ASPECT TA-890 SYSTEM

USER MANUAL

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Issue 1.3

Contents

EC DECLARATION OF CONFORMITY

Manufacturer

Turbosound Ltd

Star Road, Partridge Green, West Sussex, RH13 8RY, UK

Products

T-25 Power Amplifier

T-45 Power Amplifier

LMS-D6 Loudspeaker Management System

LMS-D24 & LMS-D26 Loudspeaker Management System

Standards

Safety	EN60065:2003
Relevant Specifications used as basis for tests	EN66103-1:1996
	EN55103-2:1996

Category

Professional apparatus for use in Commercial Light Industrial and controlled EMC environments.

CE Marking

All products are marked in accordance with the relevant statutory requirements.

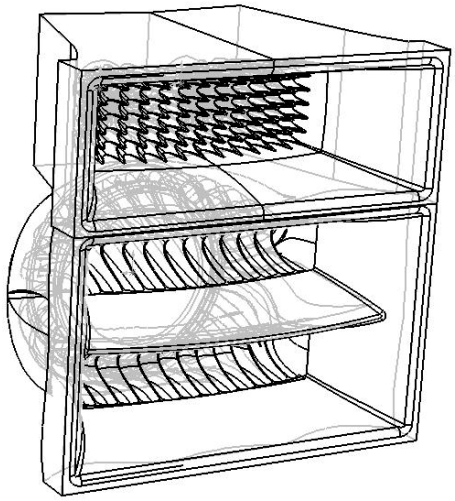
INTRODUCTION

Turbosound Aspect System Concepts

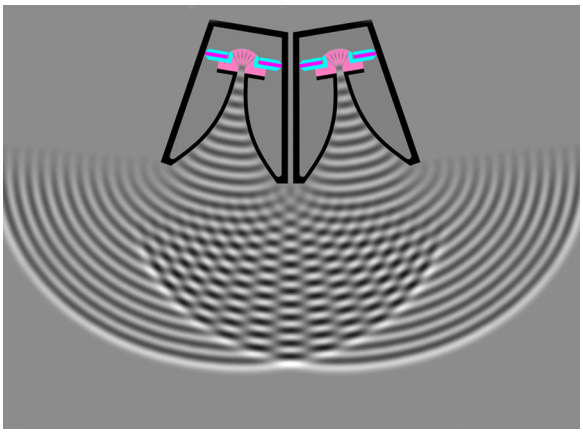
The TA-890 system is a modular point source loudspeaker system designed to deliver extremely high fidelity audio. The system is easily scaleable from large and medium scale concert touring applications to small clubs and events.

The Aspect system concept centres around the exceptional directivity of the patented Polyhorn™ devices employed in the high frequency and high-mid frequency sections of the mid/high enclosure. In contrast to the majority of conventional horns, the Polyhorns develop a more consistent frequency response across all seats of an auditorium with minimal interference between adjacent enclosures.

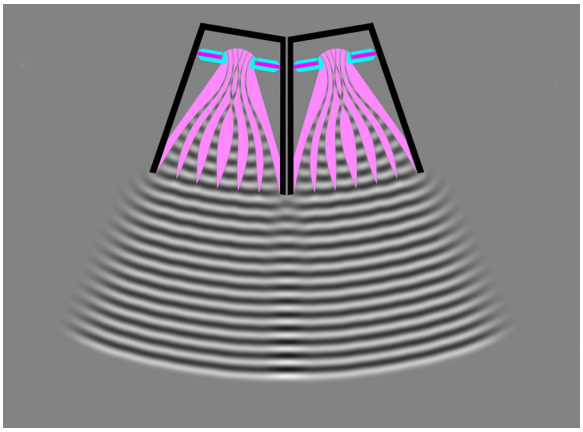
The Turbosound Polyhorn™



The patented Polyhorn™ devices – employed in both the high frequency and high-mid frequency bands – exhibit a sharp cut-off at the edges of the dispersion pattern, making it possible to produce seamless coverage of a venue with minimal destructive interference between elements, however many individual enclosures are deployed in the cluster. The Polyhorn™ devices generate a phase-coherent and smoothly-curved wavefront which matches the array curvature, whose centre becomes the virtual point source.



Conventional HF horns produce destructive interference



Poyhorn™ - smoothly curved wavefront

The TA-890H mid-high enclosure forms the main component of flown clusters, and can be orientated either horizontally or vertically (the mid/high section pictured above is square and rotatable) in order to match venue specifics such as rigging height and audience sightline restrictions. It can also be usefully employed as a front or side fill cabinet.

The TA-890L low frequency enclosure can either be integrated in a flown cluster with TA-890H enclosures, due to its identical size and flying hardware, or can be ground stacked.

ASPECT TA-890 TURNKEY SYSTEM CONCEPT

Aspect is available as an integrated audio system package, comprising loudspeakers with integral flying hardware, amplifier racks and all necessary drive and control equipment in an extremely compact and manageable form. In addition, the system has been designed to truck pack efficiently and handle easily.

The concept of assembling a system around standardised components ensures absolute compatibility between users, although sufficient flexibility is built into the rack design to allow for varying requirements such as the ratio of bass cabinets to mid-highs, or 4-way or 5-way operation. Aspect systems from different sources may therefore be freely combined without difficulty. This provides owners with a considerable competitive advantage in servicing the requirements of international touring productions, and in co-operating with other Aspect suppliers within the worldwide network.

The controller functions as an electronic loudspeaker management system, comprising a 24dB per octave crossover, with factory preset limiters matched to the power amplifiers, digital time-alignment and electronically balanced inputs and outputs.

A standard Aspect integrated sound system consists of:

- TA-890H mid-high enclosures
- TA-890L low frequency enclosures
- Flybars, adjustable flying chains and flybar trunk
- Loudspeaker break-outs and multi-way extensions
- Multi-way returns system
- LMS-D6 or LMS-D26 system controllers
- AMP-890 ampifier racks with:
    - T-45 and T-25 power amplifiers
    - Three phase 32A power distribution
    - Multi-way and local speaker connections

The Loudspeaker Management System (LMS) Concept

Turbosound Loudspeaker Management Systems are more than just electronic crossovers. They provide full digital alignment of all components in the Aspect enclosures, to ensure coherent acoustic output. They also incorporates a number of features which contribute to overall system reliability and ease of setting-up.

All system parameters such as crossover frequencies, limiter settings and equalisation can be simply called up from a factory-set menu, making it possible to maintain consistent and repeatable system performance.

Because the power amplifiers are included as part of the Aspect system, the controllers are able to utilise output limiters which are precisely matched to the system requirements, being pre-set to prevent the amplifiers from clipping. Inputs and outputs are fully balanced, providing isolation between the controller and the amplifier inputs. These factors contribute to high reliability in the adverse circumstances often encountered under arduous touring conditions.

LMS-D24, LMS-D26 and LMS-D6 Loudspeaker Management Systems

Use of the LMS-D2X and LMS-D6 loudspeaker management systems ensures accurate time-alignment of the system drive units and also provides a facility for users to select additional delay, either to compensate for physical displacement of ground-stacked bass enclosures relative to flown high packs, or to provide full range delay for correct image localisation or use in distributed systems. It should however be noted that the high-Q, and therefore long throw, properties of the Aspect system generally eliminates the need for distributed delayed systems, even for very large audiences.

Amplifier Racks

Aspect amplifier racks are fully loaded and fully equipped for the most demanding concert touring applications. They are fitted as standard with two T-25 model amplifiers and three T-45 model amplifiers, Socapex speaker break-outs as well as local connectors, single phase or three phase mains distribution, and multi-way signal input and link connectors. All the component parts are rigidly mounted in a 12U steel space frame with removeable panels, and housed in a road case with heavy duty wheels.

Power Amplifiers

In addition to the Turbosound T-25 and T-45 model amplifiers supplied with turnkey Aspect systems, the following other power amplifier brands provide sufficient performance and mechanical compatibility to perform well with Aspect loudspeaker systems:

- MC2 E series
- Lab Gruppen FP series
- Crest Pro series
- QSC Powerlight II series

Digital Controllers

In addition to the Turbosound LMS-D6 and LMS-D26 loudspeaker management systems, the following digital crossovers have been tested and are recommended for use with Aspect systems:

- BSS FDS366
- XTA DP224, DP226 and DP428

Aspect Loudspeaker Components

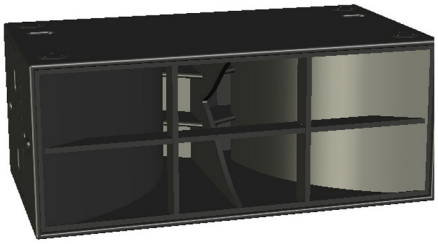
All the drive units have been designed in-house specifically for the Aspect system and are manufactured exclusively for Turbosound. This means that they are expressly suited to their intended purpose, and make use of innovative features to ensure premium performance.

Neodymium magnets are used throughout all drive units. This results in higher efficiency, less power compression and reduced overall weight. Low-mid frequency drivers are designed to be rear-facing in the enclosure, enabling the heatsink / phase plug to be placed in the air flow to aid cooling.

TA-890L Low Frequency Enclosure

The TA-890L low frequency enclosure covers the low frequency range from 35Hz up to 100Hz. It contains two very high power 15" neodymium drive units loaded with TurboBass™ devices. The TA-890L is a very compact enclosure, identically sized to the TA-890H, and its minimal size and low weight ensures easy handling. It is designed to provide beneficial low frequency coupling when used in multiples. The enclosure may be ground-stacked or flown using its integral flying hardware.

TSW-218 Subwoofer



The TSW-218 is designed to cover the sub and low frequency ranges from 25Hz to 100Hz, and can be used as part of a 5-way Aspect system in order to reinforce sub-bass frequencies. It utilises two custom designed neodymium 18" drivers loaded with TurboBass™ devices. The proprietary loading technique and horn flare design produces significant mutual coupling between adjacent enclosures, resulting in sensitivity gains of up to 110dB with eight units coupled.

TA-890H Mid-high Enclosure

The TA-890H enclosure covers frequencies above 100Hz and contains a total of five drive units. A pair of 10" neodymium low-mid frequency drivers loaded with TurboMid™ devices covers the frequency range from 100Hz to 400Hz. The low-mid drivers are rear-facing in the enclosure, providing not only additional cooling by placing the magnet/heatsink assemblies in the path of the airflow, but also acting as phase plugs. A specially developed 10" low-mid driver loaded with a LMF Polyhorn™ device covers the range from 400Hz to 4kHz. The remaining frequencies are covered by a pair of 50mm dome drivers loaded with Polyhorn™ waveguides specifically designed for this purpose.

The TA-890H mid-high enclosure is designed to provide a precise array angle of 25° horizontal x 15° vertical. This high Q provides the projection necessary for true long throw applications such as large arena and outdoor productions.

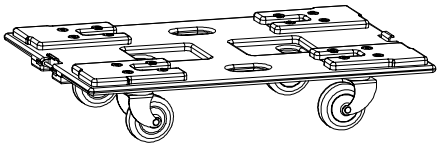
The Polyhorn™ and TurboMid™ devices are unique to Turbosound and are covered by principle patents world-wide. They utilise specialised forms of horn loading which provide exceptionally low distortion and high efficiency from cone-type drive units. The subjective effect of these devices is greater clarity and transparency of reproduction when compared with conventional compression drivers and horns.

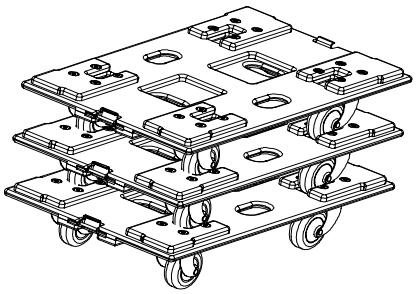
The TA-890H is fully equipped for all touring applications with independent flying systems. This allows cabinets to be configured horizontally providing considerable flexibility of use.

It includes a hinged rear access door, integral multi-way speaker cable, removable wheel board, ergonomically placed flush handles, weatherised beech plywood construction and optimised truck-pack dimensions. The TA-890H enclosure is exactly the same size as, and of very similar weight to, the TA-890L.

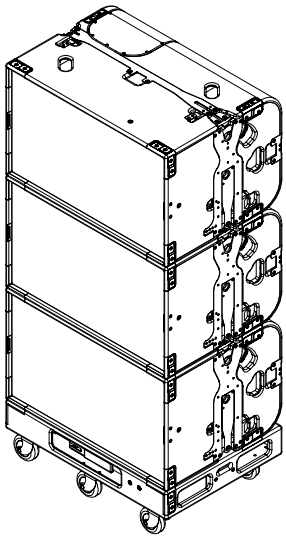
Transportation

TA-890 cabinets include a removable wheelboard which clips to the front of the cabinet, allowing single units to be conveniently transported. These are designed to be stackable, so that when not in use they can be neatly stored without taking up floor space. The wheelboards will fit both mid-high and low frequency cabinets.





Up to three TA-890 cabinets can be stacked on a WB-890 wheel dolly, and this allows the cabinets to be pre-configured and locked at the warehouse using the integral flygear. Cabinets can then be wheeled in or out of a truck straight on to a stage area ready to be flown. The stack is stabilised by ratchet straps which attach to the flygear on the top cabinet and are tightened by means of recessed levers on the wheel dolly.



Optional heavy duty transit covers are available for TA-890 cabinets. These fasten at the front of the cabinet with velcro straps.

Aspect Flying Systems

To take full advantage of the very precise dispersion properties of the Aspect system, an integral rigging system has been developed. The flying system is inherently safe, flexible and simple to use, and even though it is integral to the box, it may be quickly and easily removed for safety testing. The rigging design allows the creation of clusters and arrays that can be assembled quickly and with a minimum number of crew, and with full control of the angles between enclosures and of their vertical inclination, to suit a wide variety of requirements.

FLYING AND STACKING

Overview

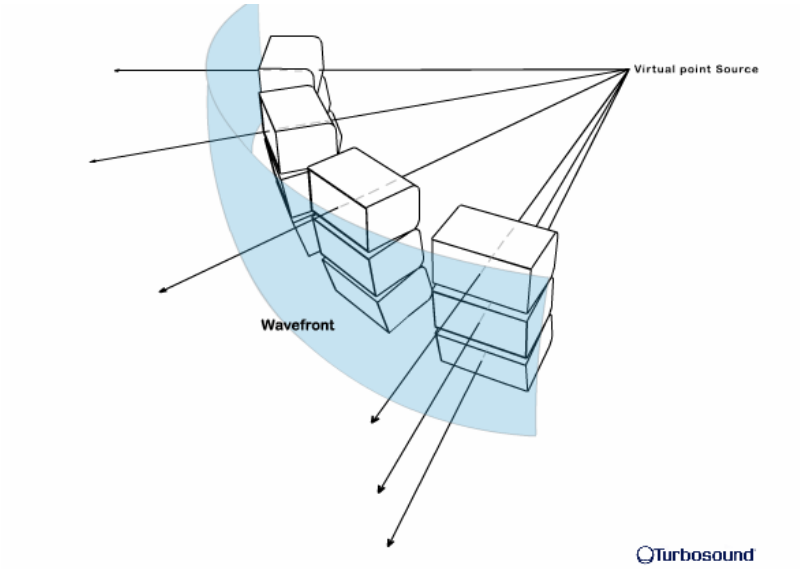
The Aspect system flying hardware is specifically designed to take advantage of the precise horizontal directivity characteristics, as well as allow a wide range of adjustment of the vertical angles between adjacent enclosures, and the overall vertical inclination of each column of enclosures. This means that arrays can easily be optimised to suit the coverage requirements of any situation.

Sound radiating from adjacent cabinets will successfully blend over a range of included angles, creating a coherent point-source image, and this results in the ability to tailor both the overall coverage and the SPL at a given distance.

The concept of arraying the TA-890 Aspect system is to create part of the surface of a sphere. A small part of a large sphere will form a high-directivity (long-throw) system with a high SPL at a distance, whereas a large part of a small sphere will be of lower directivity producing less SPL at a distance, but having a wider angle of coverage. This approach leads to the creation of a virtual point source behind the array, where sound appears to emanate from a single point in space.

There are some simple rules to follow to help achieve this goal:

- Obtain a smooth even curve in the horizontal plane.
- Use a similar amount of tilt on each column.
- Ensure that the bottom corners of each column are in line with each other.



GIGMATE™ ACOUSTIC SIMULATION

While the Aspect System is remarkably intuitive in terms of building arrays and aiming them, and requires no theoretical calculations in order to achieve optimum coverage of a room or audience space due to its inherent 'point-and-shoot' nature, there may well be situations where some prior knowledge of a venue can save time in setting up and configuring the PA. In order to aid in this process, Turbosound offers the GigMate™ software acoustic simulation package, a version of the generic EASE Focus program that is based on current EASE 4.1 data.

GigMate™ provides an accurate elevation representation of sound pressure level and coverage of a room, given the dimensions of the audience areas and location of available rigging points in the venue. The database allows for flown clusters of TA-890 touring or TA-880 trapezoidal enclosures, or for ground stacked arrays.

Setting up a Venue - Overview

The Audience Area window provides a way add or remove Audience Areas and define their location in the space. A venue can be selected from a range of standard venue presets or set up from scratch using the X and Y co-ordinates menus to define the location, size and angle of the listening areas.

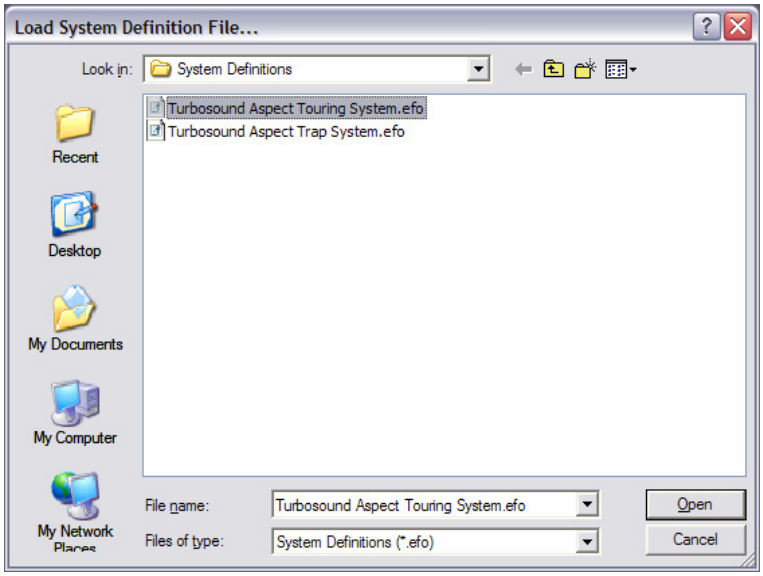
The PA is set up by choosing either a flown cluster or ground stack. Box count, cluster position, tilt angle and splay angle can all be selected independently.

The mapping properties allow the user to select frequency bands from 100Hz to 10kHz and also bandwidth from one-third octave to broadband.

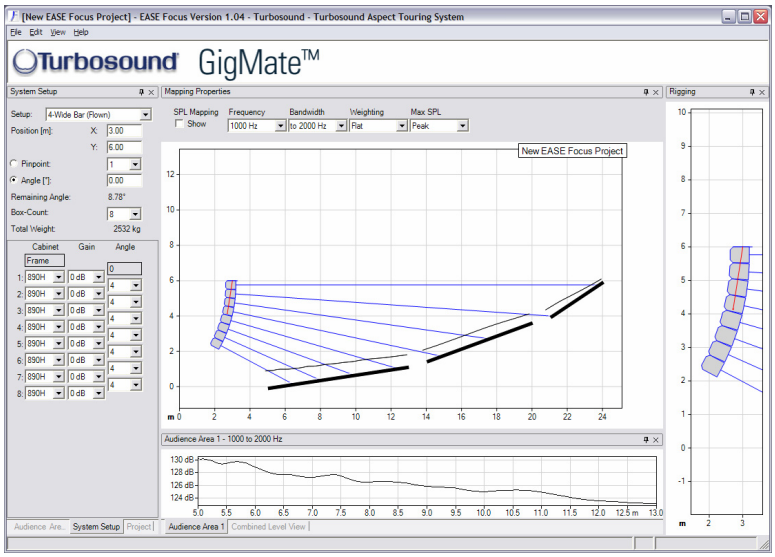
Once mapped to achieve satisfactory room coverage and level, results can be saved and printed as a .rtf file. The program will also calculate the total weight of the cluster as well as its overall physical size.

Running Turbosound GigMate™ / EASE Focus for the first time:

When you first start the program you must set the system file that it is to use. The installation files include two Turbosound Aspect System files as shown below:



Select the Touring version cabinets. You will now be presented with the GigMate™ main screen.



The screen is split into four main areas:

System Setup

The left hand side of the screen is where you define the system, auditorium and project. Tabs On the bottom of this window allow you to toggle between modes.

Mapping Properties

This is the main window which will display the system as configured in the System Setup window along with the audience areas and mappings.

