

Universal H.V. power supply

Selectable:

VOLTAGE DOUBLER or BRIDGE RECTIFIER CIRCUIT

WARNING

THIS POWER SUPPLY CIRCUIT BOARD USES LETHAL VOLTAGES!

THIS IS NOT A BEGINNERS PROJECT!

***IF YOU HAVE NEVER WORKED WITH HIGH VOLTAGE BEFORE, SEEK THE
ADVICE OF SOMEONE WHO HAS!
IT MAY SAVE YOUR LIFE!***

INTRODUCTIONS

For

Bare PCB

KIT

ASSEMBLED

The Tactical Radio Gear, ***Universal H.V. power supply*** is intended for amateur radio amplifiers, requiring up-to a 4.5KV plate supply. The design is conservatively rated for 4500 VDC @ 2A ICS; and contains most everything needed on one PC board.

The ***Universal H.V. power supply*** is unique, in that either a Bridge or voltage-doubler configuration can be selected. Every feasible protection & safety possibility has been included in this design.

BUILDERS

BARE BOARD

Dimensions of the board: 6.9" x 7.97" inches. The height above the PCB is determined by the capacitor used, (1.97" inches nominal for the 50mm caps).

For those planning to build their own, the voltage rating of the filter capacitor chosen, will determine the power supplies maximum working voltage. The PCB layout uses the popular 10mm snap-in electrolytic capacitors:

- ❖ The ***Universal H.V. power supply*** will accept the common (10mm) lead-spacing. 30mm, (1.18"), or 35mm, (1.39") diameter snap-in capacitors. (1.97" inches nominal for the 50mm caps). Ten capacitors are provided, each one with provision for its own equalizing resistor.

FEATURES

Kit Unit Components

- ❖ The **Universal H.V. power supply kit**, uses: 10 x 30mmx53mm, capacitors: 680uF @ 450vdc. Tolerance: +/-20% Temperature rating 105°C
- ❖ 20 x 1KV @ **10amp** diodes, with **600A** peak surge (10A10) 5 x per leg
- ❖ 10 x 1/4" terminal-lugs - or solder the wires to the board
- ❖ PCB comes with 5 Nylon 2" stand-offs'

