ASPECT TA-880 SYSTEM

USER MANUAL

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EC DECLARATION OF CONFORMITY

Manufacturer
Turbosound Ltd
Star Road, Partridge Green, West Sussex, RH13 8RY

Products
T-25 Power Amplifier
T-45 Power Amplifier
LMS-D6 Controller
LMS-D26 Controller
LMS-D24 Controller

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.

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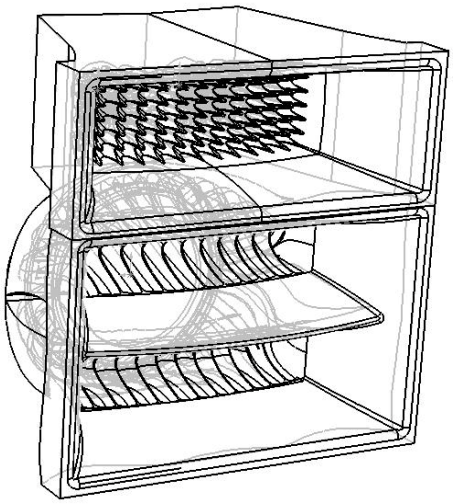
INTRODUCTION

Turbosound Aspect System Concepts

The TA-880 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 ground-stacked and flown concert touring down 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, Polyhorns develop more consistent frequency response across all seats of an auditorium with minimal interference between adjacent enclosures.

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 phase-coherent and smoothly-curved wavefronts which match the array curvature, whose centre becomes the virtual point source.



The TA-880H trapezoidal mid/high enclosure forms the main component of ground-stacked or flown arrays. It can also be employed as a front or side fill cabinet. The TA-880HM high-mid enclosure and TA-880LM low-mid enclosure are available for use in specific fill applications to cover near-field audience areas such as downfills or front-of-stage fills. The TA-880L low frequency enclosure is designed to be ground stacked in bass arrays as well as providing ground support for TA-880 enclosures.

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The Aspect Polyhorn™ Concept

The patented Polyhorn™ design effectively solves the problem of the tendency for exponential horns to beam with increasing frequency. Dividing the multi-cellular horn into multiple tapered waveguides guarantees that the path length of each micro-horn is equal from the surface of the driver diaphragm to the horn mouth, and ensures that all frequencies from all parts of the diaphragm arrive at the horn mouth together. This provides the wavefront with uniformity of phase. A further benefit of the Polyhorn™ geometry is that the sound wave does not suffer from edge-diffraction effects which have a tendency to confuse the directionality of the sound source.

Each cabinet in an array of Aspect loudspeakers contribute to the generation of a single, cohesive, and more or less continuous wavefront without noticeable comb-filtering effects. In addition, the Polyhorn™ design offers the possibility of locating the acoustic centre well behind the motor system and even the enclosure. The wavefront radii can now be arranged to coincide with the array curvature, forming a single virtual point source.

Because of the Polyhorn™ design's sharp cut-off, its array angle can in practice be taken as being the same as the dispersion angle.

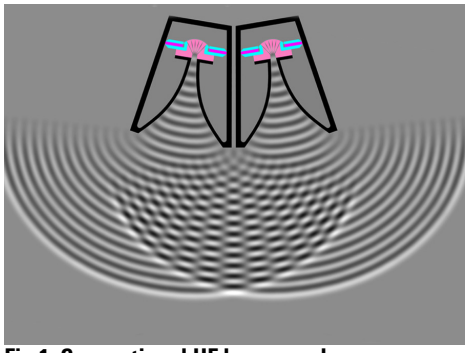

Fig 1. Conventional HF horns produce destructive interference

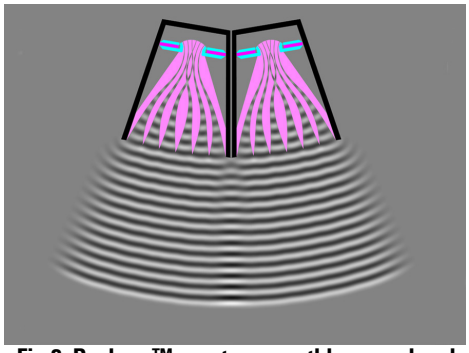

Fig 2. Poyhorn™ creates smoothly curved and phase-coherent wavefront

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Aspect TA-880 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 system 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.

The standard trapezoidal Aspect integrated sound system consists of:

- TA-880H mid-high enclosures and TA-880L enclosures
- Flybars, 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

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The Loudspeaker Management System (LMS) Concept

Turbosound Loudspeaker Management Systems are more than just electronic crossovers. As well as steep slope active filters and high performance limiters, they provide full digital alignment of all components in the Aspect enclosures, to ensure a coherent acoustic output. They also incorporates a number of features which contribute to overall system reliability and ease of setting-up and use.

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 can be 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-D26/D6 Loudspeaker Management Systems

Use of the LMS-D26 or LMS-D6 loudspeaker management system 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

The 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 signal 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.

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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 224. 226 and 428

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.

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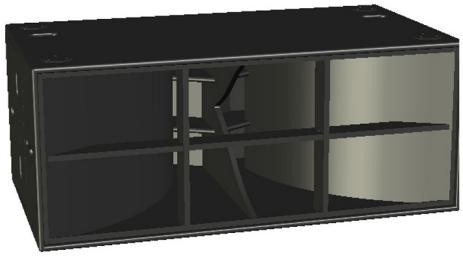
TA-880L Low Frequency Enclosure

The TA-880L low frequency enclosure covers the low frequency range from 40Hz up to 100Hz. It contains two very high power 15" neodymium drive units loaded with TurboBass™ devices. The TA-880L is a very compact enclosure 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 is designed to be ground-stacked.

TSW-218 Subwoofer



The TSW-218 is designed to cover the sub and low frequency ranges from 25Hz to 160Hz, 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 adjeacent enclosures, resulting in sensitivity gains of up to 110dB with eight units coupled.

TA-880H Mid/High Enclosure

The TA-880H 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-880H 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.

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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-880H can be equipped for touring applications with an external flying system consisting of removeable swords and fixed angle flybars.

TA-880HM High-Mid Enclosure

The TA-880HM enclosure contains high frequency and high/mid frequency elements only and is designed is to be used as a downfill or in-fill enclosure, either flown or ground-stacked. It covers the frequency range from 405Hz to 20kHz, and provides a coverage pattern of 25°H x 15°V.

The TA-880 external flying system of removeable swords allows all types of TA-880 enclosures to be combined freely in flown clusters.

TA-880LM Low-Mid Enclosure

The TA-880LM enclosure is a low-mid frequency only enclosure and is designed is to be used as a downfill or in-fill enclosure, either flown or ground-stacked. It covers the frequency range from 100Hz to 405Hz.

As with the TA-880HM above, it can be combined into TA-880 clusters using removeable swords.

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Transportation

An optional WB-880H wheelboard is available which clips on to the front of the TA-880H 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 unecessary floor space.

TA-880L bass cabinets are fitted with heavy duty wheels.

Optional heavy duty transit covers are available for TA-880H cabinets. These simply slide over the box and fasten underneath the cabinet with velcro straps.

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Aspect trapezoidal Flying System

To take full advantage of the very precise dispersion properties of the Aspect system, an external rigging system has been developed. The flying systems are inherently safe, flexible and simple to use. 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 vertical angles between enclosures and their vertical inclination, to suit a wide variety of requirements.

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FLYING AND STACKING

Overview

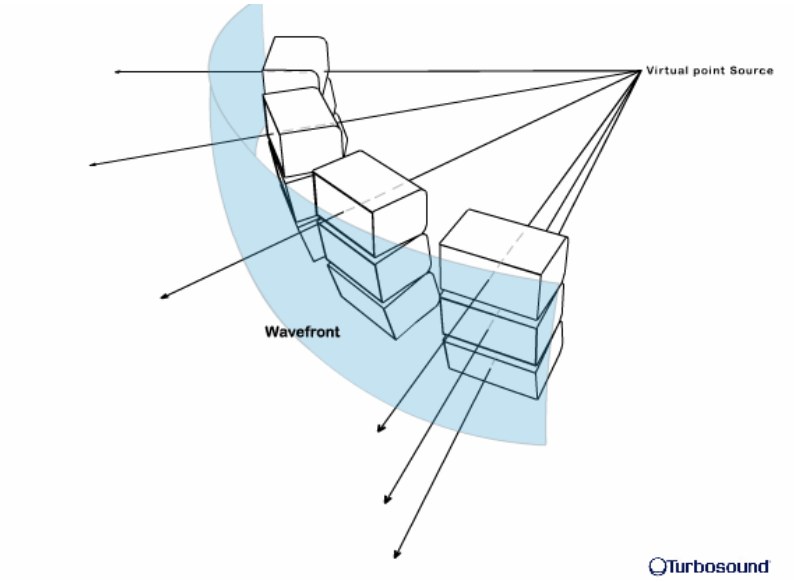
The Aspect system flying hardware is specifically designed to take advantage of the precise horizontal directivity characteristics, as well as allow a wide range of adjustment of the vertical angles between adjacent enclosures, and the overall vertical inclination of each column of enclosures. This means 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 a point-source loudspeaker 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 of sound behind the array.

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.



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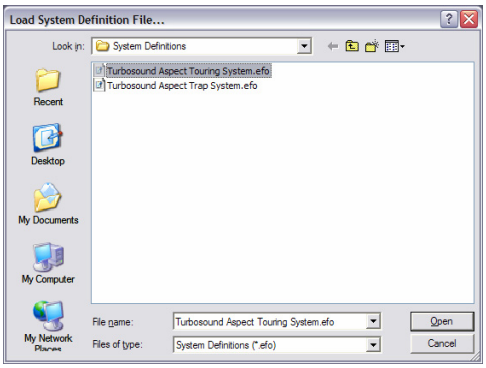
GIGMATE™ ACOUSTIC SIMULATION

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.

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 Trapezoidal version of Aspect.

You will now be presented with the GigMate main screen.

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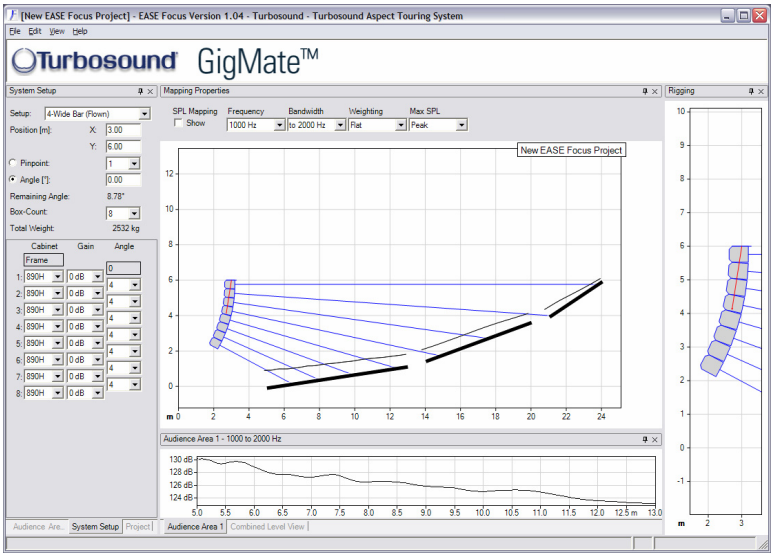

The screen is split into four main areas:

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.

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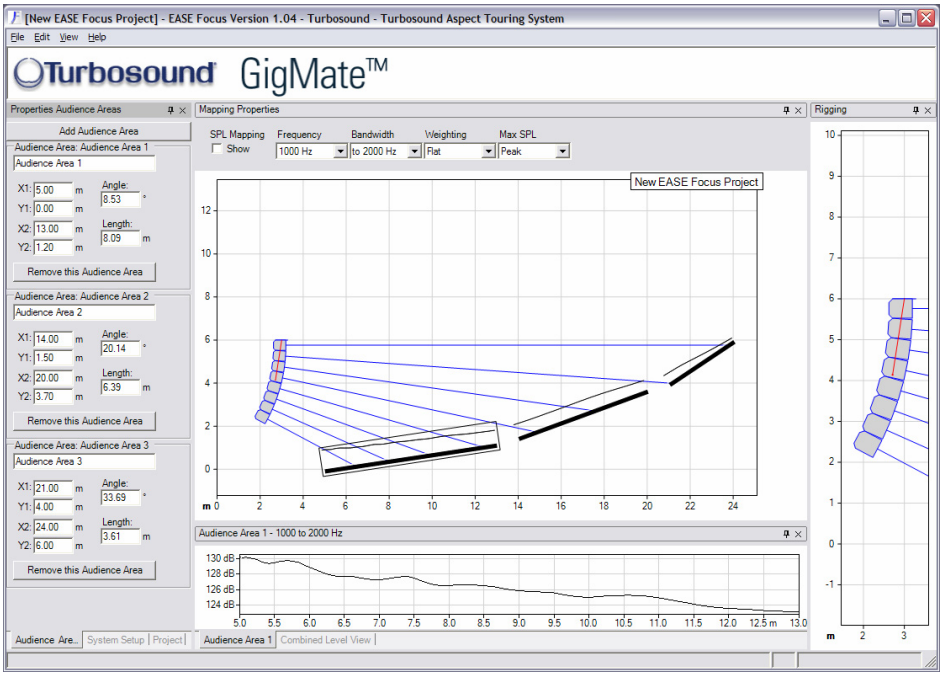
Designing a system

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 show 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.

