



MTD 115a

OWNER MANUAL

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You are the owner of at least one MTD 115a sound reinforcement/monitor loudspeaker system. The present manual has been written to provide you with the information you may require to operate the MTD 115a system.

Furthermore, we also have enclosed specific information relevant on how to configure the system, how to include it as a part of a global sound system design, and how to install it.

Finally, we have enclosed the measured data according to the E.A.S.E. software process , in order to allow accurate prediction of the system performance in installations.

We are confident that the information provided in this manual will be sufficient in most cases of operation. Nevertheless, your regional distributor, or ourselves as a manufacturer, do remain available to provide you some advises, help, or consultancy services whenever you may need it.

In this respect, we are also willing to cooperate with designers, consultants and architects, who are not directly using the system, but who do need a thorough knowledge of its behaviour in order to achieve an optimum prescriptive design.

2.1 THE MULTIPLE SOURCES CONCEPT

Covering an audience with a sound field is the aim of any sound system design. It is rather easy in very small spaces, where the "Hi-Fi" type of approach is suitable, provided the available power is sufficient. A stereo pair of loudspeakers is an easy system to install, and the results are fairly predictable.

In order to cover larger audiences, two avenues are capable of providing satisfying solutions:

- * The coupling of a certain number of sound sources in arrays, each array being in turn equivalent to one sound source.

- * Multiplying the sound sources by dividing the audience in areas which are covered by individual sources. In this case, the Haas effect is exploited by introducing delay lines upstreams in the system to provide a correct localisation.

We consider that the coupling of sound sources in arrays can only be satisfying if it meets some criterion which have been defined by Christian Heil & Marcel Urban, "Sound fields radiated by multiple sound sources arrays" AES paper preprint 3269, presented at the 92nd Convention, Vienna 1992.

These criterion are met by our V-DOSC and ARCS products, designed for large-scale sound reinforcement. In many designs, however, it is practically impossible to meet these criterion together with a sufficient level of versatility for small to medium scale applications: If a product is to be arrayable, it typically leads to an enclosure design that cannot be used in single or very small configurations.

Our approach to versatile small size systems is the one of multiplying sound sources, and providing delay lines whenever necessary. In this respect, our first design criterion is the total coherence of each individual source.

This criterion is fully met only with coaxial axisymmetric designs, as already demonstrated years ago by a famous studio monitor British manufacturer.

Only this type of assembly can provide a smooth transition between the LF and HF ranges, the directivity of the two transducers at the crossover frequency being the same by definition.

(Note that it is ***not*** the case when a coaxially mounted HF driver is loaded by a small horn placed inside the LF cone, instead of being loaded by flare of the cone itself).

Further, the true single source at all frequencies, as achieved by a coaxial axisymmetrical design, is obviously superior in coherence to any combination of two independent sound sources: even if such independent sources are designed to provide the same directivity behaviour (which is never the case!), these two sources are not located at the same place in this case.

Some other benefits in terms of quality can be obtained from an axisymmetrical load, as demonstrated by M.A.Dodd "A wide dispersion constant directivity dual concentric driver", presented at the 92nd AES Convention, Vienna 1992, preprint n° 3257, and by P.Newell "Round the horn", Studio Sound vol.36 n°3, March 1994.

These benefits can be briefly described as a smooth acoustical impedance loading the compression driver and a short time window of horn reflections which is much more acceptable than longer ones due to long horn designs.

Further, the coupling of the wave generated by an axisymmetric sound source, providing a directivity smoothly increasing with frequency, with the acoustical environment of a typical auditorium is optimum:

The reverberation time, typically, decreases smoothly beyond 1 kHz. At the largest distances, the energy in the low frequencies is fairly constant due to the reverberant field. The aiming of the loudspeakers can be adjusted in order that the maximum HF energy is directed towards these areas, hence balancing the SPL attenuation with distance occurring in the direct field.

At nearer distances, the off axis attenuation at higher frequencies provides a similar tonal balance, the attenuation with distance being smaller.

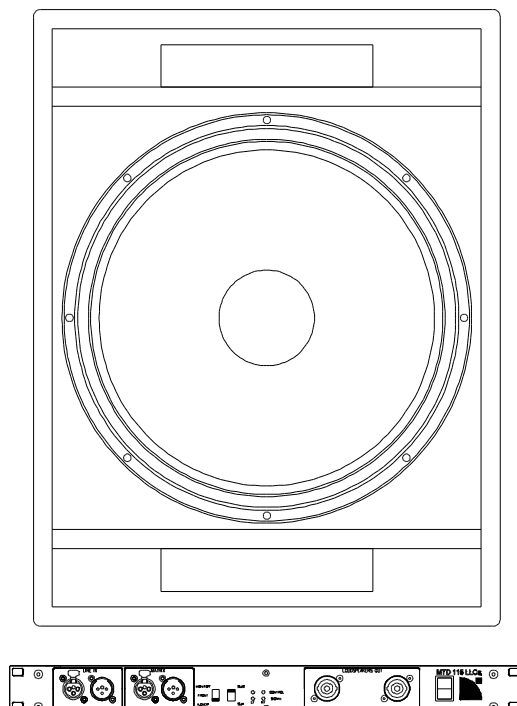
The coaxial axisymmetric sound source therefore provides the optimum directivity to obtain an even coverage and a very constant tonal balance in a typical semi-reverberant auditorium.

The experience of sound system design and installation that we have acquired throughout years of practice has extensively confirmed this, and on this ground, we are firmly convinced that coaxial axisymmetric loudspeakers designs are the best tools for designing a multiple sources sound system.

2.2 ELEMENTS OF THE SYSTEM

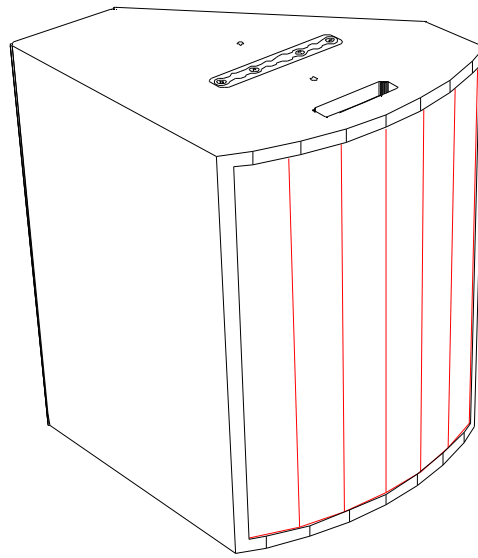
a) The MTD 115a system comprises two main elements, i.e. the MTD 115a enclosure, the MTD 115 LLCa line-level controller and it can be complemented by any subwoofer of our range.

For operation, the MTD 115a system must also include some power amplifiers, cables and connectors. Although these are not necessarily supplied together with the system itself, and not necessarily from the same supplier, they must be regarded as parts of the system.



In this respect, the selection of these components is of utmost importance for obtaining the best performances of your MTD 115a system. Your regional distributor, or ourselves as a manufacturer, are the most qualified to specify these components.

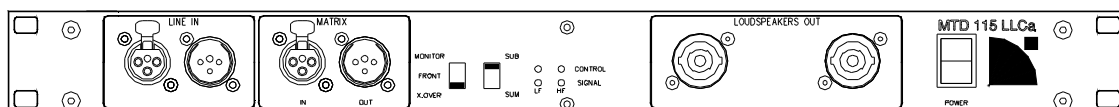
THE MTD 115a ENCLOSURE is a wedge-shaped wide-band enclosure equipped with a 15" & 2" coaxial axisymmetric driver assembly. It is to be operated in bi-amplification with the MTD 115 LLCa controller.



MTD 115 LLCa CONTROLLER is a mono unit providing filtering and signal processing functions for the MTD 115a enclosure. It is to be connected in loop with two amplifier channels, one for LF and the other for HF. The signal inputs and the loudspeaker outputs are located on the front. One mono/sub signal output is located at the rear.

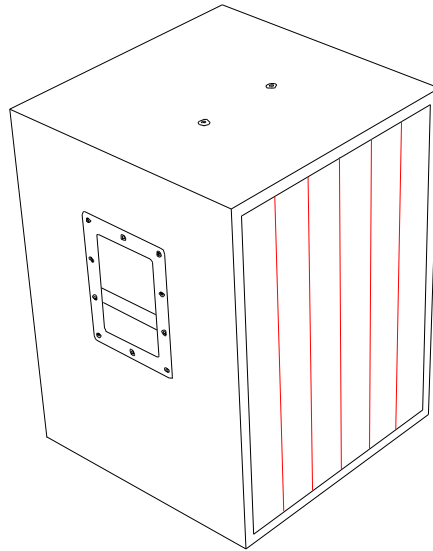


REAR

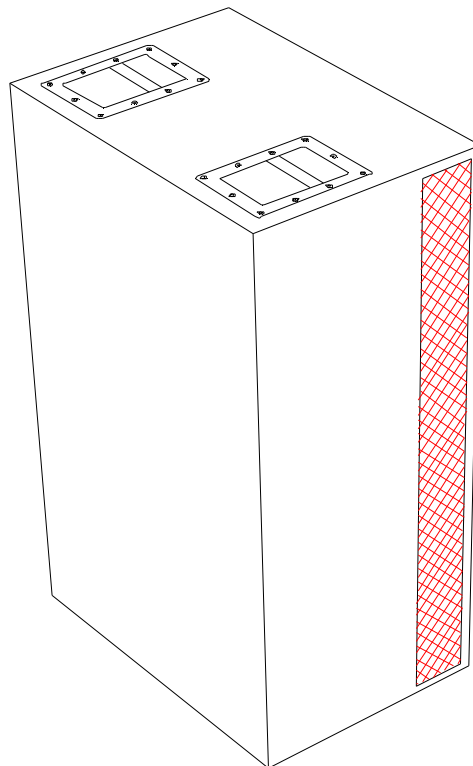


FRONT

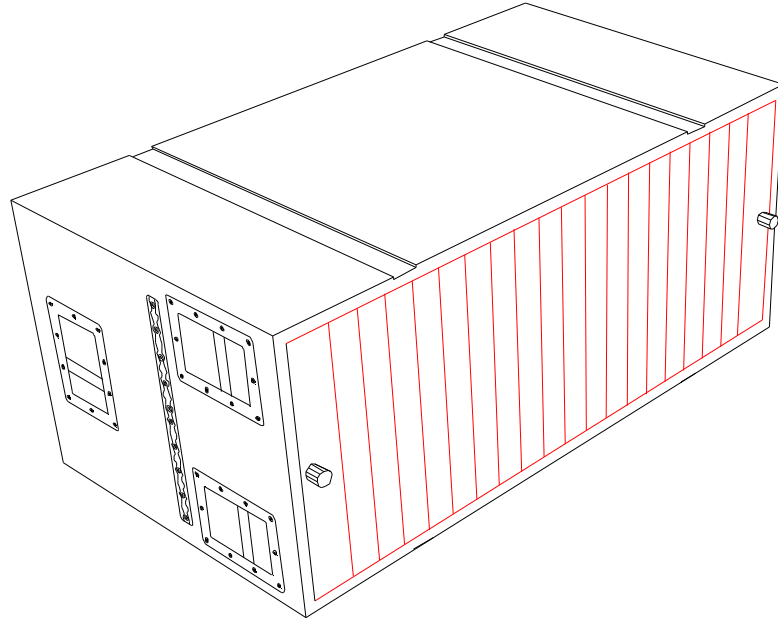
THE SB 115 ENCLOSURE is a single reflex-loaded enclosure equipped with a 15" driver. It is a bass-extension enclosure.



THE MTD 118 ENCLOSURE is a dual-chamber reflex loaded enclosure equipped with a 18" driver. It is a subwoofer.

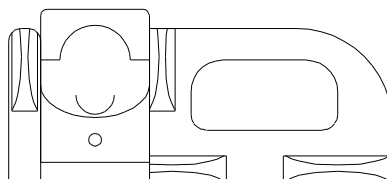


THE SB 218 ENCLOSURE is a large format reflex loaded enclosure equipped with two 18" drivers. It is a subwoofer.

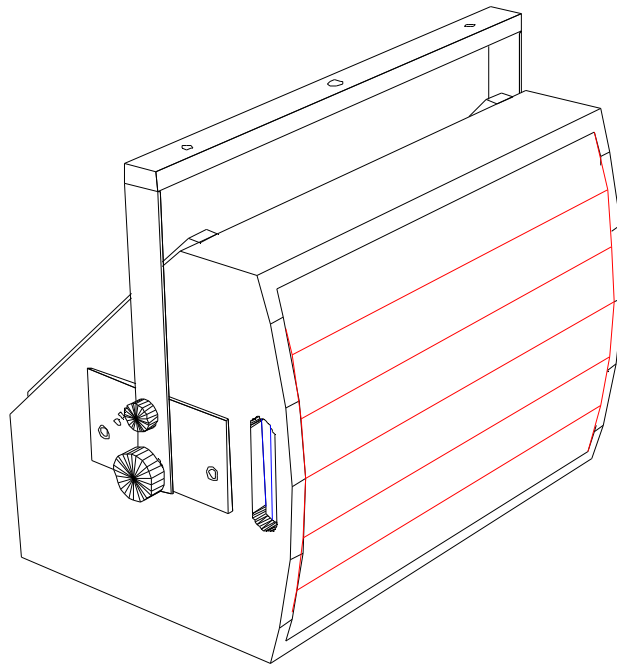


b) HARDWARE & ACCESSORIES

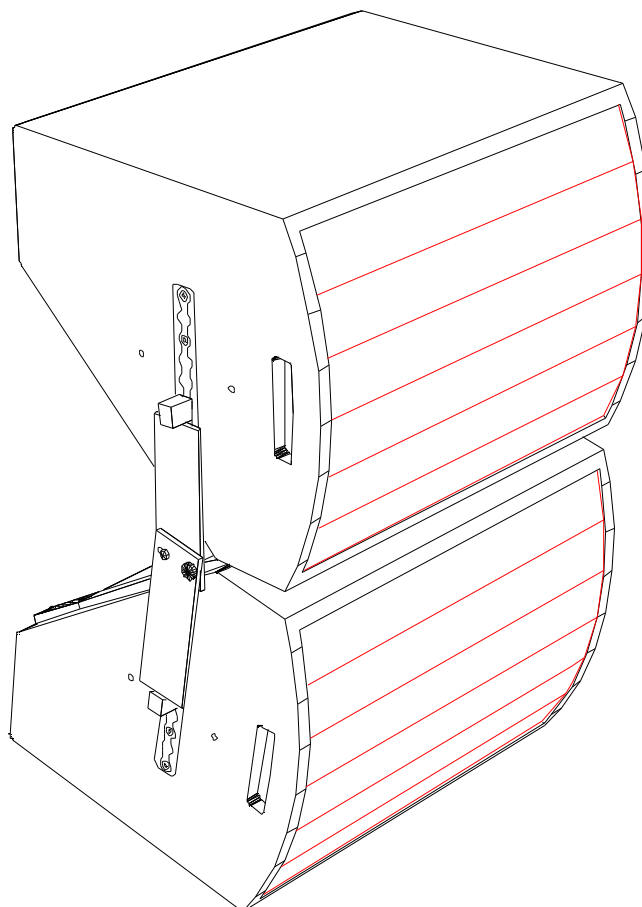
PION 2 Flying stud, Aeroquip standard



ETR 2 Adjustable U.Brace for wall or scaffold mounting



COUPL 115 Pair of coupling brackets for arraying 2 X MTD 115a horizontally



3. APPLICATIONS, CONFIGURATIONS & DIAGRAMS

3.1 APPLICATIONS

a) FRONT OF HOUSE SOUND REINFORCEMENT

The MTD 115a system is a full range two ways active system which is to be operated only with the dedicated MTD 115 LLCa controller, connected in loop with two channels of power amplifier. It can be used with or without a subwoofer of the L-ACOUSTICS range.

