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PS Audio aspen FR10

The most compact of three floorstanding models in what will ultimately be a four-strong range, PS Audio's 'triple ABR' aspen FR10 packs a deceptively huge punch

Review: **Adam Smith & Paul Miller** Lab: **Paul Miller**

For a 50-year-old company that released its first loudspeaker barely two years ago, PS Audio has not been resting on its laurels. Coming swiftly on the heels of the flagship £30,000 aspen FR30 [HFN Jun '22] are a raft of junior siblings. First up was the £20,000 FR20 [HFN Apr '23] and now we have the baby floorstander of the range, the £10,000 FR10. As an aside, I don't think we'd be letting the cat out of the bag by revealing a fourth model is in the pipeline – the two-way, ABR-loaded FR5 standmount. If it isn't priced at £5000, I'll eat my hat.

One glance at the FR10 will suggest that it's very closely related to its bigger brothers but, in detail, the only thing that the aspen FR10 shares with its pricier stablemates is the tweeter. This is a 64mm planar magnetic design using a Teonex diaphragm with etched-on 'voice-coil' and driven in a push-pull configuration by a pair of rare-earth magnets [see PM's boxout, opposite]. The midrange driver operates in exactly the same way and has a similar construction but is both smaller than the units used in the FR20 and FR30 and now sits below the tweeter in the FR10. With a length of 200mm rather than 255mm, it is driven by an array of 35 magnets, compared to 56 in the larger driver.

CROSSOVER RETHINK

The FR10's shorter midrange driver operates over a narrower 550Hz-1.75kHz bandwidth than the 400Hz-2.5kHz achieved by the bigger version in the FR20 and FR30, which also means the 64mm tweeter has to reach down that bit lower here [see PM's Lab Report, p47]. Deployed near the bottom of the cabinet, the FR10's twin 165mm bass drivers are also smaller than the 200mm units used on the larger designs. The cones are a non-woven carbon fibre foam 'sandwich' while the motor unit has a split magnetic gap and multiple Faraday rings to improve field uniformity and reduce distortion.

The FR10's woofers also have a simpler, single corrugated rear suspension, rather than the twin setup of the 200mm units,

PLANAR SIMPLE

Developed by PS Audio's Senior Loudspeaker Design Engineer, Chris Brunhaven, the aspen range's planar magnetic (PM) mid and treble drivers are core to the performance and sound of this speaker family. PM drivers are attractive for any number of reasons but principally for the elegance of a single, directly driven diaphragm with no translational components. A conventional driver will include a voice-coil former, spider/suspension, dustcap/phase plug, cone and surround, etc, that can all contribute to resonances and reflections, the latter from misterrmination at the various mechanical boundaries. Planar diaphragms are also very light – 12µm Teonex here – while the 'voice coil' is nothing more than a few turns of 17µm etched aluminium on the surface with, again here, a reversed turn at the outer edge for damping. The low sensitivity of earlier PM drivers is countered with powerful neodymium magnets but the precise corrugation, clamping and damping of the diaphragm is also key – ensuring the film responds in a uniform and predictable fashion is the biggest obstacle faced by any designer lured by the *potential* of PM driver technology.

