

# SILICON CHIP



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## BUILD THESE SENSATIONAL RIBBON TWEETER SPEAKER SYSTEMS



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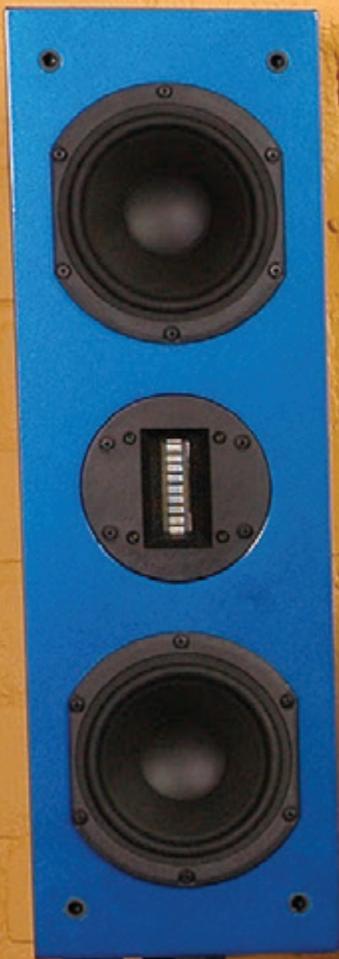
**Bringing a  
Vintage TV  
Back to Life**

*Sensational sound from ribbon t*

# Build the Signature

*These new speakers are among the very  
They use the very-high-performance Founte  
They will be a very good match to our-recent*

Design by RUSSELL STOREY



**tweeters**

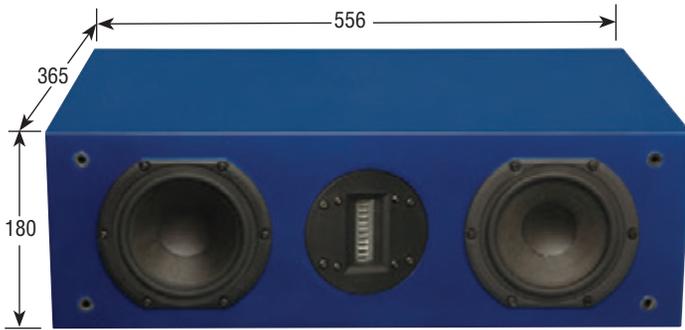
# *Series* Loudspeakers

*best kit speakers that money can buy.  
Peak ribbon tweeters and Peerless woofers.  
Fully described 20W class-A stereo amplifier.*

Words by LEO SIMPSON



At far right is the HD260 tower system and its dimensions while below is its centre channel variant the HD260C. The HD360, at right, uses a 6.5-inch woofer. The pick of the two systems is the HD260 because of its considerably higher efficiency: 92.5dB/1m/1W. Both systems produce commendably low harmonic distortion.



**S**ince we completed our description of the 20W class-A stereo amplifier a few months ago, readers have been asking us for a kit speaker system to match its performance.

As it happens, the Signature Series have been in development for over a year now and we are very pleased to present a complete set of speakers which can be used in stereo or home theatre systems.

They provide excellent stereo spread and definition, very wide and smooth frequency response with very low harmonic distortion. And while they are eminently suitable for our Class-A amplifier, they can be matched up to any amplifier with a power output up to 120 watts per channel, when running normal program material.

The heart of these speakers are the very high performance Fountek ribbon tweeters. For those who are not familiar with ribbon tweeters, consider them as an extremely light filament of aluminium foil suspended between the poles of an extremely strong magnet. The audio signal from the

amplifier is passed directly through the ribbon and the interaction of the current with the strong magnetic field deflects the ribbon back and forth to produce sound.

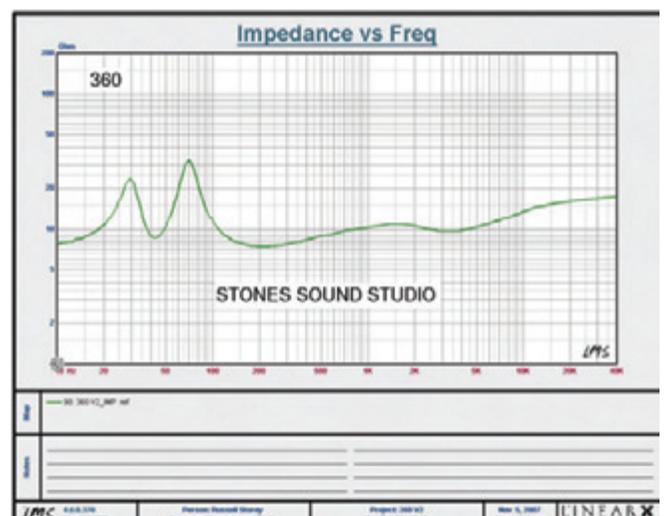
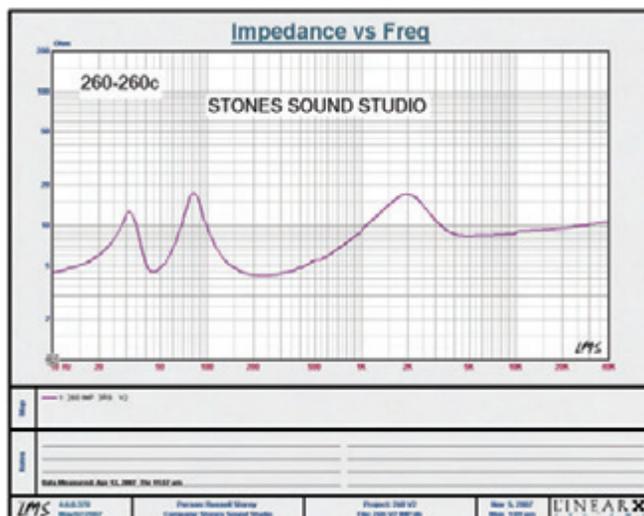
Incredibly, such an apparently flimsy system can produce deafening sound levels and with unsurpassed fidelity, transient response and so on.

Ribbon tweeters have been around for a long time but until recently they have been largely confined to very expensive esoteric loudspeakers systems and their reliability and ruggedness was always a little suspect.

In the particular Fountek JP3.0 ribbon speakers featured here, the aluminium ribbon weighs a mere 11 milligrams and is just 9 microns thick – much thinner than the proverbial human hair!

The aluminium ribbon is 66mm long and 8mm wide and suspended between the poles of a Neodymium magnet with a gap flux of 0.6 Tesla.

As you might expect, such a short piece of aluminium represents a very low resistance and it cannot be driven



The impedance curves for both the Signature Series speaker systems show the classic “double hump” at the bass end, due to the tuning provided by the bass reflex port.



This series of photos show the lineup of the drivers used in the Signature series. The woofers are made by Peerless and both have rugged dies cast chassis. The ribbon tweeter is made by Fountek and incorporates very high quality matching transformer. Note the fine mesh protecting the ribbon from curious fingers.

directly by any normal audio amplifier. Hence, the tweeter has an integral matching transformer with a frequency response to 120kHz. This results in a very flat tweeter impedance of  $7\Omega$  from 1kHz to 40kHz. The basic tweeter is also extremely efficient and in fact, is used with resistive attenuation to match the Peerless woofers used here.

Two separate stereo pairs of loudspeakers are presented, the Signature Series HD260 and HD360 systems. In addition, a centre channel variant of the HD260, the 260C was designed to complement the 260 and 360 for high-end Home Theatre A/V systems.

Depending on your budget, you may decide to build



The overall frequency response of the Signature Series HD260 and HD360 speakers is commendably flat to below 50Hz. This is the response of the HD260.

either the HD260s or HD360s for a high performance stereo system. Alternatively, for high-end Home Theatre A/V system, you may decide on a mix of the HD260 (front) and HD360 (rear) together with the HD260C for the centre-front channel.

Whichever approach you take, you can be sure that you will be getting a sensational speaker system. Make no mistake, these ribbon units are the finest tweeters we ever heard. They are so clean in their definition and the pin-point localisation of instruments in a stereo spread has to be heard to be believed.

On top of that, these speakers have very low distortion – measured at around 0.3% THD at 1kHz and 1 watt.