Audience Area

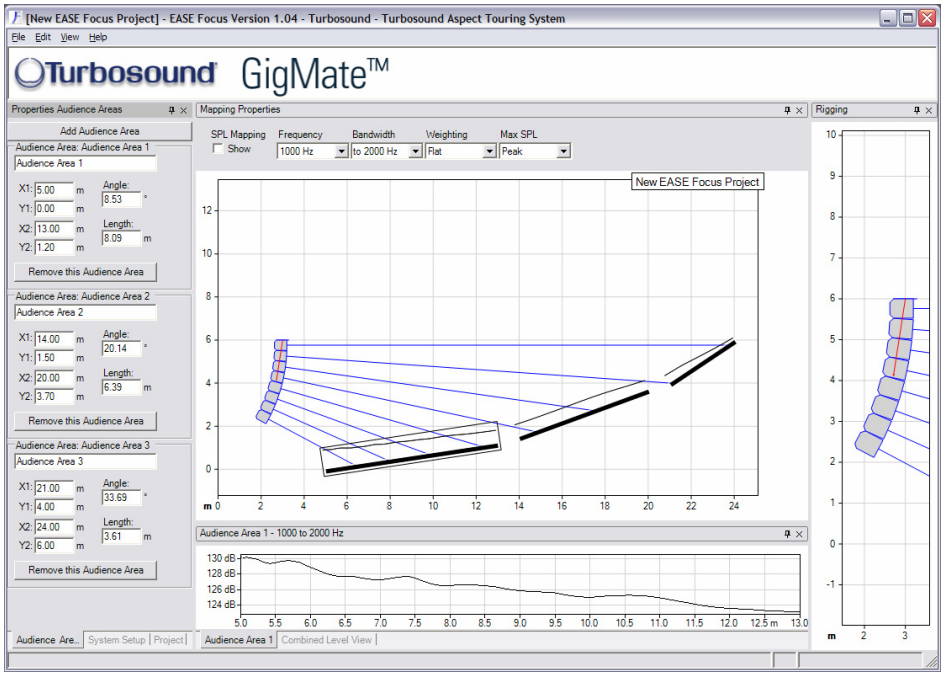
Beneath the main Mapping Properties window this graphically displays the SPL on each audience area, or across a combination of audience areas.

Rigging

The far right window shows the detail of the system configuration and is especially useful in larger venues where the speakers shown in the main window become very small.

Designing a system

To design a system begin by defining the venue/audience areas by clicking on the “Audience Area” tab in the bottom left of the screen.

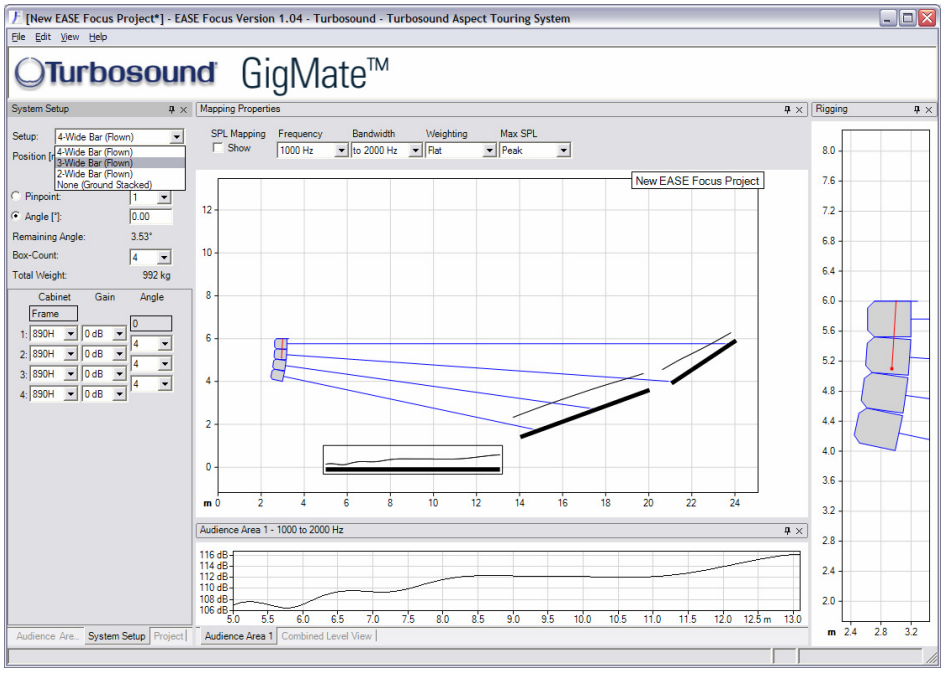


Within this window you can edit or remove existing audience areas, and create new ones.

There are two methods of defining an audience area. In either case you must define the X1/Y1 coordinate of the start of the area, you can then either enter the X2/Y2 points or its length and angle.

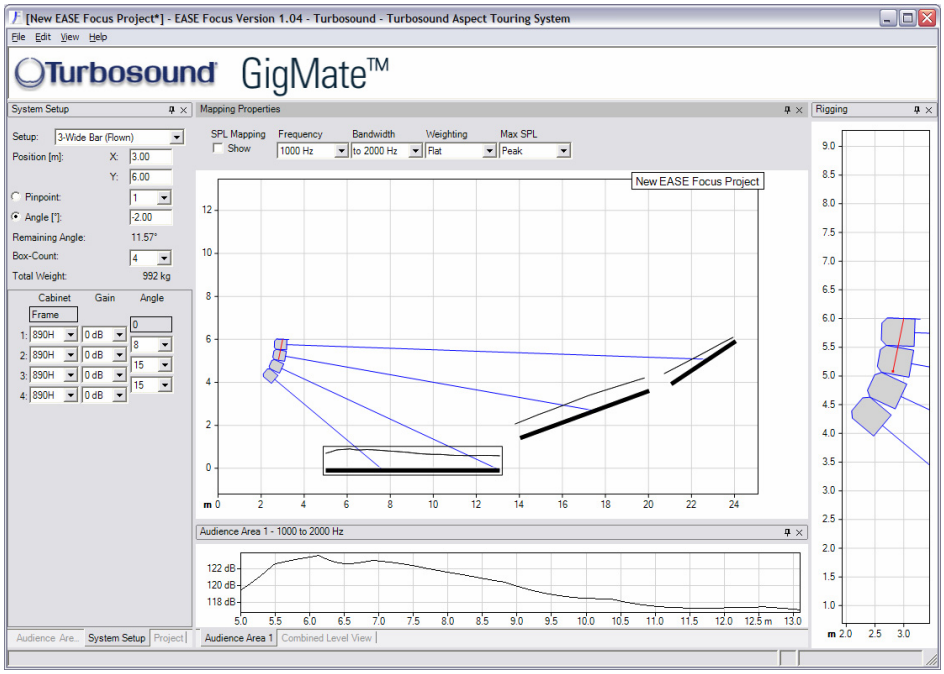
As you create audience areas they are shown graphically in the main window.

The next step is to design the loudspeaker array using the “System Setup” window. Select the “System Setup” tab in the bottom left of the screen and begin by choosing the desired flybar or groundstack in the drop down box at the top left of the window.

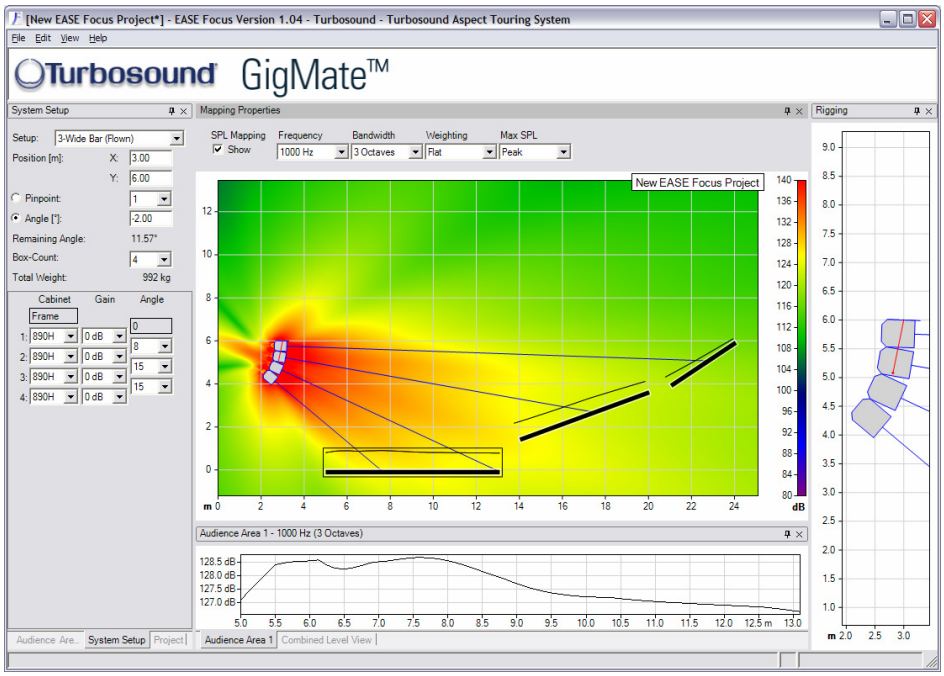


Now select the number of cabinets deep that you wish to hang or stack from the “Box Count” drop-down menu. Trim height, or PA wing height can now be set in the “Position” field.

If a mix of Low and High cabinets are to be used then select in the “Cabinet” window the type and location in the array of each box. The angle between cabinets can now be set in the “Angle” list. Each cabinet has an aiming line that can be used to determine the centre of each cabinet’s dispersion. Adjust the trim height, top angle and inter-cabinet angle to achieve optimum coverage.



Now that the general design has been established the system performance must be mapped. At the top of the main window there is an “SPL Mapping” checkbox. This will map the system output at the frequency and bandwidth selected in the adjacent dropdown boxes. For most applications a one-third octave mapping gives realistic and useful data.

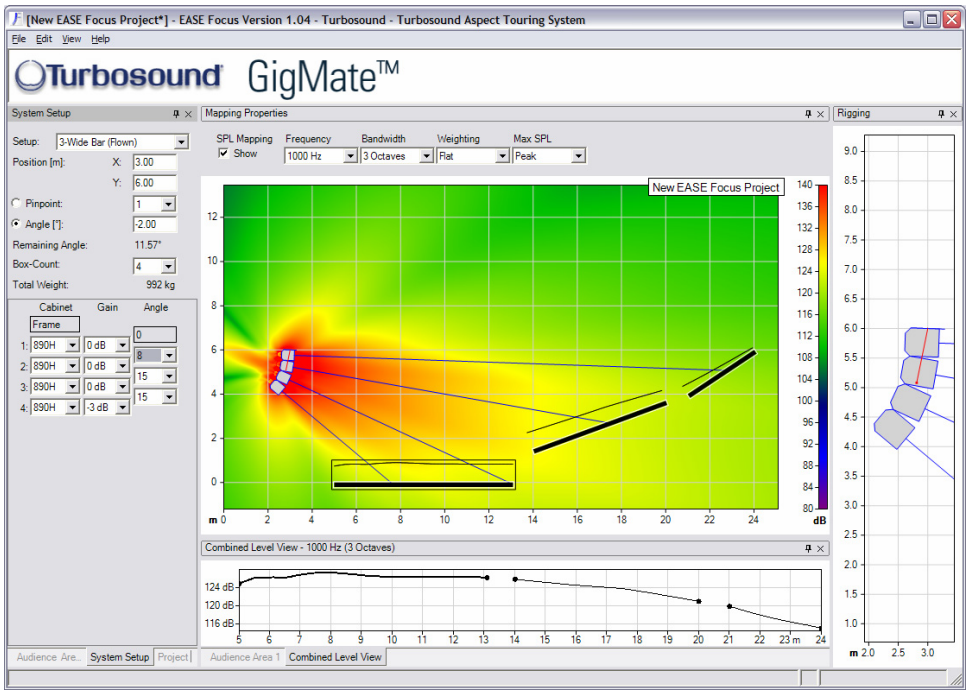


The Audience Area graph at the bottom of the window shows the SPL, as specified in the SPL Mapping lists, on the selected Audience Area. The selected area is highlighted in the main window and the graph is repeated onto each area. Selecting the “Combined Level View” tab will show the SPL across all areas simultaneously.

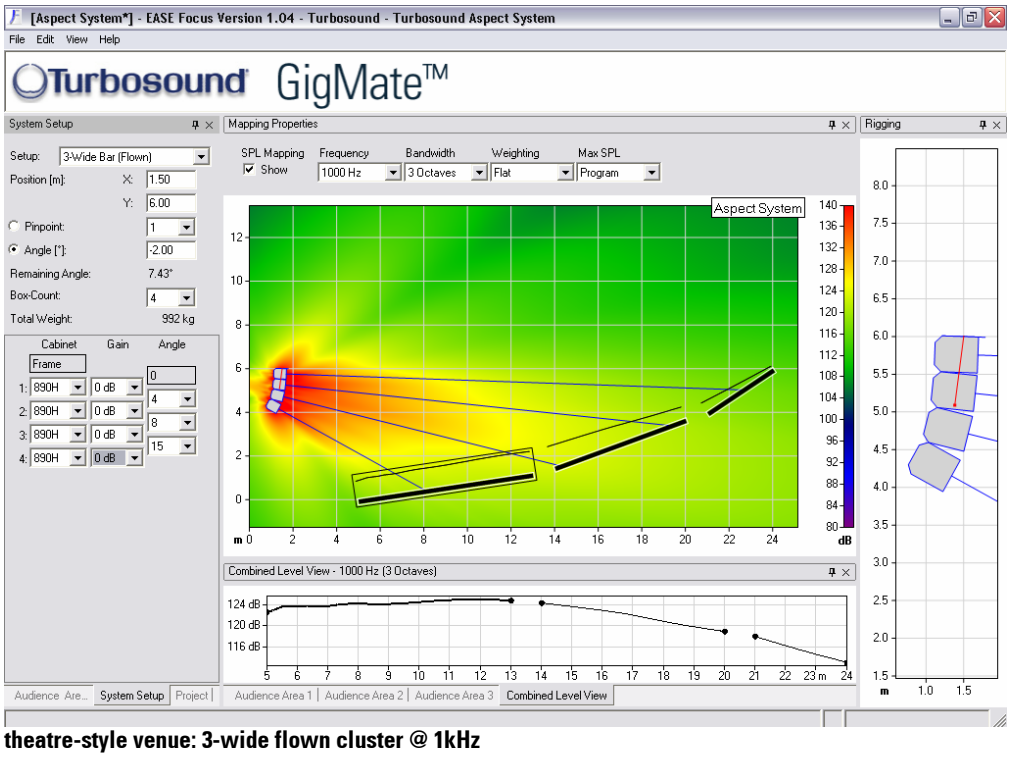
Now that the system is mapped, the inter-cabinet angles or row attenuation may be trimmed to provide the smoothest coverage. Typically the bottom row of the system will require some attenuation and should be on it’s own “Amp way” to achieve this.

Changing the system

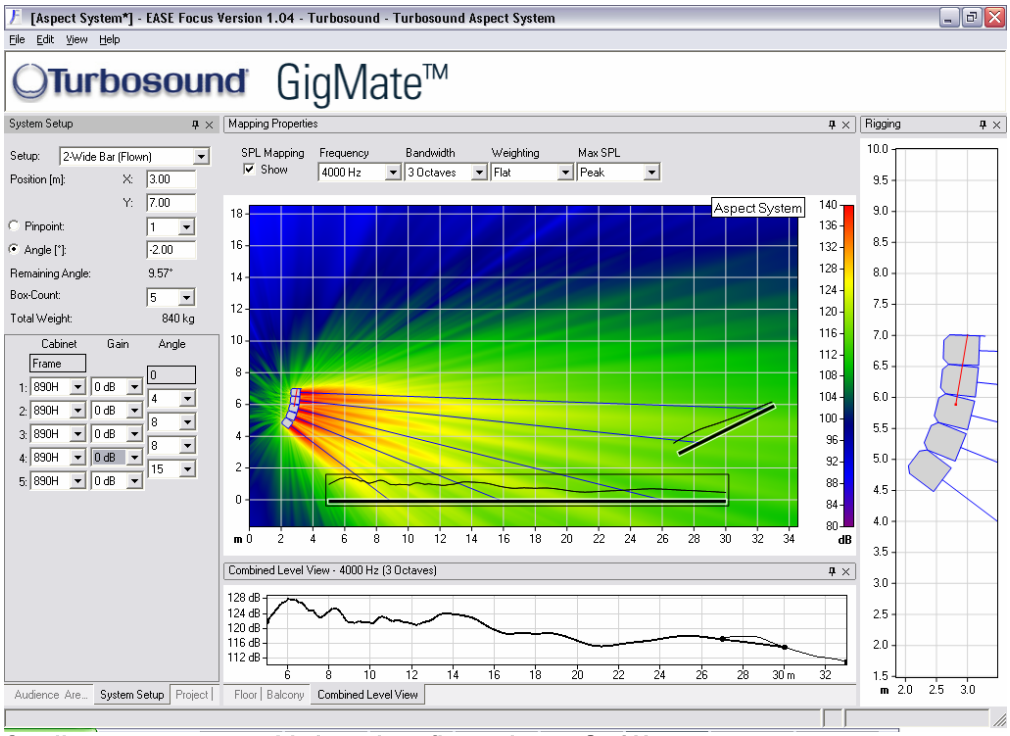
GigMate™ currently includes both the Aspect Touring TA-890 Series and the Trapezoidal TA-880 series products. To switch between systems use Edit/Change System on the menu bar and select from the list.



Two typical examples are shown here.



theatre-style venue: 3-wide flown cluster @ 1kHz



Small arena system; 2-wide by 5 deep flown cluster @ 4kHz

Safety Notes on Rigging

The Turbosound TA-880 system has been designed and constructed to a high standard of safety, and tested to the most demanding of specifications with a safety factor of 13:1. Always wear protective headwear, footwear and eye protection in accordance with local regulations. Anyone involved in flying ANY sound system, especially in a touring capacity, should take note of the following advice:

The rigging of a flown sound system may be dangerous unless undertaken by qualified personnel with the required experience and certification to perform the necessary tasks. Fixing of hanging points in a roof should always be carried out by a professional rigger and in accordance with the local rules of the venue. The house rigger and/or building manager must always be consulted.

You should observe particularly the following points:
Inspect rigging systems and cabinets for damage before proceeding to assemble a flown array. If any parts are damaged or suspect, DO NOT USE THEM.

When initially ratcheting a column of speakers it is good to bear in mind the expected angle of inclination so as to avoid ending up with too much of the strap left on the ratchet. This is important because the ratchet can only take three complete turns before it releases itself.

WARNING: If a tilt strap is released suddenly, the column of enclosures may tend to swing violently forwards and care must be taken to avoid danger to persons in the vicinity. It is essential to check that nobody is standing immediately in front of the column, and to give a suitable warning, before the strap is released. Ideally, two persons should support the column from the side whilst the strap is released, or alternatively the bottom row may be returned to the ground before release. In any event it is essential that all personnel in the vicinity are aware that the system is about to move and that they must keep clear.

Aspect Flying System components have been individually tested in accordance with the following regulations:

The Health and Safety at Work Act 1974

The Supply of Machinery (Safety) Regulations 1992

The Lifting Operations and Lifting Equipment Regulations 1998

Each component is covered by a Record of Load Test Certificate, which may be obtained on request from Turbosound, quoting the indentifying number(s) from the flying equipment. A copy of a sample certificate is reproduced overleaf.

Sample Certificate of Load Test

TECHNIQUE
Engineering Ltd
LIFTING EQUIPMENT SPECIALISTS & GENERAL ENGINEERS

Gilmans Industrial Estate
Natts Lane • Billingshurst
West Sussex • RH14 9EZ
Tel • 01403 784678
Fax • 01403 784978
www • technique-engineering • com

RECORD OF LOAD TEST

RECEIVED 11 FEB 2005

Certificate No.	INFORMATION ONLY
Date of Issue	INFORMATION ONLY

This document complies with the essential requirements of the relevant sections of the following statutory regulations:
The HEALTH AND SAFETY AT WORK ACT 1974
The SUPPLY OF MACHINERY (SAFETY) REGULATIONS 1992
The LIFTING OPERATIONS AND LIFTING EQUIPMENT REGULATIONS 1998

Name & Address of Customer / Owner of Equipment	Location of Equipment
Turbosound Ltd Star Road Industrial Estate Partridge Green Horsham West Sussex RH13 8RY	
Customer Order Ref. -	QA Ref (if applicable) n/a

Identifying Number(s)	Description of Equipment	Quantity	Safe Working Load (SWL)	Test Load Applied (Proof Load)
M131.1 M131.2 M131.3 M131.4	ASPECT FLYING BAR FB-890/3A	four	900kg	1800kg

SAMPLE

IMPORTANT: THIS EQUIPMENT MUST BE THOROUGHLY EXAMINED BY A COMPETENT PERSON (as defined by LOLER) AT LEAST ONCE EVERY 12 MONTHS FOLLOWING THE DATE ON WHICH IT IS FIRST TAKEN INTO SERVICE. A RECORD MUST BE KEPT OF WHEN THE EQUIPMENT IS FIRST USED AND OF ALL SUBSEQUENT THOROUGH EXAMINATIONS.

I hereby declare that the equipment described in this record has been load tested as detailed and thereafter examined and that as far as can be determined by such visual examination, found to be free from any defect likely to affect safety.

Signed _____

M F Divey
Director (Engineering / Quality)
Technique Engineering Ltd

Registered in England No 2753606 • Established 1992 • VAT Registration No 620 5713 70

Flying Hardware

The 'A' system flying bars consist as follows:

- Single bar – supports a vertical column of cabinets up to 8 deep.
- Twin bar – supports two vertical columns up to 8 deep.
- Triple bar – supports three vertical columns from a single pick-up point or with chain bridles, specifically designed for outdoor use with ground support towers
- Mother beam – used to connect multiples of single bars and/or twin bars in a modular fashion, allowing the creation of speaker clusters up to and including full 360° arrays.
- Extender beam – connects half a mother beam to a two-wide bar and a single bar, which can be bridled from one motor or picked up by two points
- Spacer bar – used to join and maintain the distance between flying bars.

Flying boxes in their horizontal format is simply achieved by suspending vertical columns of loudspeakers using chains attached to lifting points on the fixed angle flybars depicted below. Based on the predicted 25° of horizontal coverage from a single cabinet, it is an easy job to assess how many columns, and therefore which particular combination of flybars, will be needed to achieve the required coverage. The top chains are adjustable to allow the cluster to hang either close to the bar where trim height is critical, or further away when more radical kelp is applied to the columns. In addition, all flybar assemblies allow the user two options to vary the width at the flybar to accommodate deep arrays.

Wide and Narrow Flybar Settings

In order to accommodate the wide range of vertical coverage requirements dictated by a particular venue, all flybars - except the single bar - offer two sets of lifting points, enclosure attachment points and lifting strap points. The narrow setting is designed for a column of cabinets in the 'A' or horizontal orientation and will be more than adequate for the majority of applications. However, the wide setting provides the additional horizontal spacing at the flybar to allow for a vertical column of up to eight cabinets deep to be flown where more vertical coverage is called for. No additional parts or flybars are required to accommodate virtually all situations; it can all be achieved using only one type of flybar.

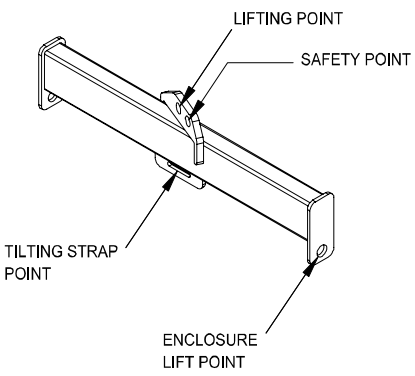
Figure 1. Single A-System Flybar FB-890/1A

The single flybar is fabricated from box steel section with integral lifting point, safety point, enclosure suspension tabs and tilting strap pick-up point, designed to fly a single box or vertical column of boxes up to eight deep. The bar can be flown from a single one-tonne motor.

Single bars are manufactured as left and rights units, and so can be used to combine in a modular fashion with double bars and mother beams to form part of larger configurations.

The net weight of the single flybar is 11kg.

FB-890/1A SINGLE FLY BAR (LEFT)



FB-890/1A SINGLE FLY BAR (RIGHT)

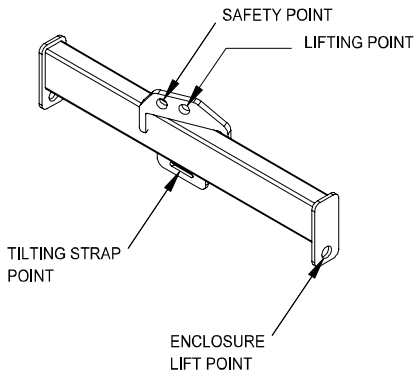
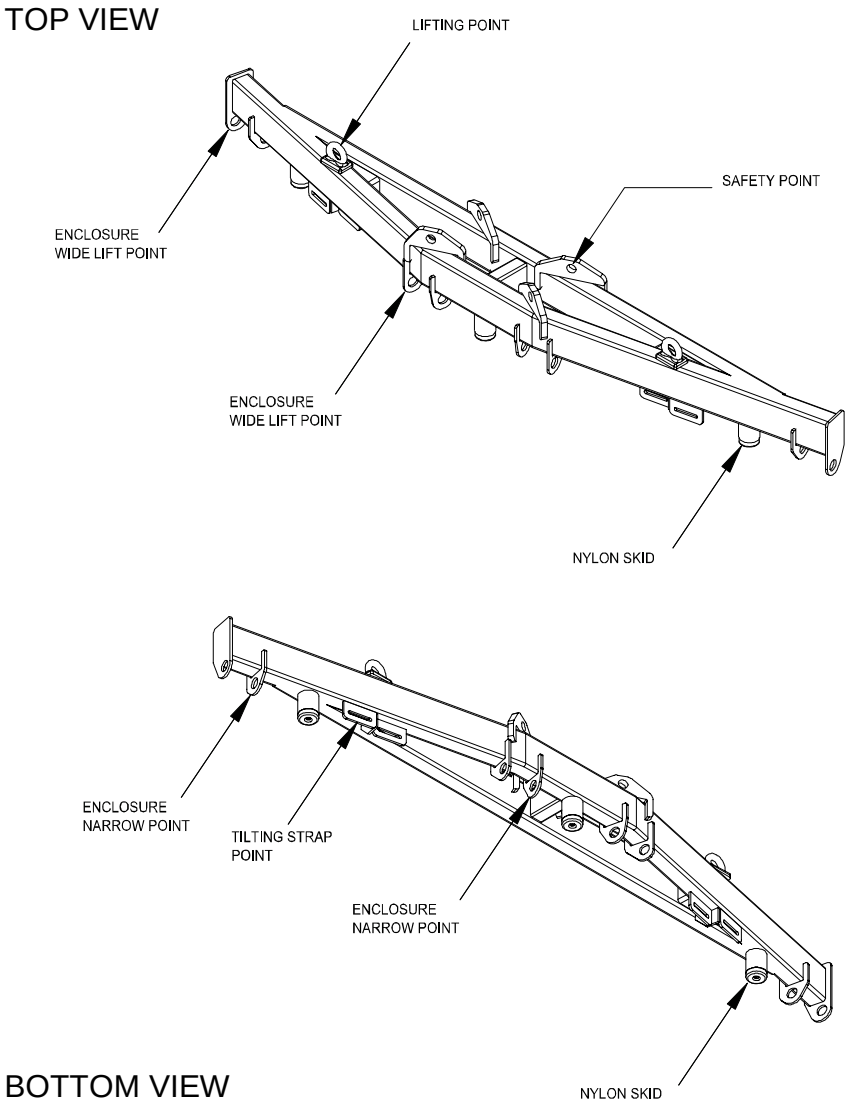


Figure 2. Double A-System Flybar FB-890/2A

A fixed angle double bar fabricated from box steel section and designed to fly two vertical columns of cabinets up to eight deep per column. It provides alternative cabinet suspension tabs and tilt strap points for narrow or wide configurations (when flying more than four boxes deep the wide configuration allows for the additional amount of kelp required), plus lifting points and safety points. A two-wide, six deep cluster can be flown from a single one-tonne motor using a CB-890 chain bridle. Nylon skids are provided on the underside of the bar to ensure it is stable during transportation and handling, and to avoid accidental damage to the enclosure tabs.

The net weight of the bar is 42kg.

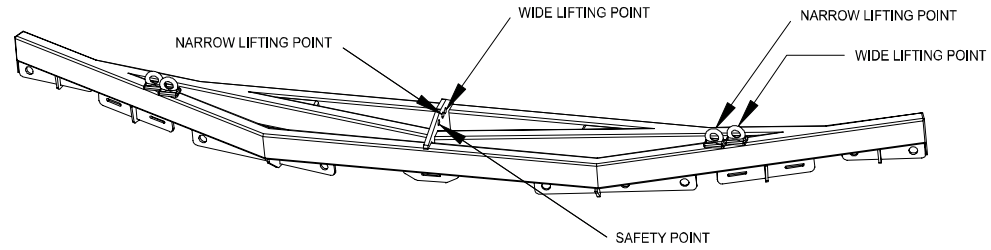


Figue 3. Triple 'A' System Flybar FB-890A/3W

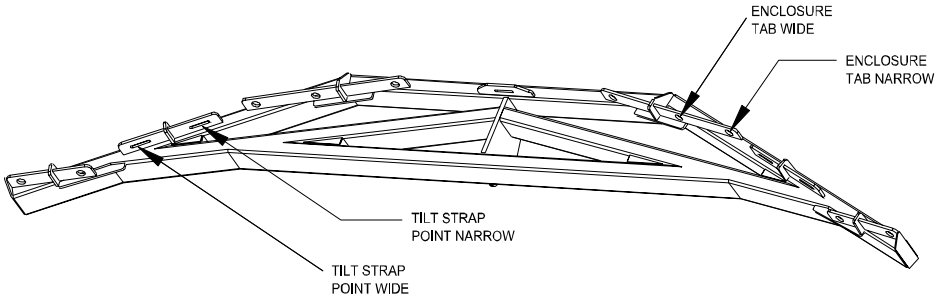
A fixed angle triple bar designed to fly three vertical columns of cabinets in the 'A' or horizontal orientation. It provides both narrow and wide configuration settings in order to accommodate deep arrays of up to eight cabinets.

The FB-890A/3W can be flown using either the single lift points or the chain bridle lift points.

The net weight of the bar is 80kg.



TOP VIEW

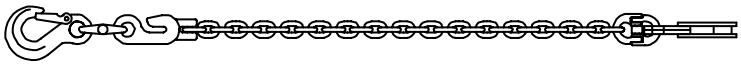


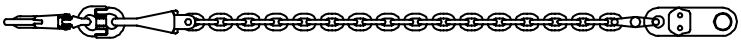
BOTTOM VIEW

FC-890 Flying Chains

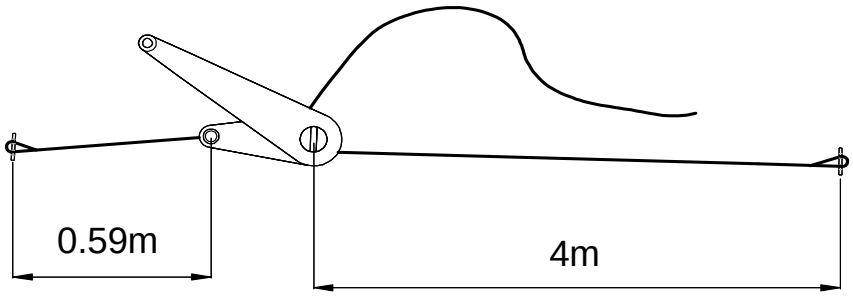
An adjustable length flying chain, consisting of a top hook, chain with adjusting choke, and a cabinet link, is used to connect the cabinets to the flybars. The top chain from the flybar to the first cabinet can be adjusted to gain more height on the system and also improve the looks. Alternatively if you are flying four or more cabinets deep with a lot of kelp it is good to give the top chain some additional length as this makes racheting easier.

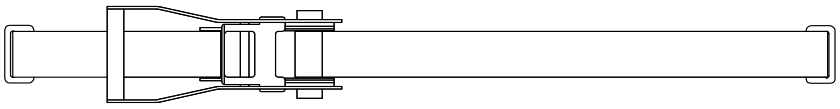
Chains are universal (not handed) and therefore can be used for either side of the cabinet. FC-890 flying chains are load tested to 560kg.





TS-890 Tilting Straps



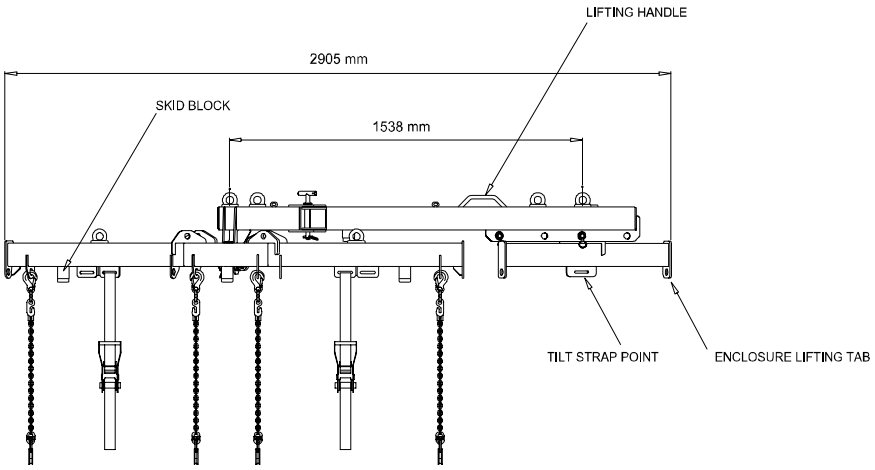


The tilting strap, TS-890, is in two parts. The longer part is attached to the tilt strap point on the flying bar using the buckle at its end. The other part of the strap with the ratchet is hooked into the tilt strap point on the underside of the bottom enclosure. The free end is then threaded through the ratchet and the strap tightened to achieve the desired tilt. The tilt strap is designed to ratchet in both directions so that the amount of tilt on a column may easily be increased or reduced incrementally.

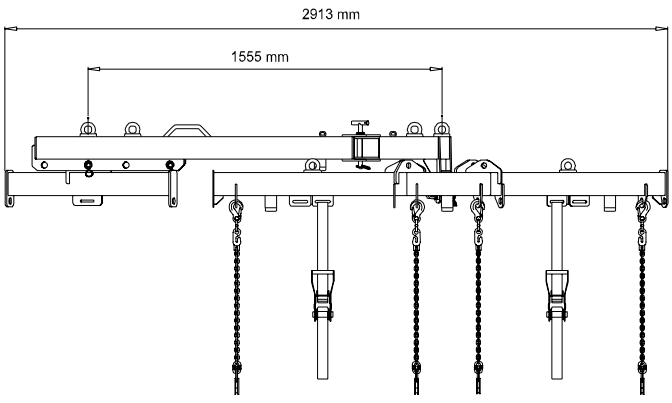
Three-wide hang using MB-890, EB-890, FB-890/2A and FB-890/1A

Consists of a FB-890/1A single bar and a FB-890/2A double bar, coupled with a left or right hand side FB-890MB motherbeam and one MBE-890 left or right side extender beam. The geometry of the system ensures that the optimum 25° horizontal angle is maintained between columns. This configuration can be bridled from a single one-tonne point when flying uip to three cabinets deep. When flying four or more cabinets deep up to a maximum of six, two motors must be used.

The total net weight of this configuration is 110kg, including straps and chains.



LEFT HAND SIDE
Handles are not to be used for lifting or safety ropes



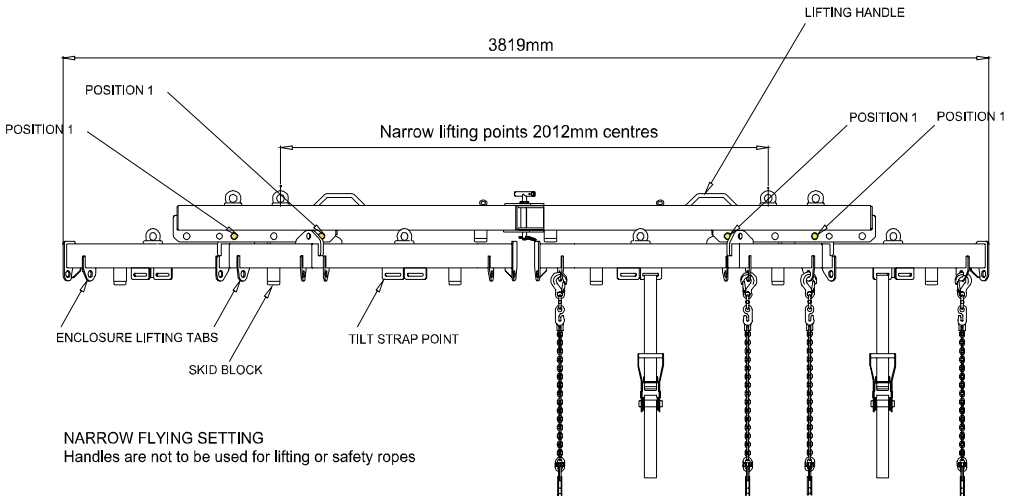
RIGHT HAND SIDE
Handles are not to be used for lifting or safety ropes

Four-wide hang using MB-890 and FB-890/2A

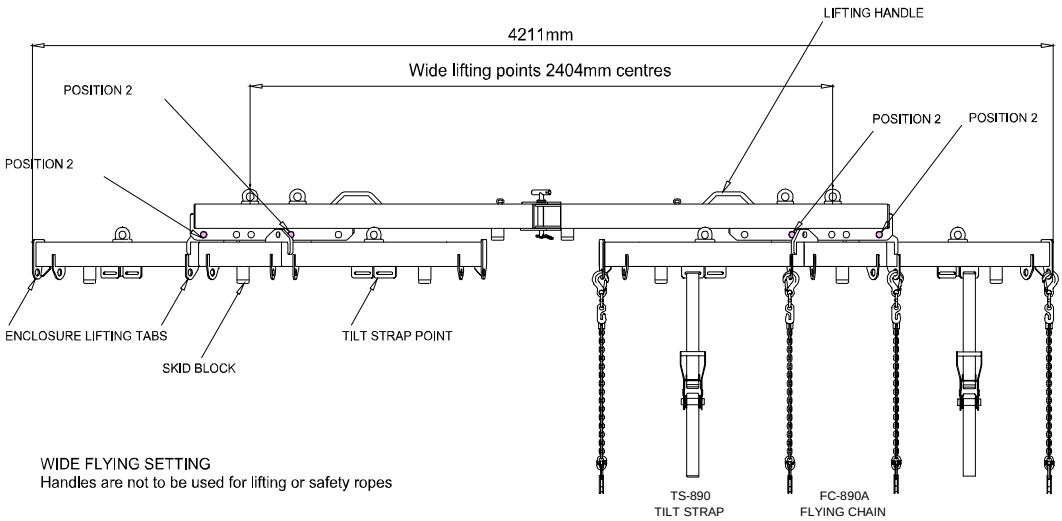
Consists of two FB-890/2A double bars, coupled with an MB-890 motherbeam. The geometry of the system ensures that the optimum 25° horizontal angle is maintained between columns. The diagrams below illustrate both narrow and wide flybar settings.

The flybar has two lifting points. These can be bridled from a single one-tonne point when flying cabinets three deep or less on the narrow setting. For larger arrays of four or more cabinets deep up to a maximum of eight, or when using the wide flybar setting, it is essential to use 2 motors.

The total net weight of this configuration is 160kg, including straps and chains.



NARROW FLYING SETTING
Handles are not to be used for lifting or safety ropes



WIDE FLYING SETTING
Handles are not to be used for lifting or safety ropes

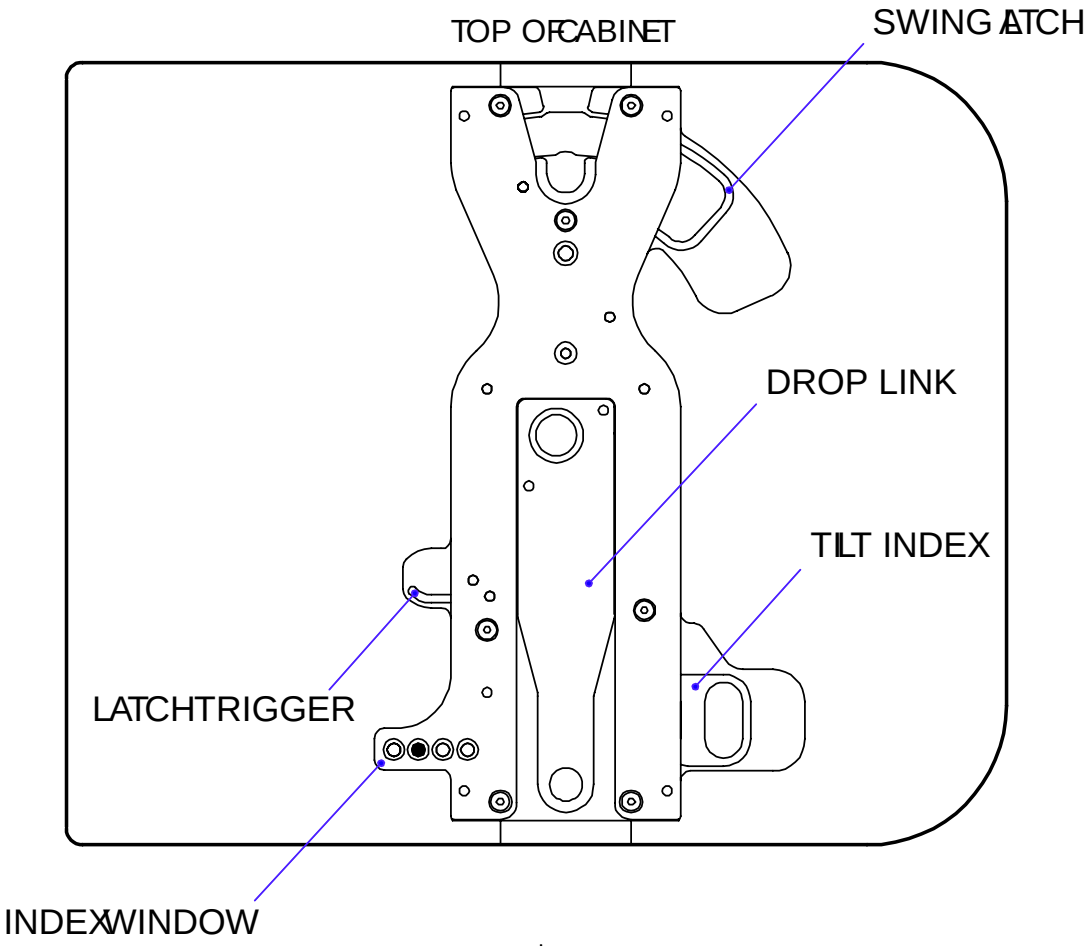
Integral Flying Hardware

Aspect cabinets are flown and connected in vertical columns by means of the integral flygear that is rebated into the cabinet sides. In this way the load of the cluster is taken entirely through the steelwork and not through the box. It essentially consists of a moveable drop link that engages into a receptacle in the cabinet below with a choice of inter-cabinet angles.

All parts of the flygear are fitted flush with the woodwork of the cabinet, and can quickly and easily be removed for safety testing.

The following diagram decribes the various parts of the flygear.

'A' System Flygear



1. Drop Link

A retractable sliding mechanism that extends downwards to engage in the flygear of the cabinet below. It is backed with an anti-vibration spring.

2. Swing Latch

A spring-loaded lever that secures the flying chain or the drop link of the cabinet above. Pull back to locate the drop link, release to engage.

Connecting Flying Chains to the Cabinet

To connect the top chain to the cabinet, pull the swing latch back, insert the cabinet link into the slot and release the swing latch. Repeat for the second flying chain. A white filled circle visible in the safety window gives clear visual indication that the link is properly engaged and that the box is safe to lift.

Figure 1 – insert cabinet link

Figure 2 – release swing latch

Connecting Cabinets - 'A' System

The optimum method is to stack cabinets in vertical columns underneath the flybar position, ensuring that the corner locators line up properly. Cabinets can now be linked and pre-configured.

With one hand, pull back the swing latch at the top of a cabinet while at the same time releasing the drop link on the cabinet above it using the latch trigger. Use the tilt index to set the required vertical angles between cabinets. A white circle visible in the drop link window indicates that the drop link is fully engaged.

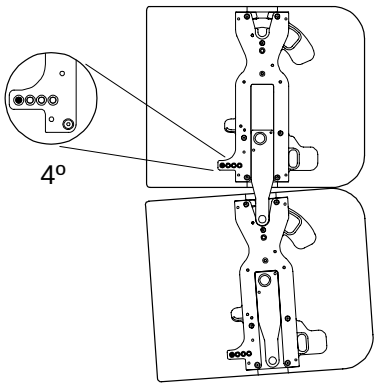
Note: DO NOT under any circumstances fly cabinets until you have checked that the safety indicator is visible on all cabinets.

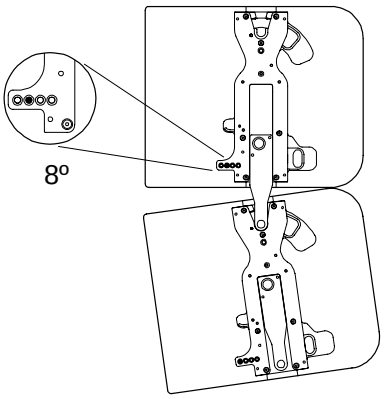
Repeat this procedure until all cabinets in the column are linked.

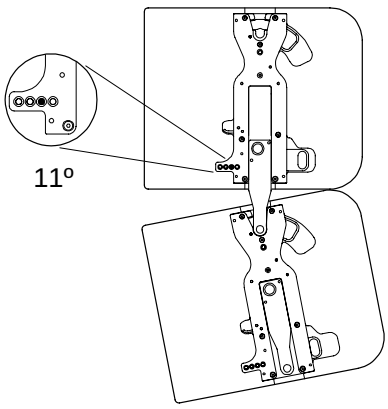
Setting Vertical Angles – 'A' System

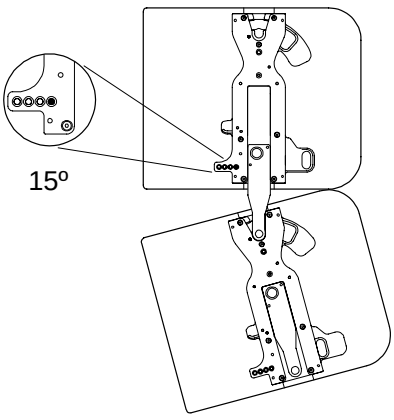
The position of the tilt index determines the distance between cabinets, and hence the vertical angle when the column is lifted. There are four possible discrete increments. The vertical inter-cabinet angles are as follows:

Swing link position	Inter-cabinet angle
1 (nearest front of cabinet)	4°
2	8°
3	11°
4 (nearest rear of cabinet)	15°









Attaching the Tilt Straps

When all cabinets have been linked and the top chains attached, the tilt straps can now be attached.

First attach the longer strap to the flybar by sliding the flat buckle into the tilt strap attachment point. Slide the flat buckle on the shorter strap into the tilt strap point on the bottom of the cabinet, insert the free end of the strap through the centre of the ratchet spindle, and pull to apply some tension before ratcheting the column.

WARNING

The tilt strap is designed to ratchet in both directions, an improvement over previous versions which did not allow incremental tilt reduction. However, at all times please note that if the tension on the strap is released suddenly, the column of enclosures may tend to swing violently forwards and care must be taken to avoid danger to persons in the vicinity. It is essential to check that nobody is standing immediately in front of the column, and to give a suitable warning, before the strap is released. Ideally, two persons should support the row from the side whilst the strap is released, or alternatively the bottom row may be returned to the ground before release. In any event it is essential that all personnel in the vicinity are aware that the system is about to move and that they must keep clear.

Fig 1 – attach buckle

Figure 2 – take up slack

SAFETY NOTE: The Turbosound TA-890 system has been designed and constructed to a high standard of safety and tested to the most demanding of specifications with a safety factor of 13:1. However, anyone involved in flying ANY sound system, especially in a touring capacity, should take note of the following advice: The rigging of a flown sound system may be dangerous unless undertaken by qualified personnel with the required experience to perform the necessary tasks. Fixing of hanging points in a roof should always be carried out by a professional rigger and in accordance with the local rules of the venue. The house rigger and/or building manager must always be consulted.

Turbobass Directivity

The Aspect series TA-890L bass bin and the TSW-218 subwoofer are “Turbobass” devices, comprising horn-loaded drivers. Whilst this horn loading does aid in tuning the device and adding some sensitivity, the relationship between horn length and the bandwidth covered by the enclosures means that each source is effectively an omni-directional point source.

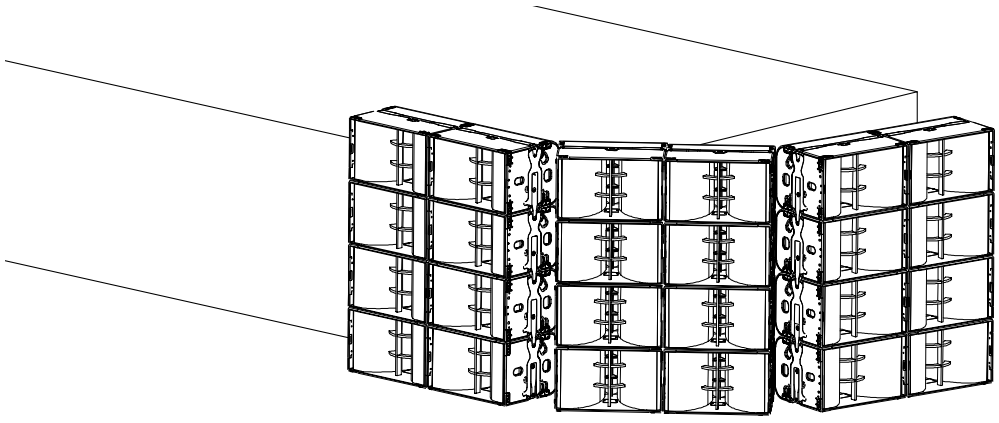
Therefore any LF pattern control experienced when using an Aspect system derives from adjacent enclosures within an array or from the relationship of a left to right stack

Bass Enclosure arraying

Aspect bass enclosures are most efficient when ground stacked in a block. Not only do they benefit from improved coupling when there are no air gaps between them, but they also couple to the ground. However, some of this energy may be absorbed by nearby obstructions such as barriers or a tightly-packed standing audience. Sound pressure levels may also be excessive for members of the audience if they are able to get too close to the enclosures. When stacking on the stage or on a platform, particularly outdoors, it is preferable to close the gap between the platform and the floor with sheets of plywood. This results in increased sound projection into the audience and less leakage backstage.

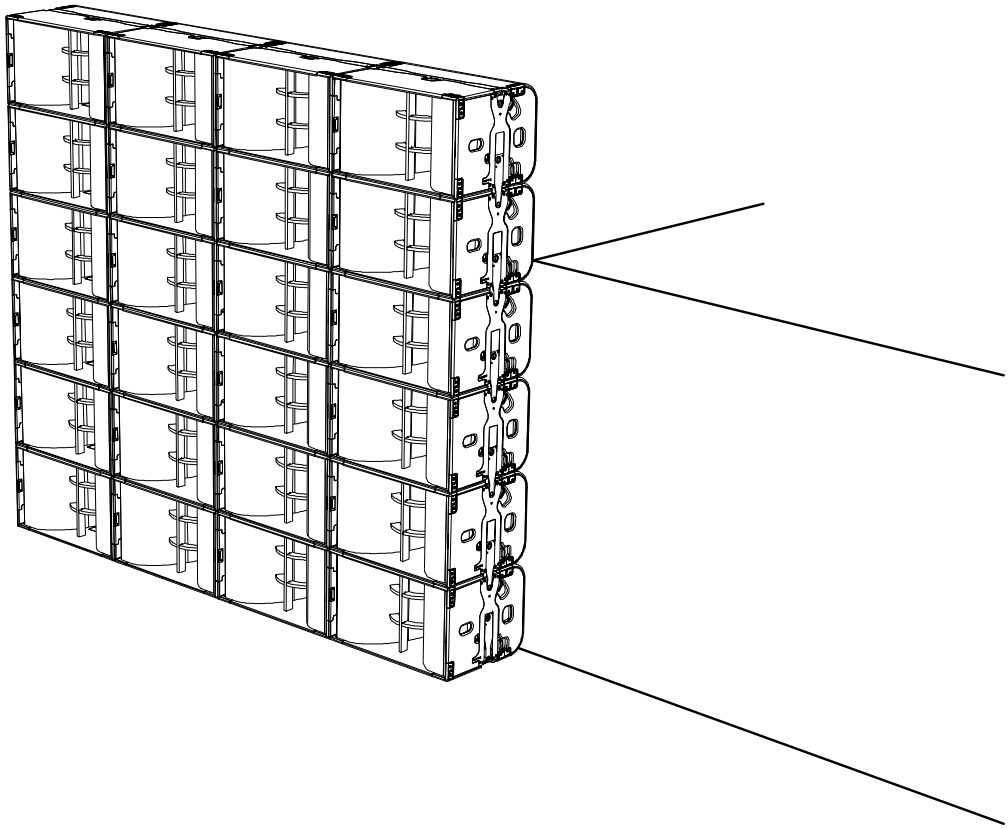
Aiming - directivity of the stack

The directivity of the bass stack will depend on its dimensions and curvature. A tall thin stack will disperse a lot in the horizontal plane and become narrow in the vertical plane whereas a wide stack will narrow in the horizontal plane. There is usually an optimum compromise between the two so that a smooth transition can be obtained between the effect of the coupling of the two stacks down the centre line of the room and the effect of the individual stacks beaming on their axis. Also adding some curvature to the stack will help to increase the directivity of the stack especially in stopping beaming at higher frequencies.



Tall, thin bass stacks work best, preferably in blocks of six or eight bins high by two wide. When space permits use two or three of these blocks, placing the onstage block flush with and parallel to the stage, with a second and additional identical offstage blocks slightly separated from the first and angled outwards by 40°.

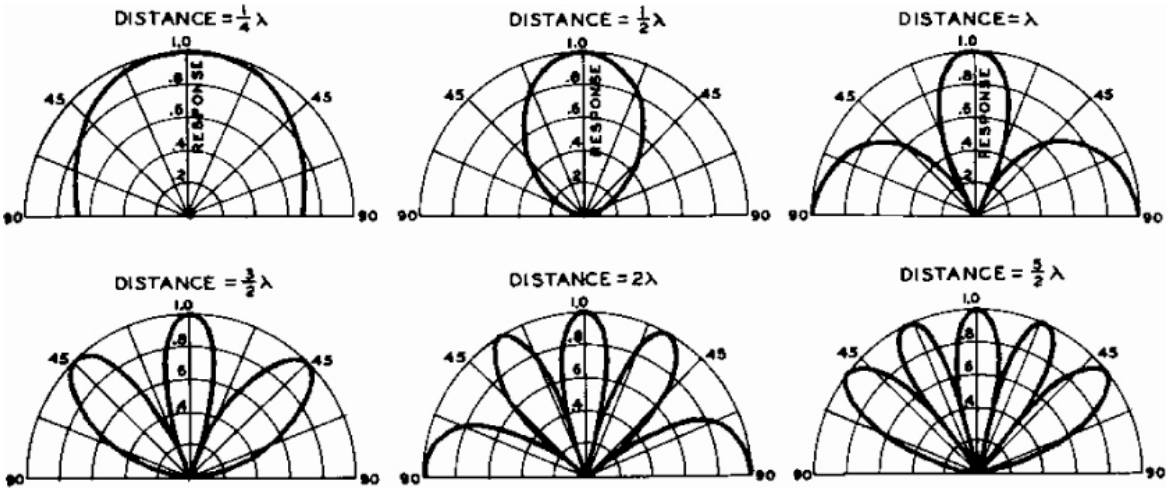
Stacking bass cabinets in a line in front of the stage will produce narrower dispersion in the horizontal plane, while giving wide vertical dispersion.



The typical Left to Right problem

One of the most common problems on large scale events results from the relationship between the left and right bass stacks.

Due to the difference in distance and arrival time at any point between two point sources, in this case bass arrays, there will inevitably be some positive addition and some negative cancellation between sources.



A B C

D E F

The above graphs show the relationship between two point sources when separated by different multiples of a wavelength.

The cancellations shown above are due to the phase relationship between two sources at a given point between them. When the sources are perfectly in phase the addition between them gives 6dB of additional gain. If, due to positioning, one of the sources is 180 degrees out of phase complete cancellation is experienced.

To further illustrate the problem it is important to remember that since each frequency has a different wavelength the summation and cancellation between enclosures will change at different frequencies.

For example presume that two bass bins are spaced 11ft apart (a wavelength at 100Hz) so at 100Hz the dispersion from the 2 sources will be as figure C. At 50Hz the dispersion will be as figure B. Similarly at 200Hz the dispersion will look like figure E.

Whilst several manufacturers have attempted to solve this using DSP based systems at present there is not a working solution in the market.

In theory by splitting the LF energy into several bands and then spacing the left/right stacks differently depending on frequency this effect can be solved or at least minimised. However, due to the available space within a venue and the maximum roll-off available from common crossover systems we consider this to be neither effective or practical.

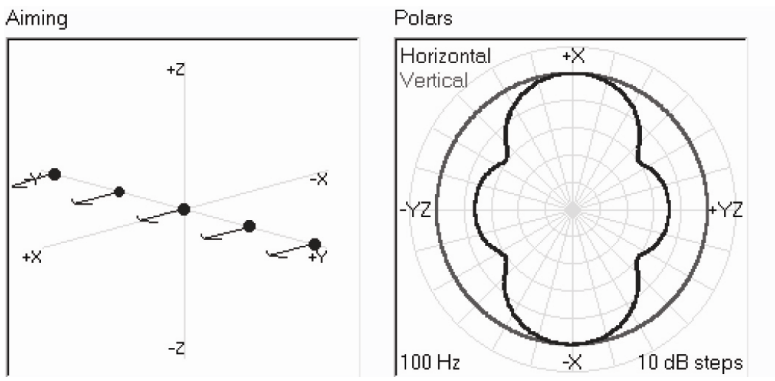
If a large system is going to be configured with left and right bass stacks it can be preferential to stack the bass bins in a wide fan with the onstage column flush and parallel to the stage and with a large distance between the left and right stacks. This ensures each bass array has some pattern control. Angling individual columns outwards also helps to minimise the cancellation effects detailed above.

There are several ways of minimising cancellation problems, involving different numbers of enclosures and different stacking options.

Creating Directional Bass arrays:

It is possible to build bass arrays which provide an amount of horizontal pattern control and also go some way to solving the problem of multiple summation and cancellations on a large system. All the examples detailed below presume that the enclosures are placed in free space and are therefore not effected by the constraints of a venue.

Bass in a line:



The above balloon shows the pattern control given by spacing units ¼ of a wavelength apart @ 50Hz (5.5ft apart).

The result here is tight horizontal pattern control with two side lobes. This is a common application of subwoofers used in the field.

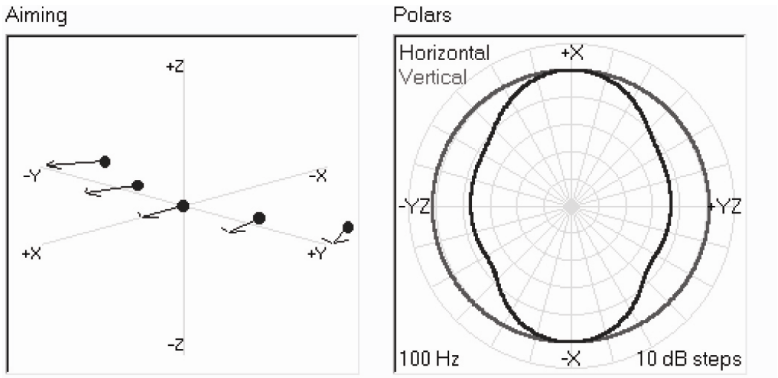
There are however, several points to notice.

Firstly, almost as much energy is produced behind the array as in front of it, which can create problems on stage or on multiple-staged outdoor events.

At the same time this will always provide a tightly controlled beam, providing focused low end energy which will drop off sharply outside the coverage area.

On a large site it will be necessary to extend the line to multiple sources in order to provide enough horizontal coverage.

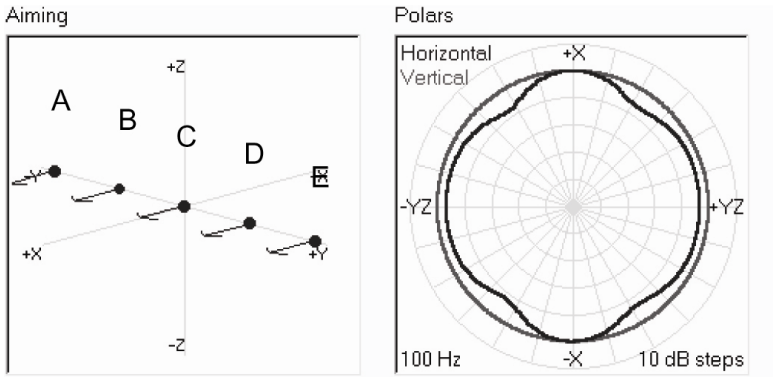
Fanned bass



Again the sources are spaced ¼ of a wavelength apart however this time there is a 15 degree arc across the array.

The result here is a broader horizontal dispersion than the previous example. This solves the issue of a beam of bass being too tight, but can further accentuate problems on stage due to the tightly focused LF energy behind the middle of the array.

Bessel Array



In the above example five bass bins are again spaced ¼ of a wavelength apart. However in this example the outside two are reduced in gain by 3dB. The inside pair are out of phase while the middle unit is in phase.

This is known as a Bessel array, and will create the smoothest horizontal coverage possible at a given frequency.

Whilst this approach works well it is important to balance this against the practicality of setting up three or more discreetly processed LF bands within the system architecture.

General observations of long lines of bass

Aspect bass enclosures cross over at 100Hz into the mid/high box. This means that a lot of the punch from a kick drum is provided by the 2 x 15" bass enclosure. If the bass bins are deployed in a configuration based on a long line across the front of the stage it is important to ensure that the top of the stack is above head height (which may not be possible due to sight lines restrictions) as the audience will absorb some of the attack provided by the 2 x15" enclosure.

With extremely long lines of bass the relationship between the flown mid/high clusters and the line of bass can create a problem around the crossover point, as the time alignment between the enclosures can only be correct in a limited coverage area.

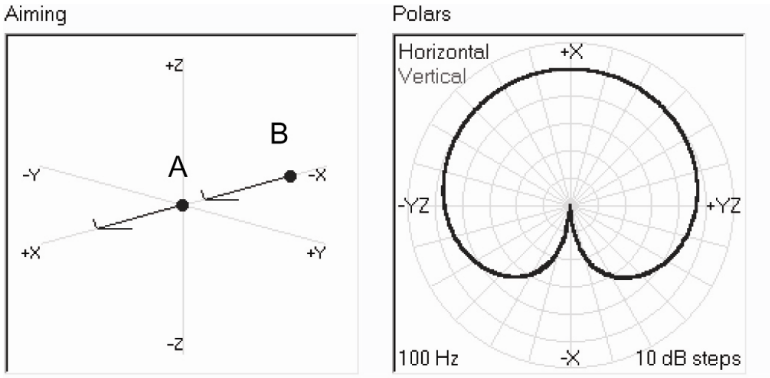
When using both the 2 x 15" bass bin and 2 x 18" ultrasub it is desirable to try and keep the enclosures in the same plane as each other to avoid time alignment and cancellation problems through the crossover region.

End firing array

Under today's market conditions it is often necessary to abide by strict environmental considerations. This is particularly pertinent at open air festival sites where there are multiple stages and external noise limits.

Aspect TA-890H mid/high boxes are uniquely positioned in a line array dominated marketplace to deal with this problem by allowing the user to tailor the horizontal and vertical dispersion to the desired coverage area.

It is also possible to do this with the low end by creating a cardioid subwoofer array.



The above example shows the performance of a cardioid subwoofer array.

The main bass stack is firing forward. A second bass stack is placed behind the first by ¼ of a wavelength @ 100Hz, out of phase and delayed by 2.5ms.

This creates a cardioid pattern dispersion pattern and will result in very steep reduction of LF behind the stack – this is ideal where a very controlled environment is required.

It is worth noting that this requires additional processing and will result in a lower output than using the enclosures in a more conventional manner.

Summing up

Generally left and right bass stack are deployed. These should be kept as far apart as possible, and stacked high or fanned to minimise beaming. Toeing these out can hep to reduce cancellation between left and right stacks.

On large sites or in situations where left to right cancellation is particularly bad, a fan shaped array will solve the problem. When possible smoother coverage can be obtained by using additional processing to create a Bessel array.

If noise pollution is a serious problem and space and logistics permit it is desirable to create an end-firing array. Whilst this will not help solve any left to right cancellation this will greatly reduce the amount of energy produced behind the array.

Whenever practical, when spacing the enclosure ¼ of a wavelength apart do so at around 80Hz with Aspect TA-890L enclosures but lower at 60Hz when used in combination with the TSW-218.

Deployment of large scale sound systems is often a compromise it is advisable to explore these possibilities well in advance of a show to determine the best possible results for the venue. Always remember that large amounts of LF energy a short distance from the audience area may well cause hearing damage if deployed poorly. Turbosound accepts no responsibility for loss of hearing due to the misuse of our systems.

Ground stacking

In certain situations, indoors or outdoors, it may not be possible to fly any part of the system. In this case, the same general rules apply as for flown arrays. High packs should be kept well above head-height and angled carefully for even coverage. The integrated 'A' system flygear permits convenient ground stacking of both 890H mid-highs and 890L low cabinets. Small wood blocks (acoustic compensators) may be used to tilt mid-high cabinets downwards for the floor areas while the flygear is used to give predictable upwards angles, with the TS-890 tilt strap being used to lock the top cabinet in position. Various combinations of cabinets up to seven boxes high can be assembled to suit differing venue requirements.

In the example below, the first three cabinets are bass enclosures, stacked with the flygear loacked and with zero angle between them. These provide ground support by elevating the mid/high cabinets to a suitable height (the HF section of cabinet 4 is approximately 1.8 metres from the ground). A compensator is inserted between cabinets 3 and 4 in order to point the first mid/high slightly downwards onto the audience

LMS SERIES LOUDSPEAKER MANAGEMENT SYSTEMS

Introduction

This section is provided with the aim of assisting sound engineers, installers and consultants to fully understand Turbosound Loudspeaker Management Systems, and to obtain the full benefit of their capabilities.

The LMS-D6 and LMS-D26 are dedicated Loudspeaker Management Systems, specially configured for Turbosound's Aspect Systems, and to be used in conjunction with Turbosound AMP-890 amplifier racks.

General features & facilities

Unpacking

As part of Turbosound's system of quality control, this product is carefully checked before packing, to ensure flawless appearance. After unpacking the unit, please inspect for any physical damage and retain the shipping carton and all relevant packing materials for use should the unit need returning.

After unpacking the unit please check carefully for damage. If damage is found, please notify the carrier concerned at once. You, the consignee, must instigate any claim. Please retain all packaging in case of future re-shipment.

There will be a small packet of spare fuses with the unit. Please keep them in a safe place.

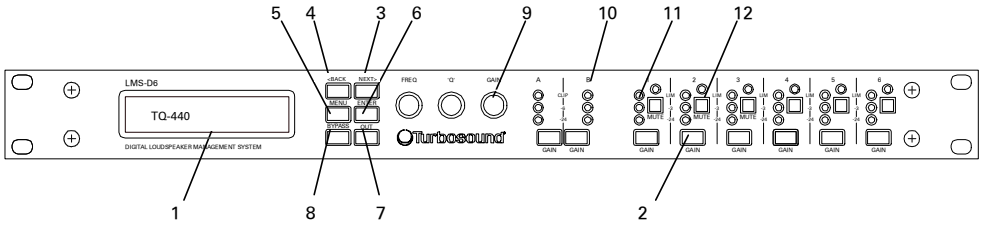
If any damage has occurred, please notify your dealer immediately, so that a written claim for damages can be initiated. See the Warranty section at the end of this manual.

Mechanical Installation

A vertical rack space of 1U (44mm / 1.75") is required for each unit. If used in a mobile or transportable system, the unit must be supported at the rear by additional bracing or shelving, to prevent vibration-induced metal fatigue of the racking ‘ears’. Failure to do this will impair reliability and invalidate the Warranty. The rack casing will need a depth of 425mm (minimum) to clear the connectors.

Adequate ventilation must be provided by allowing sufficient room around the sides and rear of the unit to permit free circulation of air. Forced cooling is not required, a factor which aids component longevity. The front of the unit should not be exposed to long term direct sunlight as this can have a detrimental effect on the display lens.

LMS-D6 Front Panel Functions



1. LCD Display - Shows menu options, output information and adjustment parameters.

2. Gain Keys - Two input and six-output ‘gain’ keys allow instant access to the gain screen for each channel. Pressing a second time selects the last function edited.

3. Next Key - Moves the display forwards through the list of available parameters for the current input or output channel.

4. Back Key - Moves the display backwards through the list of available parameters for the current input or output channel.

5. Menu Key - Activates the main menu on the LCD display. Pressing a second time selects the last menu edited. Different menus are selected by pressing the ‘BACK’ and ‘NEXT’ keys or using the ‘FREQ’ control.

6. Enter Key - Enters the chosen menu and confirms menu selections.

7. OUT Key - Exits the menu.

8. Bypass Key - Allows the currently displayed parametric section to be bypassed. (Note: The Highpass / Lowpass filters and limiters can not be bypassed.)

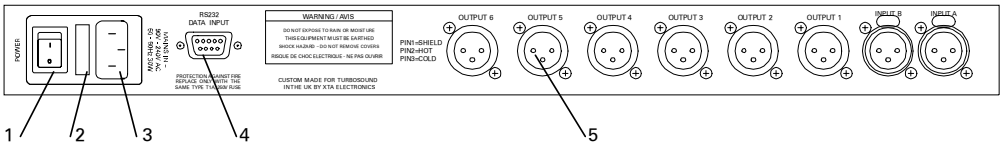
9. Parameter Controls - The three velocity sensitive rotary encoders allow the relevant parameter, on the LCD screen, to be adjusted.

10. Input Meters - Displays available headroom before input clipping occurs. The bottom green LED is set at -24dB, with the orange 0dB LED set at 3dB below clipping. The top, red LED displays digital overflow and can therefore light without all the other LEDs becoming illuminated.

11. Output Meters - Displays headroom before limiting occurs. The bottom green LED is set at -24dB, with the orange ‘LIM’ LED set at the limiter threshold for that channel. The top, red LED indicates 4dB of limiting.

12. Mute Keys – One mute key per output channel.

LMS-D6 Rear Panel Functions



1. Power Switch.

2. Mains Fuse - Located in a finger-proof fuseholder adjacent to the mains inlet. Always replace this fuse with the correct type as shown on the rear panel legend. (N.B. A spare fuse is located in this holder.)

3. Mains Power - Connected via a standard IEC socket. A compatible power cord is supplied with the unit.

4. External - RS232 via a 9-pin DIN DEE socket, for connection to a PC.

5. XLR Inputs and Outputs - 3 pin XLR connectors are provided for each audio input and output. All terminations are fully balanced, pin 2 Hot, pin 3 Cold and pin 1 not connected.

Mains Power

The LMS-D6 must always be connected to a 3 wire grounded AC supply. It is supplied with a standard IEC power cord with conductors as follows:

BROWN	Power line Live (Phase)
BLUE	Power line Neutral
GREEN/YELLOW	Safety Earth and ground connection

Units supplied to the North American market are fitted with an integral moulded 3 pin connector, which is provided to satisfy UL & CSA safety standards.

Voltage Setting

The LMS-D6 is provided with an auto-seeking power supply, and therefore requires no external adjustment for correct operation with international AC line voltages ranging from 60 to 250 volts.

Safety Earthing

The green/yellow wire of mains cord must always be connected to the electrical installation's Safety Earth or Ground. It is essential for personal safety, as well as proper operation of the unit.

The green/yellow wire is internally connected to all exposed metal surfaces. Any rack framework which this unit might be mounted into is assumed to be connected to the same grounding circuit. The LMS-D6 has balanced audio connections and does not require disconnection of this or any other safety earth for the avoidance of hum loops. If any problems are experienced with hums or buzzes, careful attention to the signal cable grounding will effect a cure.

AC Power Fusing

The incoming mains power fuseholder is mounted on the rear panel. If the fuse needs to be replaced it must be properly rated as follows: 20mm 1A 250 V type T. It is important for continued safety that this specification is adhered to. It is very unlikely that this fuse will fail during normal use, and such a situation must be treated with some caution as to the cause.

Powering Up

When the LMS-D6 is switched on by operating the power on-off switch located on the rear panel, the internal circuitry carries out a series of routine diagnostic tests.

After the switch-on cycle, the screen will revert to displaying the delay program name that was in use when the unit was last powered down.

The internal memory automatically saves all settings when the unit is switched off, so there is no need to re-load delay and temperature information every time the system is powered-up. The memory contents are retained indefinitely without the need for an internal backup battery.

Audio Connections

The LMS-D6 audio inputs are RFI filtered and electronically balanced. The outputs are electronically balanced and fully floating. Overall, the unit is designed to operate at any signal levels ranging -10dBu up to +20dBu. The outputs will drive into loads of 600 Ohms or greater and both inputs and outputs are intended to be 'fuss free', regardless of an installation's complexity.

The connector wiring is as follows:

INPUT	OUTPUT
PIN 1 N/C	PIN 1 N/C
PIN 2 HOT (+)	PIN 2 HOT (+)
PIN 3 COLD (-)	PIN 3 COLD (-)

Input and Output Connector Wiring

Balanced Wiring

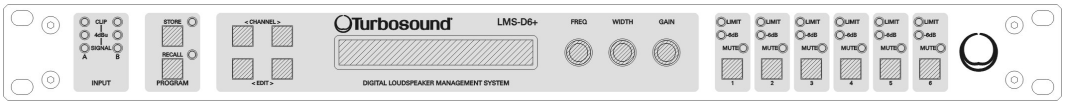
Whether a system is wired to a 'pin 3 hot' or a 'pin 2 hot' convention will not matter as long as the wiring of hot & cold phases to both the input and output XLR connectors is the same.

At the LMS-D6 input, the convention is 'screen goes forward with the signal'. Input cable screening therefore needs to be connected at and derived from the signal source end, as pin 1 on the input XLR is not connected to the LMS-D6 chassis nor signal ground.

Time correction for loudspeaker driver placement

When a loudspeaker sound system is constructed which utilises different loudspeaker drivers for separate frequency bands, it is inevitable that the sound sources are non-coincident. The effect of this is that phase and time differences occur, producing a substantial cancellation of the signal around the crossover region. There is also a general lack of transient clarity or smearing of the sound, resulting from an inaccurate combining of the wavefront. The LMS-D6 provides and maintains the optimum relative signal delay between drivers.

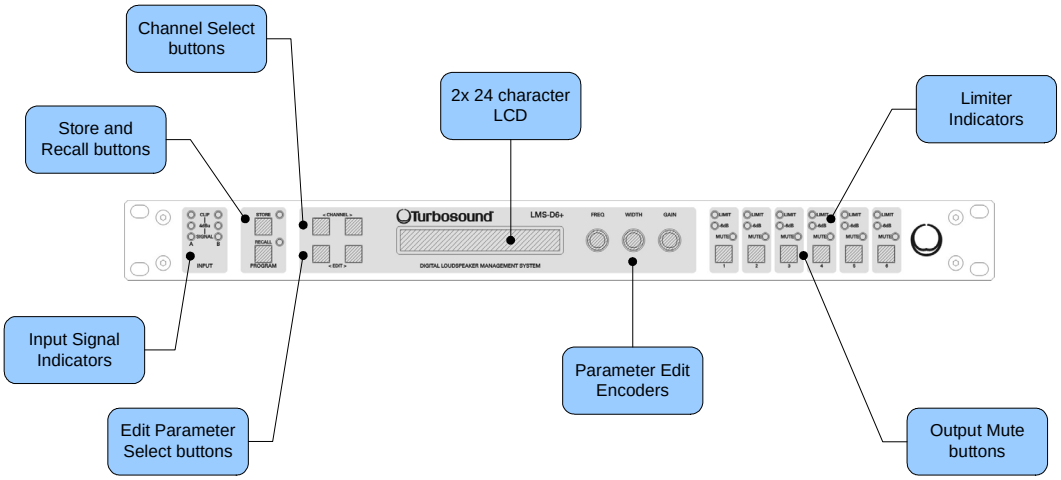
LMS-D24 AND D26 LOUDSPEAKER MANAGEMENT SYSTEMS



Features

- Minimal signal path design, providing exceptional audio quality with carefully optimised processing and high performance converters for a full >111dB dynamic range, 96kHz sampling rate and minimal filtering. Audio-grade capacitors are used in the analogue signal path.
- Sonically superb ADC / DAC combination; a carefully matched pairing of the best devices from Burr Brown and Wolfson.
- Newly released family of Analogue Devices SHARC DSP.
- Extended bandwidth; 96kHz sampling frequency provides for a nominally flat response to 40kHz.
- Front panel parameter rotary encoder provides a familiar and easy to use control format with all filter information displayed simultaneously on a backlit LCD display.

Front Panel Functions



Input Signal Indicators – A set of three pairs of LED's indicate signal present, +4dBu and input clip for both channels. The signal present LED's operate at approximately –40 dBu, giving a useful indication of even relatively low input signal levels. The +4 dBu LED's are intended to show nominal operating level and can also be useful for setting system gain structure. Clip LED's warn the user of input overload and operate at +19 dBu.

Program Store and Recall – these controls provide access to 45 presets. Pressing the store button allows the user to name a preset and choose which memory location it will be held in. Pressing store button again completes the process. The Recall function operates in a similar way, pressing the recall button allows the user to select which preset they require, pressing the button for a second time, then confirming, recalls the new DSP settings. The unit allows the user to set up user programs with full access to all parameters.

Note that presets cannot be stored or recalled when secure mode is activated.

Channel Selection Buttons – the currently selected channel is displayed on the top left hand corner of the LCD. Pressing the channel buttons scrolls through the available input and output channels and finally through the utility functions and back to the default screen. If operating a stereo-linked preset the channel name will indicate the channel pairing. For example 'A+B' means both input A and B parameters. The name of the output will be shown briefly at the top of the display when stepping onto an output.

Edit Select Buttons – the currently selected edit parameter is displayed on the bottom left corner of the LCD. Pressing the edit select buttons moves through the available parameters for the current input or output.

Text display – preset, channel, parameter and status information is shown on the 2x 24-character text display. In most screens the currently selected channel is displayed on the upper line and the edit parameter on the lower line. To simplify the display and enhance security, some parameters or parameter pages are omitted when not relevant.

Parameter Knobs – three velocity sensitive parameter knobs are used to adjust parameters shown on the display. Up to three parameters are displayed on the screen. The parameter name is shown above the parameter value in each of the three screen sections. The parameter knobs have a fixed association with the screen sections; the rightmost parameter knob adjusts the rightmost parameter and so on.

Output signal and limiter indication – two LED's are provided for each output channel. These show the signal level relative to the limiter threshold. The yellow LED will light when the signal is 6dB below the threshold and the red warning LED will light when the limiter threshold is reached.

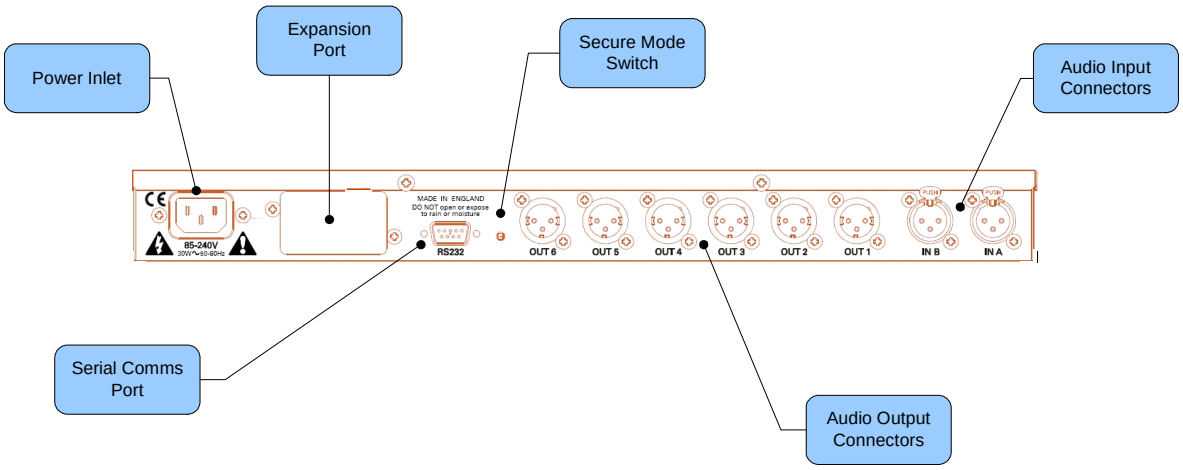
Mute buttons and status LED's – each output has a mute button and associated mute status LED. Pressing the button toggles the mute on and off.

Note that the mute buttons do not function when the Secure Mode is activated.

Secure Button (on the rear) – a momentary button is fitted behind the rear panel, between the output XLRs and the RS232 port. When activated, this will disable all the front panel controls so they cannot affect the signal path, making the unit secure against tampering. When in secure mode, the indicators still operate normally.

Note that the communications port is still active in secure mode.

Rear Panel Functions



Power Inlet – provides connection to a suitable mains electricity supply using the cable supplied. The controller has a switch mode power supply that is capable of operating with a nominal mains voltage of 80 to 240v, 50/60Hz without re-configuration.

Network expansion port – where a future network card can be fitted.

Audio Input connectors – these are fully balanced and are wired pin 1 ground, pin 2 hot and pin 3 cold. The two inputs have pin 1 connected directly to the chassis and feed the signal processing chains. If an unbalanced source is used, a connection should be made between the pin 3 'cold' signal and the ground connection of the unbalanced source.

Audio Output connectors – the processed outputs are impedance balanced, and are wired pin 1 ground, pin 2 hot and pin 3 cold. An unbalanced input may be driven by by connecting pin 3 'cold' signal to the ground connection of the unbalanced destination input. Note that output pin-1's are ground lifted at audio frequencies but connected to ground at RF for good EMC performance. The intention being that the amplifiers the processor is driving should be responsible for the grounding of their input cable shields.

Communications port connector – the unit may be controlled entirely from another controller (typically a Personal Computer), running an application that is compliant with the ObCom standard. Connection will normally be made to the controller via this serial port connector. This port is also used for updating the firmware in the unit.

Note: The communications port is NOT disabled when the front panel is made secure using the secure button.

OPERATING THE LMS-D24 AND D26

Starting up

The unit will energise as soon as power is applied to the IEC inlet; there is no power switch. During the start up process the firmware application model number and version numbers are displayed and the outputs are muted until the unit has completed its internal checks. Once the start-up routines are complete and the unit is ready to pass audio, the DSP signal path will be restored to the current settings when it was last powered down and the audio signal is gradually ramped up to its correct level.

Selecting a Factory Preset

There is a library of thirty Factory Presets to suit a range of Turbosound enclosures.

Factory Presets contain some parameters that are fixed and hidden from view; the remainder of the DSP parameters are available for user manipulation. The number and type of hidden parameters is dependant on the Factory Preset, typically crossover frequencies, output delay and some EQ's are hidden; those settings that are a function of the loudspeaker cabinet design and should not require adjustment for different applications.

To recall a Factory Preset for a particular cabinet or system, press Recall and use the left hand parameter knob A to scroll through the available factory preset locations (as indicated by a box symbol after the preset number). Once the appropriate preset has been selected press recall again, at which point you will be asked to confirm the action by pressing recall for a third time. This is to guard against accidental recall of Presets.

Factory Presets are locked so they cannot be over-written. The user can, however, store an edited version of a Factory Preset in any free preset location.

Details of all the Factory Presets can be found in Appendix A.

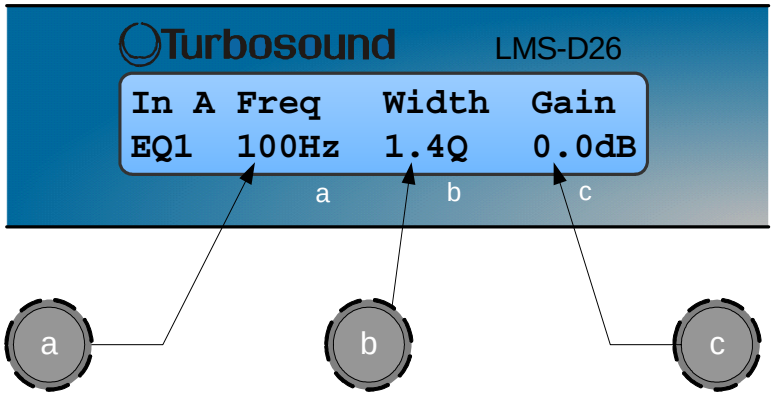
Creating a Crossover

In addition to the Factory Presets the unit has two further 'Base Presets'; mono and stereo. These Base Presets are stored in locations 1 and 2 respectively, they can be used to develop settings for any loudspeaker combination and are recalled in the same way as the Factory Presets described above. These Presets are also locked but the user can name and store their own edited versions in any free preset location.

Navigation and Viewing Parameters

(Note: The LMS-D26 is shown in all the following screen shots; however the features and parameters apply equally to the LMS-D24)

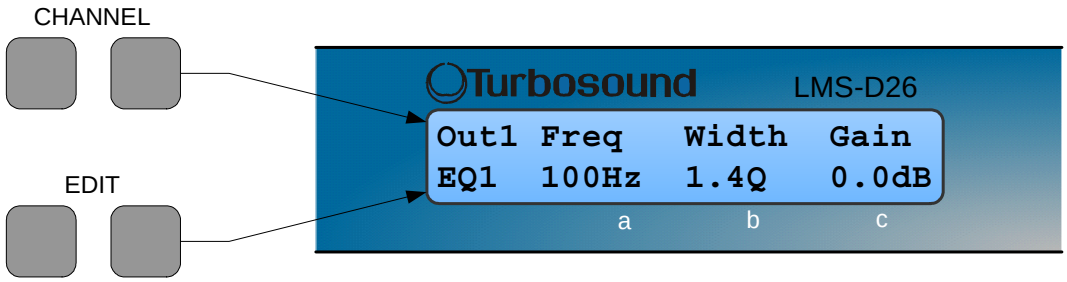
Many of the processing elements in each input and output path have features that may be controlled by the user, such as gain, frequency or limiter threshold. We call these adjustable features parameters.



A parameter may be adjusted when it is displayed by turning one of the three-parameter knobs. Each of the three-parameter knobs is associated with a zone on the display. Adjusting the leftmost parameter knob will change the value of the parameter showing in the leftmost zone of the display and so on. Turn a knob clockwise to increase the value of a parameter, or anti-clockwise to decrease it. The knobs are velocity-sensitive so turning a knob rapidly will cause the action to 'accelerate', so the value changes more rapidly.

Navigation

The DSP parameters are organised by channel. The currently selected channel is shown in the top left hand corner of the display. You can navigate between the channels by pressing the channel buttons. Pressing the channel buttons will scroll through the channels, utilities and back to the default screen. When using a Preset that is stereo linked, the channel selection will reflect this. For example '1&4' indicates outputs 1 and 4. When navigating onto an output channel, the usage of the output, as define in the factory preset, will be shown briefly at the top of the screen.



