

S C I E N C E

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

HELLHAWK

USER MANUAL V.3

50 WATT

## Intro

Thank you for purchasing a Science Hellhawk 50W guitar amplifier! This manual goes over the different features of the amplifier, maintenance, tube, and warranty information as well as some general tube amp info.

## Front Panel

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

**Full gain control:** Adjusts the overall gain for the Full channel. This channel is voiced to have more low-end, warmth and an overall darker tone. The Full channel can be blended to taste with the Focused channel or muted by turning the gain control all the way down.

**Focused gain control:** Adjusts overall gain for the Focused channel. This channel has a tighter low-end and an upper-mid range and high frequency emphasis. The Focused channel can be blended to taste with the Full channel or muted by turning the gain control all the way down.

**(Pull) Bright switches:** Each gain control has its own respective bright switch, which boosts the upper frequencies in either channel. Pull the knob(s) to activate bright boost. (Note: the effect of this control is diminished the higher the gain controls are set.)

**Treble:** Adds treble frequencies to both channels when turned clock-wise.

**Middle:** Adds midrange frequencies to both channels when turned clock-wise.

**Bass:** Adds bass frequencies to both channels when turned clock-wise.

**High Cut:** Control upper-most frequencies and harmonics. The effect of this control becomes increasingly apparent the more the amp becomes overdriven, smoothing out the highest harmonics present in distorted tones. The control will not dull clean tones or cut into the critical mid frequencies.

**Loudness:** Controls the overall the volume of the amplifier.

**On/Off switch:** Turns the amplifier on and off.

**Standby/Play switch:** With the amplifier ON, Standby mode mutes the sound allows the tubes to heat up before applying high voltage in Play mode. Leave in this mode for 30 seconds to a 1 minute before switching into Play mode. Standby can also be used to mute the amplifier while leaving the tubes warm short breaks. For long breaks it is best to turn the amplifier completely off.

To turn off the amplifier, follow the same turn-on procedure in reverse – allowing the amp to

idle in Standby mode for about 30 seconds before powering off. While it is perfectly okay to turn the amp off immediately, idling in standby before powering off 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.

## **Rear Panel**

**120 VAC power input:** Plug in the included standard IEC power cord here. For use with 120 VAC (USA) only unless otherwise specified.

**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!

**Footswitch jack:** Plug included 2-button footswitch here.

## **Speaker Jacks and Impedance Selector**

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

**Using one speaker cabinet:** With the amp OFF, match the impedance selector with the speaker cabinet's impedance. Always verify a speaker cabinets impedance before using with the amplifier. An impedance mismatch can potentially damage the amplifier.

**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 because there is not 2 ohm tap on the Hellhawk's output transformer.

## **Footswitch**

The first button on the footswitch toggles between the Full and Focused gain controls. When the LED is illuminated the Focused channel is on.

The second button blends both the Full and Focused channels together when the LED is illuminated. When the Blend is switched off, the amp will go back to the channel of the first button.

*Tip: The first button can be switched while in Blend mode, allowing the user to switch back to either channel.*

## **Bias adjustments**

**Left bias adjustment:** Controls the bias of the left output tube, V5 (See tube chart on pg. 10). The setting is locked in place by the outer locking nut. To make an adjustment, slightly loosen the outer locking nut.

**Right bias adjustment:** Controls the bias of the right output tube, V4 (See tube chart on pg. 10). The setting is locked in place by the outer locking nut. To make an adjustment, slightly loosen the outer locking nut.

**Test jacks:** For use with standard multimeter probes.

**Black common probe jack:** Plug in common meter probe here.

**Left red probe jack:** Plug in probe to monitor left output tube's bias voltage.

**Right probe jack:** Plug in meter probe to monitor right output tube's bias voltage.

## **Bias procedure (50-watt version)**

**WARNING!:** Maladjustment of the bias controls can lead to output tube failure. The bias adjustments are not fool-proof, and output tubes can be under-biased because a reasonable bias range needs to be given to account for different output tube samples. If under-biased for a sustained period output tubes will likely fail. Science Amplification is not responsible for output tube failure due to mal-adjustment of bias controls.

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

Note: A electronic volt meter (digital preferred) with a millivolt setting is needed to make bias

readings/adjustments. A digital multimeter can be found cheaply at any hardware store. Here's the cheapest we've found on the web, which is totally sufficient for the job:  
<http://www.harborfreight.com/7-function-digital-multimeter-90899.html>

With a speaker cabinet plugged in, turn on the amp, let it warm up for about 30 seconds, then take off Standby into Play mode (The volume can be all the way down for the test). Let the amp run for a minute or two.

Next, set the multimeter to DC millivolts (mV).

Insert the black test probe into the black jack on the rear panel, and the red probe into either red jack. The left jack measures the bias of the left output tube (V5), and the right jack measures the bias of the right output tube (V4).

For the correct bias range you should read between:

- **6L6:** 37mV to 43mV
- **EL34:** 31 mV to 36mV
- **KT88:** 31 mV to 36mV

Anything lower settings will not harm the tubes, but anything higher than:

- 41 mV and up per tube for **EL34s**
- 50mV and up for **6L6s**
- 41 mV and up for **KT88**

will lead to shortened output tube life or imminent failure.

Remove the red probe, and insert it into the other jack to check the reading. Ideally it should be the same as the first reading, but a couple millivolts difference is no big deal.