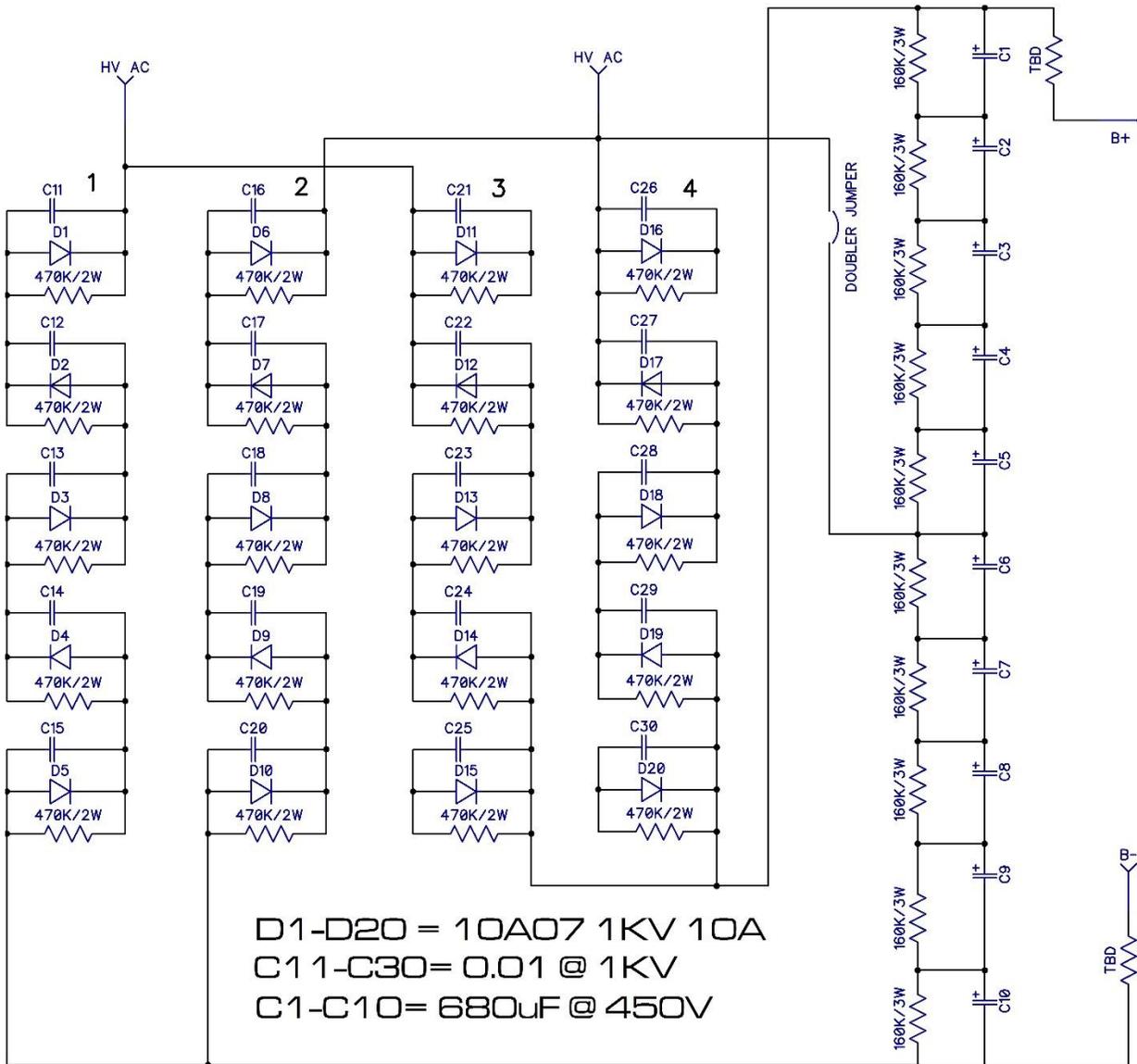
❖ PCB MECHANICAL DETAILS

- ❖ The PCB is a Heavy-Duty 2mm thick board, with 2 ounce copper on both sides.
- ❖ 1/4" - Spade lugs provide convenient connections, to make installation & removal of the module fast & easy.
- ❖ (5) X 8-32 mounting holes are provided, for insulated stand-offs, to mount the PCB.
- ❖ .01uF @ 1KV disc, capacitor is provided for each of the rectifier diodes. These caps suppress the commutation spikes, which are generated, when the diodes turn on to charge the reservoir capacitor, near the peak of the input sine wave. These suppression capacitors are especially important for sensitive equipment, like high-performance transceivers' where commutation spikes can infiltrate the whole system!
- ❖ Each diode has a 470K/2W equalizing resistor, for additional spike/surge and glitch protection; common with some types of tubes; and AC Line service(s)? They also provide a bleed-down path.
- ❖ Each filter capacitor has a 360K/3W equalizing/bleeder resistor providing a second bleed down path.
- ❖ Provisions for meter multiplier resistors, are located at both the B- & B+ ends of the power supply. Multiple accessory (3W) resistor positions, are provided on each buss, to allow the user to design their own IP monitoring arrangement & glitch resistor arrangement(s) if mounted on the PCB.
- ❖ The builder can determine what value(s) of equalizing resistors are best for their particular circuit arrangement.

USE CAUTION!!

This supply has two bleed-down paths for safety: The multiplier resistor string and the equalizing resistor string.

**NEVER ASSUME THEY ARE WORKING!!
ALWAYS FOLLOW THE SAFETY PROCEDURES ABOVE
AND STAY ALIVE!!!**



DANGER HIGH VOLTAGE

ALWAYS DISCONNECT POWER BEFORE SERVICING!

ALWAYS WATCH/MONITOR THE HV FALL TO ZERO!

ALWAYS KEEP ONE HAND BEHIND YOUR BACK WHILE WORKING ON ANY POTENTIALLY ENERGIZED CIRCUIT!

NEVER WORK ON ANY ELECTRONIC CIRCUITRY WHILE UNDER THE INFLUENCE OF DRUGS OR ALCOHOL OR WHEN TIRED OR SLEEPY!

ALWAYS USE A SHORTING BAR CONNECTED TO A LOW VALUE RESISTER TO BLEED OFF ANY POTENTIAL RESIDUAL CHARGE ON THE FILTER CAPS!

REMEMBER IT'S YOUR LIFE AT STAKE!!!