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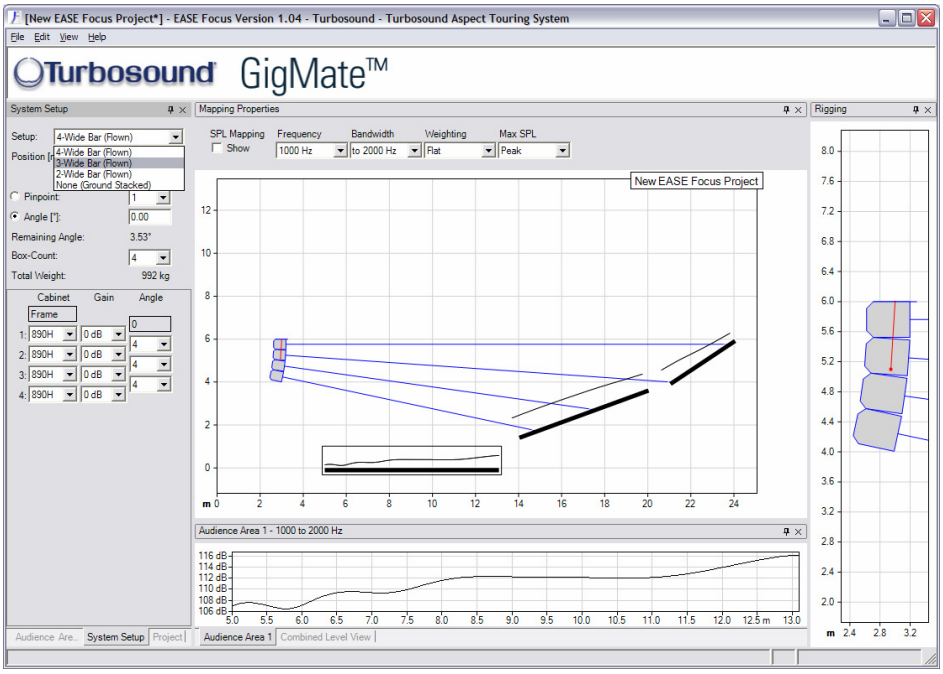

Now select the number of cabinets deep that you wish to hang or stack in the “Box Count” dropdown. Trim height, or PA wing height can now be set in the “Position” field.

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 intercabinet angle to achieve optimum coverage.

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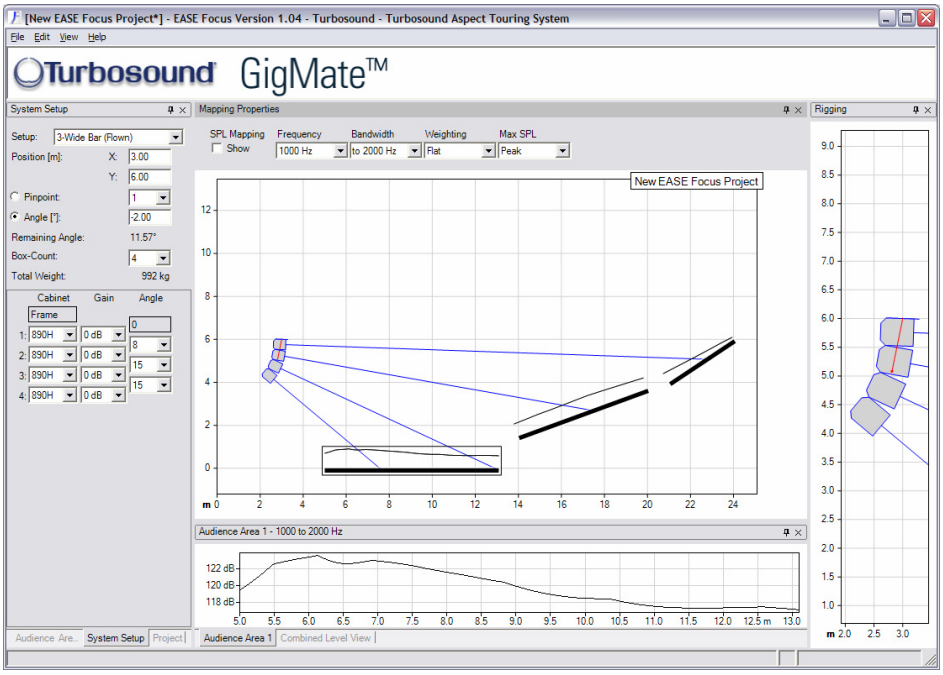
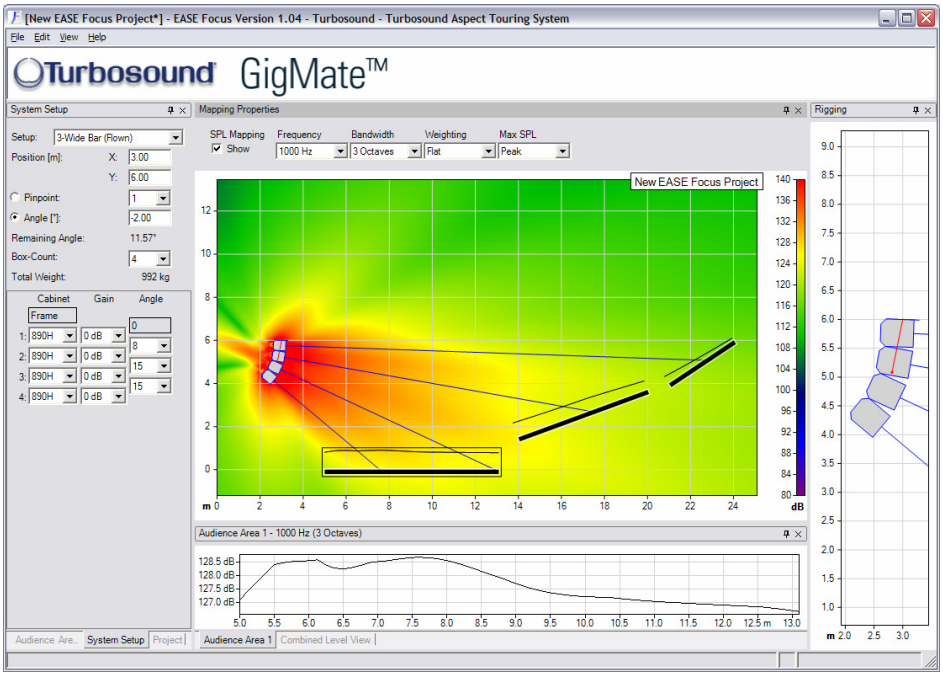


Now that the general design has been established the system performance must be mapped. At the top of the main window there is an “SPL Mapping” checkbox. This will map the system output at the frequency and bandwidth selected in the adjacent dropdown boxes. For most applications a 3 octave mapping gives realistic and useful data.



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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 op each area, Selecting the “Combined Level View” tab will show the SPL across all areas simultaneously.

Now that the system is mapped the intercabinet 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.

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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.

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Sample Certificate of Load Test

TECHNIQUE
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RECORD OF LOAD TEST

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

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FLYING HARDWARE

The Aspect TA-880 flying system consists as follows:

- Flying swords and safety lynch-pins – support a single cabinet.
- Flying chains – link the top row to flybars.
- Twin bar – supports two vertical columns.
- Triple bar – supports three vertical columns
- Chain bridles for twin and triple bars

The flying system is based around the use of removeable flying swords which pass through slots machined in the enclosure and are held captive by safety linch-pins through holes in the swords, locating into load-rated metal fixings incorporated into the handle boxes. The flying system eliminates the need for costly integral flying hardware, thereby not penalising those users who exclusiv ely ground stack and therefore have no flying requirements.

Horizontal Coverage

Because the Polyhorn's design dramatically reduces the acoustic energy outside of the specified 25° horizontal dispersion pattern, it is recommended that Aspect TA-880 enclosures always be arrayed in a smooth even curve, resulting in an array angle of 25° between boxes. Based on this assumption 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.

The following table illustrates how many columns of loudspeakers and which flybars should be used to achieve a given horizontal coverage.

Required Horizontal Coverage	Number of Colums	Flybar
25°	Single column	N/A
50°	Two columns	FB-880/2W
75°	Three columns	FB-880/3W

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Vertical Coverage

Vertical coverage is dictated by the physical dimensions of the room and the location of the audience spaces. The number of boxes required in a vertical column is therefore determined by a number of factors including the trim height of the cluster, the vertical coverage you are trying to achieve, and the distance or projection required.

Wide and Narrow Flybar settings

The flybars are equipped with two choices of cabinet suspension tabs and tilt strap points for each column of loudspeakers. These are provided in order to accommodate different numbers of cabinets in a vertical column. The narrow setting is sufficient when flying columns up to two deep. However when flying three or four cabinets deep the wide setting - with its wider horizontal spacing - allows sufficient downward tilt before the backs of the lower boxes touch.

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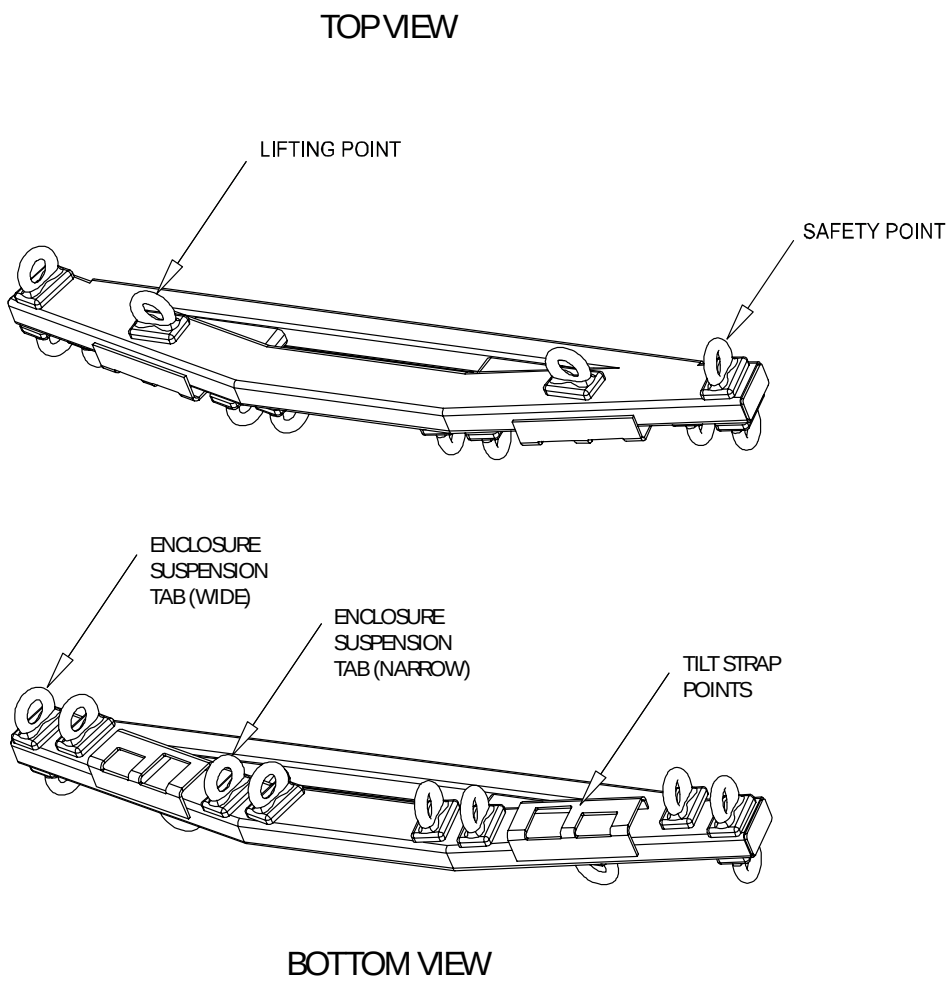
Two-wide trapezoidal flybar FB-880/2W



The **FB-880/2W two-wide flybar** is a fixed angle double bar designed to fly two vertical columns of cabinets up to four deep per column. It provides alternative cabinet suspension tabs and tilt strap points for narrow or wide configurations (when flying more than two boxes deep the wide configuration allows for the additional amount of kelp required).

