

# Tube Amplification Guitar Pedal

Rishi Nandha V

With Guidance & Help from Mr. Peter Bossier and Mr. Bart Boydens

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## 1 Background

Before the age of semiconductors, for the purpose of signal amplification, Vacuum Tube Triodes were used. These got replaced by transistors eventually due to the uncertainty in behaviour of these tubes and the variation induced by the surroundings of the Tube. Nevertheless, a good amount transistor circuit design ideas originate from our experience with these Tubes that preceded them: Class-A and Class-AB amplifiers especially.

Although these Tubes are deprecated in most electronics applications, these are particularly sought after in the Music world. The iconic "distortion" sound that guitarists use til-date is but an artefact of amplification using such tubes. The classic amplifier heads used in the 80s and 90s were all using tubes and rectifiers to process the signal that comes out of a guitar, and are considered the peak of guitar signal processing even today.

Even though amplifier simulations model this distortion from the tubes well, there is still some scope to try out using actual tubes to do the same just. Moreover, with the amount of transparency that has been achieved today with solid state or digital amplifiers and nearly-flat response speakers, the iconic "distortion" sound could potentially be captured in a guitar pedal that adds a pre-amplification audio effect instead of a full-size amplifier head. Hence we try to build a Guitar Pedal with a Tube Amplifier with knobs controlling key parameters that affect the response.

## 2 Schematic Design

We divide the schematic into 5 sections for convenience:

1. Input Stage
2. Tube Amplification Stages
3. Tone Control
4. Output Stage
5. Power Regulation

## 2.1 Input Stage

The Input Stage includes a fuse and a non-inverting Op-Amp amplifier. The fuse is essentially a measure to protect the guitar from any large surge of current in case the experimentation in the pedal main amplification stages causes one. The non-inverting amplifier with a potentiometer in the feedback path lets us control the input volume that is being fed into the grid of the first tube amplification stage thus giving us more control on over-driving the tube or not. Moreover a non-inverting amplifier is chosen so that the amount of current drawn from the guitar pickup itself is minimized.

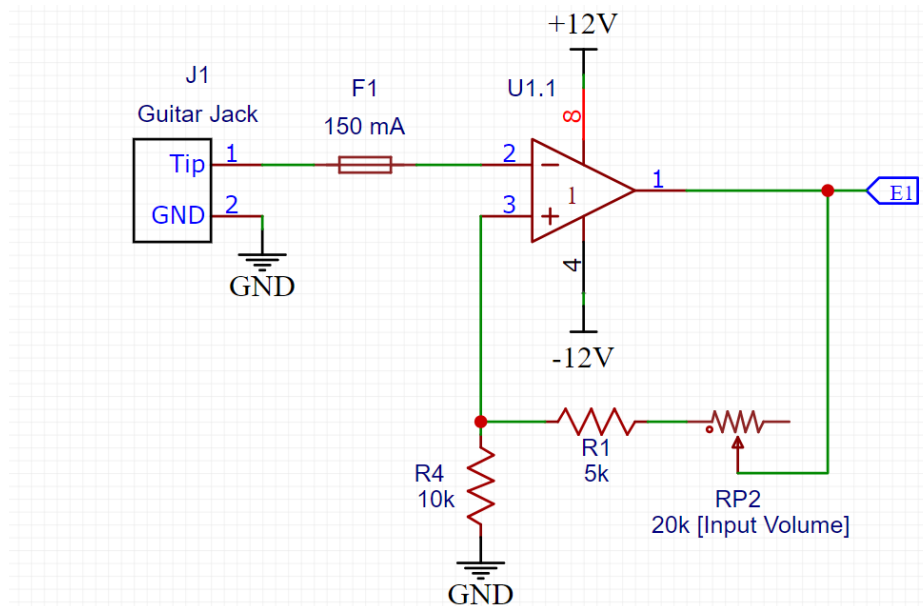


Figure 1: Schematic - Input Stage

As for the values of used, we estimate that 150mA is a safe amount of current to flow (even though not much should flow because we have connect it such that not much current will flow). The non-inverting amplifier's R1 and RP2 values are chosen to emulate the typical range of the output impedance of guitar pickups ( $5k\Omega - 25k\Omega$ ). Moreover, R4 is chosen to allow an input volume control from  $0.5\times$  to  $2.5\times$

## 2.2 Tube Amplification Stages

## 2.3 Tone Control

## 2.4 Output Stage

## 2.5 Power Regulation

## 3 Investigation

**4 Methodology**

**5 Results**

**6 Discussion**