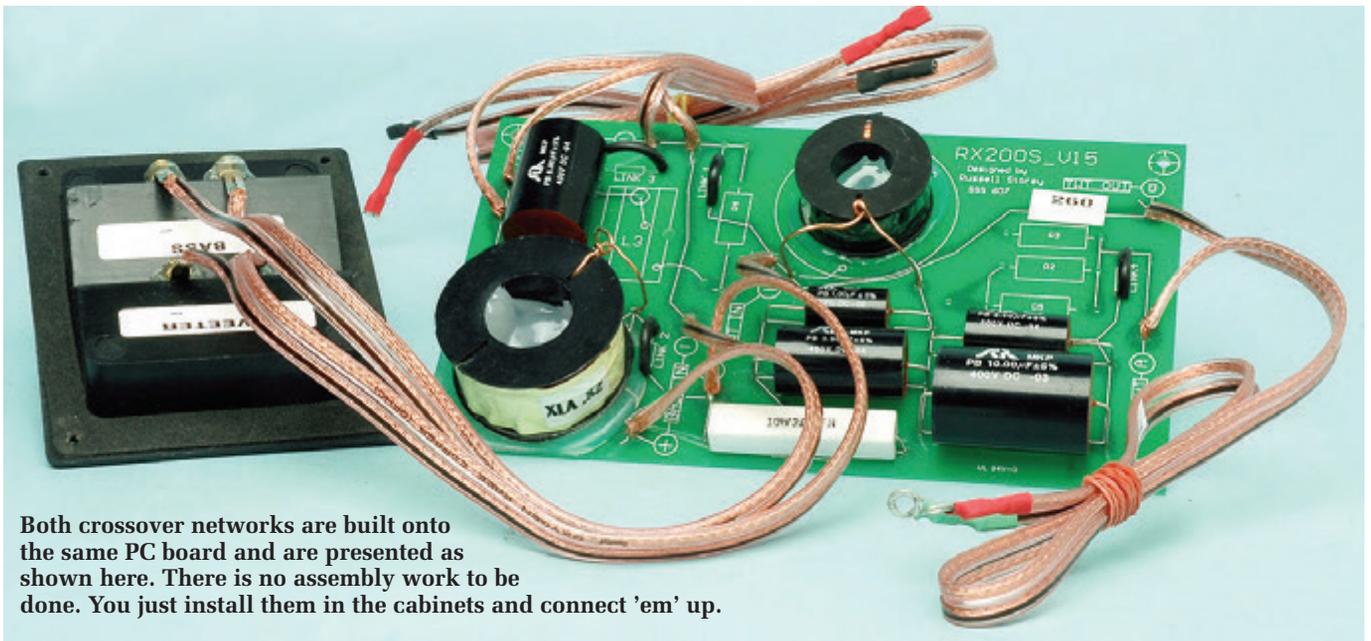
## HD260 & HD360

The HD260 is a small tower speaker using the Fountek ribbon tweeter and two Peerless HDS 832873 5-inch mid/range woofers. This uses a Nomex paper cone, a very large ferrite magnet and neoprene rubber roll surround. The HD260 system has exceptional efficiency of 92.5dB/1m/1W and will provide very good volume levels from the SILICON CHIP 20W class-A amplifier, even in large rooms.

The HD260 is a MTM (midrange-tweeter-midrange) arrangement (also known as D'Appolito) with a rear bass reflex port. The HD260C centre speaker is identical in every respect except that the tweeter is rotated through 90°, so that it will be vertical when the cabinet is laid on its side.

The smaller HD360 bass reflex system uses the Fountek ribbon tweeter and Peerless 830883 6.5-inch midrange woofer, also with a rear port. Its efficiency is somewhat lower but still quite respectable at 87.5dB/1m/1W.

Both speaker enclosures were developed using LEAP



Both crossover networks are built onto the same PC board and are presented as shown here. There is no assembly work to be done. You just install them in the cabinets and connect 'em' up.

5 wave diffraction analyser and FFT vibration analysis software. The resulting enclosures have a Butterworth low pass filter response to ensure optimum bass and transient response.

While the enclosures are relatively small, they are very strong and rigid to ensure very low panel resonances. They are made from 18mm MDF (medium density fibreboard) while the baffle is made from two thicknesses (36mm), to allow the ribbon tweeter to be flush-mounted and still provide maximum rigidity.

In addition, the inside edge of the woofer holes are chamfered to prevent diffraction effects at midrange frequencies and the HD-260 has internal bracing of the large side panels.

### Rear bass port

Both enclosures employ a rear port to ensure a reduction of overall driver distortion and cross-modulation which can be generated by front ports. According to the designer, with a front port a form of speaker (low frequency) distortion and cross modulation is generated by the compressed air exiting the port out of phase with the woofer creating (modulation) interference of the woofer cone. This interference of the woofer cone occurs at medium to high playback levels (port velocity) and is one of the factors reducing overall dynamic range or head-room of the transducers and speaker system.

The port itself is 63mm in diameter with small flared ends. All this is done to keep distortion at a minimum.

### Crossover networks

Using the best drivers and a carefully designed cabinet would be a waste of time without an equal standard in the crossover networks. In the Signature Series the crossover networks are quite complex (Linkwitz Riley with Bessel /Butterworth response). They were developed to enable good linear phase and minimum distortion through the passband and overlap regions of both the woofer and ribbon tweeter.

They have been developed with bi-wiring in mind so

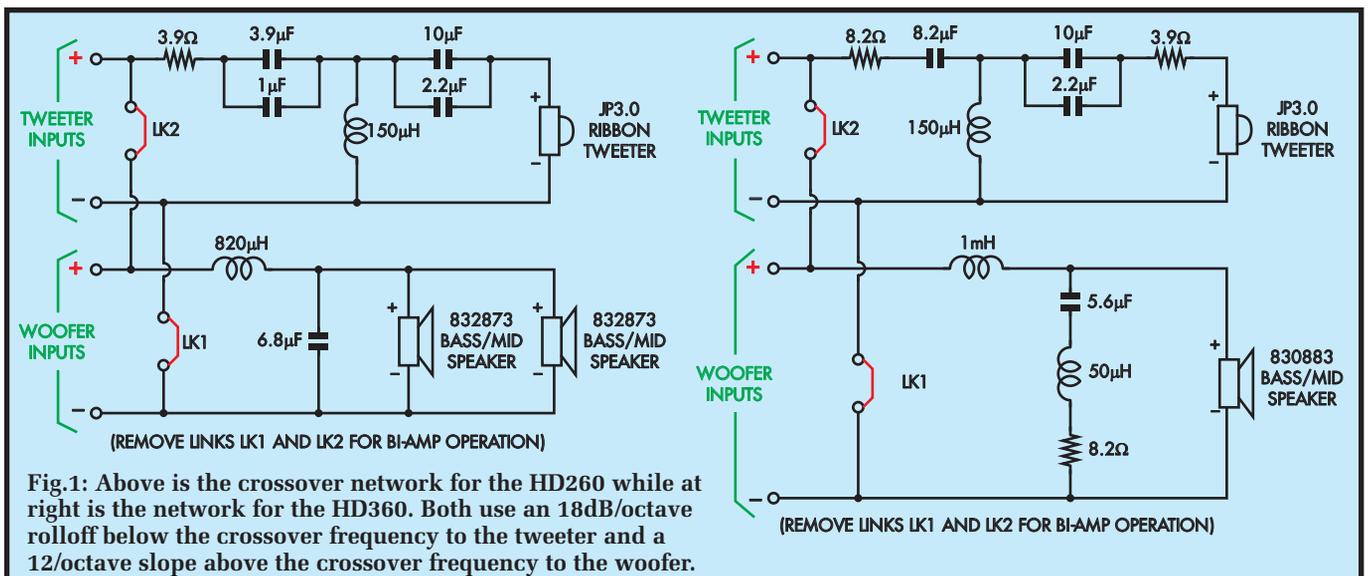
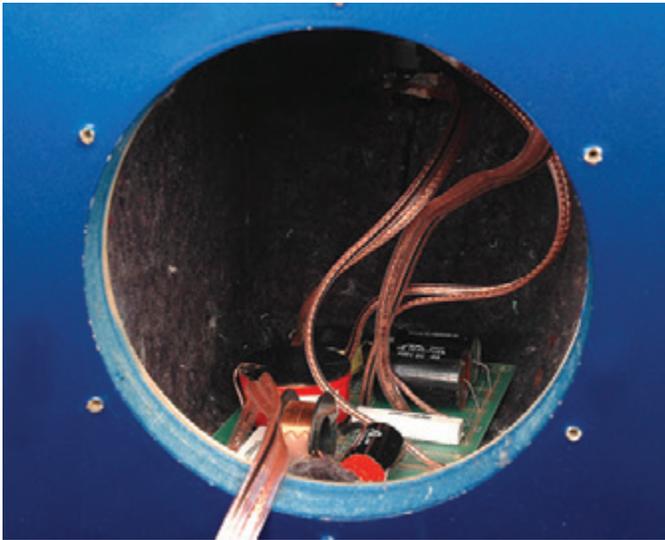


Fig.1: Above is the crossover network for the HD260 while at right is the network for the HD360. Both use an 18dB/octave rolloff below the crossover frequency to the tweeter and a 12/octave slope above the crossover frequency to the woofer.



