



flexarray

**TFA-600H
TFA-600HW
TFA-600L
TFA-600B
TFA-600HDP
TFA-600HWDP
TFA-600LDP
TFA-600BD**

USER MANUAL

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EC Declaration of Conformity

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

Products:

TFA-600H

TFA-600L

TFA-600HDP

TFA-600LDP

T-25 Power Amplifier

T-45 Power Amplifier

T-475 Power Amplifier

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.

Introduction

Congratulations, you have purchased a professional loudspeaker product from the FLEX ARRAY series of loudspeakers, designed to give you the best in audio quality and many years of reliable, trouble-free operation. It offers excellent pattern control, safe and practical rigging hardware, superior audio quality, proven reliability, self-powered options, full technical documentation including EASE data, and the backing of a world leader in acoustics technology including a comprehensive warranty against manufacturing defects. Please read through this manual carefully before you attempt to operate the loudspeaker system. It contains valuable information which will enable you to quickly and easily connect the loudspeakers to your amplifiers and outboard equipment; important system and set-up checks; and flying and stacking instructions.

Thanks

Thank you for choosing a TURBOSOUND loudspeaker product for your application.

By engaging in an on-going rigorous program of research and development all TURBOSOUND products are carefully engineered for world class performance and reliability.

If you would like further information about this or any other TURBOSOUND product, please contact us. Detailed product information is available on our web site at:

www.turbosound.com

We look forward to helping you in the near future.

Unpacking

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

Flex Array Concepts

The Flex Array system is a modular flexible array loudspeaker system designed to deliver extremely high fidelity audio in a range of medium scale fixed and portable sound reinforcement applications.

Flex Array combines elements of line array theory and virtual point source theory in one loudspeaker product, and for the first time offers virtually unlimited flexibility in adapting to a huge variety of venue types and audience areas.

The Polyhorn™ Concept

The patented Polyhorn™ effectively solves several of the problems associated with conventional exponential horns: namely the tendency to 'beam' with increasing frequency; and the undesirable comb filtering effects generated between adjacent devices due to the variable curvature of the wavefront caused by the horn's geometry.

The Polyhorn™ is split into multiple cells, or individual 'hornlets', which connect the diaphragm to the horn mouth. 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.

The Polyhorn™ geometry ensures 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 containing Polyhorn™ devices contributes 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 Polyhorn™ devices exhibit a sharp cut-off at the edges of the dispersion pattern, making it possible to achieve seamless coverage of a venue with minimal destructive interference between elements, irrespective of how many individual enclosures are deployed in the cluster. 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.

The Polyhorn™ design allows the extension of an application central to Turbosound's philosophy – the use of cone drivers to cover mid-range (especially vocal) frequencies and the freedom to apply relatively high crossover frequencies in order to minimise the distortion common to metal-diaphragm compression drivers. The Polyhorn™ is employed in the high-mid section of the Flex Array TFA-600H, loading a custom-designed 6.5" high power neodymium drive unit.

The Dendritic Horn

The patent-pending Dendritic HF horn utilises the same essential acoustic principle as is employed in the Polyhorn: namely the application of equal path length hornlets to generate a phase-coherent wavefront at the horn mouth. An extension of the principle allows the Dendritic horn to act as the waveguide for a 1" throat compression driver, and key to the operation of this new approach is the divide-by-two rule. Each section of the Dendritic waveguide is split exactly two ways, ensuring that the signal in each leg is identical. In this manner the output from a single compression driver is spread evenly across sixteen small outputs.

Although adaptable to a range of output configurations, the Dendritic horn lends itself most naturally to a slot output. By virtue of its tightly contorted pathways, the Dendritic creates a very compact device, typically cutting 40% off the length of the external envelope.

The Flex Array Mid/High Waveguide

The Flex Array TFA-600 combines both Polyhorn and Dendritic horn technologies in a single, physically aligned mid/high waveguide with equal path lengths, which produces a phase-coherent wavefront at the horn mouth. The Dendritic horn's compact dimensions allows the high frequency driver to be located directly in front of, and mounted concentrically with, the high-mid frequency driver. The horn's shallow geometry, comprising the combined horn and the concentric mounting of the mid frequency and high frequency drivers, results in a very compact enclosure with a depth of only 560mm (22"). This is beneficial both for keeping cluster footprint small and is also a convenient dimension for trucking.

The combined waveguide is square in section, allowing it to be rapidly and easily removed and rotated within the enclosure to suit the intended application. In this way the 75° horizontal by 16° vertical coverage pattern can be readily transposed relative to the orientation of the cabinet.

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 loudspeaker enclosures, to ensure coherent acoustic output. They also incorporate 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-preset menu, making it possible to maintain consistent and repeatable system performance.

Because the power amplifiers can be included as part of the audio system, the controllers utilise output limiters which are matched to the system requirements, being preset to prevent the amplifiers from clipping under normal operating conditions. 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.

In addition, LMS-D2X series controllers are equipped with built-in network capability, allowing maximum control and flexibility over the loudspeaker system's performance and security.

LMS-D2x Loudspeaker Management Systems

Use of Turbosound loudspeaker management systems ensures accurate time-alignment of the system drive units and also provides a facility for users to select additional delay, either to compensate for physical displacement of ground-stacked bass enclosures relative to flown high packs, or to provide full range delay for correct image localisation or use in distributed systems.

Power Amplifiers

In addition to the Turbosound T-series amplifiers recommended for use with Flex Array systems, the following other power amplifier brands provide sufficient performance and mechanical compatibility to perform well with Flex Array loudspeaker systems:

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

Digital Controllers

In addition to the Turbosound LMS-D24 and LMS-D26 loudspeaker management systems, the following digital crossover has been tested and is recommended for use:

- XTA 4 series controllers

Self-Powered Loudspeakers

Flex Array series cabinets are optionally available with integrated networkable Class D amplifier modules in a self-powered format, taking consistent performance and ease of use to a new level. Featuring lightweight high-power amplifiers using 96kHz DSP and operating at better than 90% efficiency, self-powered Flex Array products eliminate the need for separate amplifier racks and controllers, as well as the attendant cabling.

Due to their extremely high efficiency and modern, high performance power supplies, the amplifier module only adds a few kilos to the overall net weight of the loudspeaker.

The sophisticated DSP allows multiple internal preset recall either via the rear panel or over a remote link.

Self-powered loudspeakers can be conveniently controlled and monitored over a network with a PC running TurboDrive™ software.

Class D amplifier modules can be retrofitted to non-powered enclosures in place of the Speakon connector panel, providing a quick and effective upgrade path.

Model Information

TFA-600H Three-Way Loudspeaker



The TFA-600H is a compact, trapezoidal, modular three-way switchable tri-amped/bi-amped loudspeaker. It combines a patent-pending Dendritic HF waveguide and a patented midrange Polyhorn™ in a single physically aligned waveguide. This geometry allows the enclosure's dispersion to be easily adapted to line array or virtual point source implementation.

The loudspeaker's 75° horizontal dispersion pattern maximises the direct sound field while reducing reverberant energy. Two Flex Array columns arrayed at 55° provide an ideal 130° of horizontal coverage for wider auditoriums or outdoor events.

Neodymium drive units are used throughout the product in order to achieve exceptionally low net weight, making it convenient to transport, handle and rig. In addition the drive units are symmetrically located within the enclosure, which contributes to the smooth and consistent horizontal coverage. The upper crossover point is positioned at 6kHz, giving the legendary Turbosound midrange power and clarity that is only possible from a paper cone type transducer.

The enclosure has both vertical and horizontal flying systems integrated into the cabinet. The horizontal system uses a simple and effective drop link mechanism which permits easy positioning and angling of each cabinet within any given line array configuration. Enclosures are equipped with captive biscuits for use with chain links in virtual point source clusters, and with a range of flying yokes for rigging enclosures in point source applications.

The 15mm birch plywood cabinet is equipped with a perforate steel grille with foam backing, and recessed handles on the sides, rear, top and bottom. A recessed rear panel carries two parallel-linked Speakon NL8 connectors for input and loop-through connections.

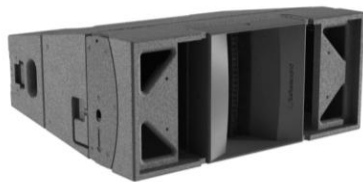
TFA-600HW Wide Dispersion Three-Way Loudspeaker

A wide dispersion version of the standard TFA-600H, but with a wider 100°h x 16°v coverage pattern. The cabinet is identically sized and features the same integrated flygear - making it possible to either integrate the TFA-600HW in a cluster of TFA-600H cabinets (for example as downfills at the bottom of the hang), or to fly these on their own to simply achieve a wider

coverage. This model is quickly identified by the 'W' legend visible through the window on each side of the cabinet.

The mid/high section is rotatable to allow a swap of the horizontal and vertical coverage patterns, and in this configuration the TFA-600HW also works well as a stage lip infill cabinet.

TFA-600HDP Self-Powered Three-Way Loudspeaker



The TFA-600HDP is a networkable, digitally self-powered, bi-amplified, trapezoidal three-way enclosure combining a patent-pending Dendritic HF waveguide and a patented midrange Polyhorn™ in a single physically aligned waveguide.

It features a new generation of innovative lightweight Class D amplifiers, utilising revolutionary 96kHz DSP technology to give operating efficiency in excess of 90%. Two independent amplifier channels power the LF and MF/HF drivers separately. Neutrik™ Powercon connectors provide mains input and output to permit powering of two further cabinets, while 3-pin XLRs are used for input and parallel link signal connections. RJ45 network connectors enable multiple loudspeakers to be controlled and monitored over a BVNet network using TurboDrive™ software.

The enclosure has both vertical and horizontal flying systems integrated into the cabinet in order to facilitate simple and intuitive rigging with a minimum of external parts. The horizontal system is used to create flown or ground-stacked line array configurations. The vertical rigging system is used for single box and virtual point source applications. This flexibility of use is made possible by the rotatable mid/high section.

TFA-600HWDP Wide Dispersion Self-Powered Three-way Loudspeaker

The TFA-600HWDP is a wide dispersion networkable, digitally self-powered, bi-amplified, trapezoidal three-way enclosure combining a patent-pending Dendritic HF waveguide and a patented midrange Polyhorn™ in a single physically aligned waveguide.

It features two independent Class D amplifier channels powering the LF and MF/HF drivers separately. Neutrik™ Powercon connectors provide mains input and output to permit powering of two further cabinets, while 3-pin XLRs are used for input and parallel link signal

connections. RJ45 network connectors enable multiple loudspeakers to be controlled and monitored over a BVNet network using TurboDrive™ software.

The enclosure has both vertical and horizontal flying systems integrated into the cabinet in order to facilitate simple and intuitive rigging with a minimum of external parts. The horizontal system is used to create flown or ground-stacked line array configurations. The vertical rigging system is used for single box and virtual point source applications. This flexibility of use is made possible by the rotatable mid/high section.

TFA-600L Compact Horn-loaded Subwoofer



The TFA-600L is a compact, horn-loaded subwoofer enclosure designed to be flown or ground stacked with TFA-600H enclosures. It consists of a single 18" neodymium drive unit loaded with a TurboBass™ device in a birch plywood cabinet. The TFA-600L utilises the same drive unit as the larger TSW-218 horn-loaded subwoofer and employs the same loading techniques, so these two bass enclosures can be freely mixed in any application. The proprietary 18" drive unit is the result of a development project that has produced a unique neodymium motor system. The magnet system drives a dual-spider, split 4" voice coil which provides linear BL (magnetic force) with displacement, ensuring optimum control from the motor assembly and very low harmonic distortion, even at the excursion limits. The 4" voice coil also results in a lower system moving mass than equivalent 5" units, resulting in higher sensitivity and exceptional response to fast transient peaks.

The enclosure is equipped with an integrated flying system which enables it to be flown at the top of a column of Flex Array loudspeakers using a simple conversion frame between the bass enclosures and mid/highs. The same conversion frame is used to create a stable Flex Array ground stack. A pole mount socket is provided for use with flying yokes.

The 15mm birch plywood cabinet is equipped with a perforated steel grille with foam backing and recessed handles on the sides and back, and is supplied with heavy duty wheels in order to aid trucking and handling.

A recessed panel at the rear of the cabinet carries two parallel-linked Speakon NL4MP connectors for input and loop-through connections.

TFA-600LDP Compact Self-Powered Horn-loaded Subwoofer



The TFA-600LDP is a compact, networkable, digitally self-powered, horn-loaded subwoofer enclosure designed to be flown or ground stacked with Flex Array TFA-600HDP mid/highs.

It features a new generation of innovative lightweight Class D amplifiers, utilising revolutionary 96kHz DSP technology to give operating efficiency in excess of 90%. A Neutrik™ Powercon connector provides mains input and 3-pin XLRs are used for input and parallel link signal connections. RJ45 network connectors enable multiple loudspeakers to be controlled and monitored over a BVNet network using TurboDrive™ software. The enclosure is equipped with an integrated flying system which enables it to be flown at the top of a column of Flex Array loudspeakers using a simple conversion frame between the bass enclosures and mid/highs. The same conversion frame is used to provide a stable Flex Array ground stack. A pole mount socket is fitted for use with flying yokes.

The 15mm birch plywood cabinet is equipped with recessed handles on the sides and back, and is supplied with heavy duty wheels in order to aid trucking and handling.

TSW-218 Horn-loaded Subwoofer



The TSW-218 is a horn-loaded subwoofer incorporating Turbosound's patented loading principles, designed for use in applications requiring accurate and powerful reproduction of low frequency energy at very high levels. Its ability to reproduce program material with such integrity makes the TSW-218 applicable for both fixed or mobile systems which require energetic low frequency response without stress or enclosure corrective equalisation.

The TSW-218 incorporates the TurboBass™ device, which employs a high-velocity partial horn-loading technique, giving precise cone control at high power levels. The proprietary 18" drive units are the result of a development project that has produced a unique neodymium motor system. The magnet system drives a dual-spider, split 4" voice coil which provides linear BL (magnetic force) with displacement, ensuring optimum control from the motor assembly and very low harmonic distortion even at the excursion limits. The 4" coil also means a lower system moving mass than equivalent 5" units, resulting in higher sensitivity and exceptional response to fast transient peaks.

The TSW-218 is capable of outstanding electrical to acoustic power conversion. Optimisation of the stepped horn flare produces a dramatic increase in sensitivity when multiple units are coupled.

TSW-218DP Self-Powered Horn-loaded Subwoofer



The TSW-218DP is a digitally self-powered horn-loaded subwoofer incorporating Turbosound's patented loading principles, designed for use in applications requiring accurate and powerful reproduction of low frequency energy at very high levels. Its ability to reproduce program material with such integrity makes the TSW-218DP applicable for both fixed or mobile systems which require energetic low frequency response without stress or enclosure corrective equalisation.

The TSW-218DP features a lightweight Class D amplifier, utilising revolutionary 96kHz DSP technology to give operating efficiency in excess of 90% and delivering 2500 watts in bridge mode with abundant headroom into the two LF drivers. Four selectable presets provide a choice of crossover points and delay settings depending on application. A Neutrik™ Powercon connector provides mains input and 3-pin XLRs are used for input and parallel link signal connections. Two RJ45 network connectors are provided.

The TSW-218DP incorporates the TurboBass™ device, which employs a high-velocity partial horn-loading technique, giving precise cone control at high power levels. The proprietary 18" drive units are the result of a development project that has produced a unique neodymium motor system. The magnet system drives a dual-spider split 4" voice coil which provides linear BL (magnetic force) with displacement, ensuring optimum control from the motor assembly and very low harmonic distortion even at the excursion limits. The 4" coil also means a lower system moving mass than equivalent 5" units, resulting in higher sensitivity and exceptional response to fast transient peaks.

The TSW-218DP is capable of outstanding electrical to acoustic power conversion. Optimisation of the stepped horn flare produces a dramatic increase in sensitivity when multiple units are coupled.

Network Capability

Self-powered Flex Array loudspeaker systems are supplied with built-in network functionality – enabling fast, intuitive control and monitoring of all networked devices via the BvNet protocol using Turbosound's TurboDrive™ software. Flex Array features brand new DSP, offering multiple internal preset recall via the rear panel or by a remote link.

LMS-D2x series controllers are equipped with network cards as standard and are pre-configured with factory programs for all non-powered Flex Array models.

TurboDrive™ offers user control of input EQ, delay and mute, although key factory settings such as limiting and driver correction are locked out on DP models to maintain consistent voicing and driver protection while ensuring maximum flexibility of use.

