* was unlike both CD and my previous experience of vinyl LP; I had to reach back to my recollection of master tapes to find an appropriate analogy.

My Linn is by no means for the chop, but comparisons with this new table were unhelpful as the two turntables sounded so different. While the Linn had moved substantially closer to tape originals with the recent *Keel* and *Radikal* upgrades in our opinion, the *Criterion* showed just how far there was still to go, albeit at a massive price premium. I operated the *Criterion* in a £100,000 system, but am sure that it

could happily partner still more costly components, and feel it has certain sonic parallels with the excellent Wilson *MAXX III* and Avalon *Isis* speakers, in terms of depth, scale, and dynamic power.

However, it was essential to make sure that every detail of support, levelling, cable dressing and system alignment was given due attention in order to extract all the *Criterion/Copperhead* combo's capabilities. It is rare to find a system which rewarded such diligence so handsomely in better sound, but this is a familiar characteristic of truly excellent audio sources.

The necessarily restricted comparative environment means that truly accurate characterisations are not possible here. In no particular order, the dynamic range has close to thrilling power and depth. The system could be run as loud as one wished, with patently uncompressed peak levels and deeply contrasting quiet sections imbued with abundant, well focused detail. Surface noise was very low, speaking volumes for both the non-resonant nature of the disc interface and for the tonearm itself, not forgetting the high mass plinth structure and selected table support. Often one quite forgot that the vinyl medium was playing at all. Dropping the stylus into the lead-in groove resulted in dead sounding 'pock', no boom or ringing, no exaggerated 'click-ting', and often nothing more until the music begins.

The bass was very well extended, even, notably percussive, and very well differentiated. Uncommon bass detail was extracted from distantly miked classical recordings, exploring bass percussion from orchestral bass drum to tympani – how it was played and where it was located in the recording space. Rock material had a vital sense of power, propulsion and stability, which drove the music forward, and demonstrated very good timing and rhythm. This table really swings in a spectacular manner, and proved exciting and involving on all kinds of music. Bass lines underpin the rhythm, as they should, and it does not unduly favour either rock or classical: both deliver highly rewarding musical flow and foot tapping involvement.

If the bass was impressive, a similar picture continues throughout the frequency range. It's impossible to separate the highly 'connected' sound of the turntable from the tonearm, the whole assembly sounded very neutral and tape-like, highly detailed, evenly balanced, low in perceptible grain or distortion, avoiding excessive sibilance yet delivering highly articulate vocals with delicate, subtle and open sounding high frequencies. By default it was capable of revealing clearly the varying if minor set of replay errors commonly heard in many fine LP playing systems.



*Main bearing upper hub*

*Below: Motor and base*



It was (and Continuum's designers would love us to think so) as if the usual vinyl replay difficulties – those subtle noises, colorations and distortions – had been comprehensively identified and systematically ground down to an irreducible minimum below the threshold of audibility. That still leaves technical matters such as stylus tracking and the inherent tracing error of a radial (pivoted) arm design of finite length, yet subjectively these seemed unimportant in the overall result. And if the midrange is glorious by conventional standards the treble does not fall behind. While clean, mint records play excellently, rough or worn records (as I also noted with the improved Linn) play better than expected, emphasising the music rather than any noise or distortion.

Deep, clear and transparent ambience became audible, with a pitch stability that just has to be heard, the kind of precision normally associated with a cutting lathe. My notes keep referring to the high quality of the bass, from a plastic disc no less, its clarity and percussive power continuing to surprise. As a loudspeaker enthusiast, it reminded me of those rare occasions when a really neutral contender teaches anew the content of one's discs. This turntable has the character of an actively driven, sealed-box 15 inch bass: impressively percussive, clearly distinguishing complex patterns, and discriminating between different sources and their innate characters.

Midrange coloration is so low I was reminded of an electrostatic speaker, yet I am listening with a conventional moving-coil cartridge. The musical delivery is so strong that the previously identified character and identity of the cartridge somehow fades away; its minor shadings of timbre are barely noticed in the face of the overall grip and clarity of the player. Those subtle touches of sibilance, the mid-bass warmth, forget them; these were noted in the last platform, and might not have been the responsibility of the cartridge at all.

So often the performance of components are relative, and a favourable balance of characteristics

### The System

Avalon *Eidolon Diamond*, Quad *ELS63*, Krell *402* late series, Krell *402e*, Audio Research *Reference 5* and *Reference 2*, Naim *Superline/Supercap*, Transparent *XL mm2* cables: mains, interconnect, loudspeaker, (plus VDH custom mc silver hybrid phono cables) References Naim *CDS3*, Linn *LP12 Radikal*, *Keel*, Naim *Aro*, Koetsu *Urushi Vermilion* and *Sky Blue* cartridges. Finite Elemente *Pagode* and *Pagode Master Reference* equipment stands.

is sought. But the *Criterion/Copperhead* seeks to establish the absolute. Vocals sing out with crisp and coherent but blended articulation. Massed choirs are not rendered perfectly – in my view they almost never are – but the *Criterion* digs more deeply than before in separating detail and moving nearer to natural choral groups than the congested roar heard from some recordings with many replay systems.

If the midrange is glorious the treble does not fall behind. You simply do not know how good vinyl treble can be, and how good your chosen cartridge is until it's fitted to a player like this. The treble is informative detailed, airy, focused and transparent, and strong stereo images continue into the treble with great acuity, which also made precise cartridge alignment very easy by ear. There is an underlying and wholly satisfying clarity, recovering layer upon layer of musically harmonious detail.

The sonic impact made by this player is immediate, muscular and accessible and does not require nuances of descriptive expression; it simply gets there fast and gets on with the job, capturing your attention with first rate music replay.

### Tweaking

While I could be dismissed as a damn nuisance for messing about, I was sufficiently intrigued by this turntable's performance to work out some optimisations, none of which alters my main thrust. Consider, therefore, that the following possibilities are merely icing on the cake. Mentioned above, deleting the alloy arm lead out loop and replacing it with a locating piece of BluTack or similar was worthwhile, adding extra micro detail which was both highly rewarding and somehow also added to the upbeat nature of the beast.

Tapping around (as you do), I identified a mild

boom in the lower mid from the top cover of the control electronics. With no heat evident here, I put a copy of *Stereophile* on top, muting this resonance, and clearly (if modestly) clarifying the sound in this particular frequency region.

While it is true that there is no electrical connection between the arm wiring and the player (or the rest of the electronics), RFI control could be worth pursuing, as the player as a whole is connected to the mains and is therefore an RFI environment. Several mains filters and filter cables were tried, generally showing improvements in low level detail. Such filters also reduce electrical noise from the TT power supply of course.

Gently thumping the shelf supporting the control electronics unit also revealed another upper bass resonance in my setup. I freed up an adjacent *Pagode* and moved the vacuum unit and control box to it, leaving the player alone on the *Master* table. Its spare shelves were put aside, and their support bars were damped with a few magazines and paperbacks. This is one tweak I can strongly recommend: do use two platforms, one for the turntable alone, the other for all its electronics.

I was also very sceptical that extinguishing the plinth backlight would have any effect, but it does, and in context the unmistakable if mild gain in clarity did not seem at all spurious or trivial. Blind testing confirmed that this improvement was not imaginary.

Everything one comes to admire about the sound quality this player offers is improved by the optimisations, cumulatively adding perhaps as much as 12 per cent. This player's intrinsic resolution is so high it amply rewards detailed, logical and well planned installation.

### Test Results

Too heavy to move to the lab, the testing had to be moved to the player. Some were purely empirical and involved setting the system to high gain with the stylus down and tapping component parts to assess vibration paths and possible resonances. When measuring rumble with the test lacquers, it was obvious that the contribution from the *Criterion* was well below the test threshold, and separate analysis found negligible evidence of motor noise or bearing rumble. The wow and flutter readings also sat at the test threshold (0.02% NAB, 0.032% Din B wtd), while speed accuracy and stability were excellent (see clean centre signal on spectrum analysis).

Very high torque was observed at the platter surface (the measurement aided by that convenient and effective electronic LED stroboscope from [www.keystrobe.com](http://www.keystrobe.com)). No conceivable degree of cartridge stylus drag can slow down the *Criterion*,

The kit ready for assembly



even before taking account of the huge rotary momentum of the platter. Despite the high inertia, it comes up to speed rapidly.

Practical vibration isolation will depend on the support and room construction. It is clear that the platter, plinth and vacuum hold-down arrangement is singularly quiet in respect of airborne acoustic feedback coupling. The favoured 'clamp' is a finely crafted conical rubber moulding with an alloy collar which reliably pulls down over the disc centre on application of the vacuum. It always worked, no matter what the disc. Likewise the vacuum pump was silent save at initial start up, and occasional top up pulses were inaudible at the listening location (either from the unit or the disc surface). (See graph comparing felt mat with Continuum hold down.)

Tonearm effective mass was close to 8.5g in a balanced condition, while bearing friction and lead torque was very low (at the 10mg threshold). Coupled resonance testing showed low activity from both the vacuum clamped disc and the tonearm, confirming the neutral sound (see graph). Low resonance activity aids cartridge tracking, and the test *Urushi* tracked very well, giving channel separation averaging an excellent 36dB, 200Hz-10kHz.

Our particular sample was missing some thread cutting over the full height of the spindle, preventing use of the optional screw-down high mass clamp – no great disappointment in my opinion.

**Conclusions**

Consider the floor construction, as the choice of stand will significantly affect performance. My listening room is founded in a concrete slab, and the player was comparatively remote from the speakers, assisting both floorborne and acoustic couplings. Continuum's larger *Caliburn* has an 'isolating' magnetic suspension in its stand, and

opinion is divided as to whether our more rigidly coupled *Criterion* sounds rather more 'grounded', and more upbeat. Such matters will also depend on your house and floor build, local vibration levels, system layout in the room, and player location in respect to the speakers. I have not heard all the turntable contenders in this price sector, and certainly not under comparative conditions, so any potential purchasers are advised to keep an open ears and if necessary travel to potential demonstrators with their favourite vinyl.

Nevertheless from what I have heard, I feel that the Continuum team have thoroughly researched the technical aspects of the complete design, and these correlate well with a wholly musical and neutral sound, including highly non-resonant disc and cartridge platforms, extremely stable speed, a very powerful low noise motor, low noise ultra rigid platter bearing, alongside low noise arm bearings supporting a light, low energy storage and non-resonant arm structure.

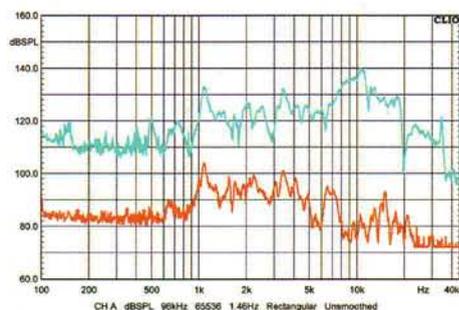
Low level noise is a big issue for LP replay. Even when not heard directly, it still seems to modulate transparency and deep reverberant decays, and masks fine detail. The *Criterion* is a truly low noise system, and it shows. Extraordinary and rewarding dynamic range is an immediate outcome. It combines the highest audiophile levels of neutrality and information retrieval with excellent, thrilling dynamics and very good rhythm and timing. You just want to go on listening to this product. This is not the work of trial and error but the product of a professional team of engineers and scientists, an expression of intelligent, state of the art sound engineering.

My experience with the *Criterion/Copperhead* has been so musically rewarding that I have no hesitation in giving a firm recommendation. Just wait and see what we decide for our end of year awards.

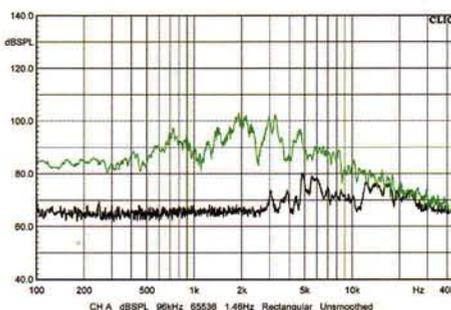


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Continuum Criterion Arm Resonance Analysis, at cartridge and at bearing (below). The results show very good structural control of vibration



Impulse Spectrum: felt mat above, vacuum hold down below



Continuum Criterion Speed Stability: the double peak is the arm cartridge resonance resolved