The FB-880/2W has a net weight of 18 kgs.

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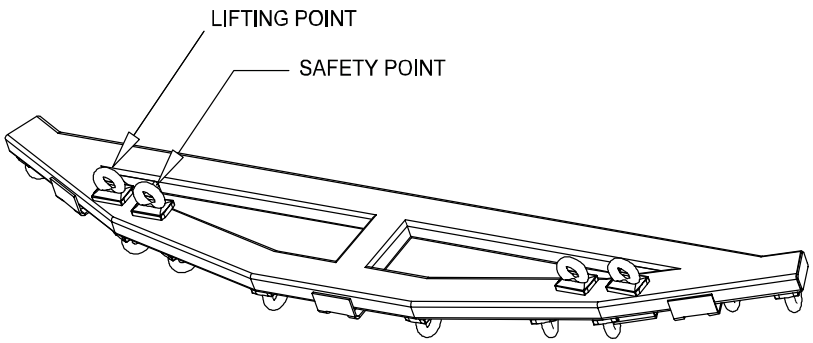
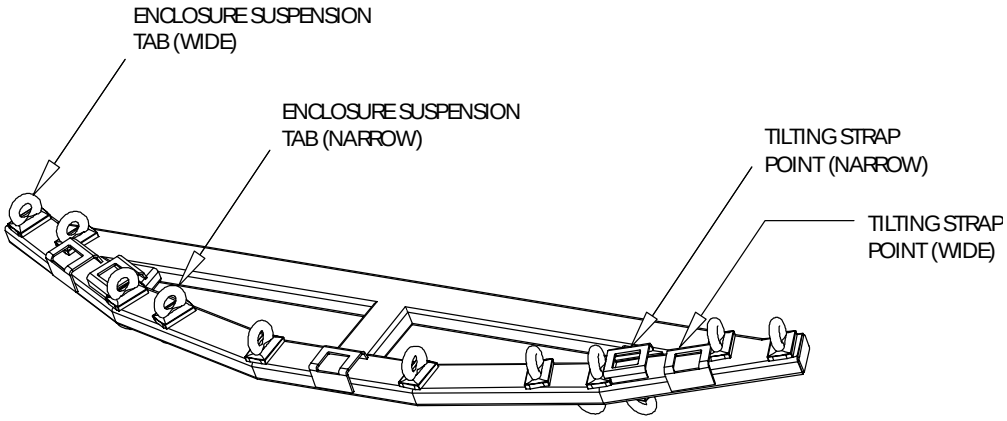
Three-wide trapezoidal flybar FB-880/3W

TOP VIEW





BOTTOM VIEW

The **FB-880/3W three-wide flybar** is a fixed angle triple bar designed to fly three vertical columns of cabinets up to a total of four deep per column. It provides alternative cabinet suspension tabs and tilt strap points for regular (up to two cabinets deep) or wide configurations (when flying more than two boxes deep the wide configuration allows for the additional amount of kelp required), lifting points and safety points.

The FB-880/3W has a net weight of 21 kgs

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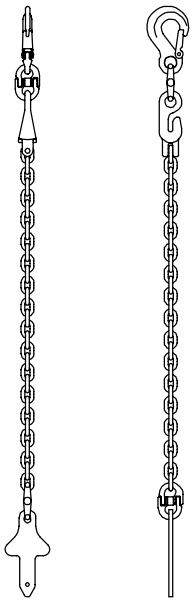
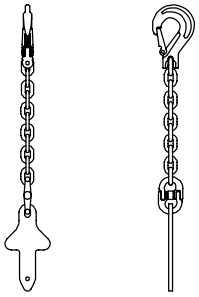
Flying Chains

Flying chains are available in two lengths.



FC-880
CHOKED CHAIN
ASSEMBLY



FC-880S
SHORT CHAIN ASSEMBLY

The **FC-880S flying chain** is a short chain designed for linking the top row (or single row) of cabinets to the flybar. It consists of a top hook, chain, connex connector and dagger. The dagger is provided with a single hole for attachment inside the cabinet's sword box using a safety linch pin. Use the short chain to gain more height on the system and also improve the looks of the cluster.

The longer **FC-880 flying chain** allows for forward displacement of the speaker cluster and easier ratcheting when flying three or four cabinets deep with a lot of tilt. It is adjustable, and can be shorted as required using the choke.

Chains are universal (not handed) and therefore can be used for either side of the cabinet. FC-880 flying chains are load tested to 250kg with a safety factor of 4:1.

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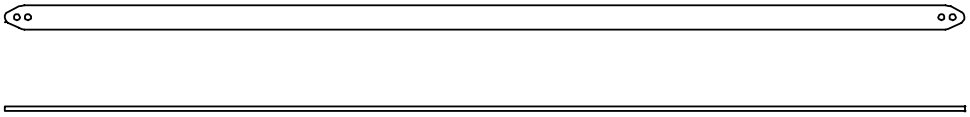
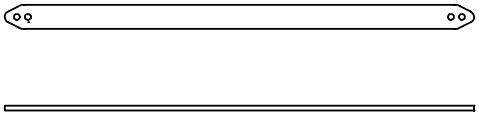
Flying Swords

Three types of flying sword are available:

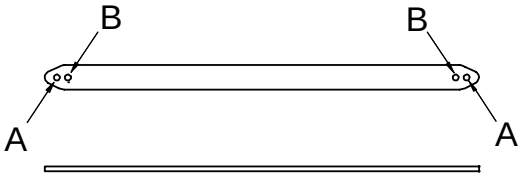
- **SW-880H swords** are used to fly TA-880H mid/high enclosures.
- **SW-880HM swords** are used to fly TA-880HM high-mid enclosures.
- **SW-880LM swords** are used to fly TA-880LM low-mid enclosures.



SW-880H FLYING SWORD



SW-880HM FLYING SWORD



SW-880LM FLYING SWORD

Flying swords are fabricated from steel and are provided with two locating holes at each end, and these allow for a range of vertical inter-cabinet angles.

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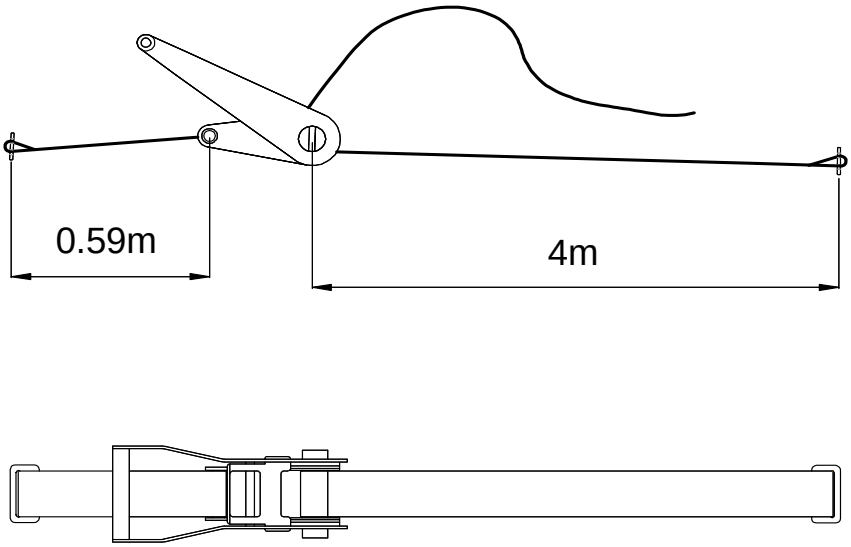
Tilting Strap



The **TS-890 tilting strap** 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 rear 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 be increased or reduced incrementally.

The TS-890 tilt strap has a net weight of 2.5kgs (5.5lbs).

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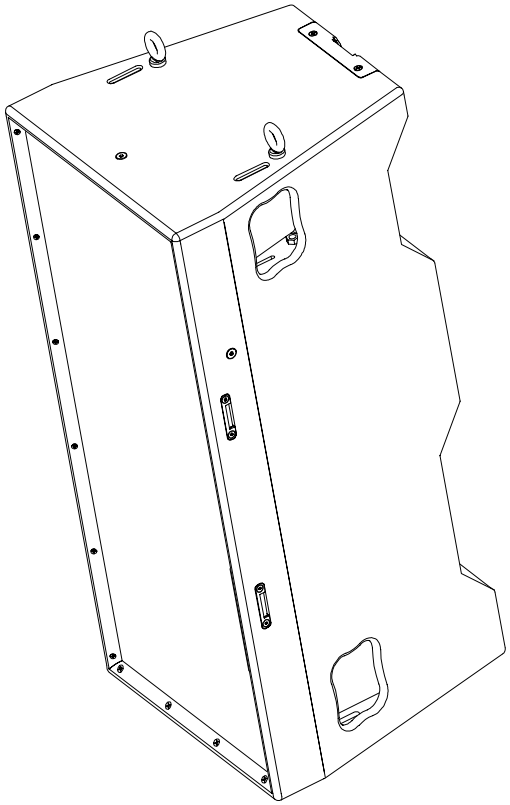
Flying a single TA-880 trapezoidal cabinet using M10 eyebolts

The simplest method of flying a TA-880H cabinet is with a pair of M10 shoulder eyebolts on the top, using a third eyebolt on the rear of the cabinet to tilt the cabinet.

1. Remove the two countersunk M10 screws located just behind the sword slots in the top of the cabinet.

2. Replace these with M10 shoulder eyebolts with a minimum thread length of 20mm (3/4")

3. Angle the cabinet as necessary using the third eyebolt position on the rear of the cabinet.



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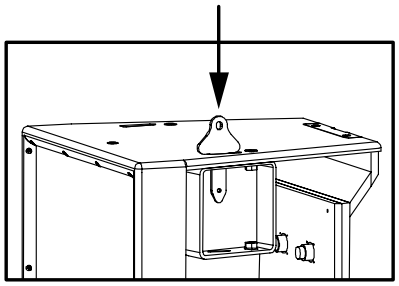
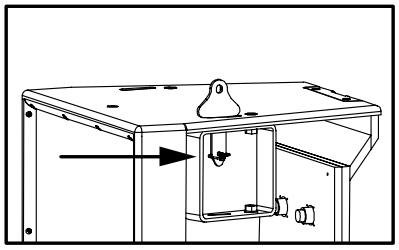
Flying a single TA-880 trapezoidal cabinet using FC-880 chains

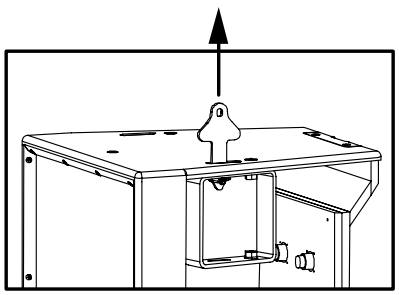
A single cabinet can be flown using a pair of **FC-880S short chains** and daggers. These simply pass through slots in the top of the cabinet and are secured with safety linch-pins inside the handle boxes. Connect FC-880S short flying chains to the appropriate suspension tabs on the flybar and check that the daggers line up with the slots. In the diagrams below only one dagger is shown for clarity.



1. Insert a dagger through the slot machined in the top of the cabinet and into the handle box as illustrated in the cutaway drawing above. The tip of the dagger located in the sword box will be visible through the handle hole. Repeat with the second flying chain and dagger.



2. Insert a **SL-880 safety linch-pin** through the small hole in the dagger from the outside of the box, and secure it by snapping the safety linch-pin so that it loops around the back of the dagger. Repeat with the second linch-pin and dagger.



3. When the cabinet is lifted the dagger is held in place by the safety linch-pin, while the slot allows the cabinet to be freely tilted.

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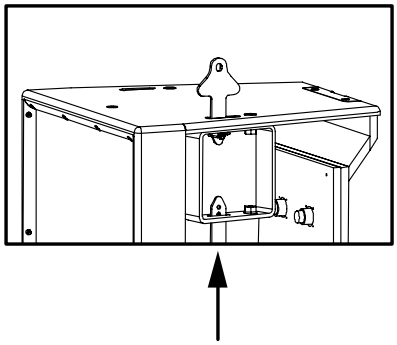
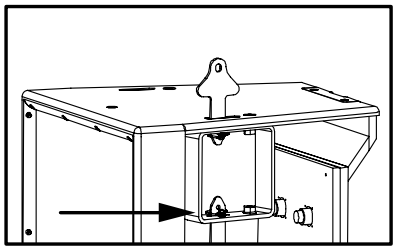
Flying a vertical column of TA-880 trapezoidal cabinets

When flying more than one cabinet deep you will need to use **SW-880H swords** to suspend and correctly position the second and subsequent cabinets. These make use of the internal sword boxes in the trapezoidal cabinet in the same way as the flying chain and dagger, and ensure that the entire weight of the column is taken through the metalwork and not through the woodwork of the cabinet. Note that there are two holes in each end of the flying sword; selection of these determines the vertical angle between cabinets and is explained in the table and diagrams below.