Here are some situations where you may need to check the bias:

- The amp sounds thin, or abnormal in any way.
- The amp is quieter than normal.
- The amp hums more than normal.
- The bias controls are accidentally maladjusted.

If a reading is below the safe range by more than 10-15mV, then it's likely a tube has failed on that side and needs to be replaced. This will also cause the other side to be higher than normal.

The output tubes will also age unequally (much like car tires), so some adjustment may be needed through out the tubes' life to keep them in balance. Although it's not necessary to keep the tubes perfectly balanced, it will keep the amp putting out maximum power with the least amount of hum.

If adjustment is necessary, first loosen the outer lock-nuts on the bias adjustments. Make move the control with a flat-head screwdriver (a guitar pick works well too), while monitoring the number on the multimeter. You may have to adjust both controls back and forth until they are balanced because they are somewhat interactive.

## **Tube life and troubleshooting**

Output tubes (V4 and V5 – See tube chart on pg. 10) generally produce a good strong sound 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 gently, sometimes abruptly causing a fuse to blow, which in turn protects the amplifier from further damage. Output tubes may also become microphonic like preamp tubes.

It's sometimes possible to see which power tube(s) is damaged. If necessary, remove the output tubes to inspect them (Remove power cord, allow tubes to cool, then grab by the plastic base, and gently pulling up in a circular motion). Here are things to look for:

- Shiny silver area on top of tube turns white.
- Burned spot on the large gray structure inside the tube.

Sometimes a output tube or preamp tube will become “microphonic” when something becomes physically loose inside the tube's glass envelope. In turn, this noise then gets amplified through the speaker. 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.

*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 or changes. All tubes will amplify the sound a little, especially preamp tubes. But for example, if you hear an intermittent ringing sound and tap each tube to find V1 is causing the ringing to start and stop, you can be sure it's the problematic tube!*

In general preamp tubes (V1, V2, and V3 see tube chart on pg. 10) can last many years, and usually become microphonic before wearing out or failing.

## **Changing preamp tubes**

V1, V2, and V3 (see tube chart on pg. 10)

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.

### **Changing output tubes**

V4, V5 (see tube chart on pg. 10)

**CAUTION!: 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.**

In general, it's best to change both output tubes at once (V4, V5 – See tube chart on pg. 10), and preferable to buy a "matched pair" from a reputable dealer. However, because of the dual-bias system, it is possible to replace only one output tube, then balancing the bias level with the existing output tube.

*Tip: Buy “burned-in” tubes when possible for maximum stability and minimal bias drift.*

To change tubes, remove the old tubes and set both bias controls all the way down (counter-clockwise). Insert the new tubes minding the “key” on the bottom of the tube, and slowly bring up both bias controls until they are equal and in the safe bias range.

If tubes are not pre-“burned-in,” check the bias after playing to see if it has drifted from the initial setting. Full burn-in may take up to 24 hours depending on the tube set. This is why burned in tubes are preferred.

### **Different tube types and bias ranges (50-watt version)**

The Hellhawk 50W can use both EL34, 6L6, and KT88 output tubes. Below are the correct bias ranges for all types:

- **6L6:** 37mV to 43mV
- **EL34:** 31 mV to 36mV
- **KT88:** 31 mV to 36mV

Anything lower settings will not harm the tubes, but anything higher than:

- 41 mV and up per tube for **EL34s**

- 50mV and up for **6L6s**
- 41 mV and up for **KT88**

will lead to shortened output tube life or imminent failure.

## Fuses

### **WARNING: Only check/change fuses with amplifier unplugged from the wall socket!**

Fuses are user-replaceable, and if a fuse needs replacement, always replace with the correct "T" type and rating. The "T" stands for "Time delay" also known as "Slow Blow." Also be sure to use the correct amperage rating (Ex. 1A = 1 Amp). These fuses are the 3AG type and are commonly available. The correct fuse values are located on the back panel of the amplifier.

If a fuse blows, it's a good thing! Fuses are put in place for safety and to protect the most expensive parts of the amplifier. Fuses can blow for various reasons, however the most common is a output tube failure. 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.

## Safety

- Always use a 3-prong cable into a grounded outlet. This makes sure the amplifier is always grounded and safe in 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 wall!
- 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 5 years (not including tubes, see below). Any part determined defective by Science Amplification within the 5 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.

Speakers carry Eminence's 7-year manufacturer's warranty. The terms can be found here: <http://www.parts-express.com/docs/warranty/eminence-manufacturer-warranty.pdf>

If you think you have a speaker problem, please contact us first.

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 paid by the owner. Science Amplification is not responsible for damage caused in return shipping. Science Amplification will pay for the return shipping 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. Don't hesitate to contact us!

### Care and Maintenance

If plexiglass panels need cleaning, use only a soft clean, and dry 100% cotton cloth to wipe off smudges with just a little pressure to avoid scratching. If needed dampen the cloth with a little water, or use Novus brand plastic polish. Avoid harsh alcohol-based cleaning products as they may cause the acrylic to “bloom.” Also avoid the ubiquitous “microfiber” cloths, which can leave lint and/or tiny scratches the plexiglass in some cases since they vary so greatly in quality.

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

Birds-eye view of the Hellhawk's tube layout. Only replace tubes with specified types listed below:

