BACK TO INDEX

# W8LM Flying System

# USER GUIDE V1.0

MARTIN AUDIO
LONDON

The Martin Experience

BACK TO INDEX

# W8LM Flying System User Guide V1.0

**General information**
W8LM Flying System User Guide
Version 1.0 November 2003

The information presented in this document is, to the best of our knowledge, correct.
We will however not be held responsible for the consequences of any errors
or omissions.
Technical specifications, weights and dimensions should always be confirmed with
Martin Audio before inclusion in any additional documentation.
In our efforts to develop and improve our products we reserve the right to
change the technical specification of our products without notice.
Martin Audio tries, whenever possible, to minimise the effects of product
changes on equipment compatibility.
Martin Audio Ltd, Century Point, Halifax Road, Cressex Business Park, High Wycombe, Buckinghamshire. UK.

# Contents

## Section 1. Flying Safety

The prime concern in the design and use of loudspeaker flying systems is safety – the safety of the public, performers and all personnel who work with flying systems.

Suspension of loudspeaker systems should only ever be undertaken by specialist, trained personnel working in association with professional riggers. Safety is crucially dependant on safe working practices, which must be learned, understood and adhered to. Everyone involved in the deployment of flown loudspeaker systems has a duty to safety.

Different operating and safety requirements between and within countries make it impossible to give universally definitive advice on safety, so it is important that users consult with local regulatory authorities for specific guidelines.

This manual is not the definitive guide to safe working practice in the use of flying systems but is advisory in nature and intended to promote safety by providing clear information on the capabilities, adjustment and safe use of the W8LM flying system.

Despite all the care taken in the design and manufacture of the flying system, Martin Audio Ltd. cannot guarantee complete safety whenever a flying system is used. Safety in use is dependent upon the safe working practices of flying system users. The advice and information contained in the manual does not absolve users from complying with any legal safety requirements and codes of practice in force at a time and place where a W8LM system is deployed.

## Important!

Everyone involved in the on-site assembly and deployment of a loudspeaker flying system has a duty to ensure the safe construction, adjustment and deployment of that flying system. It is therefore crucial that every W8LM flying system user has the opportunity to read and fully understand the advice and information presented in this manual. Every W8LM flying system user also needs to be properly trained in the safe use of the system before ever constructing and deploying the system in a working situation.

## Section 2. The System Design

The W8LM suspension system allows arrays of loudspeaker cabinets to be vertically suspended or 'flown' from suitably secure and appropriately load rated rigging points in the roof structure of a theatre, hall or indoor arena. The W8LM suspension system is rated with a safety factor of 7:1 for up to 16 enclosures and is solely and exclusively intended for use with the W8LM loudspeaker enclosure.

The maximum number of cabinets for a 7:1 safety factor of the entire system will depend on the overall tilt of the array and the splay angles between the cabinets. ViewPoint™, a proprietary Martin Audio array optimisation program, should be used to check that a particular array configuration maintains the 7:1 safety factor.

## 2.1 W8LM Rigging System Overview

The rigging system consists of the following components:

- A suspension grid from which a column of W8LM loudspeakers is suspended. One grid per column is required. Three types of grid are available – a standard grid for normal use (HAM03036), an underhanging grid (HAM03050) used to suspend W8LM's beneath a column of W8LC's and an underhanging grid (HAM03049) used to suspend W8LM's beneath WLX sub-bass enclosures. (Note that the W8LC and WLX are each covered by separate Flying System User Guides).
- Front and rear connecting mechanisms integral to the W8LM cabinet.
- Quick-release pins, captive in the cabinet.

## 2.2 Chain Motors

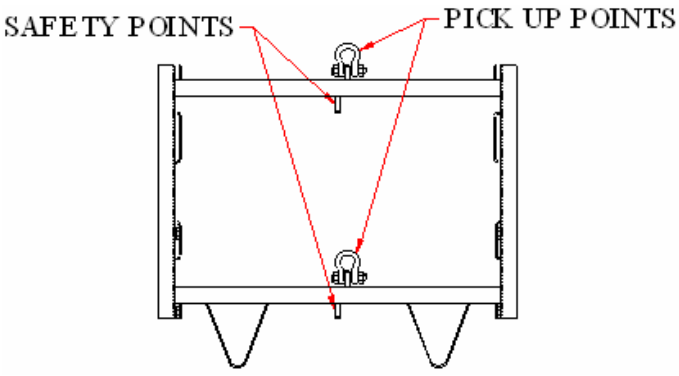
A chain motor is an additional component used to lift the suspension system into position. A chain motor is specified by its maximum safe lifting capacity in US tons or metric Tonnes. For example, a 1 ton motor is capable of lifting 1 ton.