1. Lift the first cabinet high enough to allow access to the bottom of the cabinet. Insert **SW-880H flying swords** into the cabinet from the bottom, passing them up through the box, and align them with the lower slots in the sword boxes. You will be able to judge the position of the sword by looking through the top handle box.



2. Secure the swords on both sides of the cabinet using **SL-880 safety linch-pins**.

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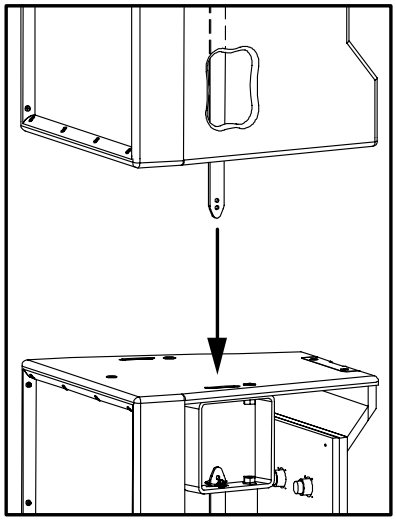
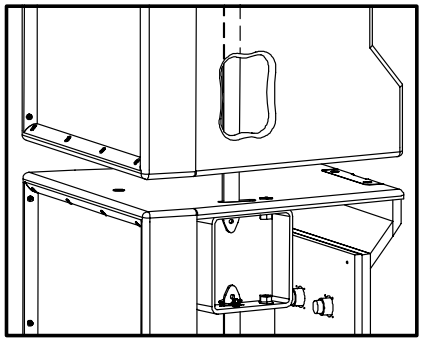
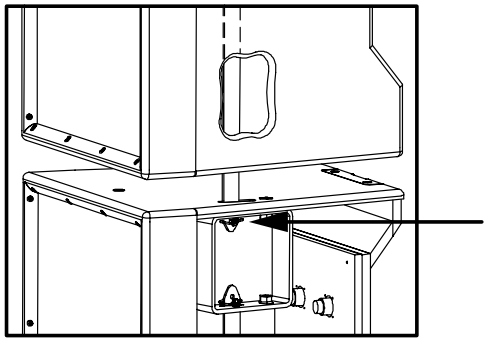


3. Position the second cabinet directly underneath the first. Fit a **BS-780 biscuit** into the top kelping braket of the lower cabinet to keep the backs of the boxes and act as the hinge. Lower the top cabinet and feed the swords into the sword boxes. Make sure that the biscuit engages into the bottom kelping bracket slot of the upper cabinet. The lower end of the swords will be visible through the handle boxes of the lower cabinet.





4. Secure them with safety linch-pins on both sides of the cabinet.

Repeat this procedure with any further cabinets required to complete the column of speakers.

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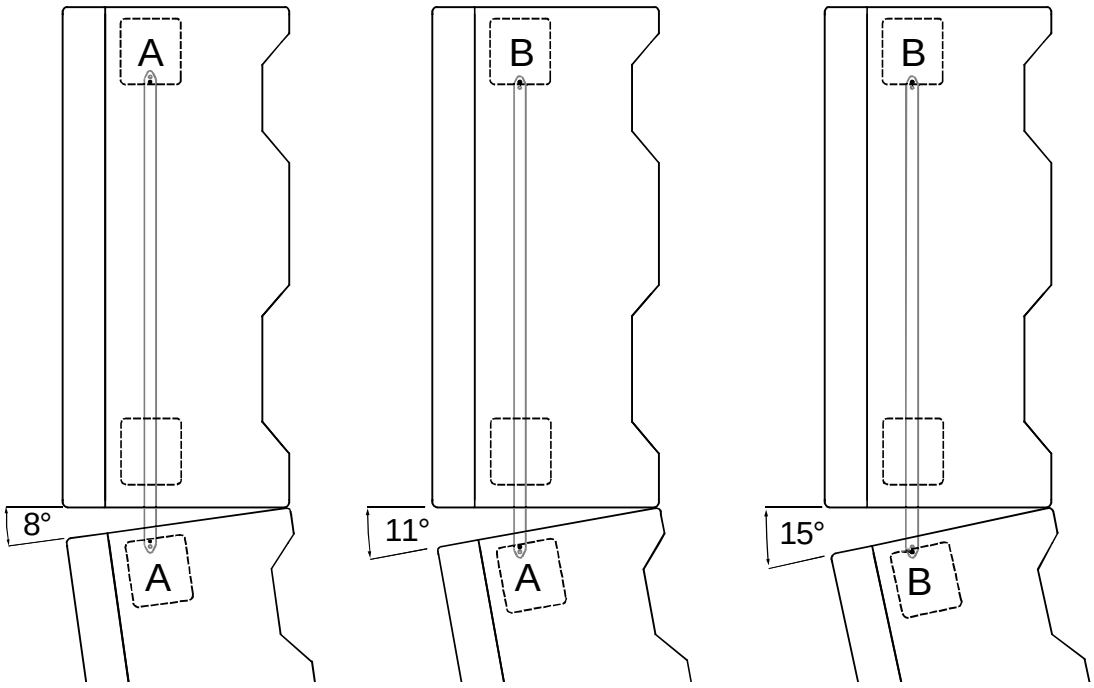
Flying swords are provided with two holes ast each end. This allows for a choice of four incremental vertical angles depending on which hole the linch-pin is located in, and which will determine the combined vertical coverage of the column.

Sword hole position	Inter-cabinet angle
A – A	8°
A – B	11°
B – B	15°



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Flying a cluster of TA-880 trapezoidal cabinets

Aspect trapezoidal flybar configurations offer two basic configurations for assembling arrays, two-wide and three-wide. These configurations will cover the majority of applications, providing up to a maximum 75° of horizontal coverage. For more complex installations or touring applications multiple flybars can be used in a modular fashion.

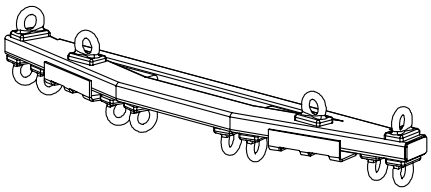
Single horizontal row

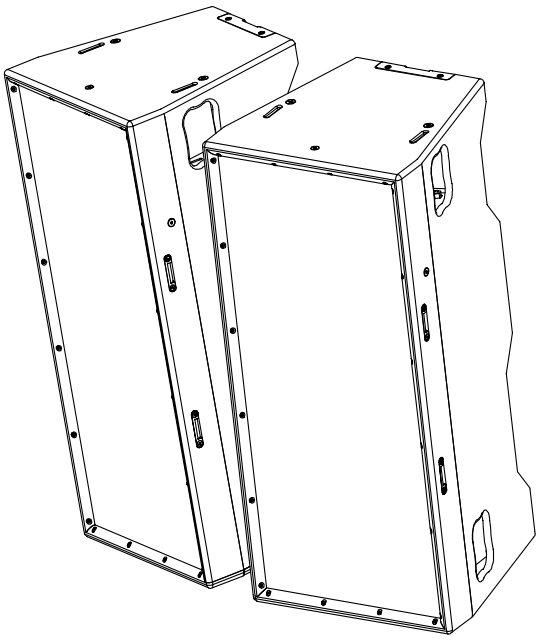
Parts required: 1 x FB-880/2W flybar
4 x FC-880 choked chain assembly
4 x SL-880 safety linch-pin
2 x TS-890 tilt strap

1. Attach flying chains to the flybar using the narrow setting

2. Insert daggers through the slots in the top of the cabinets and secure with safety linch-pins

3. Attach TS-890 tilt straps between the flybar tilt strap points and the rear of the cabinets, and ratchet to achieve the desired downward angle.





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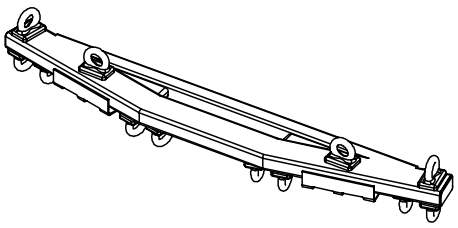
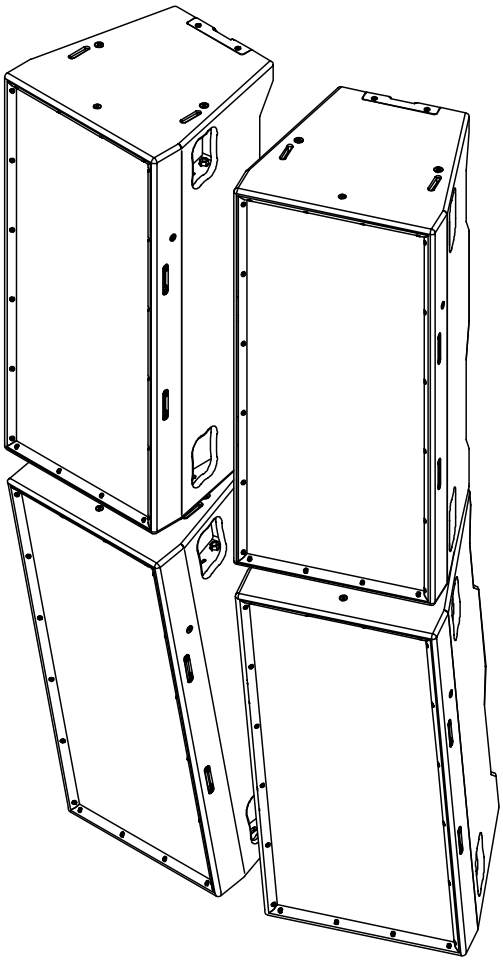
2 wide x 2 deep TA-880H array

Parts required:
1 x FB-880/2W flybar
4 x FC-880 choked chain assembly
4 x SW-880H flying sword
4 x SL-880 safety linch-pin
2 x TS-890 tilt strap





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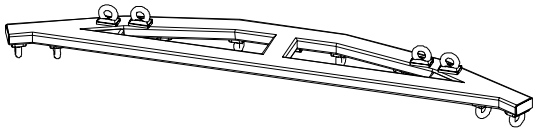
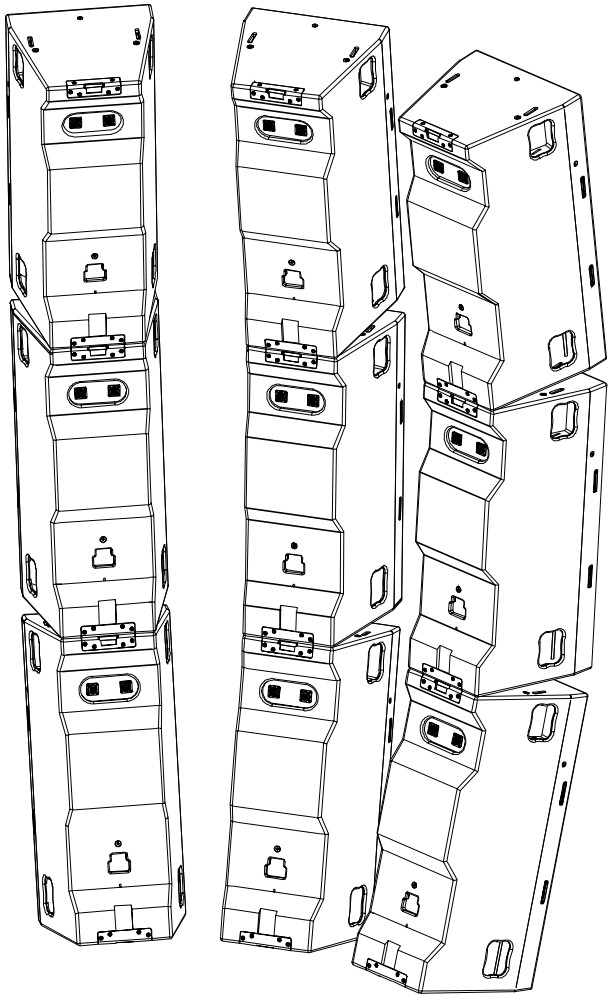
3 wide x 3 deep TA-880H array

Part required: FB-880/3W flybar
6 x FC-880 choked chain assembly
12 x SW-880H flying sword
30 x SL-880 safety linch-pin
3 x TS-890 tilt strap





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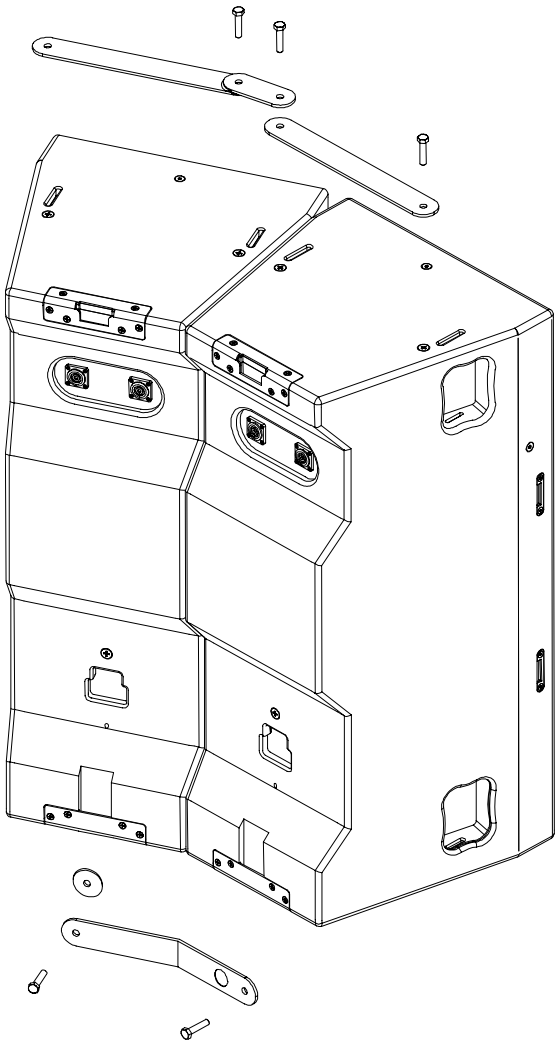
Tight-packed Flying Assemblies

When flying single rows of cabinets, especially in installed applications, it is a good idea to configure the boxes in a tight-packed arrangement in order to achieve high power density in a small space.

Modular coupling kits are available in two-wide and three-wide configurations in order to facilitate tight-packed flown clusters. The **MC-880/2 Modular Coupling Kit** consists of two top straps which attach to the box with M10 hex bolts (supplied) and a rear strap with fixes to the rear of the cabinet. These parts when combined hold the cabinets firmly together and they can now be picked up as a single block.



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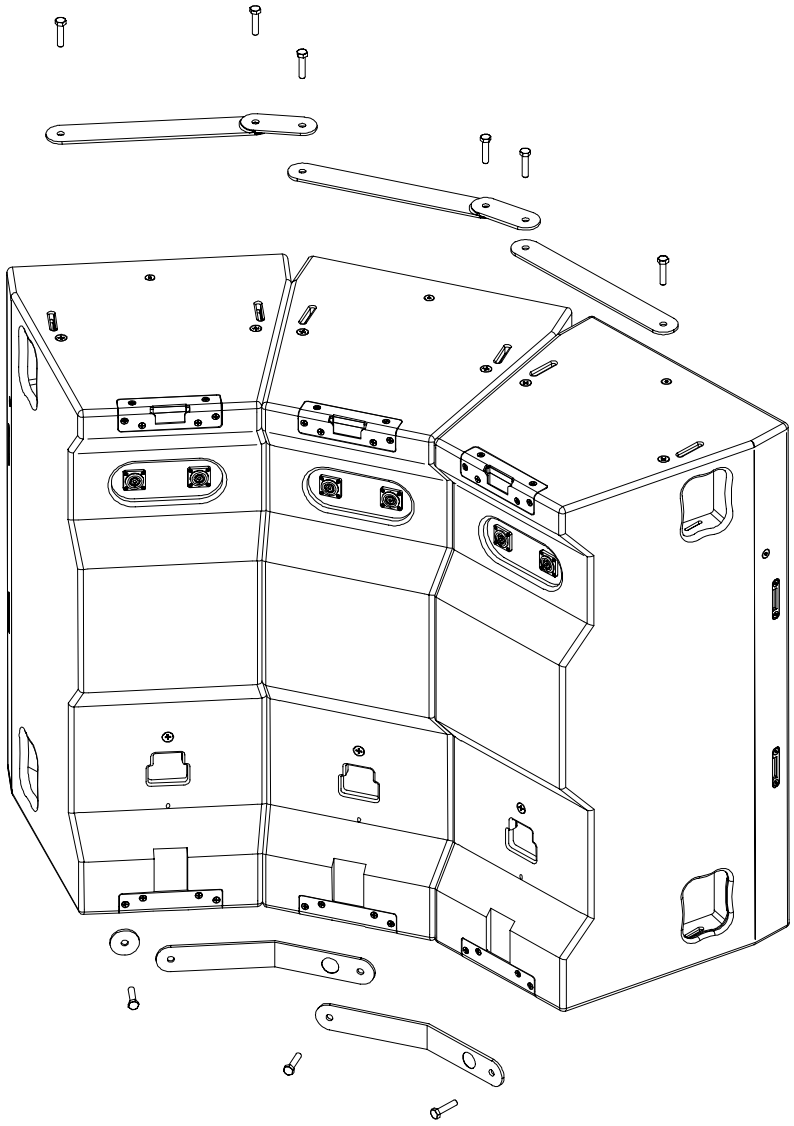
The **MC-880/3 Modular Coupling Kit** consists of three top straps which attach to the box with M10 hex bolts (supplied) and two rear strap with fixes to the rear of the cabinet. These parts when combined hold the cabinets firmly together and they can now be picked up as a single block.



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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 and likewise 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 the 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.

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Ground stacking

In many situations, indoors or outdoors, it is desirable to ground-stack 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. A three-wide stack of TA-880H cabinets supported by four TA-880L bass cabinets as pictured below provides an ideal configuration for many situations, giving 75° of horizontal coverage and standing just under 2 metres high.

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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, LMS-D26 and LMS-D24 are recommended for use with Aspect loudspeaker systems, offering varying features and facilities depending on the specific application.

Unpacking

As part of Turbosound's system of quality control, the product is carefully checked before packing, to ensure flawless appearance. After unpacking the unit, please inspect for any physical damage. If any damage has occurred, please notify your dealer immediately, so that a written claim for damages can be initiated. 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.

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.

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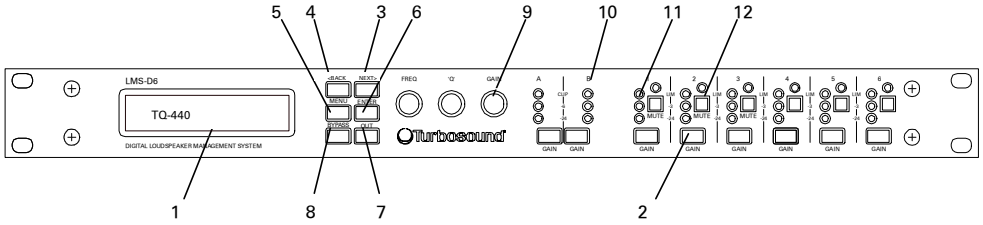
LMS-D6 LOUDSPEAKER MANAGEMENT SYSTEM



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.

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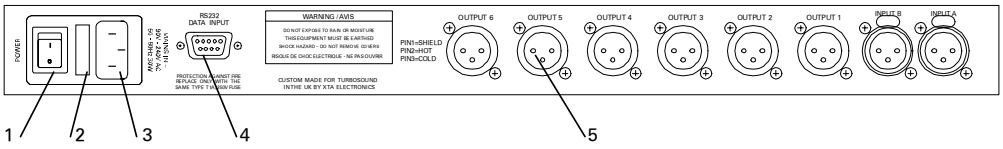
LMS-D6 Rear Panel Functions



13. Power Switch.

14. 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.)

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

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

17. 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.

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Voltage Settings

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.

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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 signal delay between the HF and HMF drivers and the LMF driver in the TFS-780H when the unit is switched to Flashlight mode, and in Floodlight mode the three drivers in the TFL-760H are physically aligned so inter-driver time delays are switched out. DSP settings for these and other Turbosound controllers are availalable from the Turbosound website Downloads area or the ftp site at ftp://ftp.turbosound.com

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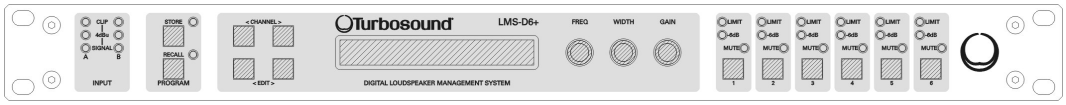
LMS-D24 AND D26 LOUDSPEAKER MANAGEMENT SYSTEMS



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.

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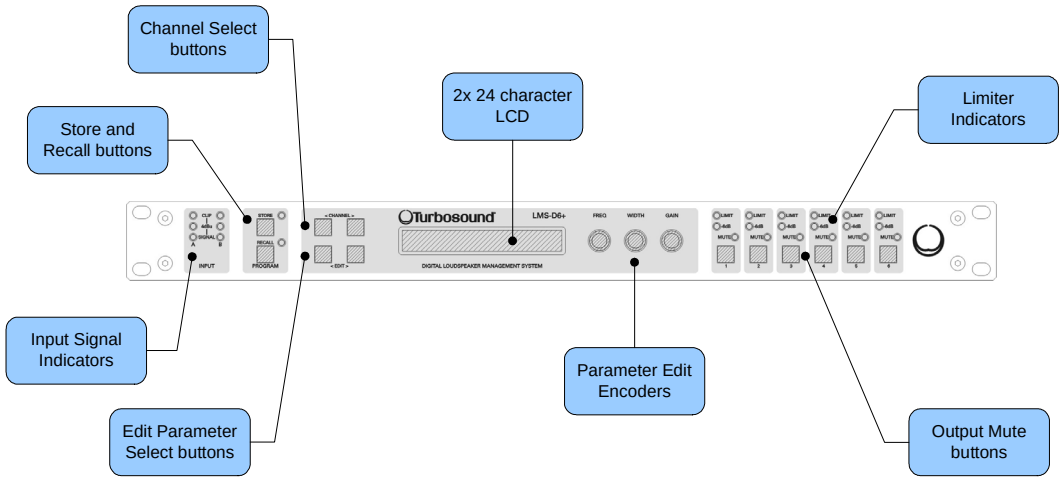
Front Panel Functions



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

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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.

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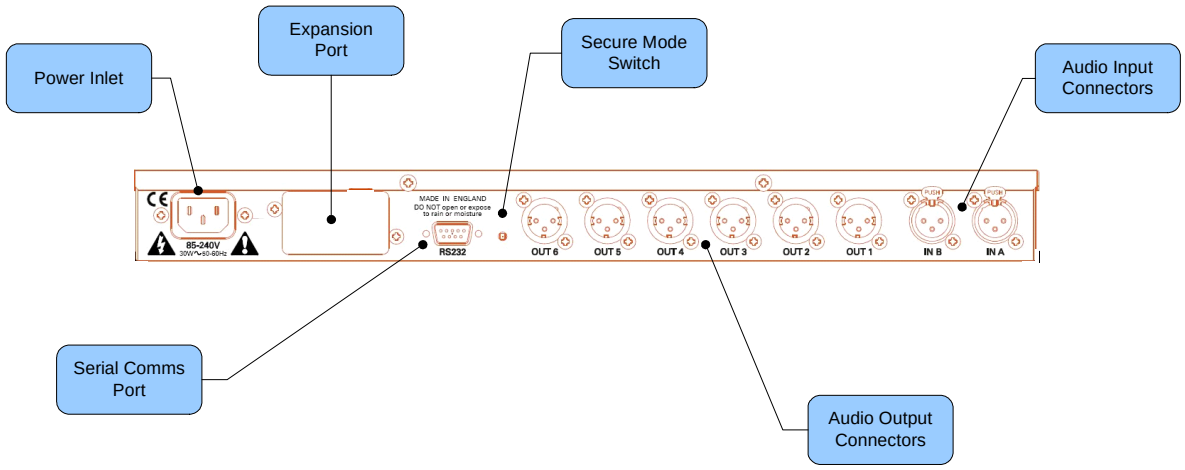
Rear Panel Functions



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.

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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.