It is to be used in sound reinforcement applications as an individual sound source or coupled in an array of two enclosures.

The ideal setup is when multiple sound sources are used with a time correction provided by delay lines for compensating the time shifts due to their respective positions.

Due to its coaxial axisymmetric arrangement, the MTD 115a behaves acoustically like a true point-source with directivity.

Both available SPL figures and low frequency extension can be enhanced with the use of subwoofers, which can be physically separated from the MTD 115a enclosures because of a low crossover cutoff frequency, i.e. 110 Hz. Nevertheless, care should be taken during the subwoofers installation to avoid phase cancellations.

Ideally, the subwoofers should be grouped together in a central stack or array, and fed with a summed mono signal. Provision for mono summing of the subwoofers signals is provided by the MTD 115 LLCa controller.

b) DELAY LINES SOUND REINFORCEMENT

It often occurs that a complete coverage of an audience requires the location of loudspeakers near some areas of the audience, rather than near the stage. A proper sound localisation can be achieved in this case by delaying the signal feeding the loudspeakers which are the closest to the audience. The rule is that the first sound wave reaching any listener must be coming from the stage.

Delaying an MTD 115a system can be achieved with accuracy. Some delay lines are provided with direct distances displays, easing the adjustment of the delay. In this situation, you should verify the temperature, such metric displays being valid normally for 20°C. Provision exists on some units for actual temperature data input. You should check this during the setup.

NOTE: Speed of sound in air

$$c = 331.6 + 0.6 t \text{ in m/s. with } t = \text{temperature of air in } ^\circ\text{C}$$

For its compact size and its wedge shape, the MTD 115a enclosure allows unobtrusive sightlines when installed in the concert hall, particularly when underbalcony location is required.

No subwoofer should be used for delay line sound reinforcement.

c) SIDE FILLS APPLICATIONS

The MTD 115a system can be used as a side-fill monitor, preferably with a MTD 118 subwoofer enclosure. In this case, the optimum setup is to install the MTD 115a enclosure on top of the MTD 118, both in a standing position. In some cases, it can be also convenient to stack the MTD 115a on top of the SB 115 bass extension enclosure.

Both enclosures having exactly the same width, these assemblies offer particularly smooth sightlines.

For a proper phase coherence at the crossover frequency, the front panels of both enclosures shall be in a vertical alignment.

When used in a side-fill application without a subwoofer, the MTD 115a should be raised above the ground to be at a correct height. Stand mounting can be provided, but any stable, non-resonant mechanical support can be considered.

A schematic diagram of a typical side-fill application setup is provided later in this chapter.

d) FLOOR MONITOR APPLICATIONS

The specific disymmetrical wedge-shape of the MTD 115a allows its use as a floor-monitor. Further, its conical and axisymmetric coverage provides a unique coherent sound field off axis, devoid of the typical acoustic cancellation occurring when two physically separated transducers are radiating the same frequency.

Explanation:

When the L.F. driver and H.F. driver are physically separated, like in most designs, this off-axis acoustic cancellation occurs when the distances between each single driver and the receiver differs by $1/2$ wavelength.

This defines a preferred listening plane, normal to a line joining the acoustic centres of the two drivers. In this case, the loudspeaker is to be used in one direction only, and cannot be turned by 90° (unless a cancellation is accepted!).

The coaxial axisymmetric arrangement of the drivers in the MTD 115a gives no variation in directivity whatever the plane of observation. The MTD 115a can be used in any position without loss of performances, and this is obviously the best situation for floor-monitoring applications.

When more than one MTD 115a is used as floor monitor dedicated to one performer, we do not recommend the positioning of two monitors converging towards the performer. This typical triangular setup is inspired from the stereo Hi-Fi, and is irrelevant with monitoring applications.

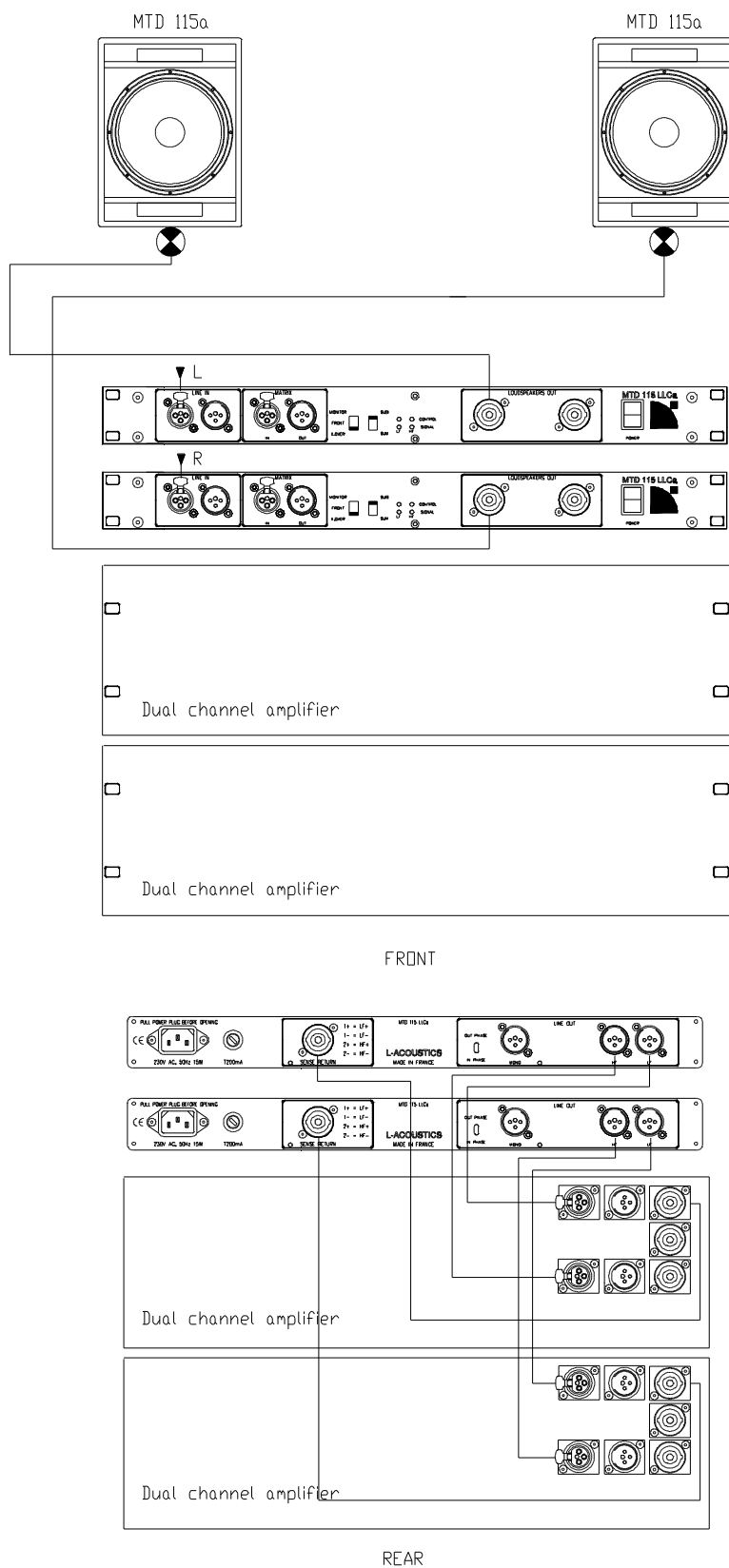
Note that in most cases, the signal fed into the pair of monitors is not stereo, but is simply the same! This results in a loss of coherence, the wavefronts from the two sources interfering with each other.

We recommend instead the linear arraying of the monitors, all aiming towards parallel directions. This setup has been proved highly satisfying when large SPL and wide coverage were desirable on stage.

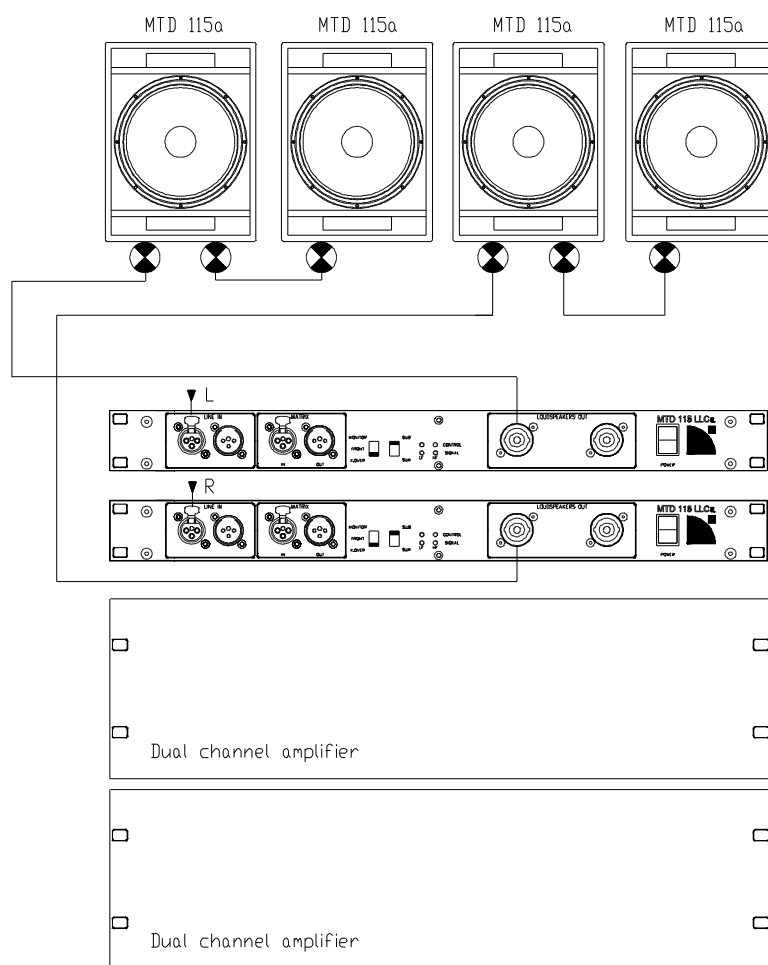
No subwoofer is to be used in this type of application.

3.2 TRADITIONAL STEREO F.O.H. WITHOUT SUB (diagrams)

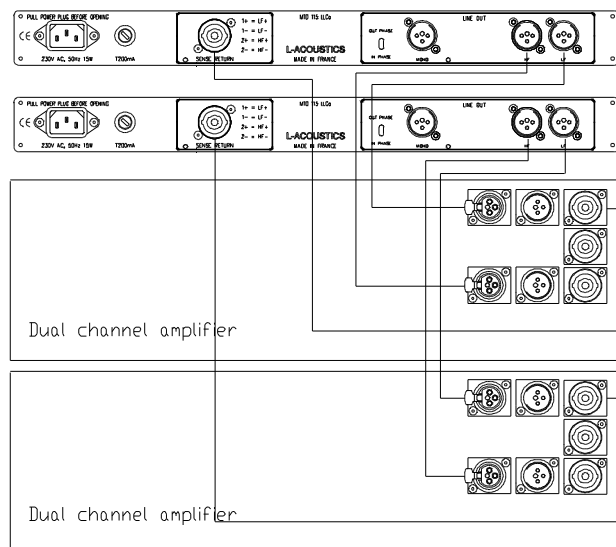
a) 2 MTD 115a



b) 4 MTD 115a



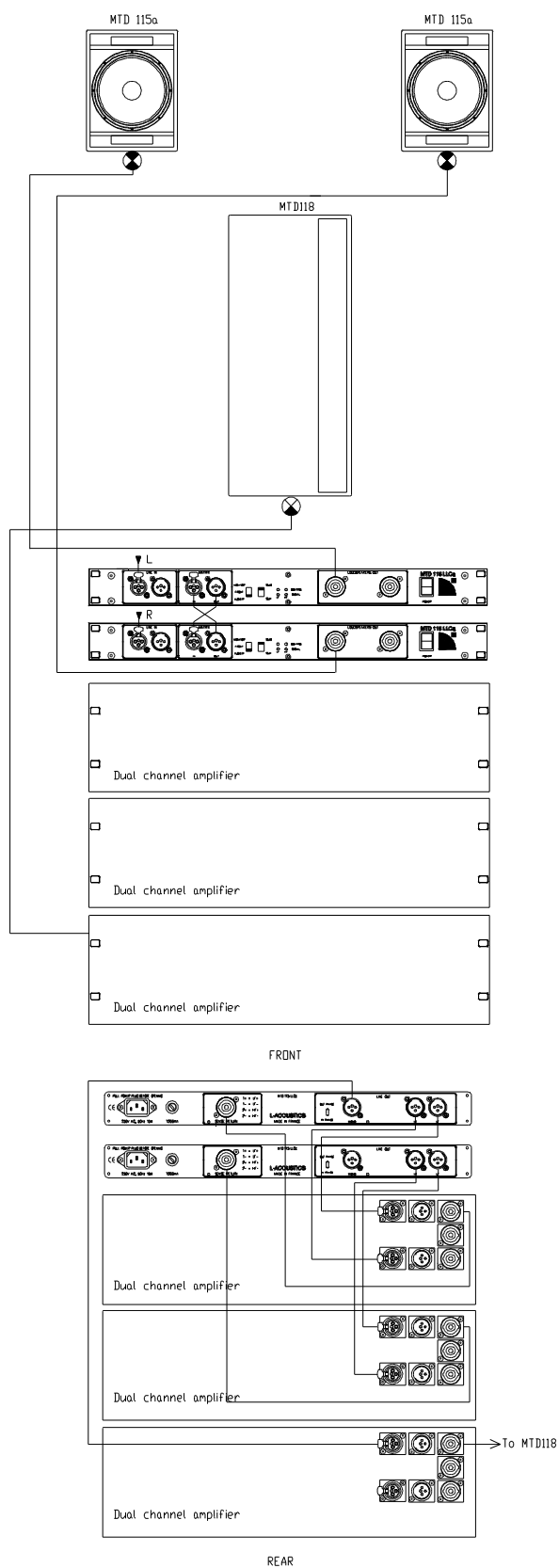
FRONT



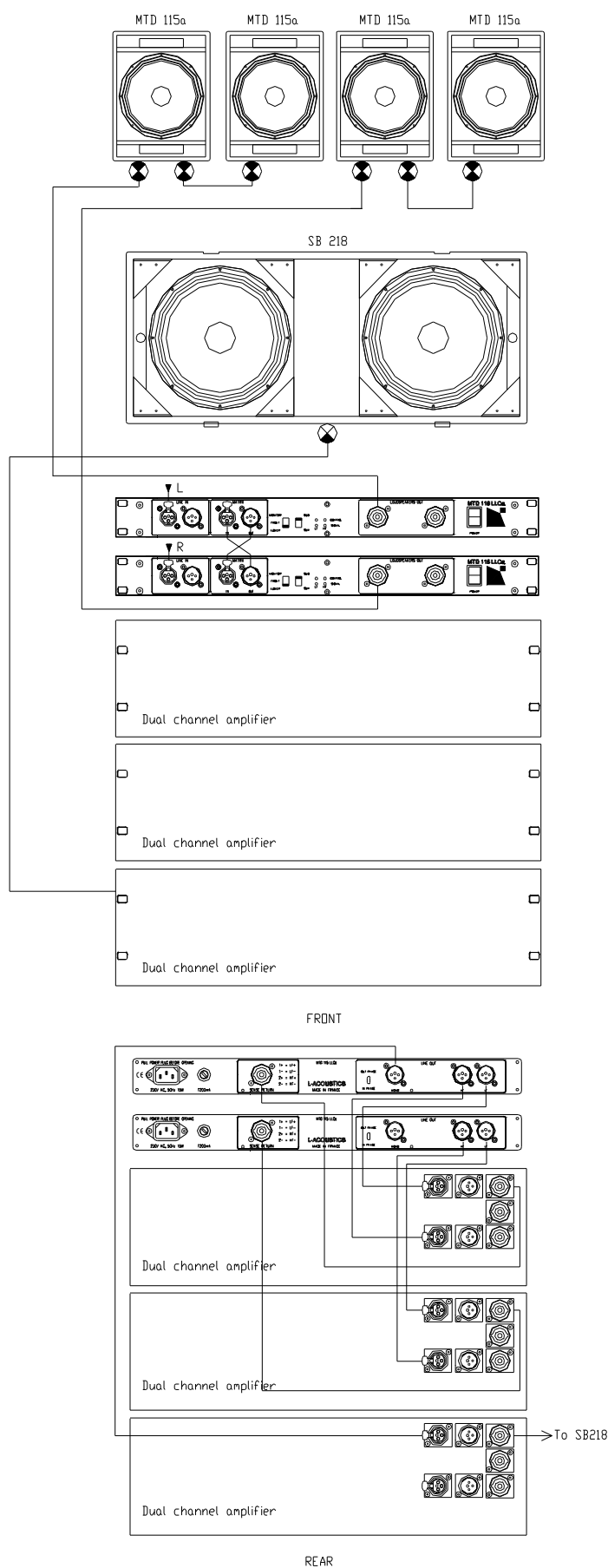
REAR

3.3 TRADITIONAL STEREO F.O.H. WITH SUB (diagrams)

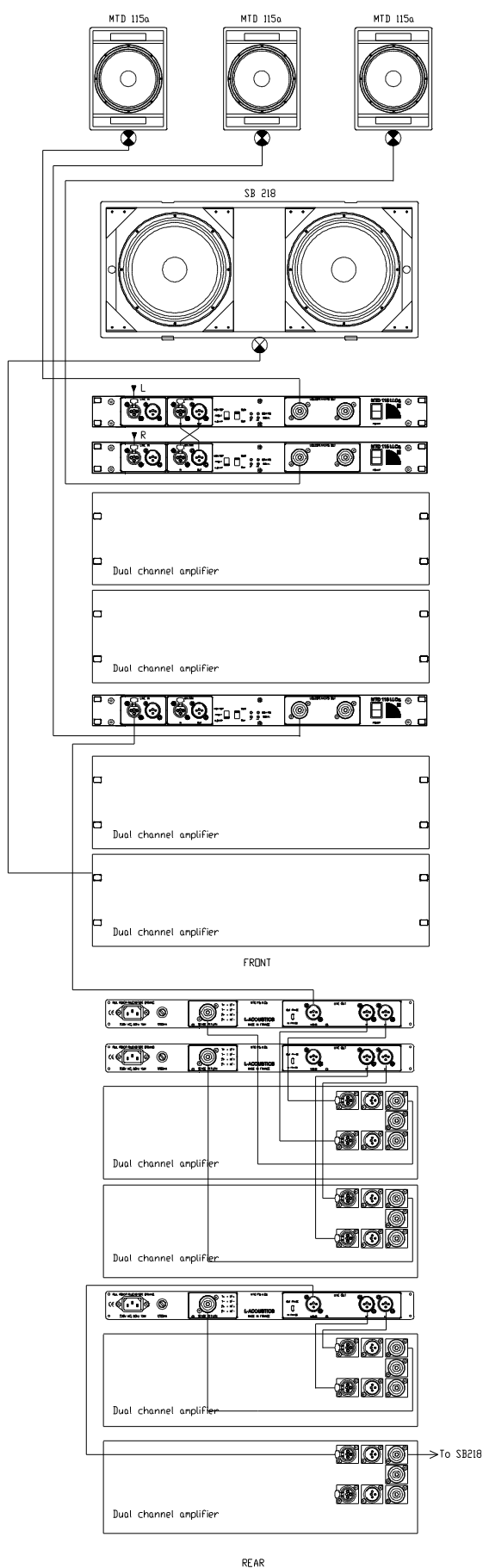
a) 2 MTD 115a + 1 MTD 118



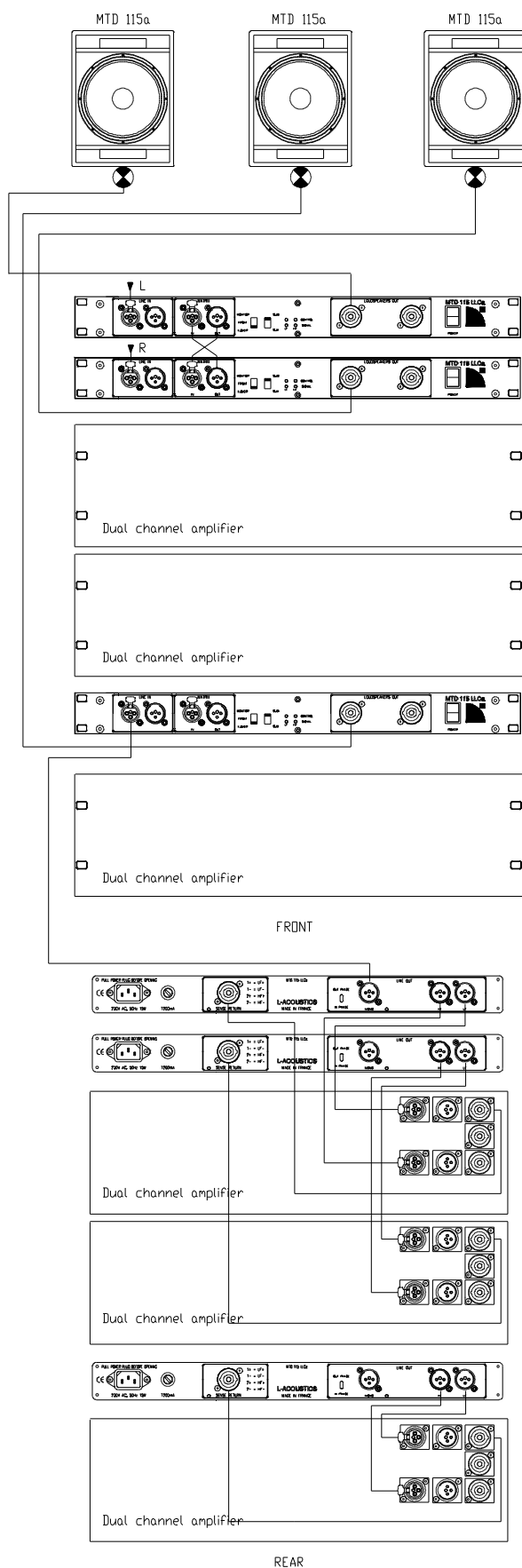
b) 4 MTD 115a + 1 SB 218



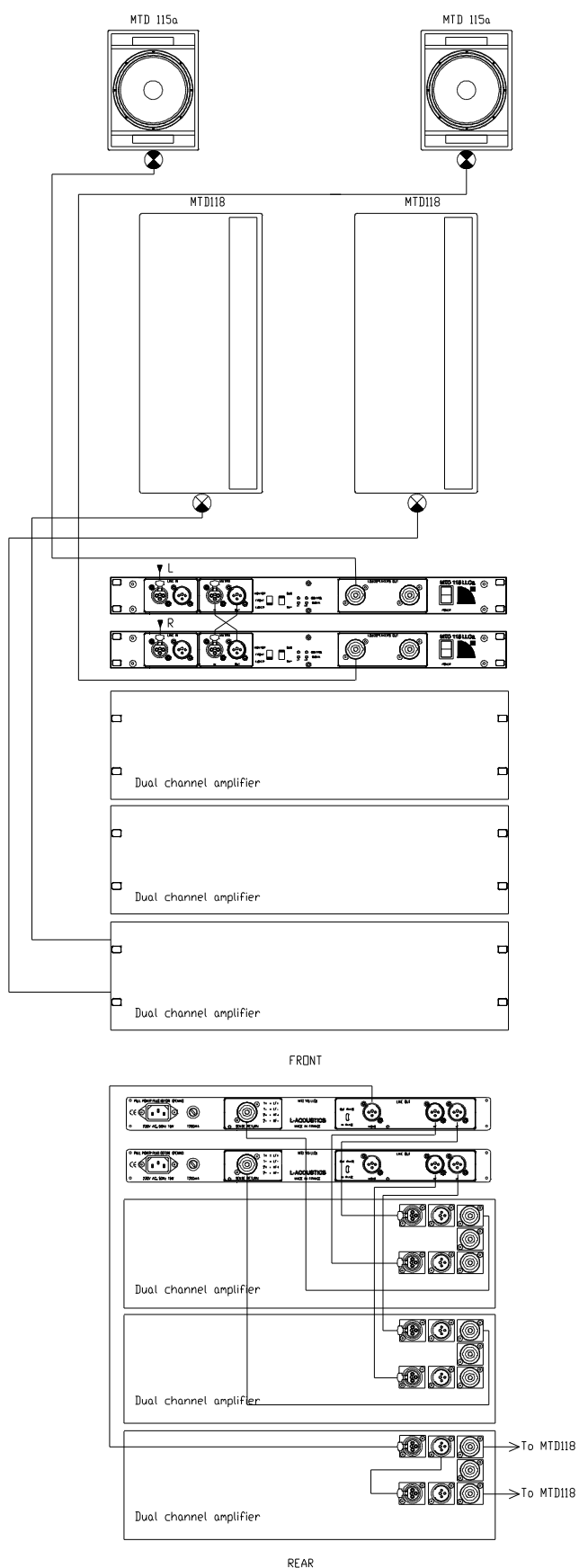
3.4 3 SOURCES F.O.H. WITH SUB (diagram)



3.5 3 SOURCES F.O.H. WITHOUT SUB (diagram)



3.6 SIDE FILL (diagram)



4. TECHNOLOGY & SPECIFICATIONS

4.1 THE MTD 115a ENCLOSURE

a) Technology

The technology of the MTD 115a is based on the two-ways dual concentric type. The flare of the L.F. cone loads directly the H.F. compression driver, hence allowing a true coaxial axisymmetry of the wavefront generated both by the L.F. and H.F. drivers. (This is not the case when a small horn is fitted inside the L.F. driver, the L.F. wavefront being splitted near the cutoff frequency, producing off-axis cancellations).

The L.F. driver is of the 15" standard with a 4" flat wire copper voice coil.

The H.F. driver is of the 2" exit standard, reduced to $1\frac{3}{8}$ " at the output of the phase plug.

The voice coil is of the 3" standard, and the diaphragm is made of titanium alloy. There is provided a conical aluminium flare matching the internal vent of the driver magnet to achieve a smooth continuity of the wave path to the edge of the L.F. cone.

