Q Acoustics 3000i Technical Brief

Introduction

Q Acoustics is proud to introduce the new 3000i range of 2-way hi-fi loudspeakers.

The new range is an evolution of the existing 3000 series which has undergone a number of innovative improvements intended to bring about significant enhancements in both performance and aesthetics for 2018. The 3000i series replaces all previous designs and forms the core hi-fi loudspeaker offering from Q Acoustics. As such it includes a large floor-standing model the 3050i and the compact and mid-sized bookshelf models, the 3010i and 3020i respectively. For home cinema use, the range is augmented by the 3090i and 3060S, a matching centre-channel speaker and an active sub-woofer.

Improved Loudspeaker Enclosure

More Realistic Stereo Image

The purpose of a good hi-fi system is quite simply to provide a musical experience in the home which comes as close as possible to the real thing. To achieve this, a stereo image that gives as good an impression of width, depth and height as would be found at a live concert is needed. Good quality drive units and a well designed cross-over are of course necessary, but unlike many other manufacturers, Q Acoustics recognises that the essential starting point for any loudspeaker is the enclosure itself. This is because even low levels of unwanted noise created by sympathetic vibrations in a loudspeaker enclosure will dramatically reduce image stability and consequently, the illusion of reality.

New Construction Methodology

Q Acoustics has found that fibre boards such as MDF have a huge advantage over alternative materials; they are easy to cut, fit and finish but crucially, because they are very dense and homogenous in their makeup, they are very well damped, avoiding unwanted resonances. Our manufacturing process eschews the simple ‘fold and glue’ construction of many inferior loudspeaker enclosures at this price point. In order to promote maximum rigidity the corners are precision-cut and internally braced. The front baffles of the 3000i are further improved by using double-thickness material to provide firm support for the mid/bass drive units and the high frequency driver suspension system.

Remodelled Q Acoustics P2P™ Bracing

A top quality enclosure requires internal bracing to maintain the proper stiffness but if this is done indiscriminately it can actually spread unwanted energy at random. Through the use of finite element analysis and laser interferometry, Q Acoustics have been able to minutely and accurately analyse the exact dynamic performance of the new 3000i enclosure structure to reveal the optimal positions which need support. The resultant bracing method, known as Q Acoustics P2P™ (Point to Point) bracing, only supports the parts of the enclosure that need to be stiffened making the new enclosures even quieter than their predecessors. Part of this process revealed that the addition of an extra precision-cut damping panel in the top of the speaker would improve the focus of the stereo image giving the soundstage more accuracy than ever before.

Larger Volume

The two bookshelf models 3010i and 3020i, maintain the same acoustically optimal front profile but have been made slightly taller and 25% deeper. This increased internal volume has enabled Q Acoustics to gain an extended low frequency response from the ported design so that more-than-ever the smaller enclosures in the range belie their diminutive stature with an impressively large-scale sound. As an added benefit the enlarged front-to-back dimension means that any cone-generated noise reflected from the back wall of the enclosure and out through the cone itself is reduced.

Retuned Q Acoustics HPE™ System

Tall loudspeaker enclosures tend to resonate at a single favoured frequency because of areas of high and low pressure which form due to standing waves. Q Acoustics engineers have employed a specially designed Helmholtz Pressure Equaliser (HPE) inside the 3050i enclosure to eliminate these 'organ pipe' resonances. Q Acoustics HPE™ converts pressure to velocity, reducing the overall pressure gradient within the enclosure, improving low frequency linearity. Figure 1 below shows the pressure differential inside a conventional loudspeaker enclosure modelled by finite element analysis.