**This photo shows the crossover network installed in the base of the HD360 enclosure.**

the tweeter and woofer filter networks are essentially quite separate, as shown in the diagrams of Fig.1 & Fig.2.

The tweeter is fed with a third-order high pass (18dB/octave) filter and the woofer is fed with a second-order (12dB/octave) low pass filter. In the case of the HD-260, the crossover frequency is 3.8kHz and 3.2kHz in the HD-360.

Both crossover networks are based on the same PC board but there are differences. Each crossover network employs air-cored inductors, non-inductive wirewound resistors and 400V metallised polyester capacitors. High quality components are used throughout.

### Building them

The designer of these Signature Series loudspeakers has been very particular in specifying how everything must go together, from the initial specification of the drivers, down to the very last detail of the cabinets, crossover components and even oxygen-free copper wiring. We don't think that last detail is really necessary but that is a story for another time.

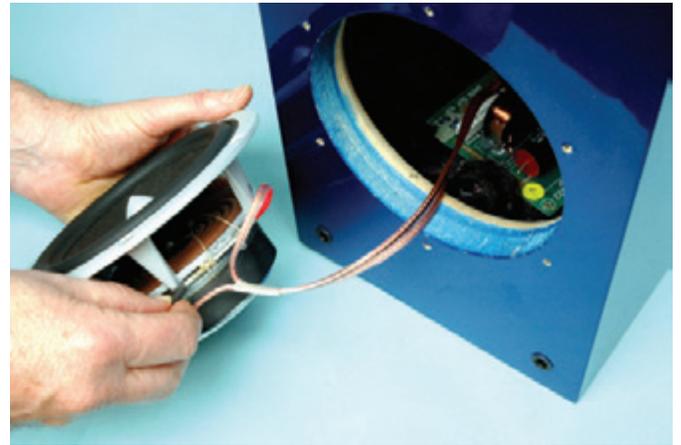
This very fine attention to detail on the part of the designer has made the task difficult for the kit supplier but it means that you, the ultimate kit-builder, will have an easy time putting them together.

The loudspeaker cabinets are supplied fully assembled in two forms, unfinished MDF or black vinyl. In the case of the unfinished MDF cabinets, it is up to you as to how you finish them.

The prototype cabinets featured in this article were spray-painted to a very high standard. If you have access to a high-pressure spray gun and spray booth, so much the better.

Alternatively, if you intend painting them, we recommend using a roller, to avoid leaving brush marks – it is amazing how brush marks can catch the light and become noticeable, especially if gloss paint is used.

Not only are the cabinets fully assembled but they also come fully lined with a grey felt, to damp internal reflections and they are also supplied with the fully finished grille cloth frames.



**Making the connections to the woofer. The terminals are colour-coded and differently sized so that you cannot make a mistake.**



**Fit the woofer carefully and do not touch the cone at this point, otherwise you may damage it. It is secured to the baffle with six Allen screws.**



**Making the connections to the tweeter. Do it exactly as the photo depicts. Don't over-tighten the nuts on the tweeters – it would be a shame to damage such a magnificent performer.**

No special tools are required to assemble the kits and no soldering is required. You will need a Phillips head screwdriver, a 3mm Allen key to install the speakers to the baffle and an adjustable wrench to attach the crossover connections to the terminals of the tweeters.

The fully assembled crossover networks even include the wiring to the speaker terminal panels – as we said, there is no soldering at all!

## Order of assembly

The order of assembly is the same, regardless of whether you are putting together the HD260s, HD360s or HD260C (centre speaker). The first step is to install the crossover network in the base of the cabinet. Check the back of the cabinet make sure you do not have it upside down – the rectangular hole for the terminal panel should be below the circular bass port.

Fit six Velcro tabs to the underside of the crossover PC board and then pass it through the lower woofer hole and secure it to the felt on the base of the cabinet. Pass the terminal panel out through the rear of the cabinet, making sure that you do not disturb the felt which covers the rectangular hole. Then secure the panel with four countersunk MDF wood screws.

Bring out the wires for the woofer(s) through their respective holes in the front baffle. Fit the push-on connectors from the crossover speaker cables to the woofer(s). The wires are colour-coded (red for positive and black for negative) are differently sized so that you cannot make a mistake when you do the connections.

Carefully place the woofer into its hole in the front baffle and secure it with six Allen head screws using a 3mm Allen key. It is important that you do not over-tighten these screws otherwise you will strip the holes in the MDF panel.

## Mounting the tweeter

Now is the time to mount the highly prized Fountek ribbon tweeters. Important: do not remove the protection label from the front of the tweeter until you have completed the assembly.

First, check that acoustic cover is fitted behind tweeter cutout hole is in place. Then bring out the tweeter wires from the crossover. These are fitted with colour-coded (red for positive, green for negative) ring terminals to suit the threaded posts of the tweeter.

Make the connections and tighten them with a small adjustable wrench – do not over-tighten them! Hint: angle the connector lugs to allow enough room between the felt cover and back of the ribbon magnet when installing the tweeter.

Then install the tweeter to the front baffle with four Allen head screws. Again – do not over-tighten them. Next, you can carefully remove the protection label from the tweeter faceplate.

## Bi-wiring option

Just back-tracking for a moment – if you intend running these speakers are bi-wired, with separate stereo amplifiers driving the tweeters and woofers, then the installation procedure is slightly different. You need to cut links LK1 and LK2 on the crossover PC boards and then remove the gold plated links from the 4-terminal panels.

Keep the plated links (possibly stick them to the rear of

the cabinets, in case you ever want to run the speakers with conventional amplifier drive (ie, not bi-wired).

A final step is to connect a 1.5V battery across the terminals of the completed loudspeaker. With the battery positive to the red terminal, the woofer cone should move forward. If that's OK, you can fit the grille cloth frames.

You are now almost ready for a listening session. When positioning your speakers in the room, make sure that they are not in the room corners and are out from the walls by around a metre or so. Ideally, they should be placed on stands so that the tweeters are at your ear level, when you are seated.

## Making your own enclosures

If you want to save some money by building your own enclosures, all the necessary dimensions and other information is accessible on the designer's website at [www.stonessoundstudio.com.au](http://www.stonessoundstudio.com.au).

If it was our choice, we would pick the complete kits rather than going to all the trouble to make the cabinets. Sure, you will save some money but there is a great deal of work involved. Consider that the front baffle needs to be laminated from two 18mm sections and you need to make the bass port with its carefully flared ends.

There are really no short cuts to making the cabinets and if you don't follow the diagrams very closely, you will prejudice the sound quality. The above site has all the information on these speakers so if you want to check any aspect of the design, you can readily do so.

SC

### Kit availability

Fountek ribbon speakers, Peerless speakers and all of the kits for the Signature Series are exclusive to Wagner Electronics, 90 Paramatta Rd, Summerhill, NSW 2130. Phone 02 9798 9233; fax 02 9798 0017.

Website: [www.wagneronline.com.au](http://www.wagneronline.com.au)

#### COMPLETE KITS

Include speakers, cross-overs, all hardware and cabinets. (Price per pair [except 260c] including GST).

#### 260

Plain MDF .....	KIT260-MDF .....	\$1299.00
Black vinyl .....	KIT260-BV .....	\$1399.00

#### 260C (one unit only)

Plain MDF .....	KIT260C-MDF .....	\$649.00
Black vinyl .....	KIT260C-BV .....	\$719.00

#### 360

Plain MDF .....	KIT360-MDF .....	\$1159.00
Black vinyl .....	KIT360-BV .....	\$1299.00

#### SPEAKER KITS (without cabinets)

Include speakers and crossovers but no cabinets and hardware. (Price per pair [except 260C] including GST).