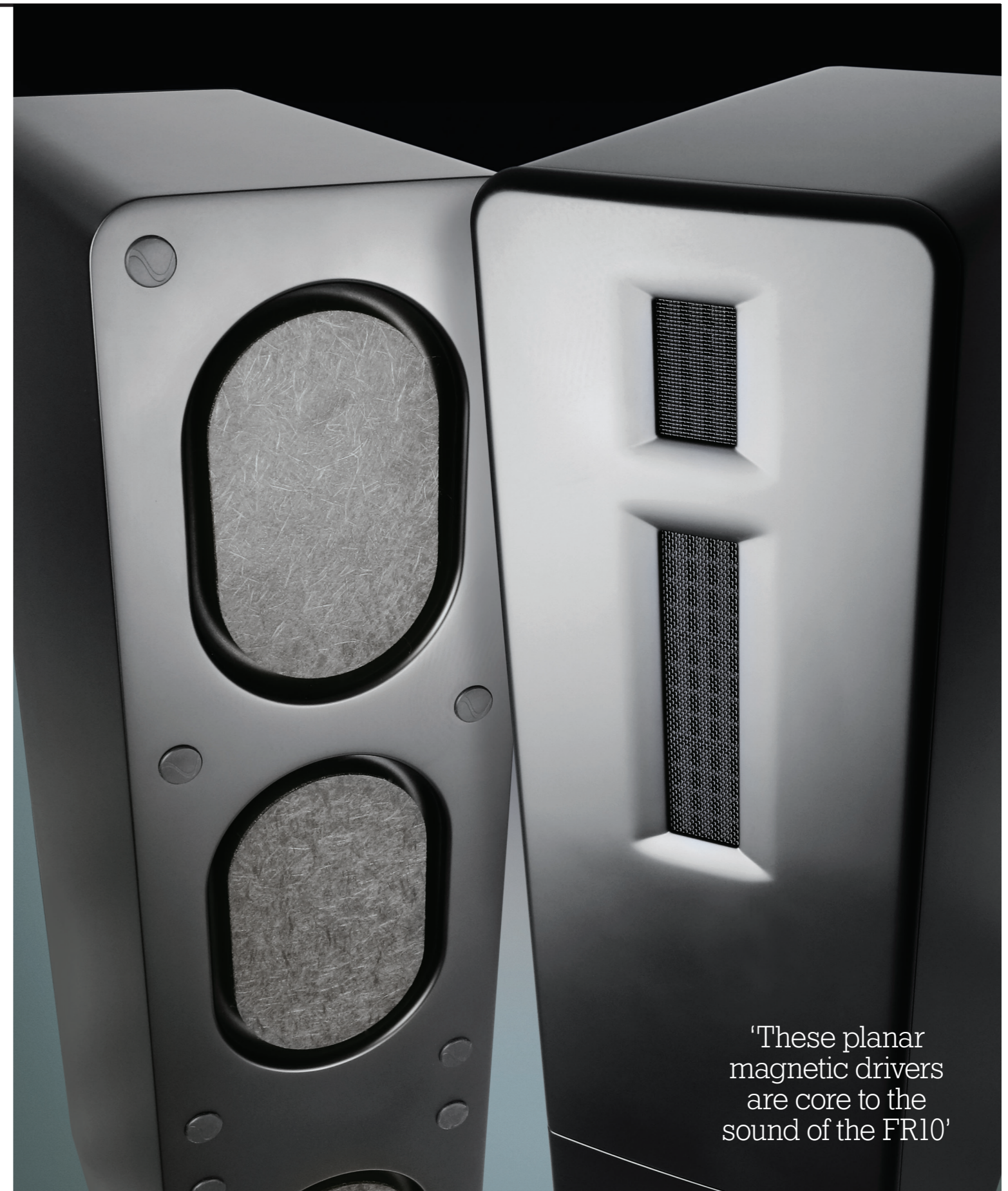
The main components – but not all the detail – of PS Audio's PM drivers are illustrated in the rendering [below] showing, from front to back (left to right), a perforated 1.5mm low-carbon steel pole plate; N52 NEO magnets (15 pieces of 3x5x50mm, but the FR10 tweeter has three rows and the midrange seven rows vs. the five rows shown here); and an acoustically resistive scrim cloth and wool felt strip. The thin-film diaphragm lies at the centre, with cloth/magnet/pole piece behind, terminating in a polycarbonate rear chamber filled with polyester/wool and Twaron fibre for acoustic loading and damping of the back wave. PM



but they still have an impressively long throw, with maximum travel of around 19mm in each direction from rest. The suspension is made from Nomex with the voice coil lead-out wires woven in. This is not uncommon on long-throw drivers, as

conventionally looped braided voice-coil leads can become a source of unwanted vibration, or even failure, at high excursion.

All the drivers on the FR10 are directly mounted onto the rear of its thermoset fibreglass resin baffle panel which, in turn,



"These planar magnetic drivers are core to the sound of the FR10"

LOUDSPEAKER

is bolted onto the open front of the main enclosure with a damping gasket between. The baffle includes reinforcing brass inserts and is held in place by long bolts that are fitted and secured through the rear of the cabinet. These full-depth bolts screw into the inserts and are tensioned on assembly to pull everything together very tightly.

READY TO RACE

While we're looking at the rear panel [see p43 and p47] – a blank canvas except for cable terminals on the FR20 and FR30 – this is where the FR10's three 230x150mm 'racetrack' shaped ABRs are to be found. These passive drivers [see PM's boxout, opposite] employ the same light and stiff sandwich cone material used for the bass drivers, except here they are flat rather than concave in profile. The relocation of these ABRs from the side (in the FR20 and FR30) to the rear of the FR10 is for cost-saving reasons, as the units no longer need to be lacquered to match the cabinets' gloss finish. Moreover, the 'biscuit tin clunk' that we observed from the hard top surface of the FR20/30's ABRs is absent from the significantly more inert, if more industrial-looking, FR10 ABRs.