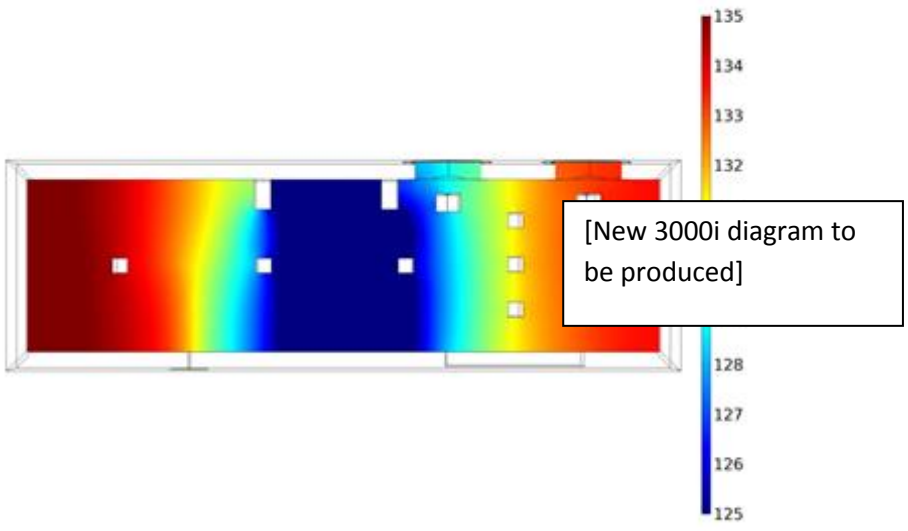


Figure 1 Pressure differential inside speaker enclosure without HPE

Areas of high pressure are coloured red and areas of low pressure are coloured blue revealing the internal standing wave which would cause the enclosure to vibrate at its resonant frequency. Compare this to the same enclosure incorporating Q Acoustics HPE™ Technology shown in Figure 2. The high pressure areas have been reduced significantly thus minimising the ability of internal standing waves to set up undesirable resonances.

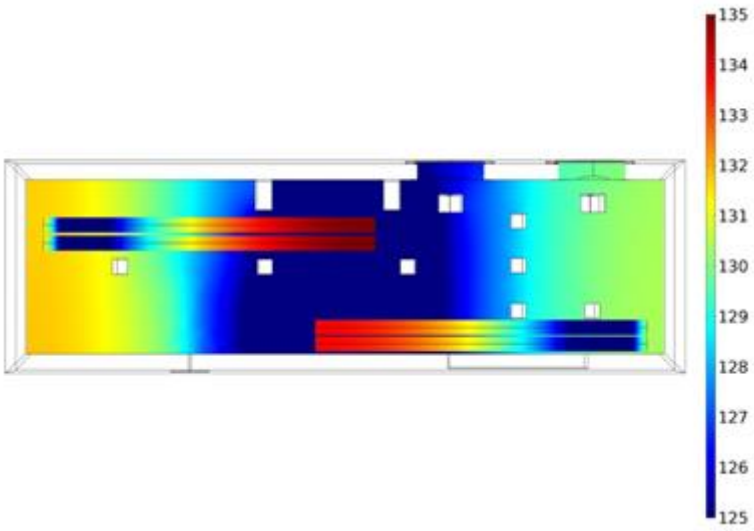
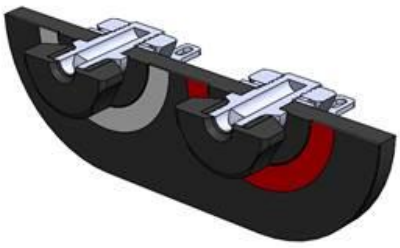


Figure 2 Pressure differential inside speaker enclosure with HPE

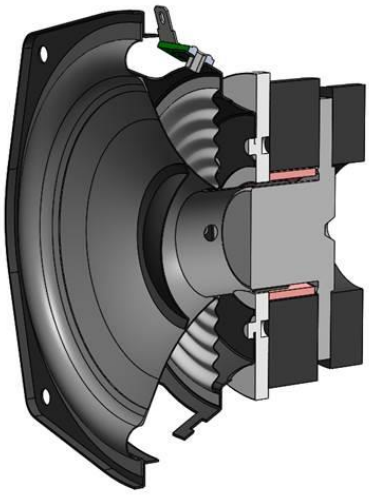
Paradoxically, of course, a poerted design relies on the tuned resonance of the port to produce extra efficiency in the low frequency response of the driver. For this special case the port tube itself is damped to cut down on unwanted vibration in this carefully tuned system. Additionally for those who wish to use the rear facing ported system close to a rear wall, specially selected and tested foam bungs have been provided as standard.