1 US ton = 2000lbs/907Kg
1 Tonne = 1000Kg/2205lbs

## 2.3 The Standard Suspension Frame (HAM03036)

The W8LM standard suspension frame, also known as a grid, has four pick-up points (lugs), two at the front and two at the rear. Two points lie along the centre-line of the grid and two are offset. The offset points (rear facing) lie above the left/right centre of gravity of the array ensuring a straight hang when viewed from the front. The two points can each be attached to separate chain motors to distribute the load between the two points and allow the entire array to be tilted within certain limits. The two centre-line (forward facing) points may be used to attach safety wires/chains.

Note: the holes in the lugs are 20mm (>3/4") in diameter and will accept shackles up to 3.25tonne W.L.L (as supplied fitted to the two pick-up points). The part number of the 3.25tonne shackle is HTK300.



The standard grid is designed to fly an array of up to 16 W8LM enclosures with a 7:1 safety factor. Please use the ViewPoint™ array optimisation program to check that a particular array configuration maintains the 7:1 safety factor.

The grid has the facility to attach to the W8LM in two positions front or rear. The front position is the one most commonly used and should always be used when tilting the array downwards.

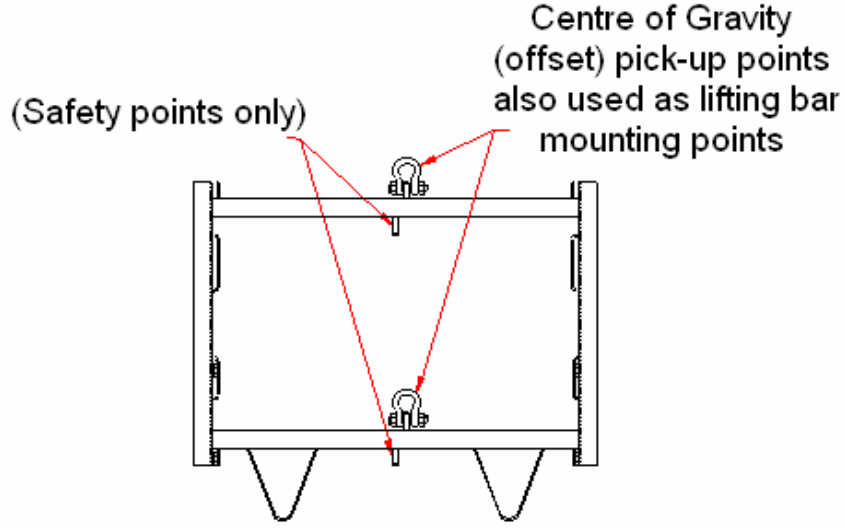
The rear position is used when large up tilt angles are called for. Note that it is still possible to tilt an array upwards when the front position is used, by a reduced amount. When designing an array, ViewPoint™, a proprietary Martin Audio array optimisation program, should be used to determine which position is best and also check that a particular array configuration maintains the 7:1 safety factor.

## Lifting Bar

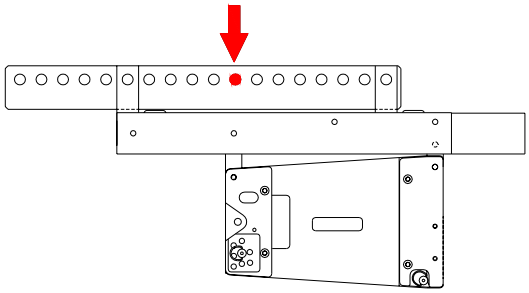
An optional lifting bar (part number: HAM03037), shown below, is available which connects to the front and rear pick-up points and permits a greater range of overall tilt angles than with the grid only.