Pressing the edit navigation buttons gives access to the various pages of parameters available for each channel. The currently selected page is shown in the bottom left hand corner of the display, this is omitted on some pages where the function is obvious. The screen shows up to three (normally related) parameters for a given part of the processing functions on a given channel.

The edit buttons allow you to scroll, in either direction, through the different processing pages for a given Channel. When you go past the last page, you will be returned to the default page.

The channel buttons allow you to scroll, in either direction, through the input and output channels, whilst trying to maintain the currently viewed processing block. If the channel you scroll to does not have the currently viewed processing block, the next one will be shown instead.

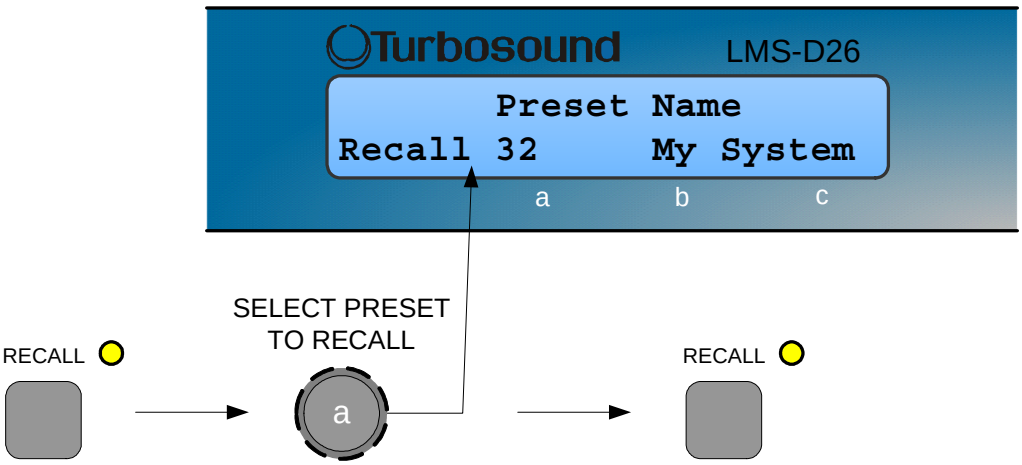
NB. When the unit powers-up, the settings will be the same as those when the unit was last switched off.

PRESETS

The device contains a total of forty-five user and Factory Presets. The user cannot overwrite the basic mono, basic stereo or Factory Preset programs.

Preset Recall

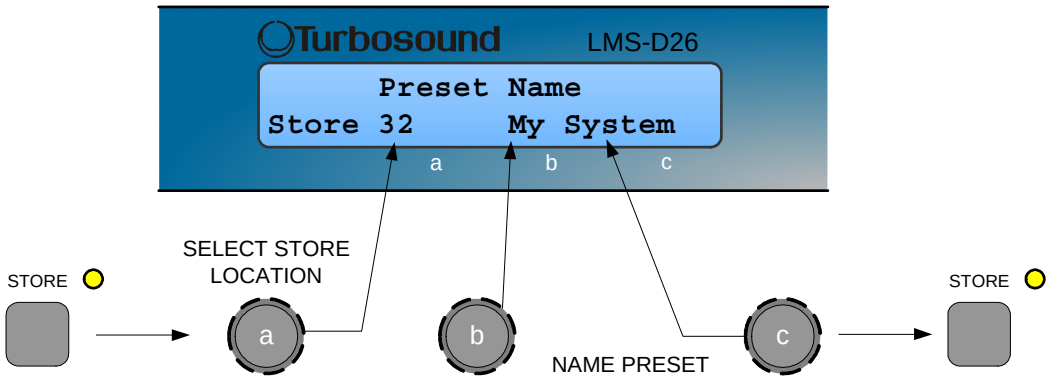
To select an existing Preset, press the Recall Button so the indicator above it illuminates. Turn parameter knob A until the required Preset number is shown on the display. Factory presets are indicated by a box symbol appearing after the preset number. Press the Recall Button again to activate the Preset. Pressing any other button will cancel the operation.



Users can develop their own Preset based on one of the basic or Factory Presets stored within the device. Once a basic or user Preset has been recalled, a user has complete freedom to adjust any or all of the parameters. Factory Presets can be used as the basis for user Presets but they have some parameters that are predefined as a function of the loudspeaker system. These parameters are 'hidden' from the user, as they should be constant regardless of application.

Preset Store

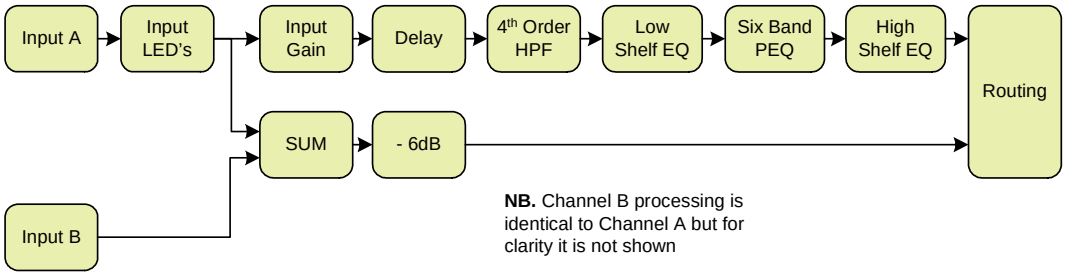
To store the current Preset in a user location, press the Preset Store Button so the indicator above it illuminates. Turn the first parameter knob until the required Preset location number is show on the display. A Preset name of up to 12 characters in length can be entered using parameter knobs B and C. Pressing the Store Button again completes the process and stores the Preset. As with Preset Recall, pressing any other button cancels the operation.



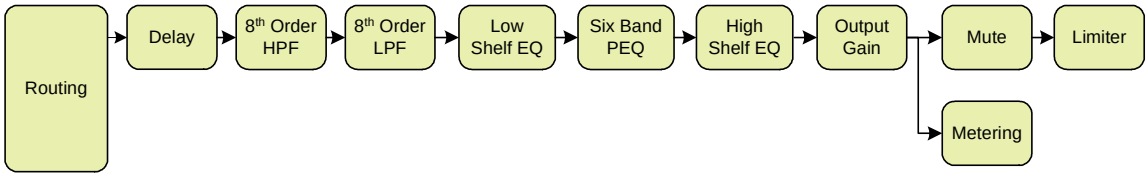
The user can overwrite non-protected Presets only; if an attempt is made to save a Preset in a location already occupied by a basic or Factory Preset a 'LOCKED PRESET' message is displayed.

DSP PROCESSING LAYOUT

Input DSP block diagram



Output DSP block diagram



Stereo / Mono Formats

There is only one 'standard' layout of the processing blocks, but flexible routing and control linking allows this layout to be adapted to a wide variety of applications.

There are two 'Formats', Mono or Stereo. With the Mono format, all outputs have unique parameter settings, and all outputs are identical in terms of processing functions and routing capability. This is the most flexible Format.

Stereo format pairs the inputs and outputs for stereo operation, the parameters of each member of the pair being identical. The routing of inputs to outputs is fixed. This format is intended for symmetrical stereo operation, eliminating the need to make identical parameter adjustments for each channel.

The channel pairing is:

Left and Right Inputs

Outputs 1 (routed from L input) and 3 (routed from R input) [1 and 4 for LMS-D26]

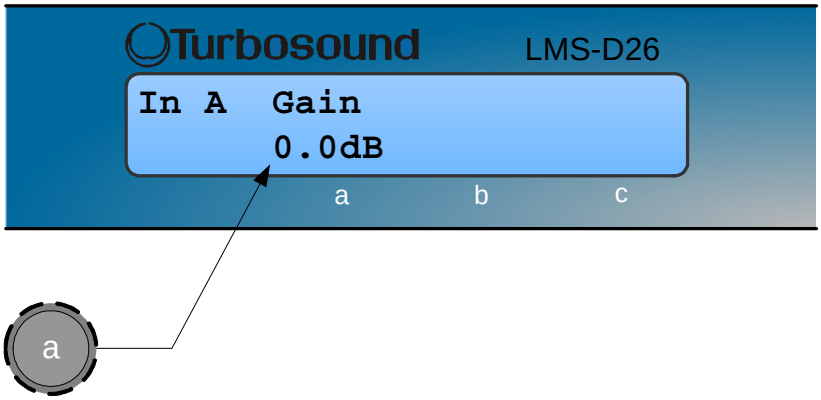
Outputs 2 (routed from L input) and 4 (routed from R input) [2 and 5 for LMS-D26]

Outputs 3 (routed from L input) and 6 (routed from R input) – LMS-D26 only]

DSP PROCESSING

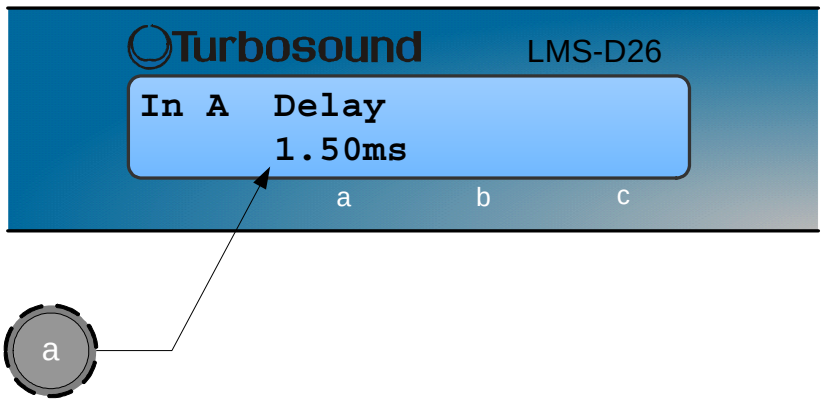
Input Channels

GAIN



Knob A: Gain, adjustable in 0.2dB steps from –80 dB to +20dB

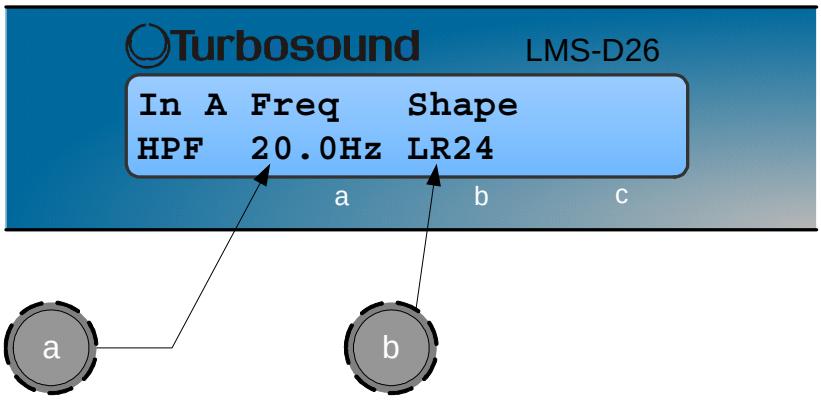
DELAY



Knob A: Delay, adjustable in variable steps from 0 to 400ms

The delay parameter is adjustable in fine steps at low values; the adjustment becomes progressively coarser as the value increases. The velocity sensitive Parameter Knobs therefore provide accurate setting of driver offset delays (typically below 10ms) and rapid setting of longer system alignment delays.

HIGH PASS FILTER



Knob A: Frequency, out (off), 10.0Hz to 25.6kHz in variable steps

Knob B: high pass filter type

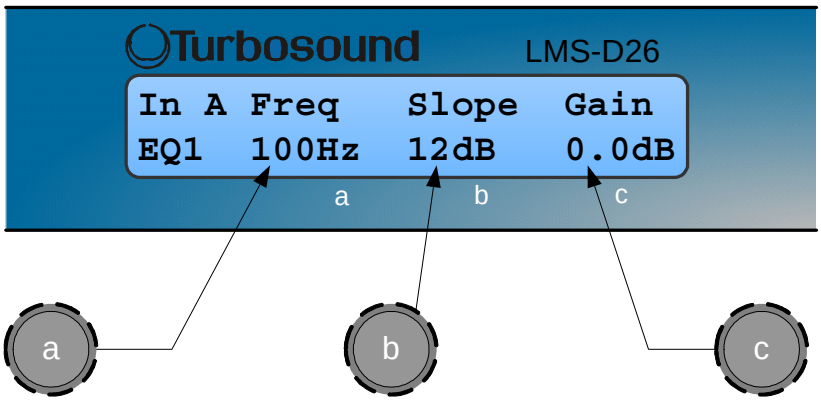
System high pass filtering is provided for the input signal. This is the preferred location for high pass filtering as it affects all outputs and can therefore improve inter-band phase relationships. Filter type is selectable from Butterworth, Bessel, Linkwitz-Riley and Hardman. Filter slopes of up to 4th order or 24dB / octave are provided. Not all filter types are available in all slopes. For example 18dB / octave Linkwitz-Riley filters do not exist.

The Hardman type filter is always described by its' order as the filter becomes progressively steeper rather than following a linear slope so a dB/octave description is not accurate.

Parametric Equalisation

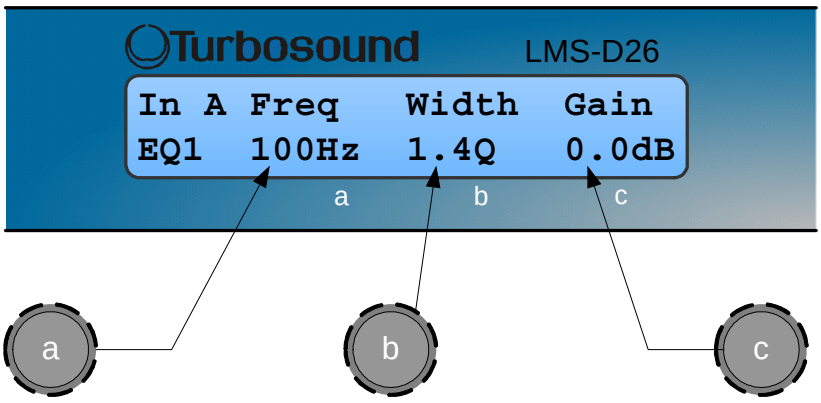
Eight sections of equalisation are provided, two shelving filters and six fully variable parametric sections.

High and Low shelving filters



Knob A: Frequency, 10.0Hz to 25.6kHz in variable steps
Knob B: Slope, 6 to 12dB / octave in 1dB steps
Knob C: Gain, +/-15dB in 0.2dB steps
The frequency is specified as point where the filter deviates by 3dB from the gain value.

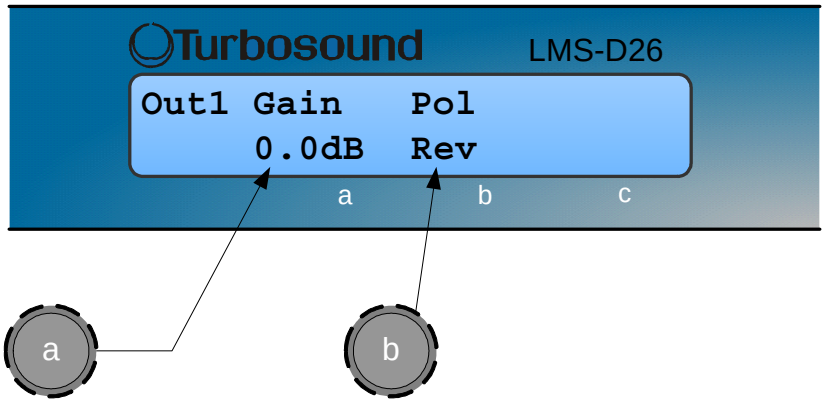
Parametric filters



Knob A, Centre Frequency, 10.0Hz to 25.6kHz in variable steps
Knob B, Width, display selectable, Q or BW (Bandwidth)
BW adjustable from 0.05 to 5 octaves in variable steps
Q adjustable from 14.2 to 0.2 in variable steps
Knob C, Gain, +/-15dB in 0.2dB steps

OUTPUT CHANNELS

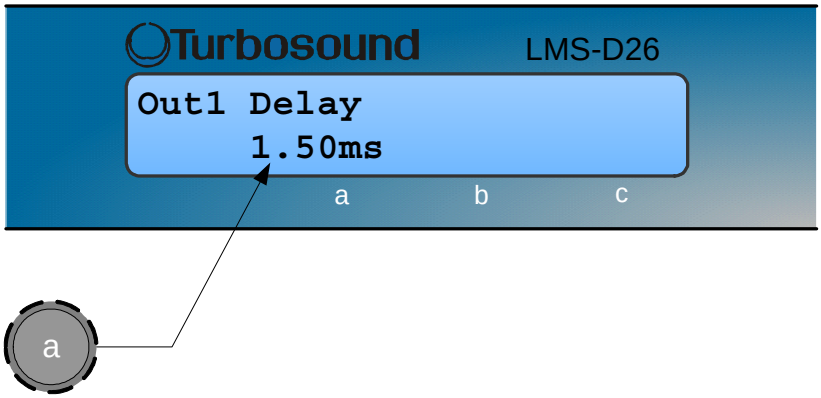
Gain and Polarity



Knob A: Gain, adjustable in 0.2dB steps from –80 dB to +20dB

Knob B: Polarity, selectable, normal or reversed with reference to other outputs

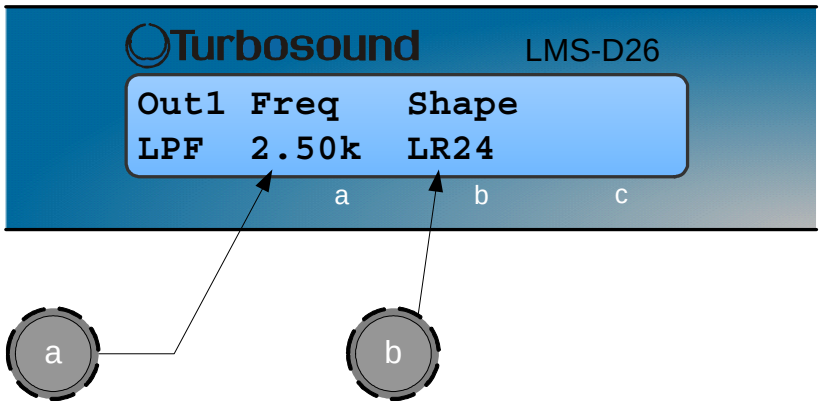
Delay



Knob A: Adjustable in variable steps from 0 to 80ms

As for input delay, velocity sensitive Parameter Knobs provide finer adjustment at low levels and rapid selection of higher values.

High and Low Pass Filters



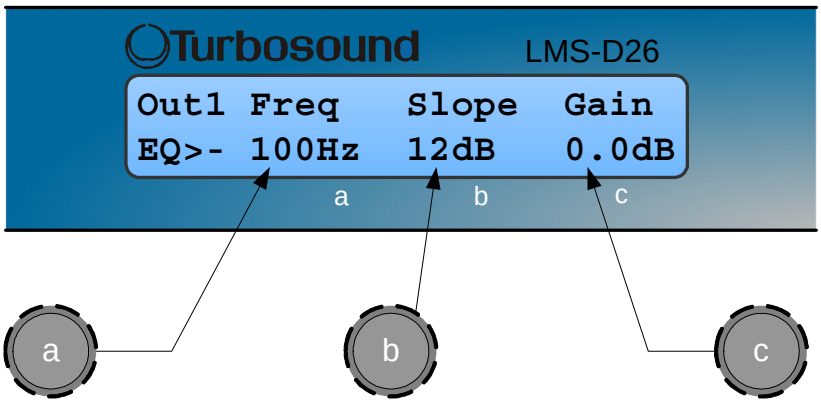
Knob A: Frequency, <<out, 10.0Hz to 25.6kHz, out>>
Knob B: high pass filter type

Filter type is selectable from Butterworth, Bessel, Linkwitz-Riley and Hardman. Filter slopes of up to 8th order or 48dB / octave are provided. Not all filter types are available in all slopes. For example 18dB / octave Linkwitz-Riley filters do not exist.

The Hardman type filter is always described by its' order as the filter becomes progressively steeper rather than following a linear slope so a dB/octave description is not accurate.

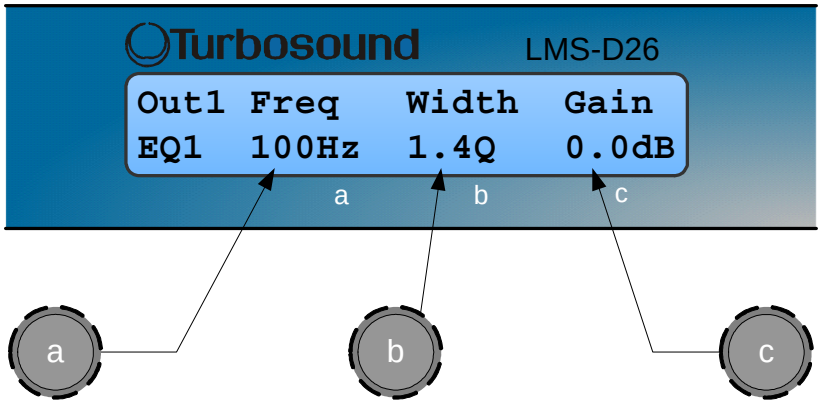
Parametric Equalisation

Eight sections of equalisation are provided in a similar format to the input channel equalisation; two shelving filters and six parametric.



