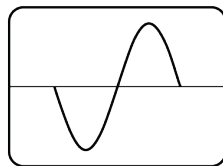


S C I E N C E  
A M P L I F I C A T I O N



HELHAWK  
MkII



USER MANUAL

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## Intro

Thank you for purchasing the Hellhawk MkII amplifier! This manual covers the amp's different features, maintenance, tube, and warranty information in detail.

## Front Panel

**Input Jack:** 1/4" jack for your guitar.

**Channel I/Channel II Switch:** This mini-toggle switch allows you to select Channel I or Channel II when no footswitch is plugged in. With the footswitch plugged in, the front panel switch is overridden/inactive.

**Gain 1:** Controls the overall amount of gain of Channel I, the cleaner of the two channels. This channel ranges from warm cleans to classic vintage crunch.

**Gain 2:** Controls the overall gain of Channel I, which is the gainier of the two channels. This channel ranges from crunch to high gain.

**Bass:** Adds bass frequencies to both channels when turned clock-wise, and reduces bass when turned counter-clockwise.

**Middle:** Adds mid-range frequencies to both channels when turned clock-wise, and reduces mid-range when turned counter-clockwise.

**Treble:** Adds treble frequencies to both channels when turned clock-wise, and reduces treble when turned counter-clockwise.

**Presence:** Adds presence and bite to the power amp section of the amplifier when turned clockwise.

**Loudness 1:** Adjusts the overall volume of Channel I.

**Loudness 2:** Adjusts the overall volume of Channel 2.

**OFF/STBY(Standby)/ON switch:** 3-Way switch: down is OFF, middle is Standby, and up is ON.

**About Standby:** Standby mode mutes the sound and allows the tubes to heat up before applying high voltage to amp when turned ON. Leave in Standby for 30 seconds to a 1 minute before switching ON. Standby can also be used to mute the amplifier while leaving the tubes warm for short breaks. For long breaks it is best to turn the amplifier completely off.

To turn OFF, follow the same turn-on procedure – but in reverse order – allowing the amp to idle in Standby mode for about 30 seconds before powering down. While it is perfectly okay to turn the amp OFF immediately, idling in standby before powering down lets the filter capacitors inside the amp fully discharge. If turned off immediately, there will still be some sound as the filter caps continue to discharge, which may be annoying.

*Note: Amps fitted with the Ghost Effects Loop will experience a short delay when switching from Standby to ON. This is normal.*

**Indicator lamp:** Attractive red neon light to indicate the amp is ON.

## **Rear Panel**

**WARNING: Use with grounded power outlet only! Discard power cord immediately if ground pin is damaged/broken. The ground connection is for your safety in case of a fault condition!**

120 VAC power input: Plug in the included standard IEC power cord here. For use with 120 VAC only unless otherwise specified. Canadians, you are good to go too!

### **Fuses**

**WARNING: Only check/change fuses with amplifier unplugged from the outlet!**

Your amp is fitted with fuses for safety and to protect the amplifier's most expensive parts. Fuses are user-replaceable, and if a fuse does need replacement, always replace with the correct type and rating (as designated on the rear panel of the amplifier).

To check if a fuse is blown, push and twist counter-clockwise to remove the fuse holder and see if the small wire inside the glass is broken. There may also be a burnt area the inside of the glass.

If you replace a fuse, and it blows again, there is likely a more serious problem. Please contact us before changing the fuse again at [info@scienceamps.com](mailto:info@scienceamps.com) so we can further assist you with the trouble-shooting.

**Mains Fuse:** 1 ¼" x ¼", Slow Blow, 250V glass cartridge fuse. This fuse is fitted for safety, but can still blow under some normal amp faults. If the indicator lamp does not come on, then it is likely the Mains Fuse has blown (otherwise the lamp itself has burned out).

**HT Fuse:** 1 ¼" x ¼", Slow Blow, 250V glass cartridge fuse. If the amp produces no sound at all then it's most likely the HT Fuse has blown. The most common reason for this is a shorted

output tube.

**Output Tube Fuses (200W model only):** 1 ¼" x ¼", Fast Blow, 250V glass cartridge fuse. 200W models are fitted with extra fuse protection. If either of these fuses blow, a red LED illuminates on the back to indicate a failure. The output tubes work in pairs, and if an output tube fuse blows, power is cut off to one pair of the four KT88 output tubes (even though only one is likely damaged). This allows the amp continue to run safely on the remaining pair of tubes at half power with change in tone.

If you would like to keep running on half power until the faulty tube(s) can be replaced, it is optimal to set the impedance selector one setting below what the cab's impedance rating. For example, when running at half-power into an 8 Ohm cab, switch the impedance selector to 4 Ohms.

*Tip: You can run your 200W amp at half power by simply removing one of the fuses. Just remember to turn down the impedance selector one setting as stated above -if doing this for a prolonged period.*

### **Speaker Jacks and Impedance Selector**

*Note: Speakers must be rated for at least the full rated clean output power of the amplifier (50W, 100W, or 200W depending on your model). Under overdrive conditions, the clean power can be exceeded by tens of watts, and therefore it is preferable to use speakers whose combined power rating exceeds the clean power rating. This topic is up for debate as some speaker manufacturers rate their speakers with this in mind (i.e. four 25W rated speakers may be OK for a 100W amp), however it is still better safe than sorry!*

**CAUTION: Always verify a speaker cabinets impedance before using with the amplifier. An impedance mismatch can potentially damage the amplifier and is not covered under warranty.**

**Using one speaker cabinet:** With the amp OFF, plug in speaker a cabinet either Speaker Output jack.

**Using two speaker cabinets:** When using with two speaker cabinets, both must be the same impedance (i.e. two 8 ohm cabs), and the impedance selector should be set for half each cab's impedance. For example:

- When using two 8 ohm cabs: Set the impedance selector should be set to 4 ohms.
- When using two 16 ohm cabs: Set the impedance selector should be set to 8 ohms.
- Using two 4 ohms cabs: This configuration is not supported.

## **Footswitch Jack**

1/4" jack for the included footswitch. Connect with 1/4" instrument cable (not included). Toggles between Channel 1 and Channel 2. When the red LED is illuminated, Channel 1 is active.

## **Effects Loop (optional):**

The Ghost series effects loop is designed to work ideally with instrument level effects (i.e. effects pedals) and some line level equipment (i.e rack effects units) gear. In general, time-based effects such as reverb and delay are best placed in the effects loop. The effects loop is located after the preamp section of the amp, where most of the overdrive/distorted tone is generated. This allows time-based effects to be heard more cleanly and clearly. For example, plugging a delay into the effects loop allows you to delay your distorted tone, giving a clear delay effect. Conversely, plugging a delay into the input of the amplifier would overdrive the delay, giving a murkier, washed-out delay sound. There is no correct way to use your effects, it's all a matter of preference.

*Note: The Return jack of the Effects Loop may also be used as a power amp input, and in conjunction with a separate preamp unit.*

*Tip: A volume pedal also works well in the effects loop, acting as an overall master volume, which can be extremely useful in a live setting, however a buffered pedal is preferred to prevent treble loss.*

**Send Jack:** Connect to the input of your effects via 1/4" shielded instrument cable.

**Return Jack:** Connect to the output of your effects via 1/4" shielded instrument cable.

## **Tube Life & Biasing**

**WARNING:** Tubes can become extremely hot during normal operation. Make sure the amplifier is OFF, and always allow tubes to cool before handling to prevent burns.

### **Preamp Tubes:**

Preamp tubes typically last many years, but fail occasionally. Typically they will become noisy or "microphonic" before they wear out. This is characterized by ringing, static, or popping noises.

### **Changing Preamp Tubes:**

V1, V2, V3, V4 (see tube diagram on pg. II)

To remove tubes, gently pull upward using a very slight circular motion if necessary. When re-inserting a preamp tube, mind the pin/socket orientation as they are “keyed” to insure proper installation.

### **Output Tubes:**

Output tubes (See tube diagram on pg. II ) generally produce a strong output for 6 months to a year when played regularly, then they may become dull sounding, and/or the amplifier may begin to lose some power. Output tubes may last much longer depending on how hard the amp is played. Sometimes they die gracefully, sometimes abruptly causing a fuse to blow, which in turn protects the amplifier from further damage.

It's sometimes possible to see in plain view which power tube(s) is damaged. If necessary, remove the output tubes to inspect them by grabbing the plastic base, and gently pulling up in a shallow circular motion.

Here are things to look for:

- The shiny silver area on top of tube has turned white (tube has lost vacuum).
- Burned spot(s) on the large gray structure inside the tube (tube has “red-plated”/drawn excess current).
- The filament is not lighting up (not common, but can happen).

Like preamp tubes, sometimes output tubes can become “microphonic.” This occurs when some part internal part of the tube becomes physically loose. In turn, this noise then gets amplified. The noise can be anything from static, a high-pitched ringing, or intermittent sputtering noises. This is usually exacerbated by vibration from the speaker cabinet. If you think a tube may be microphonic, try isolating the amplifier from the speaker cabinet to see if the noise stops.

*Tip: If you think you have a microphonic tube, you can very gently tap on each tube with a pencil's eraser to see if the sound becomes worse, stops, or changes. All tubes will amplify the sound of a tap little, especially preamp tubes, but for example, if you hear an intermittent ringing sound and tap each tube to find V7 (for example) is causing the ringing to start/stop, you can be sure it's the problematic tube!*

### **Changing Output Tubes:**

V5, V6 (100 & 200W version only) and V7, V8 (see tube diagram on pg. II)

In general, it's best to change all output tubes at once and preferable to buy a “burned-in” matched set from a reputable dealer.

Output tubes can be replaced and biased by a qualified technician, however if you would like

to replace and bias the output tubes yourself, please see the detailed information about your amp's biasing system and bias procedure in the following sections.

## **Bias Control & Test Points**

Every Science Amplifier comes equipped with user-accessible bias test points and bias control located on top of the chassis, adjacent to the output tubes. They can be accessed by removing the rear panel of the amplifier.

Please see the diagram on pg. 11 to identify the controls and test points.

**Bias Control:** The bias control is a recessed slot adjustment (looks like a 1/4" jack at first glance), which can be adjusted with a normal flathead screwdriver.

**Test Points** (for use with standard multimeter probes):

- **Ground 1, Black:** Plug in negative multimeter probe here while measuring bias for V5 and V6.
- **V5, Red:** Plug in positive multimeter probe to measure V5 output tube bias.
- **V6, Red:** Plug in positive multimeter probe to measure V6 output tube bias.
- Test points below are only fitted on 100W & 200W models:
- **Ground 2, Black:** Plug in negative multimeter probe here to check bias for V7 and V8.
- **V7, Red:** Plug in positive multimeter probe here to measure V7 output tube bias.
- **V8, Red:** Plug in positive multimeter probe to measure V8 output tube bias.

## **Bias Measuring & Biasing Procedure**

### **What is bias?**

Simply put, bias refers to the idle current flowing through the output tubes. In fact, all tubes need to bias, but in guitar amps the bias of the preamp tubes is permanently set and does not need adjustment. Here we will be only discussing the measurement and adjustment of the output tubes' bias current.



**CAUTION: Maladjustment of the bias controls can lead to output tube failure. The bias adjustment is not fool-proof, and output tubes can be under-biased (i.e. too “hot”). The bias control needs a wide enough range to accommodate different tube types and sets (tubes vary from set to set), and therefore it is possible to under-bias the output tubes in some cases. If under-biased for a sustained period, the output tubes will likely fail. Science Amplification is not responsible for output tube failure due to maladjustment of bias controls.**

**Please familiarize yourself with the bias procedure before making bias adjustments. If you feel uncomfortable making adjustments, take the amp to a qualified technician. We do, however, encourage you to bias yourself. It is easy once you get the hang of it, and can save you quite a bit of cash!**

**WARNING: Adjusting the bias requires the amplifier to be ON. The output tubes adjacent to the test points and adjustment control get very hot during normal operation and there is a potential burn hazard. Be careful near those hot tubes!**

Here are some situations where you may need to check and/or adjust the bias:

- You are changing tubes.
- You are changing tube type from EL34 to 6L6 or vice versa (applies to 50W and 100W models only).
- The amp is quieter than normal.
- The amp has a hum that is not affected by the setting of the Loudness control.

#### **What you'll need:**

- A phillips screwdriver to remove the amp's back panel.
- An electronic volt meter (a digital model is preferred) with a millivolt setting. These can be found inexpensively and just about any one will do.
- A small to small flathead screw driver to adjust the bias control.
- A speaker cabinet to plug into.

#### **Biasing Procedure**

(Please reference the tube diagram on pg. 11)

#### **Measuring & Adjusting Output Tube Bias:**

- I. Use a phillips head screw driver to remove the rear panel of the amplifier.

2. With a speaker cabinet plugged in, turn the amp to Standby, let it warm up for about 1 minute, then turn ON.
3. Set your multimeter to DC millivolts (mV).
4. Insert the negative/common test probe into the black test point (ground). On 100W and 200W models use the black test point that adjacent to the tubes you are measuring.
5. Plug the positive probe into the red test point behind the tube you are measuring.
6. Take note of the reading on the meter.
7. Remove the probe from the red point, and repeat the procedure for each tube. On 100W and 200W models, move the negative probe to the other black test point nearest the tubes you are measuring.

Your readings should be the same within 10 millivolts, which means the tubes are reasonably matched. If a reading on a particular tube is below the safe/suggested ranges (see below) by more than 10-15mV, then it's possible a tube has gone bad and needs to be replaced.

Here are the bias settings/ranges for each tube type and model. Biasing on the lower, "cooler" side will slightly increase headroom and tube life. Biasing higher, or "hotter" will encourage quicker power tube distortion, but slightly decrease tube life. These differences are very subtle, however.

- **50W & 100W model:**  
EL34: 30mV to 40mV  
6L6: 36mV to 46mV
- **200W model:**  
KT88: 25mV to 35mV

8. If adjustment is necessary, turn the bias control with the small flathead screwdriver while monitoring the number on the multimeter to obtain the desired setting.

### **Changing Output Tube Bias:**

1. If ON, turn the amplifier OFF and wait for tubes to fully cool. To remove, gently grab the plastic or metal base and pull upwards, using a very slight circular motion if necessary.

2. Insert the new tubes, minding the “key” on the bottom of each tube so that it matches with the socket.
3. Turn the bias control to minimum (All the way counter-clockwise).
4. Follow steps 2-7 from the “**Measuring & Adjusting Output Tube Bias**” instructions above.
  1. Turn the bias control clock-wise with a small screwdriver until you reach the desired bias setting listed above and also on the **Tube Chart & Bias Diagram** on pg. 11
  2. Allow tubes to idle for 15 minutes, then recheck bias and adjust if necessary.

## **Safety**

- Always use a 3-prong cable into a grounded outlet. This makes sure the amplifier is always grounded and safe during the rare occurrence the chassis should become "live" (electrified).
- Tubes become very hot during normal operation. Allow them to cool before handling to prevent burns.
- Never change tubes with the amplifier ON.
- Always make sure the amp's vents are open, allowing heat to escape and air to flow freely.
- Keep the amp away from moisture, and never put any beverages on top of the amplifier, no matter how convenient it may seem!
- Only change fuses with the amp unplugged from the outlet!
- There are potentially lethal voltages present inside the amplifier. Do not open the amplifier chassis unless authorized and are a qualified technician.

## **Limited Lifetime Warranty**

Science Amplifiers are warranted to be free from defects in workmanship for the lifetime of the original owner. Electronic components such as capacitors, resistors, transformers, jacks, and potentiometers are warranted for 3 years (not including tubes, see below). Any part

determined defective by Science Amplification within the 3 year period shall be repaired or replaced by Science Amplification without charge for parts and labor provided the unit is returned and transportation costs prepaid. Science Amplification will pay return shipping costs to the original owner. Any unauthorized repair, modification, or tampering voids this warranty.

The warranty excludes:

- Normal wear and tear: worn out tubes, jacks, cosmetic damage, etc.
- Misuse and abuse: operating the amp without a speaker connected (although the amp has some built-in protection against this), operating the amp into the wrong speaker load, improper tube installation, using the wrong value fuses, maladjustment of bias controls, etc.
- Accidental damage: Dropping the amp, spilling liquid inside, etc.
- Acts of "God": Natural disasters and other non-preventable/foreseeable events that damage the amplifier.
- Tubes, unless within manufacture's warranty period of 90 days (replacements offered at manufacturer's discretion).
- Any damage caused by authorized or unauthorized repair or modification that is not performed by Science Amplification.

For warranty service, please email [info@scienceamps.com](mailto:info@scienceamps.com) for return authorization. Amplifiers must be sent back in the original packaging or equivalent packaging. The cost of return shipping to Science Amplification is to be prepaid by the owner. Science Amplification is not responsible for damage caused in return shipping. Science Amplification will pay for the shipping back to the customer after the warranty work is completed.

In general, we will be able to fix your amp for free, and help with tube changes, etc. if needed. We will also be happy to modify the amp in any way possible until the amp is perfect for you. Non-warranty repair is also available – please inquire for shop rates.

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## **Care and Maintenance**

Do not use household cleaning products. If control panels need cleaning, use only a soft clean dry or damp cloth to wipe off smudges. To clean tolex, wipe with a damp cloth.

Periodically check the 4 mounting screws on the bottom to make sure they are tightened.

These screws secure the chassis to the head cabinet, and also insure contact to the aluminum RF shielding plate inside the cabinet.

If possible, move the amplifier when the tubes have had the chance to cool down for a couple minutes. Because the tubes get very hot, the elements inside become more vulnerable to physical damage until the tubes have cooled. In general, try to move the amp off stage last.

## Tube & Bias Diagram

Birds-eye view of the Hellhawk's tube layout and bias controls:

