LE Series Monitors

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LE2100S • LE1500S • LE1200S

Unite Your Audience The Martin Audio Experience



LE Series Monitors

THE LEGEND LIVES ON

Martin Audio introduced the first LE monitor – the LE200, in the 1970's. Since then, its successors – the LE400 and LE700 have become industry standards, selling in their thousands and gracing the most prestigious stages for an unrivalled who's who of artists.

With such a heritage, designing the new LE Series was a challenging prospect, involving extensive consultation with monitor engineers and an intensive development program. Combining visual appeal with world-class performance, the new LE Series represents a major step forward in monitor technology.

LE Series Monitors – still the definitive reference to which all others will aspire.



a. Highlighted hardwood rails



b. Highlighted bulkheads

Figure 1. Sectional views of the LE1500S

THE CONCEPT

A new range of world-class stage monitors capable of generating exceedingly high SPL's with a minimum of distortion; housed in contemporary styled, camera friendly cabinets of lightweight, yet exceedingly robust construction and eminently suitable for any reference situation.

This concept was derived from a wish list drawn up by leading monitor engineers and gave rise to both acoustic and constructional challenges - all of which have been imaginatively overcome. The outcome is three new models worthy of the Martin Audio LE prefix; the 2-way LE1200S and LE1500S and the three-way LE2100S.

Contemporary styling would have been impossible to achieve with conventional flat-panel cabinet building techniques and so a combination of curved, multi-laminate ply panels, solid hardwood rails and substantial internal bracing were employed (*Figure 1*).

The rear curve and base of the larger two cabinets (the LE1500S and LE2100S) is formed from a single panel. Two hardwood rails span the entire width of the top and front of the cabinet, integrating the curved panel and retaining a substantial and extensively braced baffle. The upper rail is supported on internal bulkheads and 25mm thick birch-ply side-cheeks. These bulkheads not only support the mass of the baffle, they also brace the curve, significantly increasing its rigidity.

The LE1200S utilises the same techniques optimised for the smaller cabinet.

A common problem with stage monitors, where the connectors are placed on the front, rear or side of the enclosure, is their vulnerability to abuse either by energetic performers or from audience tampering.

The new LE Series monitors overcome this by placing the connectors in a discreet recessed panel located on the bottom of the cabinet. A cable channel from the panel out to the rear of the cabinet ensures that the signal to the monitor is safeguarded without detracting from its smooth, uncluttered appearance.

There is an additional connector in each handle pocket to facilitate quick deployment when required.



a. Coverage area. The SPL contour shown over a 5 x 8m rectangle viewed from above



b. Directivity data produced from the boundary element model showing the performer's head at 1650mm high above the LE1500S monitor

Figure 2. Directivity control of the Differential Dispersion horn



Location of the connectors

DIFFERENTIAL DISPERSION

Martin Audio has long been heralded for ground breaking horn design and the Differential Dispersion horns in the new LE Series continue that tradition. The HF horn plays a hugely important role in stage monitors. The key to being able to achieve the very high SPL's and consistent coverage required, without running into feedback problems or excessive spill, is a horn with very precisely controlled dispersion. The aim is for the performer to be able to move over a wide area without hearing significant changes in frequency response or SPL. This can only be achieved with a horn design with defined, Differential Dispersion characteristics.

In order to cover the artist area shown in *Figure 2*, the horn beamwidth needs to vary from 100° at head height when the performer is right over the monitor, through 80° at the main axis of the horn and reducing to 60° further away from the monitor. As the performer moves away from the monitor, they move from a wide dispersion region into narrower dispersion region. This narrowing increases the output of the horn so that the SPL is the same even though the performer is further away.



Figure 3: Section through an LF motor. Steel – grey; Voice coil – silver/grey; Neodymium magnet – blue; Shorting ring – orange

LF DRIVE UNITS

The LF drive units have an incredibly important role to play in the 2-way monitors - being asked to produce midfrequencies, at minimum distortion, whilst simultaneously producing high-level, low frequency signals. The LF units for the LE1200S and LE1500S have been specially designed to cover this wide bandwidth, with highly linear motors and optimised moving parts to ensure that very clean midrange is maintained even when running at high excursion.