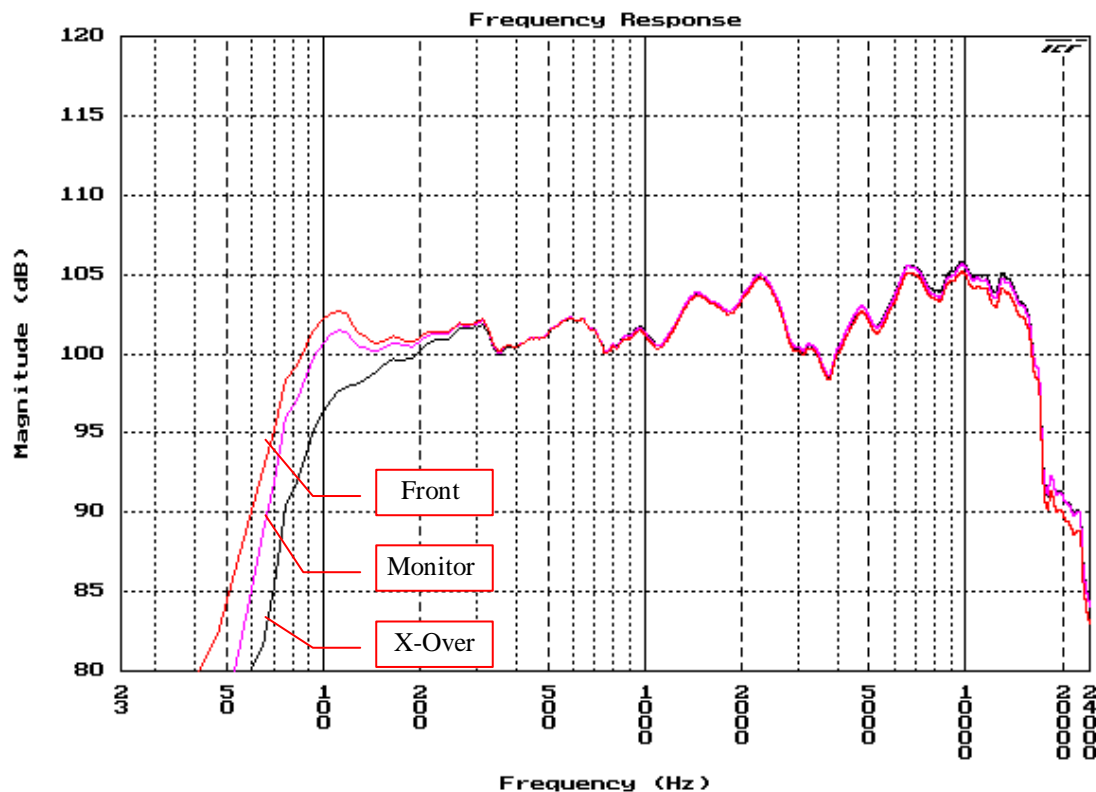
The same magnet is used for the H.F. and L.F. drivers, being provided with two opposite air gaps.

b) Specifications

Frequency response:	60 Hz - 18 kHz +/- 3 dB.
Nominal impedance:	8 Ohms on both ways
Minimum recommended amplification	L.F. 500 Watts H.F. 200 Watts
Continuous maximum S.P.L. @ 1 m. (measured in half-space, pink noise)	125 dB.
Nominal directivity	90°, conical

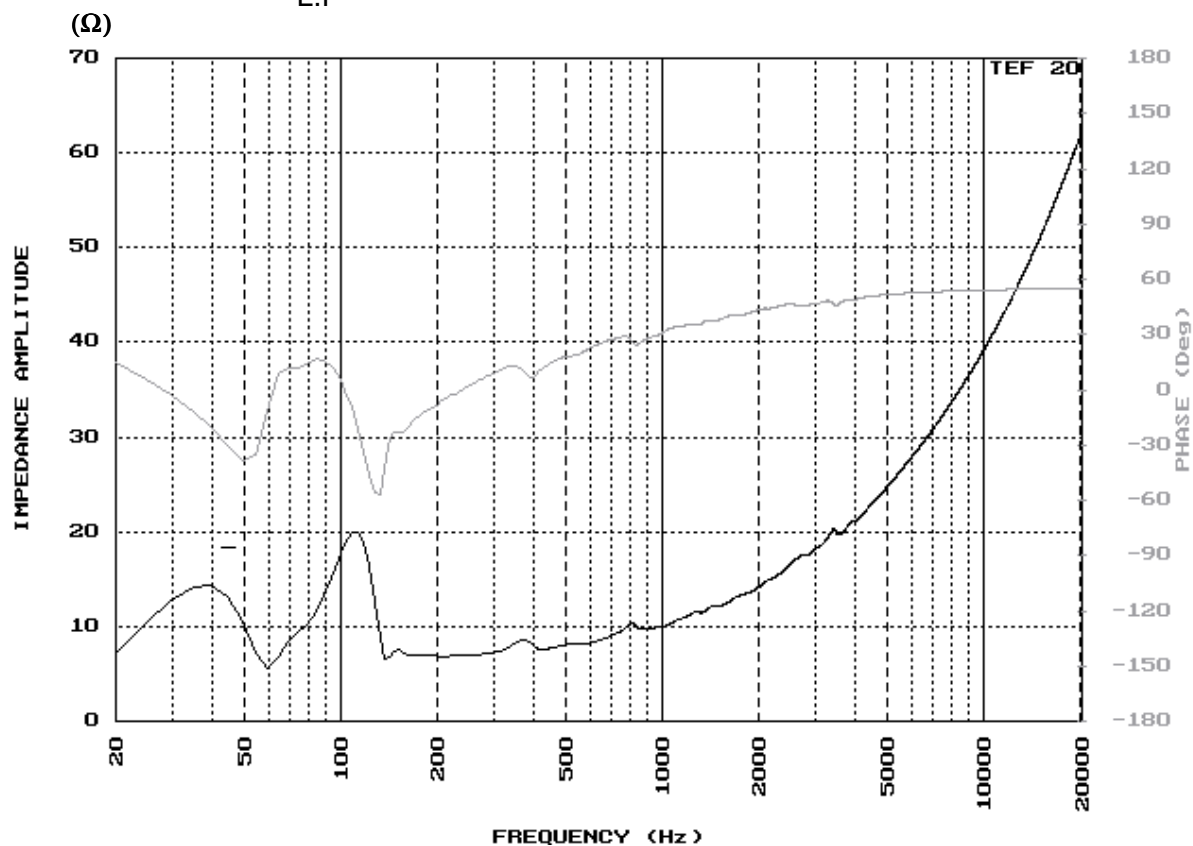
c) Measured frequency responses

c-1 : Amplitude/Frequency response (1m, input=2.83V)

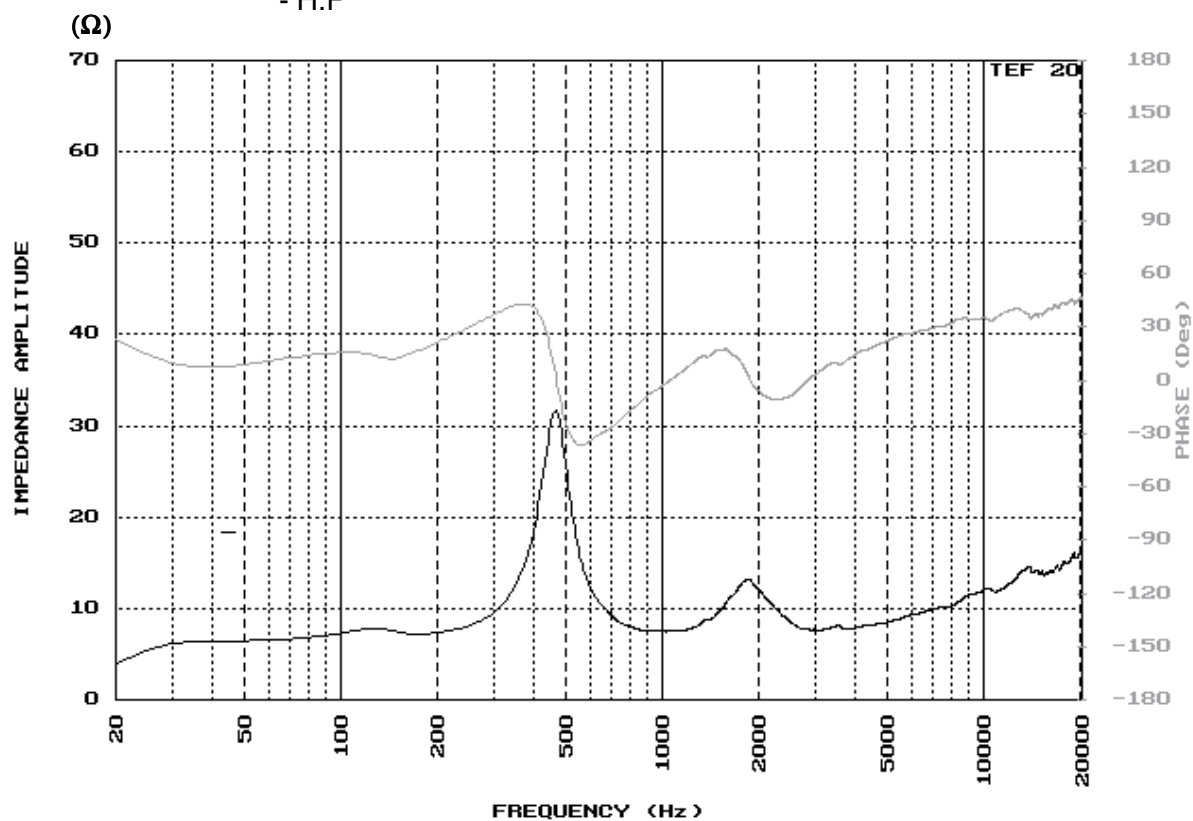


c-2 : Impédance amplitude & phase response

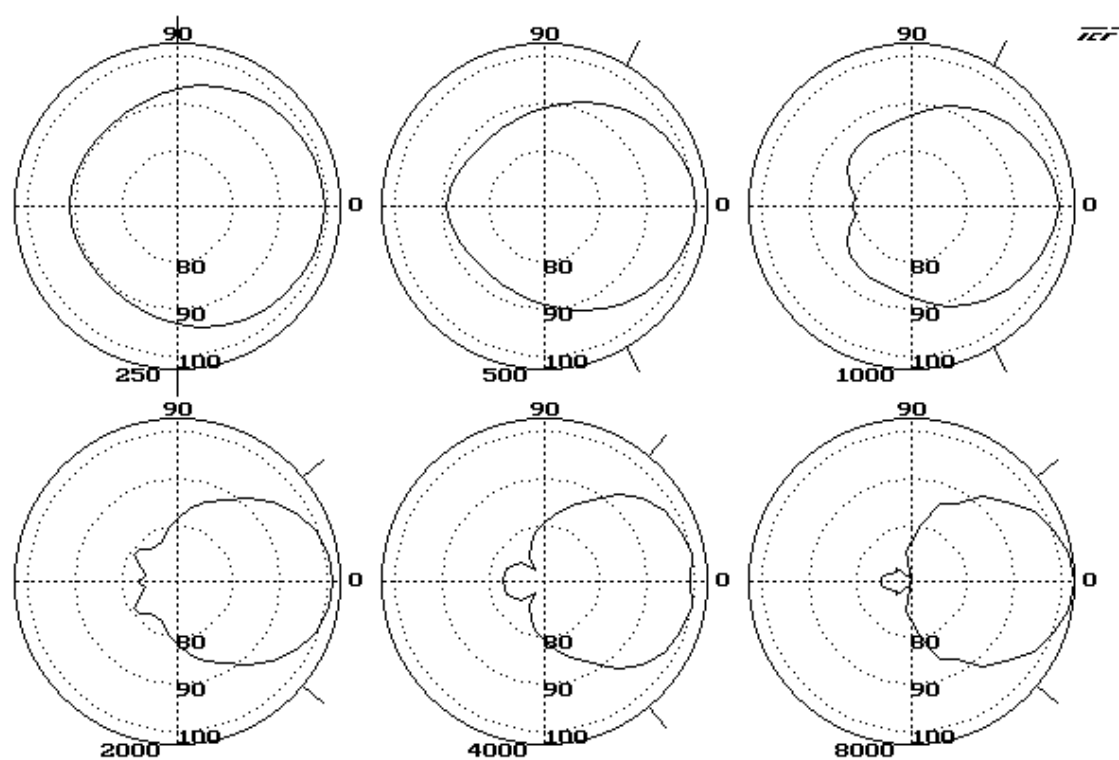
- L.F



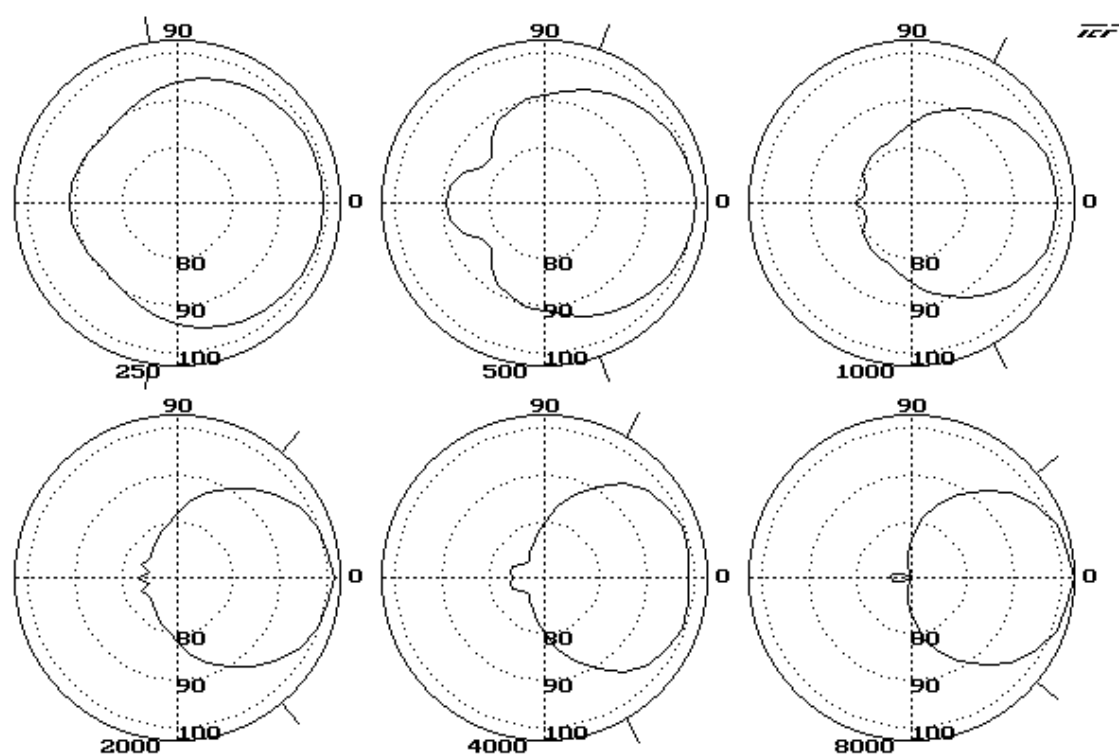
- H.F



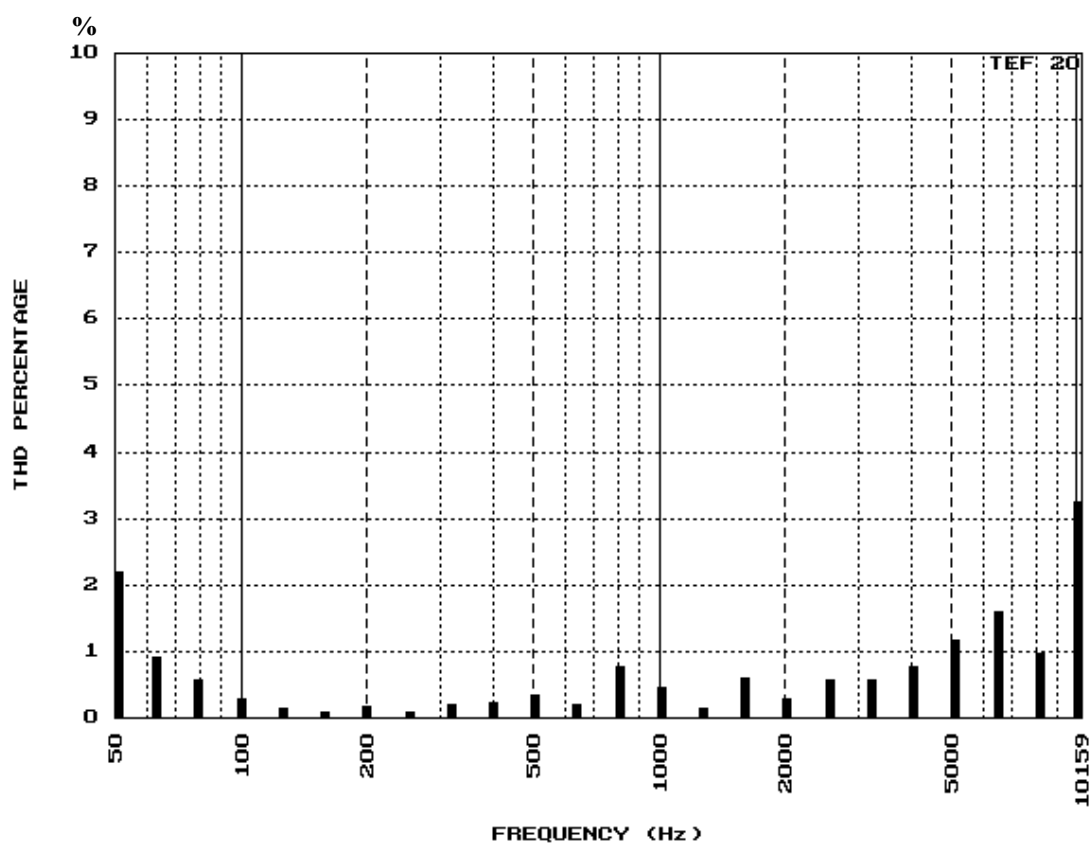
c-3 : Polar response
- For 0°horizontal



- For 0°vertical



c-4 : Total harmonic distortion (V = 2.83V)



d) EASE measurements chart, in accordance with the EASE specifications.

F = 250 Hz

	0°	10°	20°	30°	40°	50°	60°	70°	80°	90°
0°	0,0	0,0	0,0	0,0	0,0	0,1	0,1	0,1	0,1	0,1
10°	0,2	0,2	0,2	0,2	0,1	0,2	0,2	0,2	0,2	0,2
20°	0,6	0,6	0,6	0,5	0,5	0,3	0,4	0,4	0,4	0,4
30°	1,1	1,1	1,0	1,2	1,0	0,9	0,9	0,9	0,8	0,8
40°	1,8	1,8	1,7	1,7	1,7	1,5	1,6	1,5	1,5	1,3
50°	2,5	2,4	2,4	2,3	2,4	2,2	2,0	2,1	2,0	1,9
60°	3,5	3,4	3,5	3,4	3,2	3,3	3,0	2,9	2,7	2,6
70°	4,3	4,2	4,3	4,1	3,9	3,9	3,6	3,8	3,5	3,4
80°	5,3	5,2	5,1	5,0	4,9	4,8	4,9	4,8	4,5	4,4
90°	6,3	6,2	6,2	6,1	5,9	6,0	5,9	5,8	5,8	5,7
100°	7,2	7,2	7,1	7,2	7,0	7,0	6,7	6,9	6,8	6,8
110°	8,1	8,3	8,2	8,1	8,1	8,2	8,2	8,4	8,2	8,2
120°	8,7	8,8	8,8	8,9	8,9	9,0	9,0	9,1	9,1	9,2
130°	9,1	9,4	9,3	9,4	9,5	9,6	9,9	9,8	9,9	10,0
140°	9,1	9,2	9,3	9,4	9,3	9,7	9,7	9,9	10,2	10,1
150°	8,9	9,0	9,1	9,1	9,0	9,3	9,4	9,2	9,5	9,6
160°	8,6	8,6	8,7	8,7	8,7	8,8	8,8	8,8	8,9	8,9
170°	8,4	8,4	8,7	8,4	8,4	8,5	8,6	8,6	8,5	8,5
180°	8,3	8,3	8,3	8,3	8,4	8,2	8,2	8,2	8,3	8,2

F = 500 Hz

	0°	10°	20°	30°	40°	50°	60°	70°	80°	90°
0°	0,0	0,0	0,0	0,0	0,2	0,0	0,0	0,1	0,0	0,0
10°	0,3	0,3	0,3	0,3	0,3	0,2	0,3	0,3	0,4	0,3
20°	1,2	1,1	1,1	1,0	1,1	0,9	0,7	0,8	0,8	0,7
30°	2,4	2,3	2,2	2,1	2,0	2,2	1,9	1,6	1,7	1,6
40°	4,0	3,8	3,7	3,5	3,4	3,5	3,2	2,9	2,8	2,6
50°	5,5	5,3	5,1	4,9	4,7	4,8	4,4	4,2	4,0	3,8
60°	7,3	7,1	6,8	6,6	6,7	6,4	5,9	5,7	5,4	5,2
70°	8,9	8,7	8,4	8,2	7,9	7,8	7,4	7,5	6,9	6,7
80°	10,3	10,0	9,8	9,5	9,7	9,2	8,8	8,3	8,5	8,0
90°	11,5	11,0	11,2	10,7	10,5	10,2	10,3	9,7	9,5	9,2
100°	12,3	11,9	11,5	11,2	10,8	10,4	10,1	9,7	9,3	9,9
110°	13,0	12,8	12,6	12,3	12,2	11,9	11,7	11,8	11,5	11,1
120°	13,4	13,3	13,2	13,0	12,9	12,8	12,6	12,7	12,4	12,5
130°	13,7	13,9	13,9	14,0	14,1	14,5	14,3	14,4	14,4	14,7
140°	13,7	14,1	14,4	14,7	15,1	15,4	15,9	16,5	16,9	17,5
150°	13,3	13,6	14,1	14,5	15,2	15,4	15,8	16,2	16,6	17,0
160°	12,4	12,7	12,8	13,0	13,4	13,3	13,5	13,7	13,9	14,0
170°	11,7	11,7	11,7	11,8	11,8	11,8	11,7	11,9	12,1	12,0
180°	11,3	11,3	11,3	11,4	11,3	11,3	11,5	11,3	11,3	11,3

F = 1000 Hz

	0°	10°	20°	30°	40°	50°	60°	70°	80°	90°
0°	0,0	0,0	0,2	0,0	0,0	0,0	0,0	0,1	0,1	0,1
10°	0,5	0,5	0,4	0,5	0,5	0,6	0,5	0,5	0,5	0,5
20°	1,7	1,6	1,5	1,5	1,4	1,7	1,3	1,3	1,2	1,0
30°	2,8	2,8	2,7	2,6	2,5	2,6	2,3	2,3	2,2	2,4
40°	4,2	4,2	4,1	4,1	4,0	4,2	3,9	3,9	3,8	4,0
50°	5,6	5,5	5,6	5,8	5,7	5,7	5,8	5,8	5,8	5,9
60°	7,2	7,3	7,4	7,6	7,7	7,6	8,0	8,1	8,2	8,1
70°	8,8	9,0	9,2	9,6	9,5	9,7	9,9	10,5	10,3	10,4
80°	10,4	10,6	10,5	10,9	11,1	11,3	11,5	11,7	11,9	12,3
90°	12,0	12,3	12,5	12,9	13,3	13,6	13,7	14,0	14,3	14,7
100°	13,0	13,4	13,7	14,2	14,4	14,7	15,0	15,4	15,7	16,3
110°	13,7	14,0	14,7	15,3	15,7	16,3	16,8	17,4	17,8	17,7
120°	14,0	14,5	15,0	15,6	16,3	16,7	17,0	17,8	18,3	17,9
130°	14,2	14,8	15,4	15,9	16,5	17,1	17,6	18,2	18,7	18,3
140°	14,7	15,1	15,5	16,0	16,4	16,9	17,2	17,6	18,1	18,7
150°	15,7	16,2	16,4	16,9	17,5	17,8	18,0	18,6	19,0	19,3
160°	17,1	17,4	17,9	18,2	18,6	19,0	19,4	19,6	20,1	20,4
170°	19,2	19,4	19,6	19,7	20,1	20,3	20,6	20,8	21,0	21,4
180°	18,8	18,9	18,9	19,0	19,3	19,1	19,1	19,4	19,2	19,6

F = 2000 Hz

	0°	10°	20°	30°	40°	50°	60°	70°	80°	90°
0°	0,0	0,0	0,0	0,0	0,1	0,0	0,0	0,3	0,0	0,1
10°	0,0	0,1	0,1	0,3	0,5	0,4	0,5	0,6	0,6	0,5
20°	1,0	1,0	0,9	0,9	1,0	0,8	0,8	0,9	0,7	0,6
30°	1,0	1,0	0,9	0,9	0,8	0,7	0,8	0,7	0,7	0,6
40°	3,3	3,2	3,0	2,9	2,8	2,9	2,5	2,4	2,2	2,1
50°	6,5	6,3	6,3	5,9	5,7	5,5	5,4	5,2	5,0	4,7
60°	10,7	10,4	10,1	9,9	9,6	9,3	9,2	8,9	8,5	8,3
70°	14,0	13,7	13,4	13,1	12,8	12,6	12,3	12,0	11,8	11,9
80°	16,3	16,1	16,1	16,0	15,8	15,9	15,7	15,6	15,6	15,2
90°	18,5	18,5	18,8	18,9	19,2	19,2	19,4	19,5	19,7	19,3
100°	20,4	20,5	20,6	20,7	20,5	20,9	21,0	21,1	21,5	21,4
110°	22,5	22,6	22,7	22,8	22,6	23,0	23,1	23,0	23,4	23,6
120°	24,9	24,9	25,0	24,8	24,7	25,0	24,9	24,6	24,9	24,9
130°	28,0	27,9	27,7	27,6	27,3	27,2	27,0	26,8	26,6	26,2
140°	24,6	24,8	25,0	25,2	25,9	25,7	25,9	26,1	26,3	26,2
150°	23,8	24,1	24,2	24,3	24,6	24,7	24,8	25,0	25,2	25,6
160°	22,6	22,8	22,8	23,1	23,3	23,4	23,6	23,8	23,9	23,9
170°	22,3	22,5	22,5	22,6	22,7	22,6	22,9	23,0	23,3	23,7
180°	22,0	22,2	22,4	22,5	23,7	22,9	23,1	22,7	23,4	24,0

F = 4000 Hz

	0°	10°	20°	30°	40°	50°	60°	70°	80°	90°
0°	0,0	0,0	0,0	0,1	0,0	0,0	0,0	0,0	0,0	0,0
10°	0,7	0,7	0,7	0,7	0,9	0,8	0,8	0,8	0,8	0,9
20°	2,1	2,0	1,9	1,9	1,8	1,9	1,7	1,8	1,6	1,6
30°	4,0	3,9	3,8	3,8	4,0	3,7	3,6	3,4	3,5	3,3
40°	6,9	6,8	6,7	6,9	6,4	6,5	6,2	6,1	6,0	5,8
50°	10,2	10,2	9,9	9,7	9,3	9,5	9,1	8,9	8,7	8,7
60°	13,6	13,2	13,0	12,7	12,3	12,0	11,7	11,4	11,1	11,4
70°	15,5	15,4	15,2	15,3	14,9	14,6	14,3	14,4	14,1	14,1
80°	17,5	17,6	17,4	17,3	17,2	17,1	17,0	16,9	16,8	16,8
90°	20,1	20,1	20,1	20,1	20,2	20,2	20,0	20,0	20,0	19,9
100°	22,2	22,2	22,2	22,0	22,0	22,0	22,0	21,9	22,1	21,9
110°	24,3	24,2	24,1	23,9	23,8	23,6	23,5	23,3	23,2	23,4
120°	24,7	24,7	24,7	24,7	24,3	24,7	24,6	24,7	24,7	24,8
130°	24,5	24,7	24,8	24,9	25,0	25,2	25,3	25,4	25,6	25,5
140°	22,8	23,2	23,6	24,0	24,4	24,7	25,1	25,5	25,9	26,3
150°	22,6	23,0	23,4	23,8	24,2	24,6	25,0	25,5	25,9	26,2
160°	25,5	25,5	25,5	25,5	25,8	25,5	25,3	25,5	25,5	25,5
170°	26,6	26,7	26,8	26,8	26,9	26,9	27,0	27,1	27,1	27,5
180°	25,0	26,0	24,6	25,0	24,2	25,2	25,0	24,8	24,4	25,0

F = 8000 Hz

	0°	10°	20°	30°	40°	50°	60°	70°	80°	90°
0°	0,0	0,3	0,2	0,4	0,3	0,5	0,4	0,4	0,5	0,4
10°	1,1	1,2	1,2	1,5	1,3	1,2	1,5	1,5	1,6	1,4
20°	1,2	1,2	1,3	1,5	1,4	1,5	1,5	1,4	1,6	1,8
30°	4,7	4,7	4,6	4,8	4,4	4,5	4,4	4,4	4,3	4,1
40°	8,4	8,2	8,0	8,0	7,7	7,9	7,3	7,1	6,9	6,9
50°	11,5	11,4	11,3	11,4	11,2	11,3	11,0	10,9	10,8	10,8
60°	16,0	15,9	15,7	15,8	15,5	15,4	15,3	15,2	15,1	14,7
70°	17,6	17,7	17,7	18,0	17,9	17,9	18,0	18,1	18,1	18,2
80°	22,7	22,6	22,5	22,6	22,4	22,3	22,2	22,1	22,0	21,9
90°	26,7	26,7	26,8	27,0	26,9	26,9	27,0	27,1	27,1	27,3
100°	28,4	28,6	28,8	29,2	29,2	29,4	29,6	29,8	30,0	29,9
110°	33,7	33,5	33,3	33,4	33,0	32,8	32,6	32,5	32,3	32,5
120°	37,2	36,8	36,4	36,2	35,6	35,3	34,9	34,5	34,1	34,2
130°	34,4	34,5	34,6	34,9	34,8	34,9	35,0	35,1	35,2	35,1
140°	30,9	31,3	31,7	32,4	32,6	33,1	33,5	33,9	34,4	34,7
150°	31,3	31,7	32,0	32,5	32,6	32,9	33,3	33,6	33,9	34,0
160°	30,0	30,3	30,6	31,2	31,3	31,7	32,0	32,3	32,7	33,1
170°	29,1	29,4	29,7	30,2	30,3	30,7	31,0	31,3	31,6	31,2
180°	28,3	28,6	28,9	29,4	29,5	29,8	30,1	30,4	30,7	30,6

4.2 THE MTD 115 LLCa CONTROLLER

a) Functions

The MTD 115 LLCa controller performs the following functions:

* Band rejection : The frequencies that cannot be reproduced by the system are rejected, i.e. below 40 Hz (in "Front" configuration) and above 20 kHz.