260 Kit .....	SPK260 .....	\$799.00
260C kit.....	SPK260C (one driver only).....	\$399.00
360 kit.....	SPK360 .....	\$699.00

# STONES SOUND STUDIO

## RIBBON SPEAKER KIT

### MANUAL

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**260C**

**360**

**260**

Designed

By

Russell Storey

# **Loudspeaker Description and Building Instructions**

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# Loudspeaker Description

## The Ribbon Speaker Performance

Here at Stones Sound Studio we have engineered Super High Definition Ribbon Speakers to reproduce all analogue and digital stereo programs including CD, HD-DVD, SACD analogue turntables and multi channel A/V home theatre sound systems

The 260 260c & 360 Ribbon Speakers provide excellent depth of field, holographic 3D sound staging, fast tight bass midrange, crystal clear top end detail, extreme dynamic range with very low distortion on any type of program material from low to high volume levels

The 260C centre channel speaker complements the 260 and 360 ribbon speakers for high-end Home Theatre A/V systems. I recommend complementing the ribbon speakers with the high quality R1000 12" subwoofer for very low frequency articulate bass for medium to large rooms

The 260 and 360 ribbon speakers have been designed to become a sound reference for both home theatre and audio systems enabling listeners to hear finer instrument detail in analogue and digital recordings

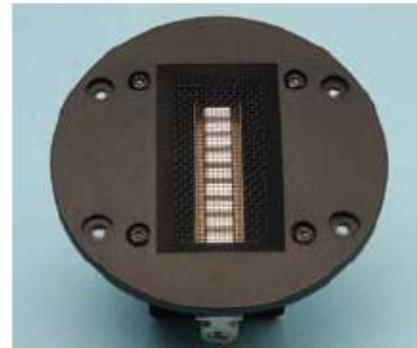
The low distortion, wide bandwidth and large dynamic range provided by this Ribbon Speaker series enables listeners to appreciate the effects of any upgrades or changes made to their electronic equipment , cables ,components and program material providing many years of enjoyable listening.

*Russell Storey*

# Loudspeaker Description

## Ribbon Speaker Kit Design Concept

The aim of a good high definition loudspeaker is to reproduce any instrument or sound as realistically and as close as possible to the original sound source. While these attributes are achievable to a degree using a standard woofer /soft, dome tweeter combination an even better solution is a woofer /ribbon tweeter loudspeaker. I chose a Pure Ribbon tweeter because of the speed low mass and detail to enable a speaker design with true super high definition sound reproduction of any instrument or sound effect



832873 5"

830883 6.5"

JP3.0

## **Tweeter: Fountek Ribbon**

The Fountek Jp3.0 pure ribbon tweeter with high frequency transformer has the ability to deliver extremely fast transient detail and low distortion from very low to high volume levels and enables a truly realistic sound when compared to planar ribbon or dome tweeters.

The Jp30 ribbon tweeter diaphragm has a very low moving mass of only 11mg (dome tweeter > 300mg) and is fitted with High Flux density rare earth neo magnets. To convert very the low impedance of the ribbon diaphragm to an 8-ohm primary the Jp3.0 is fitted with an ultra wide bandwidth 120 KHz transformer, resulting in a flat frequency response minimum phase change from 1 to 40 kHz.

## **Woofer: Peerless Bass/Midrange**

To complement the speed ,dynamics and accuracy of the JP3.0 ribbon tweeter the Peerless HDS 832873 5" and HDS 830883 6.5" with Nomex paper cones were selected for their natural sound signature, excellent bass lower mid range detail very low distortion , wide dynamic range , fast transient time , phase and frequency response.

# Loudspeaker Description

## The Ribbon Speaker Enclosures

The Bass Reflex enclosure was developed using LEAP 5 wave diffraction analyzer and FFT vibration analysis. An Extended Bass Shelf (EBS) / Butterworth low pass filter response was implemented with the enclosure to ensure optimum low extended bass and fast transit speed from the woofers.

The Enclosures feature flush mounted ribbon tweeter, rear port and are manufactured from 18mm MDF.

The Front Baffle is 36mm thick laminated MFD which ensures minimum movement of driver chassis and maximum enclosure damping for very tight bass and low cabinet resonance.

## Centre Speaker

The 260C Centre Speaker has a wide horizontal sound field due to the use of an MTM speaker configuration and provides excellent detail of voice and home theatre effects. The enclosure and crossover network are the same as the 260 except the ribbon tweeter has been rotated 90 degrees on the front baffle to complement the woofer sound fields.

## Enclosure Bracing Rib

Acoustically bullet shaped internal bracing ribs are fitted to the side and top panels to provide strength and further improve bass transients and reduce panel resonance modes.

## Enclosure Felt Damping

The enclosure is fitted with acoustic felt damping to the top, bottom, left & right and rear internal panels of the woofer chamber to reduce internal mid frequency standing waves and slightly damp the mid frequency back waves from the woofer cones. In addition, two layers of acoustic felt are fitted inside the back panel.



# Loudspeaker Description

- **Enclosure Rear Port**

A rear port was employed in the ribbon speaker design to ensure a reduction of overall transducer distortion and cross modulation generated by front ports.

With a front port a form of speaker (low frequency) distortion and cross modulation is generated by the chamber compressed air exiting the port out of phase with the woofer creating (modulation) interference of the woofer cone and ribbon diaphragm .This interference of the woofer cone occurs at medium to high playback levels (port velocity) and is one of the factors reducing over all dynamic range or head room of the transducers and speaker system.

This mechanical process is similar in principal to FM & AM radio wave modulation only in this case, the radio carrier wave is the transducer cone or ribbon diaphragm and the modulator is the low frequency compressed air radiated from the port.

### **Port Flare**

A simple 63 mm (ID) port size with small flared ends was chosen over large flared ports to provide minimum port velocity, cone excursion and minimum woofer power compression at average to high volume levels.

At average to high volume levels, large radius ports cause eddy current airflow resistance at the inlet, exit flare, and thus more power compression, less dynamic range and increased driver distortion.

### **Enclosure Bracing and Felt Acoustic Damping:**

An MDF timber acoustic bracing rib was designed with a bullet round over on the edges to reduced unwanted chamber resonance, standing waves (pressure particle bunching) caused by the back waves of the bass/ mid woofer and to reduce unwanted side panel resonant modes

Grey Felt 6mm thick acoustic material is fitted to the top,bottom,left,right and rear panels and carefully folded over the bracing rib to act as an absorber ( air brake) on lower midrange frequencies that cause modulation of the cone and port vent . Two layers of 6mm felt are added to the inside of the rear panel and further damping is added the rear of the ribbon tweeter to reduce air turbulence of the rear port and interference from the back of tweeter magnet assembly

### **Grill Panel**

The grill panel is located on the front baffle by grill pegs and cups and incorporates the use of low loss acoustic grill cloth. The grill frame features round over of the timber grill frame internal and external edges which reduce diffraction of the sound generated by the speaker drivers .A special low loss grill cloth has been used to reduce attenuation of high frequencies from the ribbon tweeter and woofer. *“ To enable the very best sound quality and listening experience I recommend the grill panel be removed from the speaker box “*

### **Enclosure Features Summary:**

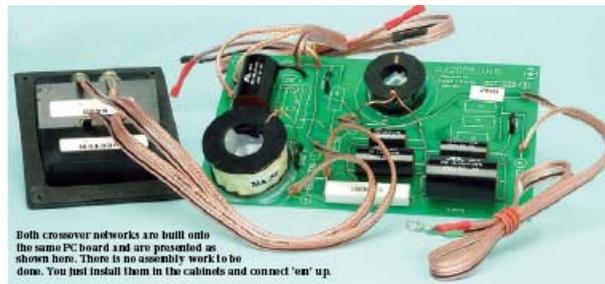
- Low resonance baffle design with 36mm thick laminated 18mm MDF
- High volume level High Velocity low compression port with round over at both ends
- MDF acoustic bracing rib with bullet shaped round over on edges
- Acoustic felt damping on all walls and rear panel
- Acoustic Felt cover behind ribbon tweeter
- Acoustic grill panel cloth Low loss
- Grill panel frame internal & external frame round over's
- woofer hot cut outs 16mm roundovers on inside edge

# Loudspeaker Description

## Crossover 260 260C 360

The Linkwitz Riley (Bessel /Butterworth) crossover unit was developed to enable good linear phase and minimum THD distortion through the pass band and overlap regions of both the woofer and ribbon tweeter whilst providing wide dynamic range and excellent low mid and high level continuity of detail .

