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L-ACOUSTICS MTD LINE

MTD108a, MTD112b, MTD115b

OPERATOR MANUAL

FOREWORD

Thank you for purchasing the MTD108a, MTD112b or MTD115b sound reinforcement system.

This manual is intended to provide you with the information you require to install and operate your MTD loudspeaker enclosure in a wide variety of professional sound reinforcement applications.

Specific information and recommendations are included regarding system design, sound design and installation. We are confident that the information provided in this manual will be sufficient for most applications, however, should you require further assistance your distributor or L-ACOUSTICS® are available to provide additional technical support.

MANUAL ORGANIZATION

- The Introduction gives a brief presentation of coaxial technology and the MTD line.
- Chapter 1 introduces MTD108a, MTD112b, MTD115b loudspeaker enclosures plus accessories
- Chapter 2 discusses MTD power amplification and cabling
- Chapter 3 describes MTD processing using LLC analog controllers
- Chapter 4 provides examples of MTD packaging
- Chapter 5 discusses sound design aspects
- Chapter 6 outlines MTD installation procedures
- Chapter 7 discusses MTD system operation and maintenance procedures
- Chapter 8 provides MTD108a, MTD112b and MTD115b specifications

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0. INTRODUCTION

Effectively covering an audience is the goal of any sound reinforcement system design. This is straightforward in small spaces where a left/right stereo configuration is suitable provided that the available power is sufficient, i.e., a stereo pair of loudspeakers is a relatively easy system to install and the results are fairly predictable. Things become more complex when larger audience area coverage is required and there are two possible approaches:

1) Multiplying the number of sound sources by dividing the audience into areas which are covered by individual sources. In this case, the Haas effect is exploited and the goal is to reduce audible interference effects by dissociating or decoupling the individual sound sources (delay lines can also be introduced to provide proper localization). This is the distributed sound reinforcement, or multiple sound source approach, and the MTD line of enclosures is highly suited for this type of sound design.

2) Coupling a number of individual sound sources to form a loudspeaker array, with the objective that each array becomes the equivalent of a single sound source.

For the second approach, conditions for achieving proper coupling of individual arrayed sound sources have been defined by Dr. Christian Heil and Professor Marcel Urban, in "Sound Fields Radiated By Multiple Sound Source Arrays" (AES paper preprint 3269, presented at the 92nd AES convention in Vienna, 1992). Additional conditions were published in the AES preprint "Wavefront Sculpture Technology" (WST) that was presented at the 111th Convention, NYC, 2001 (preprint 5488). The theory that was developed defines the acoustic coupling conditions required for effectively arraying individual sound sources. These conditions are satisfied by the ARCS®, dV-DOSC™ and V-DOSC® products which are intended for medium- to large-scale sound reinforcement applications. However, in most cases, it is not feasible to meet WST criteria while at the same time having a sufficient level of versatility for small- to medium-scale applications. In other words, if a product is to be arrayable, it typically leads to an enclosure design that cannot be used in single or very small configurations. A different set of loudspeaker enclosure design specifications apply that are more suited to the multiple source sound design approach.

The L-ACOUSTICS approach to distributed sound reinforcement using multiple sound sources starts with the specification that each individual loudspeaker enclosure should behave as a totally coherent source. This criterion can be achieved using coaxial components which are well-suited to the design of highly versatile, small format systems. The use of coaxial components has been popularized over the years by a famous British manufacturer for studio monitoring applications – to the best of our knowledge, L-ACOUSTICS was the first manufacturer to use coaxial technology in professional sound reinforcement applications and the current MTD line is a continuation of the heritage that was introduced in 1989.

Coaxial, dual concentric components provide a smooth transition between the LF and HF sections since, by definition, the directivity of the two transducers is matched at the crossover frequency. In addition, the directivity is horizontally, vertically and diagonally symmetric (axi-symmetric). This results in true, single source behavior and the performance obtained is superior in terms of coherence when compared with any combination of two independent sound sources (separate woofer plus horn-loaded compression driver, for example). This is the case even if the independent sources are designed to provide the same directivity behavior (which is rarely the case) since the acoustic centers of the two sources are not located at the same physical location.

Other benefits obtained using the coaxial, axi-symmetric configuration are smooth acoustical impedance loading for the compression driver and a short time window of reflections which is far more acceptable than the longer reflection sequences that are produced by traditional horn designs. In addition, the wavefront radiated by an axi-symmetric sound source has directivity that is smoothly increasing with frequency which helps to match the acoustical environment of a typical auditorium. Normally, the reverberation time in auditoria decreases smoothly above 1 kHz and at greater distances in the venue, the low frequency energy is fairly constant due to the reverberant field.

Loudspeaker focus or aiming can be adjusted so that maximum HF energy is directed towards the farthest listening areas, therefore balancing the SPL attenuation with distance that occurs in the direct field. At closer listening positions, the off-axis attenuation at higher frequencies provides a similar tonal balance and the attenuation with distance is less.

The coaxial configuration therefore provides the optimum directivity required in order to obtain even coverage and constant tonal balance in a typical semi-reverberant auditorium. Extensive sound design and installation experience acquired by L-ACOUSTICS over the years confirms this and we are confident that coaxial, axi-symmetric loudspeaker enclosures are the best tools for multiple source, distributed sound design.

MTD108a, MTD112b and MTD115b loudspeaker enclosures provide the basic starting tools for distributed sound reinforcement and, in fact, that's what MTD stands for : Mul-Ti-Distributed.

1. THE MTD SYSTEM

The MTD line consists of: MTD108a, MTD112b, MTD115b loudspeaker enclosures with their respective analog line level controllers (MTD108 LLC, LLC112b-st, LLC115b-st or LLC115b-2w), MTD rigging accessories and SB115, SB118 or SB218 subwoofers. Please note that amplifier racks plus loudspeaker cables are not specified but should meet the minimum specification requirements outlined below.

1.1 MTD SYSTEM COMPONENTS

LOUDSPEAKER ENCLOSURES

(1) **MTD108a**
Passive 2-way coaxial loudspeaker, containing 8" loudspeaker, 1" exit high frequency compression driver with 100 degree axi-symmetrical coverage.

(2) **MTD112b**
Passive 2-way coaxial loudspeaker, containing 12" loudspeaker, 1.4" exit high frequency compression driver with 85 degree axi-symmetrical coverage.

(3) **MTD115b**
Switchable active/passive 2-way coaxial loudspeaker, containing 15" loudspeaker, 1.4" exit high frequency compression driver with 85 degree axi-symmetrical coverage.

SUBWOOFER ENCLOSURES

(4) **SB115**
Front-loaded, bass-reflex design, single 15" subwoofer for low frequency extension

(5) **SB118**
Dual bandpass-loaded, single 18" subwoofer for high level, extended bandwidth applications.

(6) **SB218**
Front-loaded, bass-reflex design, dual 18" subwoofer for high level, extended bandwidth applications.

For more information concerning SB115, SB118 and SB218 subwoofer enclosures please consult the SB Subwoofer User's Manual

LINE LEVEL CONTROLLERS

(7) **MTD108 LLCa**
Stereo analog line level controller for use with the MTD108a

(8) **LLC112b-st**
Stereo analog line level controller for use with the MTD112b

(9) **LLC115b-st**
Stereo analog line level controller for use with the MTD115b in passive mode

(10) **LLC115b-2w**
Mono analog line level controller for use with the MTD115b in 2-way active mode

MTD RIGGING ACCESSORIES

(11) **ETR 8** : Adjustable U-Bracket for ceiling, wall or scaffold mounting of the MTD108a in either horizontal or vertical orientations

(11) **ETR 1** : Adjustable U-Bracket for ceiling, wall or scaffold mounting of the MTD112b (vertical orientation only)

(11) **ETR 2** : Adjustable U-Bracket for ceiling, wall or scaffold mounting of the MTD115b or SB115subwoofer (vertical orientation only)

(12) **PION 1** : Single stud Aeroquip flytrack fitting-to-ring for use as a safety attachment in conjunction with MTD112b and ETR1, or MTD115b and ETR2

LOUDSPEAKER CABLES

(12) **F-CABLE (SP7, SP25)**
Loudspeaker cable, 4 conductor, 4mm^2 conductor cross-section, 7 m (20 ft) or 25 m (80 ft) length, equipped with 2 x Speakon connectors

(13) **F-LINK CABLE (SP.7)**
Loudspeaker link cable, 4 conductor, 4mm^2 conductor cross-section, 0.7 m (2 ft) length, equipped with 2 x Speakon connectors (for paralleling MTD enclosures).



MTD108a



ETR8



MTD112b



ETR1



MTD115b



ETR2 (for MTD115b or SB115)



PION1



F-CABLE DO7



F-LINK CABLE DO.7

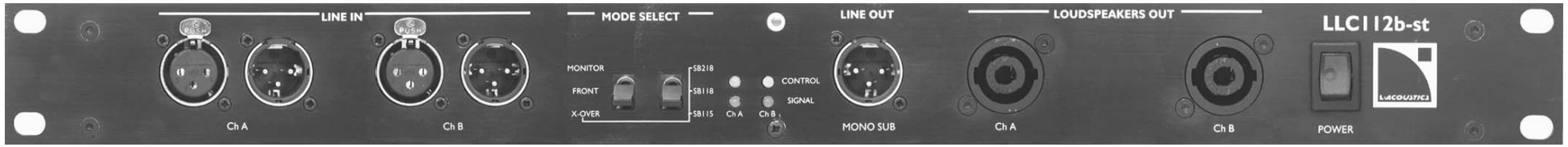
Figure 1: MTD System Components



MTD108 LLCa (front)



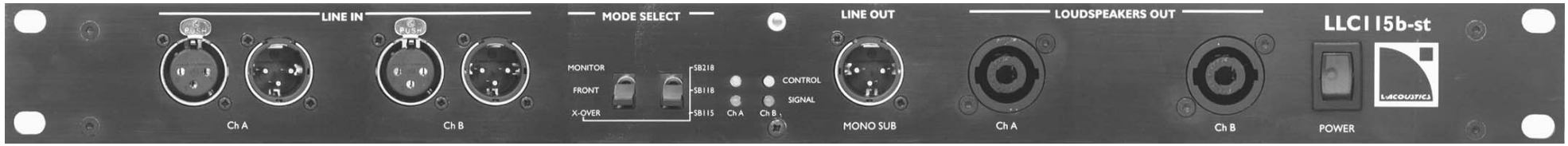
MTD108 LLCa (rear)



LLC112b-st (front)



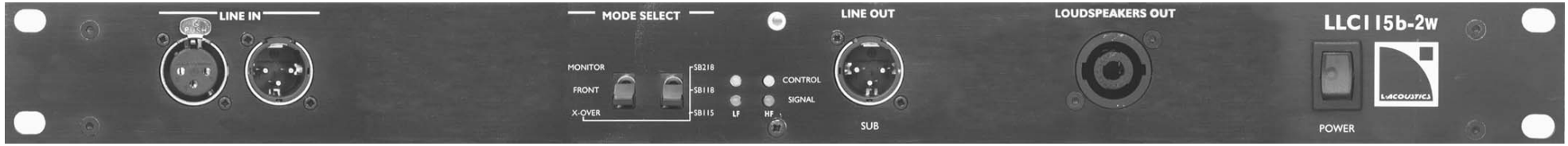
LLC112b-st (rear)



LLC115b-st (front)



LLC115b-st (rear)



LLC115b-2w (front)



LLC115b-2w (rear)

Figure 2: MTD LLC Controllers

1.2 MTD OVERVIEW

L-ACOUSTICS MTD108a, MTD112b and MTD115b loudspeaker enclosures along with their respective analog controllers provide highly versatile, multi-purpose systems that are designed for distributed sound reinforcement. Intended for medium-scale touring, sub-hire or fixed installation, the MTD line of enclosures benefit from the economy, packaging and "plug and play" ease of use afforded by their companion LLC analog line level controllers.

The MTD108a is a passive 2-way loudspeaker containing a 1" neodymium compression driver that is directly loaded by the 8" loudspeaker in a coaxial configuration. The MTD112b is a passive 2-way loudspeaker containing a 1.4" exit compression driver and 12" loudspeaker in a coaxial configuration while the MTD115b is switchable active/passive and features a 15" loudspeaker plus 1.4" exit compression driver. As discussed in the introduction, advantages of the coaxial approach include: single point source radiation and excellent phase response, total wavefront coherency at all frequencies and axi-symmetrical directivity that produces identical horizontal and vertical coverage. Coaxial design also provides LF/HF superimposed dispersion characteristics that are free of polar lobing effects typical of traditional horn and woofer combinations. The end result is natural, studio monitor level sound quality, ideal for proximity use and perfectly matching semi-reverberant environments.

The MTD108a, MTD112b or MTD115b are ideal for distributed sound reinforcement and can also be used in medium power front-of-house (FOH) applications for theatres, clubs, multi-purpose venues or corporate events. Examples of distributed systems include delay rings for large-scale installations, surround effects channels for theatre or multimedia, distributed reinforcement for sports venues, and delays for speech reinforcement in convention centre ballrooms. Due to their compact, wedge-shaped format, axi-symmetrical directivity and full range passive design, MTD enclosures also provide a cost-effective, high performance floor monitor solution for live sound reinforcement. When used with additional subwoofers such as the SB115, SB118 or SB218, the MTD line of enclosures can also be used for side fill or drum monitoring applications.

The L-ACOUSTICS MTD108LLCa, LLC112b-st, LLC115b-st and LLC115b-2w are dedicated analog controllers that provide optimum signal processing and protection for the MTD108a, MTD112b, MTD115b (passive mode) and MTD115b (active mode), respectively. Active sense return monitoring guarantees safe system operation with LLC controllers providing both thermal protection and cone excursion limiting. LLC controllers also generate a subwoofer feed with switchable high pass filtering and equalization for use with SB115, SB118 or SB218 subwoofers. Front panel design also allows LLC controllers to function as a patch panel, providing an ergonomic, cost-effective solution for amplifier rack packaging.

Pole mount sockets are included as standard and all MTD enclosures are Omnimount-ready. Adjustable U-brackets are available as optional rigging accessories, allowing MTD enclosures to be ceiling-, wall- or scaffold-mounted. As standard on the MTD112b and MTD115b, single stud anchor plates are included for installation of a safety steel using the optional PION1 (single stud Aeroquip flytrack fitting-to-ring) accessory.

1.3 MTD108a SPECIFICATIONS

The MTD108a is a passive 2-way coaxial full range loudspeaker containing one 8-inch, direct radiating low frequency component and one 1-inch titanium diaphragm, neodymium magnet, compression driver. As a full range system, the frequency response is 85 - 20k Hz with less than ± 3 dB variation and the usable bandwidth is 65 – 20k Hz (-10 dB). Sonic quality and the ratio of performance-to-size were the chief design criteria for the MTD108a and its frequency response is exceptionally flat, providing excellent fidelity and optimum speech intelligibility.

The MTD108a is ideal for distributed sound reinforcement in theatre, corporate, restaurant, retail, club, or television (A/V) applications and is an excellent candidate for delay ring, front fill or under balcony use. The ultra-compact format of the MTD108a allows for visually discrete installation in all of these applications. The MTD108a is equally useful as a compact, high-efficiency floor monitor for concert, theatre, dance, corporate or television applications. Given its superb fidelity and dynamic response, the MTD108a is effective in situations that are typically unaccustomed to sound reinforcement, in particular, for classical music and opera where high quality sound reinforcement is essential.

The cone body of the 8" low frequency component provides pattern control loading of the compression driver and yields a 100-degree (±15 degrees) conical directivity that is vertically, horizontally and diagonally symmetrical (i.e., axi-symmetric). As implemented in the passive crossover network, the crossover point between low and high sections is 2 kHz. Long term power handling capacity is 250 Wrms at a nominal 8 ohm impedance and connection to the loudspeaker is made via two parallel 4-pin Neutrik Speakon connectors.

For floor monitoring, the MTD108a has either 22.5° or 45° listening angles with respect to vertical for short throw or long throw applications, respectively. Dimensions are 42.1 cm (16.6 in) high, 25.0 cm (9.8 in) wide by 24.2 cm (9.5 in) deep and the weight is 10.5 kg (23.1 lbs). Cabinet construction consists of 15 mm (0.6 in) and 18 mm (0.7 in) Baltic birch plywood with joints that are sealed, screwed and rabbeted. The finish is maroon gray, high resiliency paint and the front of the loudspeaker is protected by a black powder-coated 1.5 mm (0.06 in) thick steel grill that is covered with 5 mm (0.2 in) thick acoustically transparent open cell foam.

The MTD108a has 4 integral rear attachment points for wall mounting using an optional Omnimount rigging accessory along with a 36 mm (1.42 in) diameter pole mount socket for tripod mounting. An integral top plate and the bottom pole mount socket also allows for rigging the MTD108a using the optional ETR8 adjustable U bracket.

The L-ACOUSTICS MTD108LLCa is a stereo analog controller that provides optimum equalization and band limiting for the MTD108a along with system protection and processing for use with subwoofers. Active sense return monitoring guarantees safe operation and the controller provides both thermal protection and cone excursion limiting.

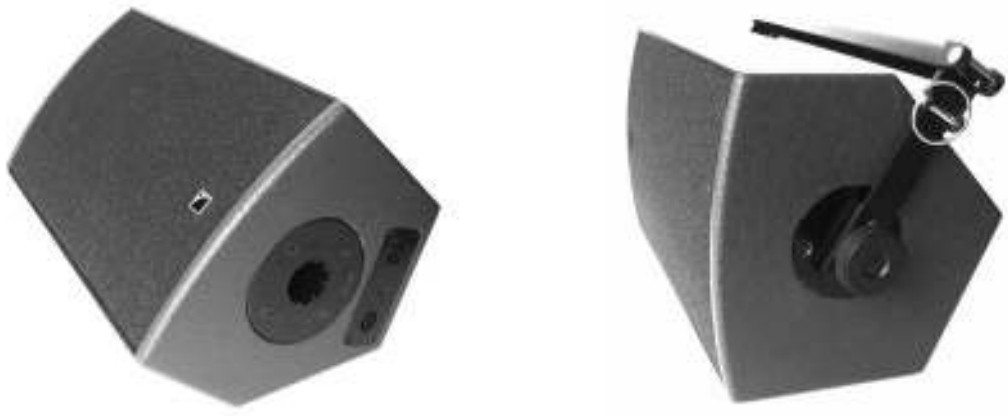


Figure 3: MTD108a passive 2-way (8" LF + 1" HF) coaxial loudspeaker

1.4 MTD112b SPECIFICATIONS

The MTD112b is a passive, two-way, coaxial full range loudspeaker containing one direct radiating, bass reflex-loaded 12 inch low frequency transducer and one 1.4 inch exit, 3 inch voice coil diameter, titanium alloy diaphragm compression driver. As a full range system, the frequency response is 70 Hz to 14 kHz with less than ± 3 dB variation and the usable bandwidth is 55 Hz to 16 kHz (-10 dB).

The cone body of the low frequency component provides pattern control loading of the compression driver, yielding an 85-degree (± 20-degree) conical dispersion pattern that is axi-symmetrical. The 2nd and 3rd order passive filters employed in the MTD112b provide a 1.2 kHz crossover point between low and high frequency components. Long term power handling is 450 Wrms at a nominal 8 ohm impedance and connection to the loudspeaker is made via two parallel 4-pin Neutrik Speakon connectors.

The MTD112b has a truncated wedge shape with a curved front profile. When used on its rear side, the front baffle of the enclosure is oriented at a 45 degree angle with respect to vertical, allowing the enclosure to be used as a floor monitor.

Dimensions are 54 cm (21.3 in) high, 41 cm (16.1 in) wide at the front of the enclosure, 16.5 cm (6.5 in) wide at the rear of the enclosure and 37.5 cm (14.8 in) deep. Enclosure weight is 26.5 kg (58.4 lbs) and cabinet construction consists of 18 mm (0.70 in) and 30 mm (1.18 in) Baltic birch plywood with internal steel bracing and joints that are sealed, screwed and rabbeted. The finish is maroon-gray high resilient paint and the front of the enclosure is protected by a black powder-coated, 1.5 mm (0.06 in) thick steel grill that is covered with 10 mm (0.4 in) thick acoustically transparent open cell foam.

The MTD112b has a 36 mm (1.42 in) diameter pole mount socket mounted on the bottom side and a single stud anchor plate mounted on the rear side along with four threaded inserts for attachment of an optional Omnimount bracket. Four recessed attachment locations are available (two on each top and bottom side) for rigging the enclosure with the optional ETR1 adjustable U-bracket accessory.

The MTD112b is used with the LLC112b-st stereo analog controller that monitors power amplifier outputs and employs sense return processing to provide thermal protection and cone excursion limiting for the loudspeaker components. The analog controller provides band limiting and corrective component equalization with three settings that are designed for front-of-house, floor monitor or two-way operation with subwoofers. The LLC112b-st controller also performs signal summation of the two input signal channels and provides a line level output signal with selectable band limiting and equalization for use of the MTD112b in conjunction with SB115, SB118 or SB218 subwoofers.

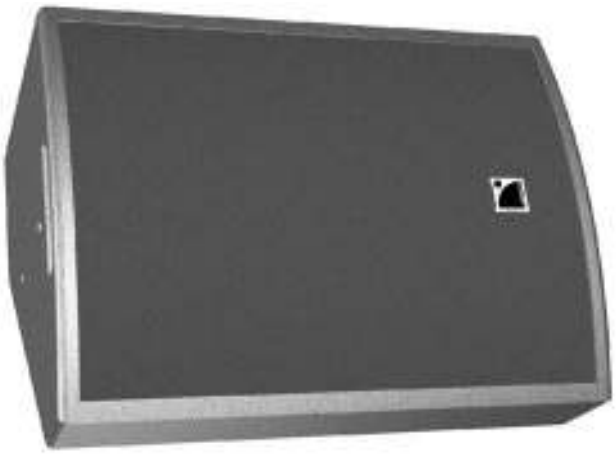


Figure 4: MTD112b passive 2-way (12" LF + 1.4" HF) coaxial loudspeaker

1.5 MTD115b SPECIFICATIONS

The MTD115b is a switch-selectable active/passive, two-way, coaxial full range loudspeaker containing one direct radiating, bass reflex-loaded 15 inch low frequency transducer and one 1.4 inch exit, 3 inch voice coil diameter, titanium alloy diaphragm compression driver. As a full range system, the frequency response is 65 Hz to 14 kHz with less than ± 3 dB variation and the usable bandwidth is 50 Hz to 16 kHz (-10 dB).