To attach the lifting bar, remove the two shackles from the pick-up lugs on the grid and attach the lifting bar to the lugs using the same shackles.

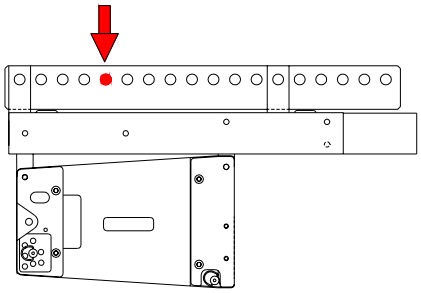
Please use the correct lugs i.e. the horizontally offset lugs ***behind*** the front and rear cross pieces.



The lifting bar also has a number of holes along its length to facilitate single-point suspension using a single motor hoist. The bar can be attached as shown or rotated through 180° so that it protrudes from the front of the grid, in order to allow a greater degree of up tilt.



**LIFTING BAR REAR POSITION**



**LIFTING BAR FORWARD POSITION**

**ViewPoint™ indicates optimum lifting position with red arrow**

Once again, ViewPoint™ should be used to determine which position is best and also to check that a particular array configuration maintains the 7:1 safety factor.

The table below shows the typical number of cabinets that can be flown using 0.5 and 1 ton motors with the standard grid weighing 20.5Kg (45lbs) and optional lifting bar weighing 7.5Kg (16.5lbs). The W8LM enclosure itself weighs 29kg (64lbs).

| Single Point<br>1 x 0.5 ton Motor | Single Point<br>1 x 1 ton Motor | Front and Rear Points<br>2 x 0.5 ton Motors* | Front and Rear Points<br>2 x 1 ton Motors |
|---|---|---|---|
| 12 cabinets | 16 cabinets | 16 cabinets | 16 cabinets |

***** Note that the front to rear weight distribution becomes more critical using 0.5 ton motors when the array is tilted. For example, if the array is tilted far enough so that all the load is borne by the rear point alone, then the maximum number of cabinets permitted would revert to the figure for a single point i.e. 12 cabinets. Again the use of ViewPoint™ is strongly recommended.

# Warning!

**Careful calculations must always be made to ensure that all components are used well within their rated safe working load before the array is lifted.**

**Never exceed the maximum load ratings marked on motors or suspension frames. Always raise and lower the load slowly and avoid rapid changes in load distribution that could result in a sudden jolt to the suspension components.**

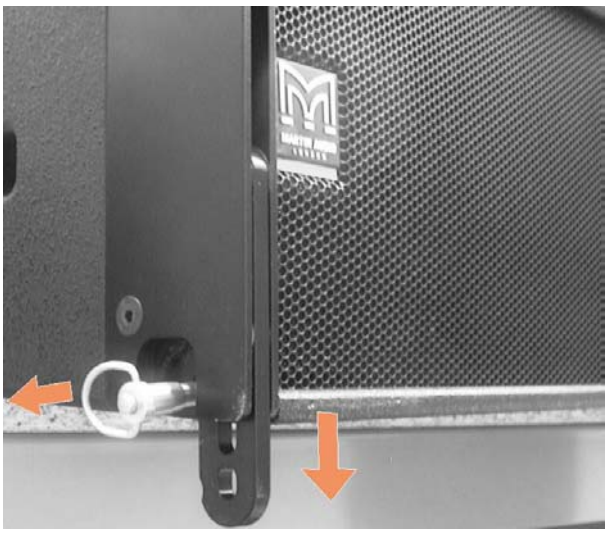
## 2.4 W8LM Enclosure Rigging Hardware

The W8LM enclosure has steel rigging hardware at the front and rear of the enclosure.

### Front cabinet rigging

At either side of the front of the enclosure, a sliding tongue is stored within the front rigging assembly.

Removing the quick release pin from its parking position allows the tongue to drop down into the front rigging assembly of the enclosure below where it is secured using the same quick release pin to form a hinge.