All the drive units are united by a bespoke crossover that employs metallised polyester capacitors, wire-wound resistors and air-cored inductors. The DC resistance of the crossover inductors can adversely affect the bass section, but PS Audio's main 2.4mH component is wound using 15-gauge wire – nearly 1.5mm in diameter – so that a low series resistance and high power handling is ensured.

The FR10's cabinets are available in black/dark grey and white colourways, but the finish is satin rather than the gloss of the larger models. The built-in bases are in naturally anodised aluminium on the white speakers and black anodised on the black finish. Four feet are included and these are fully adjustable from the top for levelling. Conical spikes are pre-fitted as standard but these can be unscrewed and removed, leaving behind rubber feet for use on hard floors. Twin magnetically-attached, light frame grilles are also provided.

Finally, the speaker's packaging is as secure as it is simple to pop open and deliver the FR10s into your room. Even the top foam packing piece has been designed to be the perfect height for the speaker to be tipped sideways onto and then tipped off again to stand upright. It's thoughtful, and makes unpacking these 35kg designs an absolute doddle.

Less of a doddle is optimising the position of the FR10s. PS Audio's literature goes into good detail about this and I would strongly recommend heeding its advice. Connected to my usual Yamaha C/M-5000 amplifiers [HFN Aug '20] and moved into a 33x14ft room, I spent most of an afternoon fine-tuning their positioning to get them just so.

ALL THE RIGHT MOVES

PS Audio's tweeters have excellent lateral dispersion but, like some conventional ribbon tweeter designs, have a relatively narrow vertical 'sweet spot'. Stray too far – sit too high or too low – and top-end output starts to drop off. Also, those three rear-facing ABRs work hard and if the FR10s are too near to a rear wall then its bass output can swamp everything. Ultimately I ended up with them around 3ft feet (1m) from the rear wall and 18in from the sides.

Get everything right, and the FR10s offer a seamless presentation across the frequency range. Successfully integrating multiple drive units is never the easiest

of tasks, especially when two are planar magnetic and the others are conventional moving-coil types. Fortunately, the FR10s never once gave the impression that I was listening to a few different drivers that just happened to be playing simultaneously. By contrast, PS Audio's 'blending' of its various drivers proves to be truly harmonious.

TAKING AIM

The FR10s have a charming openness and spatiality, but I also loved the way this could be fine-tuned by the degree of toe-in. Aim them at the listening seat and the central image solidity is quite uncanny, albeit with a tiny hint of glare from the tweeter firing directly at you. Go wide and the whole soundstage just opens up, but the focus becomes a little more diffuse. You'll want to experiment to strike the preferred balance.

For my room, that balancing point was with the speakers toed in to aim around a foot or so behind my head. In this set-up they created a soundstage that was wide and deep, but also well ordered. Johnny Cash and Willie Nelson's version of 'Ghost

RIGHT: The FR10 is supported on alloy 'short stands', while the hot-pressed MDF cabinet houses a combination of two (smaller) 165mm carbon fibre/PMI foam sandwich coned bass units with no fewer than three 150x230mm ABRs on the rear [see p47]

'They can thunder out a window-rattling performance'



PASSIVE RADIATION

An ABR (Auxiliary Bass Radiator) is a potentially superior method of reflex-loading an active bass unit and extending its low frequency 'heft'. The traditional port tube is, of course, the more cost-effective option for designers but, as I discuss below, the 'plastic pipe' is not without its shortcomings. PS Audio, like GoldenEar and others [HFN Jan '24], is a fan of ABRs – here the mass of air within a port tube is substituted for the more substantial moving mass of a diaphragm to form a Helmholtz resonator with the compliance of the air trapped in the cabinet. It's effectively a drive unit without a motor (so no voice coil and no magnet) but with a more compliant surround to ensure free and extended excursion at very low frequencies. In this case the FR10's lightweight, flat but very rigid sandwich cones, with a soft rubber surround, are designed to offer 2-3x the displacement of the active, front-facing 165mm sandwich coned drivers.

The exact shape of the ABRs is not critical at these very low frequencies/long wavelengths so PS Audio has opted for an oval (230x150mm) profile simply to maximise the useable surface area on the rear of this fairly narrow cabinet. (Strictly, it's neither oval nor elliptical, but shaped like a race track.) The uniformity of the rubber surround between its linear and curved sections requires some attention, but this has been well understood since the development of the earliest flat sandwich 'ovals', including the famous KEF B139 driver from the 1970s – the latter offered in 'active' and 'passive' forms.