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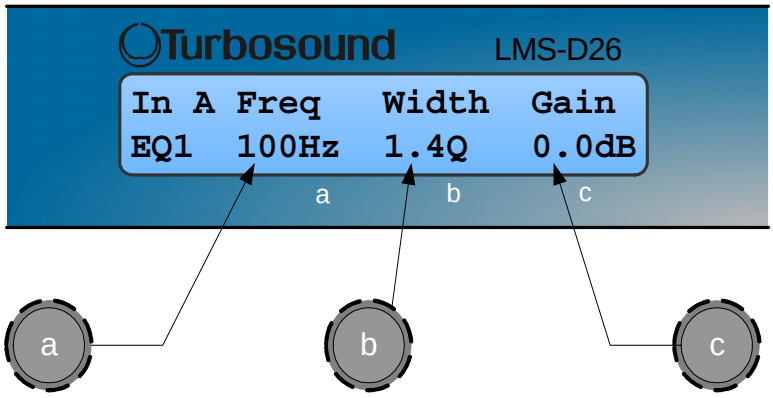
Navigation and Viewing Parameters

(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.

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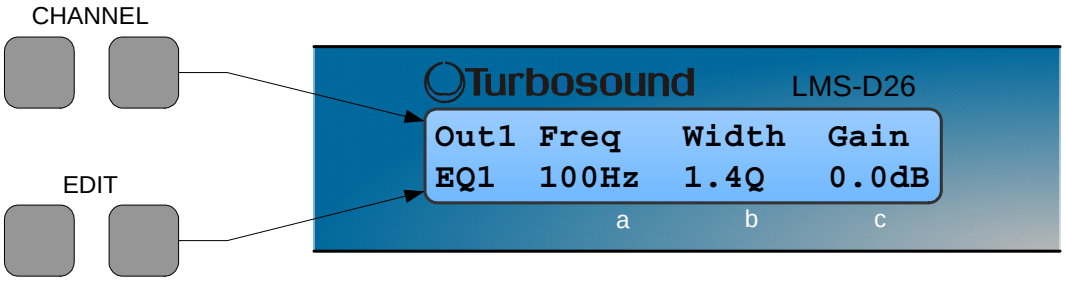
Navigation

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.

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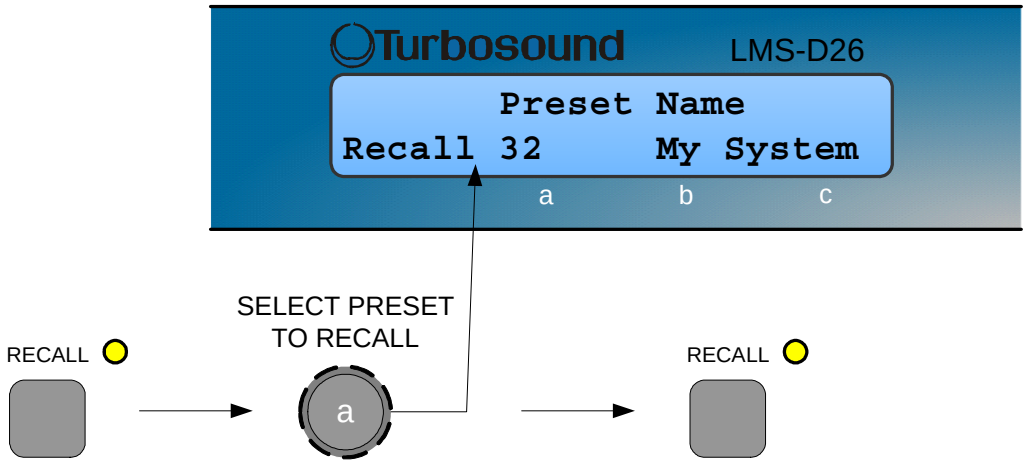
Presets

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.

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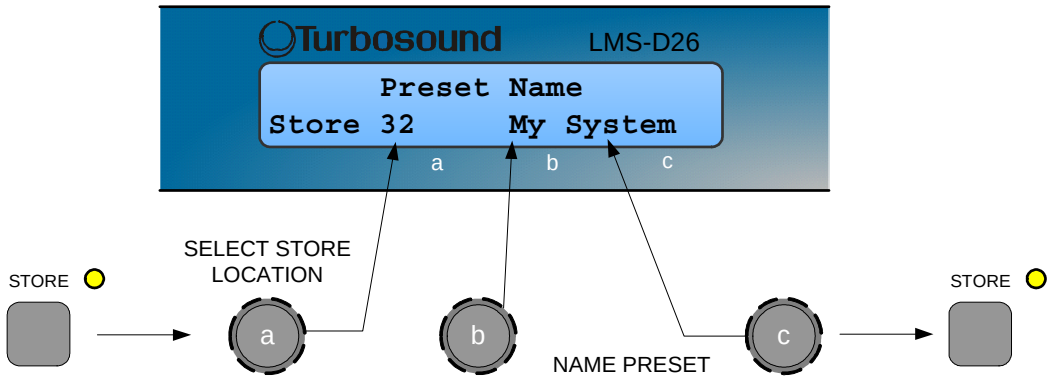
Preset Store

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.

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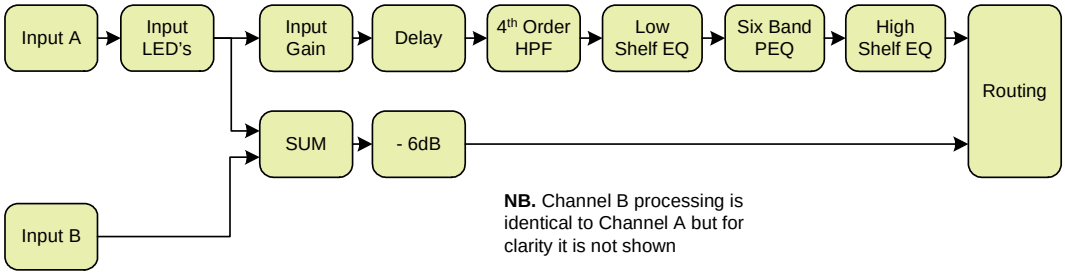
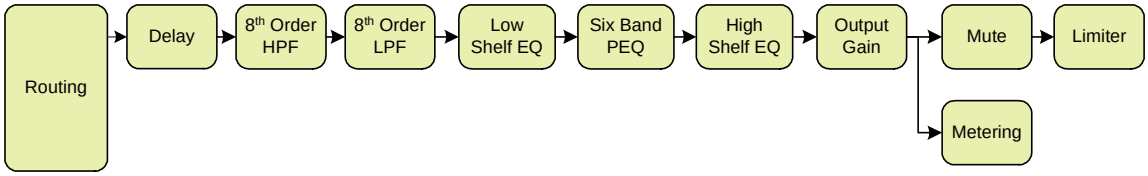
DSP Processing Layout

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]

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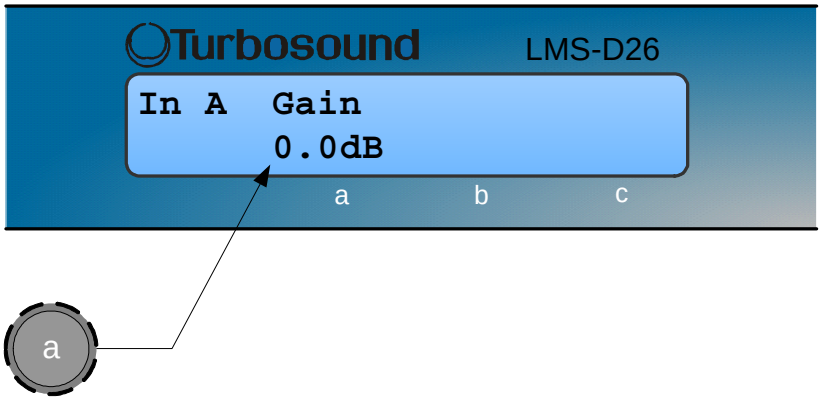
DSP processing

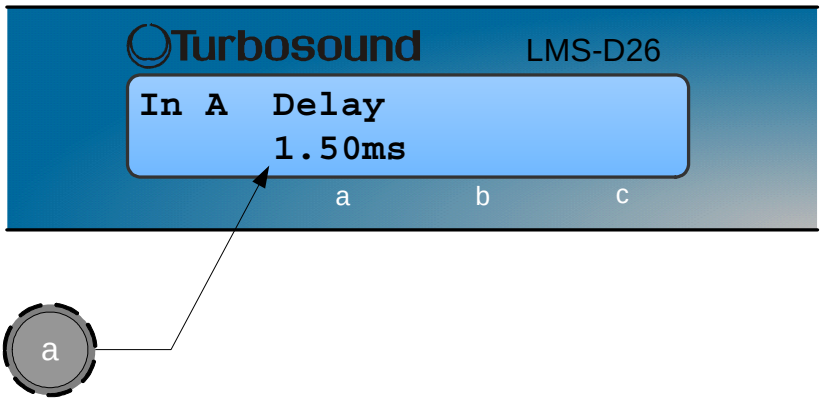
Input Channels

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.

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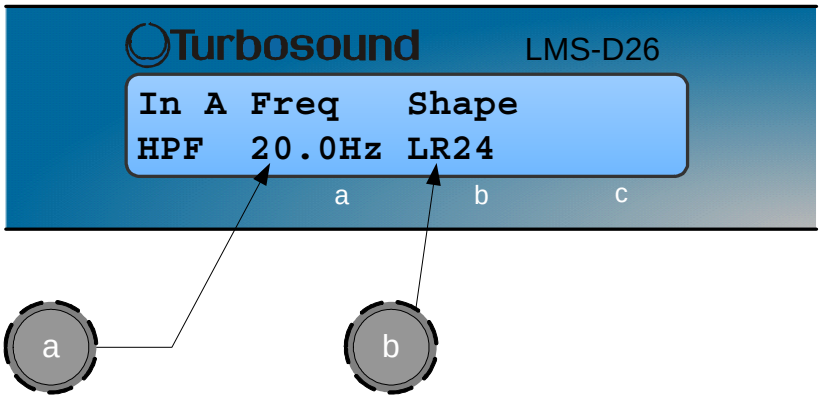
High Pass Filter



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.

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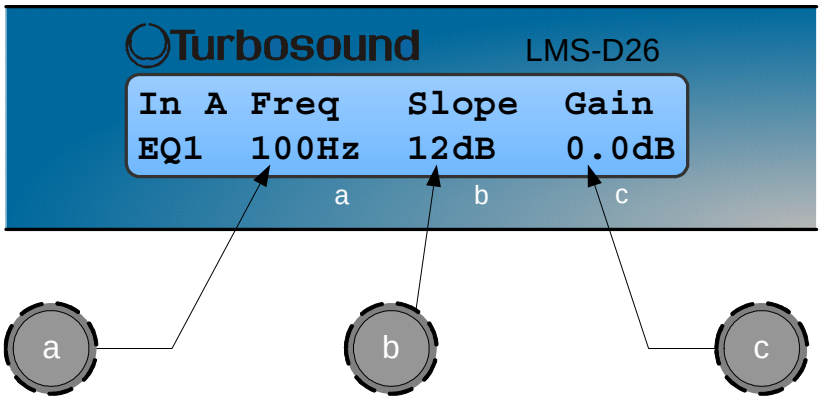
Parametric Equalisation

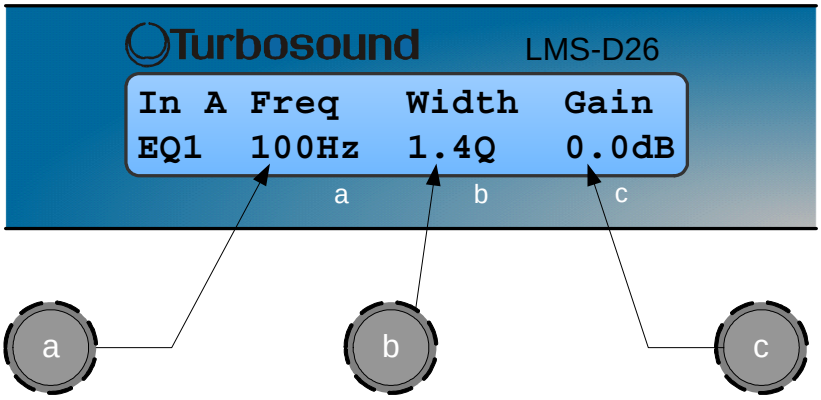
Eight sections of equalisation are provided, two shelving filters and six fully variable parametric sections.