Single controllers are connected via RS232, while multiple units (controllers or self-powered loudspeakers) are connected to a PC via a simple **BVNet USB adapter**.

TurboDrive™ Quick Reference Setup

The following is a quick reference setup guide for networked systems. For more detailed setup instructions please refer to the TurboDrive™ User Guide, available as a pdf download from our ftp site ftp://ftp.turbosound.com/downloads/tech_data/software/turboDrive.

Computer System Requirements

Minimum system requirements are as follows:

- PC with Pentium processor
- Windows NT, 2000, XP or Vista
- CD ROM or internet access
- RS232 or USB port

The TurboDrive™ software is available from the CD supplied with your BvNet interface, or as a download from our website at www.turbosound.com. We recommend that you always check the website for the latest version of the software.

Hardware Requirements

In addition to a desktop PC or laptop as described above, the following equipment is required in order to assemble a system network:

- Linea Research USB & RS232 Interface (available from Turbosound, stock code 16F0005)
- Linea Research Accessory Power Supply (optional, available from Turbosound, stock code 15F0010)

- CAT5 type network cables
- Self-powered loudspeaker(s) **OR**
- Loudspeaker(s) **AND** LMS-D24 or LMS-D26 loudspeaker management system(s)

To create a network follow the steps below:

1. **Install the TurboDrive™ software**

from the CD supplied or download from the Turbosound website
ftp://ftp.turbosound.com/downloads/tech_data/software/turboDrive.

2. **Install the drivers**

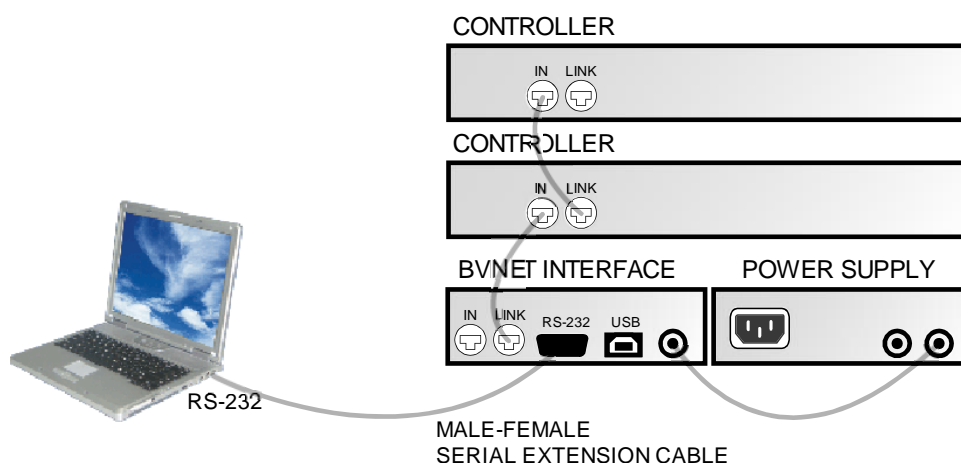
If you are connecting via RS232 there is no need to install drivers. If you are connecting via a USB port install the drivers which can be found on the CD that was supplied with your Linea Research BvNet interface.

3. **Connect a LMS-D2x loudspeaker management system to a PC**

BvNet is the method of connecting multiple devices over a network, and this is done with the Linea Research USB & RS232 Interface (available from Turbosound) which enables devices to be connected either using RS232 or the RS485 standard carried over CAT5-type cables.

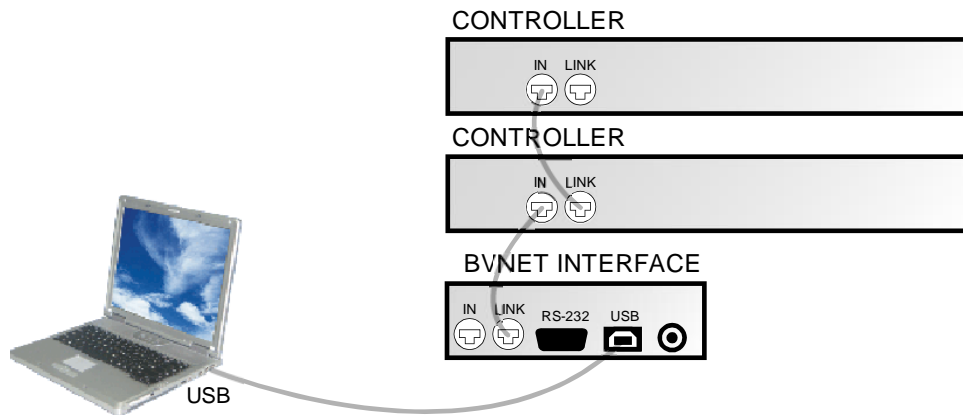
Using RS232

Connect your computer to the RS232 port on the BvNet interface using a standard 9-pin serial cable. External power is required for RS232 operation and this should be supplied by the Linea Research Accessory Power Supply System.



4. **Using USB**

Connect your computer to the BvNet interface using a USB Type A to USB Type B cable. External power is not required when using USB.



5. **Connect network devices** in a simple daisy-chain fashion with CAT5 type cables in the order you want them to appear in the devices window.
6. **Launch the TurboDrive™ software**
On the first launch, the application will prompt for an authorisation code. The code is PJLUWZ
7. Select the **COM port** from Network > Com Port
8. Click the **Online** toolbar button
9. Click on one of the devices that appear in the tree view to **Launch the Panel**

GigMate™ Acoustic Simulation

While the Flex Array 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 – 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 the creation of flown clusters, or for ground stacked arrays, of TFA-600H mid/high and TFA-600L bass enclosures.

Setting up a Venue - Overview

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

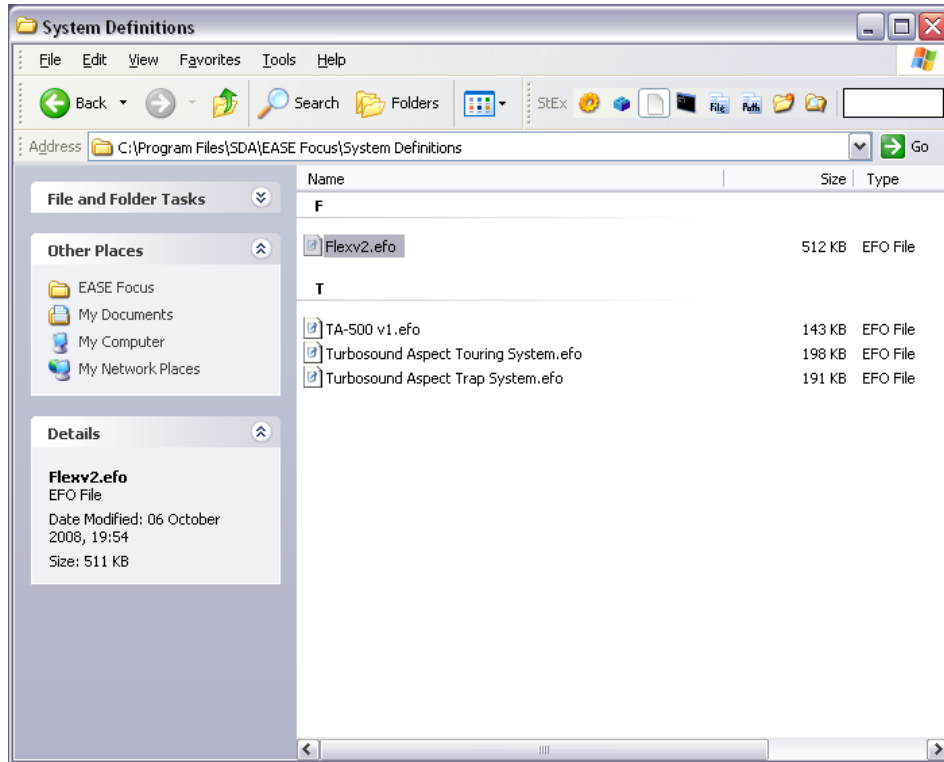
The PA is set up by choosing either a flown cluster or ground stack. Box count, cluster position, tilt angle and splay angle can all be selected independently.

The mapping properties allow the user to select frequency bands from 125Hz to 8kHz, and also bandwidth from one-third octave to broadband. Weighting and level can also be selected here.

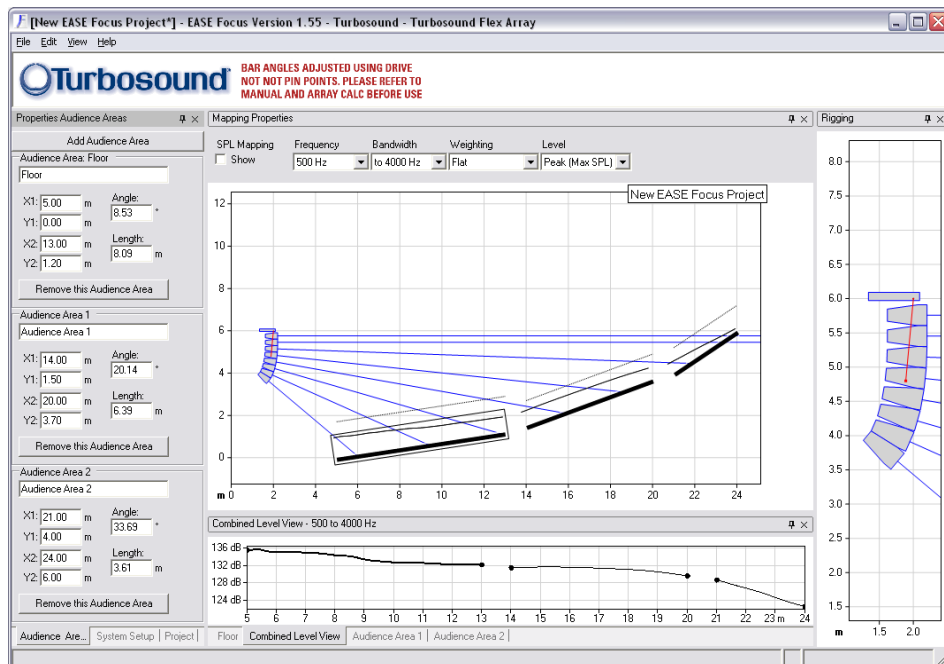
Once mapped to achieve satisfactory room coverage and level, results can be saved and printed as a .rtf file. The program will also calculate the total weight of the cluster as well as its overall physical size.

Running Turbosound GigMate™ 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 the Flex Array file, as well as the Aspect TA-500 file and two Turbosound Aspect TA-890 Touring System files as shown below:



Select the Flexv2.efo file . You will now be presented with the GigMate™ main screen:



The screen is split into four main areas:

System Setup

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

Mapping Properties

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

Audience Area

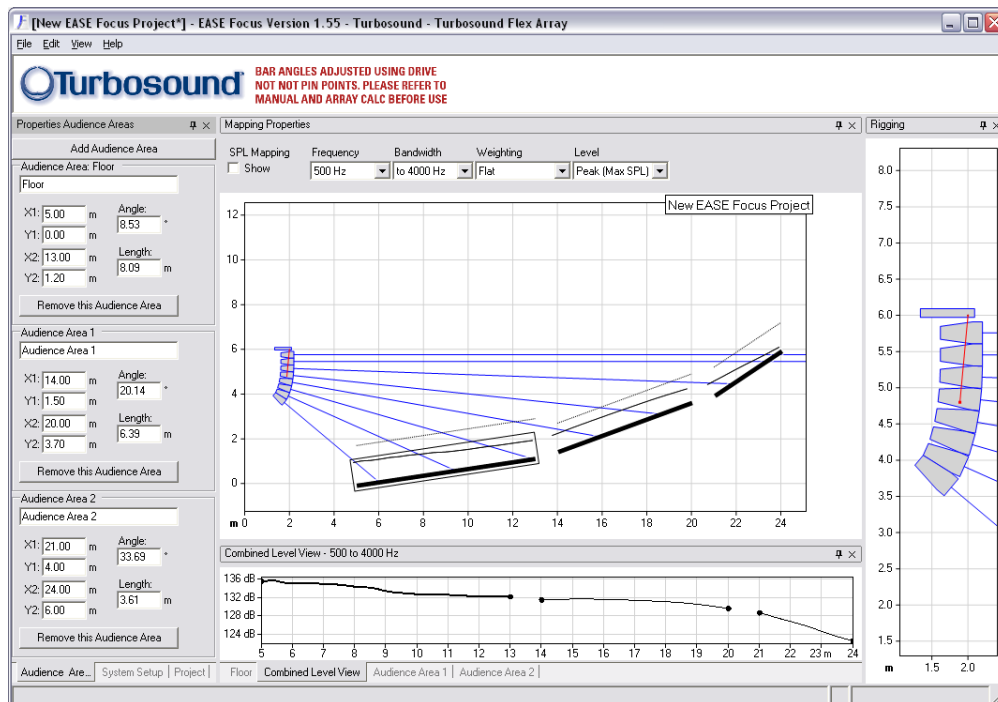
Beneath the main Mapping Properties window this graphically displays the SPL on each audience area, or across a combination of audience areas.

Rigging

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

Designing a System

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



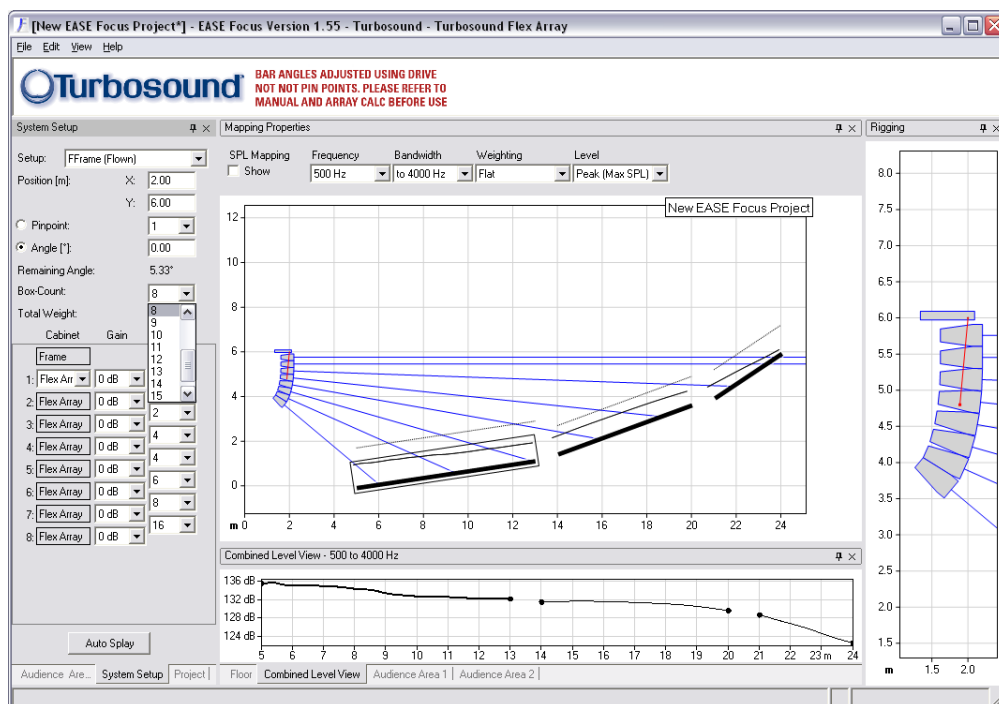
Within this window you can edit or remove existing audience areas, and create new ones.

