Building and Operating: The Keyall HV + kit
grounded filament transformer (xfmr)
from Jackson Harbor Press

Introduction:

The Keyall HV + is the result of a suggestion from Wes, W3KW. The circuit is the same as the Keyall HV plus a simple regulated 3.3 Volt power supply. This allows the builder to embed the kit inside a tube rig using the 6.3 VAC filament winding to provide power instead of a battery. In addition, the builder may elect to add an MOV and/or an RC snubber circuit to protect the output of the Keyall HV + from transients.

General notes on building the Keyall HV +

The two MOSFET transistors should be handled as little as possible to prevent static damage. The builder should use a grounding strap and anti-static mat if available or at the very least, work on a grounded metal surface and be sure to touch ground prior to touching the MOSFETs.

One decision the builder should make before starting construction of the Keyall HV + kit is how the project will be mounted in the rig. The circuit board can be mounted to the case with small standoffs fastened with 4-40 or M3 sized hardware. The holes for the two MOSFET transistors should NOT be used for mounting the board if the transistors are mounted horizontally because the transistor tabs are electrically connected to the drain of the transistor. Two diagonal mounting holes should be sufficient to mount the board to the case. Note that only the hole below Q2 is grounded, the other three holes are unconnected.

The components should be inserted a few at a time, soldered in place and then leads clipped.

Building the Keyall HV +

Step 0) Check the schematic of the transmitter. If one side of the filament transformer is GROUNDED then do NOT install diodes D2 or D4 in step 3e below.

Step 1) Get the parts together: All of the required board mounted components have been supplied but you will still have to provide off-board items to fully implement the kit. These items include:

mounting hardware, 4-40 or M3 sized
wire and solder

Step 2) Identify and orient the components: Most of the components should be fairly easy to identify and place - see the parts list and the parts placement diagram for descriptions. The PVI chip cannot be inserted incorrectly as the pinout is keyed. The MOSFET transistors just need to be mounted with the tab side AWAY from the PVI chip (printed side towards the PVI).

Step 3) Place and solder the components on the main circuit board: Use the parts placement diagram for information on the placement and orientation of the parts. If one side of the filament transformer is grounded use the second parts placement diagram titled: grounded filament xfmr. Clip the leads after soldering. Here is a suggested sequence:

a) mount C3 and C4 (small yellow capacitors marked 104) as shown at the bottom left of the board – then solder and clip the leads

b) mount U2 (TO-92 regulator marked 78L33) between C3 and C4 with the flat side away from the bottom edge of the board – then solder and clip the leads

c) install D5 (red 3mm LED) above C3 with the flat side (short lead) to the right - then solder and clip the leads

d) install C2 (1000 uF electrolytic cap) to the right of D5 with the negative stripe down – then solder and clip the leads

e) ***do NOT install D2 and D4 if one side of the filament transformer output is grounded*** - bend one of the leads of D1 to D4 over 180 degrees (usually I do the cathode, banded lead) and install at the 4 positions above D5 and C2. Make sure that the banded lead goes to the hole with the minus (-) sign. Then solder and clip the leads

f) this is a good point to check that the power supply section works. Hook up a 6.3 VAC source to the board ***(ground one side of the source by connecting it to the pad marked gnd to the right of C4 and connect the other to either of the points marked 6.3 VAC filament)*** . The LED should light dimly and the output at the pads marked gnd and + should be about 3.3 Volts.

g) form the leads of R1, the 120 ohm resistor (brown-red-brown-gold) – install as shown at the bottom center of the board – then solder and clip the leads

h) if the optional 6 pin DIP socket is being used, prepare the socket by clipping pin 5, also, insert the clipped pin (or some wire) in the hole of the pin socket to prevent accidentally installing the PVI incorrectly. Install the socket at the bottom left of the board as shown on the parts placement photo. Solder the leads.

If the socket is NOT being used, install the PVI as shown in the parts placement photo and solder the leads.

i) Install C1, the yellow .01 uF capacitor marked 103, as shown on the parts placement photo. Solder and clip the leads.

j) Q1 and Q2, the MOSFETs, can be inserted either horizontally or vertically. Install them as shown on the parts placement photo, then solder and clip the leads.

Step 4) Check the board: Before proceeding, take the time to check the bottom of the board for solder bridges. Use the bottom view photo as a guide to visually check for these shorts. It may help to clean the flux from the board and then use a strong light in conjunction with a magnifying glass to see these problems. Also, double check the orientation of the components.