ABRs offer advantages over ports because they avoid the turbulent airflow that may result from high tube velocities – a source of 'chuffing' and other distortions – while attenuating enclosure quarter-wave and other resonances that would otherwise sail clear from a duct. ABRs can also assist in the optimum low-frequency tuning of a speaker in a room. Ideally, the ABRs would be placed in force-cancelling guise opposite one another on the sidewalls of the cabinet, as we saw in the FR30 and FR20. While this confers benefits in resonance control, for reasons of aesthetics and economy PS Audio has placed its ABRs on the rear of the FR10 with the lowest radiator very near the floor to leverage further reinforcement from boundary gain. In practice, the FR10s may also be sited closer to the rear wall, bringing two boundaries into play, and potentially lifting the bass still further without causing major anomalies in response. **PM**



Riders In The Sky' [...VH1 Storytellers; American Recordings 3145869522] gave the two singers a vast ambience to work in. Every breath, string pluck and strike or tap of percussion was clean and focused, while the audience applause was truly vivid.

GRAND DESIGNS

It became clear to me very quickly that the FR10s are a compelling companion if you want to have your music presented in a way that properly

LEFT: Planar magnetic 200mm mid and 64mm tweeter both feature PEN (Teonex) diaphragms, and are mounted behind the compression-moulded fibre glass/resin composite baffle. Satin white and satin black finishes [pictured here] are offered with matching grilles

fills your room. It's easy to forget that – at just over a metre tall and 30cm wide – they really are quite compact. However, they sound considerably bigger than their sleek cabinets would suggest, generating an impressive feeling of scale and authority from a soundstage that's typically 'grand'.

This is achieved without favouritism over musical genre or number of performers. Give them a big orchestral piece to work with and the FR10s will fill your listening area with unflappable precision, ensuring nothing important is missed. However, they will also take something simpler and seemingly expand it to ensure you are put right into the heart of the action.

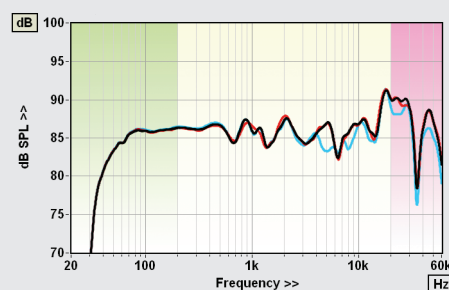
As a result, stripped-down tracks like Nickel Creek's 'Reasons Why' [Reasons Why: The Very Best; SUG-CD-4022] suddenly ☞

LAB REPORT

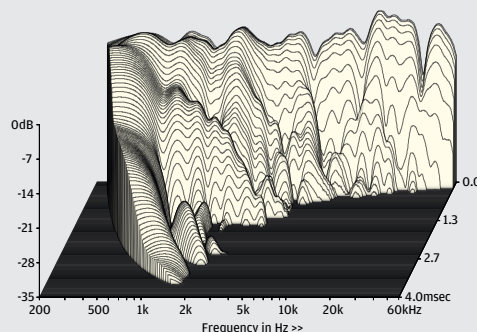
PS AUDIO ASPEN FR10

While the midrange FR20 model [HFN Apr '23] is not unlike a scaled-back FR30 [HFN Jun '22] in design and performance, the new FR10 is very much 'its own man'. For example, while the FR20/30 crossovers are engineered to achieve a 'flat, nominal 4ohm impedance curve', the FR10's load shows a more obvious swing in impedance of 30ohm/5.8kHz and phase ($\pm 51^\circ$) as the 64mm planar tweeter gets into its stride. The toughest, though not especially 'tough', load is still in the bass where the minimum 3.45ohm/165Hz is joined by $+33/-49^\circ$ swings in phase to deliver a perfectly 'driveable' min. EPDR of 1.7ohm at 88Hz and 365Hz.