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

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

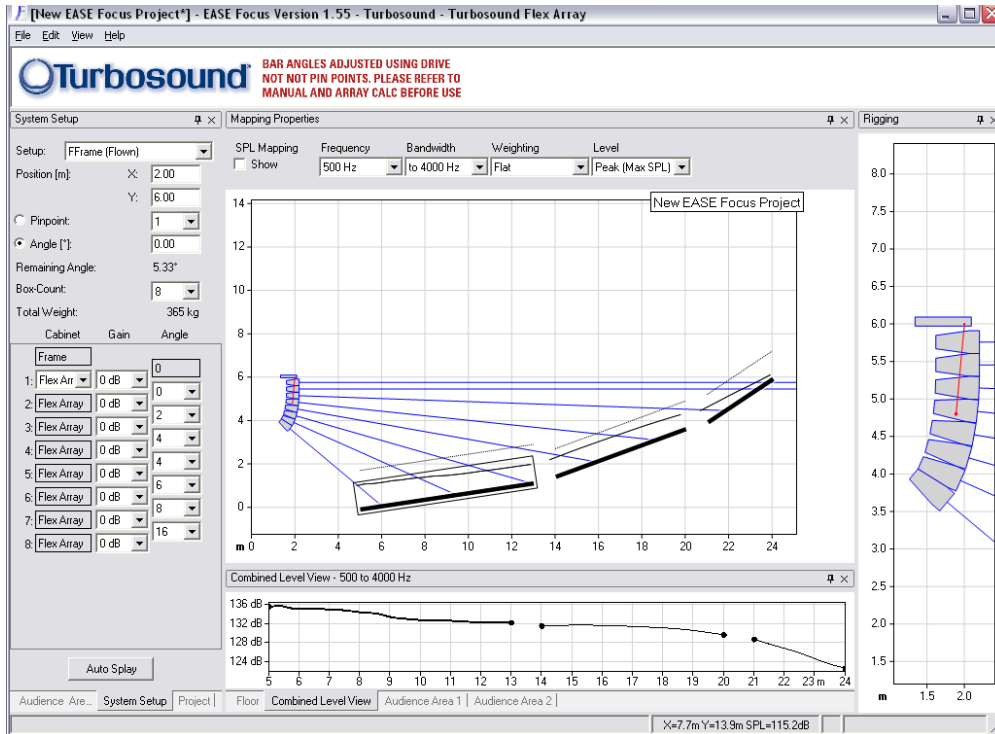
Designing the Loudspeaker Array

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 ground stack in the drop down box at the top left of the window.



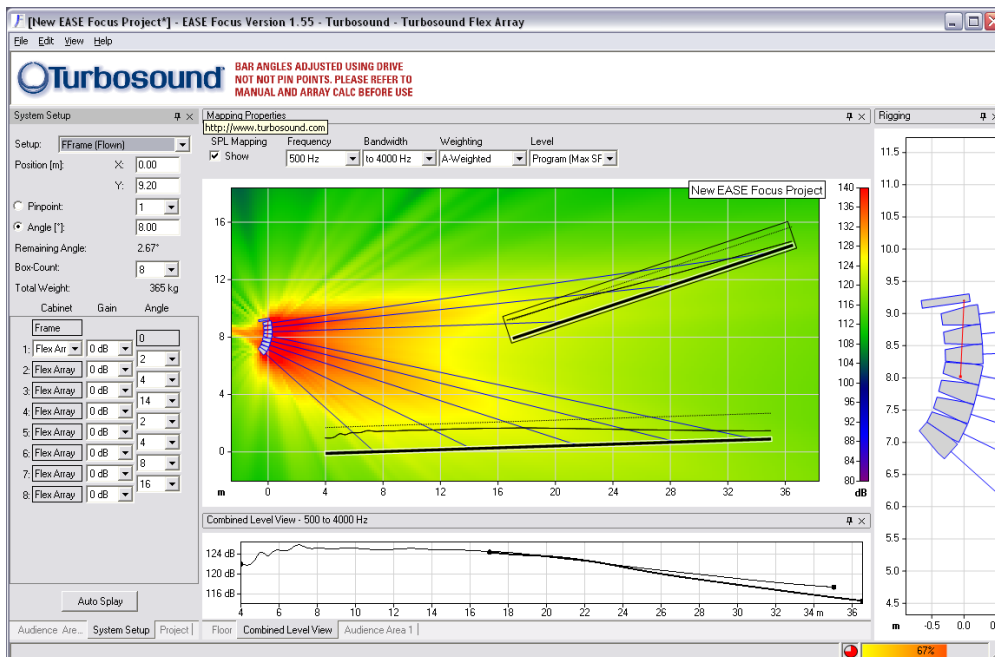
Now select the number of cabinets deep that you wish to hang or stack from the “Box Count” drop-down menu. Trim height or PA wing height can now be set in the “Position” field.

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



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

System Mapping Performance

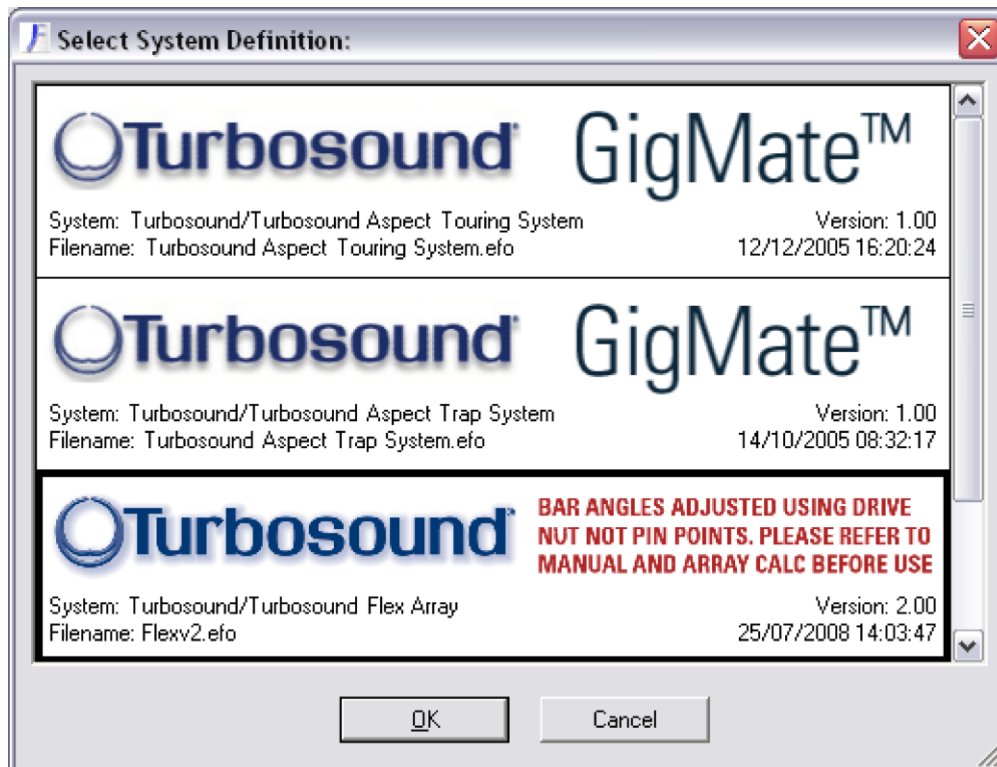


The Audience Area graph at the bottom of the window shows the SPL, as specified in the SPL Mapping lists, on the selected Audience Area. The selected area is highlighted in the main window and the graph is repeated onto each area. Selecting the “Combined Level View” tab will show the SPL across all areas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

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

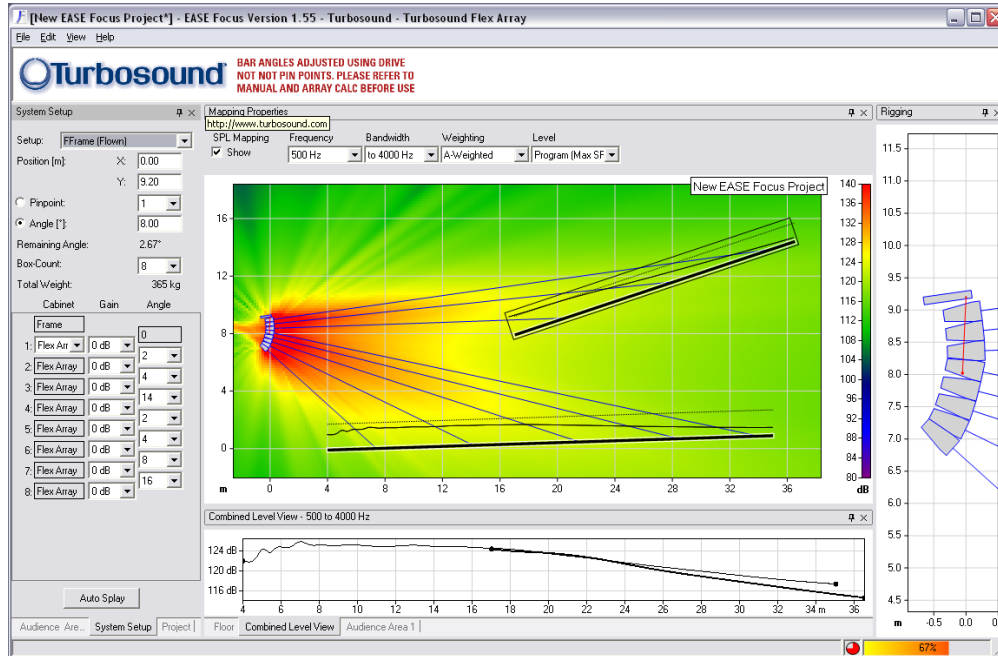
Changing the System

GigMate™ currently includes Flex Array TFA-600 systems, as well as Aspect Touring TA-890 series, trapezoidal TA-880 series and TA-500 wide dispersion series products. To switch between systems use Edit/Change System on the menu bar and select from the list.

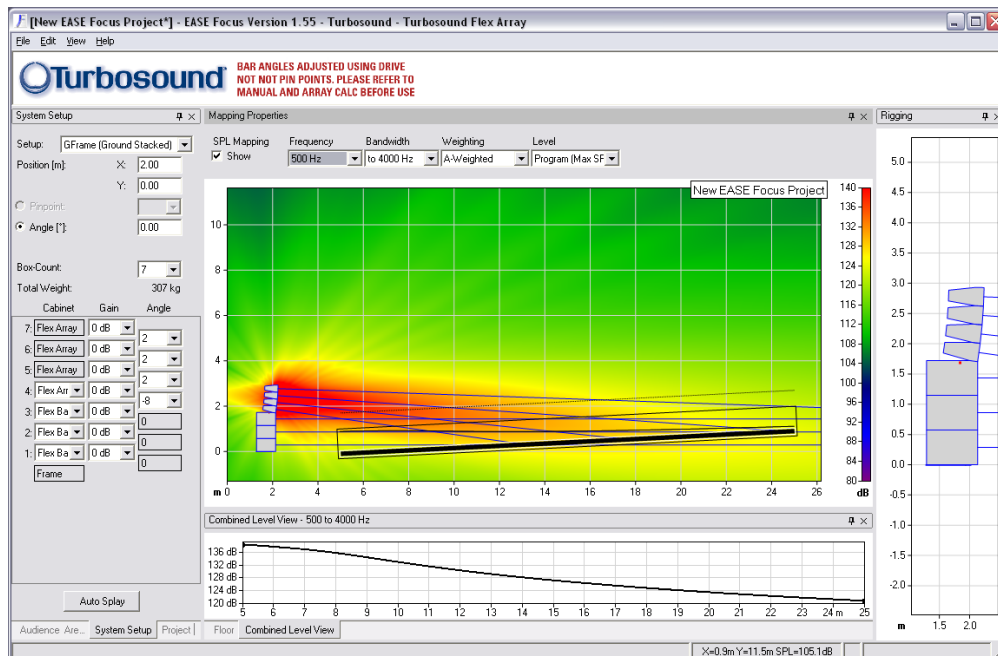


Some typical examples are shown here.

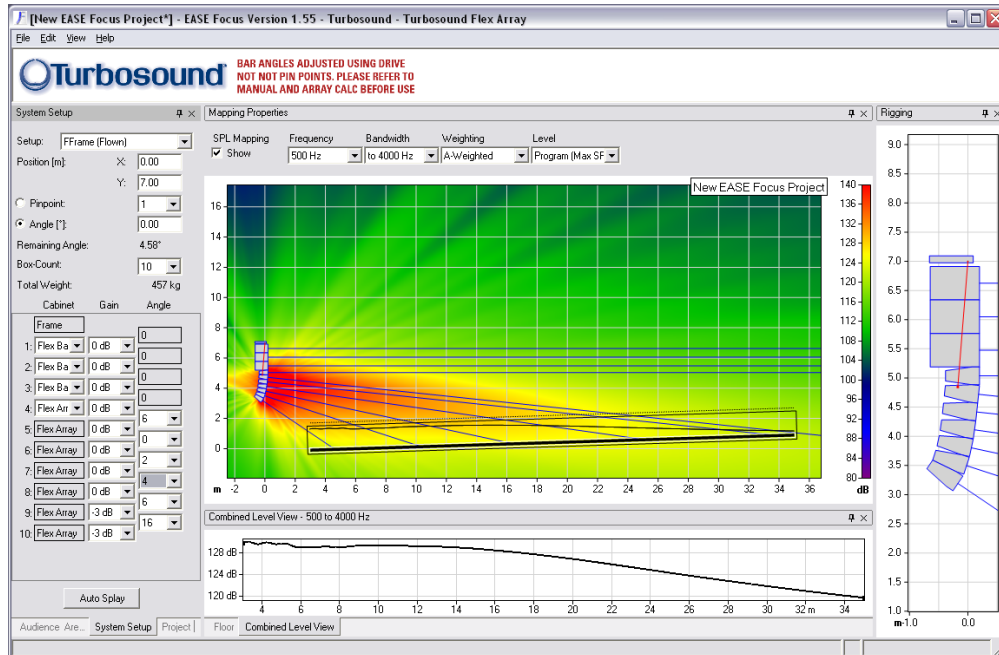
Theatre-style venue



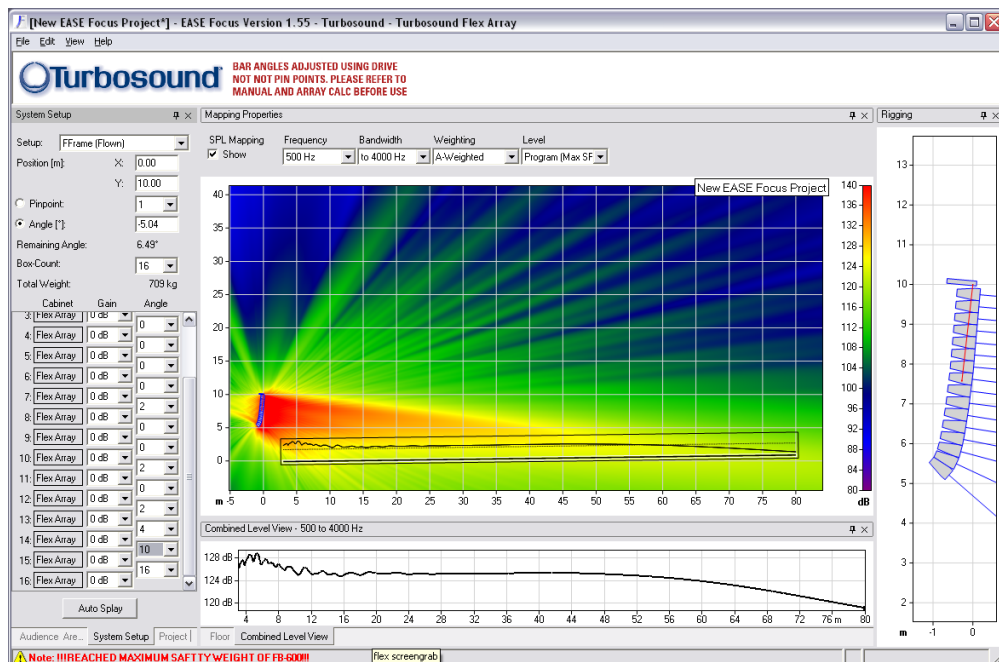
Ground stacked system with bass enclosures



Flown system with bass enclosures



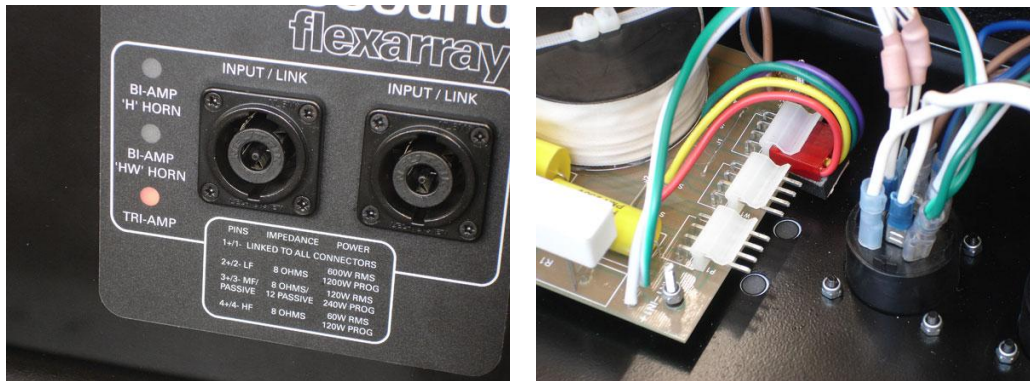
Festival system



Tri-amp / bi-amp configuration

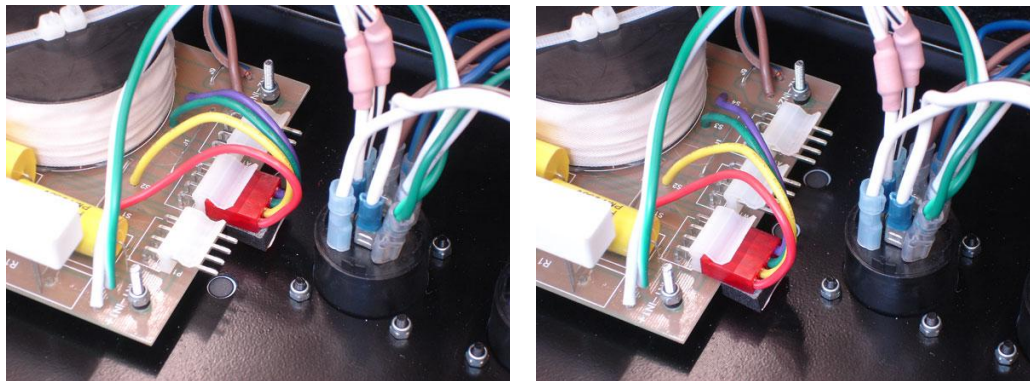
TFA-600H enclosures can be configured either in fully tri-amped mode, or bi-amped with passive HF. They are shipped from the factory as standard in tri-amped mode, although changing from one to the other is a simple case of changing the position of a jumper located behind the connector panel. Please note that the rear flygear must be removed in order to access the connector panel.