* Filtering : The unit is a two ways crossover at 1.2 kHz. Filtering functions are also provided at 110 Hz for X.OVER configuration and on the "sub" channel.

* Equalisation : The unit equalises the frequency responses of the drivers/enclosure assembly. The EQ functions are of the parametric type, especially designed for minimum phase alteration. The EQ does vary according to the selected configuration in the L.F. range.

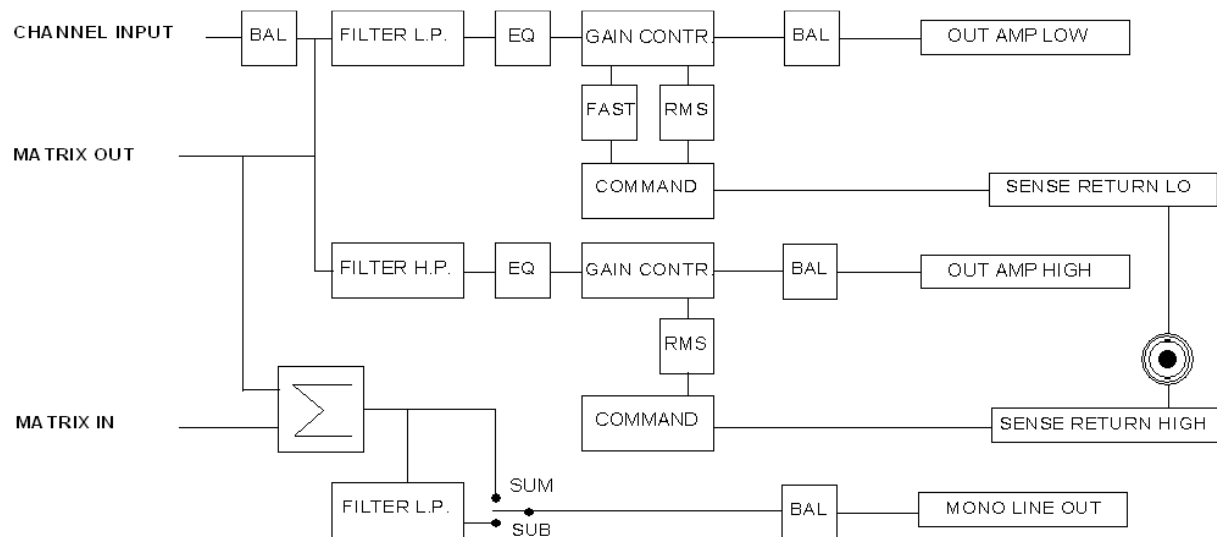
* Limitation : The unit takes the power amplifier in a global feedback loop, using the output of the amplifier to control VCAs limiting the output of the unit . The control signal is derived from the "sense return" path.

3 limitations functions are provided: cone excursion limitation for the L.F. driver
 thermal limitation for the L.F. driver
 thermal limitation for the H.F. driver

All these functions are carefully adjusted for minimum audible effect and thorough driver protection.

* Mono summation: The inputs of two MTD 115 LLCa controllers can be summed to derive a mono signal capable of driving a central source. This mono signal can be the simple sum of the inputs, for driving a central broad-band source, or can be filtered for driving a central subwoofer.

b) Synopsis

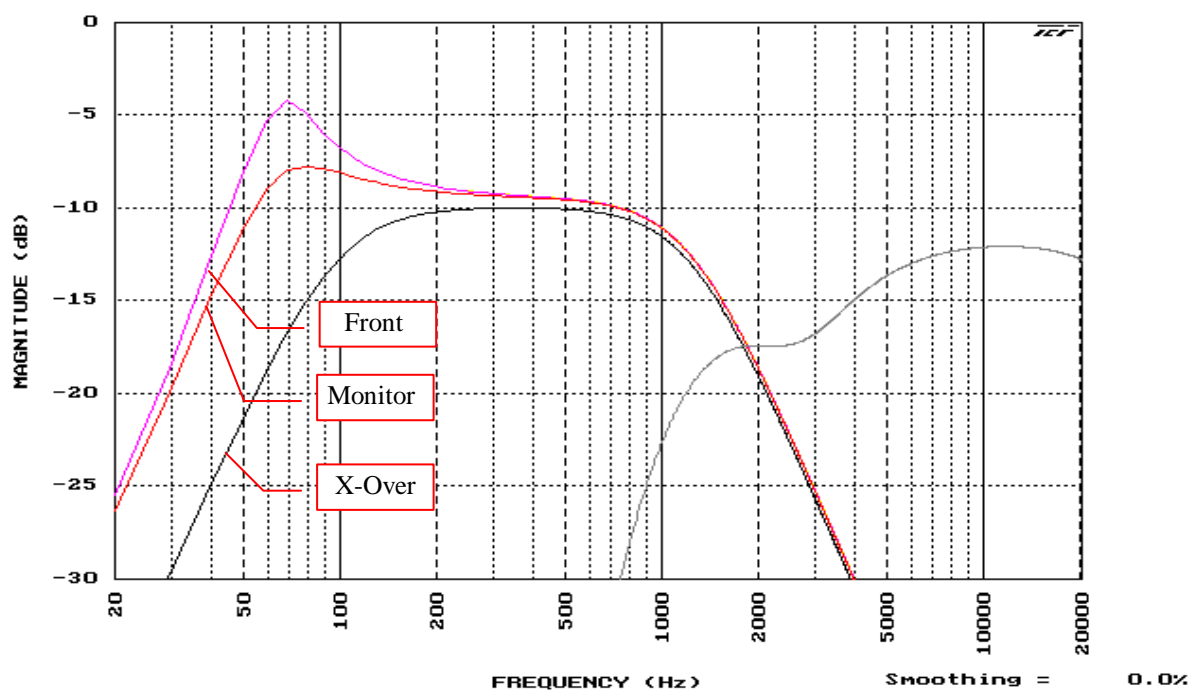


c) Specifications

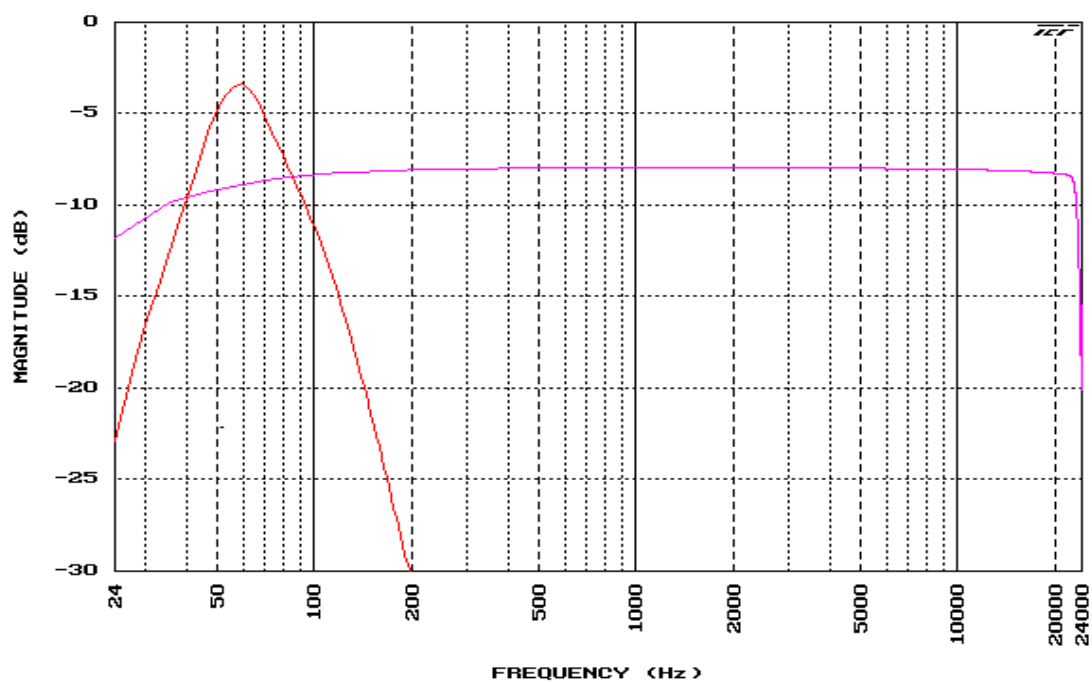
Overall gain :	0 dB
Max. input level :	+22 dBu
Input impedance :	10 k Ω
Noise section LF :	<-86 dBu
Noise section HF :	<-92 dBu
Maximum T.H.D. :	<0.1%

d) Transfer functions

* LF + HF Outputs (Input = -10dBV)

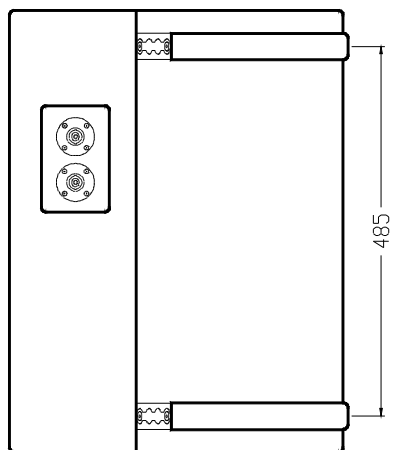
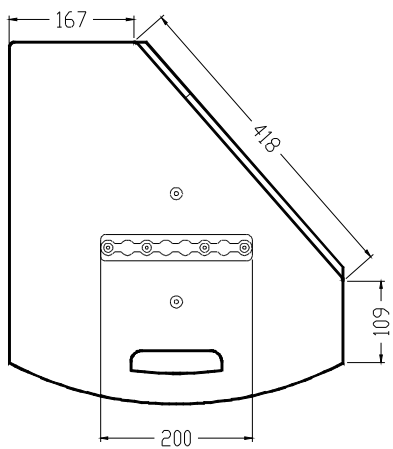
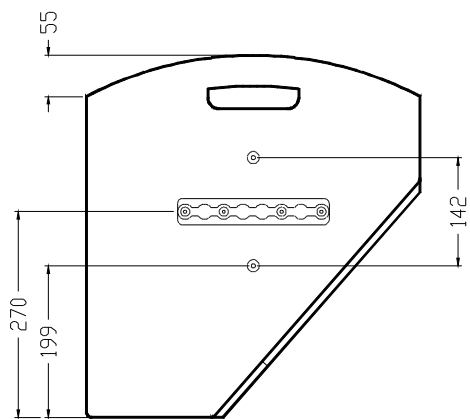
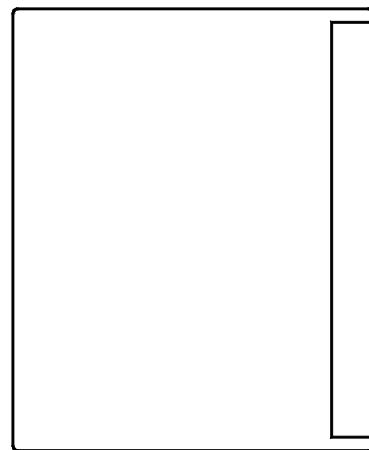
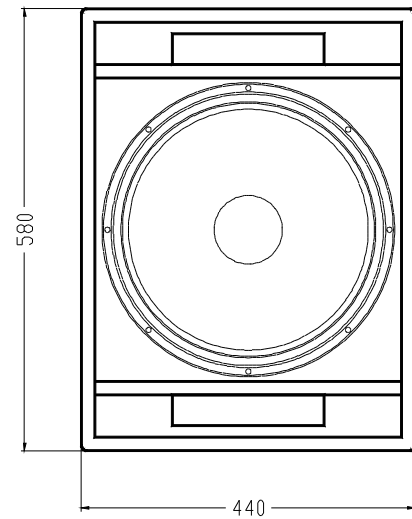
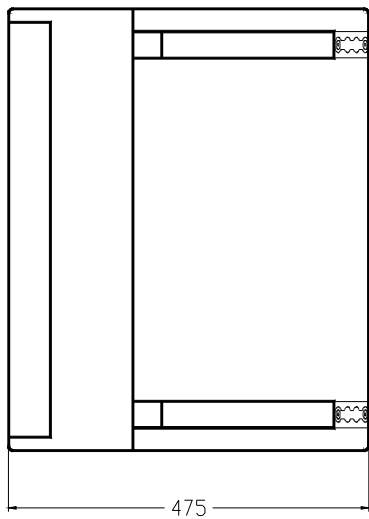


* SUB + SUM MONO Output (Input = -10dBV)



5.1 THE MTD 115a ENCLOSURE

- a) External description
See next page



Scale:1/10

b) Shipping

The size of the package of an MTD 115a enclosure is:

H = 58 cm. (23")

W = 56 cm. (22")

D = 69 cm. (27")

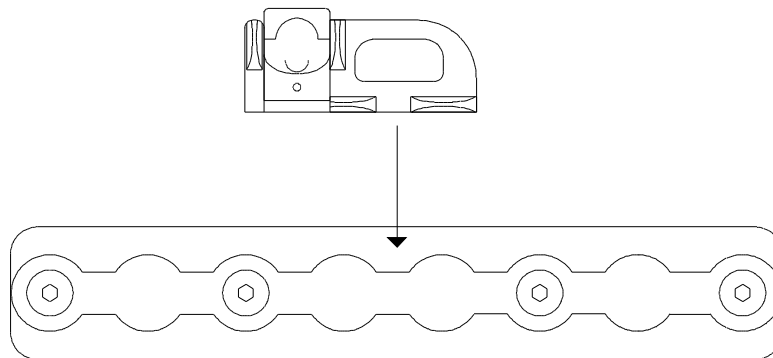
The total shipping weight is: 33 kg(72 lb)

Warning: The package should not be exposed to water or moisture

c) Fittings

2 Aeroquip type rails ("E" rails) are provided for rigging; they are located symmetrically on the top and the bottom of the MTD 115a cabinet, parallel to the front panel.

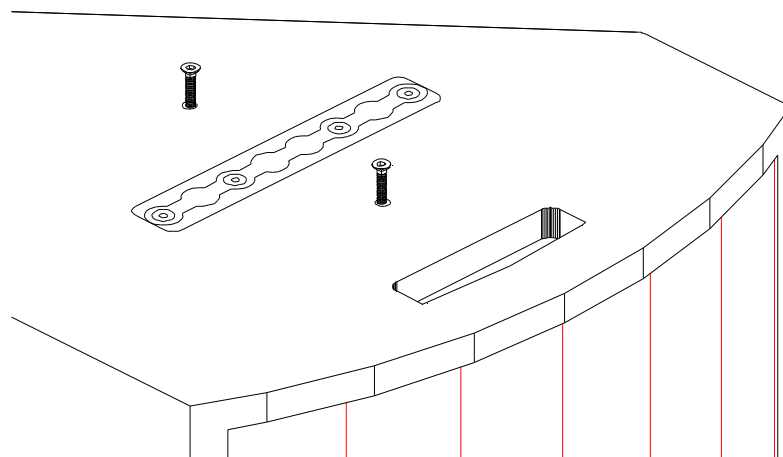
Two types of studs can be used to be locked in the rails, a single-point type and a double-point type (PION 2). We strongly recommend the use of double-point type which provides the highest level of security.



Grille: the front grille is made of honeycomb perforated 1.5 mm. thick steel with epoxy catalytic black finish. The drivers are further protected by a reticulated polyurethane foam 10 mm. thick.

The grille is fixed to the enclosure by 4 apparent screws.

4 Fixing nuts are provided, 2 on each top/bottom side. They can be used either for accessories fitting or for U bracket mounting.



d) CONSTRUCTION

The MTD 115a cabinets are constructed of 18 mm. (0.7") Baltic Birch plywood, rabbeted, screwed and glued.

Internal steel bracing guarantees both flying security and long-term reliability of the cabinets under the most demanding touring conditions.

The structured heavy duty paint provides excellent scratch resistance for a long-lasting smooth appearance. The paint is also made available for maintenance.

The colour is RAL 8019 maroon-grey.

The drivers are fixed to the cabinets with screws and "Big Head" type nuts, allowing numerous mounting/dismounting operations without the nut dropping, like traditional "T" nuts often do.

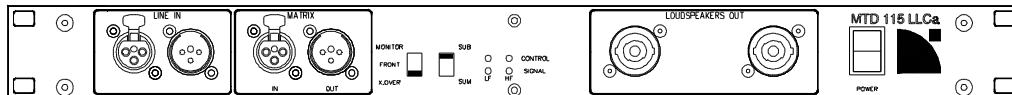
The screws are treated against corrosion.

5.2 THE MTD 115 LLCa LINE-LEVEL CONTROLLER

a) External description



REAR



FRONT

b) Shipping

The size of the package of an MTD 115 LLCa unit is:

H = 8.5 cm. (3")

W = 53 cm. (21")

D = 44 cm. (17")

The total shipping weight is: 4.5 kg.(10 lb)

Warning: The package should not be exposed water or moisture

c) Unpacking

When unpacking the MTD 115 LLCa controller unit, take care of not tearing the plastic sleeve which can be useful for eventual re-packing.

Do not drop the unit when unpacked.

A mains supply lead is provided outside of the plastic sleeve. It is provided with an Europa type connector at one end and a French standard mains plug connector at the other end. When using the unit with non-continental compatible mains standards, simply cut the plug and replace.

d) Rack mounting

The MTD 115 LLCa controller unit should be rack mounted. It requires 1 U rack space.

For mounting in a rack, use 4 screws with plastic spacers in order not to damage the front panel finish.

The weight of the unit being low, no rear clamping is required.

Before rack mounting, read the following 6.3 paragraph of chapter 6, regarding connections: many connections are on the front panel.

Avoid exposing the unit to excessive heat, sun, moisture during operation. When located in the same rack as one or more power(s) amplifier(s), check that the fan operation of the amplifiers is normal, and that the air path is not obstructed.

Whenever possible, close the rear door of the rack, most operational connections being on the front: The power amp and the controller together in a rack become one operational unit, avoiding losses of time and potential errors in connections.

6. INSTALLATION AND WIRING

6.1 HARDWARE AND ACCESSORIES

Once the optimum location has been determined for speakers installation (from the acoustic environment and the characteristics of the systems), hardware accessories are provided to ease their installation.

a) MTD 115a accessories

a.a) Rigging stud PION 2

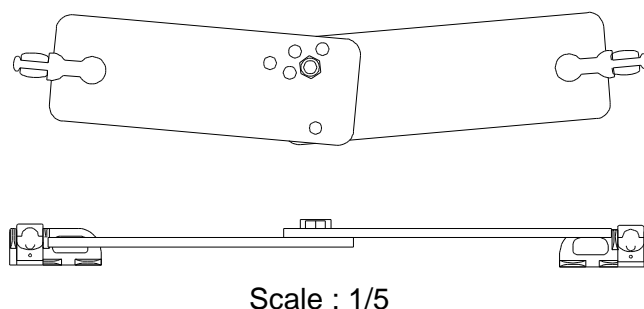
See drawing page 8

a.b) U. bracket ETR 2



Scale : 1/5

a.c) Adjustable coupling brackets for 2 X MTD 115a COUPL 115



6.2 CONNECTORS & CABLES

a) MTD 115a :The connectors at both ends of the 4 conductors cables for connecting the MTD 115a are of the 4 pins Speakon type.

Two Speakon sockets are provided on the front panel of the MTD 115 LLCa controller, for parallel operation of two speaker enclosures.

The wiring is as follows:

1+ = L.F.+

1 - = L.F. -

2+ = H.F.+

2 - = H.F. -

b) In order to preserve a correct damping factor, which is essential both to the sonic qualities of the system and to prevent overshoot of the cone displacement function (which can eventually result into mechanical damage), it is desirable to keep the loudspeaker wires as short as possible, and of a gauge offering a low resistance per unit length.

The following chart provides the information on the minimum wire section vs. length.

Section area / Gauge		Max.recommanded length			
		8Ω		4Ω	
Metric(mm2)	Imperial	Metric	Imperial	Metric	Imperial
2.5	13	10 m.	30 ft.	5 m.	15 ft.
4	11	18 m.	60 ft.	9 m.	30 ft.
6	8	30 m.	100 ft.	15 m.	50 ft.
10	6	45 m.	150 ft.	23 m.	75 ft.

c) Line -level connections

All the line-level connectors are of the 3 pins XLR type. The wires are microphone type, i.e. one pair of conductors plus a conducting shield.

The wiring is as follows:

BALANCED

1 = Earth

2 = Hot

3 = Cold

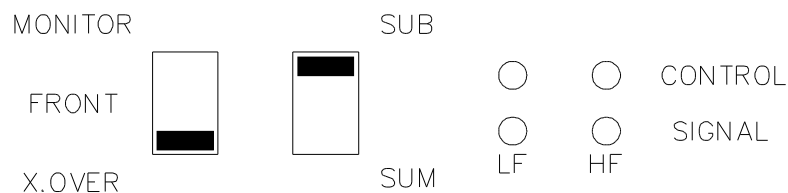
On the MTD 115 LLCa, the inputs and the output are balanced.

The "matrix" connections shall simply be consistent (1 to 1; 2 to 2; 3 to 3) and without any strap.

d) sense return connection

The "sense return" is a path for a signal output of the power amplifier (2 channels, LF & HF) to both the loudspeaker(s) and a control signal for the limiting functions of the LLCa controller. It is to be of the same type as a loudspeaker cable, with a 4 pins Speakon plug at one end (the wiring is the same as for loudspeakers), and a connector assembly at the other end which is compatible with the outputs of the power amplifier.

6.3 CONTROLLER WIRING & KEY SELECTIONS



a) Rear connections (left to right)

* Connect the mains supply with the mains cord provided in the package. The Euroconnector shall be connected to the corresponding socket at the rear of the unit. The mains plug shall be selected according to local standards.

* A fuse is provided. Its value is 0.2 Amperes, of the slow type.

* Connect the outputs of two amplifier channels to the "sense return" socket. Warning! when new, old type Speakon connectors are a bit hard to turn by 1/4 turn, which is necessary to establish the contact.

* If you use a central source or a subwoofer, connect a modulation shielded cable (one pair) to the "sum/sub" output. This output provides the signal to feed a power amplifier. It is line-level and balanced.

* Connect the two principal outputs of the unit, i.e. L.F. and H.F. to two channels of a power amplifier. **CHECK THE CORRESPONDANCE BETWEEN THE L.F. AND H.F. CHANNELS AND THE WIRING OF THE SPEAKON OUTPUT CONNECTOR!**

note: one stereo power amplifier can be used for both H.F. and L.F., each channel being assigned to one way. Alternatively, two halves of two different stereo power amplifiers can be used, the H.F. way not requiring as much drive power as the L.F. one. In such a configuration, take great care of matching the sensitivity & gain of the two power amps.

b) Front connections (left to right)

* Connect the signal input (XLR, balanced) to the female socket.

* If necessary, connect the male input of the unit to the female one of another unit. These two connectors (M & F) are in parallel.

* MATRIX connections. These connections are to be used only for mono sum or subwoofer operation. When the mono output is not in use, do not use the MATRIX connections.

The matrix connections are used to connect two MTD 115 LLCa fed with two different signals (L+R) together. The MATRIX OUT of one unit is to be connected to the MATRIX IN of the other unit, and vice-versa. Hence, this is a cross-connection using two cables.

The summed signal is then present at both mono outputs of the two MTD 115 LLCa units. When needed, one can be used for subwoofer operation and the other one for a central source, for instance.

The MATRIX connection lines are unbalanced whereas the mono rear output is balanced.

* The first key is to select the configuration of the MTD 115a.

MONITOR provides a frequency response which is best matched to floor-monitor applications.

FRONT provides a broad-band frequency response which is best matched to usual sound reinforcement applications.

X.OVER provides a frequency response which is high-pass filtered at 100Hz, to be used when subwoofers are in operation.

* The second key is to select the configuration of the mono output.

SUB provides a band-pass filtered summed signal of the inputs of controller. The crossover frequency is 100 Hz. The high-pass section of the SUB filtering is set for both the SB 115 and the MTD 118 as standard (40 Hz, boost at 50 Hz). On option, it is available set for the SB 218 (25 Hz, boost at 33 Hz).

SUM provides a straightforward broad-band summed signal of the inputs of two controllers.

When it is desired to use a summed, unfiltered mono signal and separately a subwoofer mono signal, just switch the selection keys accordingly; The MATRIX connections must be done.

* The "control" display LED's indicate that the threshold of limiters operation has been reached. They are assigned to the L.F. and H.F. channels independently.

* The "signal" display LED's indicate that a signal is present at the input, the threshold being set at -15 dB.

* The power switch is provided with a led display indicating that the unit is being mains supplied.

* Two loudspeaker outputs are provided. They are connected in parallel, allowing 4 Ohms operation.

To summarize, the mono output provides 2 configurations to the user :

- 1 . Sub-Low extension :
The 2 front panel switches, are respectively in position SUB and X-OVER and the rear panel switch is in position OUT PHASE.
- 2 . Central full range extension :
The right switch of the front panel is in position SUM.
The selection of the left switch depends on the choice of use.
The rear panel switch is in position IN PHASE.

IMPORTANT NOTICE: DO NOT CONNECT THE LOUDSPEAKER IN PARALLEL WITH THE "SENSE" CABLE AT THE OUTPUT OF THE AMPLIFIER!

6.4 SOUND SYSTEM DESIGN

The art of designing a sound system is a profession in itself, and the relevant skills and knowledge are supported by a few pertinent books. It is therefore neither to be described extensively, nor even summarised in a product user manual.

Further, we would like to underline how useful it is to involve a specialised engineer in any sound system design, whether he is an independent consultant or a house engineer, as the best products can produce the worst results if improperly set-up.

The object of this paragraph is to help the sound system designer in his task when MTD 115a systems are to be installed, simply by reminding a few features which are specific to this type of design.

a) Bi-amped, "processed".

The MTD 115a are practically very loud with respect to their size, and are capable of covering wide audience areas. There is no "magic" behind this: The MTD 115 LLCa controller ensures that the signal fed to each driver is acceptable for this driver, and this is performed in real-time. This means that there is no need to keep a safety margin, when using the MTD 115a. Even an inexperienced user can use the MTD 115a system at its full potential without risk.

The only true risky situation occurs when the amplifiers are clipping, providing very high frequency components at full level. This is likely to occur when the amplifiers driving the loudspeaker are underrated.

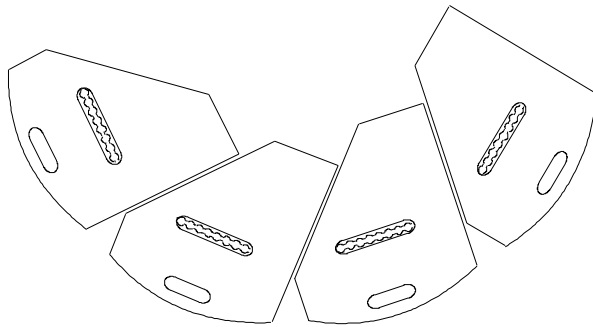
MINIMUM AVAILABLE VOLTAGE OUTPUT OF THE AMPLIFIERS FOR DRIVING THE MTD 115a:

L.F. DRIVER: 60 volts permanently, continuously for more than 10 seconds.

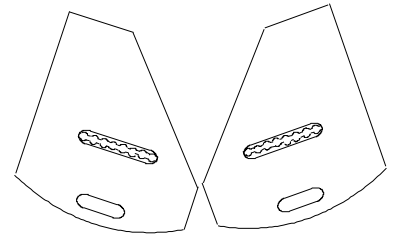
H.F.DRIVER: 40 volts permanently, for more than 10 seconds.

b) Single source

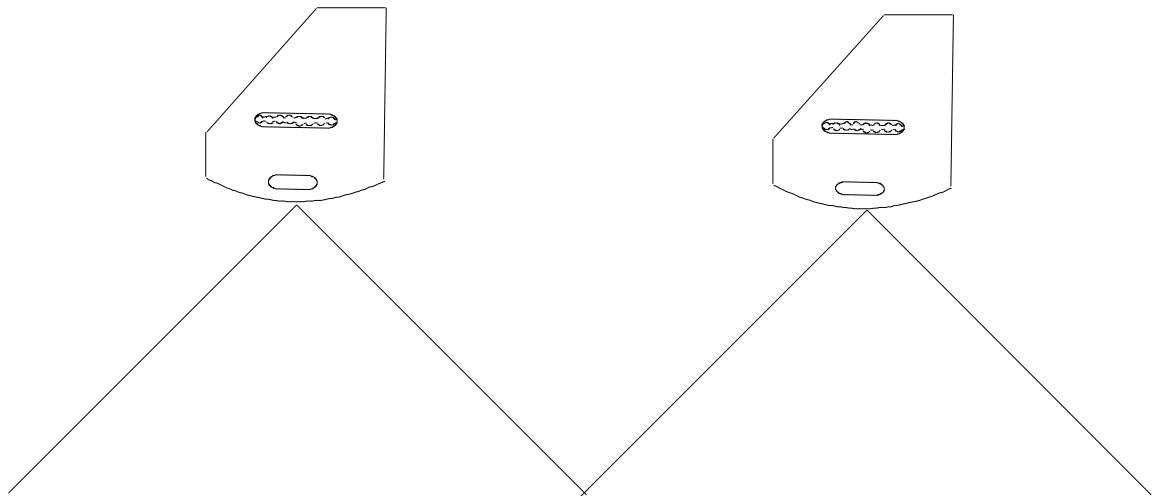
Due to its dual-concentric technology, the MTD 115a can provide a true point-source. This is a great advantage which is lost when coupling enclosures together. Although it is feasible, and sometimes necessary to couple two enclosures to achieve some power or SPL requirements from one source, the sound system designer should bear in mind that he will find more easily a high-quality result by dissociating the enclosures whenever possible.



AVOID



WORKS



BEST

c) Speaker aiming.

The dual-concentric design provides a directivity that slowly increases with frequency. The advantage of this is the optimum match in terms of coverage with the reverberant fields of typical auditorium: The loudspeakers provides the maximum of energy exactly in the direction towards which it is aimed. This means that the speakers should be aimed towards the seats where the reverberant field is dominant, that is the rearmost seats.

Off axis, the listeners are nearer of the loudspeaker, and hence the tilt of the tonal balance due to the reverberant field nature is less important. This is compensated by the attenuation of HF energy off axis, i.e. the listeners placed near of the loudspeakers should be off the axis, and still within the nominal coverage.

The tonal balance can therefore be very similar at the near seats as well as at the remote ones.

A proper equalisation can then be performed to achieve the desirable tonal balance , which will be valid for most of the audience.

In a multi-source configuration, simply replace the term "rearmost seat" by the term "seats which are the furthest away from the loudspeaker allotted to cover this part of the audience area". It really works.

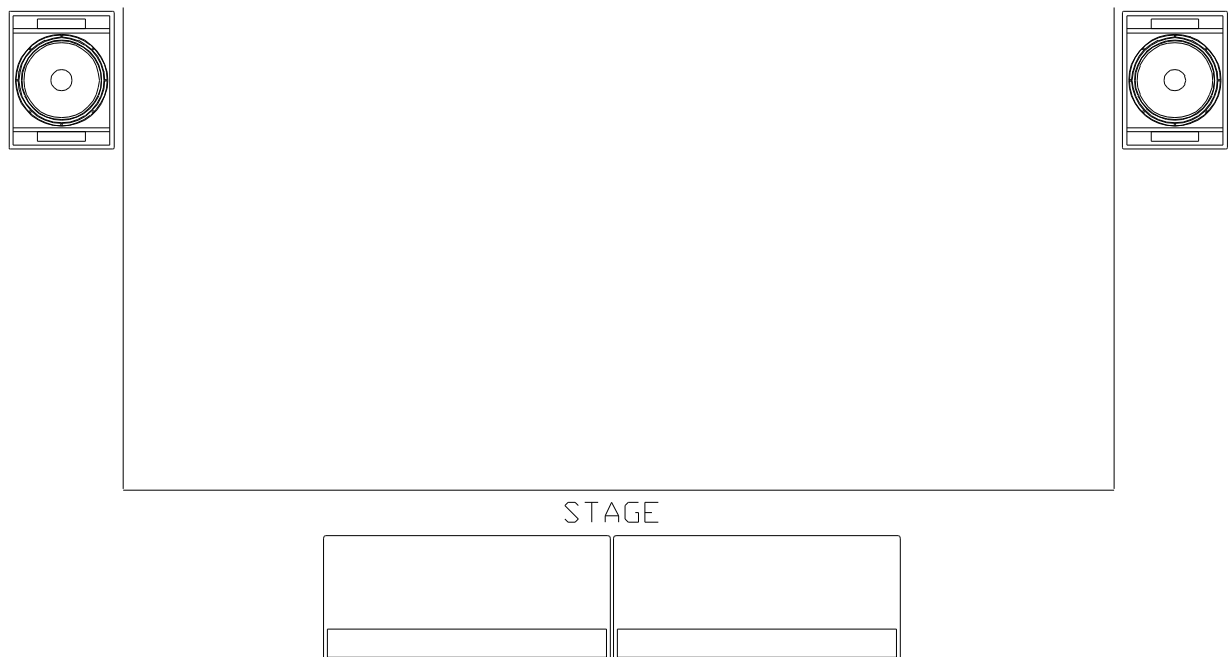
To summarise, the MTD 115a should be aimed at the rear of the part of the audience they are to cover, unlike constant directivity designs which are typically aimed at the centre of the audience part they are to cover.

d) Subwoofer location

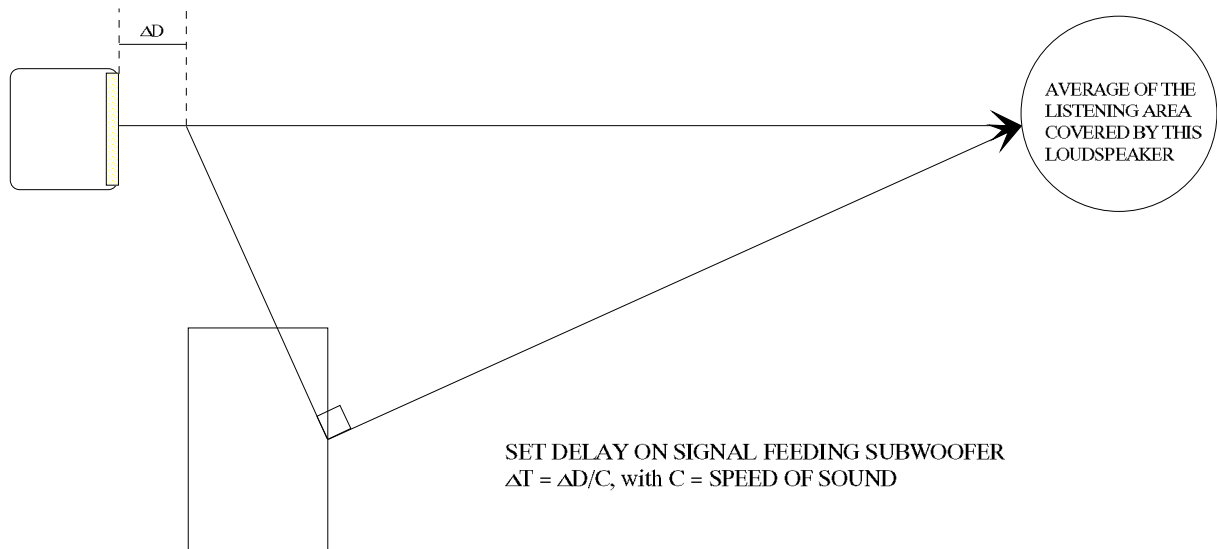
- Front of House applications

For F.O.H. applications, the subwoofers will be operated preferably in mono, fed with a signal from the "sub" output of a MTD 115 LLCa controller. In this case, the subwoofer(s) shall be located in a central position, approximately at a distance which is equivalent from the left and right speakers.

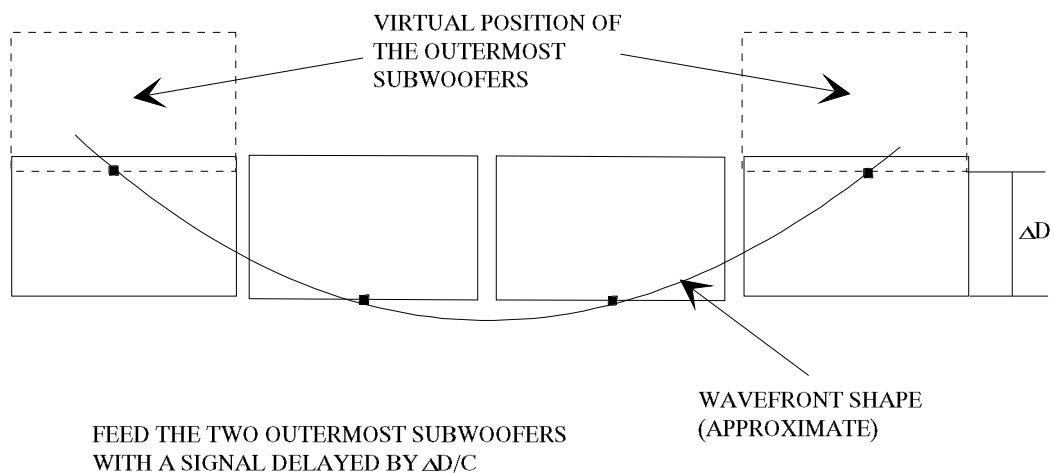
Preferably, the subwoofers will be located on the floor, or against a hard wall. If this can be achieved, one MTD 118 subwoofer per pair of MTD 115a will provide sufficient output. Two SB 115 would be needed, whereas one SB 218 will be sufficient for 4 MTD 115a.



If the difference of distance between the subwoofers and the MTD 115a at a point which is roughly in the middle of the direct field area reaches 1.7m, acoustic cancellation will occur around this point at the crossover frequency. This should be compensated by correct repositioning of the subwoofers. If, for practical reasons, this cannot be achieved it is to be done virtually with the help of a delay unit for a proper time alignment.



When arraying a large number of subwoofers, they can become overdirective even at very low frequencies. Using a delay unit for the signal feeding the outermost enclosures can provide an accurate control of the directivity, and is therefore recommended.



- Side-Fill applications

For side-fill applications, the MTD 115a will be simply located on top of a floor-standing MTD 118 or SB 115. The key selection switches on the controller will be respectively "X.OVER" and "SUB".

No summation shall be done, and hence the MATRIX connections shall not be used: the MTD 115 LLCa unit, the "Sub" enclosure and the MTD 115a are to be considered as one individual system.

6.5 PHASE CHECK

A phase check of every installation must be performed. This shall be done with a polarity checking system, like, for instance, the SCV PC 80 MKII.

This system comprises two devices, a generator and a receiver. The checking procedure is as follows:

1°Generator

- a) disconnect one output of the mixing desk, and replace it by the output of the PC 80 generator.
- b) the PC 80 generator should be switched on "HOT PIN 2"
- c) turn the whole system ON
- d) switch the generator ON, with level at minimum.
- e) crank up the level until you obtain a reasonably measurable sound ("Plop,Plop")

2°Receiver

- a) connect a microphone to the input of the generator
- b) switch the "HOT PIN" to 2 or 3 according to the wiring of the microphone
- c) switch to EXT.MIC
- d) switch the PC 80 receiver ON
- e) Place the microphone near each loudspeaker fed with the signal of this output of the mixing desk, and observe if the lightened LED is the red one (negative polarity) or the green one (positive polarity)

3°Loudspeakers

- a) MTD 115a Bass: Because it is a two ways coaxial device, you will have to check separately the polarity of the HF and the LF. Turn the channel of the relevant HF amplifier down, and place the microphone near the centre of the loudspeaker, at a distance comprised between 5 cm. and 50 cm. The green LED must be lightened at every "Plop", showing that the polarity is positive.
- b) MTD 115a HF: Turn down the channel of the relevant LF amplifier, and on the one of the HF amplifier. The microphone can remain at the same position as for bass check. The red LED must be lightened at every "Plop", showing that the polarity is negative.
- c) SUBS: All the subs must show a negative polarity, with the red LED on. Be careful with the MTD 118! because of its double chamber load, this polarity check provides opposite results according to the location of the microphone. The microphone should be located very near of the exit slot, and at the centre of it. Placing the microphone at one end of the exit slot will provide inverse results. When the location of the microphone is in center, the polarity must be positive polarity (green LED).

- 4°Do it again, for each output of the mixing desk.

7. MAINTAINANCE & MISCELLANEOUS

7.1 MTD 115a ENCLOSURE

a) Periodic check.

The response of the enclosure should be checked periodically, to prevent deviations due to wear, shocks or any event. This should be done at least every two years for systems not being submitted to heavy-duty use. For systems being used nearly everyday, or systems touring, this period should be reduced to six months.

This check can be performed with a well displayed 1/3 octave analyser, or even preferably a TEF or a MLSSA analyser. It should refer to the on axis amplitude/frequency response presented in page 19 of the present document.

The fixing of the chassis driver assembly should also be checked, as the metal screws could become loose after being submitted to intense, long duration mechanical vibrations.

The quality of the contacts and the locking of the SPEAKON connector should also be checked.

b) Phase check.

Whenever a diaphragm is replaced, the wiring polarity should be checked with a phase check device as mentioned in **6.5** (page 40). The HF driver must be in inverse polarity with respect to the LF driver when the signal is fed through the MTD 115 LLCa control unit. It should be in the same polarity when fed directly from the phase checking device to the enclosure.

7.2 MTD 115 LLCa

a) Fuse

The fuse can be changed or verified directly from the rear panel of the unit (see drawing). When operated under 220/240 volts mains supply, the proper fuse value is: 200mA

b) Other internal

No user adjustment is provided inside the unit. In case of a fault occurring, the unit shall be serviced only by an authorised agent, or simply returned to the manufacturer.