The PM tweeter is obliged to work to a lower 1.75kHz in the FR10 – it rolls in at 2.5kHz in the FR20 – and this extended 34kHz bandwidth ($-6\text{dB re. } 10\text{kHz}$) spans the mid/treble where the largest $\pm 4.4\text{dB}$ and $\pm 4.6\text{dB}$ response errors, respectively, occur and where some minor bass/mid driver modes carry through [see CSD waterfall, Graph 2]. Pair matching is a superb 0.8dB (re. 200Hz-20kHz), however. The response is smoother with the grilles in place [blue trace, Graph 1] while the 4-5dB step at 15kHz is softened by toeing the speakers in (or out) or by making adjustments to your seated height. Sensitivity meets PS Audio's 86.5dB/1kHz spec. and while this is modest for the cabinet size it has – wisely – been traded for a bass extension of 38Hz ($-6\text{dB re. } 200\text{Hz}$), courtesy of two 165mm woofers being supplemented by three rear-facing ABRs – tuned to 35Hz – and offering 2.5x the radiating area. While bass THD is a moderate $\sim 0.8\%$ (re. 90dB/1m), nearfield analysis also shows the LF to be clear of cabinet modes or other obvious standing waves. PM



ABOVE: Response inc. nearfield summed driver/ABR(s) [green], freefield corrected to 1m at 2.83V [yellow], ultrasonic [pink]. Left, black; right, red; w. grille, blue



ABOVE: Some mild modes associated with the carbon/foam woofers and PM mid, but PM tweeter is 'clean'

HI-FI NEWS SPECIFICATIONS

Sensitivity (SPL/1m/2.83V – 1kHz/Mean/IEC)	86.5dB / 85.6dB / 84.2dB
Impedance modulus: minimum & maximum (20Hz–20kHz)	3.45ohm @ 165Hz 30.3ohm @ 5.76kHz
Impedance phase: minimum & maximum (20Hz–20kHz)	-52° @ 14.2kHz $+51^\circ$ @ 3.3kHz
Pair matching/Resp. error (200Hz–20kHz)	0.8dB/ $\pm 4.4\text{dB}/\pm 4.6\text{dB}$
LF/HF extension ($-6\text{dB ref } 200\text{Hz}/10\text{kHz}$)	38Hz / 34.4kHz/34.6kHz
THD 100Hz/1kHz/10kHz (for 90dB SPL/1m)	0.75% / 0.15% / 0.35%
Dimensions (HWD) / Weight (each)	1050x299x413mm / 34kg

LEFT: The planar mid and treble drivers crossover at a 'low' 1.75kHz but there's a split at 550Hz that allows for separate bass [bottom left] and mid/treble [bottom right] 4mm input terminals. Three 150x230mm ABRs substantially augment the FR10's bass output

[Decksanddrumsandrockandroll; Wall Of Sound WALL CD015].

That said, they really come into their own when things are softer and more considered. Much as they made me grin when fed something punchy and hard-hitting, on occasion I wished their dual bass driver/triple ABR combination would rein things in just a little. The aggressive synth bass lines on the dance track 'Jumbo' from Underworld's *Beaucoup Fish* [JBO 1005438] bounded along superbly but the FR10s were slightly casual in applying the brakes. Some low notes or percussive effects, such as the foot-tapping that accompanies Eric Clapton on 'Hey Hey' from his *Unplugged* LP [Reprise Records 9632-45024-1], failed to stop on the proverbial sixpence.

RICHLY DESERVED

Where the music is inherently more restrained, however, the level of low-end detail, generous weight and enveloping warmth offered by the FR10s is hugely appealing. Relaxed and with my eyes closed, the double bass on the Holly Cole Trio's version of 'I Can See Clearly Now' from *Don't Smoke In Bed* [Manhattan Records CDP 7811982] seemed right in front of me, its performance deep, rich and deliciously resonant. Add in Miss Cole's exquisite vocals, and I was one very happy listener. ☺

HI-FI NEWS VERDICT

PS Audio is definitely on a roll with its aspen loudspeaker series. The new FR10 slots comfortably into the range alongside its bigger brothers, promising a big-hearted, ebullient and hugely enjoyable performance across the board. They do need care and time taken in their setup but, once suitably positioned, they reward handsomely, offering a scale and level of authority that belies their compact dimensions.

Sound Quality: 88%



became incredibly powerful. Sara Watkins' bluegrass vocals soar during the verses and can cause some loudspeakers to edge into raucousness, but the FR10s took every crescendo in their stride.

CAN YOU DIG IT?

As the icing on the cake, the sheer musicality, nuance and finessed imaging of these speakers is underpinned by a bass weight that, again, appears to make a mockery of their compact dimensions. The FR10s dig impressively deep and are more than happy to thunder out a window-rattling performance if required, as evidenced by the solidity and scale they bought to Propellerheads 'Take California'