New Binding Posts



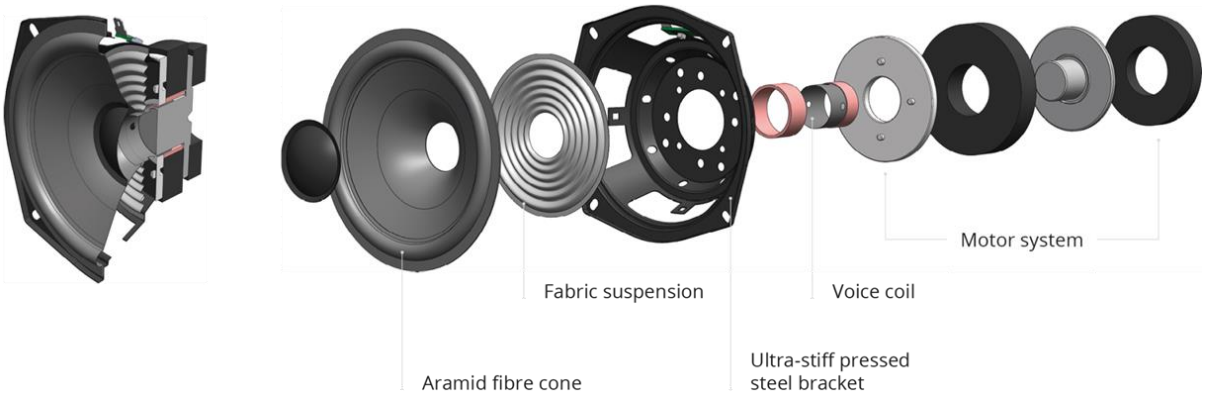
The all new loudspeaker terminals have been re-tooled to comply with the low-resonance design philosophy of the rest of the enclosure. The new fixing method means that there is no longer a large mounting panel with the potential to produce unwanted vibration and add colouration to the sound. Instead the terminals are let into the rear panel with only the smallest holes penetrating the cabinet for the cross-over connections. At the same time the binding posts themselves have been made extra low profile so that the speaker can still be positioned very close to a rear wall even when banana plugs rather than spades or bare wires are used.