A 2nd order low pass with a 3rd order high pass filter slope was chosen after evaluating many different design combinations to provide optimum isolation between low and high frequencies. Time compensation of the driver xyz location and rising peaks response in the woofer and tweeter on and off axis were reduced by fine tuning crossover component values thus enabling coherent coupling from bass to tweeter combination through out the crossover region. The fully finished crossover PCB includes all components, high quality internal wiring and Velcro mounting tabs



**Components** used in the Ribbon Speaker crossover are High quality Non-Inductive resistors, Copper Air core Inductors, SCR 400V metalized MKP capacitors.OFC 384 strand copper wiring

## Crossover Features Summary

- Fully finished PCB includes all components and wiring ready to install
- Soldering: None required Wiring cable: Internal speaker cable high quality OFC 384 strand with push on connections
- Speaker terminals: 4mm twin gold plated binding post
- Filter 2 way off set Bessel / Butterworth, linear phase
- Frequency: 260 260c 3.8 KHz 360 Freq 3.2Khz
- Order: 2nd Lp, 3rd Hp

## Speaker Cable type internal wiring & amplifier

OFC 384-speaker cable is made from a low loss pure OFC copper. The cable is a type of Litz wire construction formed from 384 thin copper wires woven into a low profile flat rectangular shape and then insulated with a clear polymer jacket. This excellent combination of shape and size ensures the OFC 384 speaker cable has minimal HF loss from the skin effect found in round conductors and also enables a lower overall impedance which provides better bass depth, midrange transients and dynamics.

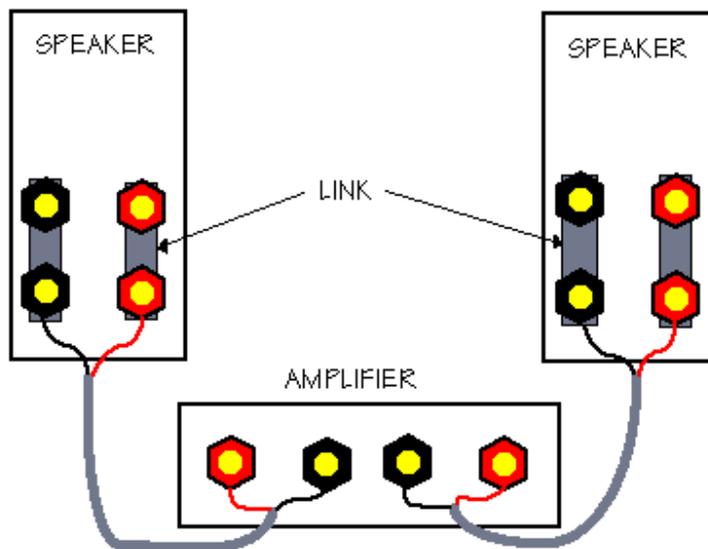
Other speaker cable I recommend to are QED Nordost Chord Kimber Audio Quest

# Loudspeaker Connection

260 260C 360

## Speaker Cable Wiring (Standard)

Connect the speaker cables to the bottom pair of terminals on the rear speaker terminal cup for a standard connection to your amplifier



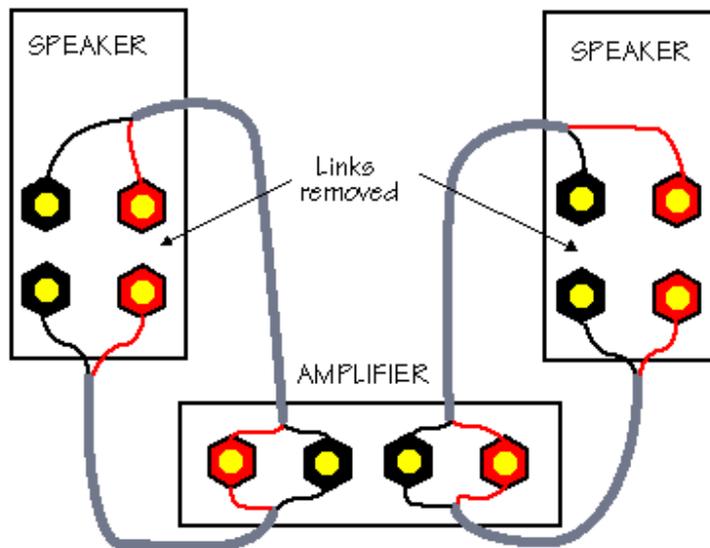
# Loudspeaker Connection

260 260C 360

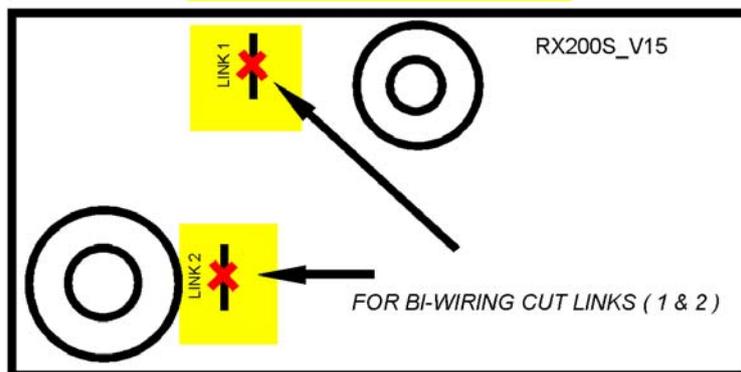
## Speaker Cable (BI Wiring)

The term bi-wire simply refers to the fact that you will be running *two sets* of loudspeaker cables from your amplifier to *each* of your speakers.

- ✓ Remove the 2 links from the *rear* speaker terminal cup .
- ✓ Cut links (1,2,) on the *internal* crossover board



CROSSOVER BOARD BI-WIRING



# Building Instructions

## 260 260C and 360

### Installation of the Woofer & Crossover PCB

#### 1) Crossover Board (Bottom) 260-260C 360

- ✓ Fit Velcro Tabs to underside of the crossover PCB (see p17)
- ✓ Fit crossover assembly through lower woofer hole and secure with 5 Velcro tabs onto the felt at bottom of speaker box (see p18)
- ✓ Fit speaker 4 terminal plate through felt and rear panel mounting hole then secure with 4 MDF countersunk wood screw(see p19 p20)

#### 2) Woofer (Bottom) 260-260C 360

- ✓ Fit Lower bass /mid speaker crossover cables through the front baffle hole (see p21)
- ✓ Fit push on connectors from the crossover speaker cables Red (+V) and Black (-ve) to the speaker terminals of the lower woofer (see p21)
- ✓ Fit lower bass /mid speaker to the front baffle with six Allen head screws using a 3mm Allen key
- ✓ Re check all driver screws but do not over tighten (see p22 23)

#### 3) Fountek Jp3.0 Ribbon Tweeter (Installation Check List)

- ✓ Check acoustic felt cover is fitted behind tweeter cut out hole before installing tweeter
- ✓ Do not connect a battery or dc ( direct voltage) across ribbon terminals .Ribbon has been pre tested in factory
- ✓ *Do not remove Ribbon protection label until speaker box the installation and dc testing is completed (see 27*