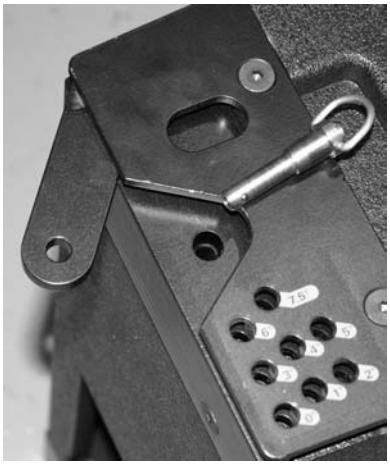
With this arrangement, the fronts of adjacent enclosures are securely locked together with only a few millimetres spacing between them for tight hf coupling.

Quick release pin HTK175

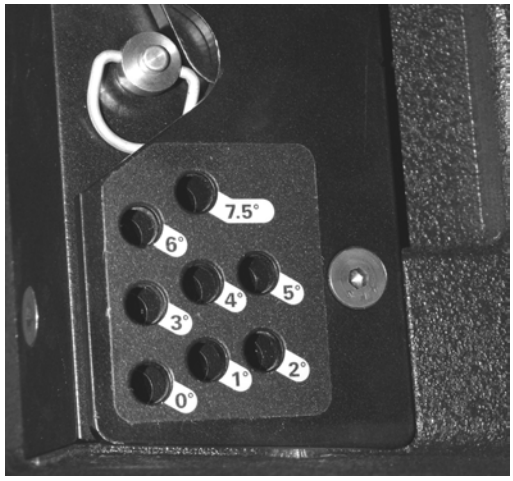
## Rear cabinet rigging

At either side of the rear of the enclosure, there is a channel housing a steel splay arm, used to set the splay angle between enclosures. In transit, the splay arm is held in place by a quick release pin.

After removing the quick release pin, the arm is swung up into the channel of the enclosure above and fixed at the required splay angle by the insertion of the quick release pin.



Rear view showing splay arm




Hole positions for various splay angles

Each rear channel has a set of holes marked 0°, 1°, 2°, 3°, 4°, 5°, 6° and 7.5°

# Warning!

**Prior to use, inspect all components of the array, including the chain hoists, suspension frames, enclosure, its front and rear rigging assemblies and pins etc. for damage, cracks, deformations, broken welds, corrosion or missing parts that could affect the strength and safety of the array.**

**The load bearing capabilities of the building or support structure should always be assessed, inspected and certified by an appropriate professional engineer.**

## 2.5 Safety Factor

The W8LM suspension system will only perform as designed when all four connection points are utilised. However, the W8LM 7:1 safety factor is based on a worst-case scenario, where only two suspension points are supporting the enclosures below them. This could occur in tilted arrays where the load is shifted forward or back. The 7:1 safety factor means that the suspension system has an ultimate strength that is 7 times the weight of the equipment being suspended.

The 7:1 safety factor will be maintained for up to a maximum of 16 boxes in the array when using the standard grid. The effect of introducing very significant tilts to large arrays (e.g.12-16 boxes) could be to reduce the safety factor of the system below the 7:1 figure and should be avoided. The permitted limits of tilt can be determined using the proprietary ViewPoint™ software as part of the array design process.

Note that the underhanging grid (HAM03050), used to suspend W8LM's beneath a W8LC column, has a safety factor of 7:1 for 8 W8LM's and the underhanging frame (HAM03049) used to suspend W8LM's beneath WLX sub-bass enclosures has a safety factor of 7:1 for 16 W8LM's.

Again, always use ViewPoint™ to design the array and to check the safety factor.

### Safety Wire Ropes/Chains

Although the flying system is conservatively load rated, for maximum safety, an additional secondary rigging point should always be provided and used. Suspension points on the grid that are not being used for the chain motors may be used to attach safety bridles to a suitable, secure overhead rigging point, structurally independent of the main hanging point for the system. It is recommended that any safety bridles remain permanently attached to the grid as a reminder that they must be used.

**Note!** The practice of crossing one safety bridle to an adjacent load hoist is not recommended, in the event of a motor or system failure this would induce a violent rotating action that would induce shock loads in directions the system is not designed to cope with.

## Section 3. Planning and Constructing Arrays.

### 3.1 Planning

A site survey should be conducted before arriving on site and a rigging plan prepared. The rigging plan should include details of the number and type of cabinets to be flown, their position in the array as well as the angles needed to best cover the audience areas of the venue. The plan should also include the weight, intended height and position of the load(s) to allow the venue riggers to select the rigging points needed to suspend the flying system from the roof of the building.

ViewPoint™ should be used to design the array to check that the configuration maintains the 7:1 safety factor. A ViewPoint™ array plot should be given to the rigger in charge (see Section 3.1b).

## 3.1a Load limits

To maintain the 7:1 safety factor of the flying system, the above hook rigging - roof structure, rigging and motor chain hoists - should all be capable of supporting loads 7 times that of a fully loaded flying system. The full load safety margin of the flying system is only achievable when both flying system and load are either vertically suspended or tilted within certain limits. Very significant deviations from the vertical of large arrays could reduce the safety factor to below the 7:1 figure.

Again, ViewPoint™ should be used to design the array to check that the configuration maintains the 7:1 safety factor.

## 3.1b Rigging, loading and motor hoists

The rigging plan allows users to determine the exact position of the rigging points needed for the array described. The chains or steels suspended from the rigging points should hang vertically with the array attached - if they do not, then the horizontal shearing forces introduced by misalignment will reduce the load safety margin of the flying system. Because of this factor, users must ensure the correct position and spacing of the rigging points. But the most obvious result of miss-positioning will be that the whole system will not array in the intended manner.

Normally, a W8LM system is flown from two separate front and rear rigging points. However, it is also possible to fly a system from a single rigging point or crane hook by using the optional lifting bar. For single point suspension the load ratings of the motor hoist above hook rigging and the rigging point will all need to be considered very carefully and in some instances may need to be double that used for normal twin point suspension. To ensure that the rated load safety factor of the W8LM flying system is maintained, always check the actual total load of the flying system, rigging and loudspeaker cabinets.

In calculating the total load on each rigging point, remember to include the weight of the motor, cables and any additional rigging.

The table below shows the typical number of cabinets that can be flown using 0.5 and 1 ton motors with the standard grid weighing 20.5Kg (45lbs) and optional lifting bar weighing 7.5Kg (16.5lbs). The W8LM enclosure itself weighs 29kg (64lbs).

| Single Point<br>1 x 0.5 ton Motor | Single Point<br>1 x 1 ton Motor | Front and Rear Points<br>2 x 0.5 ton Motors* | Front and Rear Points<br>2 x 1 ton Motors |
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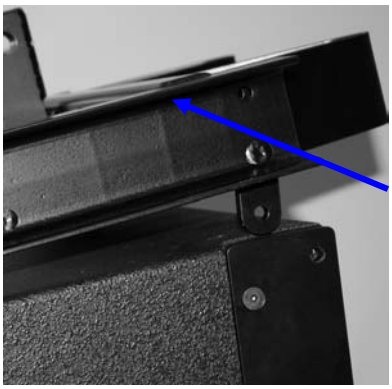
## 3.2 Constructing an Array

Assembly and deployment of W8LM arrays is carried out one box at a time. After attaching the grid to the first box, each box is placed face down at the rear of the array and attached one at a time, by the rear points. The grid is raised and the front of the cabinet is then swung up and the front points attached.

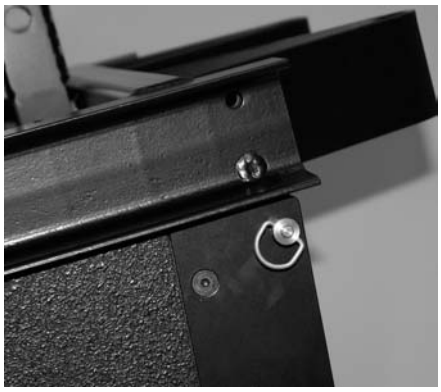
The process is then repeated for the next box.

**Step 1**

Position the first box on the floor as shown. Remove the quick release pins at the front of the grid which secure the captive front tongues and lower the grid into position on top of the box.

