EM80 Magic Eye Driver Board – User Guide

WARNING - HIGH VOLTAGE IS PRESENT ON THE PCB, CAPACITORS CAN HOLD A CHARGE EVEN AFTER POWER IS REMOVED. TAKE CARE, EXERCISE CAUTION. THIS IS NOT A TOY!

A little Background

The driver board is designed to provide an easy way to experiment with the EM80/6BR5 magic eye tube. Driving magic eye tubes requires that a high voltage or B+ voltage is provided to various parts of the tube, along with a suitable heater voltage of 6 – 6.5 Volts.

The driver board provides the regulation needed to correctly feed the tube with the needed B+ voltage, but does not provide the power or plate transformer, this needs to be supplied by the end user.

Convenient screw terminal blocks allow for the easy attachment of the power supply cables and later in this document various options for providing the B+ voltage are discussed.

An RCA jack is also provided so that various inputs can be made to the driver board. Typically an amplified audio signal can be connected here to provide a simple visual of the audio.

Setting up the board – Power options

As supplied the board still requires a few extra parts. Most obvious is the EM80 or 6BR5 tube. These are available from various sources. All of these tubes are now very old and even so called New Old Stock (NOS) tubes could have sat in storage for many decades. This means that the tubes may be ‘soft’ or even unusable. Try to find a vendor that has some feedback on the tubes being sold to judge the quality of the products being sold, and the vendor’s reputation. Also look for some type of money back guarantee to see if ‘bad’ tubes can be exchanged or returned for refund.

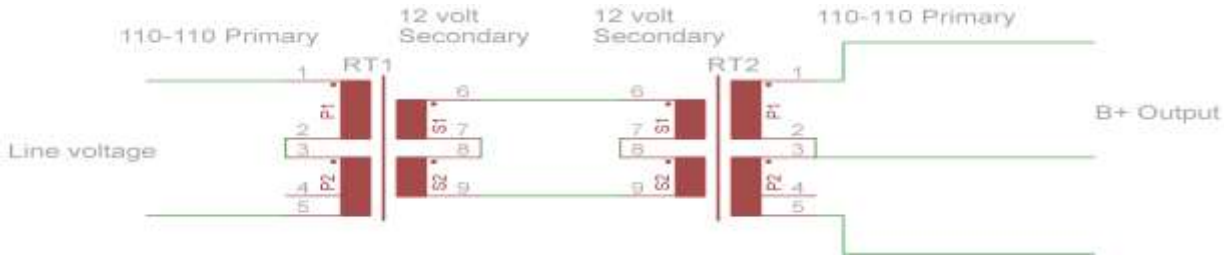
In addition to the tube the board also needs a source of high and low voltage. Typically the high voltage is going to be around 250 – 300 Volts and the low voltage 6 – 6.3 Volts. The 6.3 Volts can be DC or AC so a wall wart type power supply can be used for this voltage.

Electro-Resales

The high voltage or B+ supply is best supplied by a plate transformer with a secondary voltage of 150-0-150 up to 250-0-250 volts.

Plate transformers are getting harder to find surplus and new they can be expensive. A Hammond 260A Plate and filament transformer can be around $60 new. This is the best option as it provides the B+ and heater voltages, if a plate transformer is not a possible option, some alternative are shown below:

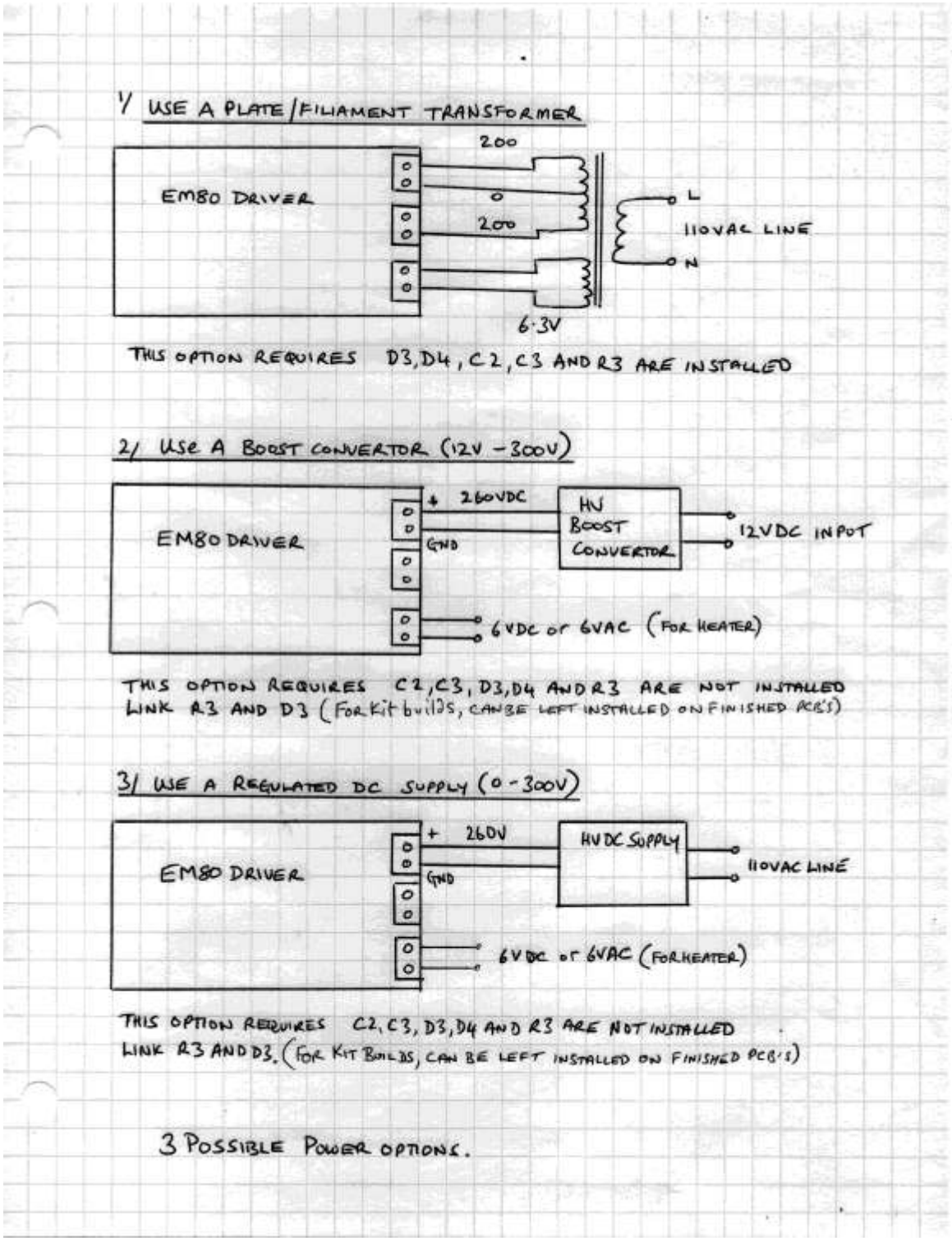
1. Back to back transformer arrangement. This uses two transformers with dual 110 Volt primaries and say 6 - 12 volt secondary's. Low cost transformers can be used in this set up. The primary of the first transformer is connected to the line voltage and the secondary is connected to the secondary of the second transformer, so that the second transformer Primary now outputs around 220 Volts which is sufficient to drive the B+ This diagram illustrates a possible set up:



2. The use of a high voltage boosts convertor. The booster takes 12 volts DC and outputs 100-300 volts of high voltage DC. While this is an option, this is best for those boards being built from kits as several components will not need to be installed. D3 & D4, C2 & C3 along with R3 are not required. If a finished board has been purchased these components can be left installed. The boost convertor will need to be set at around 260 Volts output and connected to the top most screw terminal block, with positive on the top terminal.

3. Another option is the use of a fully regulated HVDC supply. If this option is available, like for the boost converter, some components already on the board or included in the kits, D3, D4, C2, C3 and R3 are not needed but, can be left installed. The regulated supply will be connected to the top screw terminal block with the positive (+) connected to the top terminal.

The following chart drawn by Forrest Mims (Sic) helps to illustrate these options.



Setting up the board - Input options

Typically this type of display is used as a simple visualizer for an audio signal. When the board is first powered up the tube should show a single thin vertical line in the center of the tube display with small ‘fans’ at the lower left and right. To move the fan or expand the display requires a voltage to be applied to the control grid of the tube.

If the tube is going to be used in an audio application the easiest way to achieve this is to use a small amplifier (LM386 type) whose input is connected to the audio source and the output or speaker connection of the LM386 amplifier is connected to the EM80 driver board.

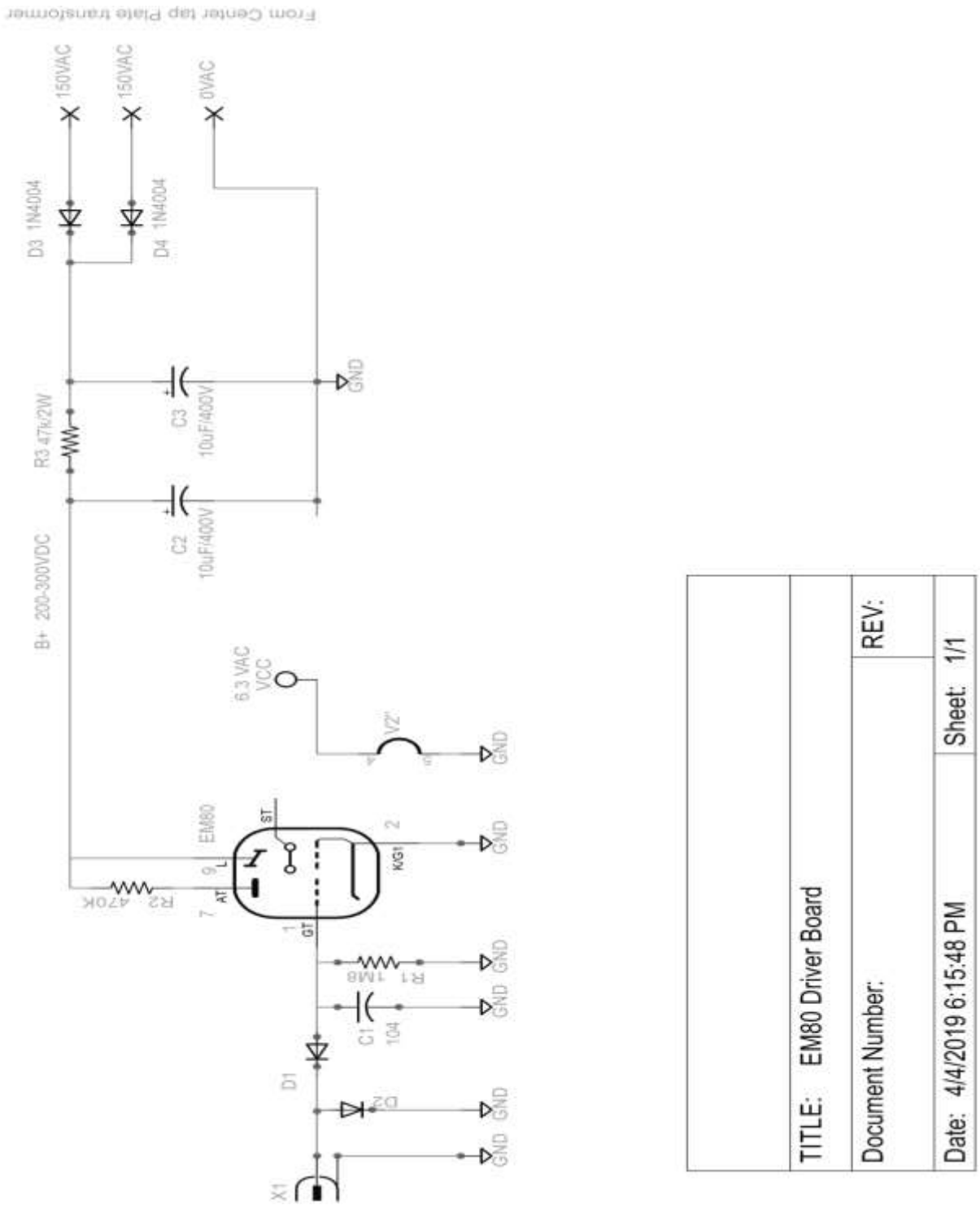
The amount of ‘drive’ required to move the tube fan display is quite narrow so some experimentation is needed with the amplifier settings.

It is also possible to move the fan display by applying a voltage that varies over a range of voltages from +10 V to -10 Volts. A square or sine wave oscillator can suffice for this.

Last words

The EM80 driver board has been provided for experimenters, the basic needs to drive the tube have been incorporated on the PCB, the power and drive options are up to you.

Remember this is a board that has high voltages present on the PCB tracks, take care and be mindful of the dangers high voltages can present.


From Center tap Plate transformer
150VAC
150VAC
0VAC
D3 1N4004
D4 1N4004
R3 47k/2W
C3 10uF/400V
C2 10uF/400V
B+ 200-300VDC
GND
6.3 VAC
VCC
VZ'
EM80
ST
KG1
AT
GT
R2 470K
R1 1M8
C1 104
D1
X1
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