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

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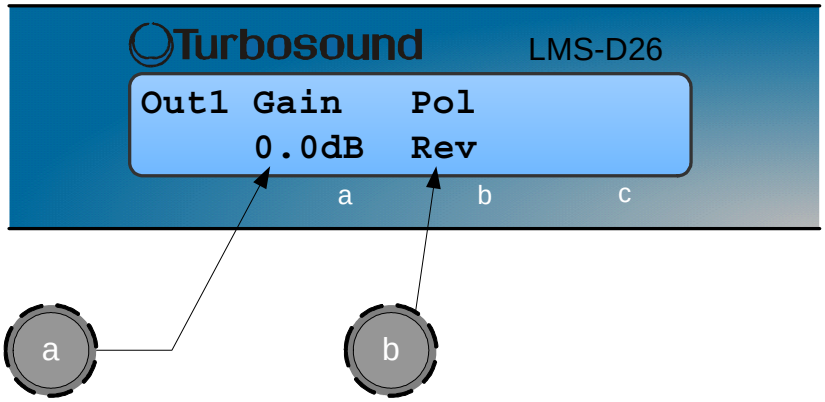
Output Channels

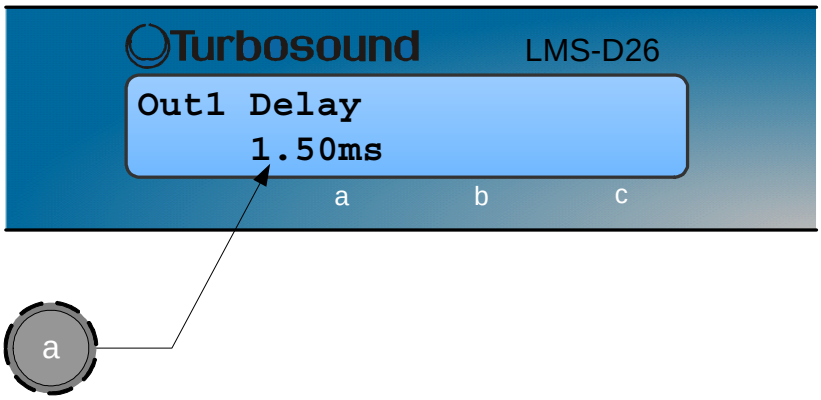
Gain and Polarity



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.

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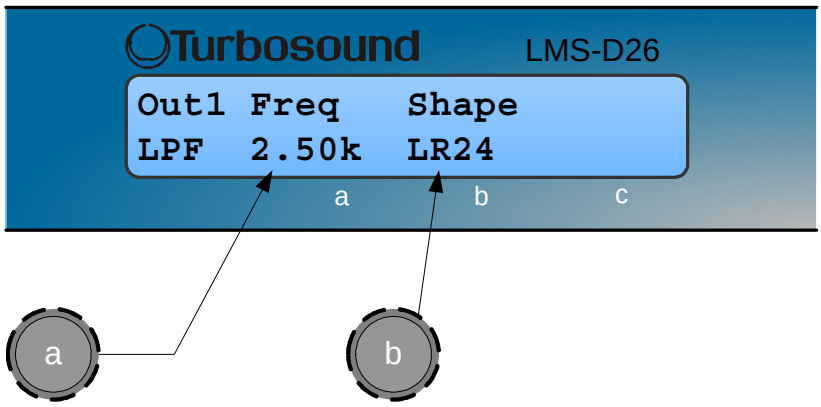
High and Low Pass Filters



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.

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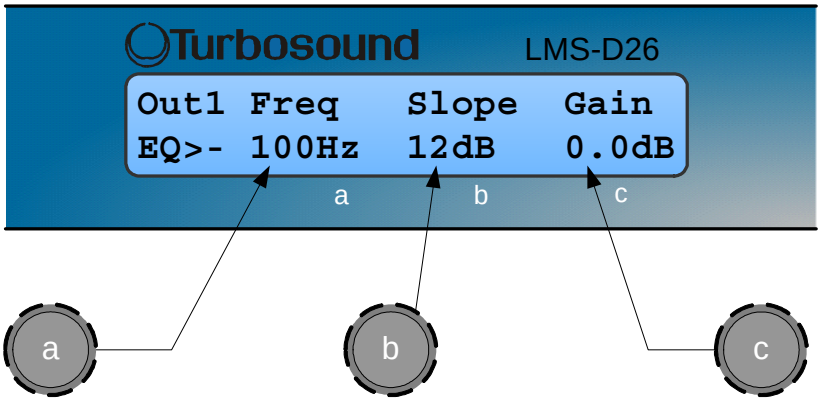
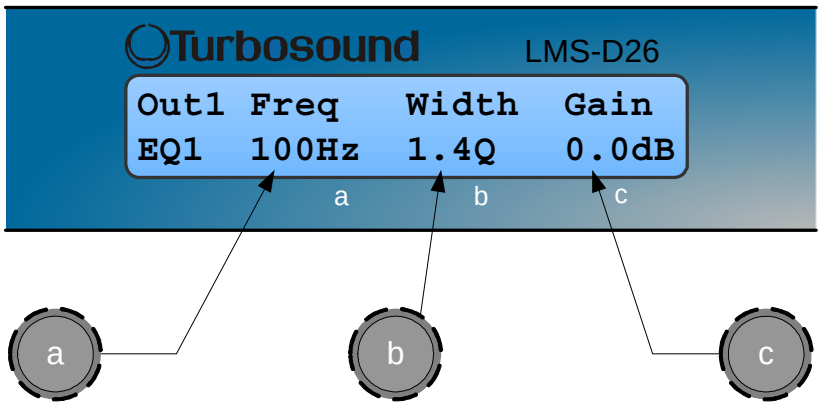
Parametric Equalisation

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

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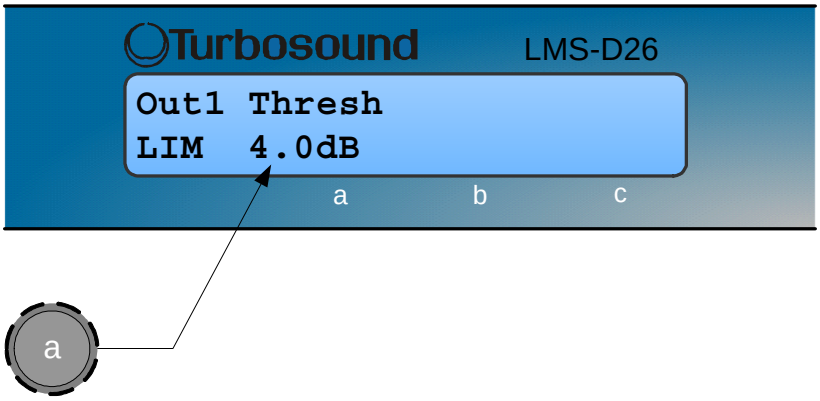
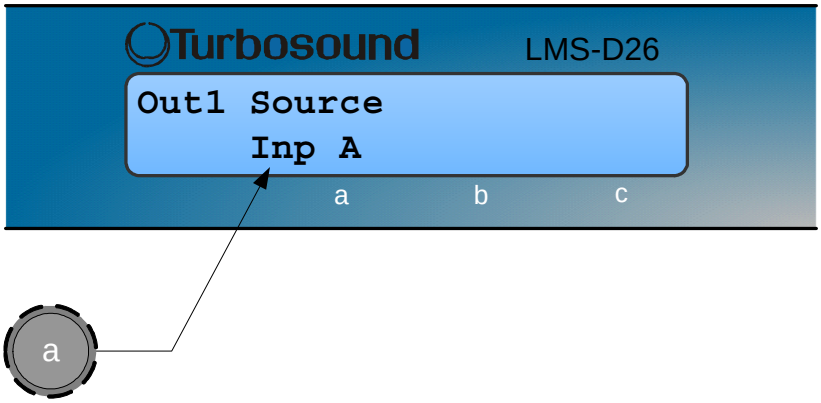
Limiters



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.

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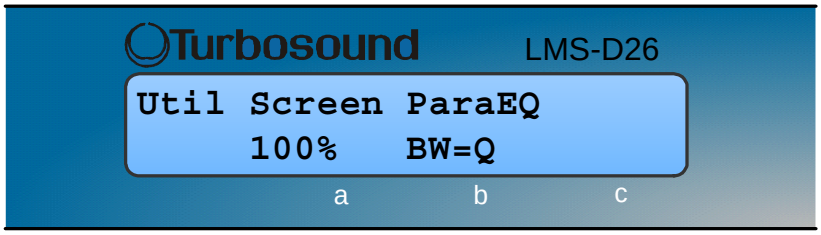
Utilities

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.



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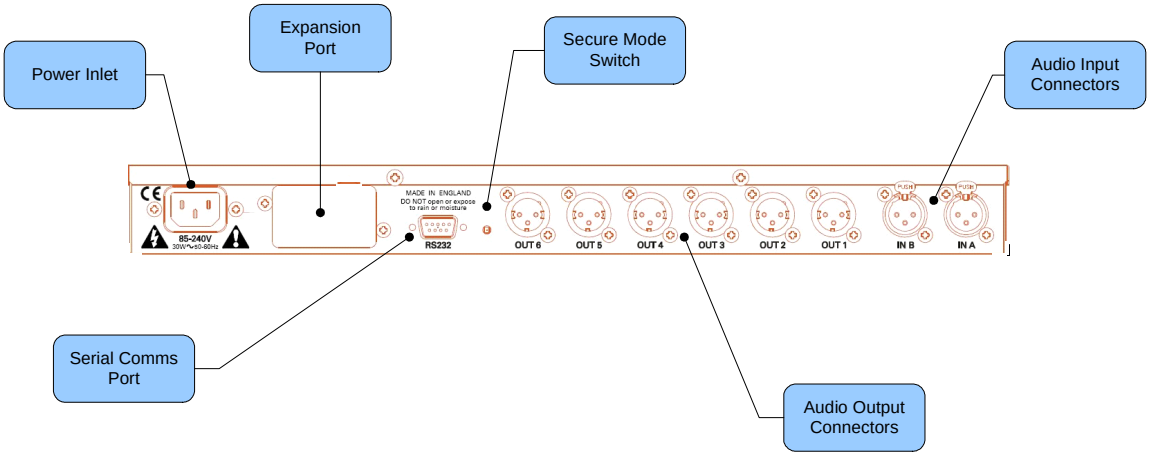
Rear Panel Functions



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.

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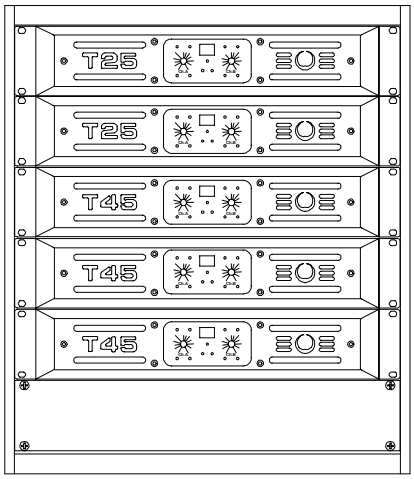
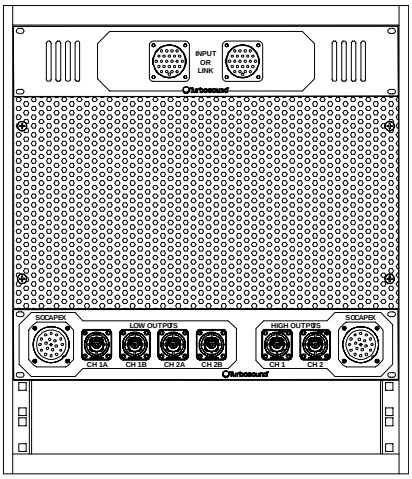
AMP-890 Aspect System Amplification Rack





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.

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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.

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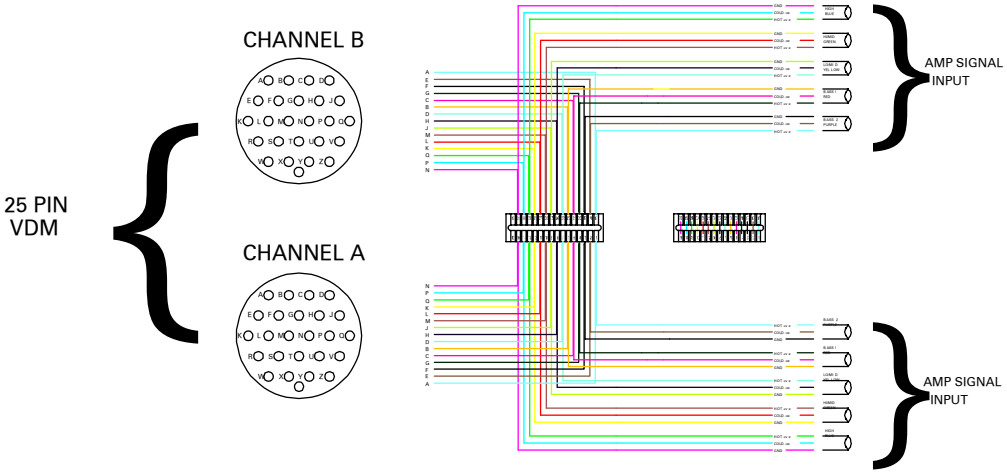
Figure 1. Amplifier Rack Signal Wiring



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.