Step 5) install the Keyall HV + in the rig

a) mount the board in the rig

b) if neither of the filament transformer leads is grounded solder a pair of wires from the two holes marked “6.3 VAC filament” to a convenient 6.3 VAC heater pair on a tube socket or terminal strip

if one of the filament transformer leads IS grounded then solder one wire from the hot (ungrounded) side of the filament transformer to either of the two holes marked “6.3 VAC filament” . Leave the other hole open. Connect a wire from the transmitter ground to the hole marked gnd to the right of C4. Be sure to remove D2 and D4 if they were installed by mistake.

c) unsolder the wires (ground and tip) from the transmitter key jack and connect those unsoldered wires to the two Keyall HV + outputs

d) finally, wire the key socket to the Keyall HV + pads marked Keyer and ground

Operation:

When the rig is powered up the LED should light up dimly. When the rig is keyed the LED should brighten.

Note that the LED will stay lit for several seconds after power is turned off – this is the 1000 uF cap discharging through the voltage regulator.

Circuit notes:

The Keyall HV + is essentially the Keyall HV circuit (a Solid State Relay) plus a 3.3 Volt regulated power supply driven by the 6.3 VAC filament power usually available in any tube transmitter.

Total current required by the Keyall HV + should be less than 20 mA.

The power supply has a full wave bridge rectifier ***(it's half-wave if the filament xfmr is grounded)*** driving a 1000 uF filter capacitor. A series red LED is used to drop a little of the excess voltage and also function as an indicator.

The SSR portion of the Keyall HV + uses a PVI (Photo Voltaic Isolator) to drive two n-channel MOSFETs. The MOSFETs have a common source connection which allows the Keyall HV + to switch positive, negative or AC currents without having to worry about polarity, just like a mechanical relay output. The PVI uses an internal LED to shine on a photodiode array to generate the approximately 10 volts of drive voltage needed for the MOSFETs to fully conduct.

The .01 uF 1000V disc bypass capacitor was added to the output of the circuit but it can be replaced by an appropriate MOV to clamp excessive voltages. In addition the user can add an RC pair on the output to act as a snubber circuit to dissipate any transient energy.

Modification ideas:

It is possible to key two different cathode keyed (positive) rigs with the same kit. One ham did this with the original Keyall to key both a transmitter and the VFO at the same time. He connected the common rig/VFO ground to the common source connection on the Keyall board, the source pin of the MOSFETs have small S on the circuit board. Note that on the Keyall HV + a hole was added connected to the common source node marked with an asterisk (*) on the board. Then one drain (small out on the circuit board) was connected to the transmitter and the other drain was connected to the VFO. The capacitor, C1, should either be omitted or connected from the common source ground to the transmitter key input. Another capacitor can be connected to the VFO if desired.

I wouldn't recommend using the kit with 12.6 VAC power. 5 VAC*may* work but 12.6 VAC will be too high a voltage. If the builder only has access to 12.6 VAC add a series resistor between one of the filament voltage tap points and the Keyall HV + power input to knock down the voltage to a more reasonable level.

The builder may want to protect the kit output transistors with an MOV (Metal Oxide Varistor) in place of C1 and/or an RC snubber pair to dissipate any energy from transient spikes. Pads and mounting space has been provided on the board. The exact values are left to the builder.

A better LED could be used, brighter/larger and it could be mounted somewhere it can be seen by the operator and wired to the Keyall HV + board. Also a white or blue LED will drop more voltage than a red LED.

Please feel free to email with any questions, comments, suggestion or problems with this kit. My email address is:

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Thanks for choosing the Keyall HV + kit and
Best Regards,

Chuck Olson, WB9KZY

4

List of parts included with the Keyall HV + kit

Ref	marking	Description
C1	103	.01 uf disc ceramic capacitor, yellow, 1000V
C2	1000 uF	1000 uF electrolytic capacitor
C3	104	.1 uf MLC capacitor, yellow, 50V
C4	104	.1 uf MLC capacitor, yellow, 50V
D1-4	1n400x	1n400x rectifier diode, x=0 to 7
D5	none	red LED, flatted shorter lead is the cathode
PVI	TLP591B	5 pin DIP, PVI (Photo Voltaic Isolator)
Q1, Q2	IRFBG30	1000V, 3A, n-channel MOSFET
R1	brown red brown gold	120 ohm 1/4 watt resistor
U1 is not used in this circuit		
U2	78L33	3.3 Volt regulator, TO-92
		circuit board
	6 pin socket	optional 6 pin socket for PVI modified to 5 pins by builder

Items you'll need to provide to complete the Keyall HV + kit

4-40 or M3 sized mounting hardware
solder, wire

Optional protective components:

R2, C5	RC snubber pair to dissapate transient spikes
MOV	Metal Oxide Varistor of appropriate voltage rating and lead spacing
	series fuse of appropriate current rating