#### 4) Fountek Jp3.0 Ribbon Tweeter 260-260C 360

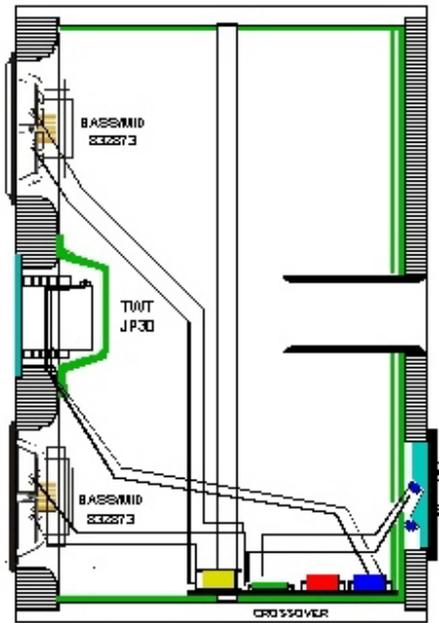
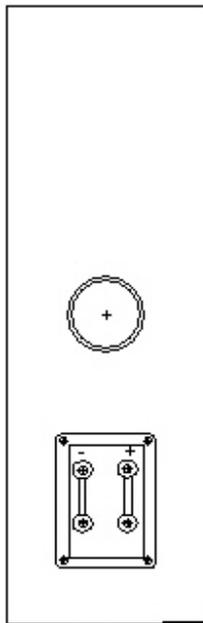
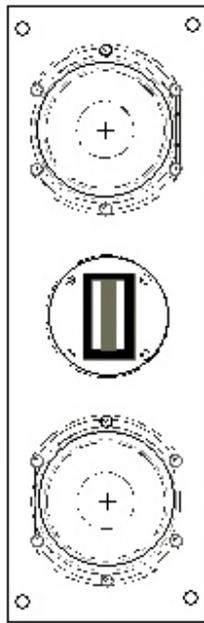
- ✓ Fit ribbon tweeter crossover cables through the bottom edge of felt cup through the front baffle hole and secure the 2 cable lugs **Red (+V)** and **Green (-ve)** to the ribbon terminal posts with a small wrench and tighten nuts firmly but do not over tighten **See (photo p24)**  
Hint: Angle tweeter cable lugs to allow enough room between felt cover and back of the tweeter when installing
- ✓ Fit ribbon tweeter to the front baffle with four Allen head screws using a 3mm Allen key Re check all screws but do not over tighten

#### 5) Woofer (Top) 260 260C

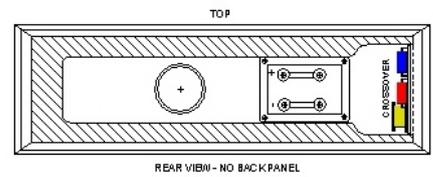
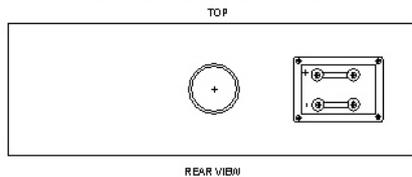
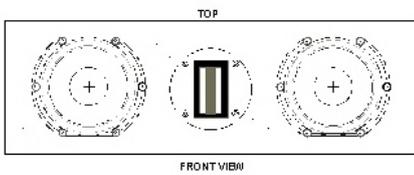
- ✓ Fit upper bass /mid speaker crossover cables through the top front baffle hole
- ✓ Fit push on connectors from the crossover speaker cables Red (+V) and Black (-ve) to the speaker terminals of the top woofer (see p21)
- ✓ Fit upper bass /mid speaker to the front baffle with six Allen head screws using a 3mm Allen key
- ✓ Re check all driver screws but do not over tighten
- ✓ **6) Ribbon 260C Centre Speaker**
- ✓ Fit Crossover Board ,bottom woofer , top woofer and ribbon tweeter as per 260 Installation steps ( 1,2,3,4,5) above (see Centre Speaker tweeter location p22 ,23)

# Building Instructions

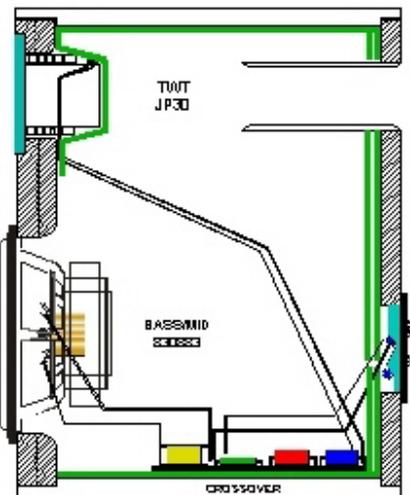
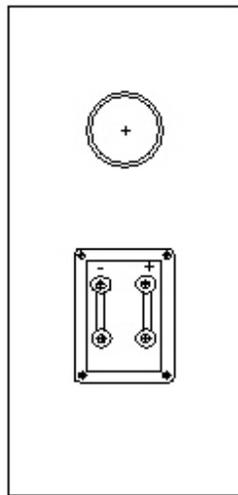
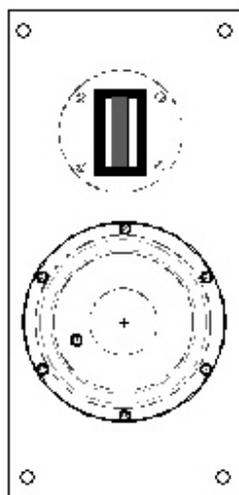
## Location of Crossover PCB and Wiring 260



## 260C CENTRE



## 360



# Building Instructions

## 260 260C and 360

### Testing the Finished Speaker Box

**Bass Speaker phase test** (dc only) is all that is normally required to test the pre built crossover wiring and speakers. Connect a 1.5v battery with a pair of clip leads across the bottom pair of speaker terminals (+ve to +ve ) RED and ( -ve to -ve) BLACK. Check that the battery is connected as per photo (**Photo 2 page 14**).

Observe that the woofers cone moves out as per (**Fig1 below**).

This means the speaker and crossover wiring is connected in phase.,

If the speaker cone moves in then the connection of the bass speaker or crossover wiring are incorrect out of phase

**Crossover Network Resistance (dc only).** (DIY optional extra for experienced Diy speaker builders and technicians)

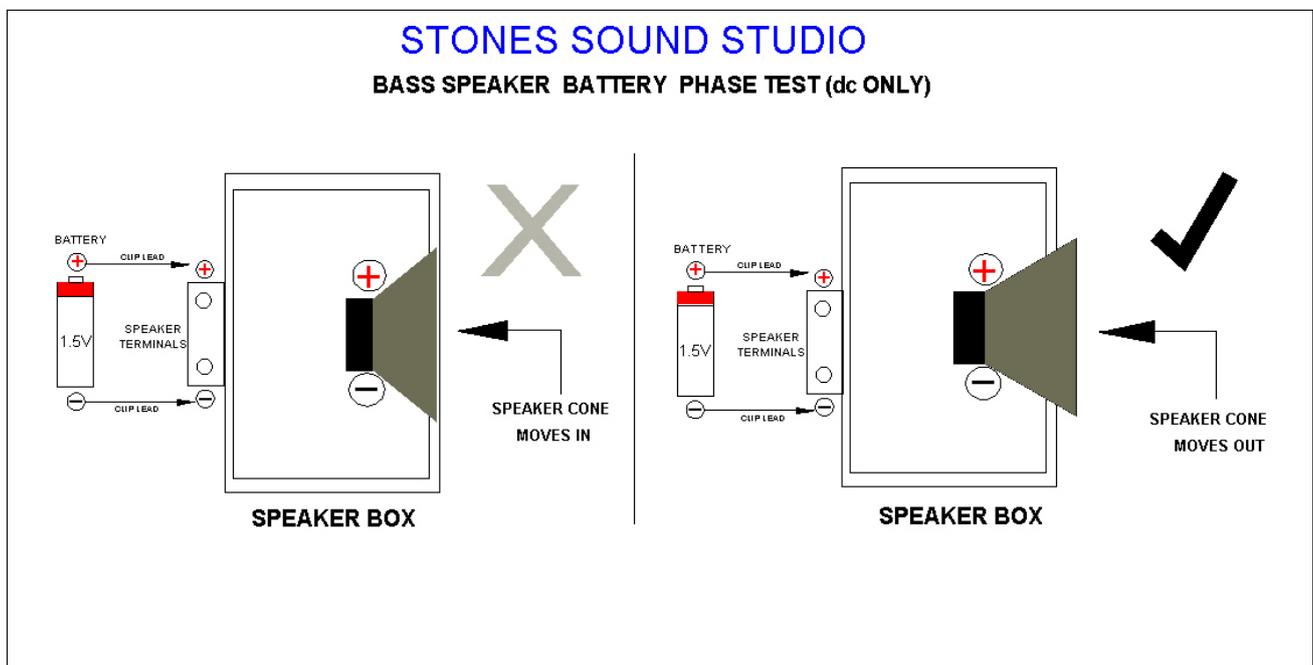
Connect a DMM (digital multi-meter) across the bottom pair of speaker terminals then switch the DMM to the ohms range and measure the (dc resistance) of the crossover network. see DMM photo (**Photo 3 page 14**)