A by-product of high excursion LF drivers is that the voice-coil inductance can vary significantly with position in the magnet gap, causing unwanted high intermodulation distortion. To overcome this, LE Series LF drive units have been fitted with an optimally positioned shorting ring (*Figure 3*). The interaction of the shorting ring with the voice coil offsets the interaction of the steel with the voice coil, minimising inductance variation. This achieves a corresponding reduction of inter-modulation distortion and the mid-band sounds much cleaner, especially at high levels.

All the LE Series LF Series drive-units use high energy neodymium magnets. These are inherently smaller and lighter than an equivalent ceramic material and make a significant contribution to the reduction in size and weight of the cabinet.

With such an optimised motor, the moving parts must also allow enough linear travel. The LE Series LF Series drive-units use triple roll surrounds and double suspensions. This ensures a consistent, symmetrical restoring force with the additional benefit of mechanical longevity.

Curvilinear cones are used throughout so that the mechanical break-up is gradual and midrange performance is not compromised. The use of lightweight aluminium wire in the voice coils allows the mass of the cone to be maintained, improving cone stiffness and internal damping, whilst achieving high midrange sensitivity.

All the drive-unit cones have a water-resistant finish.

THE LE2100S

Whilst a visually small footprint is important in many applications, there is still a requirement for the ultimate monitor for use on large stages. The LE2100S has been designed to provide the artist with the absolute maximum SPL possible from a monitor, whilst keeping to the sleek, low-profile, contemporary styling of the other models in the range.

To achieve this goal required the use of 2 x 12" LF drive-units. However, if the monitor were 2-way, and the drive-units minimally spaced side-byside, the horizontal directivity would inevitably be compromised. Figure 4a is a calculation of the on-axis and 40° off-axis SPL of 2 x 12" minimally spaced drive-units. It shows that the beamwidth narrows as the frequency rises due to interference between the drive-units. To obtain the desired horizontal beamwidth of 80°, a crossover frequency of less than 800Hz would be required which, in a two-way design, would produce unacceptably high distortion in the compression driver.

The imaginative and innovative solution was to go 3-way. The addition of a 6.5" midrange device to partner the 2 x 12" LF drivers permits а 606Hz crossover SO that the 80° frequency, beamwidth is maintained. Applying a proprietary torodial phase-bung loading to the 6.5" driver produces high mid-band sensitivity at low distortion whilst achieving constant directivity control up to 3kHz, permitting a high crossover point to be used for the compression driver. This allows the use of a 1" compression driver rather than a 1.4", giving the further benefit of improved HF extension and clarity.

The 3-way design of the LE2100S combines the advantages of maximum SPL, low distortion, horizontal symmetry and Differential Dispersion, elevating the LE Series sound and performance to a new level.



The driver array of the LE2100S Monitor



a. Theoretical model of 2 x 12" drive-units. O degrees (black) and 40 degrees off-axis SPL with 2 x 12" drive-units side by side



b. Measured directivity of LE2100S LF units in 10 degree increments normalised to on-axis

Figure 4. Horizontal directivity of 2 x 12" LF drive-units

LE2100S

Active, low profile, very high power, three-way, Differential Dispersion stage monitor

The Martin Audio LE2100S is a very high performance monitor designed for large-stage applications where maximum SPL's are required. It features twin, high-specification 12" (300mm) low frequency drivers, a unique 6.5" (165mm) midrange device and a 1" (25mm) exit compression driver mounted on a Differential Dispersion horn. Differential Dispersion technology increases the area over which a constant SPL and consistent frequency response is maintained at ear height, enabling the artist to move around more freely.

The two 12" (300mm)/3" (75mm) coil long-excursion bass drivers are reflex loaded by four triangular ports and arranged in a horizontally close-spaced format achieving directivity control right down to 500Hz to match the MF/HF section and minimise spill. Flux demodulation rings optimise upper bass clarity and reduce distortion levels at the high SPL's demanded of stage monitors. The deep curvilinear profile cones are stiff, robust and water-resistant ensuring durability in the tough stage environment.

Midrange frequencies are reproduced by a phase-plug loaded 6.5" (165mm)/2" (50mm) coil mid driver which has an 80° beamwidth to seamlessly partner both the LF array and HF horn. Triangular ports either side of the midrange assembly reduce the effective baffle area around it, helping to maintain constant directivity down to the LF/MF crossover point. The high order passive MF/HF crossover ensures that vertical directivity is seamless and uncompromised ensuring a consistent tonal balance as the artist moves around the stage. A flux demodulating ring ensures excellent midrange clarity by minimising distortion, especially at high SPL's. Use of

Ferrofluid coupled with an integrated cooling system extracts heat away from the voice coil and into the alloy basket to achieve maximum power handling and excellent transient reproduction.

The 1" (25mm) exit, 1.7" (44mm) titanium dome compression driver is partnered to a specifically engineered and proprietary Differential Dispersion $60^{\circ} - 100^{\circ}$ horizontal x 60° vertical horn. The horn is mounted into the MF/HF sub baffle overlapping the LF units to ensure low diffraction, optimum baffle size and drive unit spacing. An ultra-high-flux neodymium motor system minimises weight and yields startling levels of detail and output capability whilst the copper cap achieves extended HF response.

The Differential Dispersion horn is optimised to produce constant horizontal directivity of gradually varying beamwidth – wide (100°) above the main axis, 80° on the main axis itself and narrow (60°) below the main axis. This narrowing dispersion effectively changes the forward gain of the horn enabling the horn to throw further, increasing the range of the monitor and reducing excess spill. The HF driver is mounted at 15° to the horn mouth, ensuring the profile of the monitor is kept low whilst directing the main horn axis to ear height at approximately 1.5 metres from the monitor.

The whole of the rear and bottom of the enclosure is a single, very stiff, pressed beech laminate panel, contributing to an extremely rigid and accoustically inert cabinet.

The LE2100S is best used with the DX1.5 or DX2 controller to provide crossover, limiting and EQ functions.

FEATURES

Two 12" (300mm) ultra-long excursion high power, neodymium motor bass drivers 6.5" (165mm) high power, phase-plug loaded neodymium motor midrange driver 1" (25mm) exit titanium dome, neodymium motor compression driver Optimised constant directivity Differential Dispersion HF horn Symmetrical array, three-way, bi-amp design Contemporary, multi-laminate ply and hardwood cabinet Frequency response 56Hz-18kHz ±3dB, -10dB @ 48Hz 4 ohm nominal impedance **Discreet connectors** Fitted with 4 x M8 rigging inserts

APPLICATIONS

Very high power stage monitor Flown infill via optional yoke

TECHNICAL SPECIFICATIONS

ТҮРЕ	Three-way reflex stage monitor with symmetrically arrayed 2 x 12" LF, phase-plug loaded MF and Differential Dispersion HF horn
FREQUENCY RESPONSE (1)	56Hz-18kHz ± 3dB -10dB @ 48Hz
DRIVERS	2 x 12" (300mm)/3" (75mm) voice coil, ultra- long excursion, water-resistant cone 6.5" (165mm)/2" (50mm) ccaw ribbon voice coil, water-resistant cone 1" (25mm) exit, 1.7" (44mm) voice coil titanium
	and the second sec
	dome HF compression driver
RATED POWER (2)	MF + HF: 250W AES, 1000W peak
RECOMMENDED AMPLIFIER	800-2000W into 4 ohms
SENSITIVITY (3)	LF: 101dB MF + HF: 102dB
MAXIMUM SPL (calculated)	LF: 130dB continuous, 136dB peak
4	MF + HF: 126dB continuous, 132dB peak
NOMINAL IMPEDANCE	LF: 4 ohms MF + HF: 8 ohms
DISPERSION (-6dB)	60° - 100° horizontal (Differential Dispersion)
	60° vertical
CROSSOVER	606Hz active 3kHz passive
ENCLOSURE	89 litres
FINISH	Textured black paint
PROTECTIVE GRILLE	Black perforated steel
CONNECTORS	4 x Neutrik NL4'
FITTINGS	4 x skids
	4 x M8 inserts
DIMENSIONS	(W) 826mm x (H) 385mm x (D) 582mm (W) 32.5ins x (H) 15.2ins x (D) 22.9ins
WEIGHT	39.5kg (87lbs)





LE2100

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Notes

(1) Measured on-axis in half space at 2 metres, then referred to 1 metre.