RECOMMENDED PARTS LIST

1. Resistor: 10 X 160K OHM 3W 5% AXIAL
DigiKey's P/N: **A138396CT-ND**
Mfg.: **TE Connectivity Passive Product** P/N: **RR03J160KTB** 160K ohms $\pm 5\%$
3W Through Hole Resistor Axial Flame Retardant Coating, Pulse Withstanding, Safety Metal Film.
2. Resistor: 20 x RES 470K OHM 2W 5% AXIAL
DigiKey's P/N: **A131626CT-ND**
Mfg.: **TE Connectivity Passive Product** P/N: **RR02J470KTB** 470K Ohms $\pm 5\%$
2W Through Hole Resistor Axial Flame Retardant Coating, Pulse Withstanding, Safety Metal Film.
3. STAND-OFF: 5 X Male-Female Threaded Hex Standoff, Nylon 6/6, 1/4" Hex Size, 2" Long, 8-32 to 8-32 Size Thread.
 - a. 5 X 8-32 Hex Nut.
4. Quick Disconnect Terminal: 10 X Quick-Disconnect Circuit Board Terminals, 0.25" Wide x 0.032" Thick Tab with Support, 0.56" Overall Height.
Molex P/N: 197050002 (*Note: 10 x are provided with the PCB*).
5. Rectifiers: 5 X per leg = 20 Rectifiers 10A@1000V
Mousers P/N: **621-10A07-T**
Mfg.: Diodes Incorporated P/N: **10A07-T**
6. Capacitor: 20 X 0.01uF @ 1KV. Disc. Ceramic .250 lead spacing.
7. Capacitor: 10 X Snap In Aluminum Electrolytic Capacitors - 680uF 450Volts Digi key P/N: **565-4976-ND**
Mfr. EKMZ451VSN681MR50S

Metering Resistor(s)

A high voltage meter multiplier resistor string, is included on the board to make use of meter movements with different FS values; including terminals to supply HV sensing protection is also provided.

The resistor values are to be determined by the metering requirements. Patterns (TBD) for 3W resistors, should accommodate the appropriate voltage divider network.

For higher wattage resistor(s), the PCB pads can be jumped and the glitch resistor mounted off board.

PCB Assembly

Start by making the mounting holes on the amplifier or power supply cabinet using the unpopulated board as the pattern/template.

Next, form the leads of the 10 equalizing resistors to fit their holes in the board. Now insert the resistors in their place on a ¼ inch spacer and trim the excess leads below the board.

Don't solder the resistors in place yet, set this aside for later. Install and solder the filter caps ***paying close attention to the polarity identified by the silkscreen.***

Caution: Make sure the caps are flush, and square to the PCB. The equalizing resistors can now be soldered in place. Next install the diodes, observing their cathodes as indicated by the silkscreen on the PCB.

Note: The ¼" spade lugs are meant to be tight in their holes on the board.

Metering

Jumper the (TBD) resistor position(s) as necessary to achieve the desired metering voltages'.

Note: If for any reason the HV meter ground return is not returned the B- Rail, the bottom of the meter multiplier string has to be disconnected from the rail and grounded to the chassis. This is the case when using a multi-meter in place of a dedicated HV meter. The meter multiplier string typically results in a voltage of 1% of the plate voltage.

Testing

Using a bench power supply, e.g. 5 volts for 5KV or 3 volts for 3KV etc. Adjust your circuit for a full scale reading on your meter. Check the voltage level of the supply with a high voltage probe while monitoring the voltage at the junction of your divider.

With power removed and capacitors bled off, apply the previously monitored voltage with a bench supply and calibrate your circuit to match the HV probe reading.

WARNING

DO NOT ADJUST YOUR CIRCUIT WHILE HV IS PRESENT ON THE BOARD!!
If a 0-130vac Variac is available, use it to supply the board with ac instead of the plate transformer, in-order to check for low voltage operation.

**REMEMBER THIS IS STILL
LETHAL
VOLTAGE**

-

USE CAUTION!!

This supply has two bleed-down paths for safety, the Multiplier resistor string, and the equalizing resistor string.

**NEVER
ASSUME THEY
ARE WORKING!! ALWAYS FOLLOW THE SAFETY PROCEDURES ABOVE
AND STAY ALIVE!!**

These component values are recommended. The builder is free to specify their own values. The 10A10 rectifier's can be substituted with the popular 1N5408. Additionally the equalizer resistors can be changed to accommodate the builder's preference(s).

TACTICALRADIOGEAR.COM

Any questions contact: ***tactical.radio.gear@gmail.com***