The cone body of the low frequency driver provides pattern control loading of the compression driver, yielding an 85-degree (± 20-degree) conical dispersion pattern that is axi-symmetrical. The 2nd and 3rd order passive filters employed in the MTD115b provide a 1.2 kHz crossover point between low and high frequency components. In passive mode, long term power handling is 265 Wrms at a nominal 8 ohm impedance. In active mode, the crossover point between low and high frequency components is 1.2 kHz with 24 dB per octave Linkwitz-Riley characteristics and long term power handling is 265 Wrms for the low section and 150 Wrms for the high section at a nominal 8 ohm impedance. Connection to the loudspeaker is made via two parallel 4-pin Neutrik Speakon connectors.

The MTD115b has a truncated wedge shape with a curved front profile. When used on its rear side, the front baffle of the MTD115b is oriented at a 41 degree angle with respect to vertical, allowing the enclosure to be used as a floor monitor.

Dimensions are 58 cm (22.8 in) high, 44 cm (17.3 in) wide at the front of the enclosure, 16.7 cm (6.6 in) wide at the rear and 47.5 cm (18.7 in) deep. Enclosure weight is 32.5 kg (71.6 lbs) and cabinet construction consists of 18 mm (0.70 in) and 30 mm (1.18 in) Baltic birch plywood with internal steel bracing and joints that are sealed, screwed and rabbeted. The finish is maroon-gray high resilient paint and the front of the enclosure is protected by a black powder-coated, 1.5 mm (0.06 in) thick steel grill that is covered with 10 mm (0.39 in) thick acoustically transparent open cell foam.

The MTD115b has a 36 mm (1.42 in) diameter pole mount socket mounted on the bottom side and a single stud anchor plate mounted on the rear side along with four threaded inserts for attachment of an optional Omnimount bracket. Four recessed attachment locations are provided (two on each top and bottom side) for rigging the enclosure with the optional ETR2 adjustable U-bracket accessory.

When operated in passive mode, the MTD115b is used with the LLC115b-st stereo analog controller, and in active mode, the LLC115b-2w mono two-way analog controller is specified. Both analog controllers monitor power amplifier outputs and employ sense return processing to provide thermal protection and cone excursion limiting for the loudspeaker components. Analog controllers also provide band limiting and corrective component equalization with three settings that are designed for front-of-house, floor monitor or two-way operation with subwoofers. The LLC115b-st stereo controller performs signal summation of the two input signal channels and both controllers provide a line level output signal with selectable band limiting and equalization for use of the MTD115b in conjunction with SB115, SB118 or SB218 subwoofers.

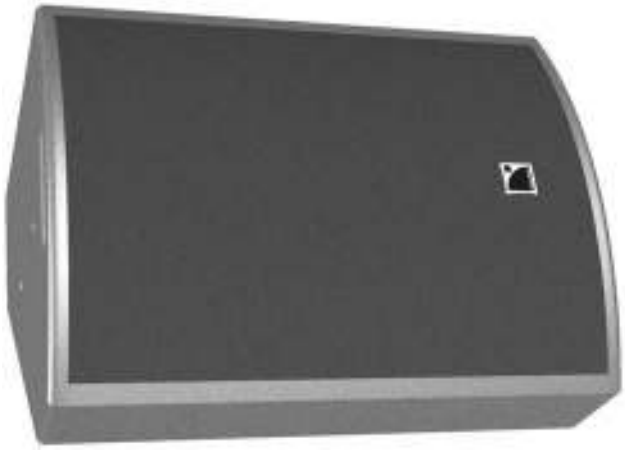


Figure 5: MTD115b active/passive 2-way (15" LF + 1.4" HF) coaxial loudspeaker

2. POWERING MTD

It is important that power amplifiers with sufficient power are used to power MTD108a, MTD112b or MTD115b loudspeakers since headroom is less likely to damage loudspeaker components than clipping. Apart from normal standards regarding construction, protection, cooling and damping factor that are expected of any professional sound reinforcement amplifier, MTD loudspeakers and LLC controllers are intended to be used with amplifiers with the following specifications:

GAIN STRUCTURE
Protection circuitry employed in all LLC Controllers is calibrated and optimized for 32 dB amplifier gain.

LLC controllers can be safely used with amplifiers having less than 32 dB gain, however, the maximum SPL output obtainable from your loudspeaker system will be less than optimum. In addition, due to the higher input sensitivity of lower gain amplifiers (i.e., less input signal level is required in order to drive the amplifier to clip) it is also possible that LLC controller limiting circuitry will not operate correctly. This could allow amplifiers to be operated under continuous clipping conditions and may result in damage to your loudspeaker.

For amplifiers with more than 32 dB gain, in extreme cases, oscillation of LLC controller sense return circuitry can occur, resulting in potential damage to the MTD loudspeaker and/or amplifier. For amplifiers with greater than 32 dB gain, please contact your amplifier supplier for technical support regarding how to calibrate the amplifier for 32 dB gain.

LIMITERS
Peak limiters on all amplifier outputs with soft clipping characteristics; attack time less than 3msec

COOLING
Temperature speed-controlled fan recommended

In practice, L-ACOUSTICS specifies power amplifiers with output power equivalent to twice the RMS power handling for the low section and equivalent to the peak power handling for the high section. These requirements typically allow the same amplifier to be used for both sections since the drive level for the HF section is attenuated relative to the LF section to account for efficiency differences (i.e., full continuous power will never be delivered to the HF section due to this attenuation). When the same amplifier is used for the HF section, the extra available power then translates into headroom for improved high frequency transient response.

Sections 2.1, 2.2, 2.3 and 2.4 give a summary of rms and peak power handling along with recommended power amplifier output specifications for operation of single or multiple MTD108a, MTD112b or MTD115b (active or passive mode) enclosures.

As standard, L-ACOUSTICS LA power amplifiers are 32 dB gain and there are four models available: LA15a, LA17a, LA24a and LA48a (please see Table 11 for a specification summary). L-ACOUSTICS LA amplifiers can be configured to provide power matching into different loads (for example, Figure 6 shows the location of MLS switches on the LA24a and LA48a rear panel).

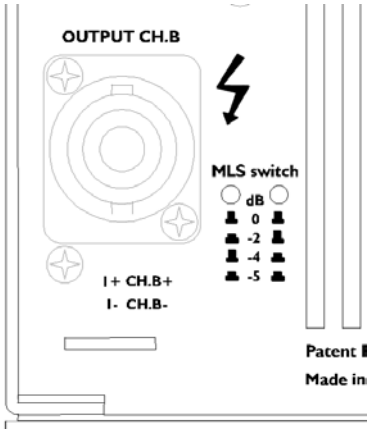


Figure 6: MLS switches on the rear panel of L-ACOUSTICS LA24a, LA48a amplifiers

2.1 POWERING MTD108a

Continuous (rms) and peak power handling ratings for the MTD108a are as follows:

45 volts rms long term (pink noise with 6 dB crest factor)
250 Watts (continuous), 1000 Watts (peak) at 8 ohms

Recommended power amplifier specification for powering single and multiple MTD108a enclosures are given in Table 1.

Table 1: Load and Power Ratings for MTD108a

MTD108a ENCLOSURE RATINGS															
ONE MTD108a				TWO MTD108a				THREE MTD108a				FOUR MTD108a			
LOAD	RMS	PEAK	REC'D	LOAD	RMS	PEAK	REC'D	LOAD	RMS	PEAK	REC'D	LOAD	RMS	PEAK	REC'D
8	250	1000	**500**	4	500	2000	**1000**	2.7	750	3000	**1500**	2	1000	4000	**2000**

Based on these specifications, recommended L-ACOUSTICS LA power amplifier specifications and MLS switch settings are summarized in Table 2. Boldface settings indicate a good power match based on the recommended power amplifier specification.

Table 2: Recommended power amplification and MLS switch settings for MTD108a

RECOMMENDED POWER AMP		**AMPLIFIER OUTPUT POWER (MLS SETTING)**			
LOAD (ohms)	POWER (W)	LA15a	LA 17a	LA 24a	LA 48a
2	2000	do not use	1200 (0 dB)	1700 (0 dB)	**2000 (-4 dB)**
2.7	1500	do not use	1080 (0 dB)	**1465 (-2 dB)**	**1665 (-4 dB)**
4	1000	600 (0 dB)	**840 (0 dB)**	**1300 (-2 dB)**	**1000 (-4 dB)**
8	500	370 (0 dB)	**430 (0 dB)**	**700 (-2 dB)**	**520 (-4 dB)**

L-ACOUSTICS LA amplifier MLS switch settings for powering the MTD108a are summarized in Table 4 and Figure 6 shows the location of MLS switches on the LA24a and LA48a rear panel.

Table 3: Recommended MLS switch settings for powering MTD108a

MTD108a MLS SWITCH SETTING			
LA15a	LA17a	LA24a	LA48a
0 dB	0 dB	-2 dB	-4 dB

2.2 POWERING MTD112b

Continuous (rms) and peak power handling ratings for the MTD112b are as follows:

45 volts rms long term (pink noise with 6 dB crest factor)
250 Watts (continuous), 1000 Watts (peak) at 8 ohms

Recommended power amplifier specification for powering single and multiple MTD112b enclosures are given in Table 4.

Table 4: Load and Power Ratings for MTD112b

MTD112b ENCLOSURE RATINGS															
ONE MTD112b				TWO MTD112b				THREE MTD112b				FOUR MTD112b			
LOAD	RMS	PEAK	REC'D	LOAD	RMS	PEAK	REC'D	LOAD	RMS	PEAK	REC'D	LOAD	RMS	PEAK	REC'D
8	250	1000	**500**	4	500	2000	**1000**	2.7	750	3000	**1500**	2	1000	4000	**2000**

Based on these specifications, recommended L-ACOUSTICS LA power amplifier specifications and MLS switch settings are summarized in Table 5. Boldface settings indicate a good power match based on the recommended power amplifier specification.

Table 5: Recommended power amplification and MLS switch settings for MTD112b

RECOMMENDED POWER AMP		**AMPLIFIER OUTPUT POWER (MLS SETTING)**			
LOAD (ohms)	POWER (W)	LA15a	LA 17a	LA 24a	LA 48a
2	2000	do not use	1200 (0 dB)	1700 (0 dB)	**2000 (-4 dB)**
2.7	1500	do not use	1080 (0 dB)	**1465 (-2 dB)**	**1665 (-4 dB)**
4	1000	600 (0 dB)	**840 (0 dB)**	**1300 (-2 dB)**	**1000 (-4 dB)**
8	500	370 (0 dB)	**430 (0 dB)**	**700 (-2 dB)**	**520 (-4 dB)**

L-ACOUSTICS LA amplifier MLS switch settings for powering the MTD112b are summarized in Table 6 and Figure 6 shows the location of MLS switches on the LA24a and LA48a rear panel.

Table 6: Recommended MLS switch settings for powering MTD112b

MTD112b MLS SWITCH SETTING			
LA15a	LA17a	LA24a	LA48a
0 dB	0 dB	-2 dB	-4 dB

2.3 POWERING MTD115b (PASSIVE MODE)

Continuous (rms) and peak power handling ratings for the MTD11b (passive mode) are as follows:

46 volts rms long term (pink noise with 6 dB crest factor)
265 Watts (continuous), 1060 Watts (peak) at 8 ohms

Recommended power amplifier specification for powering single and multiple MTD115b enclosures in passive mode are given in Table 7.

Table 7: Load and Power Ratings for MTD115b (passive mode)

MTD115b (PASSIVE MODE) ENCLOSURE RATINGS															
ONE MTD115b (PASSIVE)				TWO MTD115b (PASSIVE)				THREE MTD115b (PASSIVE)				FOUR MTD115b (PASSIVE)			
LOAD	RMS	PEAK	REC'D	LOAD	RMS	PEAK	REC'D	LOAD	RMS	PEAK	REC'D	LOAD	RMS	PEAK	REC'D
8	265	1060	**530**	4	530	2120	**1060**	2.7	795	3180	**1590**	2	1060	4240	**2120**

Based on these specifications, recommended L-ACOUSTICS LA power amplifier specifications and MLS switch settings are summarized in Table 8. Boldface settings indicate a good power match based on the recommended power amplifier specification.

Table 8: Recommended power amplification and MLS switch settings for MTD115b (passive mode)

RECOMMENDED POWER AMP		**AMPLIFIER OUTPUT POWER (MLS SETTING)**			
LOAD (ohms)	POWER (W)	LA15a	LA 17a	LA 24a	LA 48a
2	2120	do not use	1200 (0 dB)	1700 (0 dB)	**2000 (-4 dB)**
2.7	1590	do not use	1080 (0 dB)	**1635 (0 dB)**	**1665 (-4 dB)**
4	1060	600 (0 dB)	**840 (0 dB)**	**1300 (-2 dB)**	**1000 (-4 dB)**
8	530	370 (0 dB)	**430 (0 dB)**	**700 (-2 dB)**	**520 (-4 dB)**

L-ACOUSTICS LA amplifier MLS switch settings for powering the MTD115b in passive mode are summarized in Table 9 and Figure 6 shows the location of MLS switches on the LA24a and LA48a rear panel.

Table 9: Recommended MLS switch settings for powering MTD115b (passive mode)

MTD115b (PASSIVE) MLS SETTING			
LA15a	LA17a	LA24a	LA48a
0 dB	0 dB	-2 dB	-4 dB

2.4 POWERING MTD115b (ACTIVE MODE)

Continuous (rms) and peak power handling ratings for the MTD115b in active mode are as follows:

LF Section: 46 volts rms long term (pink noise with 6 dB crest factor)
265 Watts (continuous), 1060 Watts (peak) at 8 ohms

HF Section: 35 volts rms long term (pink noise with 6 dB crest factor)
150 Watts (continuous), 600 Watts (peak) at 8 ohms

Recommended power amplifier specification for powering single and multiple MTD115b enclosures in active mode are given in Table 10.

Table 10: Load and Power Ratings for MTD115b (active mode)

MTD115b (ACTIVE MODE) ENCLOSURE RATINGS																
	ONE MTD115b (ACTIVE)				TWO MTD115b (ACTIVE)				THREE MTD115b (ACTIVE				FOUR MTD115b (ACTIVE)			
SECTI	LOAD	RMS	PEAK	REC'D	LOAD	RMS	PEAK	REC'D	LOAD	RMS	PEAK	REC'D	LOAD	RMS	PEAK	REC'D
LOW	8	265	1060	**530**	4	530	2120	**1060**	2.7	795	3180	**1590**	2	1060	4240	**2120**
HIGH	8	150	600	**600**	4	300	1200	**1200**	2.7	440	1760	**1760**	2	600	2400	**2400**

Based on these specifications, recommended L-ACOUSTICS LA power amplifier specifications and MLS switch settings are summarized below in Tables 11 and 12.

Table 11: Recommended power amplification and MLS switch settings for MTD115b low section

MTD115b LOW SECTION REC'D POWER

LOAD (ohms)	POWER (W)
2	2120
2.7	1590
4	1060
8	530

AMPLIFIER OUTPUT POWER (MLS SETTING)

LA15a	LA 17a	LA 24a	LA 48a
do not use	1200 (0 dB)	1700 (0 dB)	**2400** **(-2 dB)**
do not use	1080 (0 dB)	**1635** **(0 dB)**	**1665** **(-4 dB)**
600 (0 dB)	**840** **(0 dB)**	**1300** **(-2 dB)**	**1000** **(-4 dB)**
370 (0 dB)	**430** **(0 dB)**	**700** **(-2 dB)**	**520** **(-4 dB)**

Table 12: Recommended power amplification and MLS switch settings for MTD115b high section

MTD115b HI SECTION			**AMPLIFIER OUTPUT POWER**			
REC'D POWER			**(MLS SETTING)**			
LOAD (ohms)	REC'D POWER		LA15a	LA 17a	LA 24a	LA 48a
2	2400		do not use	1200	1700	**2400**
				(0 dB)	(0 dB)	**(-2 dB)**
2.7	1760		do not use	1080	**1635**	**1665**
				(0 dB)	**(0 dB)**	**(-4 dB)**
4	1200		600	**840**	**1300**	**1000**
			(0 dB)	**(0 dB)**	**(-2 dB)**	**(-4 dB)**
8	600		370	**430**	**700**	**520**
			(0 dB)	**(0 dB)**	**(-2 dB)**	**(-4 dB)**

MLS switch settings for powering the MTD115b in active mode are summarized in Table 13.

Table 13: Recommended MLS switch settings for powering MTD115b (active mode)

		MTD115b (ACTIVE) MLS SETTING			
		LA15a	LA17a	LA24a	LA48a
MTD115b LO SECTION		0 dB	0 dB	-2 dB	-4 dB
MTD115b HI SECTION		0 dB	0 dB	-2 dB	-4 dB

L-ACOUSTICS LA 15a POWER MATRIX

		MLS SWITCH SETTING	
LOAD	CONFIGURATION	-3 dB	0 dB
16 ohms	Quad (4 channel)	95	200
8 ohms	Quad (4 channel)	200	370
4 ohms	Quad (4 channel)	380	600
2.7 ohms	Quad (4 channel)	460	
2 ohms	Quad (4 channel)	500	

L-ACOUSTICS LA 17a POWER MATRIX

		MLS SWITCH SETTING	
LOAD	CONFIGURATION	-3 dB	0 dB
16 ohms	Stereo (2 channel)	110	215
8 ohms	Stereo (2 channel)	220	430
4 ohms	Stereo (2 channel)	430	840
2.7 ohms	Stereo (2 channel)	720	1080
2 ohms	Stereo (2 channel)	870	1200

L-ACOUSTICS LA 24a POWER MATRIX

		MLS SWITCH SETTING			
LOAD	CONFIGURATION	-5 dB	-4 dB	-2 dB	0 dB
16 ohms	Stereo (2 channel)	160	200	340	520
8 ohms	Stereo (2 channel)	300	400	700	1100
4 ohms	Stereo (2 channel)	600	750	1300	1500
2.7 ohms	Stereo (2 channel)	1000	1180	1465	1635
2 ohms	Stereo (2 channel)	1200	1400	1550	1700

L-ACOUSTICS LA 48a POWER MATRIX

		MLS SWITCH SETTING			
LOAD	CONFIGURATION	-5 dB	-4 dB	-2 dB	0 dB
16 ohms	Stereo (2 channel)	220	260	410	650
8 ohms	Stereo (2 channel)	430	520	820	1300
4 ohms	Stereo (2 channel)	830	1000	1600	2300
2.7 ohms	Stereo (2 channel)	1380	1665	2130	2700
2 ohms	Stereo (2 channel)	1660	2000	2400	2900

Table 14: Output Power Ratings and MLS Switch Settings for L-ACOUSTICS LAa Amplifiers

2.5 CONNECTORS AND CABLES

MTD108a, MTD112b and MTD115b are all supplied with dual NL4 Speakon connectors. The two Speakon connectors are internally wired in parallel, allowing for loop through connection and parallel operation of multiple MTD enclosures. For passive enclosures (MTD108a, MTD112b), Speakon wiring is 1+ / 1- for normal operation (positive polarity). For the MTD115b in active mode, speakon connector wiring is as follows:

1+ = LF+
1 - = LF -
2+ = HF+
2 - = HF –

In order to preserve high damping factor (essential to the sonic qualities of the system and to prevent overshoot of cone displacement which can result in mechanical damage), it is desirable to keep loudspeaker cables as short as possible and with a gauge offering low resistance per unit length. The following chart provides information regarding the minimum wire cross-section versus length:

Table 15: Maximum Recommended Length for Damping Factor > 20

Cross Section	Gauge	8 ohms		4 ohms	
Metric (mm2)	Imperial	Metric	Imperial	Metric	Imperial
2.5	13	30 m	100 ft	15 m	45 ft
4	11	50 m	150 ft	25 m	75 ft
6	8	75 m	225 ft	37 m	110 ft
10	6	120 m	360 ft	60 m	180 ft

As standard, L-ACOUSTICS F-CABLE (SP7, SP25) and F-LINK CABLE (SP.7) loudspeaker cables are 4 conductor cables with 4 mm^2 conductor cross-section (11 gauge). SP25 cables can be used for 25 meter cable runs to power a 4 ohm load (2 x MTD108a, MTD112b or MTD115b enclosures in parallel) while maintaining a damping factor greater than 20.

3. PROCESSING MTD

3.1 L-ACOUSTICS MTD108 LLCa DESCRIPTION

The MTD108LLCa line level controller is an analog signal processing unit that optimizes the performance of the MTD108a. The stereo controller accepts two signal inputs and provides two processed outputs for the respective input channels. The main functions of the MTD108LLCa controller are as follows:

- Bandpass filtering and equalization (3 modes, selectable)
- Sense Return processing for thermal protection of speaker components and cone excursion limiting (voltage and frequency dependent)
- Mono input summation for subwoofer or center fill drive
- Crossover filtering, equalization for subwoofer drive

Three different equalization/bandpass filtering modes tailor the frequency response of the MTD108a for different applications. In MONITOR mode, high pass filtering is set at 80 Hz with a 12 dB/octave slope in order to provide an equalization contour suitable for speech reinforcement or floor monitor applications. In FRONT mode, a 50 Hz high pass filter is employed and low frequency shelving equalization provides a contour more suitable for full bandwidth music applications. In X-OVER mode, a 125 Hz high pass filter is applied since the MTD108a is intended to be used with subwoofers.

When the second front panel switch is set to SUB mode, the mono output on the rear of the controller provides a summed output of the two signal inputs with low pass filtering set at 125 Hz and equalization optimized for the SB115 subwoofer (equalization for the MTD118 or SB218 are selectable via internal jumpers). Alternatively, the summed MONO signal output can be used to feed a power amplifier allotted to a central fullrange fill loudspeaker (SUM mode).

The MTD108LLCa is connected in series with two amplifier channels for sense return processing, i.e., amplifier outputs are connected to the "Sense Return" input of the MTD108LLCa. Protection circuitry monitors the signal applied to the loudspeakers to provide thermal protection of speaker components plus voltage and frequency dependent cone excursion limiting.