Knob A: Frequency, 10.0Hz to 25.6kHz in variable steps
Knob B: Slope, 6 to 12dB / octave in 1dB steps
Knob C: Gain, +/-15dB in 0.2dB steps

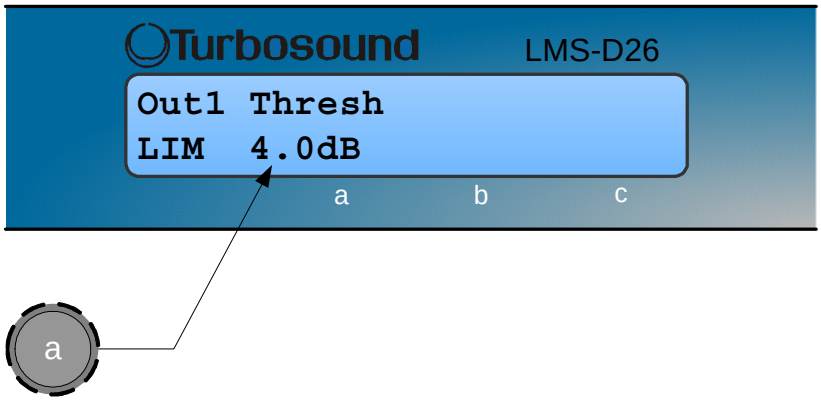
The frequency is specified as point where the filter deviates by 3dB from the gain value.



Knob A, Centre Frequency, 10.0Hz to 25.6kHz in variable steps
Knob B, Width, display selectable, Q or BW (Bandwidth)
BW adjustable from 0.05 to 5 octaves in variable steps

Q adjustable from 14.2 to 0.2 in variable steps
Knob C, Gain, +/-15dB in 0.2dB steps

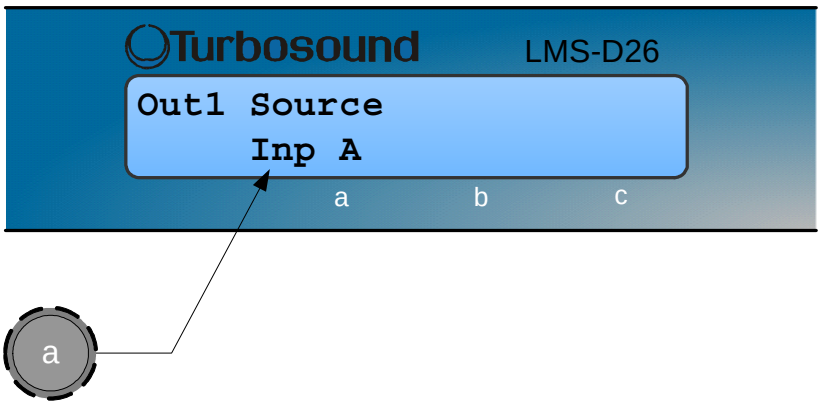
Limiters



Knob A: Threshold, -40dBu to 20dBu in 0.2dB steps

A high performance, low distortion limiter is provided on each output. Threshold is user adjustable; all other parameters are carefully calculated dependant on configuration to provide clean and effective control of signal dynamics.

Routing



Knob A: Output source, selectable; Input A, Input B or Sum A+B

Configures the routing from input to output. This function is only available in mono format Presets.

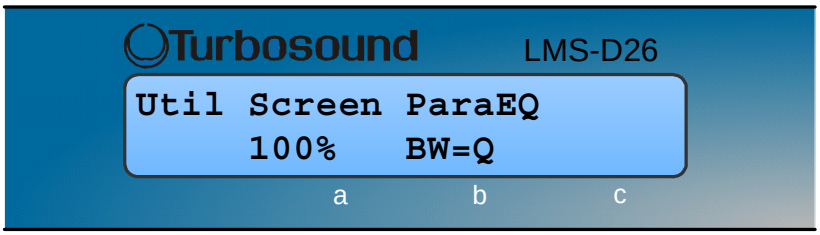
UTILITIES

Utility functions

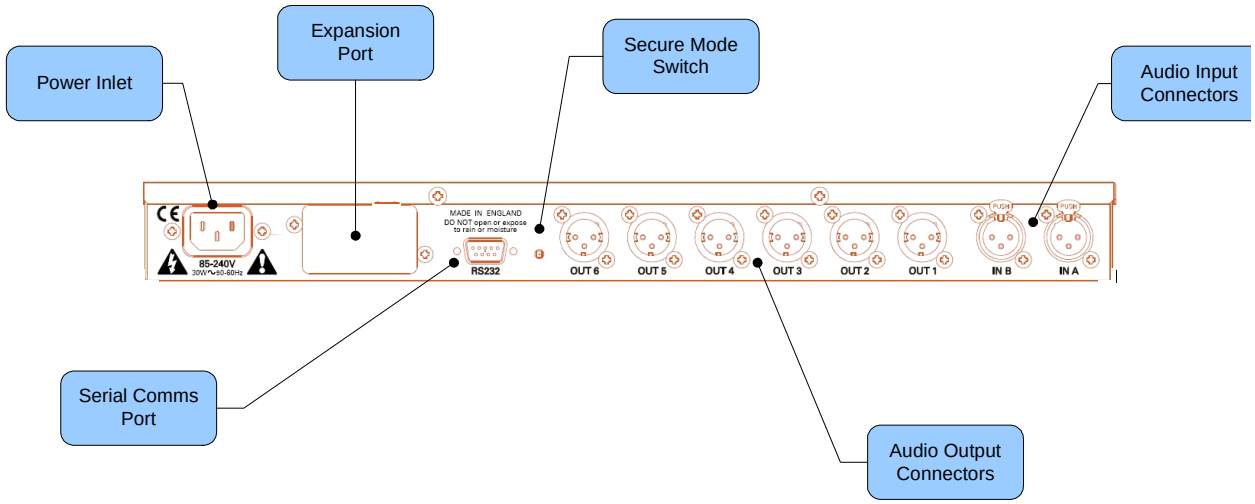
Two utility functions are provided to adjust screen contrast and the display units used for parametric equalisation bandwidth.

The device automatically adjusts for the variations in display contrast as the temperature of the LCD changes. The screen contrast utility control sets the base contrast of the screen and also allows optimization for a given viewing angle.

Parametric equalisation width parameters can be displayed in either 'Q' or bandwidth, expressed in octaves.



Rear Panel Functions



Power Inlet – provides connection to a suitable mains electricity supply using the cable supplied. The controller has a switch mode power supply that is capable of operating with a nominal mains voltage of 80 to 240v, 50/60Hz without re-configuration.

Network expansion port – where a future network card can be fitted.

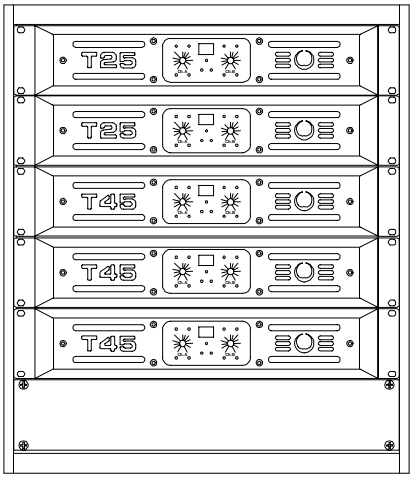
Audio Input connectors – these are fully balanced and are wired pin 1 ground, pin 2 hot and pin 3 cold. The two inputs have pin 1 connected directly to the chassis and feed the signal processing chains. If an unbalanced source is used, a connection should be made between the pin 3 'cold' signal and the ground connection of the unbalanced source.

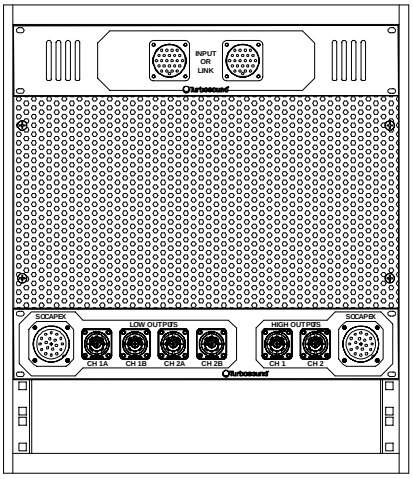
Audio Output connectors – the processed outputs are impedance balanced, and are wired pin 1 ground, pin 2 hot and pin 3 cold. An unbalanced input may be driven by by connecting pin 3 'cold' signal to the ground connection of the unbalanced destination input. Note that output pin-1's are ground lifted at audio frequencies but connected to ground at RF for good EMC performance. The intention being that the amplifiers the processor is driving should be responsible for the grounding of their input cable shields.

Communications port connector – the unit may be controlled entirely from another controller (typically a Personal Computer), running an application that is compliant with the ObCom standard. Connection will normally be made to the controller via this serial port connector. This port is also used for updating the firmware in the unit.

Note: The communications port is NOT disabled when the front panel is made secure using the secure button.

AMP-890 ASPECT SYSTEM AMPLIFICATION RACK





Racking, Cables and Connections

The AMP-890 Aspect amplification system comprises a complete amplifier rack, flightcase and cabling system which is adaptable to the varying requirements of modern concert touring.

The rack contains a total of five lightweight Turbosound T series amplifiers developed and designed in England for Turbosound by MC^2 Audio Ltd.

Input and output connectors are mounted on a pair of 2U 19" panel at the rear of the rack.

The basic rack itself is a space frame fabricated from rectangular steel sections with all necessary mounting points welded in. The top and side apertures are fitted with removable panels to allow easy access to the amplifiers and cabling.

A fully shock mounted road case with four heavy duty castors completes the system, which is designed to fit four across in a standard width truck.

Options

The rack is supplied fitted with five amplifiers as standard.

The two top amplifiers are T-25 models, and power the high frequency and high-mid frequency sections respectively. Three mid-high cabinets will normally be powered from each channel, although it is possible to run up to four cabinets for some extreme applications.

The remaining three amplifiers are all T-45 models and power the low-mid frequency and low frequency sections. Two of these T-45 are dedicated to powering the low frequency section, and the rationale behind this is as follows:

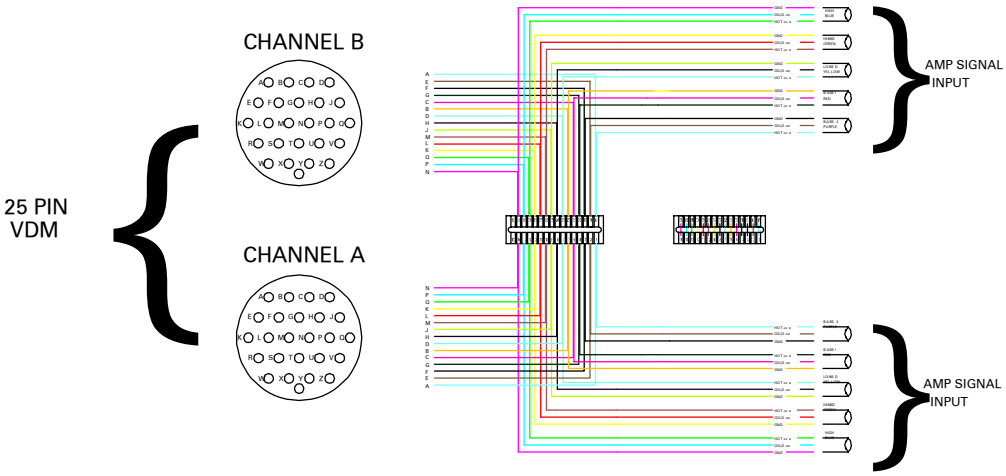
The acoustic output and low frequency cut-off of the TA-890L bass cabinets are dependent on the mutual coupling between enclosures, and on the available amplifier power. With systems of less than 12 bass cabinets per side it is recommended that the ratio of bass cabinets to mid-high is 4:3 or higher (depending on program material and musical style). Therefore the provision of an additional low frequency gives considerable flexibility in the configuration of bass cabinets in small to medium sized systems without carrying extra, and separate, power amplifiers. Alternatively it enables the implementation of a five-way system – using subwoofers for extreme LF energy while complementing the fast, accurate bass response available from the TA-890L – from only one type of rack.

Separate adjustment of the levels of left and right sides of the rack is possible on all frequency bands. Furthermore, the returns system includes a fifth way to be used either as a spare line or in conjunction with TSW-218 for large outdoor systems.

Input Connections

As will be seen from the wiring schedule below, the incoming 11 pin Veam socket is connected via the mono/stereo linking connector to the adjacent link-out Veam and to the XLR male cable plugs which connect LF, LMF, HMF and HF feeds to the amplifiers in the rack. In two-channel mode, the second Veam socket becomes the input connector for the second channel.

Figure 1. Amplifier Rack Signal Wiring



Output Connections

The amplifier outputs are wired to two 19-way CEEP (Socapex compatible) output sockets, rated at 20 Amperes per contact. The Socapex output wiring has been arranged to preclude accidental connection of the mid-high output to anything other than the TA-890H, and of the low frequency output to anything other than the TA-890L, preventing any risk of drive-unit damage.

Two 4 metre fanouts are supplied to take the 19-way cable outputs to the speakers. The low frequency fanout is fitted with six Speakon NL4FC connectors and the Mid-high fanout is fitted with four Speakon NL8FC connectors. The cables are colour coded to indicate which amplifier channels they relate to. Mating connectors are screw-locked, ensuring reliability.

In addition to the Socapex outputs, there are also separate local output connections for running speaker systems not requiring multicore loudspeaker extension cables, for example ground stacked systems.

Figure 2. Mid-High Outputs

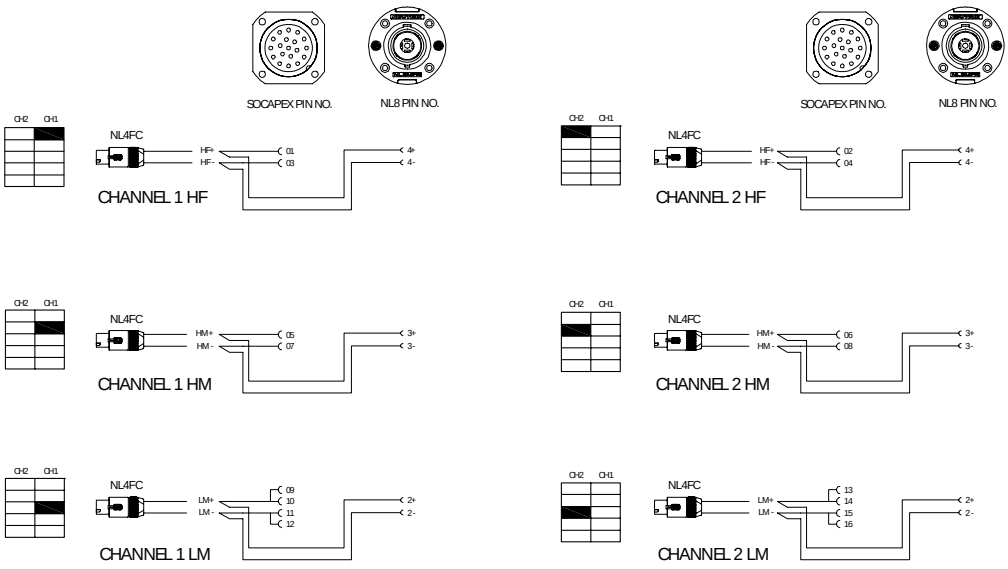
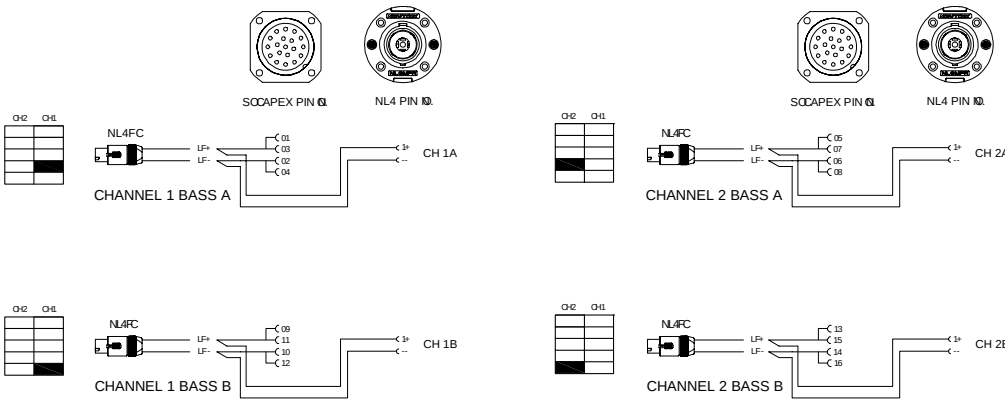
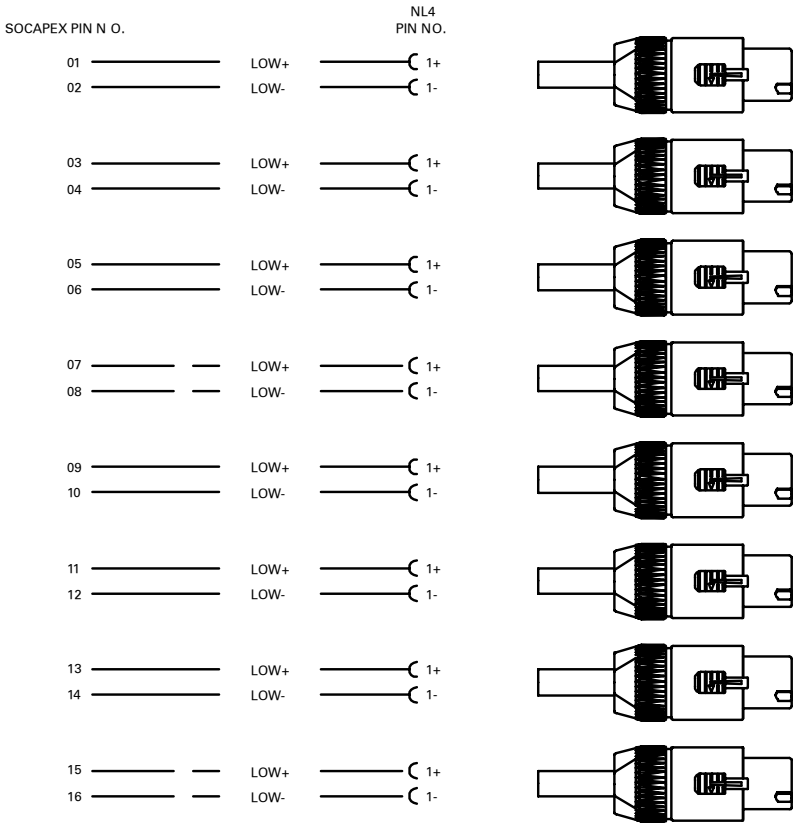


Figure 3. Bass Outputs



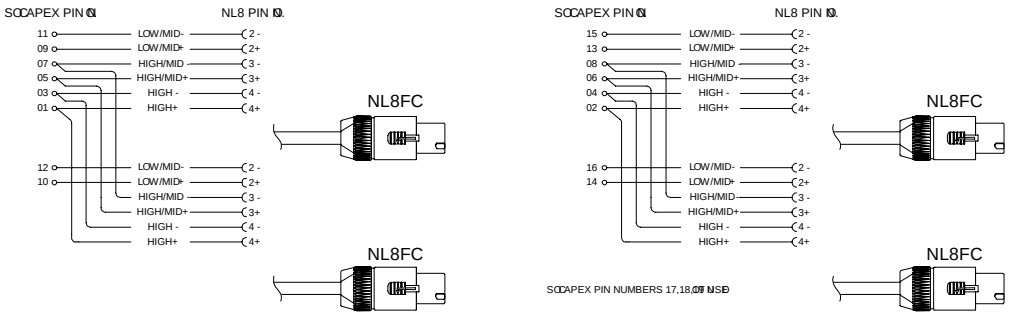
Break-out Cables – NL4 bass



SOCAPEX PIN NUMBERS 17,18,19 NOT USE D

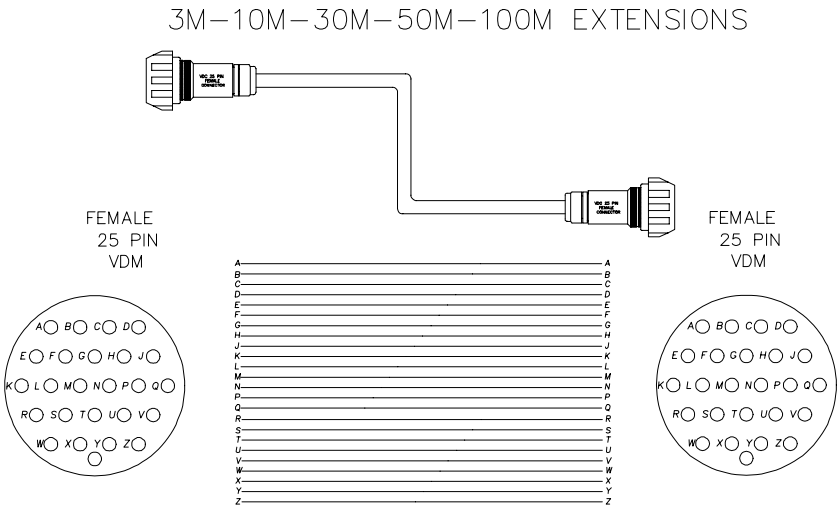
FANOUTS CAN BE SUPPLIED TO EITHER CONNECT 6 OR 8 CABINETS TO TWO AMPLIFIER S

Break-out cables – NL8 mid-high



Extension Cables

25-way extension cables are available to order in 3, 10, 30, 50 and 100 metre lengths (EX-890) for flying and/or remote positioning of amplifier racks. These cables utilise 2.5 mm^2 conductors for low line resistance and are black in colour to minimise visibility to the audience.



Mains Connections

Incoming mains power may be connected by one of a variety of C Form connectors, depending on the power system specified when the rack was ordered. Typical supply configurations are as follows:

110 V star-wired (3 phase)	110 V parallel (1 phase)
220/240 V (3 phase)	220/240 V (1 phase)

The mains power wiring utilises Wago distribution blocks with spring-loaded screwless connectors. The power wiring may therefore be quickly and easily reconfigured should the need arise, for example if conversion from single to three phase operation is required. We recommend you consult a qualified electrician in cases of uncertainty.