Drive Units



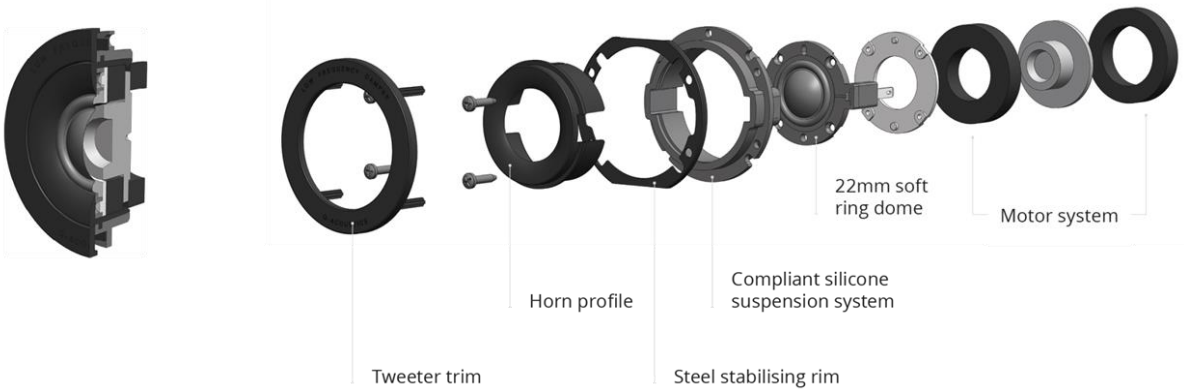
Mid/Bass Driver

Several sizes of mid/bass driver are employed throughout the 3000i series, ranging from single 100 mm and 125 mm units in the 3010i and 3020i to twin 100 mm and 165 mm units in the 3090i and 3050i respectively. Whichever model you choose the cone will be precision formed from impregnated and coated paper and is teamed with a newly developed, low-hysteresis, rubber surround. The coated paper cone provides the optimum balance between stiffness and self- damping which means it can accelerate without flexing and stop very accurately without overshoot or unwanted resonances. The rubber surround has a controlled compliance which ensures that it has low stored energy providing good termination of the driver's interface with the air, while still maintaining a lively, accurate sounding character. The voice coil has a large 25 mm diameter, which allows for higher power-handling, as well as reduced dynamic compression. The voice coil former is made of aluminium which delivers the required stiffness and yet remains strong and light reducing inertia of the overall system.

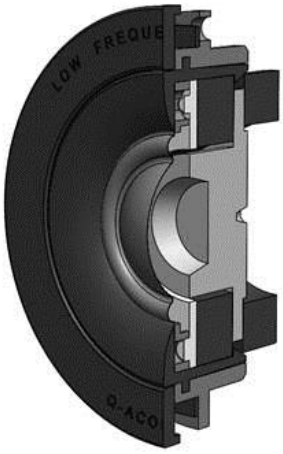


With a double ferrite magnet providing maximum sensitivity and therefore an easy to drive loudspeaker. A less well-designed drive unit would suffer from increased distortion due to the variations in the inductance of the voice coil. Ordinarily this would be caused by eddy currents induced in the magnetic material as the coil moves in and out which have the effect of modulating the load presented to the cross-over. This problem however is cleverly avoided by the addition of aluminium inductance compensation rings within the magnetic gap which soak up the eddy currents and effectively shield the magnetic poles. The result is an extremely linear and distortion free mid/bass driver.

High-Frequency Drive Unit



Finite element analysis was used to model the acoustic performance of the polyester micro-fibre soft-dome high-frequency drive unit. Too narrow a high frequency dispersion characteristic means that a speaker will not drive the room well, making it sound flat and uninteresting unless the listener is sitting in the exact 'sweet spot'. The extra-wide surround of the high frequency drive unit contributes to wide and even dispersion of upper frequencies, adding extra energy off axis. The light-weight 22 mm soft dome which it employs combined with a double ferrite magnet gives it high sensitivity and a flat frequency response right up to 30 kHz making the unit ideal for hi-res musical material. In the 3050i floor standing speaker the high frequency drive unit features larger double ferrite magnets for even greater sensitivity. Linearity is ensured by incorporating balanced-pressure design characteristics into the internal structure of the drive unit. Minute imbalances of pressure can cause audible problems at high frequencies and the unit is so designed that the internal pressures are always equalised within the soft dome.



The high frequency unit is mechanically decoupled and mounted in a brand new specially designed IsoMount™ rubber suspension system which is designed to effectively isolate the driver and speaker enclosure from reciprocal vibrations that otherwise would be transmitted between them. The IsoMount^{tm} system also ensures the tweeter is precision mounted ensuring that there are no discontinuities in the front baffle which could cause unwanted acoustic diffraction and reduce the sweet but vibrabt quality of the high frequencies.

Optimised Crossover

Carefully Selected Components

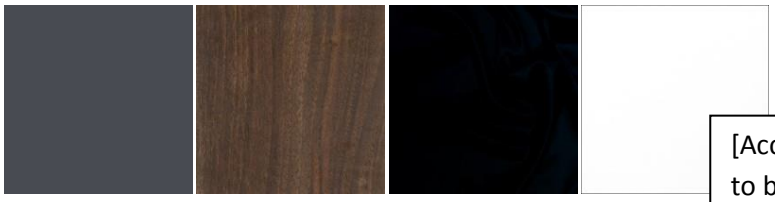
The advantages gained by using low distortion drive units and a very quiet enclosure would be wasted if the same attention had not been paid to the design of the cross-over. The scientific principles of cross-over design and manufacture are well established and the 3000i series uses a Linkwitz-Riley fourth-order acoustic crossover architecture across all models. This topology features a steep 24 dB/octave attenuation slope to give seamless integration between the drive units but more importantly all drivers are aligned exactly in phase. Any phase shift between the drivers would detract from the stereo imaging ability of the speakers and so with this eliminated we maintain the

benefits brought about by the design of the enclosure. However the science stops short of defining the quality of the sound produced by the cross-over. Without doubt passive components can have a definite sonic character and so the art of making an excellent cross-over resides in hours of listening and choosing the best blend of components for the optimum musical performance. As an example the 3020i and 3050i feature a custom made low inductance bifilar wirewound resistor in the high frequency feed because of its superior sound quality. Similarly the 3050i features an audiophile polypropylene capacitor in the same circuit.

New Enclosure Aesthetics

Contemporary Finishes

The new 3000i series speakers are available in four standard finishes; Graphite Grey, English Walnut, Carbon Black or Arctic White. All are finished with an attractive chrome bezel around each driver and feature magnetic speaker grilles.



[Accurate swatches to be provided if required]

Revised Mounting Arrangement

The bookshelf speakers work best when partnered with their purpose designed speaker stands coupled securely to the floor by integral spikes. Each model features a new mounting system which is specifically engineered to couple the speaker rigidly to the stand. Alternatively, mounting points are included for a bespoke wall mount bracket as well as rubber feet for those who literally wish to use them as bookshelf speakers. The 3050i floor-standing speakers have a built-in four point fully adjustable spiked coupling system featuring rear outriggers and rubber protection cups for those who do not wish to damage expensive wood flooring.

All-New Subwoofer

New to the range is the 3060S active subwoofer, an infinite baffle design featuring a single 200 mm long-excursion bass driver. The cabinet shares the same construction principles as the rest of the 3000i series and has integrated fully adjustable spiked feet and a hidden cable tidy control panel. It is powered by a 150 W (limiter protected) class D amplifier which due to its high efficiency requires little in the way of heat sink capacity meaning that the unit can be made incredibly compact to match the requirements of contemporary living spaces. Wherever it is placed bass reinforcement can be perfectly tailored to suit the listening room as there is an infinitely variable 25 – 200 Hz cross-over adjustment and a

1808 phase switch. With full auto-on and auto-standby functionality and a stereo/mono input facility the 3060S comes in a choice of Arctic White or Carbon Black finishes.

Conclusion

In the ongoing spirit of evolution, refinement and perfection, Q Acoustics have taken an already successful loudspeaker range and made significant improvements. The emphasis on advanced cabinet design principles that preserve the subtle sonic clues which enable the ear to perceive a solid 3D soundstage has paid dividends. Careful component matching and exhaustive listening tests have meant that the partnering electronics will do nothing to detract from the sheer enjoyment garnered by the sense of intimacy in the performance.