1. Remove the four M6 button-head screws securing the rear panel.



2. The default jumper position as shipped from the factory is **TRI-AMP** (as shown above right).

3. For TFA-600HW wide dispersion products relocate the jumper from the **TRI-AMP** PCB header to the centre position (**BI-AMP 'HW' HORN**) as shown below left.



4. For TFA-600H narrow dispersion products relocate the jumper to the extreme left position (**BI-AMP 'H' HORN**) as shown above right.

5. Replace the rear panel, replace the flygear and phase check the cabinet before operating.

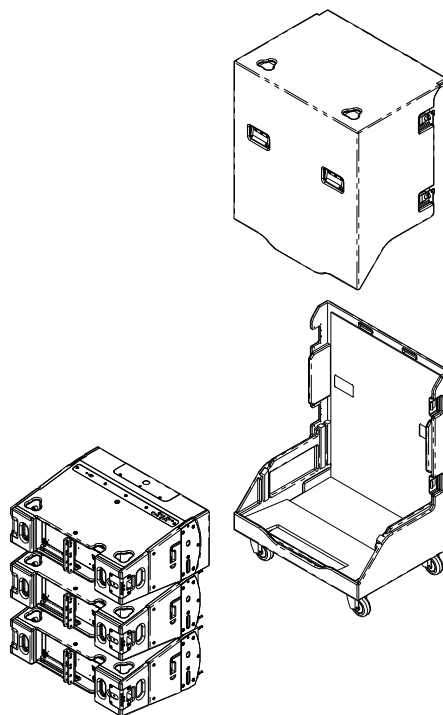
Transportation

FT-600/3 Transport Case

The FT-600/3 transport case allows a block of three TFA-600H speaker cabinets to be conveniently transported in a pre-rigged configuration, and is recommended as the most efficient way to truck and handle the cabinets. The transport case is wide enough to allow the ball-lock pins to be inserted in the flygear whilst in the case – and therefore makes it possible to lift the block of three cabinets together – while still being dimensioned to fit three-across in a standard truck.



Cabinets must be set with 0° inter-cabinet angle while in the case for transportation, although the desired cluster angles may be easily set once the block of cabinets is lifted out of the case. The use of the FT-600/3 makes for a very quick and repeatable set up.



Flying and Stacking

Overview

To take full advantage of the extremely flexible properties of the Flex Array system, two modes of rigging system have been developed and are both fully integrated into the enclosure. The two rigging systems allow either line arrays or virtual point source clusters to be assembled – intuitively, quickly and easily, and with an absolute minimum of additional external parts to suit the coverage requirements of a huge variety of professional sound reinforcement situations.

The flying systems are inherently safe, flexible, self-contained and simple to use. The load is taken entirely through the flygear and not through the cabinet's woodwork. 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 the overall cluster inclination.

Safety Notes on Rigging



The Turbosound rigging system has been designed and constructed to a high standard of safety, and tested to the most demanding of specifications. In order to ensure the highest safety standards, the information following on the assembly and safe use of rigging accessories must be carefully understood and followed.

Only use Turbosound recommended rigging accessories, which are specifically designed for their intended purpose. Do not use Turbosound rigging with other types or brands of loudspeakers. This practice may compromise safety standards and Turbosound will not be responsible for damage or injury so caused.

Do not modify the rigging accessories, or use them in any other way than that described in this user manual. Rigging components supplied as part of a complete assembly are non-interchangeable and must not be exchanged with the component parts of any other assembly.

The component parts of a Turbosound rigging accessory must only be assembled using the fasteners and methods of assembly recommended in this manual. The use of fasteners and methods of assembly not specified or approved by Turbosound may result in an unsafe rigging assembly. Welding, or any other means of permanently fixing rigging components to each other or to cabinet fixing points, is not allowed.

Rigging assemblies must only be assembled using the appropriate parts and fixings as specified in this manual using the specific mounting instructions. Rigging components or assemblies must only be fixed to Turbosound loudspeaker cabinets using the cabinet fixing points, assembly methods and fasteners specified in this manual and the specific mounting instructions.

Walls, floors or ceilings must be capable of safely and securely supporting the actual load. The rigging accessory used must be safely and securely fixed both to the loudspeaker and to the wall, floor or ceiling.

When mounting rigging components on walls, floors or ceilings ensure that all fixings and fasteners used are of an appropriate size and load rating. Wall and ceiling claddings, and the construction and composition of walls and ceilings, all need to be taken into account when determining whether a particular fixing arrangement can be safely employed for a particular load. Cavity plugs or other specialist fixings, if required, must be of an appropriate type, and must be fitted and used in accordance with the maker's instructions.

Use only the rigging accessory fixing holes indicated in this manual and the specific mounting instructions to fix Turbosound rigging accessories to walls, floors or ceilings. Where specified, the recommended maximum torque settings for screw fasteners must be strictly complied with.

Secondary Safeties

Best practice dictates that all loudspeakers flown in theatres, studios or other places of work and entertainment should (and where local laws apply), in addition to the principle load bearing means of suspension, be provided with an independent, properly rated and securely attached secondary safety.

Only steel wire ropes or steel chains of an approved construction and load rating may be used as secondary safeties. Plastic covered steel wire ropes are not permitted for use as secondary safeties.

Safety Inspections



Carefully inspect rigging systems components and cabinets for defects or signs of damage before proceeding to assemble a flown array. If any parts are damaged or suspect, **DO NOT USE THEM.**

Regular and more rigorous test and inspection of rigging components must also be carried out. Safety legislation, and test and inspection requirements, will vary from country to country. In most cases, annual independent test and inspection by a suitably approved and

qualified inspector will be required. Users must ensure compliance with all applicable safety requirements.

Turbosound recommends regular safety inspections and further recommends that a logbook be kept detailing the test and inspection history of each Turbosound rigging accessory.

Turbosound has adopted the following load safety factors:

- 12 x load safety factor: Chains, ropes, shackles, eyebolts, straps and hooks.
- 5 x load safety factor: Accessories generally employed in fixed, permanent installations.

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.



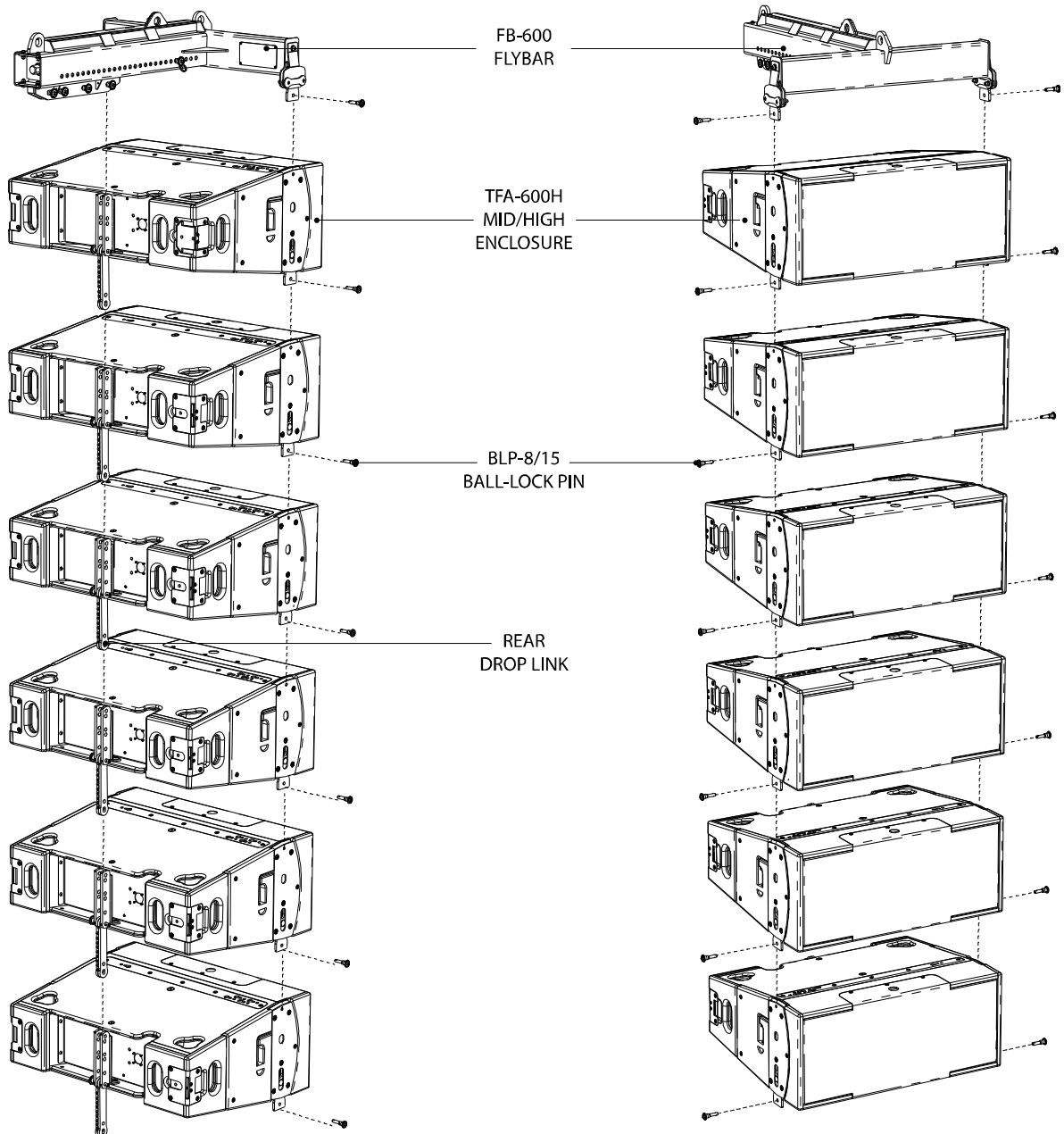
Flying System components have been individually tested in accordance with the following UK/EU regulations:

- 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 identifying number(s) from the flying equipment.

Rigging Hardware

Horizontal ('A' mode) Rigging System

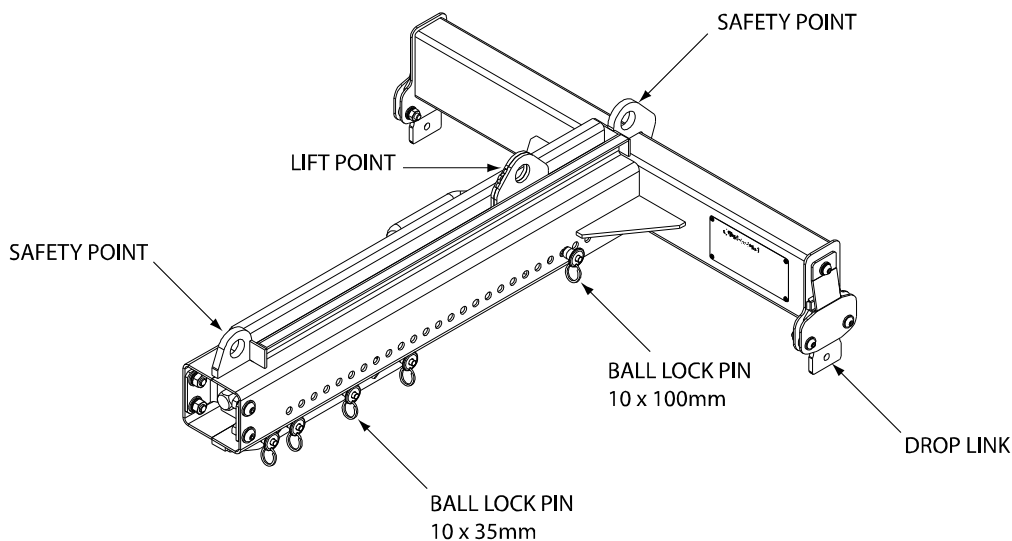


Rigging Components

The Flex Array 'A' mode, or horizontal, rigging system includes all the necessary hardware to enable vertical suspension of TFA-600 series cabinets from a single rigging point and using only a single motor rated at 1 tonne.

The FB-600 adjustable lift point flybar supports the entire weight of the loudspeaker cluster by engaging into the steel flygear rebated into the short sides of the loudspeaker enclosures, whose integrated drop links locate into the flyware of the cabinet directly underneath to form the pivot points about which cabinets are angled vertically. The drop links are secured in position with captive ball-lock pins that stow into cabinet recesses for transportation. The cabinet's rear drop link pivots down to engage in the clevis connection plate of the cabinet below in several positions, which permits a range of inter-cabinet angle adjustment, in 2° increments, from 0° to 16°.

FB-600 Adjustable Lift Point Flybar



The FB-600 is a T-shaped flybar that enables the suspension of TFA-600H mid/high and TFA-600L low frequency loudspeakers up to an SWL of 700kg, and is used for the creation of flown Flex Array line arrays. The frame is constructed from rectangular box steel section with a unique formed rear spine containing a channel in which the lift point is located.

The movable lift point can be traversed along the length of the spine from front to rear by means of a screw thread, which is turned by a 22mm (7/8") socket driven by a speed brace or hand held electric drill. The screw is located in polymer-sealed bearings requiring no maintenance under normal operating conditions, and is designed to last the lifetime of the product.

Turning the drive nut on the end of the shaft tilts the load by varying the position of the motor connection point relative to the centre of mass of the loudspeaker column. The lift point position can be altered even when under load in order to obtain the desired final cluster inclination.

The flybar's rear spine is provided with multiple locating holes along its length based on a vernier scale adjustment. A captive 100mm (4") ball-lock pin is used to lock the lift point's position when one of the two holes in the lift point aligns with a fly bar locating hole.

Floating drop links at each end of the box section engage into the flygear of the TFA-600H mid/high cabinet or TFA-600L low frequency cabinet, and are secured with captive 15mm (5/8") ball-lock pins.

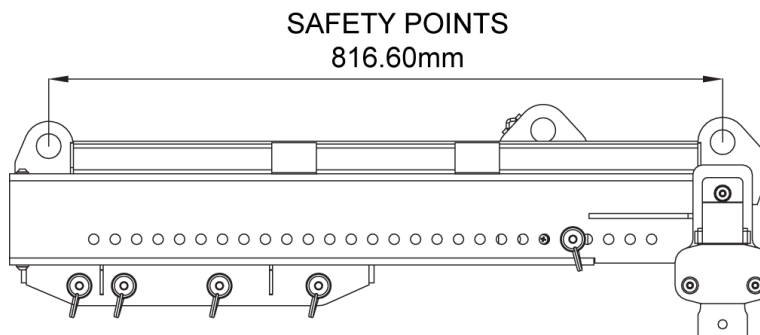
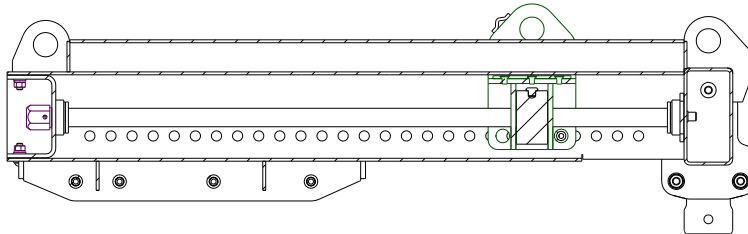
Two cabinet connection drop link positions are provided at the rear of the flybar at the correct spacing for attachment to either TFA-600L low frequency cabinets or TFA-600H mid/highs.

The net weight of the FB-600 flybar is 25 kgs.

Important Safety Notes

To ensure continued safe operation of the FB-600 flybar the following points should be noted:

- The BLP-10/100 100mm (4") locking pin should **always** be fitted to lock the lift point before lifting the flybar
- Four ball-lock pins **must** be fitted to ensure the safe lifting of the cluster
- Under no circumstances should hands be placed in the open top of the spine when the flybar is in use
- Two safety lug points are provided for attaching wire safety rope. No other part of the flybar can be used for this purpose
- Any components that are damaged should be repaired or replaced by qualified service personnel only
- In the extremely unlikely event of failure of the screw the safety and operation of the flybar is not compromised



BLP-600 Ball-lock Pins

These are provided in three sizes depending on application.

- The BLP-8/15 is used to lock cabinets together at the side pivot points and, in conjunction with the rear links, to set the vertical angles between cabinets
- The BLP-10/35 is used to locate the rear drop links in the cabinet's clevis connection plate
- The BLP-10/100 locks the position of the lift point on the FB-600 flybar

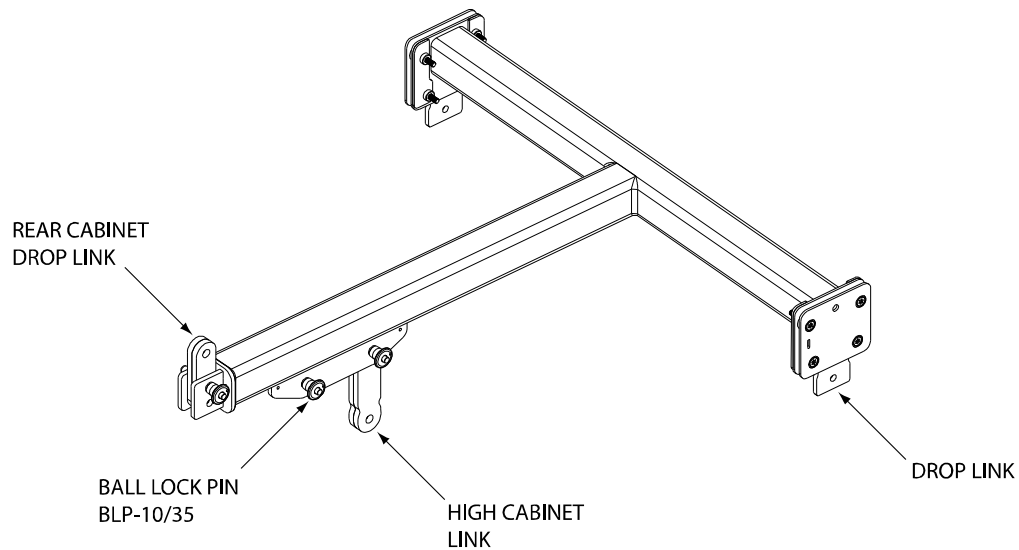
Ball-lock pins are held captive by a lanyard either on the flybar or cabinet, and are normally parked in a recess in the cabinet side, or on the flybar, when not in use to avoid the possibility of losing them. They can only be used to engage with the box above, or with an inter-cabinet coupler.

Rear Drop Link

These are supplied with each mid/high cabinet, and are used to set the inter-cabinet angle by engaging in the clevis connection plate of the cabinet below. When not in use the rear drop

CF-600 Conversion Frame

Used to interface between bass cabinets and mid/high cabinets in a flown column of Flex Array loudspeakers. The conversion frame has a SWL of 520kg which enables a column of up to a maximum of 12 TFA-600H cabinets to be suspended below it.

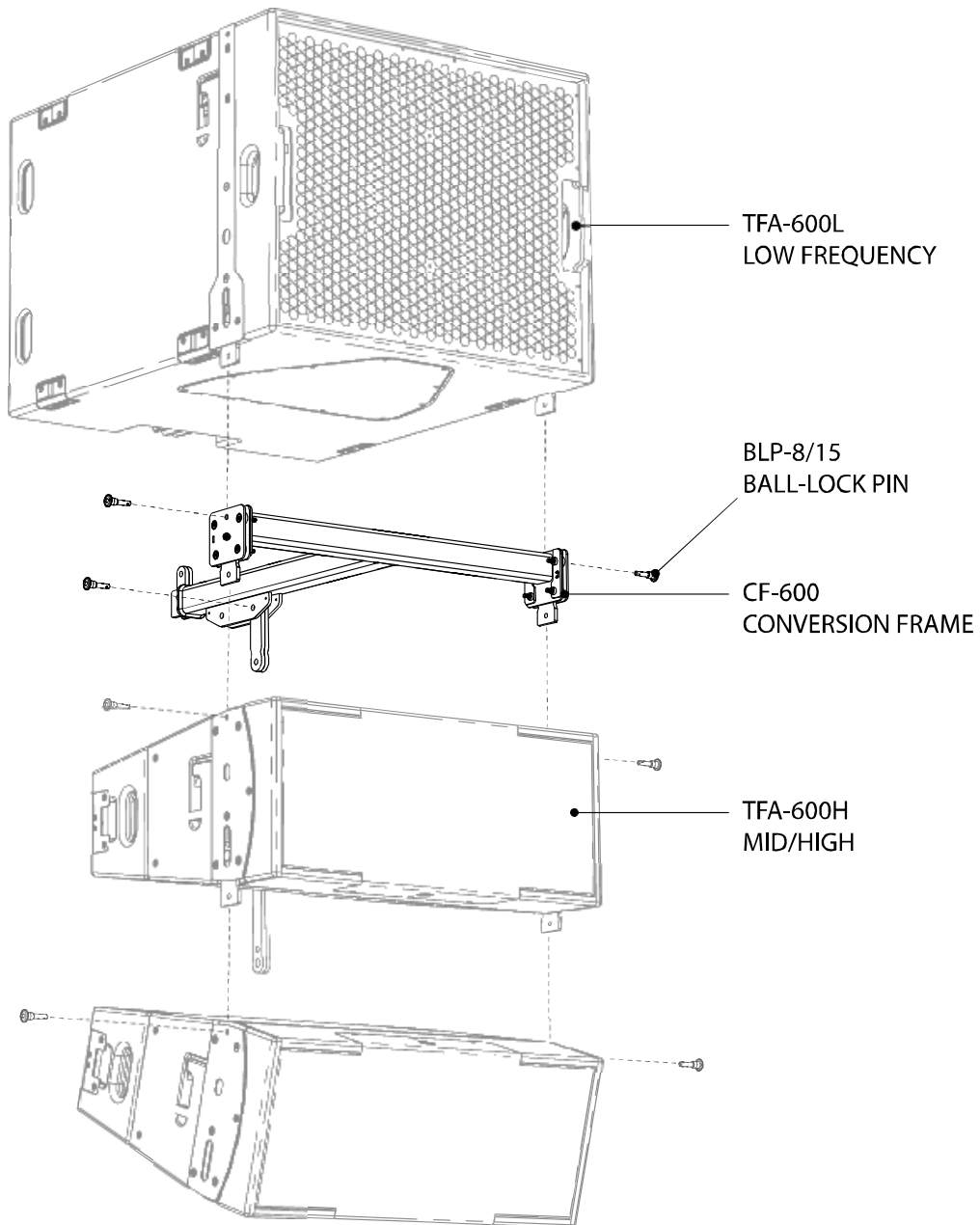


The CF-600 conversion frame also functions as a ground stacking frame, interfacing between ground stacked TFA-600L bass cabinets and the mid-high cabinets positioned on top.

The net weight of the conversion frame is 11kg (24.2lbs)

CF-600 Conversion Frame in a Flown Column

The conversion frame is fitted underneath the lowest TFA-600L low frequency cabinet in a flown column as shown in the diagram below. TFA-600H cabinets are suspended from the conversion frame using the captive ball-lock pins



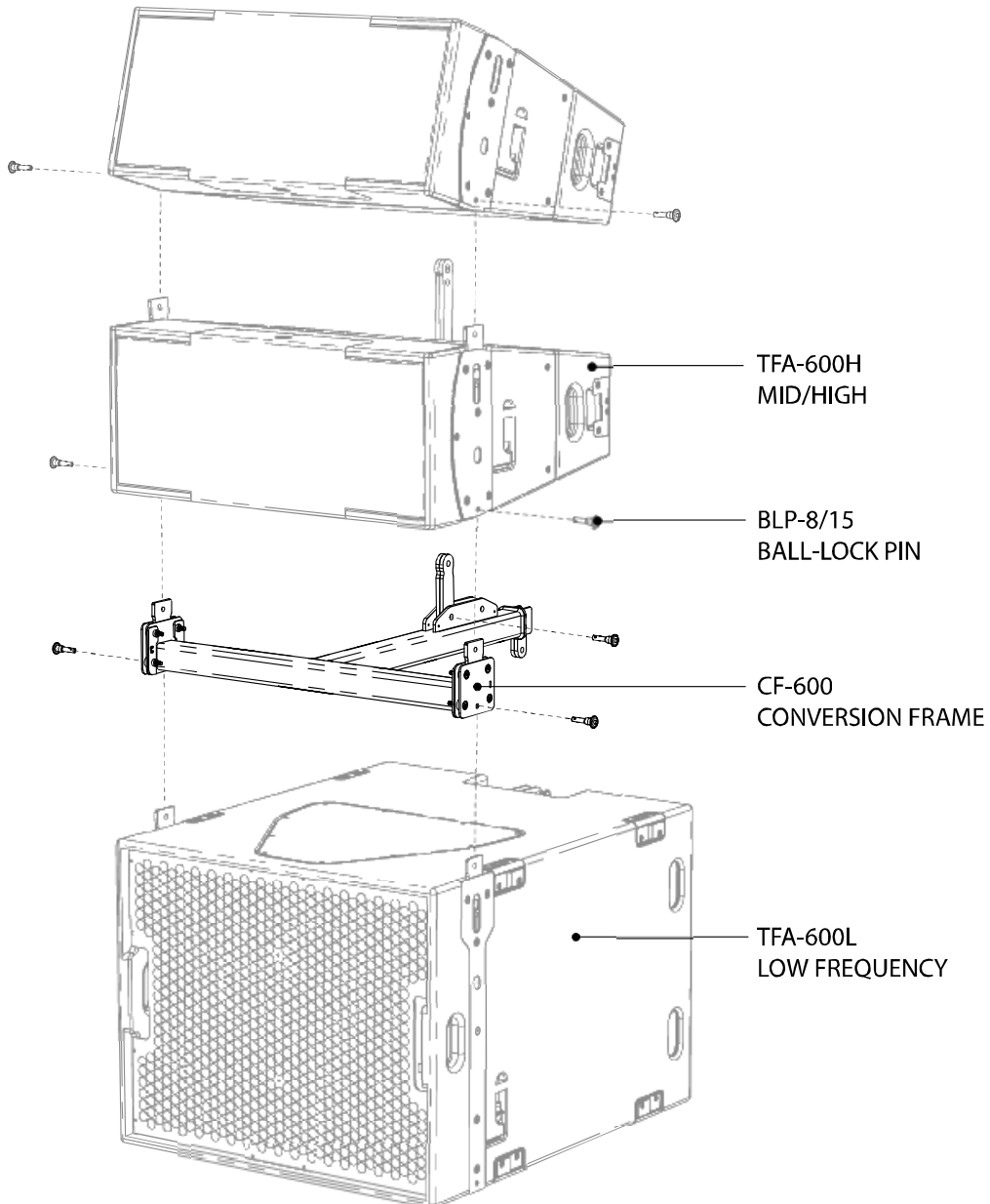
Connection to the first TFA-600H cabinet is made via two 10mm ball-lock pins which are engaged into the rear spine of the mid/high cabinet (one pin is located on the loudspeaker and one pin is located on the conversion frame).

The drop link from the TFA-600L low frequency cabinet is released by removing one of the pins and pivoting the link into the conversion frame.

The drop link from the conversion frame locates into the clevis connection plate of the top mid/high cabinet in one of several predetermined locations, which allows for a range of inter-cabinet angles.

Ground Stacking with the CF-600 Conversion Frame

In this application the conversion frame locates on the top of a ground stacked bass cabinet(s) and engages into the flygear of the first mid/high cabinet. The system allows for the lowest mid/high cabinet to be tilted down by approximately 8°.



Procedure for Flying a Column of Flex Array Loudspeakers

As described previously, the task of flying Flex Array cabinets is greatly simplified by the use of the FT-600/3 transport case which allows three mid/high cabinets to be transported, pre-rigged and lifted out of the case in one block.

1. Having established the location of the rigging points, position the FB-600 flybar directly underneath a fly point and check that the intended position of the cluster will give the required coverage. Attach a chain motor to the lift point using the shackle provided. At this point the lift point should be traversed so that it is approximately within the front half of its travel.
2. Lift the flybar and position a FT-600/3 transport case underneath. Engage the flybar drop links into the flygear of the first mid/high cabinet. Secure the drop links with the ball-lock pins that are attached to each side of the first loudspeaker cabinet.
3. Lift the flybar together with the first three cabinets sufficiently to allow a further FT-600/3 transport case with three mid/high cabinets to be positioned underneath.
4. Locate the third cabinet's drop links into the flygear of the fourth cabinet and secure with two BLP-8/15 ball-lock pins. Secure the rear drop link with a BLP-10/35 ball-lock pin.
5. Lift the flybar and continue to add cabinets either in blocks of three or singly as required to complete the specified loudspeaker cluster.
6. Adjust the angles of the lower cabinets as you go, according to the cluster design; it is much easier to do it now (lifting the weight of one or two cabinets by hand in order to release the drop link and change its position) rather than trying to adjust cabinets in the middle of a larger cluster.
7. Connect the NL8 speaker cables up the cabinets as you go along as well; they may not be reachable later on. The cables will run neatly into the cable recesses in each speaker cabinet.
8. The lowest cabinet's drop link is not used and should be parked in the rear woodwork recess with a captive ball-lock pin as shown here.



9. Adjust the overall inclination of the cluster using a speed brace or electric drill applied to the 22mm (7/8") drive nut at the rear of the flybar. An inclinometer may be used on the flybar or the top cabinet to obtain a consistent angle between the left and right PA clusters.

10. Lock the lift point with BLP-10/100 100mm (4") locking pin before lifting the flybar into its final position.

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 Turbosound LMS-D26 and LMS-D24 are recommended for use with Flex Array 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.

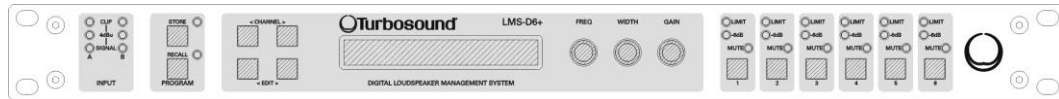
There will be a small packet of spare fuses with the unit. Please keep them in a safe place.

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 must have a depth of 425mm (minimum) to clear the connectors.

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

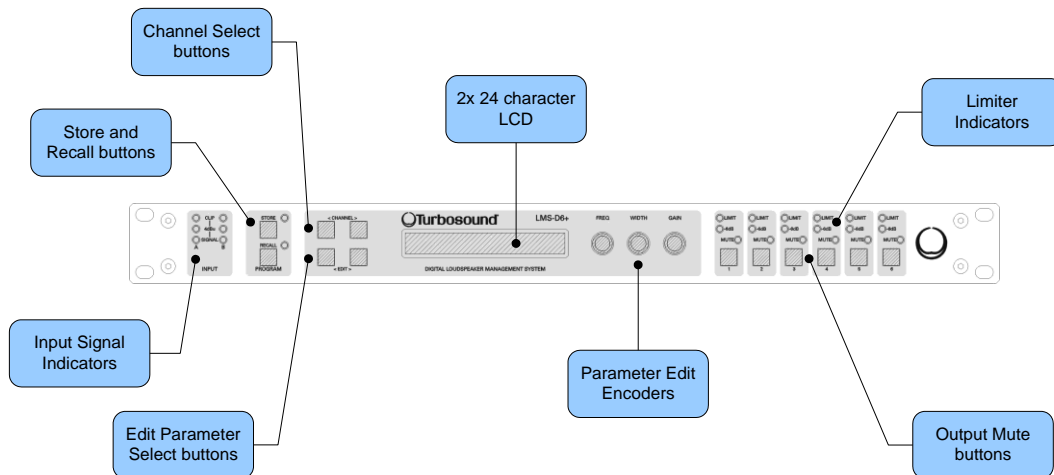
LMS-D24 and D26 Loudspeaker Management Systems



Features

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

Front Panel Functions



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

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

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

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

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

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

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

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

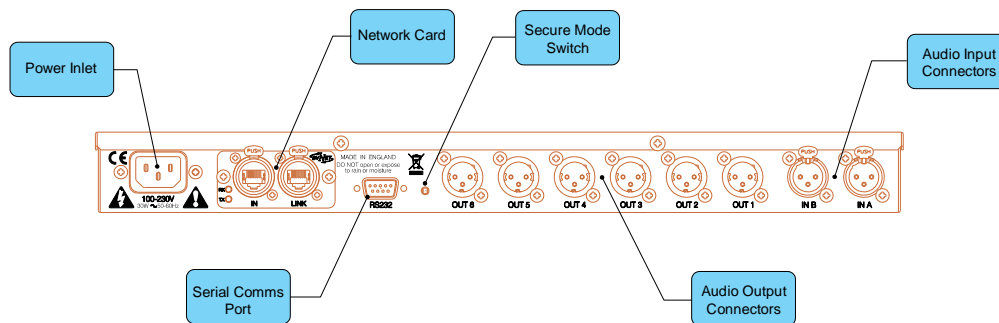
Mute buttons and status LED's – each output has a mute button and associated mute status LED. Pressing the button toggles the mute on and off.

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

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

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

Rear Panel Functions



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

Network card – connects to a PC via a BvNet interface to enable network control of the loudspeaker system.

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 connecting pin 3 'cold' signal to the ground connection of the unbalanced destination input. Note that output pin-1s are ground lifted at audio frequencies but connected to ground at RF for good EMC performance. The intention being that the amplifiers the processor is driving should be responsible for the grounding of their input cable shields.

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

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

Operating the LMS-D24 and D26

Starting up

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

Selecting a Factory Preset

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

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

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

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

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

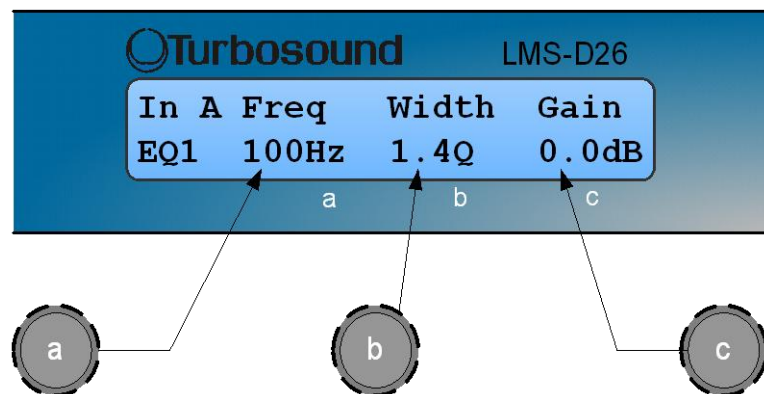
Creating a Crossover

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

Navigation and Viewing Parameters

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

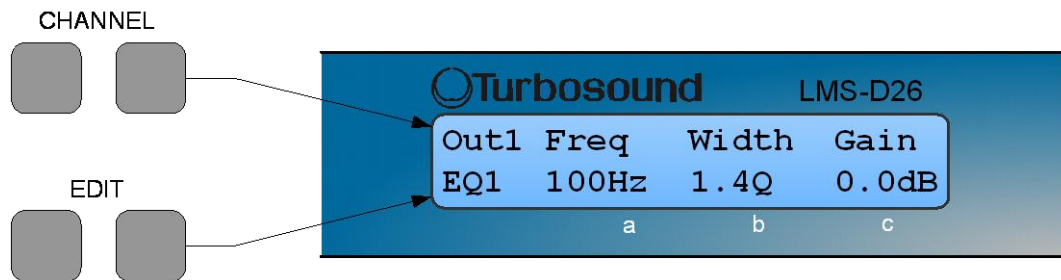
Many of the processing elements in each input and output path have features that may be controlled by the user, such as gain, frequency or limiter threshold. We call these adjustable features parameters.



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

Navigation

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



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

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

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

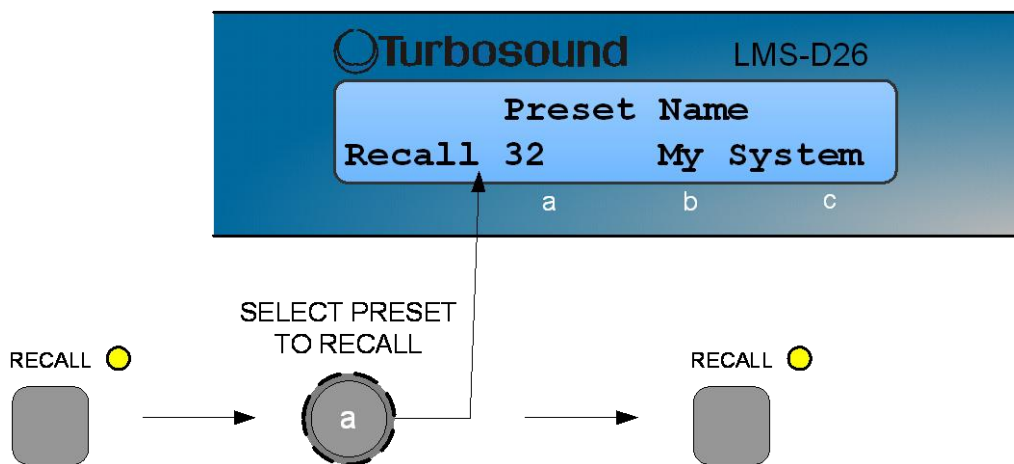
NB. When the unit powers-up, the settings will be the same as those when the unit was last switched off.

Presets

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

Preset Recall

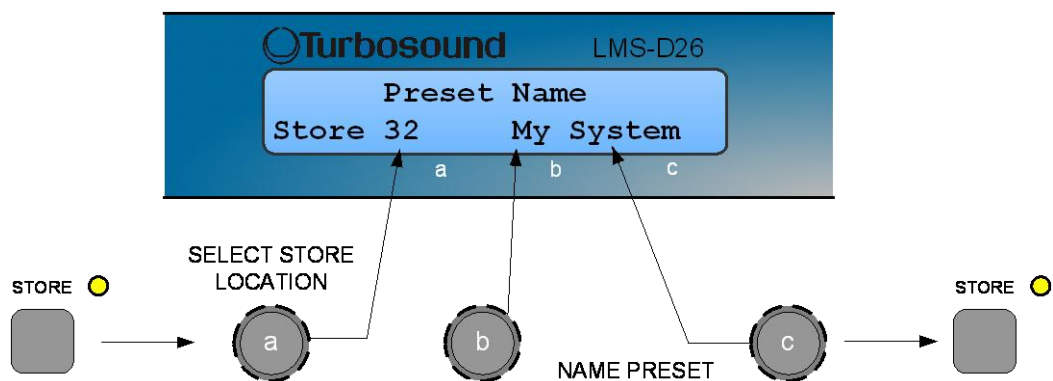
To select an existing Preset, press the Recall Button so the indicator above it illuminates. Turn parameter knob A until the required Preset number is shown on the display. Factory presets are indicated by a box symbol appearing after the preset number. Press the Recall Button again to activate the Preset.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



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

Preset Store

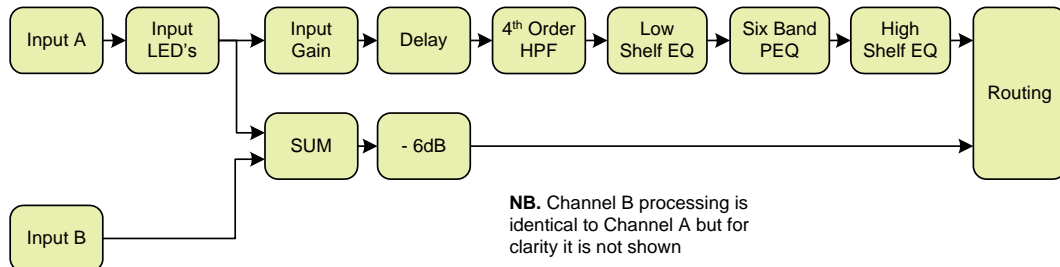
To store the current Preset in a user location, press the Preset Store Button so the indicator above it illuminates. Turn the first parameter knob until the required Preset location number is show on the display. A Preset name of up to 12 characters in length can be entered using parameter knobs B and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



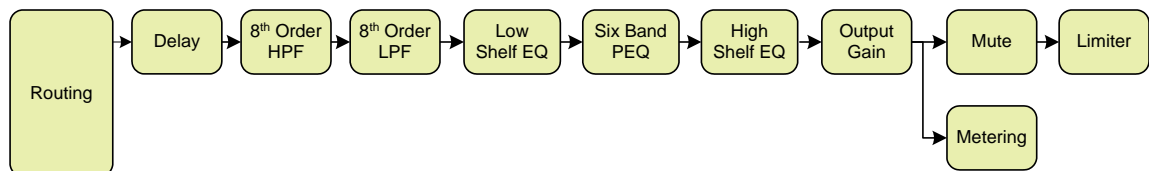
The user can overwrite non-protected Presets only; if an attempt is made to save a Preset in a location already occupied by a basic or Factory Preset a 'LOCKED PRESET' message is displayed.

DSP Processing Layout

Input DSP block diagram



Output DSP block diagram



Stereo / Mono Formats

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

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

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

The channel pairing is:

Left and Right Inputs

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

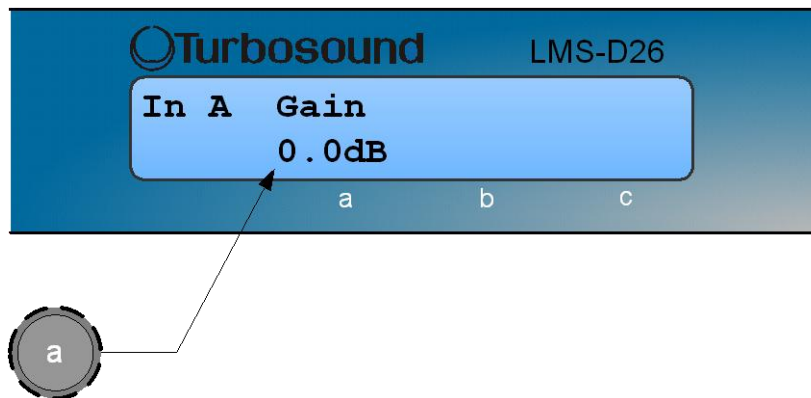
Outputs 2 (routed from L input) and 4 (routed from R input) [2 and 5 for LMS-D26]

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

DSP processing

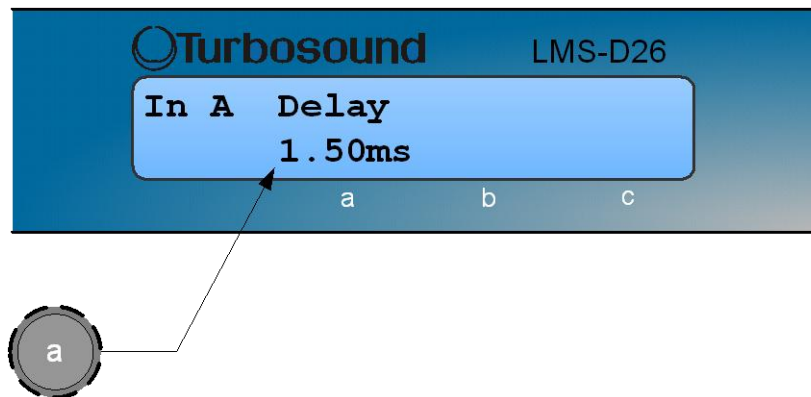
Input Channels

Gain



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

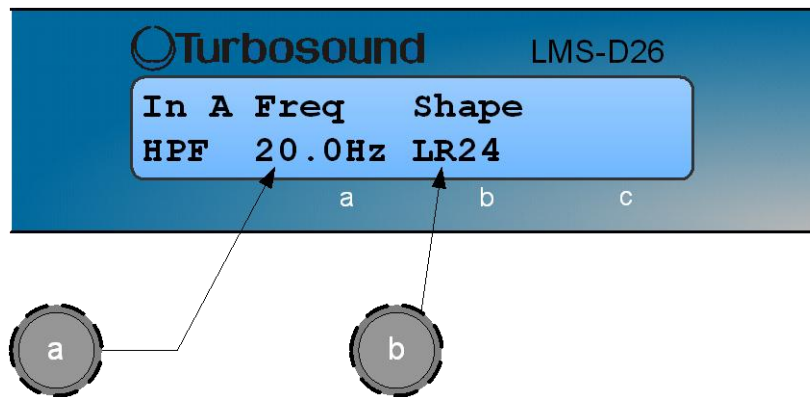
Delay



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

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

High Pass Filter



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

Knob B: high pass filter type

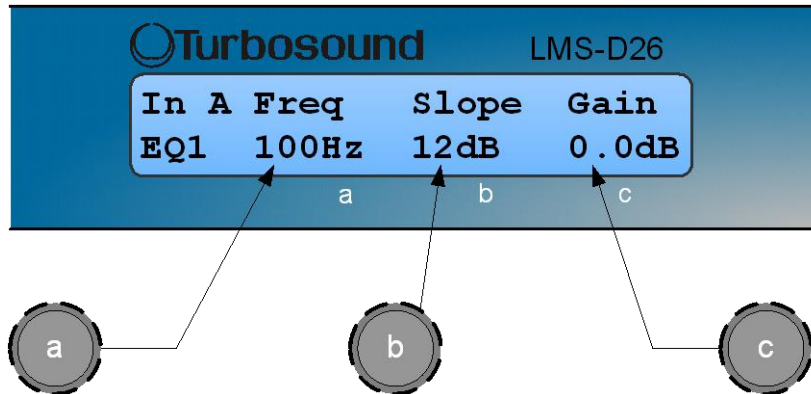
System high pass filtering is provided for the input signal. This is the preferred location for high pass filtering as it affects all outputs and can therefore improve inter-band phase relationships. Filter type is selectable from Butterworth, Bessel, Linkwitz-Riley and Hardman. Filter slopes of up to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

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

Parametric Equalisation

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

High and Low shelving filters



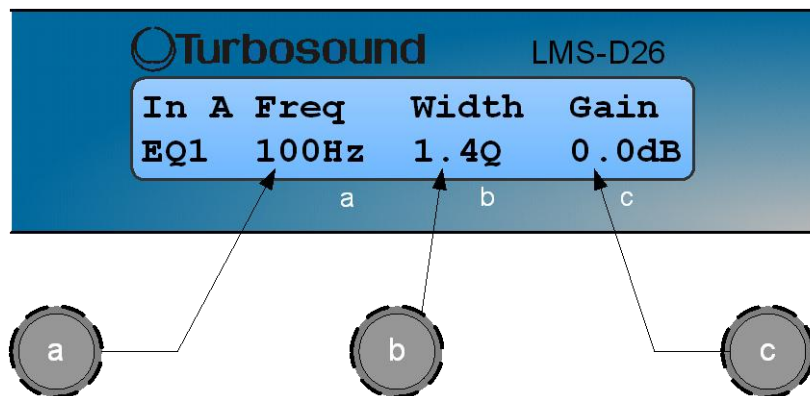
Knob A: Frequency, 10.0Hz to 25.6kHz in variable steps

Knob B: Slope, 6 to 12dB / octave in 1dB steps

Knob C: Gain, +/-15dB in 0.2dB steps

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

Parametric filters



Knob A, Centre Frequency, 10.0Hz to 25.6kHz in variable steps

Knob B, Width, display selectable, Q or BW (Bandwidth)

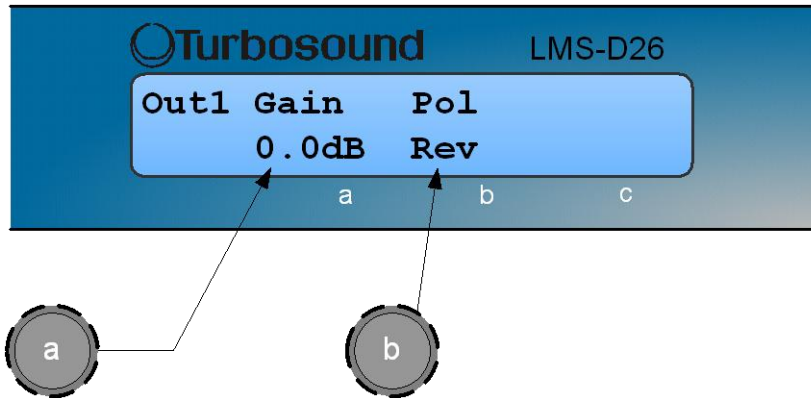
BW adjustable from 0.05 to 5 octaves in variable steps

Q adjustable from 14.2 to 0.2 in variable steps

Knob C, Gain, +/-15dB in 0.2dB steps

Output Channels

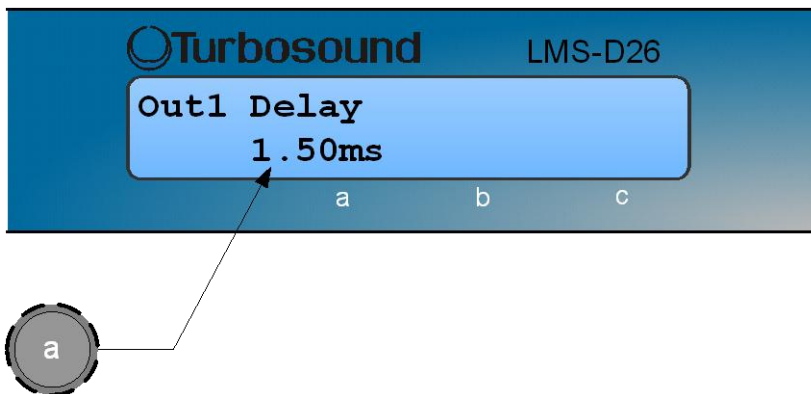
Gain and Polarity



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

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

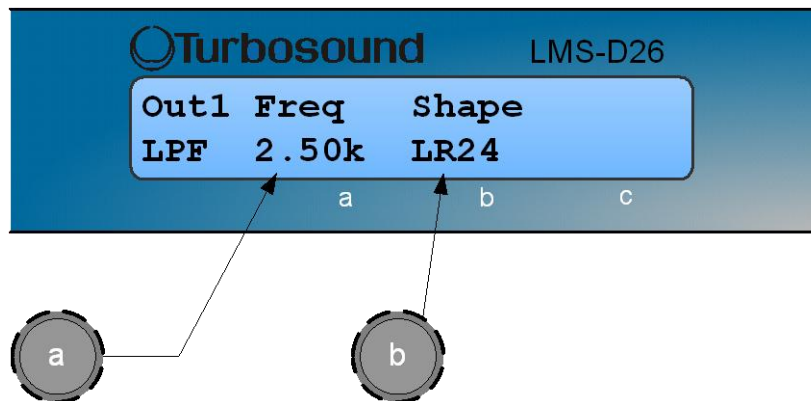
Delay



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

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

High and Low Pass Filters



Knob A: Frequency, <<out, 10.0Hz to 25.6kHz, out>>

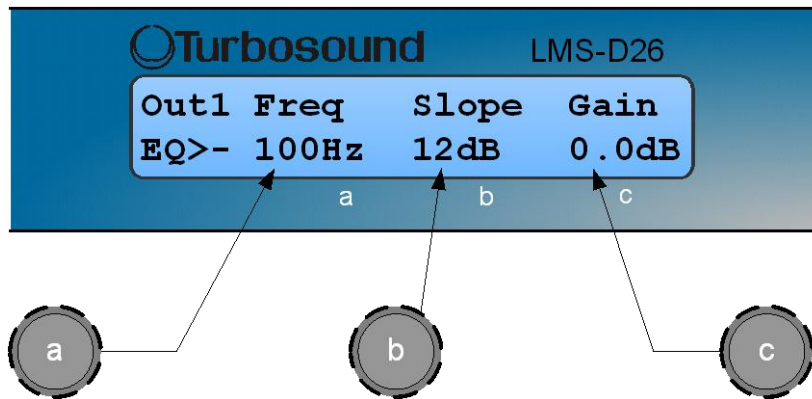
Knob B: high pass filter type

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

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

Parametric Equalisation

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

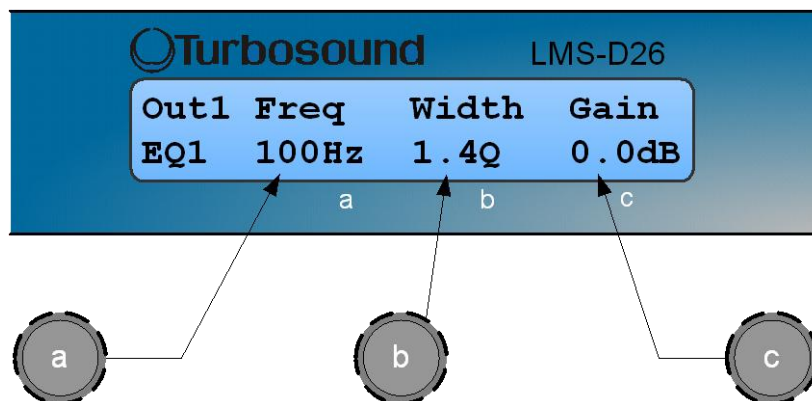


Knob A: Frequency, 10.0Hz to 25.6kHz in variable steps

Knob B: Slope, 6 to 12dB / octave in 1dB steps

Knob C: Gain, +/-15dB in 0.2dB steps

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



Knob A, Centre Frequency, 10.0Hz to 25.6kHz in variable steps

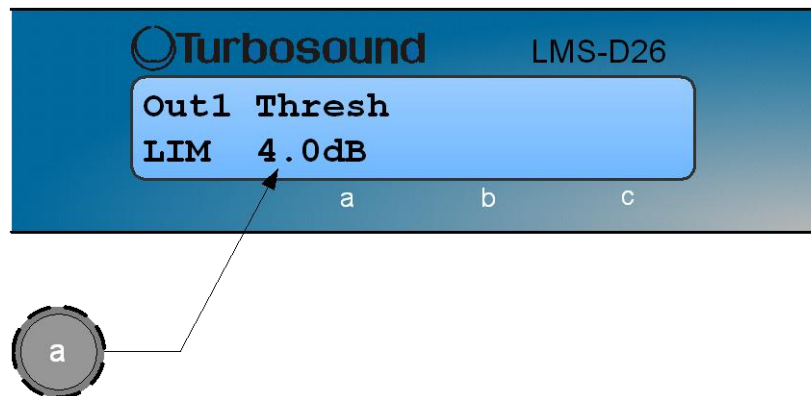
Knob B, Width, display selectable, Q or BW (Bandwidth)

BW adjustable from 0.05 to 5 octaves in variable steps

Q adjustable from 14.2 to 0.2 in variable steps

Knob C, Gain, +/-15dB in 0.2dB steps

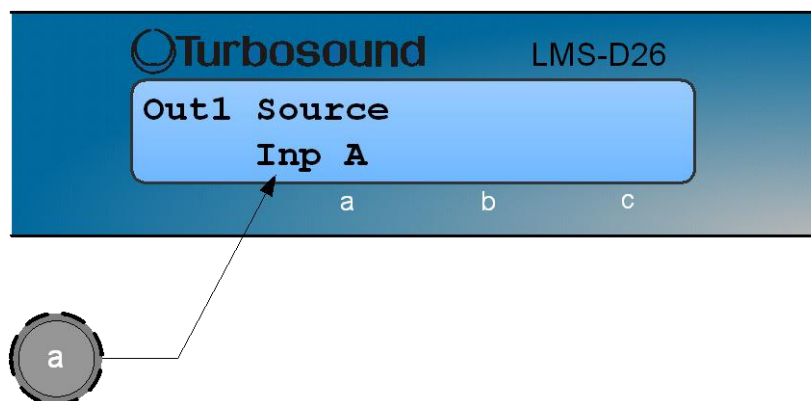
Limiters



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

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

Routing



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

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

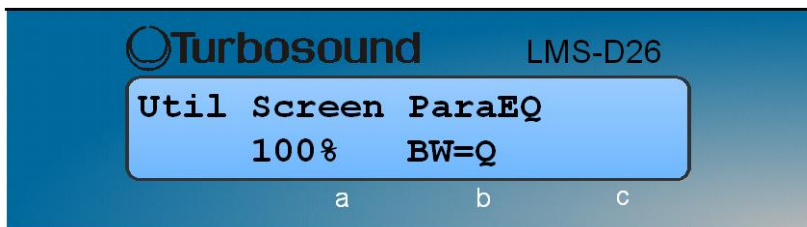
Utilities

Utility functions

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

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

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



T-Series High Efficiency Audio Power Amplifiers

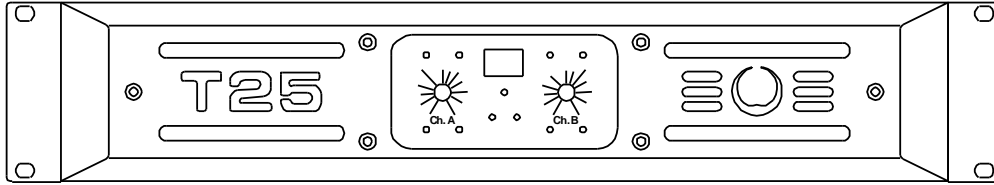
General Features & Facilities

The T-series 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.

T-series 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 or four 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 10k Ω actively balanced, fully floating input is fitted as standard.
- Front panel display of output device temperature.
- High damping factor, >400 below 1kHz.
- Low noise vari-speed fans for quiet operation.
- Front-panel accessible filter for improved dust collection.
- Consistent reliability and easy serviceability through solid, lightweight construction and modular packaging.

Front Panel Functions T-25



Mains power rocker switch – applies AC mains power to the amplifier.

Mains power LED – illuminates when AC power is applied to the amplifier.

Gain – rotary control which allows the gain of the channel to be adjusted.

Signal – blue LED indicates signal presence, active from a minimum output level of 10 watts.

-3dB – yellow LED is active when the signal is 3dB below the limiting level.

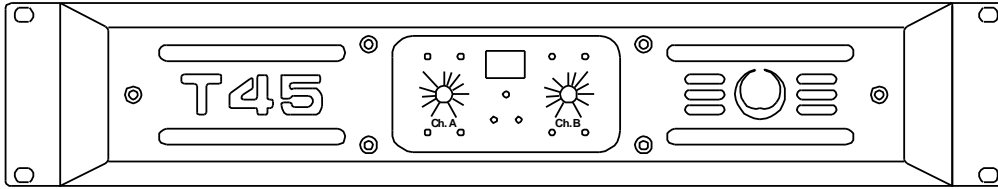
Limit – amber LED indicates operation of the limiters.

PRC – green LED indicates when the PRC for that channel has been selected.

Bridge (BRG) – green LED illuminates when bridge mode is selected.

Fault (A/P) – red LED indicates protection circuit activity.

Front Panel Functions T-45



Mains power rocker switch – applies AC mains power to the amplifier.

Mains power LED – illuminates when AC power is applied to the amplifier.

Gain – rotary control which allows the gain of the channel to be adjusted.

Signal – blue LED indicates signal presence, active from a minimum output level of 10 watts.

-3dB – yellow LED is active when the signal is 3dB below the limiting level.

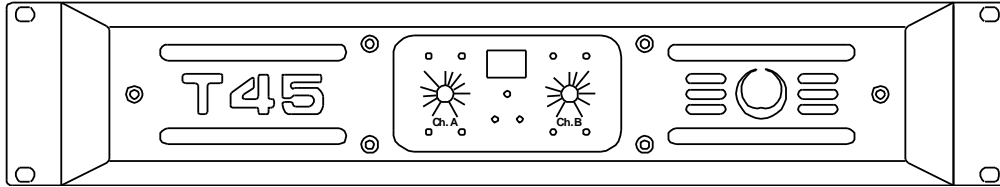
Limit – amber LED indicates operation of the limiters.

PRC – green LED indicates when the PRC for that channel has been selected.

Bridge (BRG) – green LED illuminates when bridge mode is selected.

Fault (A/P) – red LED indicates protection circuit activity.

Front Panel Functions T-475



Mains power rocker switch – applies AC mains power to the amplifier.

Mains power LED – illuminates when AC power is applied to the amplifier.

Gain – rotary control which allows the gain of the channel to be adjusted.

Signal – blue LED indicates signal presence, active from a minimum output level of 10 watts.

-3dB – yellow LED is active when the signal is 3dB below the limiting level.

Limit – amber LED indicates operation of the limiters.

PRC – green LED indicates when the PRC for that channel has been selected.

Bridge (BRG) – green LED illuminates when bridge mode is selected.

Fault (A/P) – red LED indicates protection circuit activity.

Mechanical Installation

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

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

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

Mains Power

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

Powering Up

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

Safety Earthing

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

Voltage Setting

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

Voltage Range

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

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

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

Audio Connections & Controls

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

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

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

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

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

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

Polarity

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

Input Impedance

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

When used with the LMS-D2x Loudspeaker Management System, distribution amplifiers are not required when a large number of T-25 or T-45 amplifier inputs are driven in parallel.

Gain and Sensitivity Settings

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

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

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

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

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

Attenuation & Gain Setting

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

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

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

Output Connections

A Speakon NL4 connector is provided on each channel.

Damping Factor

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

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

Damping factor is maximised by installing cables containing conductors of large cross-sectional area, and by specifying connectors with heavy-duty contacts and waterproof covers.

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 reactance 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 them apart, and preferably cross them 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

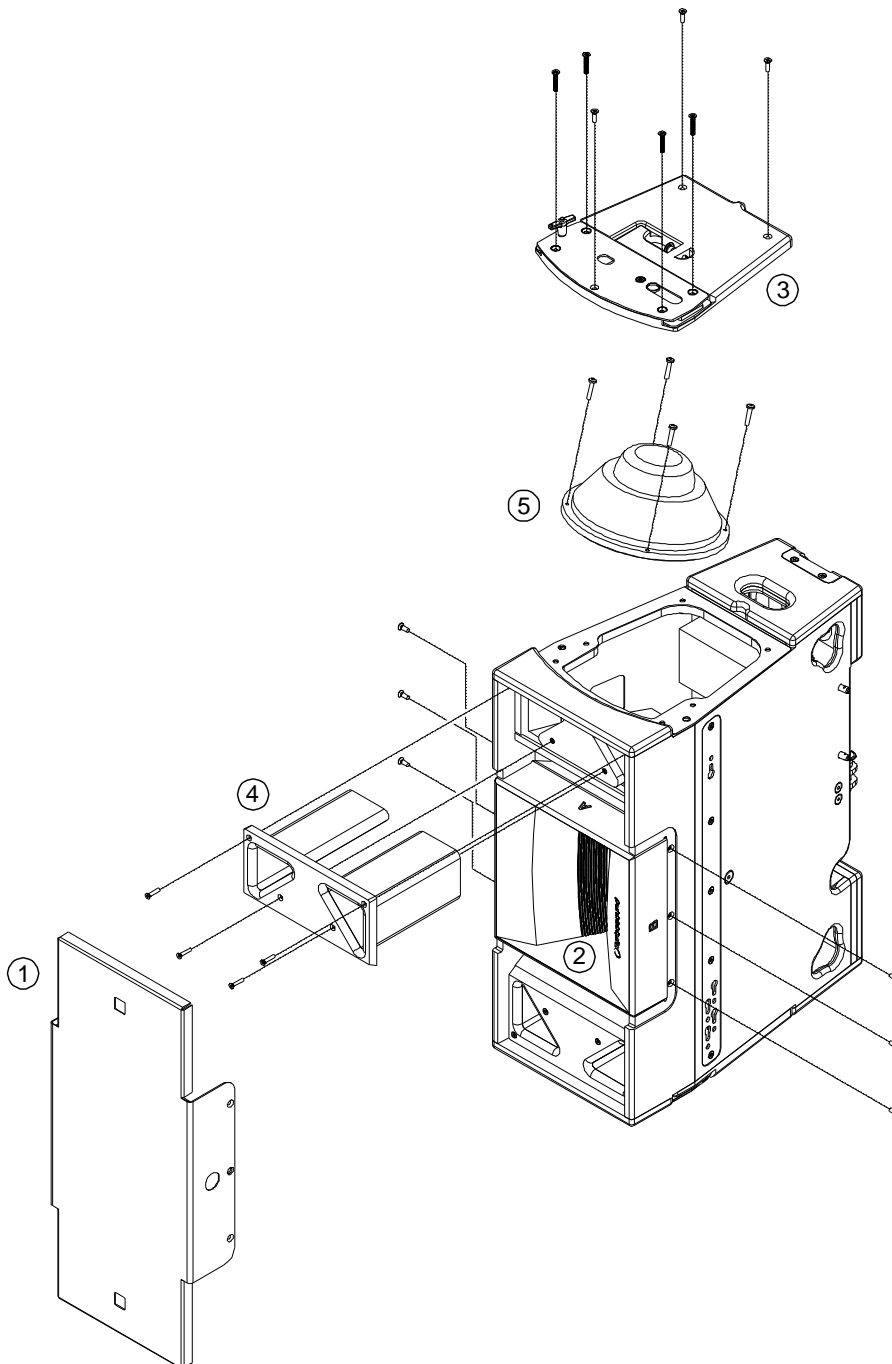
The cooling fans respond to temperature sensors within the unit to maintain a safe operating temperature. In the event of excessive temperature, the protection circuit will operate, disabling the output. The red 'AUDIO-PROTECT' (A/P) LED will indicate this condition (see fault indicator.)