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Figure 2. Mid-High Outputs

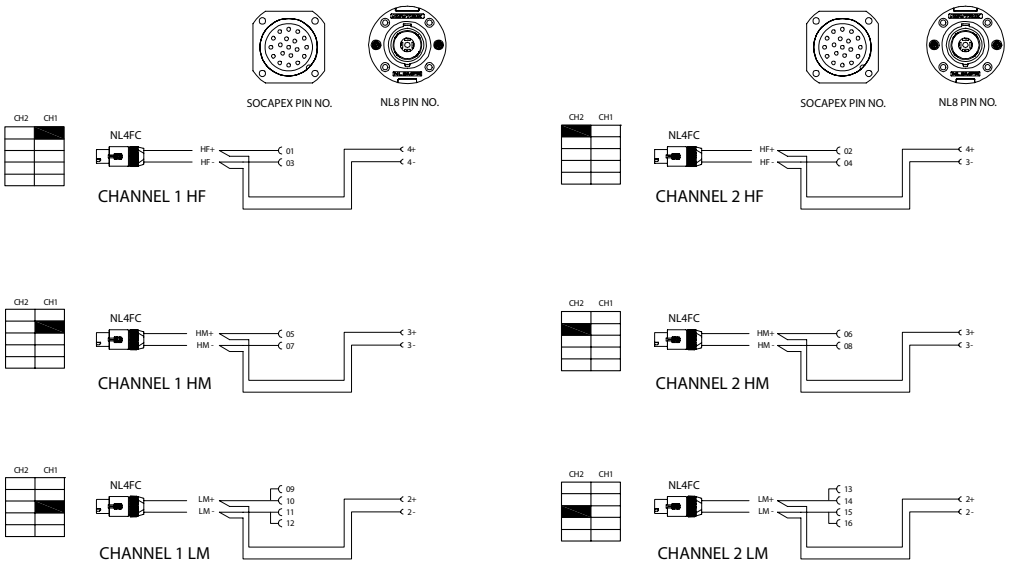
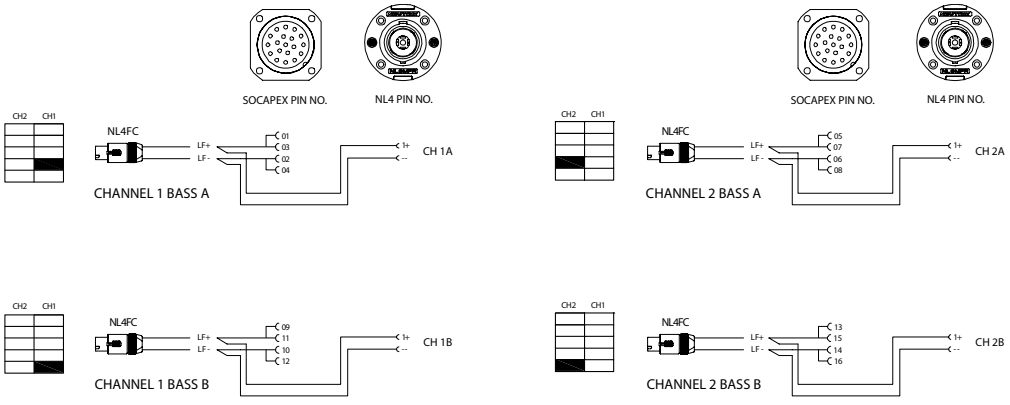


Figure 3. Bass Outputs



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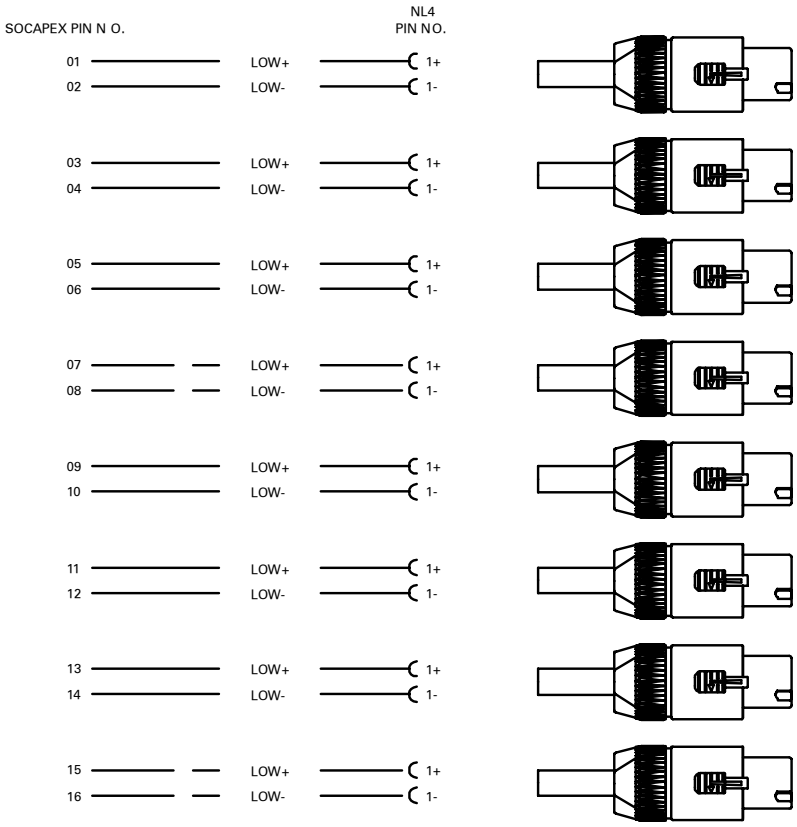
Break-out Cables – NL4 bass



SOCAPEX PIN NUMBERS 17,18,19 NOT USE D

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

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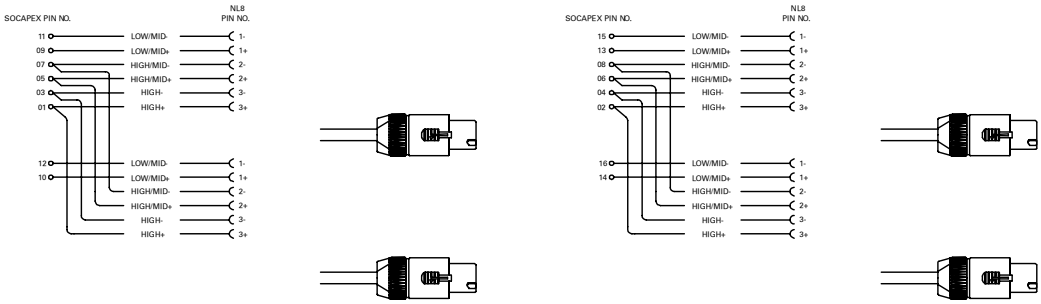
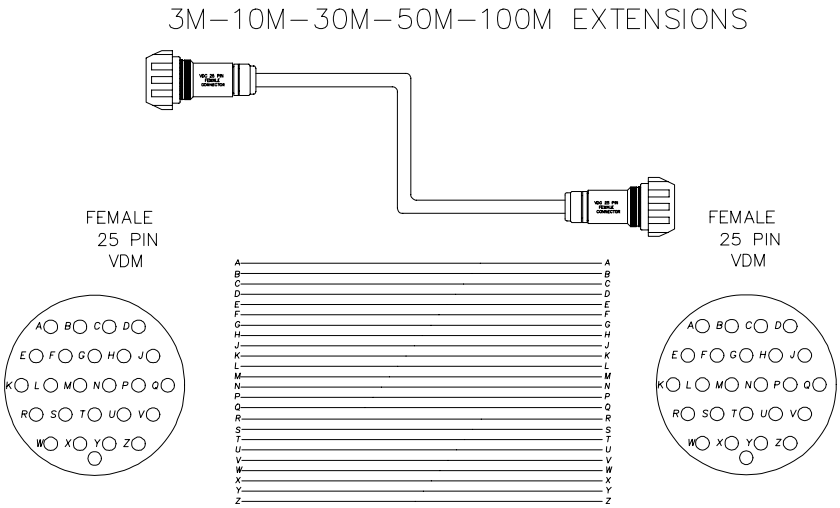
Break-out cables – NL8 mid-high



SOCAPEX PIN NUMBERS 17,18,19 NOT USED

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.



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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.

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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.

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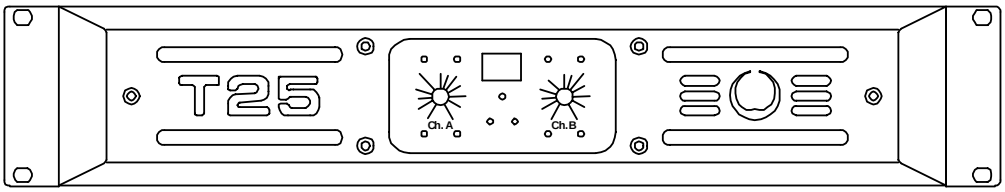
Front Panel Functions T-25



- 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.

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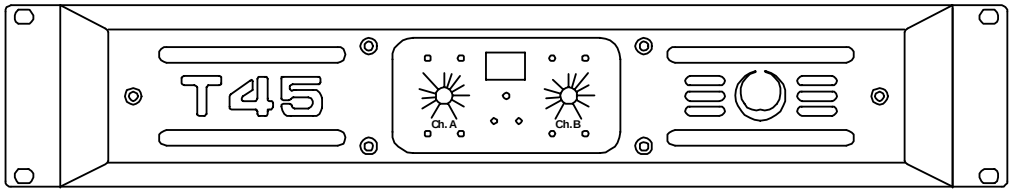
Front Panel Functions T-45



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- Mains power LED – illuminates when AC power is applied to the amplifier.
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- Bridge (BRG) – green LED illuminates when bridge mode is selected.
- Fault (A/P) – red LED indicates protection circuit activity.

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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.

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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.

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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.

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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.

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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.)

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APPENDIX A: TECHNICAL SPECIFICATIONS

	TA-880H	TA-880HM	TA-880LM
Dimensions	1025 x 477 x 463mm 40.3″ x 18.8″ x 18.3″	477 x 477 x 463mm 18.8″ x 18.8″ x 18.3″	574 x 477 x 463 18.8″ x 18.8″ x 18.3″
Net weight	59kg (130lbs)	28kg (61.6lbs)	36kg (79.2lbs)
Frequency range (±4dB)	95Hz – 20kHz	405Hz – 20kHz	95Hz – 405Hz
Array angle	25°H x 15°V	25°H x 15°V	n/a
Power handling (rms)	LMF: 500 watts HMF: 200 watts HF: 100 watts	HMF: 200 watts HF: 100 watts	500 watts
Sensitivity (1w@1m)	LMF: 108dB HMF: 114dB HF: 114dB	HMF: 114dB HF: 114dB	108dB
Max SPL (max/cont)	140dB/146dB	140dB/146dB	135dB/141dB
Crossover bands	LMF: 101Hz – 405Hz HMF: 405Hz – 4kHz HF: 5k99Hz – 20kHz	HMF: 405Hz – 4kHz HF: 5k99Hz – 20kHz	101 – 405HzHz
Nominal impedance	LMF: 8 ohms HMF: 16 ohms HF: 12 ohms	HMF: 16 ohms HF: 12 ohms	8 ohms
Construction	15mm birch ply	15mm birch ply	15mm birch ply
Connectors	NL8MP	NL8MP	NL8MP

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	TA-880L	TSW-218
Dimensions	795 x 477 x 574mm 31.3″ x 18.8″ x 22.6″	574 x 1400 x 770 22.6″ x 55.1″ x 30.3″
Net weight	50kg (110lbs)	110kg (242lbs)
Frequency range (±4dB)	45Hz – 250Hz	35Hz – 150Hz
Power handling (rms)	1100 watts	1200 watts
Sensitivity (1w@1m)	LMF: 101dB	104dB
Max SPL (max/cont)	132dB/138dB	135dB/141dB
Crossover bands	LMF: 30Hz – 101Hz	30Hz - 150Hz
Nominal impedance	8 ohms	4 ohms
Construction	15mm birch ply	18mm birch ply
Connectors	NL4MP	NL4MP

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APPENDIX B: 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.

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