Features and Benefits

P2P™ bracing – helps keep the enclosure extra quiet through computer aided placement of internal bracing

HPE™ - eliminates sympathetic resonance within large floor-standing enclosures by equalising air pressure within the cabinet

Top Damper – computer aided positioning enhances stereo imaging capability

Double Thickness Front Baffle - lends increased stiffness and added support to drive units

Damped Port Tubes - reduces vibration in the reflex port tube as air rushes in and out

Increased Cabinet Volume – lends larger scale and deeper bass to bookshelf models

Low Profile Terminals - recessed cut-out reduces cabinet noise and allows them to be used near to rear wall

22 mm High Frequency Driver – Micro-Fibre Soft Dome with wide surround creates a wide even dispersion of stereo information when listening off-axis

IsoMount™ Suspension System – decouples the high frequency driver from cabinet vibrations and vice versa for more accurate stereo sound staging, reduces diffraction

Balanced Pressure HF Design – eliminates pressure differentials within the high frequency driver, increasing linearlity

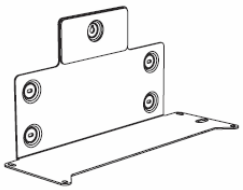
Coated Paper Cone – helps maintain absolute fidelity of the mid-bass driver preventing flexure

Aluminium Inductance Compensation Ring – reduces modulation of the speaker inductance and distortion from this source in the mid/bass drivers

Specifications

Loudspeaker	Q 3010i	Q 3020i	Q 3050i	Q 3090Ci	Q 3060S
Enclosure Type	2-way reflex	2-way reflex	2-way reflex	2-way reflex	infinite baffle
Bass Unit	100 mm (4 in)	125 mm (5 in)	2 x 165 mm (6.5 in)	2 x 100 mm (4 in)	200 mm (8 in)
Treble Unit	22 mm (0.9 in)	22 mm (0.9 in)	22 mm (0.9 in)	22 mm (0.9 in)	-
Frequency Response (+3 dB, -6 dB)	65 Hz – 30 kHz	64 Hz – 30 kHz	44 Hz – 30 kHz	75 Hz – 30 kHz	35 – 250 Hz
Average Impedance	6 Ω	6 Ω	6 Ω	6 Ω	-
Minimum Impedance	4 Ω	4 Ω	4 Ω	4 Ω	-
Sensitivity (2.83 V@1 m)	86 dB	88 dB	91 dB	89 dB	-
Stereo Amplifier Power	15 - 75 W	25 - 75 W	25 - 180 W	25 - 100 W	-
AV Receiver (2 ch. driven)	50 - 125 W	50 - 125 W	50 - 165 W	50 - 165 W	-
Internal Amplifier Power					150 W Class D
Cross-over Frequency	2.6 kHz	2.4 kHz	2.5 kHz	2.7 kHz	35 – 250 Hz (var)
Effective Volume	4.0 L (244 cu in)	6.1 L (372 cu in)	32.4 L (1977 cu in)	6.6 L (403 cu in)	10.6 L (647 cu in)
Enclosure Dimensions (WxHxD) (inc. grille terminals and feet)	150 x 253 x 252 mm (5.9 x 10.0 x 9.9 in)	170 x 278 x 282 mm (6.7 x 10.9 x 11.1 in)	310 x 1020 x 310 mm (12.2 x 40.2 x 12.2 in)	430 x 152 x 216 mm (16.9 x 6.0 x 8.5 in)	480 x 300 x 150 mm (18.9 x 11.8 x 5.9 in)
Enclosure width			200mm (7.9 in)		
Weight (per speaker)	4.1 kg (9.0 lbs)	5.5 kg (12.1 lbs)	17.8 kg (39.2 lbs)	6 kg (13.2 lbs)	8.5 kg (18.7 lbs)

Accessories

	Q 3000FSi **Speaker Stand**	**Q 3000WB** **Speaker Bracket**	**Q 60WB** **Subwoofer Bracket**
	TBA		
Dimensions W x H x D	250 x 682 x 290 mm (9.8 x 26.9 x 11.4 in)	70 x 159 x 99 mm (2.8 x 6.3 x 3.9 in)	422 x 233 x 163 mm (16.6 x 9.2 x 6.4 in)
Weight (each)	6.2 kg (13.7 lb)	0.4 kg (0.9 lb)	2.4 kg (5.3 lb)

Q Acoustics **5th April 2018**