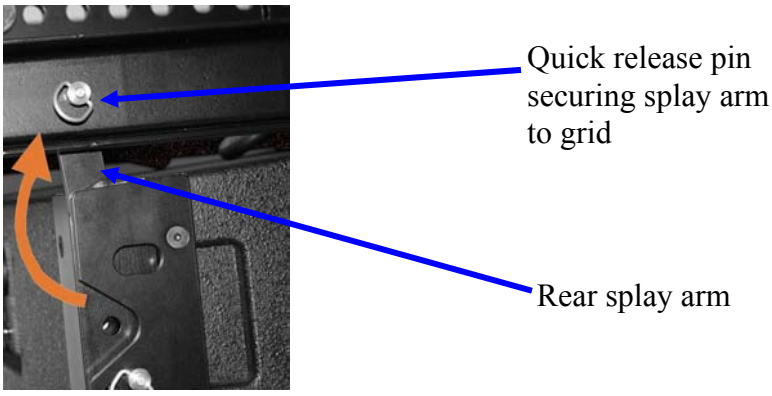


Tongue secured with quick release pin here for trucking.



To attach the cabinet front, locate the grid tongues within the front brackets of the first box. Secure the tongues in position with the same quick release pins**.**

**Please note:**
**The quick release pin is locked in position when its central button is out.**




To attach the cabinet rear, remove the rear quick release pins and swing out each of the rear splay arms from its transit position up into the receptor at the rear of the grid.

Secure each rear splay arm to the grid by inserting a quick release pin through the grid and into the hole in the splay arm.

Attach the chain motor(s) to the grid or lifting bar using the shackles provided.

**Step 2**

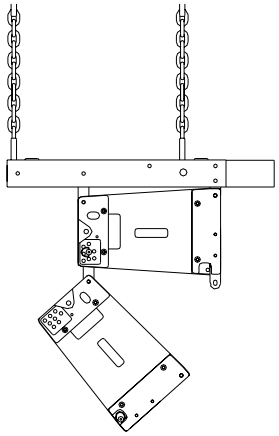
Gradually lift the grid using the motor(s) so that the rear corners of the lifted box are approximately 0.5m above the floor.

**Step 3**

Position the next box face down on the floor beneath the rear of the grid. Lower the grid to align the rear of the flown box with the box on the ground. Remove the quick release pins from their storage locations and fold out the rear splay arms.

Secure each arm in place into the rear channel of the enclosure above by inserting a quick release pin into the hole position corresponding to the cabinet splay angle required and through the hole in the splay arm.
**Make sure that the same hole position is used in both sides.**

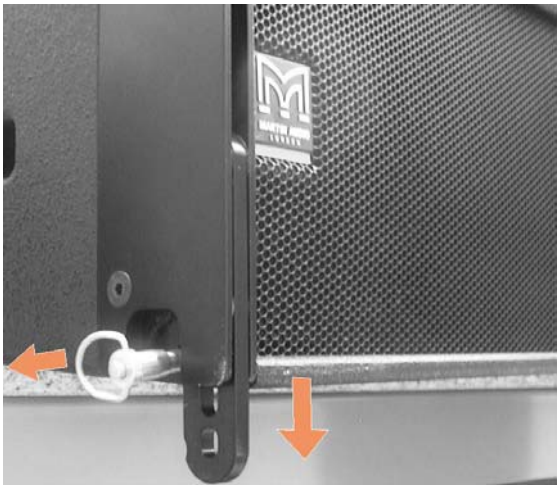
**Step 4**



Lift the whole assembly until the lower cabinet clears the floor and is free to swing.

**Step 5**

Remove the pin at the front of the upper cabinet to release its captive tongues.



Lift the front of the hanging cabinet using the handles on the side and locate the front tongues within its front rigging assembly. Secure the tongues in position with the quick release pins.

**Make sure that the upper cabinet tongue has dropped fully before inserting the quick release pin to link two cabinet fronts**

## Safety Note:

**Use great care when handling quick release pins, front tongues and rear splay arms.**

**Never insert fingers or hands between boxes when chain hoists are moving.**

**Step 6**

Repeat Steps 2-5

## Safety Checks

- **As the array is lifted, make a visual and physical check to make sure that all the front tongues are correctly located.**
- **Ensure that all quick release pins are in their correct locations and secure. The pins are locked when their central buttons are out.**

**Attach safety steels as soon as the system is at its final working height.**

## 3.3 De-rigging and Dismantling the Array.

De-rigging and dismantling the array is the reverse of the assembly procedure. All precautions and safety measures apply.

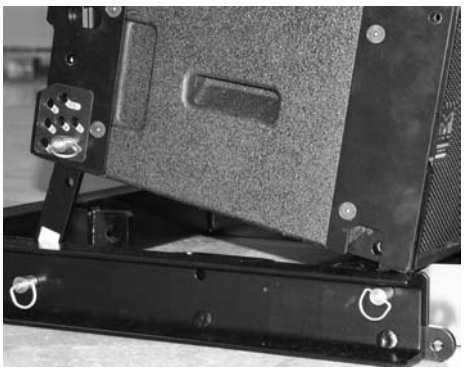
- Ensure that no-one is beneath the array.
- Remove all safety steels before lowering the array.
- Lower the array in a smooth and controlled fashion.
- Make sure multiple motors track each other to avoid excessive tilting beyond the safe working load of the system.

## 3.4 Ground Stacking

The W8LM may also be ground stacked using the standard suspension grid. The grid is designed to support ground stacks of up to 6 enclosures. The grid should be placed on a level surface and be appropriately secured. For example, if stacked on top of WSX or WLX subwoofers, ratchet straps may be used to secure the grid to the subwoofers. Always attach cabinets to the grid in the front position to ensure maximum stability. Make sure that the grid's "V" feet do not overhang the sub.

Note that the bottom box does not necessarily have to be parallel to the grid – it can be tilted up or down using ground stacking bars, (part number: HAM09002) so that the ground stack can be curved to suit the vertical coverage requirements of the venue.

**To attach the W8LM to the grid for ground stacking:**



**i)** Place the grid on a level surface in the same orientation as for flying the W8LM.

**ii)** Remove the two quick release pins that hold the captive front tongues in place and rotate the tongues out of the channels.

**iii)** Release the front tongues on the first cabinet and lower them into the channels on the grid front. Fix in place with quick release pins.

**iv)** Attach the ground stack bars into the rear receptors of the grid using the quick release pins that were removed from the front of the grid. Swing these bars up into the rear brackets of the cabinet and fix with quick release pins at the desired splay angle. (Use the two pins that are fitted to the additional pair of small attachment bars which are mounted to the sides of the grid)

**v)** Repeat with subsequent cabinets by placing the front tongues of the upper cabinet into the lower cabinet front brackets and then set the cabinet splay angle by swinging the lower cabinet splay arms up into the upper cabinets rear brackets and then pinning in place as described previously.

**When de-rigging make sure that the pins removed from the grid are put back in place in order to lock the grid's captive front tongues in position during transportation.**

## Section 4. Safety Points & Procedures.

- Rigging should only be undertaken by specialist personnel with established, proven expertise. All W8LM users must read this manual before attempting to rig a system.
- All personnel involved in rigging (or working in an area where rigging is taking place) should wear safety helmets and protective footwear.
- Personnel assembling a system on site have a duty to ensure the safe construction, adjustment and deployment of the system. Before use, all the system components must be subjected to careful and rigorous inspection and any component or assembly which appears to have been abused or damaged must be rejected immediately and replaced. A system must not be deployed if there is any doubt about its safety and integrity.
- The safety of the system is affected by its operating environment. If, for instance, a flying system is deployed out-of-doors during heavy rain, high winds or storms, safe operation may be compromised. Always be alert to slippery or moving components.
- System adjustments must be carried out by hand only - no levers, hammers, mechanical implements or other aids should be used to apply additional force.

**NOTE: Sliding parts should be kept in good condition and lightly lubricated to avoid jamming – see Care & Maintenance procedures later.**
**Distorted parts have probably been abused and should be replaced.**

- All mechanical systems show signs of wear after prolonged use. Heavy use, lack of maintenance, exposure to water or corrosive agents, deformation or damage through abuse or improper storage or transport will all accelerate wear and reduce the safety of the system. Owners and users of the flying system must take all practical steps to protect the system from deterioration and put a planned maintenance procedure into operation.

- When constructing and deploying the system is to check, check and check again. Never assume or take anything for granted - the most experienced and competent system riggers can (and sometimes do) make mistakes so always check your own work and that of the person next to you.

- Use a suitable work platform to check complete arrays. Note that it is not possible to adjust/or remove quick release pins with the array suspended in the air - the array must be lowered to the ground.

- A system technician should provide a test signal to check for correct speaker wiring and band zoning before the array is too high to correct. Always disconnect the loudspeakers at the racks before raising the system to avoid stretching cables!

- The safety of the work crew should be paramount at all times. Site safety rules must be clearly understood and observed by all.

- One competent, experienced person should be in charge of operating the hoists and should issue clear loud warnings. He should be satisfied that everyone is clear of the load before operating the hoists. Only essential rigging personnel should enter the work area.

- Ensure that no-one ventures beneath the array until safety steels have been attached.

## Section 5. Care & Maintenance.

The W8LM flying system is a safety-critical mechanical assembly so it is vitally important that users adhere to a strictly enforced and documented regime of inspection and preventative maintenance. Those who use the system must be fully informed of inspection procedures and of their role in those procedures.

The principal flying system components are all finished in a black powder coat finish. Under normal conditions of use, this finish will, unless damaged, protect the main components against rusting and corrosion. Any exposure to water, rain, or corrosive chemicals during transport or use could corrode and, therefore, weaken elements of the system. Sliding parts are at the greatest risk from rust and damage. Regular, thorough inspection for evidence of corrosion is essential. We recommend the application of a moisture displacing lubricant (such as WD40) to all sliding parts.

The system should be subjected to close visual inspection every time it is unpacked or packed. To provide a cross-check, the inspection should be carried out by more than one person.

For a realistic inspection, the system should be set up and suspended as if it were about to be used. During the set up all moving parts should be examined for free movement, looseness, or signs of wear on adjacent or mating surfaces.

- It is essential that quick release pins move freely and lock positively. Check for signs of deformation and wear.

- Splay arms (at the rear of the W8LM) should rotate easily. Check them for signs of deformation and wear.
- Sliding tongues (at the front of the W8LM) should move freely. Check them for signs of deformation and wear.
- Splay arms and sliding tongues should be parked using quick release pins after use.
- A log book should be kept with the system. This should show a complete inspection and maintenance record.
- Declarations of Conformity should be kept with the log book. No system should ever be deployed without being accompanied by these documents.

## Flying Frame (Grid)

A close visual inspection should be made of the entire surface of the suspension frames. Check for are any signs of buckling, twisting or other deformation. The surface and the weld seams of the frames should also be clean and show no signs of corrosion, erosion or cracking. The manufacturer's labels and engraved marks should not have been tampered with.

## General

Any defects which cast doubt on the safety of the flying system it should be reported. The defective part should not be used.

Permanently installed flying systems pose fewer safety problems than touring or mobile systems. Regular safety inspections should also be undertaken however.

# Section 6. Bi Annual Test and Certification

Every Martin Audio W8LM flying system is supplied with a CE Declaration of Conformity.

**In the UK, after a period of one year from the date of issue, the system will need to be thoroughly inspected by a competent person and a Certificate of Examination issued in accordance with LOLER (Lifting Operations and Lifting Equipment Regulations 1998).**

**In the UK the Certificate of Examination will need to be renewed every six months.**

Note: LOLER is a UK regulation. Operators outside the UK should comply with their local and national health and safety regulations.

## Proof Load Test

If necessary, a proof load test procedure should be carried out by an experienced test engineer, qualified and accredited to inspect, test and issue safety certificates for

mechanical lifting equipment. The test applies only to the W8LM flying frame (grid) assembly.

The serial number, date of manufacture and safe working load of the frame are all detailed on the identity plate.

- No proof load test should be carried out on any component presented as part of a W8LM flying system which does not carry the manufacturer's identity plate.
- No proof load test should be carried out on any flying frame presented as part of a W8LM flying system where the details on the attached manufacturer's identity plate have been defaced or altered.