Land Line Telephone Tap

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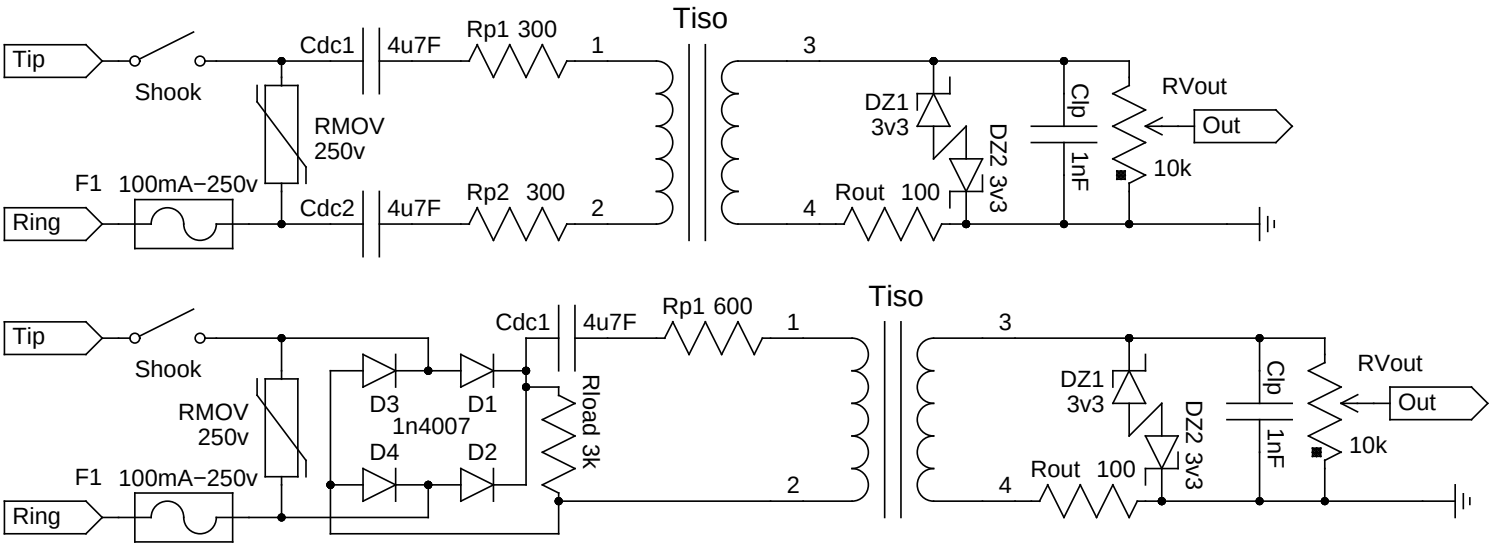

This is a circuit for a land line telephone tap directly from the wall outlet suitable for a recorder. The design goals are a clean audio signal and minimal phone line load/impact.

If properly wired, Tip is green (RJ11 pin 4) and Ring is red (pin 3). Reversals won't matter with both Cdc1 and Cdc2 blocking DC. Reversals also won't matter with the diode bridge version, but the DC offset must be higher than the voltage drop of two diodes and higher than the lowest dip in the audio. If multiple phones are on the line at the same time, this could be a problem.

Rload is needed for the diode bridge version to drain the Cdc1 block capacitor. Otherwise it will charge up and block the signal.

The phone companies don't like a constant load (even 1mA), so the dual Cdc* capacitor version would probably be better. If you're going to leave this on as a possible vox recorder interface, choose the dual Cdc* capacitor version.

As per phone line regulations, telco side parts should be rated for 200v or higher. Excessive ring voltages can exceed 200v, so I prefer 250v as a minimum. Higher is safer. Remember lightning safety, end user safety, and telco's tend to have "accidents".

The tap should be mounted into a plastic box for high voltage insulation. Standards dictate a 1k volt isolation.

S1 is used to physically disconned the circuit from the wall outlet. Turn this off when not in use. For a safer design, S1 could be a DPST switch disconnecting both Tip and Ring wires.

Rp* prevents transformer saturation and the tap (cap version) from picking up the phone line. They should be rated at least 1/2 watt.

Cdc* blocks the DC voltage coming from the phone service. Using only one Cdc may or may not block the DC voltage before the transformer depending on the line polarity (non−bridge version). Note that splitters and couplers often reverse the line polarity.

Rp* with Cdc* will form a high pass filter. Values shown are for 300Hz. Freq = 1 / (2 * PI * R * C). Telephone standards start with 300Hz as the lowest usable frequency. Increasing Rp will lower the volume. It's better to increase Cdc for lower frequencies. No matter what the high pass filter is set for, the transformer will dominate it. If decreasing the filter frequency does nothing, then it is probably the transformer blocking the lower frequencies. This is common. The only fix is another transformer.

It's not a good idea to start the high pass filter too low. 300Hz was chosen to avoid 50/60Hz power line noise and its harmonics.

The usual salvaged value for Cdc* is often 470nF (sometimes 430nF). One of these may be fine but may lower the volume a little.

Clp is an optional low pass filter to chop off the HF noise. Keep this after Rp* (or further) to avoid trashing DSL signal levels.

Tiso is a 1:1 600ohm 1kV isolation transformer. If a transformer is not used, the output will be far less protected and won't meet safety regulations. The 600ohm windings impedance match the line to help prevent echo by signal reflections (part of the telephone standards). The Rp* resistors also raise the impedance, but this isn't too big of an issue considering this circuit is receive only. Values for a 600ohm line is shown. If the tap picks up the line, evenly increase the values of Rp*. My combined values went up to 1k.

Fuse is there for safety and protection. Another could be added on the recorder side.

Rout sets a minimum output resistance if the pot is left wide open (usually 100−3.3k). It also protects the pot from over current.

Zener diodes DZ* protect the output from ring voltages (~90v) and power spikes. They should be rated for 1/2 watt or greater. Depending on the signal levels, DZ is typically 3 to 5 volts rated. Excluding these could blow up your recording input during rings.

RVout is the output volume control. A 10k pot is an audio standard. Some might perfer log taper as opposed to linear.

Variations. Both Rp* and Rout set initial volume levels. Many circuits have a single Rp being 4.7k. This made signal far too low for my phone line (which just happens to be off fiber optics). RMOV is optional but a good idea in high lightning areas.

I salvaged most of my parts from an old voice mail box I didn't like. I think my transformer might actually be a 1:2 ratio. This doesn't seem to matter that much in my case for receive only. Put the lower resistance transformer windings on the telco side.

This circuit will drop the signal level on the phone line a little bit (same as a second telephone being picked up). If the level drops too much, increase the values of Rp*. If the signal level is always too high and RVout is turned down most of the time, evenly increase the values of Rp* to lower the overall volume and lessen the load on the telephone line. I prefer to run my Rp* values a little higher to minimize the audio drop when talking on the phone (around 1k total with transformer windings).

The diode bridge version had some noticable distortion caused by capacitor charging during my tests with a large value Rload. I'm not sure why given the circuit simplicity. There was plenty of DC offset to avoid clipping. I had to increase Rload to 3k to get a clean signal and that picked up the phone line. That's somewhat OK for manual recording but not for a vox recorder. I recommend the dual Cdc* capacitor version.

Telephone Tap (Capacitor Version): Board Layout (18x23 Hole Protoboard)