3.2 L-ACOUSTICS LLC 112b-ST DESCRIPTION

The L-ACOUSTICS LLC 112b-st stereo line level controller is an analog signal processing unit that optimizes the performance of the MTD112b. The controller accepts two signal inputs and provides two processed outputs for the respective input channels plus a filtered, summed output for subwoofer drive. The main functions of the LLC 112b-st controller are as follows:

- Bandpass filtering and equalization (3 modes, selectable)
- Mono input summation for subwoofer drive
- Crossover filtering, equalization for subwoofer drive (3 models, switch-selectable)
- Sense Return processing for thermal protection of speaker components and cone excursion limiting (voltage and frequency dependent)

Three different equalization/bandpass filtering modes tailor the frequency response of the MTD112b to suit different applications (selected via front panel switch). In MONITOR mode, high pass filtering is set at 50 Hz and a modest low frequency shelf is applied to provide an equalization contour suitable for floor monitor applications. In FRONT mode, a 50 Hz high pass filter is employed and increased low frequency shelving provides an equalization contour that is more suitable for FOH use. In X-

OVER mode, a 100 Hz high pass filter is applied since the MTD112b is intended to be used with additional subwoofers.

For subwoofer drive, the second front panel switch allows for selection of bandpass filtering and equalization that is optimized for either SB115, SB118 or SB218 subwoofers. The processed subwoofer signal output is then available on the XLR connectors provided on the front or rear panels of the controller.

Note: The SB118 setting should be employed when using the LLC 112b-st controller for dV-SUB processing (bandpass filtering and equalization are compatible)

In terms of connection, two input signals (Ch A, B) are applied to the line input XLR connectors on the front panel of the LLC 112b-st. Rear panel XLR line outputs (Ch A, B) are connected to the power amplifier inputs with the amplifier outputs then connected to the controller "Sense Return" input Speakon connector (Ch A = 1+/1-, Ch B = 2+/2-). Since the amplifier is connected in a loop, LLC sense return protection circuitry can monitor the signal applied to the loudspeakers and provide thermal protection of speaker components plus voltage- and frequency-dependent cone excursion limiting provided that the power amplifier has 32 dB gain. The front panel of the LLC 112b-st is then used as a patch panel with Ch A, B loudspeakers connected via the two 4-pin Speakon connectors provided.

3.3 L-ACOUSTICS LLC 115b-st, LLC115b-2w DESCRIPTION

The L-ACOUSTICS LLC 115b-st or LLC 115b-2w line level controllers are analog signal processing units that optimize the performance of the MTD115b loudspeaker when used in passive or active mode, respectively. For stereo operation of passive MTD115b enclosures, the LLC 115b-st accepts two signal inputs and provides two processed outputs for the respective input channels plus a filtered, summed output for subwoofer drive. The LLC 115b-2w is for mono operation of active MTD115b enclosures and accepts a single signal input while providing processed outputs for the subwoofer, low and high frequency channels. The main functions of the LLC 115b-st and LLC 115b-2w controllers are as follows:

- Bandpass filtering and equalization (3 modes, selectable)
- Crossover filtering for low and high channels (LLC 115b-2w only)
- Mono summation for subwoofer drive (LLC 115b-st only)
- Crossover filtering, equalization for subwoofer drive (3 models, switch-selectable)
- Sense Return processing for thermal protection of speaker components and cone excursion limiting (voltage and frequency dependent)

Three different equalization/bandpass filtering modes tailor the frequency response of the MTD115b to suit different applications (selected via front panel switch). In MONITOR mode, high pass filtering is set at 45 Hz and a modest low frequency shelf is applied to provide an equalization contour suitable for floor monitor applications. In FRONT mode, a 45 Hz high pass filter is employed and increased low frequency shelving provides an equalization contour that is more suitable for FOH use. In X-OVER mode, a 100 Hz high pass filter is applied since the MTD115b is intended to be used with additional subwoofers.

For subwoofer drive, the second front panel switch allows for selection of bandpass filtering and equalization that is optimized for either SB115, SB118 or SB218 subwoofers. The processed subwoofer signal output is then available on the XLR connectors provided on the front or rear panels of the controller.

Note: The SB118 setting should be employed when using the LLC 115b-st or LLC 115b-2w controller for dV-SUB processing (bandpass filtering and equalization are compatible)

For the LLC 115b-st, two input signals (Ch A, B) are applied to the line input XLR connectors on the front panel of the controller. Rear panel XLR line outputs (Ch A, B) are connected to the power

amplifier inputs with the amplifier outputs then connected to the controller "Sense Return" input Speakon connector (Ch A = 1+/1-, Ch B = 2+/2-). Since the amplifier is connected in a loop, LLC sense return protection circuitry can monitor the signal applied to the loudspeakers and provide thermal protection of speaker components plus voltage- and frequency-dependent cone excursion limiting provided that the power amplifier has 32 dB gain. The front panel of the LLC 115b-st is then used as a patch panel with Ch A, B loudspeakers connected via the two 4-pin Speakon connectors provided.

For the LLC 115b-2w controller, a single input signal is applied to the line input XLR on the front panel. Rear panel LF and HF XLR outputs are connected to power amplifier input channels with the amplifier outputs then connected to the controller "Sense Return" input speakon connector (LF = 1+/1-, HF = 2+/2-). As for the LLC 115b-st, protection circuitry monitors the signal applied to the loudspeakers to provide thermal protection of speaker components plus voltage- and frequency-dependent cone excursion limiting provided that the power amplifier has 32 dB gain. The front panel of the LLC 115b-2w is then used as a patch panel with loudspeaker connection via the 4-pin Speakon connector provided.

4. MTD CONFIGURATIONS

The following section provides a number of block diagram representations of various MTD systems. Examples of floor monitor, stereo FOH system with mono subwoofers and stereo FOH system with stereo subwoofers packages are shown. Please refer to sections 4.1 - 4.3 for MTD108a examples, sections 4.4 - 4.6 for MTD112b examples, sections 4.7 – 4.9 for MTD115b (passive) examples and sections 4.10 – 4.12 for MTD115b (active) examples.

4.1 MTD108a FLOOR MONITOR SYSTEM

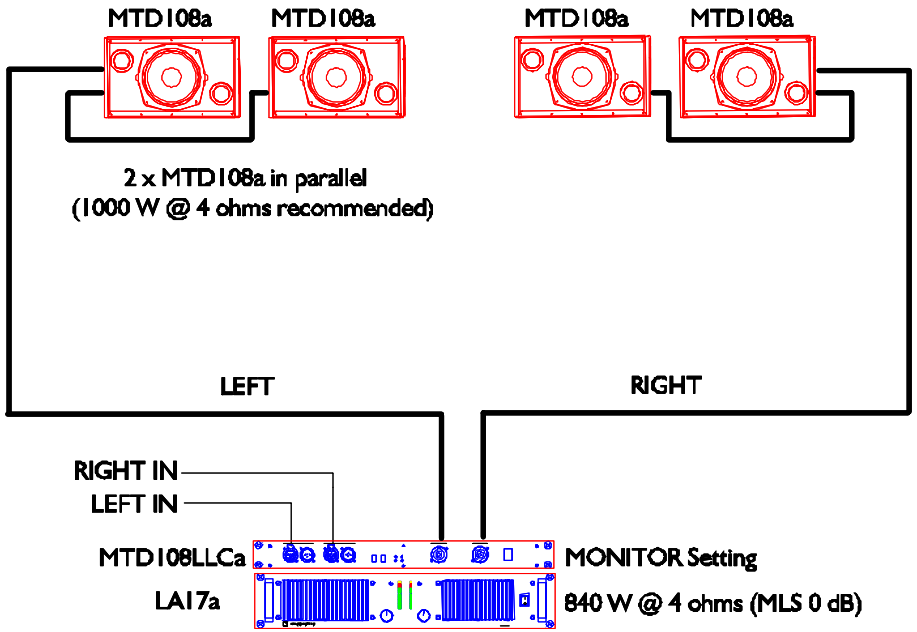
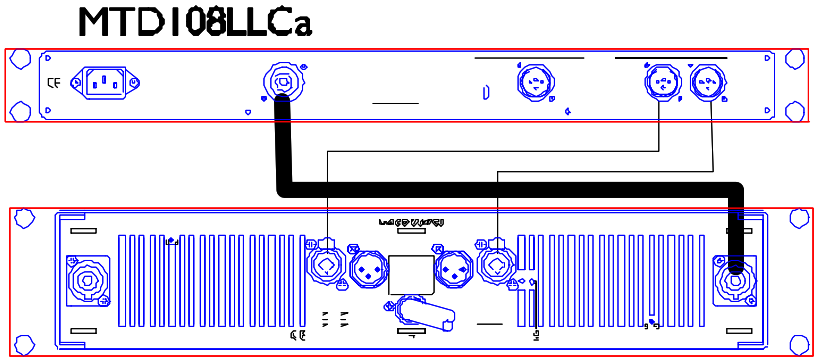


Figure 7a: MTD108a Floor Monitor System Block Diagram



LA17a
Switch Settings: MLS = 0 dB
Ch A, Ch B Clip Lim = ON
Note: Crosswired Ch A Speakon Output:
(1+/1- = Ch A, 2+/2- = Ch B)

Figure 7b: MTD108a Floor Monitor System Cabling Detail

4.2 MTD108a FOH SYSTEM (MONO SUBS)

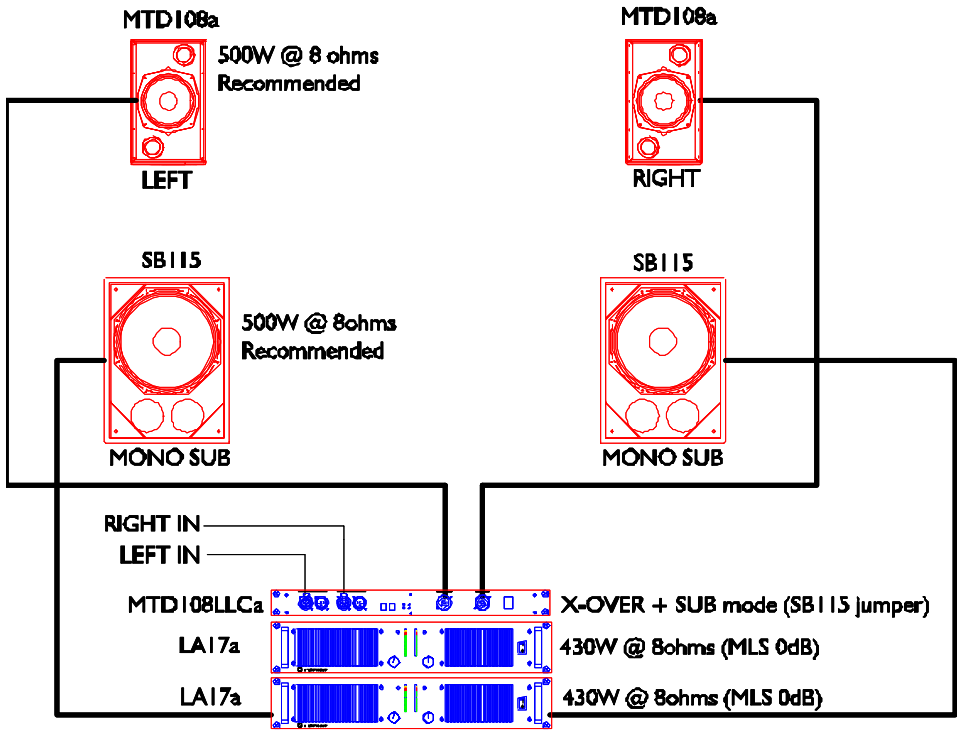


Figure 8a: MTD108a FOH System Block Diagram (mono subwoofers)

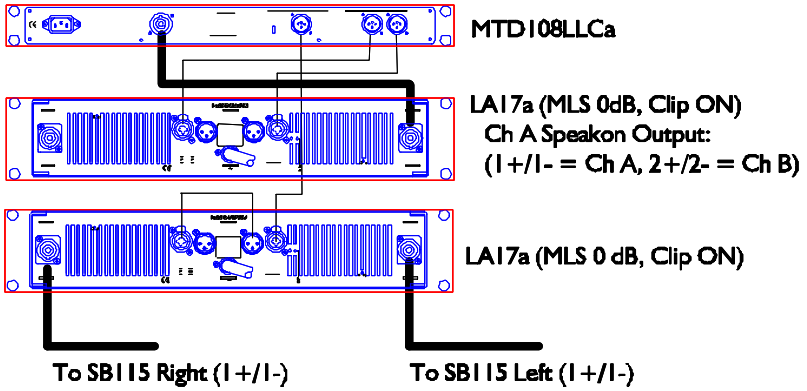


Figure 8b: MTD108a FOH System Cabling Detail (mono subwoofers)

4.3 MTD108a FOH SYSTEM (STEREO SUBS)

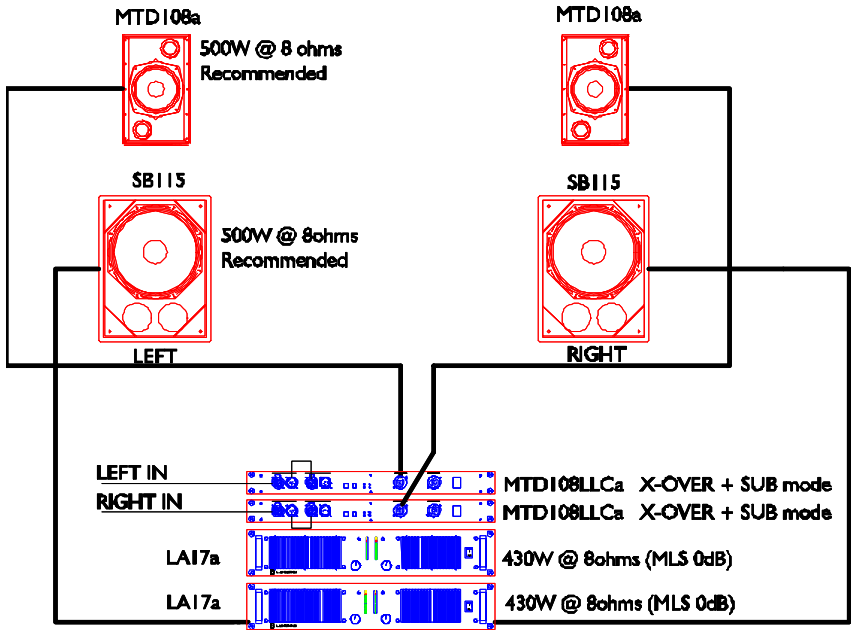


Figure 9a: MTD108a FOH System Block Diagram (stereo subwoofers)
(note: LLC ChA to ChB link provides +6 dB increase for subwoofer drive)

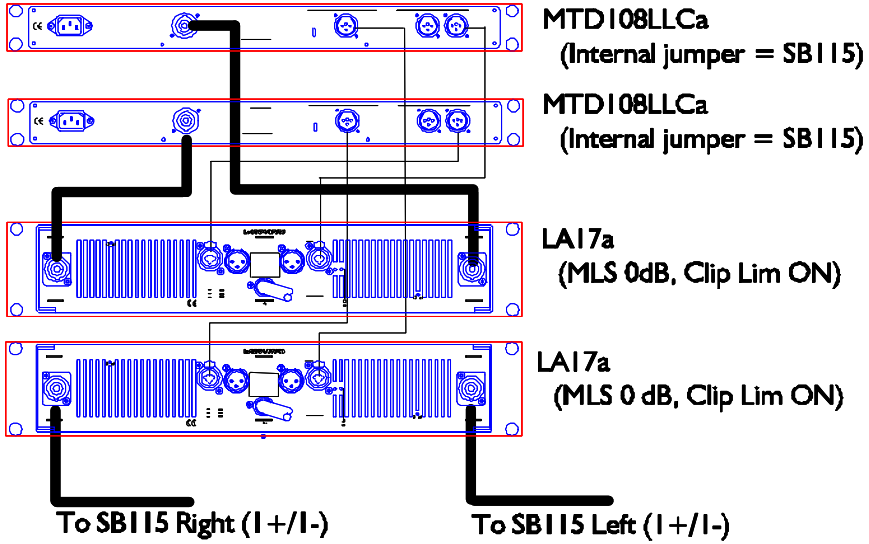


Figure 9b: MTD108a FOH System Cabling Detail (stereo subwoofers)

4.4 MTD112b FLOOR MONITOR SYSTEM

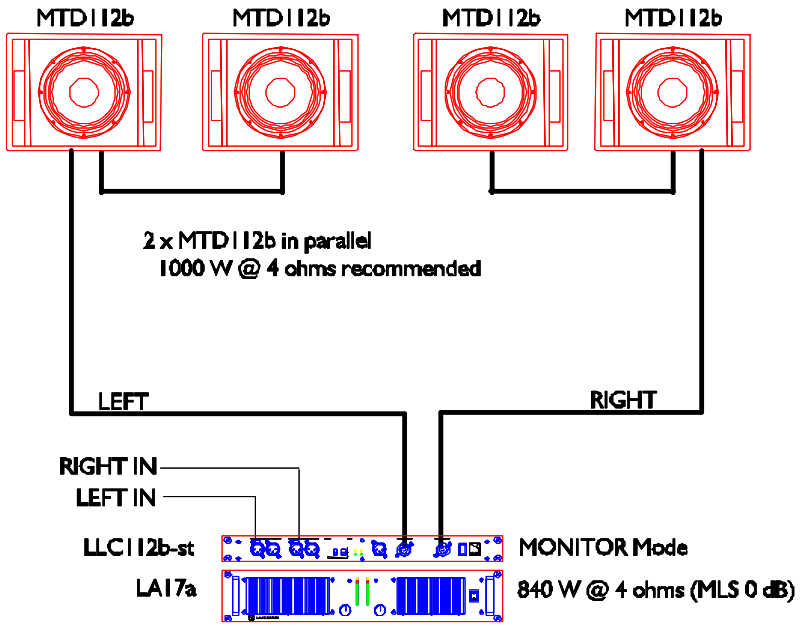


Figure 10a: MTD112b Floor Monitor System Block Diagram

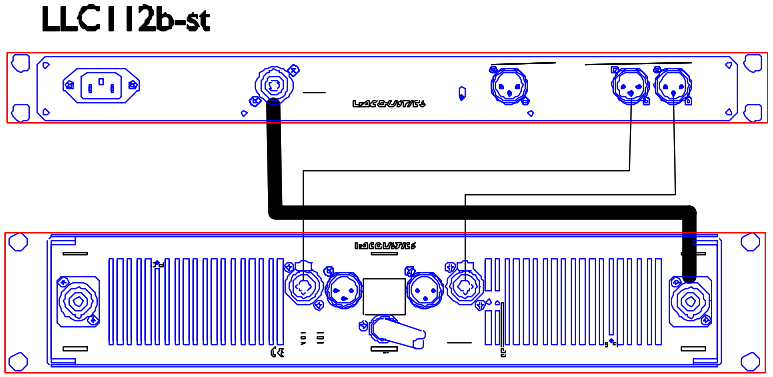


Figure 10b: MTD112b Floor Monitor System Cabling Detail

4.5 MTD112b FOH SYSTEM (MONO SUB)

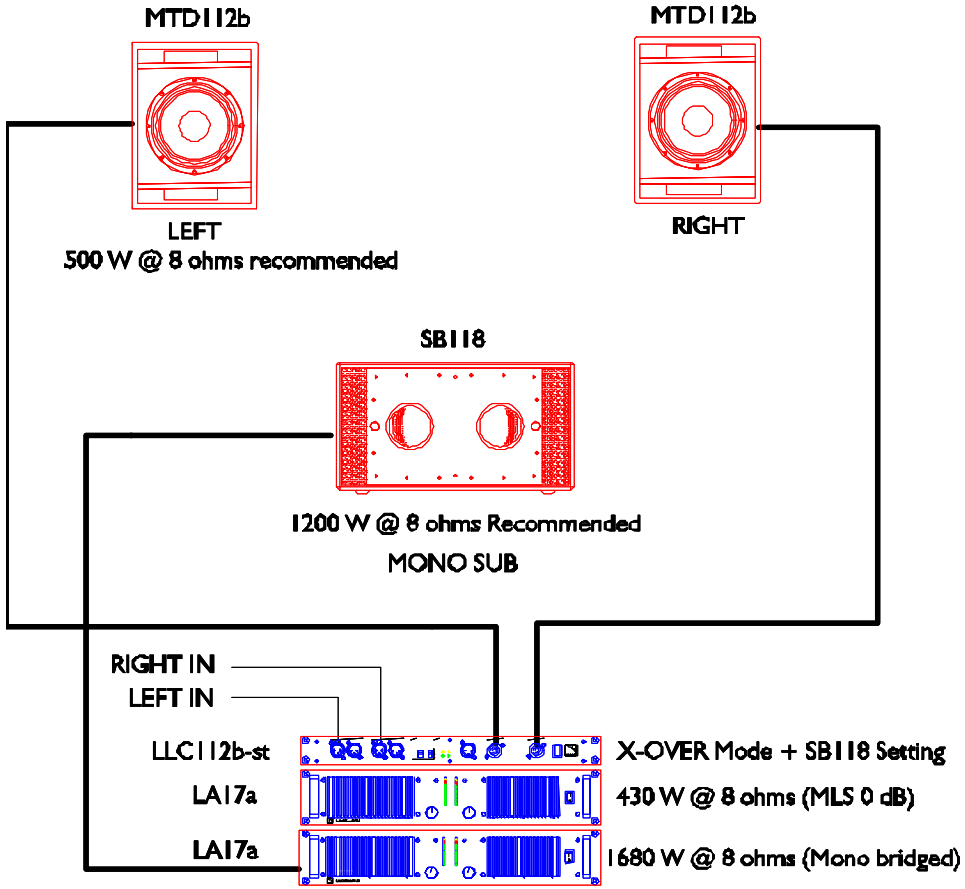


Figure 11a: MTD112b FOH System Block Diagram (mono subwoofers)

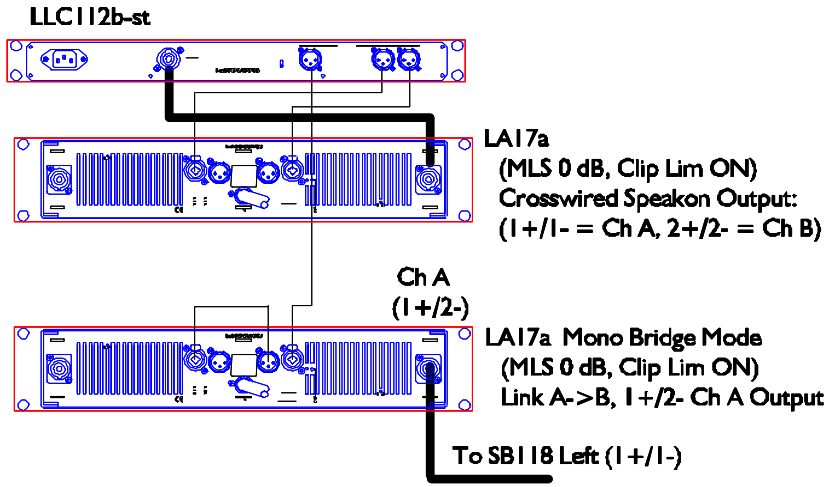


Figure 11b: MTD112b FOH System Cabling Detail (mono subs)

4.6 MTD112b FOH SYSTEM (STEREO SUBS)

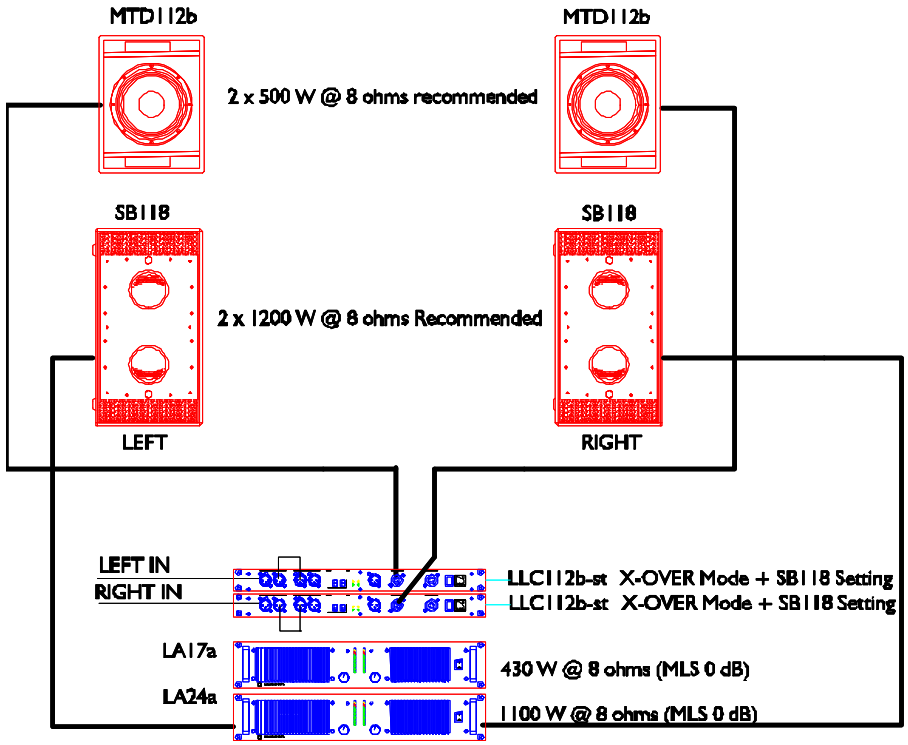


Figure 12a: MTD112b FOH System Block Diagram (stereo subwoofers)
(note: LLC ChA to ChB link provides +6 dB increase for subwoofer drive)

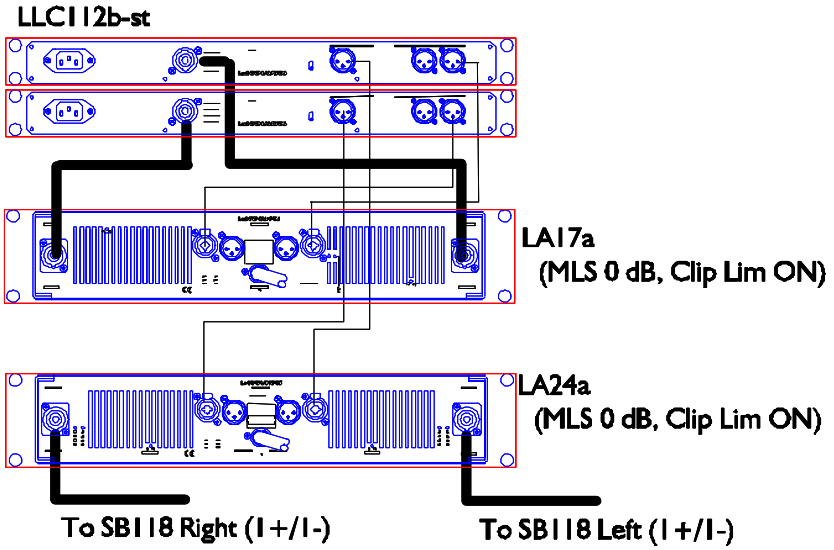


Figure 12b: MTD112b FOH System Cabling Detail (stereo subwoofers)

4.7 MTD115b (PASSIVE) FLOOR MONITOR SYSTEM

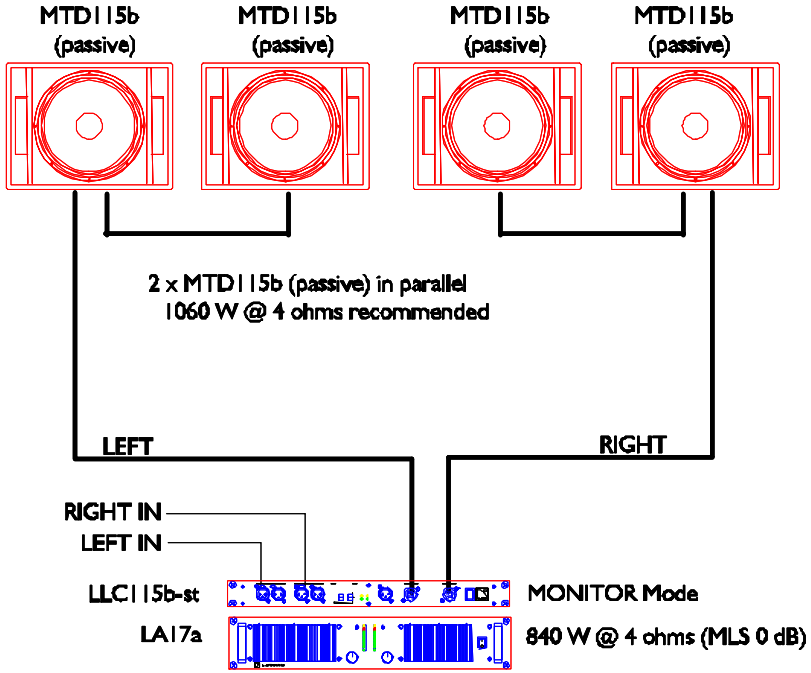


Figure 13a: MTD115b (passive) Floor Monitor System Block Diagram

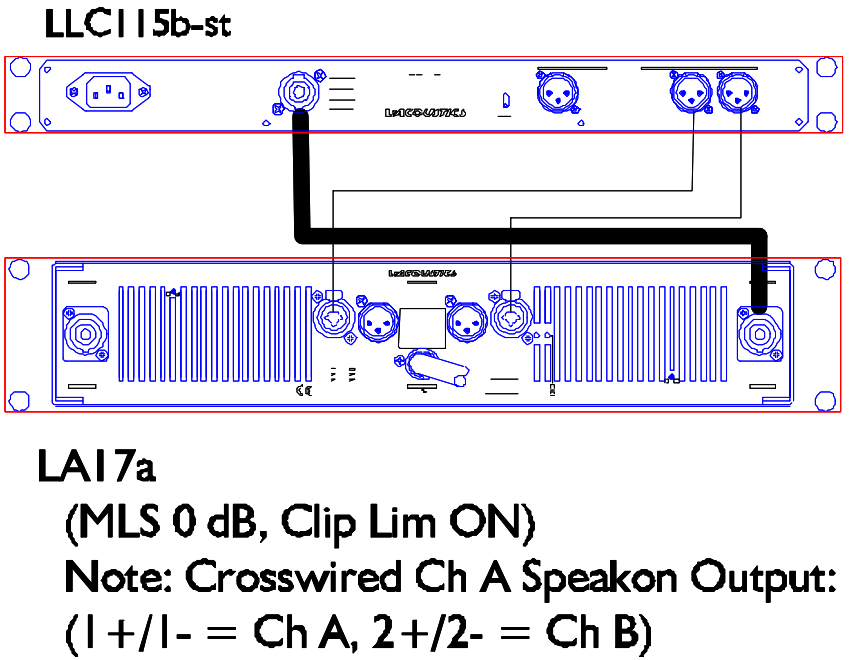


Figure 13b: MTD115b (passive) Floor Monitor System Cabling Detail

4.8 MTD115b (PASSIVE) FOH SYSTEM (MONO SUB)

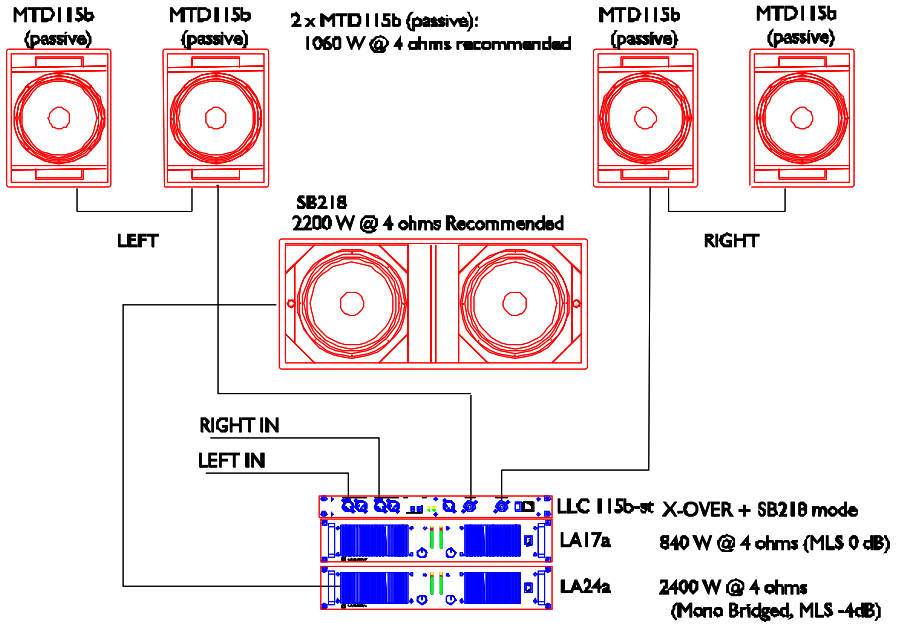


Figure 14a: MTD115b (passive) FOH System Block Diagram (mono subs)

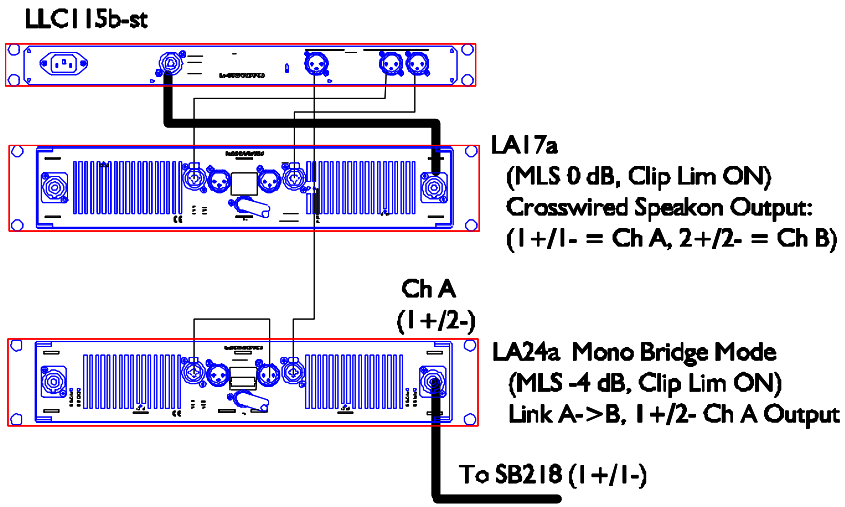


Figure 14b: MTD115b (passive) FOH System Cabling Detail (mono subs)

4.9 MTD115b (PASSIVE) FOH SYSTEM (STEREO SUBS)

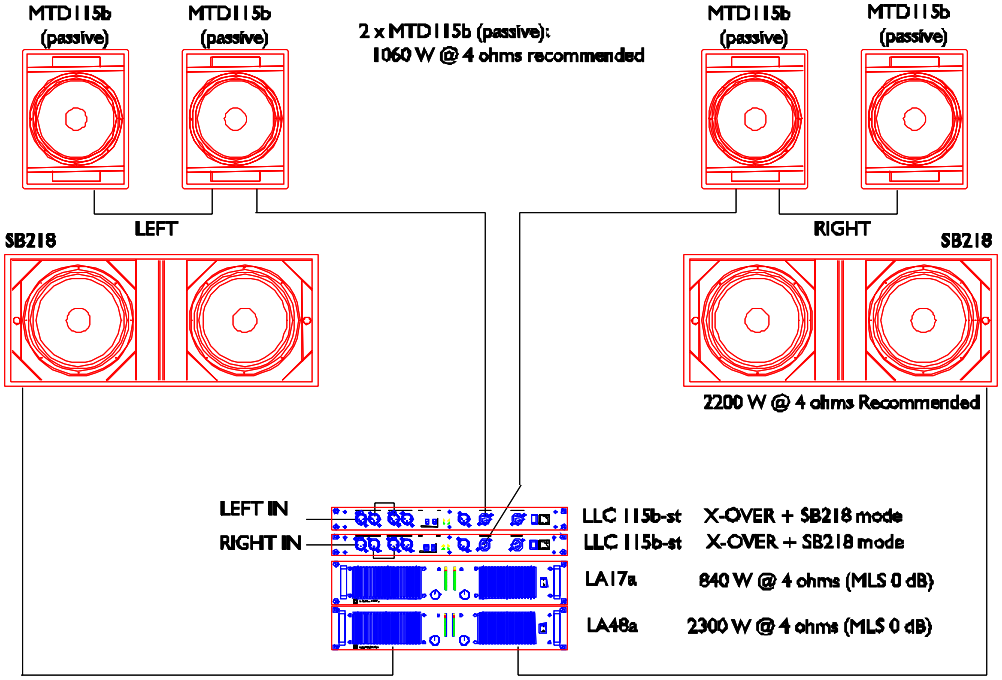


Figure 15a: MTD115b (passive) FOH System Block Diagram (stereo subs)
(note: LLC ChA to ChB link provides +6 dB increase for subwoofer drive)

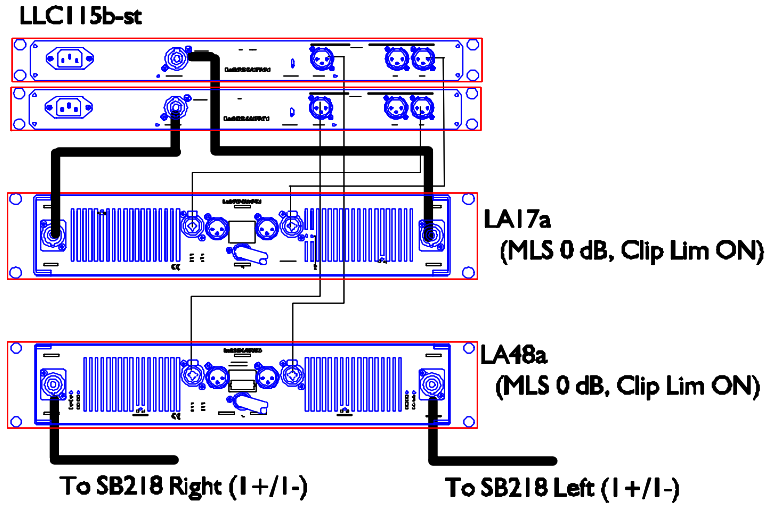


Figure 15b: MTD115b (passive) FOH System Cabling Detail (stereo subs)

4.10 MTD115b (ACTIVE) FLOOR MONITOR SYSTEM

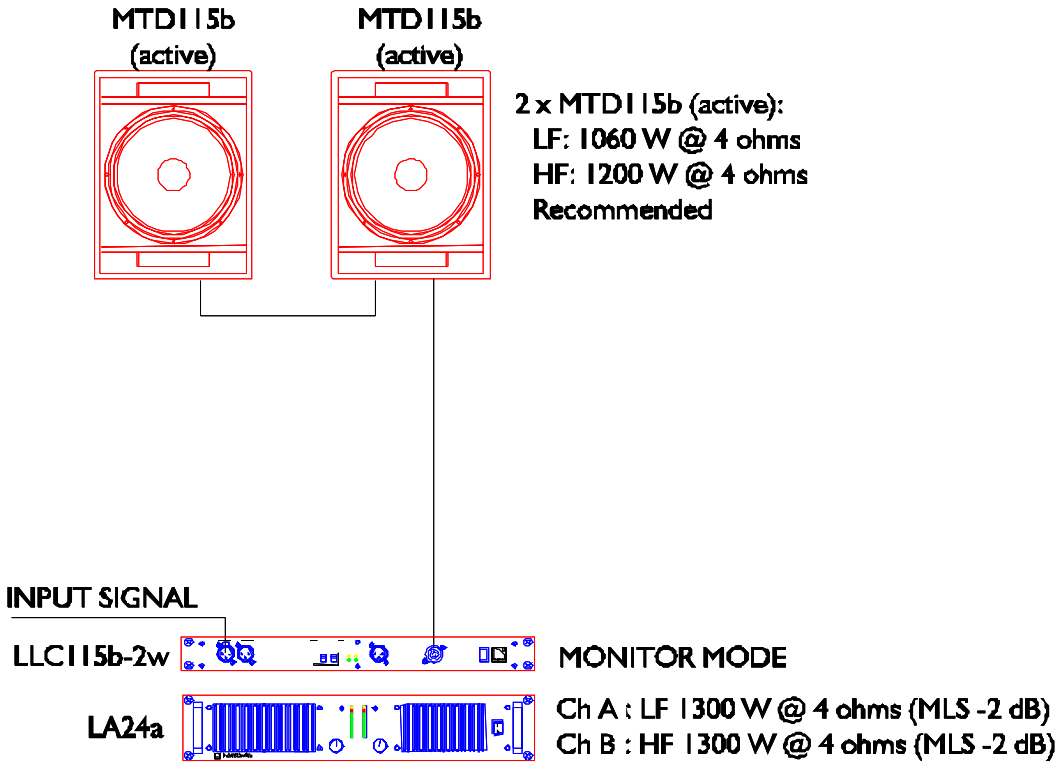


Figure 16a: MTD115b (active) Floor Monitor System Block Diagram

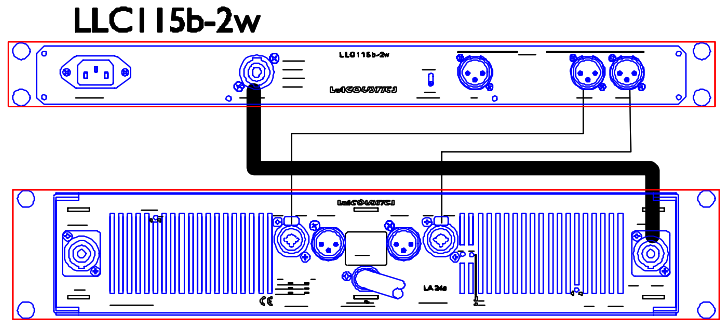


Figure 16b: MTD115b (active) Floor Monitor System Cabling Detail

4.11 MTD115b (ACTIVE) FOH SYSTEM (STEREO SB118 SUBS)

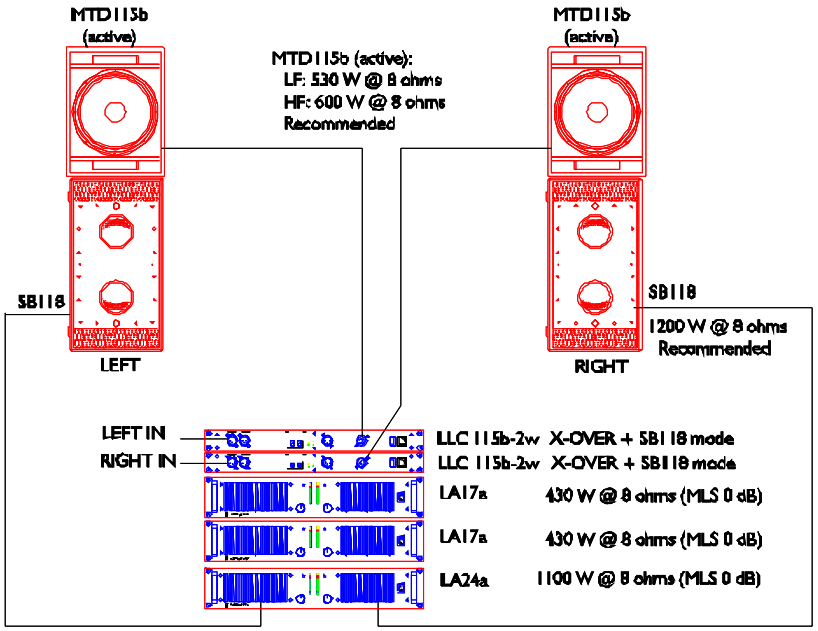


Figure 17a: MTD115b (active) FOH System Block Diagram (stereo SB118)

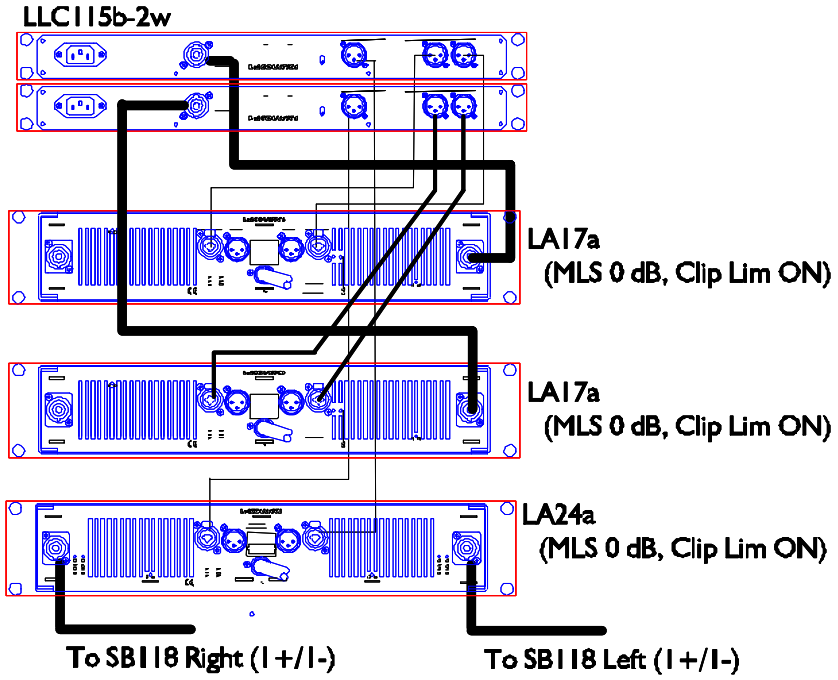


Figure 17b: MTD115b (active) FOH System Cabling Detail (stereo SB118)

4.12 MTD115b (ACTIVE) FOH SYSTEM (STEREO SB218 SUBS)

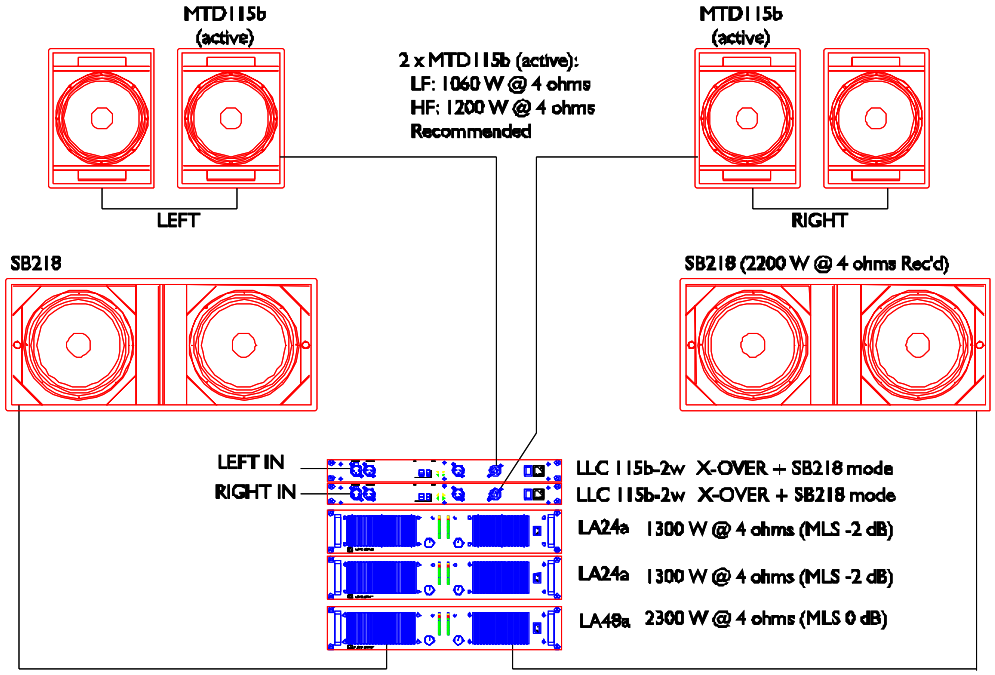


Figure 18a: MTD115b (active) FOH System Block Diagram (stereo SB218)

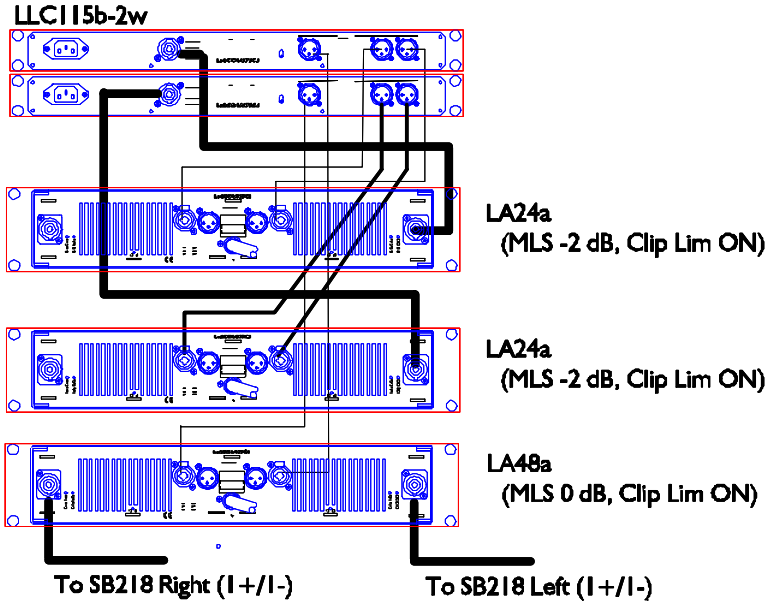


Figure 18b: MTD115b (active) FOH System Cabling Detail (stereo SB218)

5. SOUND DESIGN

5.1 APPLICATIONS

The art of designing a sound system is a profession in itself and a complete description of all sound system design aspects is beyond the scope of this manual. If necessary, we recommend the use of a specialized sound engineer or consultant since *the best products can produce the worst results if improperly set-up.* In order to get the best results, it is important to follow correct sound design principles, process your system with the appropriate LLC controller plus power amplification and properly integrate your MTD enclosures with subwoofers.

In general terms, MTD108a, MTD112b or MTD115b enclosures are intended for distributed sound reinforcement or small to medium-scale Front-Of-House (FOH) applications. FOH applications include: theatres, clubs, multi-purpose venues or corporate events. Distributed applications include: delay rings for large-scale installations, surround effects channels for theatre / multimedia, distributed reinforcement for sports venues or delays for speech reinforcement in convention centre ballrooms. Although optimized for single operation in distributed configurations, MTD loudspeakers can be used in vertical or horizontal arrays of two enclosures to enhance either SPL or coverage.

Due to their compact, wedge-shaped format and axi-symmetrical directivity, MTD108a, MTD112b or MTD115b enclosures also provide an exceptionally high performance floor monitor solution. When used in conjunction with L-ACOUSTICS SB115, SB118 or SB218 subwoofers, MTD enclosures are also suitable for side fill and drum monitoring applications.

5.2 AIMING MTD ENCLOSURES

Due to their controlled directivity behavior, MTD enclosures should be aimed so as to geometrically cover the desired audience area with the main zero degree axis roughly orientated towards the middle or rear of the audience area. Since the wavefront radiated by an axi-symmetric sound source has directivity that is smoothly increasing with frequency, this helps to match coverage, frequency response and SPL to the acoustic environment of a typical auditorium. Normally, the reverberation time in auditoria decreases smoothly above 1 kHz and at greater distances in the venue, the low frequency energy is fairly constant due to the reverberant field. Loudspeaker focus or aiming should be adjusted so that maximum HF energy is directed towards the farthest listening areas – this helps to balance the SPL attenuation with distance that occurs in the direct field. At closer listening positions, the off-axis attenuation at higher frequencies provides a similar tonal balance and the overall SPL attenuation with distance is less.

Although MTD enclosures have controlled directivity attenuation properties it is important not to have the closest members of the audience too close to the system (i.e., in order not to produce excessive sound pressure levels up close). Ideally, the ratio between the shortest and the furthest distance covered should not exceed 1:4 and in order to achieve this, it is often desirable to fly the system. However, when MTD enclosures are flown and the audience seating area begins very close to the stage, it is oftentimes necessary to use distributed front-fill speakers (for example, MTD108a) or a ground stacked left/right MTD stereo infill system in order to improve coverage and image localization for the first rows of the audience.

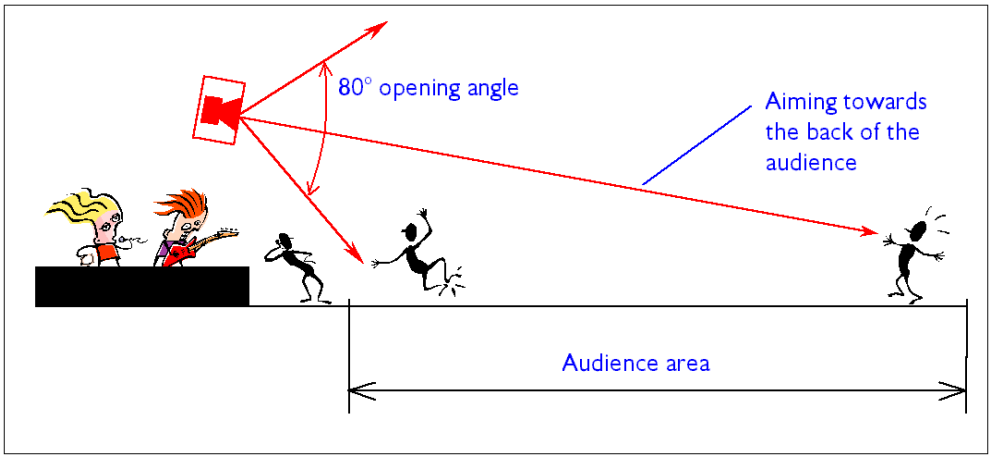


Figure 19: General guidelines for aiming MTD enclosures

5.3 ARRAYING MTD ENCLOSURES

Figure 20 shows SPL mappings at octave band frequencies for a single MTD enclosure (generated using CATT-Acoustic modeling software), demonstrating the evenness of coverage and single point source behavior that is obtained using coaxial technology.

Note: For color versions of figures 20, 21, 22 and 24 please see the MTD manual PDF file that is available for download from www.l-acoustics.com

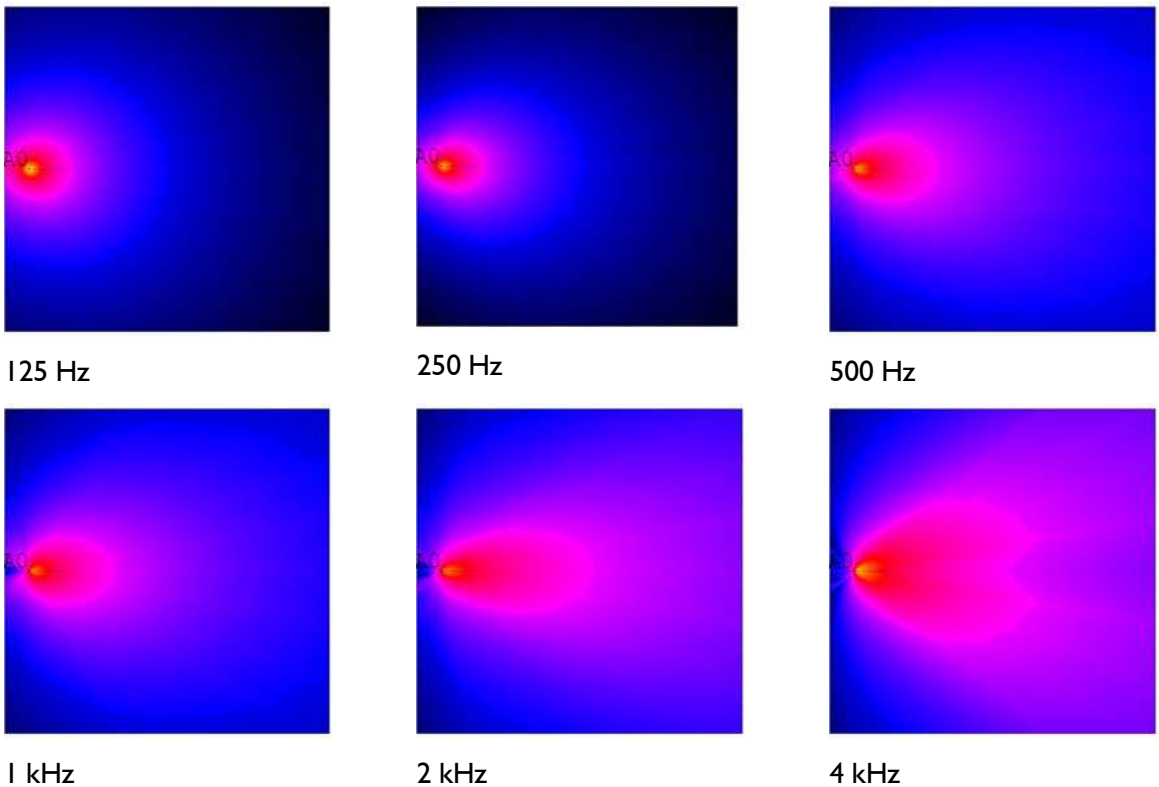


Figure 20: SPL mappings at octave band frequencies for a single MTD enclosure

Figure 21 shows SPL mappings at octave band frequencies for two MTD enclosures with a spacing of 0.5 meters. Uneven coverage above 500 Hz demonstrates the comb filtering interference effects that arise due to path length differences as a function of listener position.

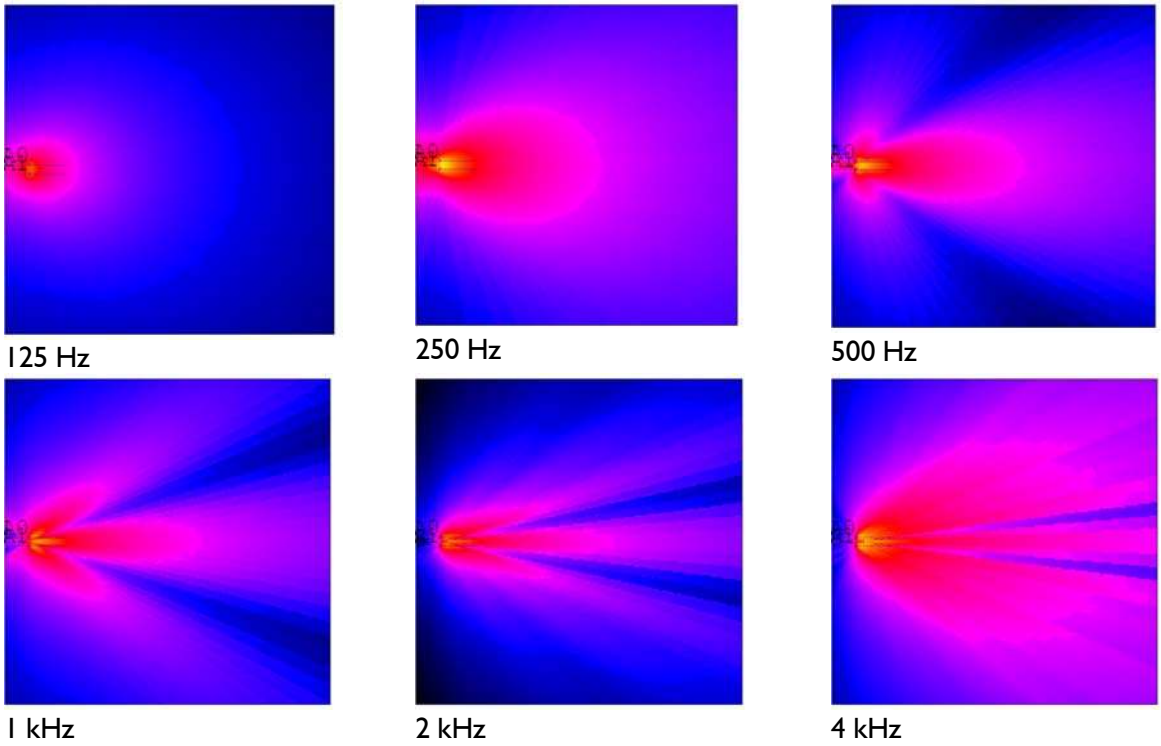


Figure 21: SPL mappings at octave band frequencies for two MTD enclosures with 0.5 metre spacing (arrayed system corresponding to the "works" case shown in Figure 23)

Figure 22 shows SPL mappings for a distributed system of two MTD enclosures with a spacing of 3 meters. Interference now occurs lower in frequency and tends to be masked by room reverberation. Compared with the closely spaced (arrayed) system of Fig. 21, there is now improved intelligibility at higher frequencies. Essentially, the key to successful distributed system design is reducing the effects of audible interference.

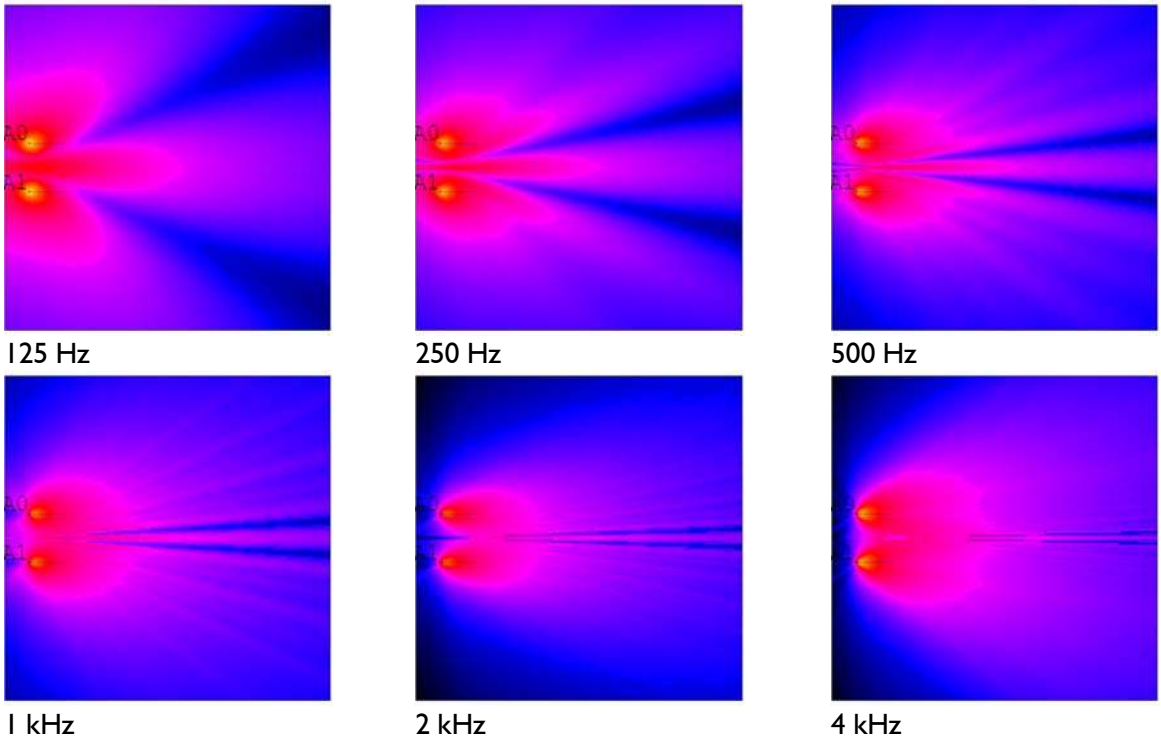


Figure 22: SPL mappings at octave band frequencies for two MTD enclosures with 3 metre spacing (distributed system corresponding to the "best" case shown in Figure 23)

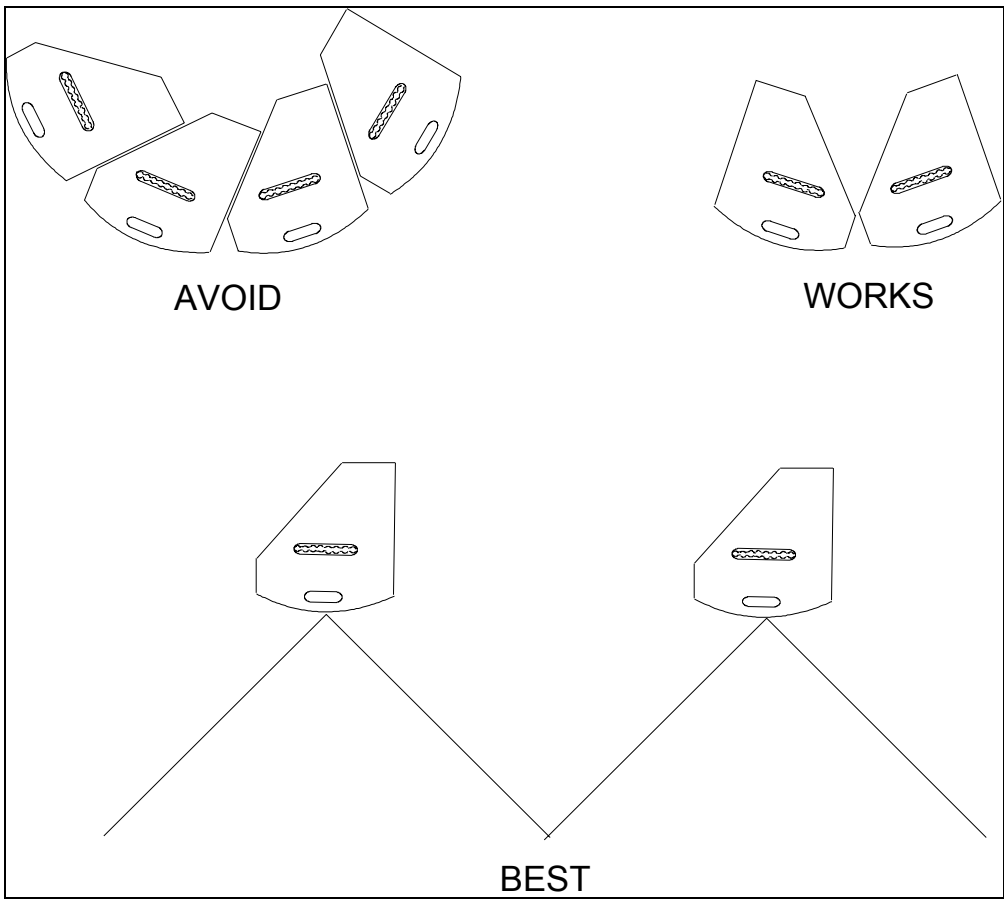


Figure 23: General guidelines for arraying MTD enclosures. The "avoid" case corresponds to the SPL mappings shown in Figure 24, "works" corresponds to Figure 21 and "best" corresponds to Figure 22.

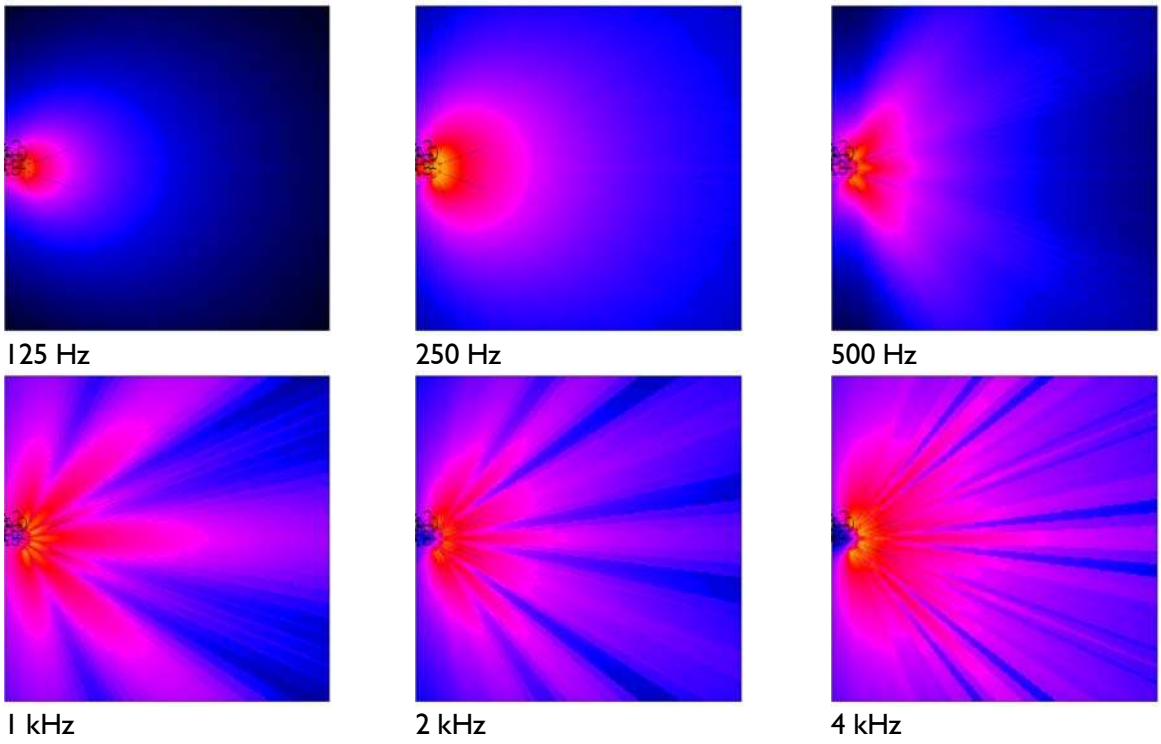


Figure 24: SPL mappings at octave band frequencies for four MTD enclosures with 0.5 metre spacing (arrayed system corresponding to the "avoid" case shown in Figure 23).

5.4 PREDICTING MTD COVERAGE

Polar data files are available for modeling MTD108a, MTD112b and MTD115b coverage using industry-standard EASE or CATT-Acoustic room acoustics modeling software packages (see Figures 20-22 for examples of typical SPL mappings).

For more information on these modeling programs, please consult:

www.ada-acousticdesign.com for EASE information

www.catt.se for CATT.

MTD108a, MTD112b and MTD115b polar data (EASE or CATT format) is available for download from: www.l-acoustics.com.

5.5 DISTRIBUTED SOUND REINFORCEMENT

As seen in Figure 22, distributed sound reinforcement using MTD enclosures can provide even SPL coverage and frequency response by reducing the effects of audible interference. For distributed installation, the optimum spacing between enclosures will depend on the listener distance and the coverage angle of the individual enclosure (-6 dB points are 100 degrees for MTD108a, 85 degrees for MTD112b, 85 degrees for MTD115b).

5.5.1 OVERHEAD DISTRIBUTED SYSTEMS

Overhead distributed system design using coaxial loudspeakers is described in Davis and Davis, Sound System Engineering, 2nd Edition, Focal Press, 1997. In this reference it is shown that an overhead crisscross pattern distribution density with center-to-center overlap provides the most uniform coverage (+/- 2 dB variation in SPL from between 250 – 5k Hz is possible). Formulae are provided for various cases: center-to-center overlap, minimum overlap or no overlap in order to determine physical layout parameters for the distributed loudspeaker grid. Interested readers are referred to Chapter 13, "Distributed Sound Systems" in Sound System Engineering for complete details.

5.5.2 DELAY SYSTEMS

MTD enclosures are highly suited for delay system installation in order to cover large audience areas. When installing delay systems, there are a few principles that should be followed:

1) Over-delaying up to 15 ms is acceptable due to the Haas effect. Greater than 15 ms is not acceptable since the delayed sound will be perceived as an echo behind the main signal. Time alignment of delays should be made using a measurement point on the axis of the reference source and the delayed source. If the delay time setting is such that the two sources arrive at the same time on-axis, the reference source will be slightly ahead of the delay source at any other location off-axis and the Haas effect will allow for correct localization. For some applications (speech), it is advised to under-delay in order to optimize off-axis intelligibility and clarity behind the delayed system (i.e., closer to the stage).

2) Spread different sources, with different delayed signals, instead of grouping them in a single location. This allows for broader coverage by the delayed sources and produces more homogeneous SPL over the delay-covered area.

3) Distributed delay positions should be along a circular arc of constant radius, centered at the stage.

4) The optimum spacing between delay loudspeakers will depend on the coverage angle of the enclosure (100, 85 and 85 degrees for MTD108a, MTD112b and MTD115b, respectively) as well as the distance to first members of the audience. Center-to-center overlap based on the -6 dB coverage angles will provide the most uniform coverage (see also 4.5.1).

Time domain-based measurement equipment is highly useful for setting delay times (for example, MLSSA, WINMLS, TEF, SMAART or SPECTRAFOO). Alternatively, Bushnell Yardage Pro rangefinder

binoculars can provide a good starting point by simply measuring the distance from the delay location to the main system, i.e., the geometric path difference.

5.5.3 COMPLEMENTARY FILL

For large-scale sound reinforcement (typically when V-DOSC, dV-DOSC or ARCS are used as the main FOH system), MTD enclosures can be used for distributed front fill (ground stacked), flown center cluster downfill, stereo in-fill, offstage fill or as distributed delays. The number of potential uses for MTD108a, MTD112b or MTD115b enclosures for fill applications is only limited by your imagination.

In all cases, proper time alignment of fill systems with respect to the main L/R FOH system is essential for obtaining optimum results. Similarly, pre-delay to time align the overall sound reinforcement system (main L/R FOH plus fill systems) with the energy generated on stage is also an important consideration, particularly for the first 10 rows of the audience. WINMLS, SMAART or SPECTRAFOO are cost-effective measurement tools for performing time alignment that are recommended.

FLOWN CENTER CLUSTER

Due to their compact size, point source behavior and generous coverage, MTD enclosures are highly suitable for center cluster applications. Typically this will be necessary when the stage opening is wide and the main left/right FOH system separation is greater than 20 meters. Apart from coverage issues, image localization is an important consideration (particularly for theatrical installations) and careful time alignment plus level balancing can significantly improve subjective localization for the audience to the onstage performers. The trim height and tilt of an MTD center cluster fill system will depend on the distance to the first rows of the audience area and, of course, on the height of the proscenium opening.

DISTRIBUTED FRONT FILL

As an alternative (or complement) to a flown center cluster, MTD enclosures can be stacked on top of a central line array of subwoofers (or any other object of suitable height) provided that the height of the HF section is appropriate for audience coverage. Typically, a stacked height of at least 1-2 meters is recommended in order to reduce audience shadowing effects and whether the audience is seated or standing should be considered. In addition to these issues, sightlines and clearance under the stage lip are also important considerations for a distributed front fill system and when space is at a premium, the MTD108a provides an excellent solution.

As for overhead distributed or delay systems, the optimum spacing between MTD enclosures will depend on the coverage angle of the enclosure (100, 85 and 85 degrees for MTD108a, MTD112b and MTD115b, respectively) and the distance to the first members of the audience. Center-to-center overlap will provide the most uniform coverage and separate time alignment delay taps for front fill enclosures can further assist in improving image localization.

STEREO INFILL

Stacked stereo infill systems using MTD enclosures either located onstage or stacked on top of L/R ground stacked subwoofer arrays can also be effective for front fill purposes. It is always a good idea to keep MTD enclosures physically as close as possible to the subwoofers in order to improve sonic integration between the fill system and the subwoofers plus to reduce low frequency proximity effects for the audience located close to the subwoofers (i.e., it's good to give the audience some high end to help offset all that sub energy!). For smaller set designs, it can also be an option to place stereo front-fill MTD enclosures close to the onstage side-fill monitoring system.

As for distributed front fill applications, the height of the HF section should be optimized to suit the audience seating area in order to reduce shadowing effects. Special attention should be paid to the first few rows and typically, a stacked height of at least 1-2 meters is recommended. If possible, use distance-attenuation loss to your advantage and try to move MTD enclosures as far upstage as

possible in order to reduce the increase in SPL over the first few rows relative to the audience further back in the coverage region.

OFFSTAGE FILL

When the horizontal coverage of the main left/right FOH arrays is not sufficient to cover the entire audience area, MTD enclosures can also be used for offstage fill. Typically, throw distance requirements are shorter and vertical coverage angles are greater, making MTD a possible solution for this application.

Some Final Notes Concerning Fill Applications

LLC equalization and processing for MTD108a, MTD112b and MTD115b loudspeaker enclosures have been specifically engineered to be sonically compatible with all other L-ACOUSTICS models. LLC controllers can be set in either MONITOR or X-OVER modes for proximity fill applications where the audience is located close to the fill loudspeaker system – for example, front fill or stereo infill configurations. For proximity fill applications, the additional low frequency shelving equalization obtained using the FRONT setting is probably not necessary (or desirable).

Time alignment of complementary fill systems with the main left/right FOH arrays is necessary in order to achieve optimum results. Placing your measurement microphone in a representative location where the fill and main system coverage overlaps generally provides a good reference point for time alignment. WINMLS, SMAART or SPECTRAFOO are cost-effective measurement tools that are recommended for this purpose.

5.6 FRONT-OF-HOUSE (FOH) APPLICATIONS

When MTD018a, MTD112b or MTD115b enclosures are used standalone (without subwoofers) for FOH applications, there are three different types of LLC processing available: 1) FRONT mode has approximately 3 dB of low frequency shelving equalization in order to provide a frequency response contour that is suitable for music applications; 2) MONITOR mode has a reduced amount of low frequency shelving equalization and 3) X-OVER mode has a 100 Hz high pass filter and no low frequency shelving equalization. Either MONITOR or X-OVER modes can be useful for speech reinforcement and classical music applications, or for when MTD enclosures are used as a close proximity fill enclosure

For 3-way operation of MTD112b or MTD115b loudspeaker enclosures with SB115, SB118, or SB218 subwoofers LLC processors should be set in X-OVER mode and the appropriate subwoofer model selected via the front panel switches.

Note: The SB118 setting should be employed when using the LLC 115b-st or LLC 115b-2w controller for dV-SUB processing (bandpass filtering and equalization are compatible)

For the MTD108LLCa analog controller, the subwoofer model is selected by changing a jumper on the circuit board inside the unit. To configure the MTD108LLCa for other subwoofers:

1. Unplug the mains cable
2. Remove the cover of the controller (#8 philips screws for the top panel and #9 for the front panel)
3. Locate the following text: SB115, MTD118, SB218, and SBX (front right side of the circuit board)
4. Place the jumper in the location corresponding to the desired subwoofer.

For all FOH applications, please refer to Sections 5.2, 5.3, 5.4 concerning MTD aiming, arraying and coverage prediction. For additional information on using MTD enclosures with subwoofers, please refer to Section 5.8.

5.7 STAGE MONITORING

Given the optimum signal processing and protection provided by their respective LLC analog controllers and due to their compact, wedge-shaped format and axi-symmetrical directivity, MTD enclosures provide a high performance, "plug and play" stage monitoring solution.

FLOOR MONITORING

For floor monitoring applications, the coaxial component configuration employed in the MTD108a, MTD112b and MTD115b provides a high degree of image and coverage stability. The benefits of axi-symmetric directivity are even more apparent since the performer is in close physical proximity to the enclosure and experiences a generous, homogeneous coverage pattern without the subjective impression (and potential feedback problems) of listening to a separate horn / woofer combination.

The MONITOR setting for the LLC analog controller is intended for floor monitoring applications since this setting features reduced low frequency shelving equalization in order to compensate for the effects of half-space loading conditions. The X-OVER setting implements a 100 Hz high pass filter and can also be used for speech reinforcement applications.

When using MTD enclosures in pairs for floor monitoring, the same principles apply as for overhead or distributed front fill systems, i.e., the optimum spacing between floor monitors will depend on the coverage angle of the enclosure (100, 85 and 85 degrees for MTD108a, MTD112b and MTD115b, respectively) and the throw distance to the performing artist (which is determined by the floor monitor angle with respect to vertical and the artist's height). Center-to-center overlap will provide the most uniform coverage and as a guideline, nominal monitor distance plus monitor separation is tabulated below in Table 16.

Apart from separation and distance to the performer, the last issue to consider when using MTD108a, MTD112b or MTD115b as floor monitors in paired configurations is whether to angle the enclosures in towards the performer. Although it looks more "rock and roll" and gives the performer the impression of having more SPL, it is generally not advised to angle wedges in but to use them with the front faces parallel to each other. Essentially, angling in wedges no longer provides optimum center-to-center overlap and results in too much overlap. Due to this excessive overlap there will be a cancellation loss of up to 8 dB in the high end (above 6 kHz, approximately) that will need to be compensated for via output gain adjustment and/or equalization. Ultimately, it all comes down to artist preference and what you're shooting for in a monitor mix but if you want optimum coverage and nominally flat, follow the spacing/distance recommendations given in Table 16 and don't angle the wedges in.

Table 16: Nominal floor monitor distance (to performer) and separation versus performer height

MTD108a (short-throw: 22.5 angle wrt vertical, 100 deg coverage)

PERFORMER HEIGHT			Performer <-> Monitor			Monitor <-> Monitor		
(cm)	(ft / in)		(cm)	(ft / in)		(cm)	(ft / in)	
160	5 ft	3 in	66	2 ft	2 in	79	2 ft	7 in
165	5 ft	5 in	68	2 ft	3 in	81	2 ft	8 in
170	5 ft	7 in	70	2 ft	4 in	84	2 ft	9 in
175	5 ft	9 in	72	2 ft	5 in	86	2 ft	10 in
180	5 ft	11 in	75	2 ft	5 in	89	2 ft	11 in
185	6 ft	1 in	77	2 ft	6 in	91	2 ft	12 in
190	6 ft	3 in	79	2 ft	7 in	94	3 ft	1 in

MTD108a (long-throw: 45 angle wrt vertical, 100 deg coverage)

PERFORMER HEIGHT			Performer <-> Monitor			Monitor <-> Monitor		
(cm)	(ft / in)		(cm)	(ft / in)		(cm)	(ft / in)	
160	5 ft	3 in	160	5 ft	3 in	191	6 ft	3 in
165	5 ft	5 in	165	5 ft	5 in	197	6 ft	5 in
170	5 ft	7 in	170	5 ft	7 in	203	6 ft	8 in
175	5 ft	9 in	175	5 ft	9 in	209	6 ft	10 in
180	5 ft	11 in	180	5 ft	11 in	215	7 ft	0 in
185	6 ft	1 in	185	6 ft	1 in	220	7 ft	3 in
190	6 ft	3 in	190	6 ft	3 in	226	7 ft	5 in

MTD112b (45 angle wrt vertical, 85 deg coverage)

PERFORMER HEIGHT			Performer <-> Monitor			Monitor <-> Monitor		
(cm)	(ft / in)		(cm)	(ft / in)		(cm)	(ft / in)	
160	5 ft	3 in	160	5 ft	3 in	147	4 ft	10 in
165	5 ft	5 in	165	5 ft	5 in	151	4 ft	12 in
170	5 ft	7 in	170	5 ft	7 in	156	5 ft	1 in
175	5 ft	9 in	175	5 ft	9 in	160	5 ft	3 in
180	5 ft	11 in	180	5 ft	11 in	165	5 ft	5 in
185	6 ft	1 in	185	6 ft	1 in	170	5 ft	7 in
190	6 ft	3 in	190	6 ft	3 in	174	5 ft	9 in

MTD115b (41 angle wrt vertical, 85 deg coverage)

PERFORMER HEIGHT			Performer <-> Monitor			Monitor <-> Monitor		
(cm)	(ft / in)		(cm)	(ft / in)		(cm)	(ft / in)	
160	5 ft	3 in	139	4 ft	7 in	127	4 ft	2 in
165	5 ft	5 in	143	4 ft	8 in	131	4 ft	4 in
170	5 ft	7 in	148	4 ft	10 in	135	4 ft	5 in
175	5 ft	9 in	152	4 ft	12 in	139	4 ft	7 in
180	5 ft	11 in	156	5 ft	2 in	143	4 ft	8 in
185	6 ft	1 in	161	5 ft	3 in	147	4 ft	10 in
190	6 ft	3 in	165	5 ft	5 in	151	4 ft	12 in

SIDE FILL OR DRUM FILL MONITORING

When used in conjunction with SB115, SB118 or SB218 subwoofers, MTD108a, MTD112b or MTD115b enclosures provide an excellent solution for side fill or drum fill monitoring. Single or double enclosure stacked configurations are the most common set-up for these applications and the MTD can also be used without subwoofers depending on the amount of LF extension expected by the monitor engineer or performing artist.

When stacked on top of vertically-oriented SB118 or SB218 subwoofers for side fill applications, MTD enclosures will physically be at a convenient height that is close to the performer's ear level. Normally for drum fill, subwoofers will be oriented horizontally in order to maintain a low profile.

For 3-way operation of MTD112b or MTD115b enclosures with SB115, SB118, or SB218 subwoofers LLC processors should be set in X-OVER mode and the appropriate subwoofer model selected via the front panel switches. For the MTD108LLCa analog controller, the subwoofer model is selected by changing a jumper on the circuit board inside the unit (please see Section 5.6 for further details).

5.8 USING MTD WITH SUBWOOFERS

For extended bandwidth sound reinforcement, MTD108a, MTD112b or MTD115b enclosures should be used with SB115, SB118, SB218 or dV-SUB subwoofers. As a quick reference, L-ACOUSTICS subwoofer specifications are summarized in Table 17 and Fig 25.

Table 17: L-ACOUSTICS Subwoofer Specification Summary

L-ACOUSTICS SUB MODEL	Freq Resp (+/- 3 dB)	Usable LF (-10 dB)	Sensitivity (1W / 1m)	RMS Voltage	POWER (cont)	POWER (peak)	MAX SPL (cont)	MAX SPL (peak)	REC'D AMP	LOAD (ohms)
SB115	45 - 100 Hz	40 Hz	94	45	**250 W**	**1000 W**	120 dB	126 dB	500 W	8
SB118	35 - 100 Hz	32 Hz	97	70	600 W	2400 W	125 dB	131 dB	1200 W	8
SB218	28 - 140 Hz	25 Hz	100.5	68	1100 W	4400 W	130 dB	136 dB	2200 W	4
dV-SUB	40 - 200 Hz	35 Hz	104.5	57	1200 W	4800 W	133 dB	139 dB	2400 W	2.7

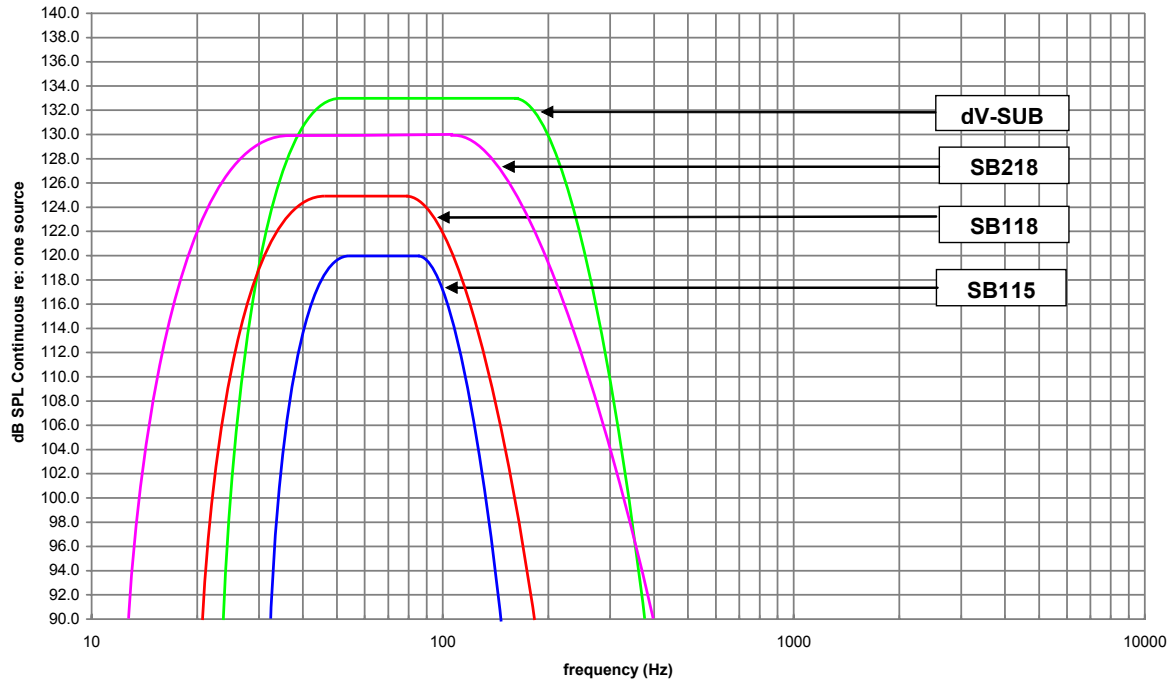


Figure 25: L-ACOUSTICS Subwoofer Continuous Unweighted SPL Comparison

The subwoofer output for all LLC analog controllers has been calibrated to provide approximately 6 dB of low frequency contour when subwoofers are used with MTD108a, MTD112b or MTD115b enclosures in a 1:1 MTD:subwoofer ratio. In order to compensate for sensitivity differences between subwoofer models, the relative sub output channel level has been adjusted for individual subwoofer settings (SB115, SB118 or SB218) so that the same 6 dB low frequency contour is obtained regardless of the subwoofer model in use.

Note: For MTD108LLCa, LLC112b–st and LLC115b-st controllers, the 6 dB low frequency contour is only obtained when both A and B channels are used (since the subwoofer output is derived as the mono sum of both input channels). For these LLC models, if subwoofers are operated in stereo then two LLC controllers are required and it is recommended that channel A inputs are linked to channel B in order to provide increased subwoofer drive level. Please see Figures 9, 12 and 15 for examples.

Note: LLC controllers do not include sense return protection for the subwoofer feed. It is important that power amplifier specifications are in agreement with the recommended values given in Table 17. For additional protection, MLS switch load matching (and/or outboard compression/limiting) is recommended.

5.8.1 Combining MTD With Subwoofers

Two cases can be considered: ground stacked systems where MTD and subwoofer enclosures are closely coupled physically or separate flown MTD loudspeakers with ground stacked subwoofers. For some applications, subwoofers are used as an effect and are not driven with the same signal as the main MTD system (separate auxiliary send from the console) while in other cases, the subwoofers are used as a low frequency extension and are driven with the same signal as the MTD enclosure.

Note: An additional LLC controller will be required to drive subwoofers separately via auxiliary send.

In general:

X-OVER mode for all LLC controllers provides a 100 Hz 24 dB/octave Linkwitz-Riley (LR24) low pass filter for the subwoofers with a complimentary 100 Hz LR24 high pass filter for the MTD112b or MTD115b low section. Complimentary 100 Hz crossover filtering optimizes the power bandwidth for the subwoofer and the low frequency component of the MTD112b or MTD115b. For the MTD108a, complimentary high pass / low pass filtering is at 125 Hz. X-OVER mode is recommended for all stacked MTD/subwoofer applications where the enclosures are closely coupled physically.

FRONT or MONITOR mode for all LLC controllers still provides a 100 Hz LR24 low pass filter for the subwoofer feed but there is now an overlapping LR24 high pass filter for the MTD enclosure (50 Hz HPF for MTD112b, 45 Hz HPF for MTD115b). Due to the overlap in the operating bandwidths of the sub and MTD enclosure, subwoofer polarity may have to be inverted due to the phase shift of overlapping crossover filters. Subwoofer polarity will depend on how the subwoofers are driven, i.e., via AUX send or with the same signal as sent to the MTD system, and when using FRONT or MONITOR settings for flown MTD / ground stacked subwoofer configurations, subwoofer polarity should be experimented with as part of the time alignment and tuning process.

5.8.2 Ground Stacked Systems

For ground stacked systems, MTD and subwoofer enclosures are physically close to each other and time alignment is simplified throughout the audience area since there are no arrival time (path length) differences between the flown MTD system versus ground stacked subwoofers. Typically, LLC controllers are used in X-OVER mode for ground stacked configurations in order to optimize power bandwidth for the subwoofer and the MTD low frequency component.

5.8.3 Separate Flown MTD with Ground Stacked Subwoofers

For a separate flown MTD system with ground stacked subwoofers, time alignment of subwoofers is required due to the geometric path difference between the two systems. This is illustrated in Figure 26, where the distance from the measurement microphone position to the subwoofers is d_{SUB} while the distance to the flown MTD system: $d_{FLOWN} = d_{SUB}$ + PATH DIFFERENCE. Delaying the subwoofers by the geometric path difference will time align the subwoofers at the reference position.

Note: Selection of the reference position for time alignment is always a compromise since the geometric path difference will vary with position.

Note: A separate digital delay unit will be required for subwoofer time alignment.

In most cases, LLC controllers should be used in X-OVER mode for flown MTD and ground stacked subwoofer configurations in (3-way mode or with separate AUX drive for the subwoofers) since the subwoofers can be used with positive polarity and this helps to simplify installation and system tuning.

However, if more low frequency energy is desired from the flown MTD system, FRONT or MONITOR settings can be used and subwoofer polarity will depend on how subwoofers are processed, i.e., whether they are driven with the same signal as the MTD enclosure or driven via discrete AUX send. Following time alignment, subwoofer polarity is a parameter to experiment with in order to obtain the best results.

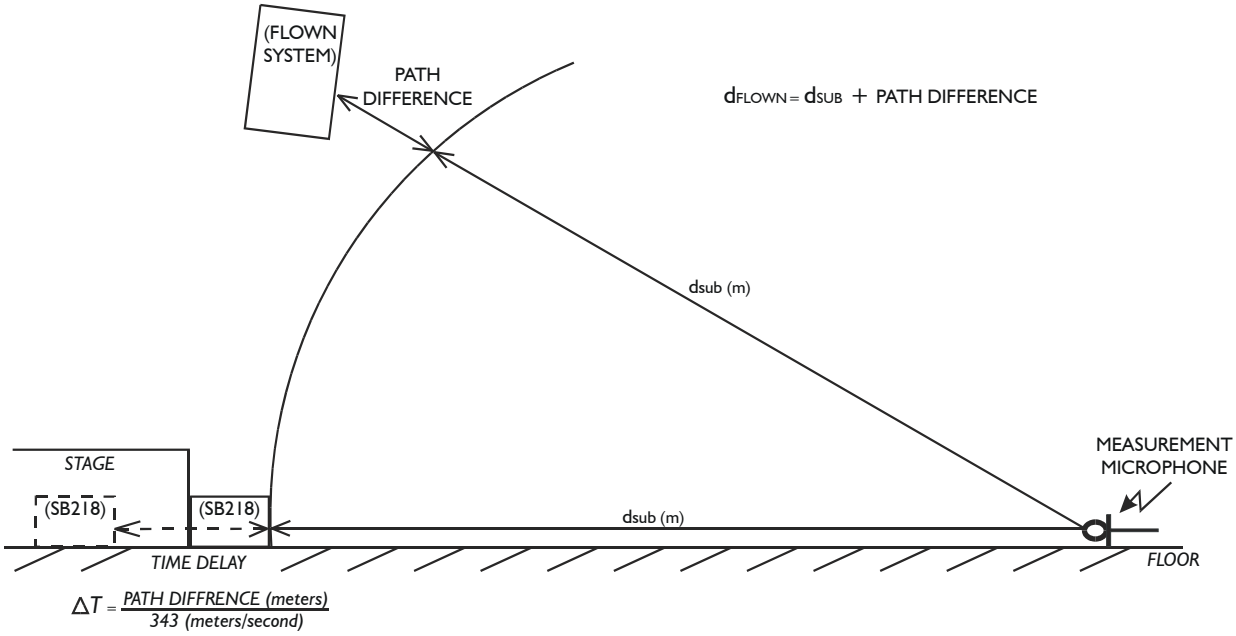


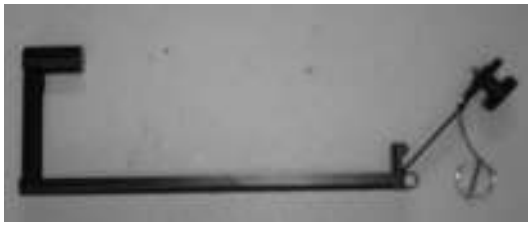
Figure 26: Illustration of subwoofer time alignment

6. INSTALLATION PROCEDURES

6.1 ETR8 U-BRACKET ATTACHMENT(MTD108a)



(1) MTD108a and ETR8 U-bracket



(2) Remove locking pin on the pivoting arm



(3) U-bracket stud mates with MTD108a pole mount socket



(4) Remove recessed set screw



(5) Rotate pivoting arm into position, select angle



(6) Secure the locking pin on the pivoting arm



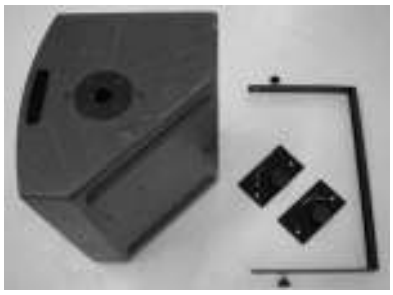
(7) Three attachment points are available for ceiling or scaffold mounting in the horizontal orientation



(8) Always install with the fixed arm on the bottom when installing the MTD108a in the vertical orientation

Figure 27: ETR8 U-bracket installation procedure

6.2 ETR1, ETR2 U-BRACKET ATTACHMENT (MTD112b, MTD115b)



(1) MTD112b and ETR1 U-Bracket



(2) Remove ETR1adapter plate attachment screws (5 mm allen key)



(3) Attach ETR1 adapter plate



(4) Repeat for other side



(5) Mounted ETR1 adapter plate – note orientation for alignment of enclosure centre of gravity



(6) Mirror image for the other side of the enclosure



(7) Remove ETR1 attachment knob and lock washer



(8) Attach ETR1 on both sides of the enclosure



(9) The smaller knob allows for tilt angle adjustment



(10) Three attachment points available for ceiling or scaffold mounting in the horizontal orientation only. Single stud plate available for safety attachment using PION1

Figure 28: ETR1, ETR2 U-bracket installation procedure

6.3 OMNIMOUNT ATTACHMENT (MTD112b, MTD115b)



(1) Remove Omnimount attachment screws (5 mm allen key)



(2) Attach Omnimount plate to enclosure



(3) Omnimount adapter can be used for installation in horizontal or vertical orientation with continuous angle adjustment



(4) Angle adjustment

Figure 29: Omnimount installation procedure

6.4 SAFETY RULES

When using ETR8 for mounting the MTD108a enclosure in the vertical orientation, always install the U-bracket with the fixed arm on the bottom and the pivoting arm on top.

ETR1 and ETR2 are for installation of MTD112b or MTD115b enclosures, respectively, in the horizontal orientation only.

L-ACOUSTICS recommends the use of safety steels at all times. The integrated single stud anchor plate and the PION1 single stud fitting can be used for safety attachment for MTD112b and MTD115b enclosures.

7. MTD SYSTEM OPERATION

Please refer to Section 4 for cabling and configuration details for typical MTD system configurations. Once the system is cabled (LLC controllers, amplifiers and loudspeakers), connect program signal lines (L/R outputs from a mixing console, for example) to the appropriate input channels of the LLC Controller(s). Recall that LLC Controllers are calibrated for use with power amplifiers having 32 dB gain (i.e., 40 x voltage gain or 1 volt input = 40 volts output).

Power on the LLC controller(s) and select the appropriate setting for 2-way operation (FRONT or MONITOR) or 3-way operation (X-OVER mode) for MTD108a, MTD112b or MTD115b plus SB115, SB118 or SB218 subwoofers.

Perform the following steps as a system check:

1) turn down the level of all amplifier channels before turning the amplifiers on
2) send a pink noise signal to the LLC controller
3) turn up the level of each HIGH amplifier channel individually (MTD115b in active mode) or each MTD (passive mode) amplifier channel and check that this provides the expected frequency band in the expected loudspeaker component. Test each HIGH or MTD (passive) amplifier channel individually until all amplifier channels have been tested.
4) repeat steps 2-3 for LOW (MTD115b in active mode) and SUB amplifier channels
5) turn off the pink noise
6) use a polarity testing device to confirm that all SUB, LOW and HIGH components are operating with positive polarity
7) set all amplifier output levels to 0 dB gain and the system is ready for use.

NOTE: Remember the old saying: "amps on last, amps off first" in order to avoid component damage due to power on/off transients.

7.1 RECOMMENDED MAINTENANCE PROCEDURES

a) HF diaphragm replacement

To access the HF compression driver diaphragm, the front grille of the MTD enclosure should be removed and the entire 8", 12" or 15" coaxial assembly de-mounted.

To remove the front grille, lift the edges of the acoustic foam and remove the screws. Screws can be found where the edges of the foam are not glued onto the grille (there is no need to completely remove the acoustic foam in order to remove the loudspeaker grille).

Once the coaxial assembly has been de-mounted, unscrew the back cover of the rear-mounted compression driver assembly to obtain access to the compression driver diaphragm.

Remove the damaged diaphragm and before installing the replacement diaphragm ensure that the voice coil gap is free from any metallic particles, dirt or other debris by using 2-sided tape and acetone, if necessary, to thoroughly clean out the gap.

After installing the replacement diaphragm, apply a low level, low frequency sine wave sweep (for example: 4 volts from 100 Hz - 1 kHz) to ensure that the diaphragm is properly centered in the gap before reinstalling the compression driver back cover. Make sure all compression driver diaphragm and back cover mount screws are securely fastened (loctite is optional but recommended).

As a final check apply a high level sine sweep over the HF compression driver's operating bandwidth (for example: 13 volts from 1 kHz to 18 kHz). Re-mount the entire MTD coaxial assembly in its enclosure and perform a system polarity check.

Following service, the damaged compression driver diaphragm should be returned to your distributor or directly to L-ACOUSTICS for warranty examination.

b) LF Service

The 8", 12" or 15" loudspeaker components of the coaxial assemblies used in the MTD108a, MTD112b and MTD115b are not field-serviceable. For field service, the entire coaxial assembly should be removed and replaced.

To remove the front grille, lift the edges of the acoustic foam and remove the screws. Screws can be found where the edges of the foam are not glued onto the grille - there is no need to completely remove the acoustic foam in order to remove the loudspeaker grille.

The damaged loudspeaker should be returned to your distributor or directly to L-ACOUSTICS for warranty examination and reconing.

c) Polarity Check

Whenever a HF diaphragm or loudspeaker component is replaced, wiring polarity should be checked with a polarity checking device. Both LF and HF components should operate with positive polarity.

d) Periodic Check

The frequency response of the enclosure should be checked periodically to check for any deviations due to wear, shock or other damage. This should be done on an annual basis for systems not subjected to demanding use. For systems being used on a daily basis for sub hire or touring, enclosures should be checked every month (or even more frequently).

A frequency response check can be performed with a high resolution RTA (real time analyzer), or preferably using WINMLS, SMAART, SPECTRAFOO, TEF or MLSSA measurement systems. Refer to the on-axis amplitude/frequency response to determine if your MTD enclosure is within specification. In addition, a response sweep using a sine wave generator is useful for checking for coil rubs, buzzes, air leaks or other undesirable mechanical vibrations as part of the periodic quality control procedure.

The mechanical attachment of both low frequency and high frequency loudspeakers should be checked periodically since mount screws can become loose after being submitted to intense, long duration mechanical vibrations. Similarly, it is a good idea to periodically check that the high frequency diagram and rear cover for the compression driver are solidly attached. The quality of the contacts and locking action of the SPEAKON connector should also be checked periodically.

7.2 SPARE PARTS

MTD108a

HP BC12	1" driver 8 Ohms	HS BC12	Diaphragm for 1" driver
HS PH82	8" recone kit	HR PH82	8" recone kit inc. labour
CM MTD108a	Front foam	MC MTD108aGRL	Front grill

MTD112b

HP BE121	12" coaxial speaker 8 Ohms	HS BE21	Diaphragm for 1,4" driver
HS BE121	12" recone kit	HR BE121	12" recone kit inc. labour
CM MTD112b	Front foam	MC MTD112bGRL	Front grill

MTD115b

HP BE151	15" coaxial speaker 8 Ohms	HS BE21	Diaphragm for 1,4" driver
HS BE151	15" recone kit	HR BE151	15" recone kit inc. labour
CM MTD115b	Front foam	MC MTD115bGRL	Front grill

CD COLNEO Neoprene glue in spray 500ML (for attachment of grille foam)

8. SPECIFICATIONS

8.1 MTD108a SPECIFICATIONS

Frequency Response

Frequency response:	85 – 20k Hz (± 3 dB)	(LLC FRONT position)
Usable bandwidth:	65 – 20k Hz (-10 dB)	

Sensitivity

(2.83 Vrms at 1 m)	94 dB SPL (85 – 20k Hz)

Power Rating			**Amplification***	**Impedance**
(Long Term)			(recommended)	(nominal)
45 Vrms	250 Wrms	1000 Wpeak	500 W	8 ohms

*Amplifiers must have 32 dB gain in order for LLC 112b-st sense return protection to function properly

Nominal Directivity (-6 dB)

Axi-symmetrical	100° (± 15°)

System Output	**SPL**		
One enclosure	116 dB (cont)	122 (peak)	FRONT mode
	117 dB (cont)	123 dB (peak)	MONITOR/XOVER mode

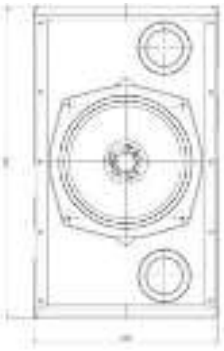
System output gives the unweighted SPL output of the system referenced to 1 m, including preset equalization and band levelling adjustment as measured under freefield conditions.
FRONT LLC setting provides a 3 dB low frequency contour under freefield conditions
XOVER LLC setting applies a 125 Hz high pass filter.

Components

LF	1 x 8" weather resistant loudspeaker (2" voice coil)
HF	1 x 1" exit neodymium compression driver (titanium diaphragm, coaxial assembly)

Enclosure

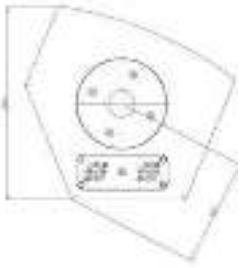
Height	421 mm 16.6 in
Width	250 mm 9.8 in
Depth	242 mm 9.5 in
Trap Angle	22.5 or 45 degrees with respect to vertical
Net Weight	10.5 kg 23.1 lbs
Shipping Weight	11.5 kg 25.3 lbs
Shipping Dimensions	490 x 330 x 310 mm 19.3 x 13.0 x 12.2 in
Connectors	2x 4-pin Neutrik speakon
Material	15 mm, 18 mm Baltic birch plywood (sealed, screwed and rabbeted angles)
Finish	Maroon-gray™
Grill	Black epoxy perforated steel with acoustically transparent foam
Rigging	Integrated flying hardware and pole mount socket, Omnimount-ready



FRONT



SIDE



BOTTOM



REAR

Figure 30: MTD108a line drawing

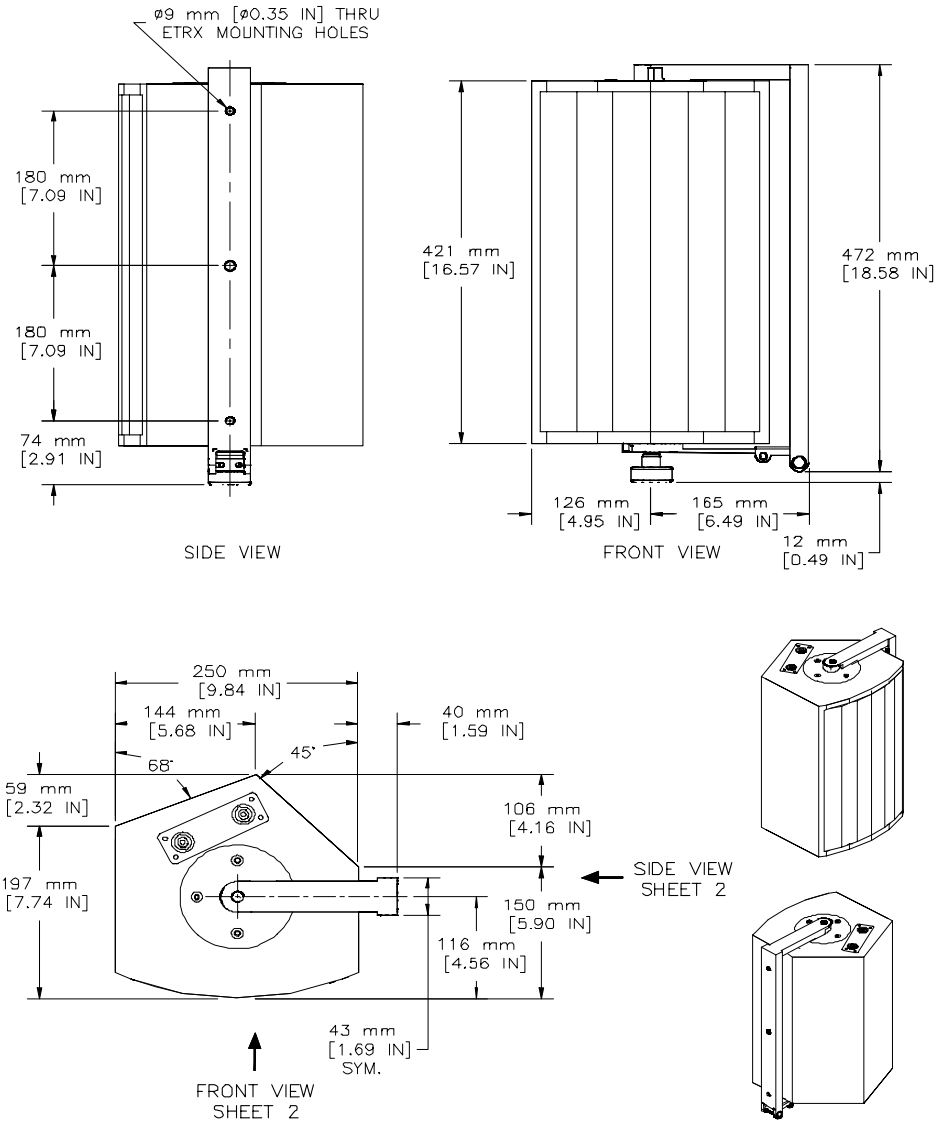


Figure 31: MTD108a plus ETR8 line drawings

8.2 MTD108LLCa SPECIFICATIONS

Technical

Inputs	Electronically balanced 10 kΩ input (pin 2 hot)
Outputs	Electronically balanced 50 Ω output (pin 2 hot)
Input Headroom	+20 dBV
Nominal Gain at 200 Hz	0 dB (unity gain)
Signal to Noise	> 84 dB
Dynamic Range	> 104 dB
THD	<0.01% (20 to 20k Hz @ 0 dBV)
Bandpass/Equalization Filters	
3 modes:	MONITOR = 80 Hz (BW12 HP)
	FRONT = 50 Hz (LR24 HP+EQ)
	XOVER = 125 Hz (HP)
	Low-pass: 20 kHz
	SB115 Subwoofer: 40 - 125 Hz (LR 24 HP/LP + EQ)
Speaker Protection	RMS limiter & peak limiter

Front & Rear Panel

Indicators	Signal: green LED for each section
	Control: yellow LED for each section
Front Panel Controls	AC power, MODE select, SUB/SUM select
Rear Panel Control	IN PHASE/OUT PHASE (MONO output polarity)
Front Panel Connectors	Channel 1, 2 XLR inputs, parallel loop through
	Loudspeaker: 2x 4-pin Neutrik speakon
Rear Panel Connectors	Sense Return: 4-pin Neutrik speakon
	MONO, Channel 1, 2 XLR line outputs
Power Requirement	100 V - 240 V 50/60 Hz
Power Consumption	15 W

Physical

Finish	Black anodized front panel, white serigraphy
Net Dimensions	483 x 44 x 305 mm
	19 x 1.75 x 12.0 in
Net Weight	3.75 kg 8.3 lbs
Shipping Dimensions	505 x 80 x 415 mm
	19.9 x 3.1 x 16.3 in
Shipping Weight	4.8 kg 10.6 lbs

8.3 MTD112b SPECIFICATIONS

Frequency Response

Frequency response:	70 – 14k Hz (± 3 dB)	(LLC FRONT position)
Usable bandwidth:	55 – 16k Hz (-10 dB)	

Sensitivity

(2.83 Vrms at 1 m)	98 dB SPL (70 – 14k Hz)

Power Rating			**Amplification***	**Impedance**
(Long Term)			(recommended)	(nominal)
45 Vrms	250 Wrms	1000 Wpeak	500 W	8 ohms

*Amplifiers must have 32 dB gain in order for LLC 112b-st sense return protection to function properly

Nominal Directivity (-6 dB)

Axi-symmetrical	85° (± 20°)

System Output	**SPL**		
One enclosure	120.5 dB (cont)	126.5dB (peak)	FRONT mode
	122.5 dB (cont)	128.5dB (peak)	XOVER mode

System output gives the unweighted SPL output of the system referenced to 1 m, including preset equalization and band levelling adjustment as measured under freefield conditions.
FRONT LLC setting provides a 3 dB low frequency contour under freefield conditions
XOVER LLC setting applies a 100 Hz high pass filter.

Components

LF 1 x 12" weather resistant loudspeaker (4" voice coil)
HF 1 x 1.4" exit compression driver (titanium diaphragm, 3" voice coil, coaxial assembly)

Enclosure

Height	540 mm	21.3 in
Front Width	410 mm	16.1 in
Rear Width	165 mm	6.5 in
Depth	375 mm	14.8 in
Trap Angle	45 degrees with respect to vertical	
Net Weight	27.5 kg	60.6 lbs
Shipping Weight	30.5 kg	67.2 lbs
Shipping Dimensions	615 x 470 x 465 mm	
	24.2 x 18.5 x 18.3 in	
Connectors	2x 4-pin Neutrik speakon	
Material	18 mm, 30 mm Baltic birch plywood	
	(sealed, screwed and rabbeted angles)	
Finish	Maroon-gray™	
Grill	Black epoxy perforated steel with acoustically transparent foam	
Rigging	Integrated flying hardware, handles and pole mount socket, Omnimount-ready	

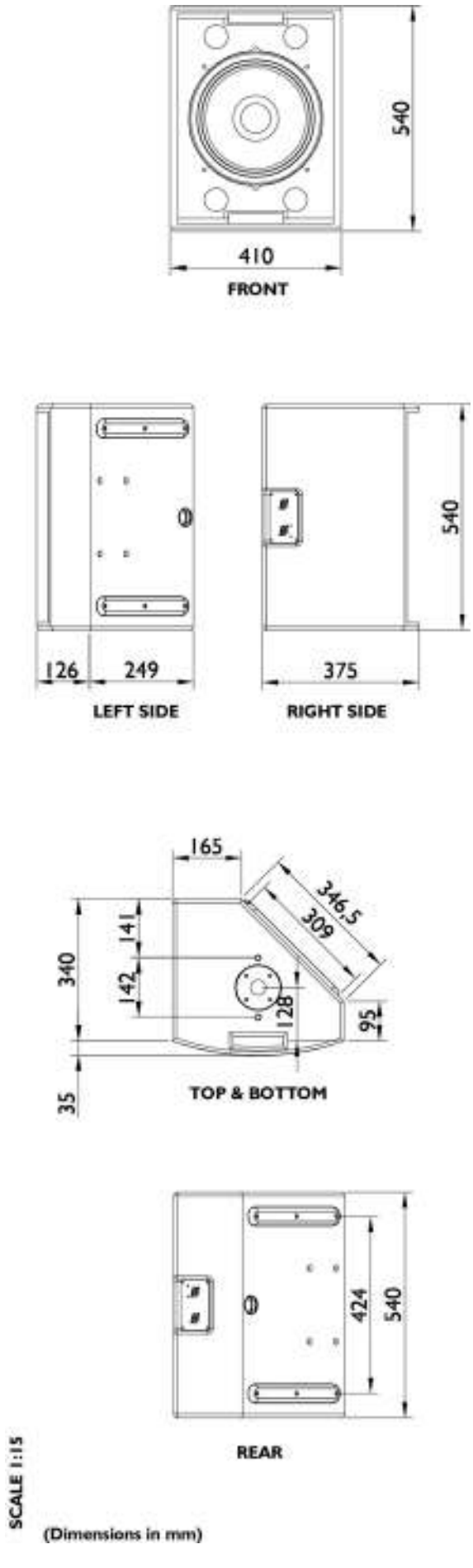


Figure 32: MTD112b line drawing

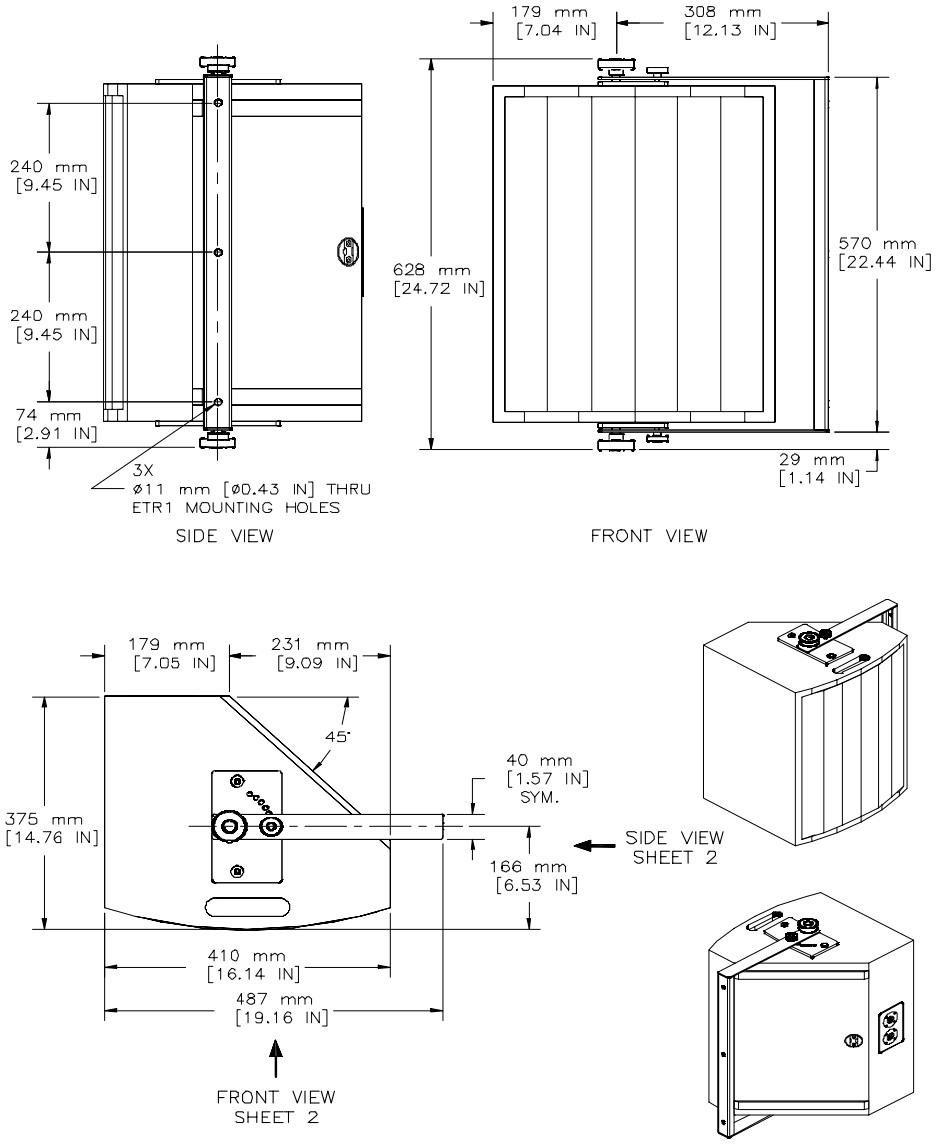


Figure 33: MTD112b plus ETR1 line drawings

8.4 LLC112b-st SPECIFICATIONS

Technical

Inputs	Electronically balanced 10 kΩ input (pin 2 hot)
Outputs	Electronically balanced 50 Ω output (pin 2 hot)
Input Headroom	+20 dBV
Nominal Gain at 200 Hz	0 dB (unity gain) in X-OVER mode
Signal to Noise	> 84 dB
Dynamic Range	> 104 dB
THD	<0.01% (20 to 20k Hz @ 0 dBV)

Bandpass/Equalization Filters

3 modes:	FRONT: 50 Hz HPF + low frequency shelving eq MONITOR: 50 Hz HPF X-OVER: 100 Hz HPF
Low-pass:	20 kHz
Subwoofer:	25, 26, 40 Hz LR24 HPF (for SB218, SB118, SB115) 100 Hz LR 24 LPF
Speaker Protection	RMS limiter & peak limiter

Front & Rear Panel

Indicators	Signal: green LED for each channel Control: yellow LED for each channel
Front Panel Controls	MODE select (FRONT, MONITOR, X-OVER) SUB select (SB115, SB118, SB218) AC power switch
Rear Panel Control	SUB POLARITY (positive, negative)
Front Panel Connectors	Ch A, B XLR inputs with parallel loop through MONO SUB XLR output (in parallel with rear panel XLR) LOUDSPEAKERS OUT Ch A, B: 2 x 4-pin Neutrik speakon
Rear Panel Connectors	Ch A, B XLR line outputs MONO SUB XLR output (in parallel with front panel XLR) Sense Return: 1x 4-pin Neutrik speakon (Ch A=1+/1-, Ch B=2+/2-)
Power Requirement	100 V - 240 V 50/60 Hz
Power Consumption	15 W

Physical

Finish	Black anodized front panel, white serigraphy
Net Dimensions	483 x 44 x 305 mm 19 x 1.75 x 12.0 in
Shipping Dimensions	505 x 80 x 415 mm 19.9 x 3.1 x 16.3 in
Net Weight	3.75 kg 8.3 lbs
Shipping Weight	4.8 kg 10.6 lbs

8.5 MTD115b SPECIFICATIONS

Frequency Response

Frequency response:	65 – 14k Hz (± 3 dB)	(LLC FRONT position)
Usable bandwidth:	50 – 16k Hz (-10 dB)	

Sensitivity

PASSIVE		
	(2.83 Vrms at 1 m)	98.5 dB SPL (65 – 14k Hz)
ACTIVE		
LF	(2.83 Vrms at 1 m)	96 dB SPL (65 – 1.2k Hz)
HF	(2.83 Vrms at 1 m)	106 dB SPL (1.2 – 14 kHz)

Power Rating (Long Term)				**Amplification*** (recommended)	**Impedance** (nominal)
PASSIVE	46 Vrms	265 Wrms	1060 Wpeak	530 W	8 ohms
ACTIVE					
LF	46 Vrms	265 Wrms	1060 Wpeak	530 W	8 ohms
HF	35 Vrms	150 Wrms	600 W peak	600 W	8 ohms

*Amplifiers must have 32 dB gain for LLC 115b-st or LLC115b-2w sense return protection to function properly

Nominal Directivity (-6 dB)

Axi-symmetrical	85° (± 20°)

System Output	**SPL**	
One enclosure	122 dB (cont)	128 dB (peak) PASSIVE/ACTIVE - FRONT mode
	125 dB (cont)	131 dB (peak) PASSIVE/ACTIVE - XOVER mode

System output gives the unweighted SPL output of the system referenced to 1 m, including preset equalization and band levelling adjustment as measured under freefield conditions.
FRONT LLC setting provides a 3 dB low frequency contour under freefield conditions
XOVER LLC setting applies a 100 Hz high pass filter

Components

LF 1 x 15" weather resistant loudspeaker (3" voice coil)
HF 1 x 1.4" exit compression driver (titanium diaphragm, 3" voice coil, coaxial assembly)

Enclosure

Height	580 mm	22.8 in
Front Width	440 mm	17.3 in
Rear Width	167 mm	6.6 in
Depth	475 mm	18.7 in
Trap Angle	41 degrees with respect to vertical	
Net Weight	31.5 kg	69.3 lbs
Shipping Weight	34.5 kg	75.9 lbs
Shipping Dimensions	655 x 500 x 570 mm (25.8 x 19.7 x 22.4 in)	
Connectors	2x 4-pin Neutrik speakon	
Material	18 mm, 30 mm Baltic birch plywood (sealed, screwed and rabbeted angles)	
Finish	Maroon-gray™	
Grill	Black epoxy perforated steel with acoustically transparent foam	
Rigging	Integrated flying hardware, handles and pole mount socket, ` Omnimount-ready	

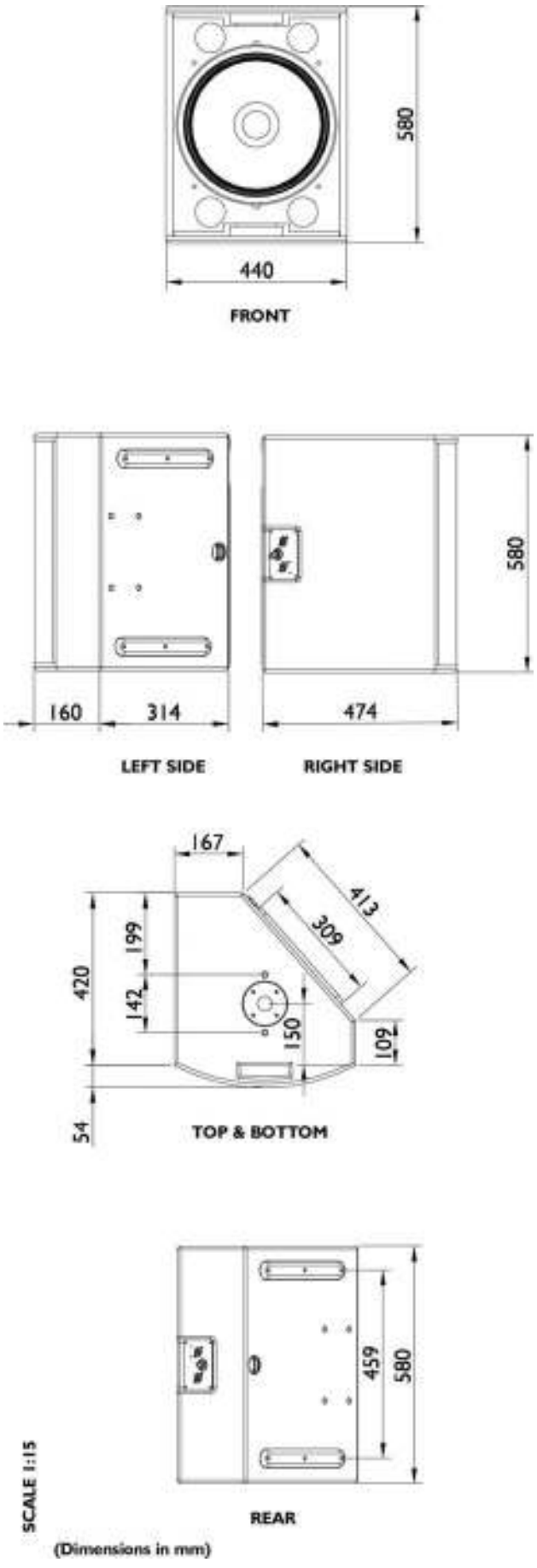


Figure 34: MTD115b line drawing

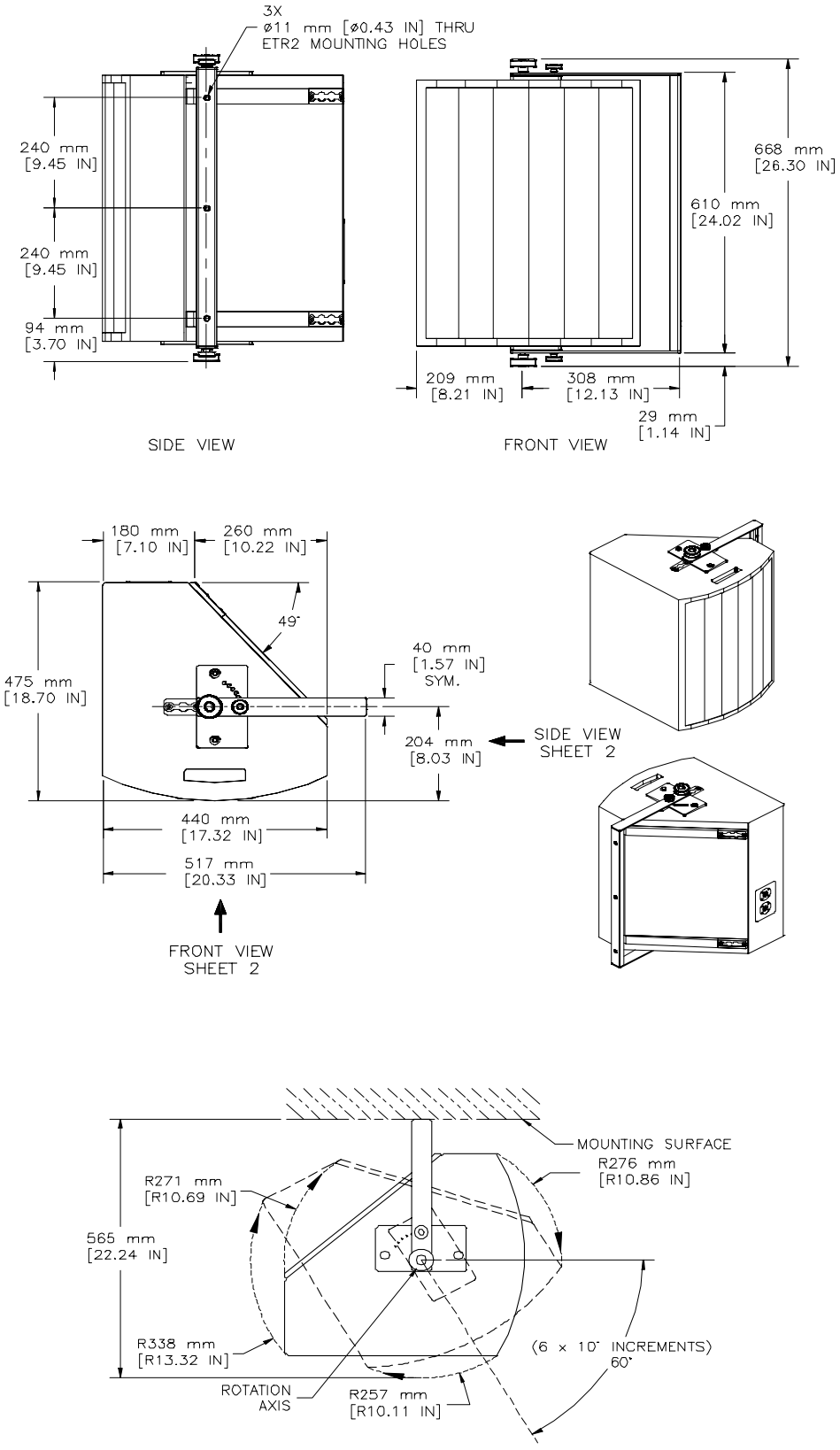


Figure 35: MTD115b plus ETR2 line drawings

8.6 LLC115b-st, LLC115b-2w SPECIFICATIONS

Technical

Inputs	Electronically balanced 10 kΩ input (pin 2 hot)
Outputs	Electronically balanced 50 Ω output (pin 2 hot)
Input Headroom	+20 dBV
Nominal Gain at 200 Hz	0 dB (unity gain) in X-OVER mode
Signal to Noise	Low-mid section > 84 dB
	High section > 92 dB
Dynamic Range	> 104 dB
THD	<0.01% (20 to 20k Hz @ 0 dBV)
Bandpass/Equalization Filters	
3 modes:	FRONT: 45 Hz HPF + low frequency shelving eq
	MONITOR: 45 Hz HPF
	X-OVER: 100 Hz HPF
Low-pass:	20 kHz
Subwoofer:	25, 26, 40 Hz LR24 HPF (for SB218, SB118, SB115)
	100 Hz LR 24 LPF
Crossover Filter	1.2 kHz, 24 dB/octave slope (LLC 115-2w)
Speaker Protection	RMS limiter & peak limiter (LLC 115-st)
	LF Section: RMS limiter & peak limiter (LLC 115-2w)
	HF Section : RMS limiter (LLC 115-2w)

Front & Rear Panel

Indicators	Signal: green LED for each channel
	Control: yellow LED for each channel
Front Panel Controls	MODE select (FRONT, MONITOR, X-OVER)
	SUB select (SB115, SB118, SB218)
	AC power switch

Rear Panel Control SUB POLARITY (positive, negative)

Front Panel Connectors

LLC115b-st

- Ch A, B XLR inputs with parallel loop through (LLC 115b-st)
- MONO SUB XLR output (in parallel with rear panel XLR)
- LOUDSPEAKERS OUT Ch A, B: 2x4-pin Neutrik speakon

LLC115b-2w

- Single XLR input with parallel loop through
- MONO SUB XLR output (in parallel with rear panel XLR)
- LOUDSPEAKER OUT : 1x4-pin Neutrik speakon

Rear Panel Connectors

LLC115b-st

Ch A, B XLR line outputs (LLC 115b-st)
MONO SUB XLR output (in parallel with front panel XLR)
Sense Return: 1x 4-pin Neutrik speakon
Ch A=1+/1-, Ch B=2+/2-

LLC115b-2w

LF, HF XLR line outputs (LLC 115b-2w)
MONO SUB XLR output (in parallel with front panel XLR)
Sense Return: 1x 4-pin Neutrik speakon LF=1+/1-, HF=2+/2-

Power Requirement	100 V - 240 V 50/60 Hz
Power Consumption	15 W

Physical

Finish	Black anodized front panel, white serigraphy
Net Dimensions	483 x 44 x 305 mm 19 x 1.75 x 12.0 in
Shipping Dimensions	505 x 80 x 415 mm 19.9 x 3.1 x 16.3 in
Net Weight	3.7 kg 8.2 lbs
Shipping Weight	4.8 kg 10.6 lbs