

# HANDBOOK

## Leema Acoustics Hydra Power Amplifier

HYDRA





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## **Declaration of Conformity**

We hereby declare that the product to which this declaration relates, is in conformity with the following standards: EN60065, EN55013, EN55020, EN61000-3-2, EN61000-3-3. The product design also follows the provisions of 73/23/EEC, 89/336/EEC and 93/68/EEC Directives.

## **Environmental Issues**

Leema operates a 100% recycling program. All waste materials generated as part of the manufacturing process at Leema's headquarters are recycled via a licensed specialist company.

Although Leema electronics operate in standby mode as opposed to being fully switched off, the power drain has been optimised to a negligible level. Contrary to popular audiophile practice, we do not recommend leaving our power amplifiers permanently powered. All Leema amplifiers have been designed to attain full operational specifications and sound quality within a few minutes of switch-on.

## **Made in the UK**

Leema products are designed and manufactured in the UK. This includes all metalwork, printed circuit boards and power transformers.

## **Contact Us**

Leema may be contacted via our website: [www.leema-acoustics.com](http://www.leema-acoustics.com) or by telephone: +44 (0)1938-811900

## Introduction

Congratulations on your purchase of a Leema Hydra amplifier.

The Leema range of products has been painstakingly engineered in the United Kingdom to offer genuine state-of-the-art performance.

Partnered with suitable equipment, Leema amplification will provide audio performance far beyond that of their competitors and will equal or better the performance of products costing many times their purchase price.

A notable feature of all Leema amplification is incredible bass power and control, due to massive current capability, together with superb clarity and finesse in the upper frequencies with stunning realism in the midband.

Purchasers should read and follow this instruction manual, paying particular attention to the user installation and safety advice section.

This manual has been written to enable you to achieve the very best performance and maximum listening pleasure from your investment.

We wish you many years of pleasurable listening... Move Your World!

With best regards

The Leema Team.

## **VERY IMPORTANT**

Before connecting your new Leema Hydra to the rest of your system, please ensure that the loudspeaker cables are correctly and firmly attached to the binding posts on the rear of the unit. All required sources and LIPS cables should also be connected **BEFORE** inserting the mains power leads to the system and powering for the first time. The Hydra amplifier has no output short circuit protection since such circuits limit the output current capability of the amplifier and even complex protection circuits have undesirable and audible side effects. Short circuiting the amplifier with power applied will damage the amplifier and can be dangerous.

## **User installation and safety advice**

Please ensure that the mains voltage of your new Hydra amplifier is correct for your region. The setting is displayed on a label below the mains power inlet. The mains voltage setting is not user adjustable, therefore the amplifier must be returned to the manufacturer if any changes are required.

Ensure the mains supply is switched off at the wall socket, or unplugged before installing or moving the amplifier.

Do not use near water, for example do not place a potted plant on top of the unit or allow drinks to be placed near the unit. If liquid is spilt in to the cabinet, remove the mains lead from the wall immediately. The amplifier should then be returned to your dealer for safety testing before re-use. Failure to do so may result in electric shock or even fire! Do not use the amplifier in damp conditions, e.g. outside of the house.

Keep away from direct sunlight and other heat sources and ensure adequate ventilation around the amplifier to maintain proper cooling. Units **MUST NOT** be stacked directly on top of each other.

Avoid touching the amplifier cabinet after prolonged use as the case and heatsinks may become hot to the touch.

Never attempt to open the cabinet. There are no user adjustable parts inside and doing so will invalidate the amplifier's warranty.

In the event of an electrical storm, remove the mains power lead from the wall outlet.

As with all high-powered amplifiers, high voltages can occur at the output binding posts. Loudspeaker connection should only be carried out with the unit switched off. Care should be taken to ensure there is no possibility of a short circuit behind the unit when in use, for example, metal framed hi-fi units may be a hazard.

Leema amplifiers do not have any output short circuit protection so extreme care must be taken.

## Hydra overview

The Leema Hydra is a very high power output, microprocessor controlled, stereo power amplifier. Thanks to the LIPS (Leema intelligent protocol system) interface, it can be used to bi-Amplify a Tucana in an audiophile stereo system, act as the power amplifier in a stereo pre-power combination or become part of a stunning home cinema or surround music system. Each component in your system will dynamically re-configure in real time depending on your individual system requirements. The microprocessor control gives an unprecedented degree of sophistication, making the Leema constellation series easy to use for all the family. No longer will only one member of the family know how to play a CD or watch a movie. The built-in intelligence learns your preferences without menus and confusing options.

**Loudspeaker Outputs**

The loudspeakers connect here. Ensure correct polarity. Red terminal is +, Black terminal is -.

**WARNING:**  
Do not make connections with unit connected to the mains supply.

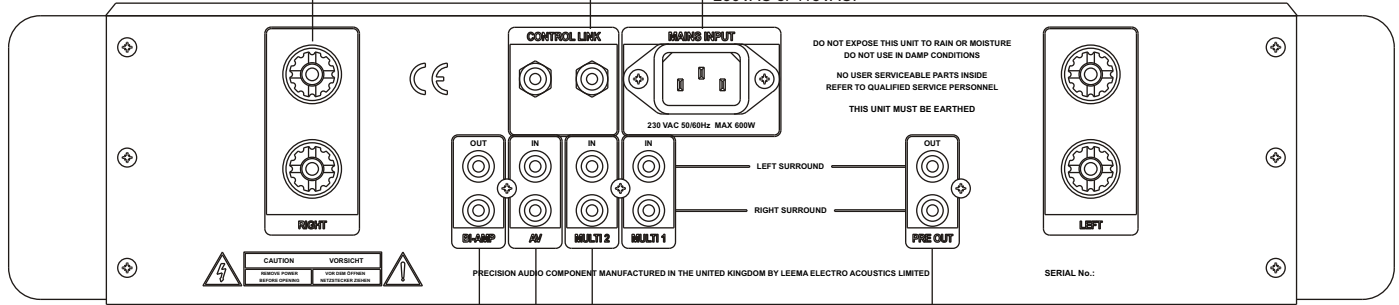
**SHORTING THE LOUDSPEAKER OUTPUTS WILL DAMAGE THE AMPLIFIER**

**'LIPS' bus connectors**

This allows communication between various Leema system components.

**Power Inlet**

Ensure that the specification indicated below the connector is correct for your area. This will either be 230VAC or 115VAC.



**BI-AMP OUTPUT**

This output is a duplicate of the PRE OUT and is used to feed another Hydra for BI-AMPING.

**AV DIRECT**

The AV Direct input is intended for connection of an AV processor or similar.

**WARNING:**  
Any source connected here **MUST** have it's own volume control. When the AV input is selected, the volume level is preset. If a fixed level source is connected here e.g. a CD player, the resulting volume level will be **extremely high**.

**INPUTS**

MULTI 1 and MULTI 2 are normally used for the surround channels of multi-channel sources, e.g. DVD players etc.

When the Hydra is used as a slave in a Pre-Power or Bi-Amp configuration, the AV input becomes the power-amp input. No other inputs are then used.

**PRE-AMP Output**

This output may be used for bi-amping or for bass extraction when used with a Leema Corvus.



## Connections

### Input connection

**WARNING:** The AV DIRECT input must not be used with sources that are not equipped with an independent volume control e.g. most CD players and DVD players. This input is designed to be used only with an external surround sound processor that has an independent volume control, or when the Hydra is used as a fixed level power amplifier, e.g. in a pre-power or bi-amp configuration. The Hydra has an internal link which must be correctly set either by the factory or by your dealer, to configure the unit for fixed level or for normal operation.

**AV DIRECT**> The Hydra's AV DIRECT input is provided for those using a dedicated external multi-channel decoder or processor equipped with a volume control. Sources with fixed output levels such as CD or DVD players **MUST NOT** be connected here. When AV is selected, the volume level defaults to a low setting and then slowly rises to a preset unity gain point. The volume of the Corvus and the Hydra will track the system's volume. Great care should be taken when using the AV direct input since an excessive volume level could easily result. However, unlike other systems, the volume control on the Leema system is still active and can be adjusted away from the pre-set point as a safety feature. Selecting another input on the Tucana then re-selecting the AV input will reset the unity gain point. In a surround system, the Tucana's AV inputs should be connected to the surround processor's left and right analogue outputs. The processor's left and right surround outputs should then be connected to the Hydra's left and right AV inputs. The remaining centre and subwoofer outputs from the processor should connect to their respective inputs on the Corvus. For a more detailed explanation of how to connect the system in AV mode please see the Corvus manual.

The AV DIRECT input becomes the power amp input when the Hydra is optionally configured for fixed level operation.

Great care should be taken when using the AV DIRECT inputs since an excessive volume level could easily result. For a more detailed description of bi-amplifying please see the next page.

**MULTI 1** > In a full surround system consisting of a Tucana, Hydra and Corvus, Multi 1 is used to connect the analogue outputs of a multi-channel source such as a DVD-A, SACD or DVD player equipped with onboard multi-channel decoding. In such a system the front left and right outputs from the source machine would connect to the Multi 1 inputs of the Tucana. The machine's surround left and right outputs would then connect to the Hydra's Multi 1 inputs. The remaining centre and subwoofer outputs from the source machine connect to the corresponding inputs on the Corvus.

**MULTI 2** > The Multi 2 inputs operate in the same way as Multi 1 and may be used for a second multi-channel machine.

### **OUTPUTS:**

**PRE OUT** > The Pre out connections mirror the selected system input e.g CD, or Multi 1. These outputs are controlled by the Tucana's volume control and can be used for a variety of uses. In a surround system they would be used to feed the Corvus' side surround extraction inputs. Other examples include feeding a second amplifier in another room for a simple multi-room system, or as a line level feed to one or two subwoofers.

**BI-AMP** > This connection is provided for those who may wish to bi-amplify a Hydra, for instance the surround channel Hydra in a home cinema system could be bi-amplified. In this scenario use the Bi-amp outputs to connect the second Hydra's AV inputs.

In a bi-amp Leema system, Tucana is used to drive the tweeters in the loudspeakers and a Hydra is used to drive the woofers. This offers an increase in clarity by reducing intermodulation distortion. The loudspeaker no longer draws bass current from the amplifier feeding the tweeter, resulting in cleaner high frequencies etc.

The loudspeakers must be suitable for bi-amping, this is normally the case where there are two pairs of binding post connections available on the rear of the loudspeaker cabinets. When bi-amping, it is Vital to remove the bridging links from the connection panel on the rear of the speakers, otherwise the outputs of the two stereo amplifiers will be connected together which will result in considerable damage. If you are considering bi-amping, please contact your dealer or Leema Electro Acoustics Ltd. for advice.

## Loudspeaker terminals

There are two pairs of shrouded loudspeaker terminals on the Hydra's rear panel, one pair for the left loudspeaker and one pair for the right loudspeaker. They can accept 4mm banana type plugs or bare wire connections, however the 4mm banana plug holes are fitted with plastic plugs to comply with BSEN60065 safety regulations. Removal of these plugs will invalidate any electrical safety approval of this product, but is necessary if banana plugs are to be used.

When using bare wires, strip about 10mm of insulation from the end of the cable, insert it in to the hole revealed by unscrewing the binding post heads. Gently screw down the head until finger tight. Do not use excessive force to tighten the posts since this can cause multi-strand cables to fray and, in extreme cases, to bridge the loudspeaker terminals causing a short circuit, which could seriously damage the amplifier.

## Cables

Never underestimate the importance of good quality speaker cables, bell wire or lighting flex will simply not do. Speaker cables can be very synergistic. The better the system resolution, the more easily the differences between cables can be discerned. To offer the best possible signal flow, Leema electronics are internally wired with NORDOST mono-filament cable. NORDOST speaker cables and interconnects will provide superb results. For those with a tighter budget, Leema's own LynX cables will fully complement the system.

## Front panel controls

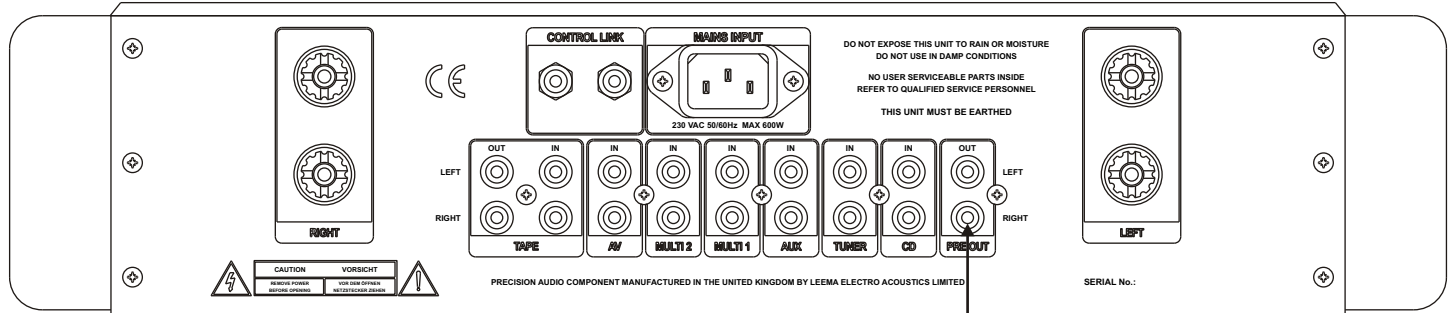
### Standby button

The standby button will be illuminated in standby mode. By default, Hydra will automatically turn on if the Tucana controlling the system has any of its multi-channel inputs selected, or if it is being used for bi-amping a system. However, the possible permutations for bi-amplified Hydras in a large scale system are potentially quite complex. For instance you could have a whole

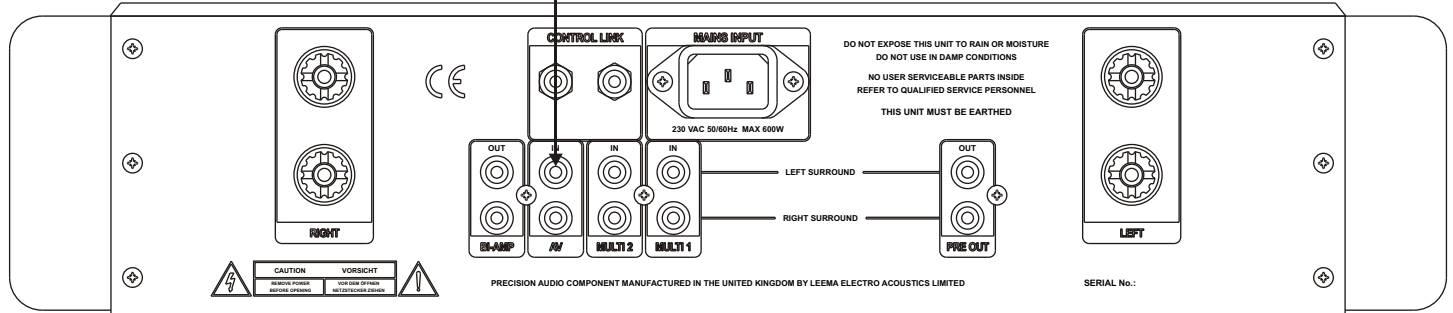
surround system which is bi-amplified, consisting of a Tucana with it's partnering Hydra covering front left and right duties, a pair of Hydras for the surround left and right channels and a Corvus and Hydra for the front centre. The Hydras would then need to power on and off in the correct sequence with their partnering units. Thankfully, their power on status can very easily be re-programmed. Simply select the required input on the Tucana, then press and hold the standby button on each Hydra you wish to associate with that input until it's information ring flashes once and the desired Hydra powers up. Repeat the Hydra re-programming sequence for each input selection on the Tucana. The Hydras will now power on correctly for each input source selection as desired.

### **Volume control**

The volume control is in fact a high quality Burr Brown precision attenuator operating under microprocessor control. The ring of blue LEDs, act as a visual indication of the volume setting. This has the advantage that it is clearly visible when viewed from a distance or when using the remote control. This method of volume control permanently ensures the highest fidelity without the gradual degeneration of conventional motorised volume controls. The volume attenuator also controls the Pre-out and Bi-amp out volume levels.



**TUCANA**



**HYDRA**

**BI-AMPING A TUCANA USING A HYDRA**

## Technical Discussion

### Topology

Starting with the pre-amp and control stage, input selection is performed by gold over silver contact relays under control of the microprocessor. The audio is then buffered by audiophile quality OP275 amplifiers in order to present the Burr Brown precision attenuators with a low impedance drive signal. Next, the controlled signal passes to the dual-mono class AB power amplifiers and also to the buffered preamp outputs.

The left and right power amplifiers are totally separate and have their own power transformers, rectifiers and reservoir capacitors. A third transformer powers the control electronics, thus completely separating the microprocessor from the audio electronics.

The power amplifiers use a well established topology comprising differential input stage, class A voltage amplifier stage with constant current load and class B output stage. Each stage is highly optimised following the general teachings of design guru Doug Self, with notable exceptions drawn from our own design research.

Each output stage uses a class A driver stage and has three pairs of very high performance, hand matched output transistors. Recently, some reviewers have been critical of the use of multiple output devices. This is completely unfounded as multiple devices offer many benefits over single pairs of devices:

- Distortion is greatly reduced at lower load impedances due to reduced beta droop.
- Output impedance is reduced due to multiple parallel-connected emitter resistors.
- Device electrical and thermal stresses are reduced offering increased reliability.
- Output current capability is increased.
- Safe operating area of the output stage is increased.

Contrary to another common misconception, 'timing' cannot be compromised.

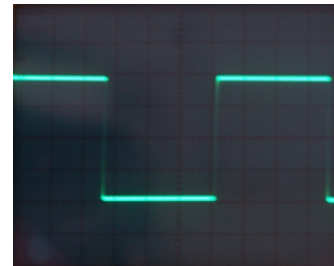
The square wave performance of an amplifier is the ultimate timing test. A look at the square wave performance of a Hydra is testament to the time domain performance of the design. If multiple devices did cause errors in the time domain, the resultant square wave would be significantly degraded. This is simply not the case. Apart from the gentle rounding of the corners, caused by amplifier input bandwidth filtering, the square wave response is virtually perfect and has no overshoot or ringing.

On the subject of ringing, if the amplifier is tested in to a load including a capacitive element, inaccurately trying to simulate an electrostatic loudspeaker, ringing will be observed at the output in response to transient signals. In fact, this ringing is not caused by the amplifier. It is simply the resonant combination of the amplifier output inductor and load capacitance. No notice should be taken of any test reports including the level and makeup of this ringing, as the results are totally dependant upon load type and applied stimuli.

The power amplifiers incorporate no output stage protection circuits. Leema designers feel that even quite complicated protection schemes remain audible. If the output stage fails due to a short circuit or component failure, power supply fuses offer safety protection and an auto-detect and disconnect circuit protects the loudspeakers from damage.

The resulting amplifier has the following characteristics:

- Low noise
- Very low distortion, typically better than class leading class A designs
- High output current delivery
- Low output impedance
- Fast and detailed yet silky smooth audio presentation
- Very robust and reliable if used correctly



Tucana 1KHz Square Wave

The following section is intended for installers, system integrators and third party manufacturers.

## **What is LIPS?**

LIPS or Leema Intelligent Protocol System, facilitates communication between various items in a Leema audio system. It allows units such as Tucana, to control other items in a chain. Leema's 5.2 surround system is a good example, where a Tucana controls a Hydra and Corvus. Key information including volume level, input selection and power control is passed through the bus enabling other units to operate in synchronisation. Intelligence is added within each receiving unit, for example, a Hydra installed as part of a surround system 'knows' that it won't be required when listening to a stereo source such as CD. Therefore, when the Hydra 'sees' the CD input, it powers itself down.

Each Leema unit can be controlled via the LIPS bus. Controlling a Tucana externally for example, enables it to be used within a home automation system.

### **LIPS Specifics**

The LIPS bus is driven by an open-drain output. Leema can supply interface modules as required. The communication standard follows the common RS232 format of No Parity, 8 data bits and 1 stop bit. The baud rate is 38400.

### **LIPS Packets**

Each communication on the LIPS bus contains a packet of four data bytes as follows:

First a header is sent with a value of 255. This alerts the receivers to incoming data.

Next, a command header is sent. For a volume command, this would be 40. (see below for details).

Next, a value relating to the command is sent. For volume this would be 0 to 248.

Finally a tail byte is sent with a value of 0.



**LIPS Protocol Headers** For further information, please contact Leema Technical Support.

Value = 20 ID header. This header is private and must not be issued by any controlling software.

Value = 30 This is a general command header. The command values are as follows:

10 = Infra Red control OFF. These commands control the local IR receiver

20 = Infra Red control ON.

100 = Power ON.

101 = Power OFF.

103 = Select Input CD

104 = Select Input TUNER

105 = Select Input AUX

106 = Select Input MULTI 1

107 = Select Input MULTI 2

108 = Select Input AV DIRECT

109 = Select Input TAPE

110 = LED ring ON

111 = LED ring OFF

Value = 40 Volume header. Valid command values are 0(mute) to 248(maximum volume)

Value = 50 Serial Pass Through. When a Tucana, Hydra or Corvus receives this header, the header and value are passed on up the bus. This enables future expansion options.

Value = 60 This is issued by Corvus. The command value contains the sub filter frequency.

Value = 70 As 60. The command value contains the sub filter slope.

Value = 80 As 60. The command value contains the extract status.

Value = 90 Spare header for future use.

Value = 100 Spare header for future use.

## Audio Specifications

Power Output: 8 ohms: 148 Watts RMS per channel, 4 ohms: 285 Watts RMS per channel

Minimum load impedance: 2 ohms.

Output Current: greater than +/- 50 Amps

Frequency response +0/-3dB @ 1W: 5Hz - 80KHz

Noise (A weighted, volume control minimum): -100dBm

Signal to Noise ratio (A weighted, ref: 285 Watts RMS 4 ohms): -104dB

THD (10 Watts RMS 4 ohms, 1KHz): 0.004%

THD (Max output before clipping, 4 ohms, 1KHz): 0.004%

Maximum DC offset: +/- 15mV

Sensitivity for maximum output (CD input): 565mV RMS

Sensitivity for maximum output (other inputs): 311mV RMS

Output Impedance: 0.057 ohms Damping Factor (8 ohms): 140

Specifications subject to change without notice.