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.)

Servicing Information

TFA-600H Mid/High Enclosure Driver Replacement



Removal of the 10" Low-Mid Drivers

1. Remove the three retaining screws at either side of the cabinet holding the grille (1) in place and set the grille aside.
2. Remove the driver access door (3) on the side of the cabinet.
3. Remove the four screws holding the port assembly (4) in place and lift it out.
4. The 10" driver (5) can now be unscrewed and removed from the cabinet, having first disconnected the wires from the speaker terminals. Make a note of the polarity for later reconnection.
5. Reinstatement is simply a reversal of the above procedure. Make sure to observe the correct polarity when connecting the replacement driver. Tighten all bolts down firmly but do not over-tighten.

Removal of the 6.5" High-Mid Driver

1. The high-mid driver is part of an assembly which also consists of the high frequency driver and combined horn flares. Place the cabinet on its back and remove the six retaining screws (three at either side of the cabinet) holding the grille (1) in place, and set the grille aside.
2. Disconnect the wires from the HF driver and from the high-mid driver, making note of the polarity for later re-connection. The horn assembly (2) can now be lifted out.
3. Place the horn assembly face down on a work bench and remove the four fixing screws holding the 6.5" driver in place.
4. Reinstatement of the high-mid driver is simply a reversal of the above procedure. Make sure to observe the correct polarity when connecting the replacement driver. Tighten all bolts down firmly but do not over-tighten.

Removal of the High Frequency Compression Driver

1. The compression driver is held in place between the high-mid driver and the horn flare assembly. Place the cabinet on its back and remove the three retaining screws at either side of the cabinet holding the grille (1) in place, and set the grille aside.
2. Disconnect the wires from the HF driver and from the high/mid driver, making note of the polarity for later re-connection. The horn assembly can now be lifted out.

3. Place the horn assembly face down on a work bench and remove the four fixing screws holding the 6.5" driver in place.
4. The HF driver can now be accessed for replacement or to replace the diaphragm.
5. Reinstatement of the high-mid driver is simply a reversal of the above procedure. Make sure to observe the correct polarity when connecting the replacement driver. Tighten all screws down firmly but do not over-tighten.

Use of thread locking compounds

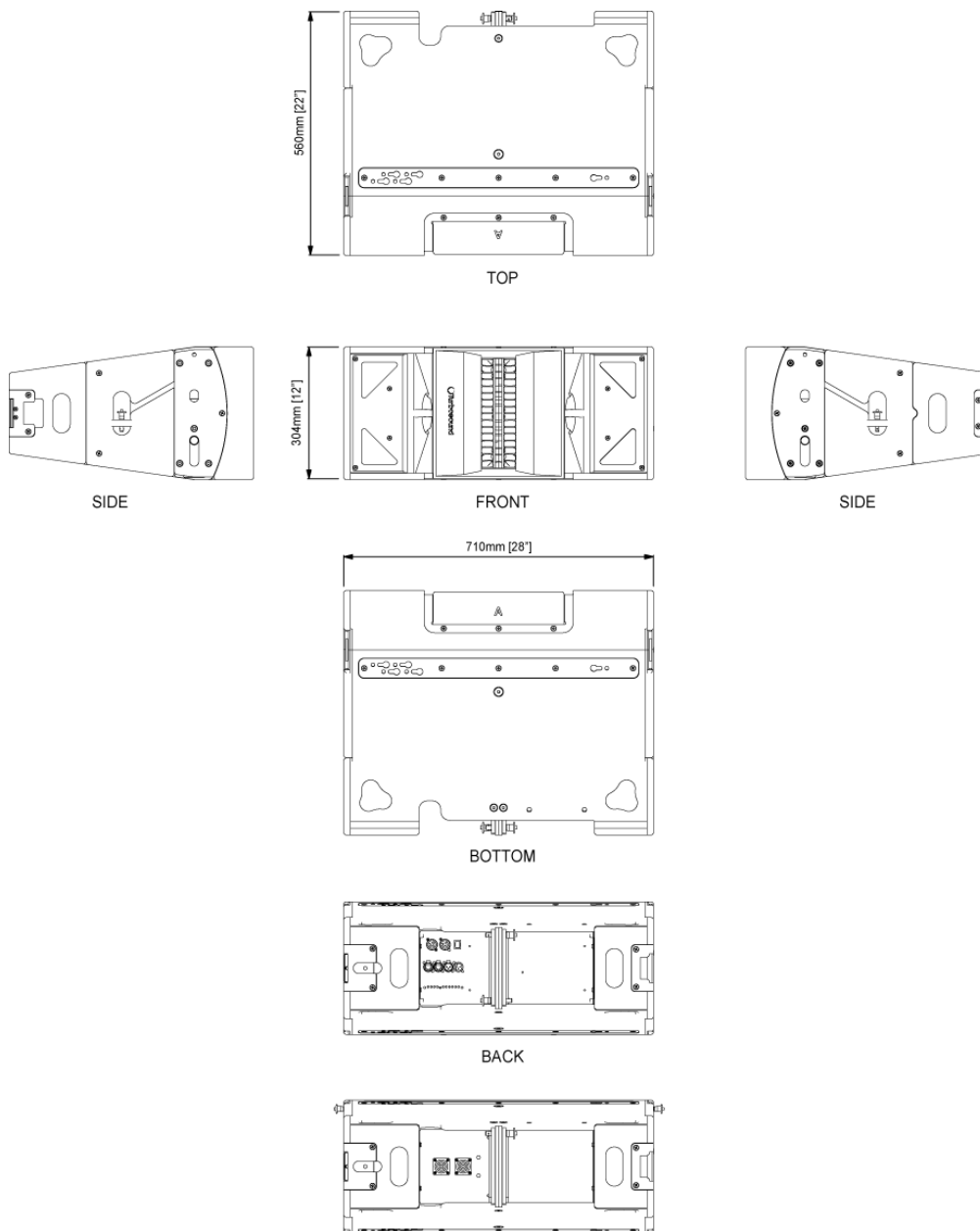
The flygear on the rear of the cabinet should be inspected regularly, and all bolts should be tightened where necessary. It is advisable to use thread-locking compounds on these fixings in order to avoid any long-term possibility of loosening.

The recommended thread-locking compound is Loctite 222. The corresponding activator, Loctite 7471, should be used to achieve 100% performance.

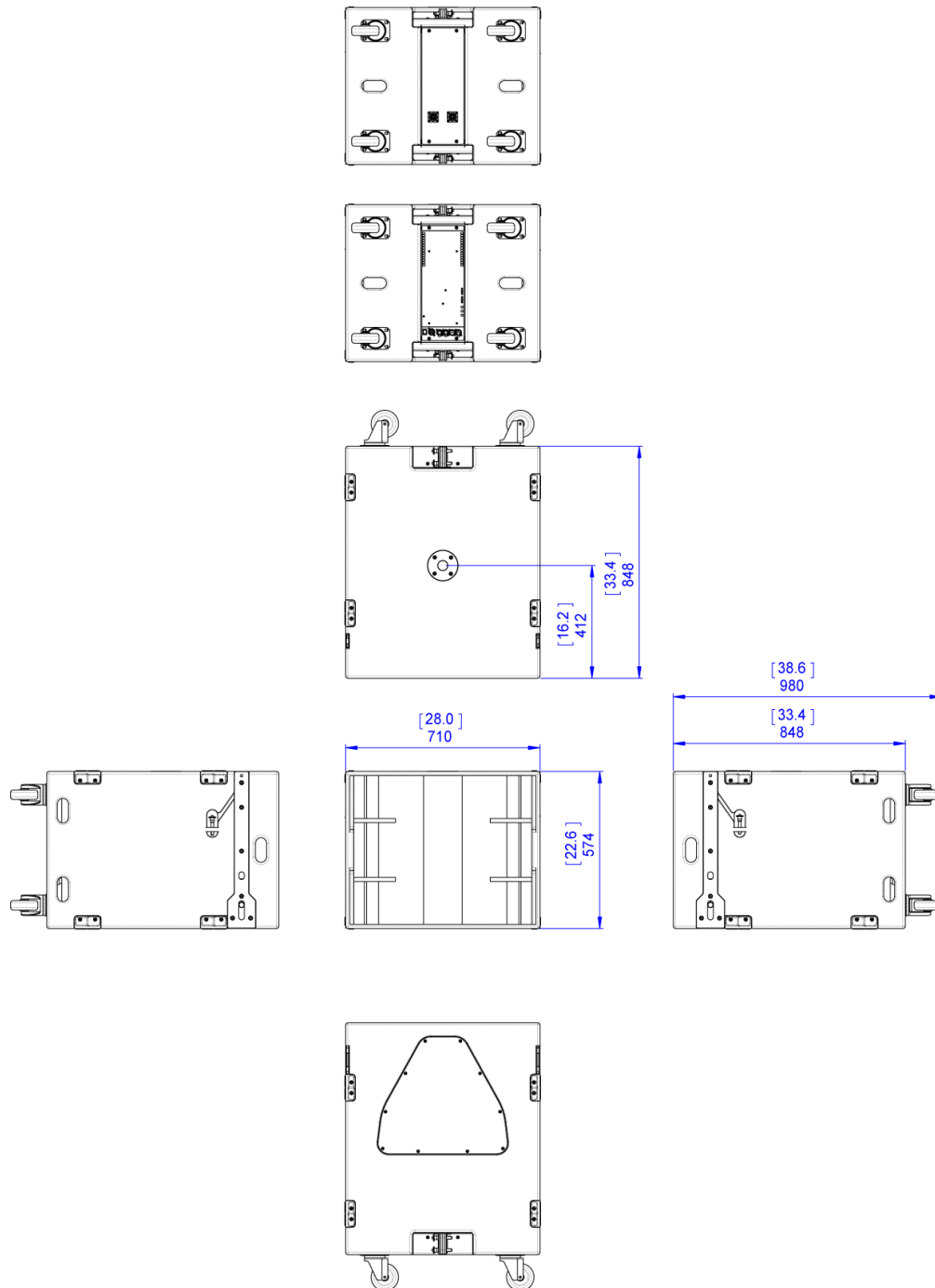
Application: Spray Loctite 7471 into the thread holes and allow to evaporate. Apply Loctite 222 thread locking compound to the bolts prior to fitting, allowing sufficient to fill all the engaged threads. Assemble components and tighten as necessary.

Product Dimensions

TFA-600H / 600HDP and TFA-600HW / TFA-600HWDP



TFA-600L and TFA-600LDP



Appendix A: Technical Specifications

	TFA-600H	TFA-600L	TSW-218
Dimensions mm (inches)	710 x 304 x 560 (28" x 12" x 22")	710 x 574 x 848 (28" x 22.5" x 33.4")	574 x 1400 x 770 (22.6" x 55.1" x 30.3")
Net weight	41kg (90.2lbs)	72kg (158.4lbs)	110kg (242lbs)
Frequency range	90Hz – 18kHz ±3dB 80Hz – 20kHz ±10dB	40Hz – 100Hz ±3dB 35Hz – 100Hz ±10dB	35Hz – 150Hz ±4dB
Dispersion	75°H x 16°V	N/A	N/A
Power handling (continuous)	LF: 600 watts MF: 120 watts HF: 60 watts	800 watts	1600 watts
Sensitivity (1w@1m)	LMF: 96dB HMF: 108dB HF: 104dB	104dB	104dB
Max SPL (max/cont)	130dB/136dB	133dB/139dB	136dB/142dB
Crossover points	Bi-amp 90Hz, 600Hz Tri-amp 90Hz, 600Hz, 6kHz	90Hz	150Hz
Nominal impedance	LF: 8 ohms MF: 8 ohms HF: 8 ohms	8 ohms	4 ohms
Construction	15mm (5/8") birch plywood	15mm (5/8") birch plywood	18mm (5/8") birch plywood
Connectors	2 x NL8	2 x NL4	2 x NL4

	TFA-600HDP	TFA-600LDP	TSW-218DP
Dimensions mm (inches)	710 x 304 x 560 (28" x 12" x 22")	574 x 710 x 848 (22.6" x 28" x 33.4")	574 x 1400 x 770 (22.6" x 55.1" x 30.3")
Net weight	43kg (94.6lbs)	75kg (165lbs)	113kg (248.6lbs)
Frequency range	90Hz – 18kHz ±3dB 80Hz – 20kHz ±10dB	38Hz – 150Hz ±3dB 30Hz – 150Hz ±10dB	35Hz – 150Hz ±4dB
Max SPL (max/cont)	130dB/136dB	133dB/139dB	136dB/142dB
Construction	15mm birch ply	15mm birch ply	18mm birch ply
AMPLIFIER			
Type	Class D inc. SMPA and networked DSP	Class D inc. SMPA and networked DSP	Class D inc. SMPA and networked DSP
Power Output	2500 watts @ 8 ohms (1kHz, 0.01% THD)	2500 watts @ 8 ohms (1kHz, 0.01% THD)	2500 watts @ 8 ohms (1kHz, 0.01% THD)
Dynamic Range	110dB	110dB	110dB
Input Clip	10dBu	10dBu	10dBu
Bandwidth	20Hz – 20kHz ±0.5dB	20Hz – 20kHz ±0.5dB	20Hz – 20kHz ±0.5dB
Power Requirements	100V to 240V AC @50/60Hz	100V to 240V AC @50/60Hz	100V to 240V AC @50/60Hz
Connectors	1 x XLR female input 1 x XLR male link wired pin 2 hot	1 x XLR female input 1 x XLR male link wired pin 2 hot	1 x XLR female input 1 x XLR male link wired pin 2 hot

Appendix B: Table of Rigging Components

Stock code	Part No.	Description
07B1070	FB-600	Screw-thread adjustable 'A' mode flybar
07B1060	CF-600	Conversion frame
07S0040	RCL-600H	Rear cabinet link
07S0055	RCL-600L	Rear cabinet link
07B1075	FK-600i	Install flying kit
07S0045	BLP-8/15	Ball-lock pin 8mm
07S0045	BLP-10/35	Ball-lock pin 10mm

Appendix C: Spare Parts List

Stock Code	Model	Description
07E015	BS-890	Captive biscuit
LS1815	LS-1815	18" Low frequency driver
LS1025	LS-1025	10" Low-mid frequency driver
LS6507	LS-6507	6" High-mid frequency driver
04A9306	CD-117	Compression driver
05B5160	RC-1815	Recone kit
05B1075	RC-1025	Recone kit
05B9315	RD-117	Replacement diaphragm
07G0320	MG-600H	Metal grille (with foam and badge)
07A0325	MG-600L	Metal grille
16F950	TFA-600HDP AMP	Amplifier module TFA-600HDP
16F913	TFA-600LDP AMP	Amplifier module TFA-600LDP
16G570		Powercon mains cable

Appendix D: 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 on 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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