T-25 AND T-45 HIGH EFFICIENCY AUDIO POWER AMPLIFIERS

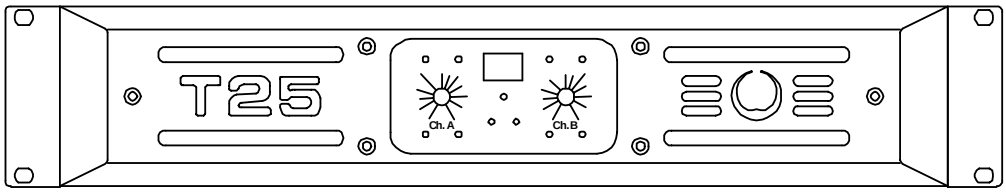
General Features & Facilities

The T-25 and T-45 are highly efficient, lightweight, rugged high power amplifiers, with many original features developed to meet the requirements of modern professional sound reinforcement, for both touring and fixed installations. They have been designed with audio quality ranking equal first alongside utility and ruggedness.

The T-25 and T-45 utilise proprietary progressive switching rail output, which enables extremely high voltage swings and peak power without compromising sonic quality. Fan speed is automatically varied as required to keep the amplifiers within temperature limits. Signal limiters are included to protect speakers from clipped signals. The amplifiers include full DC and short circuit protection to ensure trouble-free service even in harsh environments.

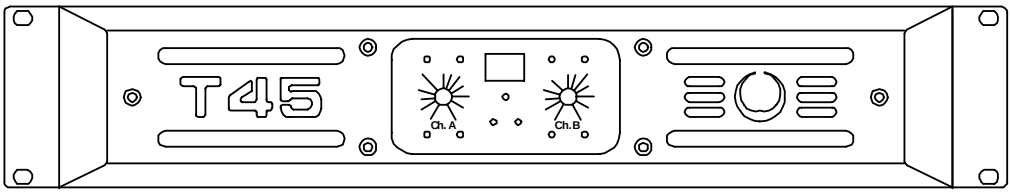
- Two independently controlled and powered channels.
- High continuous power, in excess of 1250 watts per channel into 4 ohms (T-25) and 2250 watts per channel into 4 ohms (T-45).
- -3dB indicators to ensure accurate level monitoring
- Power reduction control (PRC) allows maximum output level to be set below rated power output
- A 10kΩ actively balanced, fully floating input is fitted as standard.
- Front panel display of output device temperature.
- High damping factor, >400 below 1kHz.
- Low noise vari-speed fans for quiet operation.
- Front-panel accessible filter for improved dust collection.
- Consistent reliability and easy serviceability through solid, lightweight construction and modular packaging.

Front Panel Functions T-25



- Mains power rocker switch – applies AC mains power to the amplifier.
- Mains power LED – illuminates when AC power is applied to the amplifier.
- Gain – rotary control which allows the gain of the channel to be adjusted.
- Signal – blue LED indicates signal presence, active from a minimum output level of 10 watts.
- -3dB – yellow LED is active when the signal is 3dB below the limiting level.
- Limit – amber LED indicates operation of the limiters.
- PRC – green LED indicates when the PRC for that channel has been selected.
- Bridge (BRG) – green LED illuminates when bridge mode is selected.
- Fault (A/P) – red LED indicates protection circuit activity.

Front Panel Functions T-45



- Mains power rocker switch – applies AC mains power to the amplifier.
- Mains power LED – illuminates when AC power is applied to the amplifier.
- Gain – rotary control which allows the gain of the channel to be adjusted.
- Signal – blue LED indicates signal presence, active from a minimum output level of 10 watts.
- -3dB – yellow LED is active when the signal is 3dB below the limiting level.
- Limit – amber LED indicates operation of the limiters.
- PRC – green LED indicates when the PRC for that channel has been selected.
- Bridge (BRG) – green LED illuminates when bridge mode is selected.
- Fault (A/P) – red LED indicates protection circuit activity.

Mechanical Installation

When supplied as part of the AMP-890.2 system rack, the amplifiers are pre-installed. If an amplifier is removed from the rack for any reason, it is important to re-install it correctly. The amplifiers must be supported at the front and rear, as originally supplied. Failure to support it adequately may eventually result in vibration-induced metal fatigue of the rack mounting ears and such damage will not be covered by the warranty.

Adequate ventilation is essential, both at the rear of the rack, the sides, and also at the front. This should be considered carefully when placing covers around the racks for protection from inclement weather at outdoor events, or when using blacks to mask them from view. If the venting is inadequate, the amplifier's temperature metering will display this.

CAUTION: Air emerging from the amplifier's high efficiency heat-exchangers can reach 60°C to 70°C. To prevent personal injury or fire, please ensure that people and combustible or flammable materials (e.g. plastic waterproofing, newspaper, clothing, costumes, solvents) are kept at least 2'/0.6m from the amplifier's exhaust outlets. If venting is inadequate, the hot air can adversely affect other equipment, and may soften some thermoplastic enclosures. If using plastic coated cables, take care to dress the leads away from the airflow. Professional-grade rubber cables are not affected.

Mains Power

The T series amplifiers will operate from any international 50 - 60Hz AC mains supply between 110-120 V and 220-240 V. Separate models are supplied to match local mains supply requirements.

Powering Up

When the amplifier is switched on by depressing the black POWER rocker switch, the protection circuit will initially activate whilst the circuits stabilise. Assuming no faults are detected the POWER LED (and the signal LED if signal is present) will light up after a fewe seconds.

Safety Earthing

The Green/Yellow wire on the T-25 and T-45's mains cord must always be connected to the electrical installation's safety Earth (or Ground). It is essential for personal safety. The rack framework is connected to the same grounding circuit.

Voltage Setting

Your models will be set up at the factory for correct operation on your local voltage supply. No further adjustment is necessary.

Voltage Range

The minimum supply voltage over which the amplifier will operate is 180V for the 220-240V range, and 90V for the 110-120V range. Naturally, maximum power output will be reduced accordingly from the published ratings.

The maximum supply voltage which exceeds safe limits and causes the amplifiers to switch-off is in excess of 260 V for 220/240 V range, and 130 V for the 108/120 V range. This is however dependent on load impedance and program drive level as mentioned above.

Obviously, the mains voltage will reach these limits only in exceptional circumstances and the A/P (Audio Protect) LED will then flash.

Audio Connections & Controls

The amplifiers' actively balanced, fully-floating input connections are fuss-free, regardless of the installation's complexity.

The incoming 3-pin XLR plug should be connected, with a high grade twin-core sreened cable, as follows.

Pin 1	Screen - connect to shield
Pin 2	hot (signal +)
Pin 3	cold (signal -)

The shield connection to pin 1 at each amplifier input must be maintained under all circumstances, as TURBOSOUND will not be responsible for consequential damage arising to loudspeakers, etc., should this connection not be made.

The amplifiers are designed to operate with fully balanced equipment. Ground loops or loss of performance may be experienced if connected to unbalanced sources. If it is unavoidable, however, the following wiring convention should be used.

Pin 1	Screen - connect to chassis of the unbalanced equipment, or left disconnected at the unbalanced end
Pin 2	signal hot
Pin 3	Signal cold

Polarity

In accordance with international standards, T series amplifiers are supplied with Pin 2 hot (+), so a positive (+V) input gives a positive (+V) output from the positive (+) output terminals.

Input Impedance

Each amplifier channel has an input impedance of 10kΩ, seen between pins 2 & 3 of the XLR.

When used with the LMS-D6 Loudspeaker Management System, distribution amplifiers are not required when a large number of T-25 or T-45 amplifier inputs are driven in parallel.

Gain and Sensitivity Settings

Gain settings are changed internally by simple jumper links. Two rows of pins marked - GAIN A and GAIN B - are situated on the input PCB (PCB701). A jumper link sets the gain and the settings are as follows:

Link 1 & 2	Gives 32dB gain
Link 3 & 4	Gives 26dB gain
Link 2 & 3	Gives approx 37.5dB gain

NOTE: Factory setting is normally link 1 & 2 = 32dB gain.

Setting higher gain does not change the maximum available power but changes the level of signal input to achieve maximum power. In any case, provided that the input signal is less than 20dBu/7.7V, the built in limiter circuit will prevent distortion within the amplifier.

The gain should be set to match the signal from the source, e.g. mixer, controller, or equaliser.

Attenuation & Gain Setting

The front panel gain controls allow precise level settings, and may be used to adjust the relative levels of sections of a large system, for example downfills or side seating cover in an arena.

The front panel gain controls are also useful when initially checking a system after it has been connected up.

Note that in BRIDGED mode only the Channel A control is active.

Output Connections

A Speakon NL4 connector is provided on each channel.

Damping Factor

The T series amplifier outputs provide a high damping factor, typically 400 times at low audio frequencies. This damping helps the amplifier to control the loudspeaker drive units, provided that the resistance of the intervening cables and connectors is very low. The sonic benefits of high damping factor are most pronounced at bass and low-midrange frequencies (i.e. 10 to 600Hz) providing a subjectively tighter sound as a result of the improved reproduction of transients.

Amplifier damping factor is degraded by high resistance in the loudspeaker circuits; i.e. thin conductors, long output cable runs and tarnished, corroded or loose connections.

Damping factor is maximised by installing cables containing conductors of large cross-sectional area, and by specifying connectors with heavy-duty contacts and waterproof covers. The cable sets supplied with Aspect systems are manufactured to a high specification with these considerations in mind.

Long Speaker Lines

Whenever loudspeakers are connected to power amplifiers by long cables (above 20'/6m), there is invariably an increased risk of high frequency instability. It is aggravated by the combination of RF pickup in unshielded cables acting as aerials, and multiple complex reactances in the cable and loudspeakers.

High frequency instability can be avoided by adopting these common sense rules:

- Ensure the input wires are shielded and that the shield is connected to the amplifier's input XLR pin 1.
- Do not run output cables next to input signal lines. Keep apart, and preferably cross at right angles. If cables have to follow a similar route or path, keep them separated by at least 2 feet (0.6m).

The Cooling System

The cooling fans respond to temperature sensors within the unit to maintain a safe operating temperature. In the event of excessive temperature, the protection circuit will operate, disabling the output. The red 'AUDIO-PROTECT' (A/P) LED will indicate this condition. (See fault indicator.)

There are 4 fans connected permanently with variable speed and a jumper link to enable them from cold.

Normal dynamic signals will not cause the amplifier to overheat unless the ventilation is inadequate. (See installation section and maintenance section.)

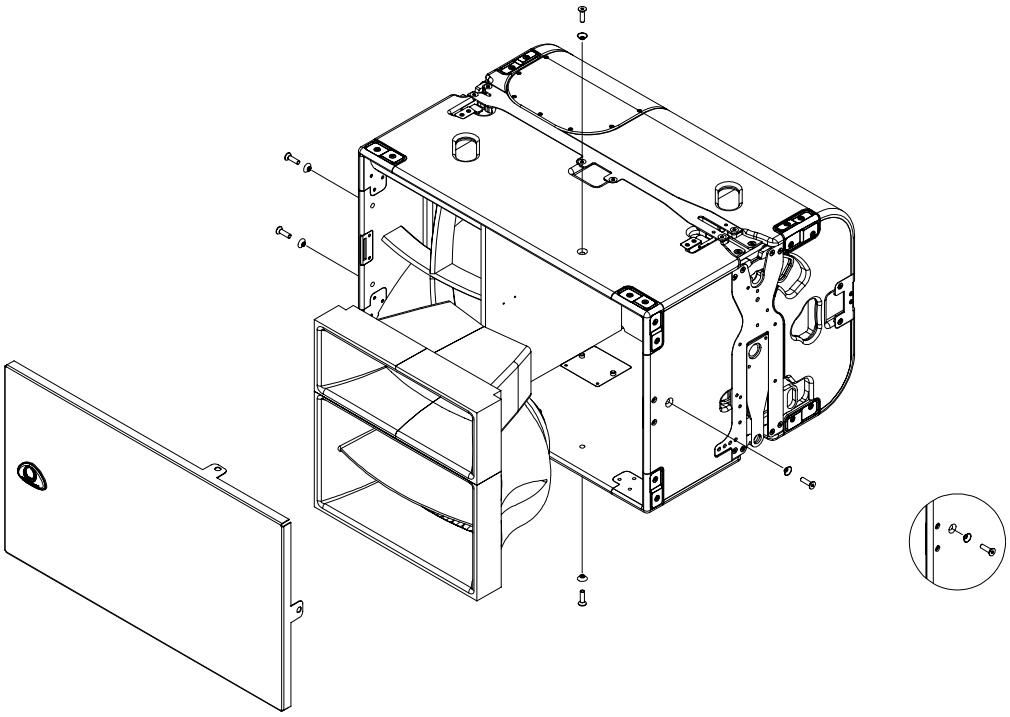
MAINTENANCE

If any of the drive units in your Aspect series cabinet should cease functioning and need to be replaced or repaired, you are advised to remove the faulty unit from the cabinet and send it to a professional service centre authorised to repair Turbosound loudspeakers.

This section covers the removal and replacement of the high frequency drivers and the high-mid driver; and also the procedure to rotate the mid/high section from A (horizontal) to B (vertical) mode, or vice versa.

It is easiest to work on the cabinet when it is placed on its back, either on the floor or on a low workbench. The only tools required for maintenance are:

M5 Allen key
M4 Allen key
Two pairs of long nose pliers
13mm ring spanner or socket



The perforated loudspeaker grille and horn assembly are held in place by five M8 countersunk screws on the top, bottom and sides of the cabinet. Locate and undo these screws using a 5mm hex key or power tool if available.

The grille is a fairly tight fit between the inner edge of the cabinet and the outer surface of the horn assembly, and can only be removed if it remains parallel with the front edge of the cabinet; do not attempt to completely lift one end out first. Using two pairs of needle nose pliers, carefully grip the grille between the perforations and, lifting each end a little at a time, pull the grille upwards until the returns on the grille clear the cabinet. Set the grille aside.

Once the grille has been removed the horn assembly can now be lifted out. Grasp the horn assembly firmly by placing both hands inside the high-mid horn moulding. Pull it straight upwards, making sure it remains parallel with the cabinet front, and away from the cabinet.

To rotate the horn moulding from 'A' mode to 'B' mode

Lift the horn assembly part-way out of the cabinet and rotate it through 90° so that the high frequency horn is now orientated towards the top of the cabinet. Lower it carefully back into the cabinet ensuring that the connecting cables do not snag.

To rotate the horn moulding from 'B' mode to 'A' mode

Lift the horn assembly part-way out of the cabinet as above and rotate it back so that the high frequency horn is now orientated towards the long edge of the cabinet. Lower it carefully back into the cabinet ensuring that the connecting cables do not snag.

Rest the horn assembly on the cabinet edge (a piece of cardboard will help to avoid damaging the woodwork) and disconnect the wires to the high frequency drivers and the high-mid drivers, taking note of the polarity. Place the horn assembly face down on a work bench if it is necessary to repair or replace drive units or diaphragms.

Removal of the high frequency driver

Using an M4 Allen key undo the M5 socket head screws holding the high frequency magnet assemblies in place and carefully lift the magnet assembly away from the rear of the horn.

The high frequency diaphragm can now be removed and replaced if necessary.

Replacement is a straightforward reversal of the removal procedure, but be careful when replacing the magnet assemblies - neodymium magnets are very strong and a steady hand (preferably two) is required when aligning the magnet with the diaphragm.

Removal of the high-mid frequency driver

In order to disassemble the 10" high-mid drive unit you will need to undo the M8 nylock nut on the rear of the high-mid horn assembly with a 13mm spanner or socket. Remove the nut, washer and nylon bushing and carefully pull the drive unit away and off the central threaded spindle.

Replacement is a straightforward reversal of the removal procedure, but be careful when replacing the drive unit - neodymium magnets are very strong and a steady hand (preferably two) is required when aligning the drive unit onto the spindle.

Replace the nylon bushing and flat washer, and make sure that the drive unit frame locates correctly inside the rim of the horn before tightening down the nylock nut.

To replace the horn assembly back in the cabinet, rest it on the cabinet edge while reconnecting the drivers, making sure you observe the correct polarity when reconnecting the cables back into the terminals of the drive units.

Lower the horn assembly into the cabinet and replace the grille, ensuring that the nylon cup washers are replaced before tightening the fixing screws.

Removal of the low-mid frequency drive units

These can be accessed by removing the curved doors on the rear of the cabinet.

To ensure an airtight seal the access doors are fitted with a neoprene gasket. These should be regularly checked to ensure the seal is tight as the gasket can “settle” over time. Once the gasket has settled tightness should be regularly checked as during regular maintenance by ensuring the seal is maintained.

General Maintenance

Cabinets should be inspected regularly as part of a routine maintenance procedure, paying particular attention to the flying hardware and fixings. Aspect enclosures should be inspected after every tour, or during the festival season after all outdoor gigs. Simple and regular application of paint with a roller will ensure the enclosures have the longest lifespan possible without permanent damage to the enclosures.

TA-890 enclosures are fitted with stainless steel fixings. However note that even stainless steel is liable to corrosion and particular care should be taken not to burr screw heads thereby removing surface coating which might accelerate the corrosion process. A regular prgramme of inspection, and where necessary replacement, will ensure that cabinets have a long and safe working life.

Flying hardware

All flying hardware is fully tested before assembly and covered by load test certificates (a sample is reproduced earlier in this manual). Individual test certificates are available upon request.

Regular inspection by a qualified and competent lifting engineer is necessary to ensure the longevity and safety of the system.

Particular attention should be paid to corrosion. Any corroded parts should be replaced. All flying system bolts are fitted using “Loctite 222” to ensure that bolts cannot loosen. As a result any replacement parts must be fitted with the same type of Loctite threadlocker.

It is essential that the droplinks are regularly checked on each cabinet for any permanent deformity. Damaged flying hardware should never be used for stacking or lifting under any circumstances.

Paintwork

Turbosound Aspect Series enclosures are coated with industry-standard Warnecke and Bohm water-based paint.

This has several advantages: it is pollution-free and therefore safe to apply in a suitable vented area, and it offers the greatest strength and bond properties possible from a water-based wood paint. A primer coat is not required on bare wood, and paint may be applied successfully on top of existing coats, ensuring simple maintenance in the field.

However as with any loudspeaker enclosures used in typical touring conditions it is essential that paintwork is regularly and sensibly maintained to ensure longevity.

Aspect series enclosures offer an extremely compact package to deal with the requirements of modern touring and as such are a relatively dense wooden enclosure. Should regular impacts cause the paint to crack it is essential that this is dealt with quickly and efficiently to prevent further damage. Observe the following precautions:

- remove any loose flakes caused by the impact
- gently sand the top surface of the paint
- roll the enclosure with a single thick coat of paint
- wait 3 hours and apply a second coat
- do not expose to moisture for a further 24 hours

Should serious damage happen to an enclosure (for example if it is dropped) it may be necessary to fill and respray the enclosure. This should be done by an experienced paint shop. if you require any help with this please contact Turbosound or your local dealer for service advice.

Do not work with enclosures with damaged paintwork especially for outdoor use. Due to the nature of modern touring these enclosures can be exposed to moisture. Untreated and exposed woodwork will absorb water. Aspect enclosures are screwed and glued together to prevent any serious structural damage due to water absorption. However increased exposure will cause the bond between wood and the paint to fail, at which stage it will be necessary to sand back the enclosure to bare wood and repaint to ensure long-term protection.

There are three simple ways to help maintain the longevity of your Turbosound Aspect 890 series enclosures:

The majority of paintwork damage is mostly caused during transportation and flying of the systems. For large scale touring Turbosound recommends using the four-high WB-8904 and WB-8904T wheelboards and stabiliser trucks. This inherently protects the enclosures against impact protected by the feet, flying hardware and securing strap.

Due to the weight of a fully loaded wheelboard it is essential that adequate protection is provided in the truck, BARS SHOULD BE USED TO ENSURE THE SYSTEM CANNOT MOVE DURING TRANSIT.

Turbosound supplies heavy duty transit covers to help protect against long term damage during transit (see page 14). drawings are available from Turbosound which will enable you to have covers manufactured locally should you prefer.

TECHNICAL SPECIFICATIONS

	TA-890H	TA-890L	TSW-218
Dimensions	795 x 477 x 574mm 31.3″ x 18.8″ x 22.6″	795 x 477 x 574mm 31.3″ x 18.8″ x 22.6″	574 x 1400 x 770mm 22.6″ x 55.1″ x 30.3″
Net weight	76 kgs 167 lbs	68 kgs 150 lbs	110 kgs 242 lbs
Power handling	LMF: 500 watts rms HMF: 200 watts rms HF: 100 watts rms	1100 watts rms	1200 watts rms
Sensitivity (1w @ 1m)	LMF: 107dB HMF: 114dB HF: 114dB	101dB	104dB
Frequency range (±4dB)	95Hz – 20kHz	45Hz – 250Hz	35Hz – 150Hz
Array angle (@ -6dB points)	25°h x 15°v	n/a	n/a
Maximum SPL (continuous)	140dB	132dB	135dB
Connectors	Neutrik Speakon NL8	Neutrik Speakon NL4	Neutrik Speakon NL4

WARRANTY

All products in this manual are warranted by Turbosound Limited to the original end-user purchaser against defects in workmanship and materials used in its manufacture for a period of one year on electronics products and two years on loudspeaker products from date of shipment to the end user.

Faults arising from misuse, unauthorised modifications or accidents are not covered by this warranty. No other warranty is expressed or implied.

This warranty does not affect any statutory rights of the purchaser.

Should any fault develop with a component of your Turbosound system the faulty unit should be sent, in its original packaging, to the supplier or your local authorised Turbosound dealer with the shipping prepaid.

You should include a written statement listing the faults found, and the product serial number must be quoted ion all correspondence relating to the claim.

IMPORTANT: We recommend you record your purchase information here for future reference.

DEALERS NAME: .....

ADDRESS: .....

PHONE NO: .....

INVOICE/RECEIPT NO./DATE . .....

SERIAL NUMBERS

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In keeping with our policy of continual improvement, Turbosound Limited reserves the right to alter specifications without prior notice.

Turbosound Limited

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United Kingdom