(2) AES Standard ANSI S4.26-1984.

- (3) Measured in half space at 2 metres with 1 watt input, using band limited pink noise, then referred to 1 metre.
- (4) Measured in half space at 2 metres using band limited pink noise, then referred to 1 metre.

(5) Measured on-axis in open (4π) space at 2 metres, then referred to 1 metre.

- (6) Measured in open (4π) space at 2 metres with 1 watt input, using band limited pink noise, then referred to 1 metre.
- (7) Measured in open (4π) space at 2 metres using band limited pink noise, then referred to 1 metre.

LE1500S

Active/passive, low profile, high power, Differential Dispersion stage monitor

The Martin Audio LE1500S is a compact, high performance stage monitor combining high output and controlled dispersion with discreet, contemporary design. It features a high–specification 15" (380mm) low frequency drive unit and a 1.4" (35mm) exit compression driver mounted on a Differential Dispersion horn. Differential Dispersion technology increases the area over which a constant SPL and consistent frequency response is maintained at ear height, enabling the artist to move around more freely.

The 15" (380mm)/4" (100mm) coil long-excursion bass driver is reflex loaded by two 4" diameter, symmetrically flared ports resulting in deep, articulate low frequency performance. A light weight voice coil and flux demodulation ring optimises midrange clarity and reduces distortion levels at the high SPL's demanded of stage monitors. The powerful neodymium motor system yields high sensitivity and low weight and the advanced cooling design reduces power compression to negligible levels. A stiff, robust and waterresistant cone ensures durability in the tough stage environment.

The 1.4" (35mm) exit compression driver uses a 3" (75mm) pure titanium dome and is partnered to a specifically engineered and proprietary Differential Dispersion $60^{\circ} - 100^{\circ}$ horizontal x 60° vertical horn. An ultra-high-flux neodymium motor system minimises weight and yields startling levels of detail and output capability.

The Differential Dispersion horn is optimised to produce constant horizontal directivity of gradually varying beamwidth – wide (100°) above the main axis, 80° on the main axis itself and narrow (60°) below the main axis. As the performer moves away from the monitor they move from the wide, into the narrow dispersion region. This narrowing dispersion effectively changes the forward gain of the horn enabling the horn to throw further, increasing the range of the monitor and reducing excess spill. The HF driver is mounted at 15° to the horn mouth, ensuring the profile of the monitor is kept low whilst directing the main horn axis to ear height at approximately 1.5 metres from the monitor.

The whole of the rear and bottom of the enclosure is a single, very stiff, pressed beech laminate panel, contributing to an extremely rigid and accoustically inert cabinet. Left and right handed versions are available to facilitate use in pairs.

Driven actively, the LE1500S is best used with the DX1.5 or DX2 controller to provide crossover, limiting and EQ functions. When operated in passive mode the LE1500S, may be used without a controller, but benefits from the EQ and limiting functions of the DX1.5 or DX2. This also ensures that both active and passive configurations will exhibit the same tonal balance when used together on stage.