#### Digital Multi Meter (DMM) Readings (average)

260 260c	DMM reading range > 3.4 to 4.4 ohms	(Nominal 3.9 ohm)
360	DMM reading range > 5.8 to 6.7 ohms	(Nominal 6.1 ohm)

**Warning:** If the DMM meter ohm readings are lower than the range given above then contact the Kit dealer for advice

**Fig 1**



# Building Instructions

## 260 260C and 360

### Testing the Speaker Box Photos 2 & 3

Photo 2

Bass Speaker Battery phase test (dc only)



Photo 3 DMM ohm measurement of the 260-260C speaker Crossover Network Resistance (dc only)



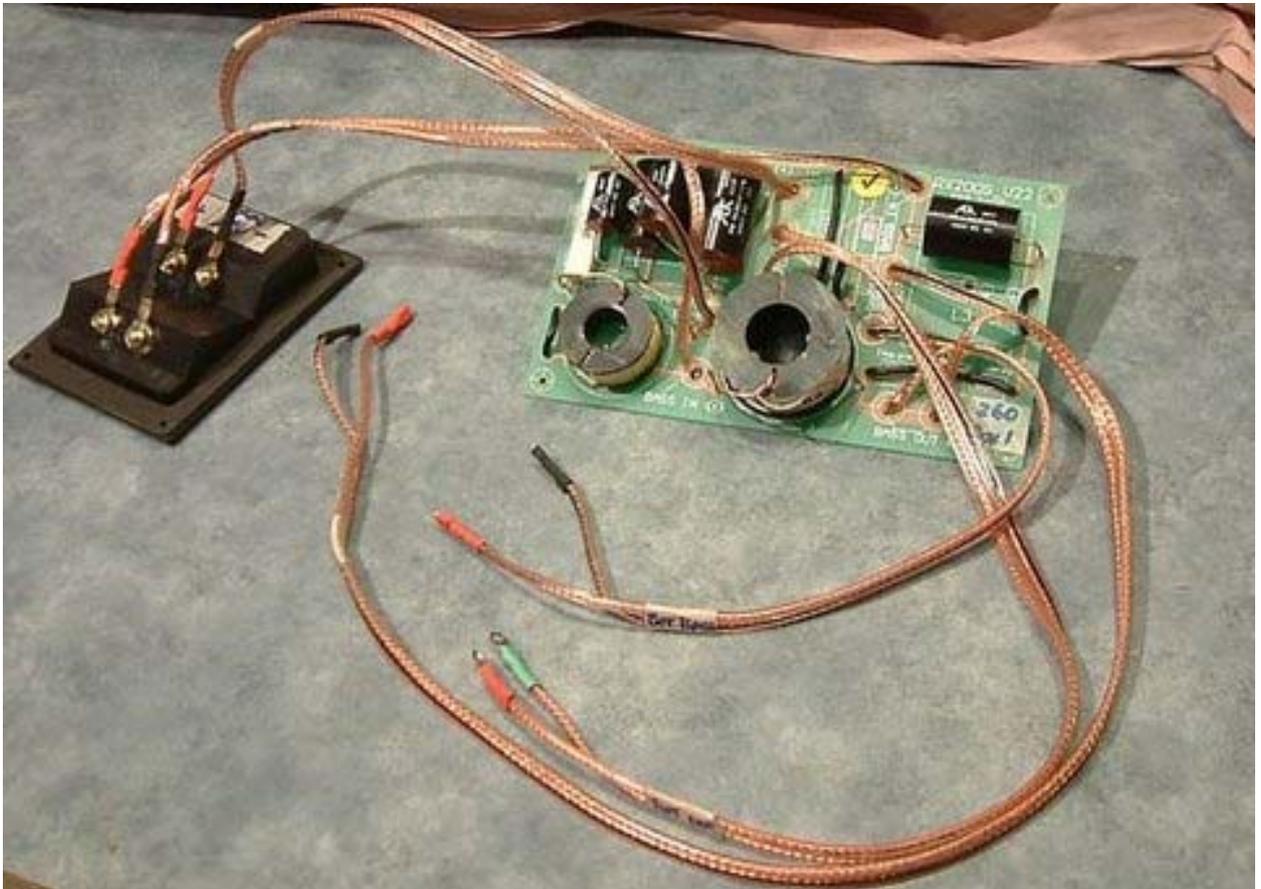
DMM ohm measurement 3.9 ohms      260-260C speaker

DMM ohm measurement 6 ohms              360 speaker

## Building Instructions

260 260C and 360

Installation Photographs



Crossover PCB assembly includes pre-wired (soldered) 4 terminal speaker cup



Crossover PCB assembly with 260 enclosure



Fit crossover assembly through lower woofer hole and secure with the Velcro tabs onto the felt at bottom of speaker box



Fit crossover assembly through lower woofer hole and secure with six Velcro tabs



Fit speaker 4 terminal cup through felt and rear panel mounting hole then secure with 4 MDF countersunk wood screw



Note: Fit speaker 4 terminal cup so terminal post faces toward the top of the box

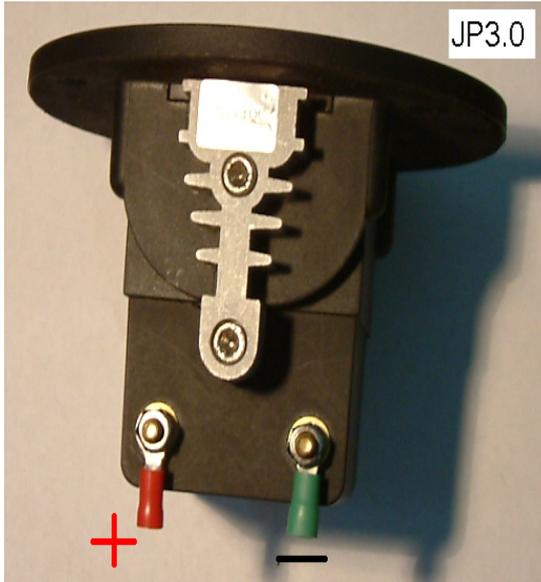


Speaker push on connector cables fitted through front speaker mounting whole cutouts



260 FRONT showing ribbon tweeter and Woofer with 3mm Allen key





### JP3.0 Ribbon

Terminal polarity Models 260 and 360 ( top view )