FEATURES

Very high output, low profile stage monitor Single 15" (380mm) ultra-long excursion high power, neodymium motor bass driver 1.4" (35mm) exit pure titanium dome, neodymium motor compression driver Optimised constant directivity Differential Dispersion HF horn Contemporary design multi-laminate ply and hardwood cabinet Active/passive crossover operation via external switch Frequency response 56Hz-18kHz ±3dB, -10dB @ 48Hz 8 ohm nominal impedance Discreet connectors Fitted with 4 x M8 rigging inserts Left or Right handed versions available

APPLICATIONS

High power stage monitor Flown infill via optional yoke

TECHNICAL SPECIFICATIONS

	A A A A A A A A A A A A A A A A A A A
TYPE	Two-way reflex active/passive stage monitor
	with Differential Dispersion HF horn
FREQUENCY RESPONSE (1)	56Hz-18kHz ± 3dB
A	-10dB @ 48Hz
DRIVERS	15" (380mm)/4" (100mm) voice coil, ultra-long
	excursion, water-resistant cone
	1.4" (35mm) exit, 3" (75mm) voice coil titanium
	dome HF compression driver
RATED POWER (2)	LF: 600W AES, 2400W peak
	HF: 80W AES, 320W peak
RECOMMENDED AMPLIFIER	800-1500W into 4 ohms
SENSITIVITY (3)	FR: 98dB
	LF: 99dB
	HF: 106dB
MAXIMUM SPL (calculated)	FR: 125dB continuous, 131dB peak
	LF: 126dB continuous, 132dB peak
	HF: 125dB continuous, 131dB peak
NOMINAL IMPEDANCE	FR/LF: 8 ohms
	HF: 16 ohms
DISPERSION (-6dB)	60° - 100° horizontal (Differential Dispersion)
	60° vertical
CROSSOVER	1.3kHz active/passive (switchable)
ENCLOSURE	70 litres
FINISH	Textured black paint
PROTECTIVE GRILLE	Black perforated steel
CONNECTORS	4 x Neutrik NL4
FITTINGS	4 x skids
	4 x M8 inserts
DIMENSIONS	(W) 710mm x (H) 385mm x (D) 582mm
	(W) 27.9ins x (H) 15.2ins x (D) 22.9ins
WEIGHT	36kg (79lbs)





<u>LE1500</u>

Notes

- (1) Measured on-axis in half space at 2 metres, then referred to 1 metre.
- (2) AES Standard ANSI S4.26-1984.
- (3) Measured in half space at 2 metres with 1 watt input, using band limited pink noise, then referred to 1 metre.
- (4) Measured in half space at 2 metres using band limited pink noise, then referred to 1 metre.
- (5) Measured on-axis in open (4π) space at 2 metres, then referred to 1 metre.
- (6) Measured in open (4π) space at 2 metres with 1 watt input, using band limited pink noise, then referred to 1 metre.
- (7) Measured in open (4π) space at 2 metres using band limited pink noise, then referred to 1 metre.

LE1200S

Active/passive, low profile, high power, Differential Dispersion stage monitor

The Martin Audio LE1200S is an ultra-compact, high performance stage monitor which combines maximum enclosure volume with optimum presentation angle in a low profile, contemporary design. It features a high-specification 12" (300mm) low frequency drive unit and a 1.4" (35mm) exit compression driver mounted on a Differential Dispersion horn. Differential Dispersion technology increases the area over which a constant SPL and consistent frequency response is maintained at ear height, enabling the artist to move around more freely.

The 12" (300mm)/3" (75mm) coil long-excursion bass driver is reflex loaded by two 3" diameter symmetrically flared ports resulting in deep, articulate low frequency performance. A light weight voice coil and flux demodulation ring optimises midrange clarity and reduces distortion levels at the high SPL's demanded of stage monitors. The powerful neodymium motor system yields high sensitivity and low weight and the advanced cooling design reduces power compression to negligible levels. The cone profile ensures excellent upper midrange dispersion due to the controlled break-up through the crossover region whilst maintaining the stiffness required for tight LF response. The waterproof coating ensures long and reliable service.

The 1.4" (35mm) exit compression driver uses a 3" (75mm) pure titanium dome and is partnered to a specifically engineered and proprietary Differential Dispersion $60^{\circ} - 100^{\circ}$

horizontal x 60° vertical horn. An ultra-high-flux neodymium motor system minimises weight and yields startling levels of detail and output capability.

The Differential Dispersion horn is optimised to produce constant horizontal directivity of gradually varying beamwidth – wide (100°) above the main axis, 80° on the main axis itself and narrow (60°) below the main axis. As the performer moves away from the monitor they move from the wide, into the narrow dispersion region. This narrowing dispersion effectively changes the forward gain of the horn enabling the horn to throw further, increasing the range of the monitor and reducing excess spill. The HF driver is mounted at 15° to the horn mouth, ensuring the profile of the monitor is kept low whilst directing the main horn axis to ear height at approximately 1.1 metres from the monitor.

The whole of the rear and bottom of the enclosure is a single, very stiff, pressed beech laminate panel, contributing to an extremely rigid and accoustically inert cabinet. Left and right handed versions are available to facilitate use in pairs.

Driven actively, the LE1200S is best used with the DX1.5 or DX2 controller to provide crossover, limiting and EQ functions. When operated in passive mode the LE1200S, may be used without a controller, but benefits from the EQ and limiting functions of the DX1.5 or DX2. This also ensures that both active and passive configurations will exhibit the same tonal balance when used together on stage.

FEATURES

Very high output, ultra-compact, low profile stage monitor Single 12" (300mm) ultra-long excursion high power, neodymium motor bass driver 1.4" (35mm) exit pure titanium dome, neodymium motor compression driver Optimised constant directivity Differential Dispersion HF horn Contemporary design multi-laminate ply and hardwood cabinet Active/passive crossover operation via external switch Frequency response 64Hz-18kHz ±3dB, -10dB @ 54Hz 8 ohm nominal impedance Discreet connectors Fitted with 4 x M8 rigging inserts Left or Right handed versions available

APPLICATIONS

High power stage monitor Flown infill via optional yoke

TECHNICAL SPECIFICATIONS

	TANKS P
TYPE	Two-way reflex active/passive stage monitor
	with Differential Dispersion HF horn
FREQUENCY RESPONSE (1)	64Hz-18kHz ± 3dB
	-10dB @ 54Hz
DRIVERS	12" (300mm)/3" (75mm) voice coil, ultra-long
5	excursion, water-resistant cone
	1.4" (35mm) exit, 3" (75mm) voice coil titanium
	dome HF compression driver
RATED POWER (2)	LF: 400W AES, 1600W peak
	HF: 80W AES, 320W peak
RECOMMENDED AMPLIFIER	500-700W into 4 ohms
SENSITIVITY (3)	FR: 9/dB
	LF: 98dB
	HF: IU60B
MAXIMUM SPL (calculated)	FR: 123dB continuous, 129dB peak
	LF: 1240B continuous, 1300B peak
NOMINAL IMPEDANCE	FP/LE - 9 ohme
NOWINAL INFEDANCE	LE. 16 ohme
	60° 100° horizontal (Differential Dispersion)
	60° vertical
CROSSOVER	1 3kHz active/passive (switchable)
ENCLOSURE	40 litres
FINISH	Textured black paint
PROTECTIVE GRILLE	Black perforated steel
CONNECTORS	4 x Neutrik NL4
FITTINGS	4 x skids
	4 x M8 inserts
DIMENSIONS	(W) 596mm x (H) 292mm x (D) 470mm
	(W) 23.5ins x (H) 11.5ins x (D) 18.5ins
WEIGHT	20.5kg (45lbs)
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<u>LE1200</u>

Notes

- (1) Measured on-axis in half space at 2 metres, then referred to 1 metre.
- (2) AES Standard ANSI S4.26-1984.
- (3) Measured in half space at 2 metres with 1 watt input, using band limited pink noise, then referred to 1 metre.
- (4) Measured in half space at 2 metres using band limited pink noise, then referred to 1 metre.
- (5) Measured on-axis in open (4π) space at 2 metres, then referred to 1 metre.
- (6) Measured in open (4π) space at 2 metres with 1 watt input, using band limited pink noise, then referred to 1 metre.
- (7) Measured in open (4π) space at 2 metres using band limited pink noise, then referred to 1 metre.

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