260 C CENTRE ribbon tweeter terminals



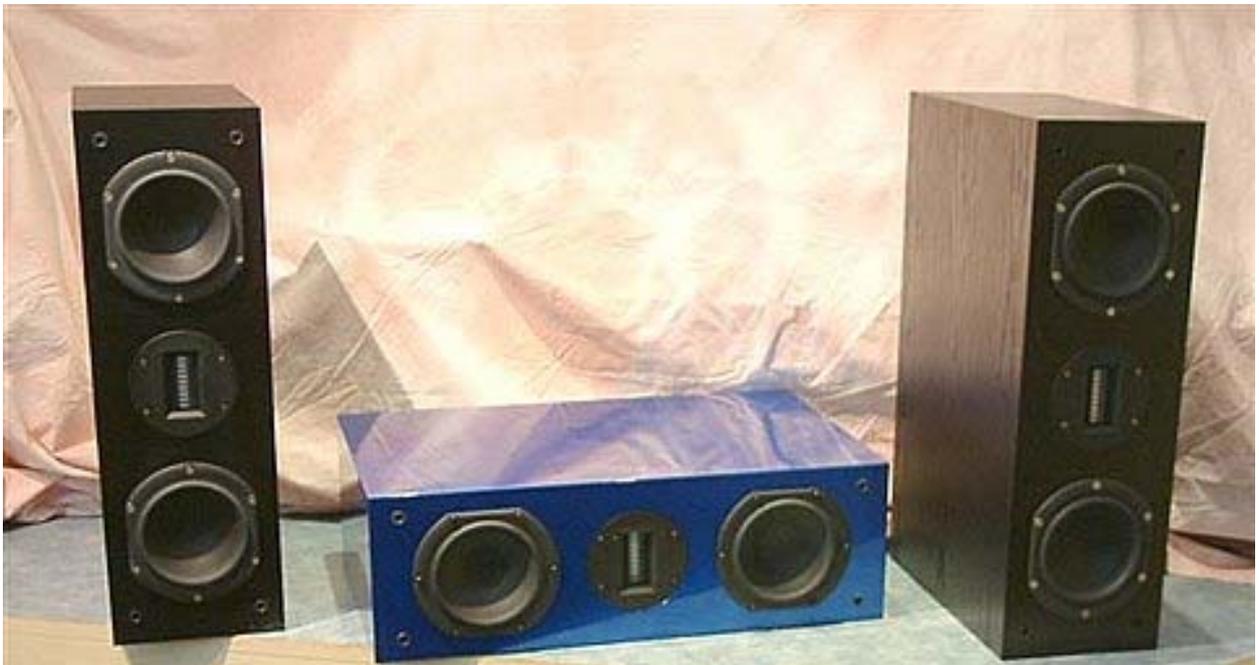


260 C CENTRE showing peerless bass/mid connections



260 C CENTRE ribbon tweeter with protection label

# Fully Assembled 260-260C



260

260C Centre

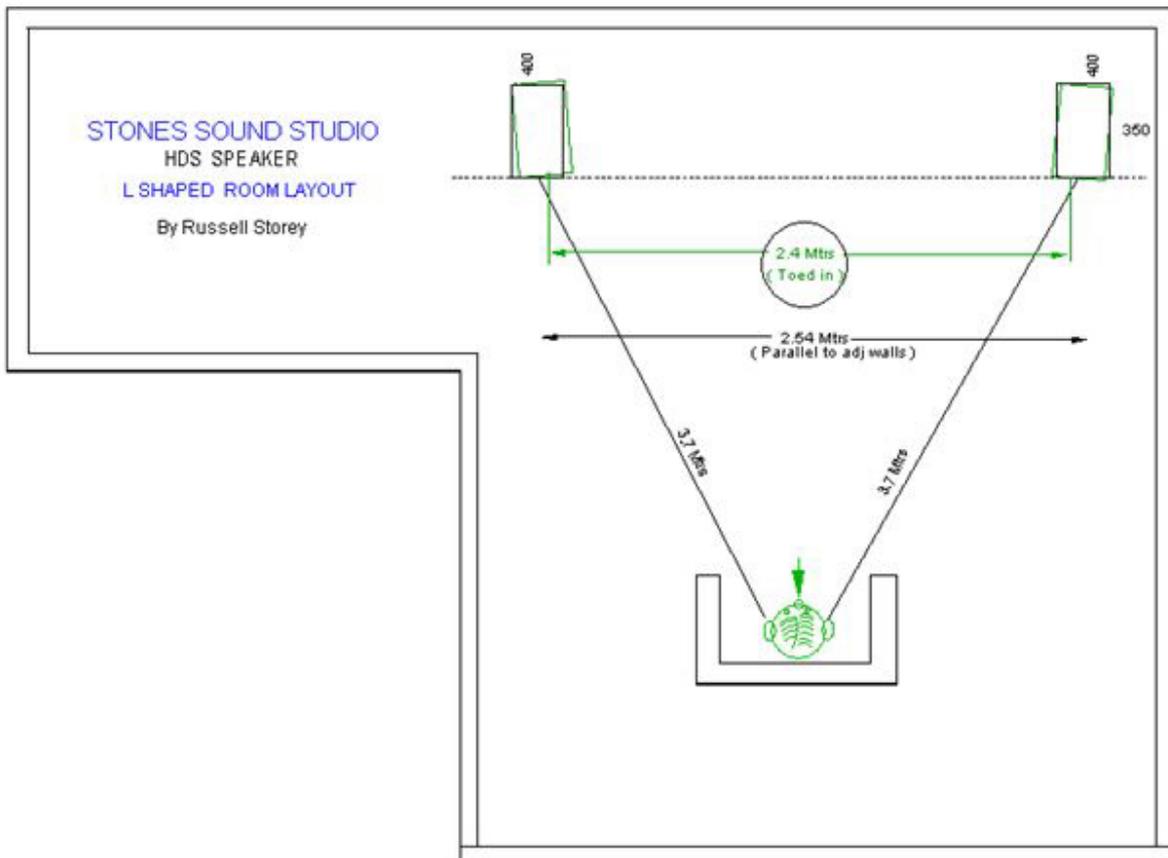
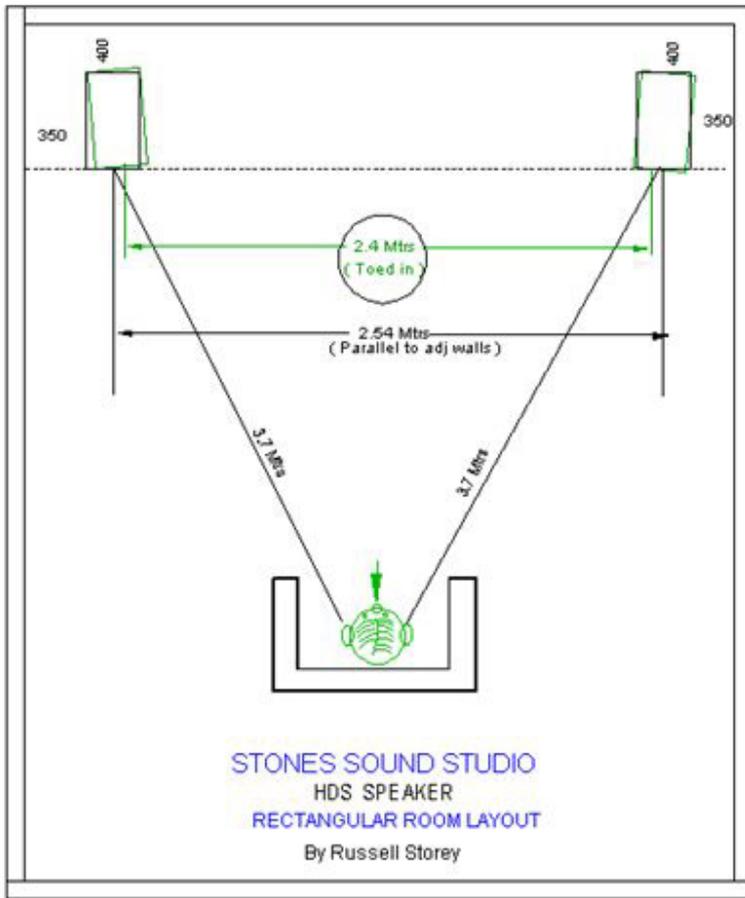
260

## Fully Assembled

360



# Recommended Loudspeaker Room Location



# NOTES

260 260C 360

## Enclosure Felt Damping

Use Furniture Felt Pad 540gms / Kg around 7mm thickness

Available in Australia from Home wrap <http://www.homewrap.com.au/>

The screenshot shows the Homewrap website interface. At the top left is the Homewrap logo with the tagline 'Packing & Supplies Pty Ltd'. To the right are links for 'Australian Homepage' and 'New Zealand Homepage'. A search bar with a 'Go!' button is positioned above a navigation menu. The navigation menu includes 'Removalists', 'Packing & Shipping', 'Self Storage', 'General Packaging', and 'All Products'. On the left side, there is a vertical menu with links for 'About Us', 'Products', 'Services', 'Specials', 'Contact Us', and 'Login'. Below this menu, it states 'We are proud members of' followed by logos for 'Australian Furniture Removers Assoc.' and 'Self Storage Assoc. of Australasia'. The main content area is titled 'Products' and 'All Products - Furniture Protection - Pads & Wraps - Furniture Felt'. It features a large image of a folded grey felt pad. To the right of the image, the product name 'Furniture Felt Pad' is displayed with the code 'TRUP3.3'. Below this, the dimensions are listed: 'Length 3.3m', 'Width 1.83', and 'Thickness 540GSM'. At the bottom of the image area, there are two buttons: 'View Enlargment' and 'PDF Brochure'.

# NOTES

260 260C 360

## Enclosure Felt Damping

### Application

Cut Furniture Felt Pad to size to fit box panels

Fit Furniture felt pad with staple gun or Water based vinyl tile glue

Fold Furniture felt pad over bracing ribs

Fit Furniture felt pad to top bottom left right and rear panels of cabinet

Fit 2 pcs of Furniture felt pad to rear panel only

Fit Furniture felt pad TWEETER cover to inside wall front baffle cabinet with air tight seal

