COMMUNICATIONS CORNER

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Phantom power

ONE OF THESE DAYS, SOMEONE IS going to write a definitive book called *Reinventing the Wheel*. It will be a book containing all the ideas rediscovered by succeeding generations. If asked for suggestions about what wheels to include, I think *phantom power* should head the list. Each new generation of students and hobbyists with whom I've been involved has "discovered" phantom power. For those of you who haven't rediscovered it yet, phantom power is a means whereby the supply voltage for a device is carried along on the same line with the signal.

The first time I ever heard of phantom power was as an assistant radio-technician on my first remote broadcast. I was the guy who lugged around heavy cases containing boat anchors (better known as portable mixers). Maybe it was the free lunch that we were served, but my supervisor took ill and I was left hanging on by my fingernails with equipment that I knew next to nothing about. Under such circumstances, everything will go wrong. (And everything did!)

First, the private phone line dropped out; then the headphones wouldn't work. Finally, after locating a public telephone, I called the head honcho at the studio who mumbled something about us being on a solid-wire circuit. He then told me to bypass the resistive pad on my mixer's output, and connect a spare dial lamp from the center tap of the mixer's output transformer to an earth ground. I was told that when the light went on I was "on the air."

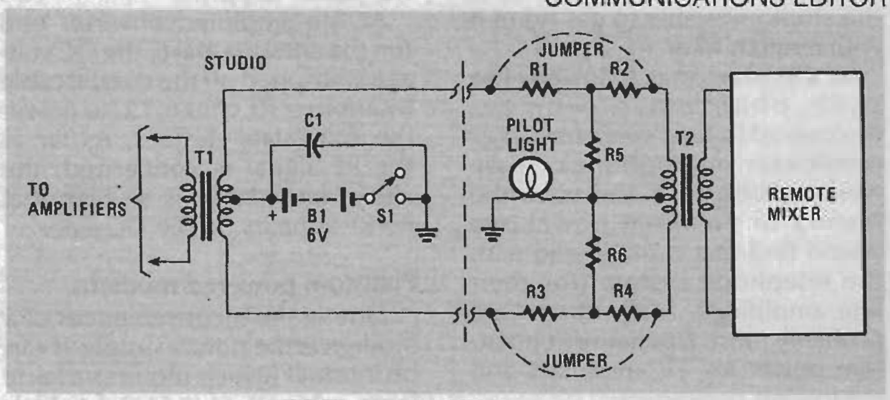

FIG. 1

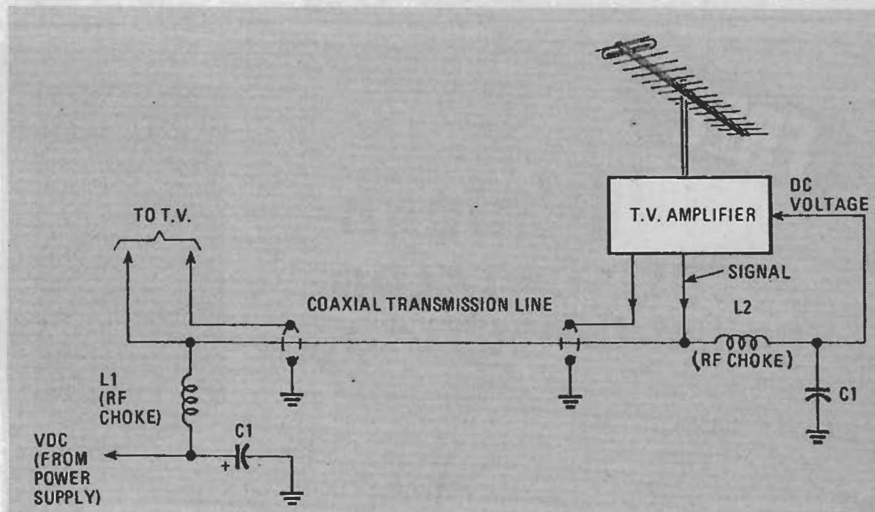

FIG. 2

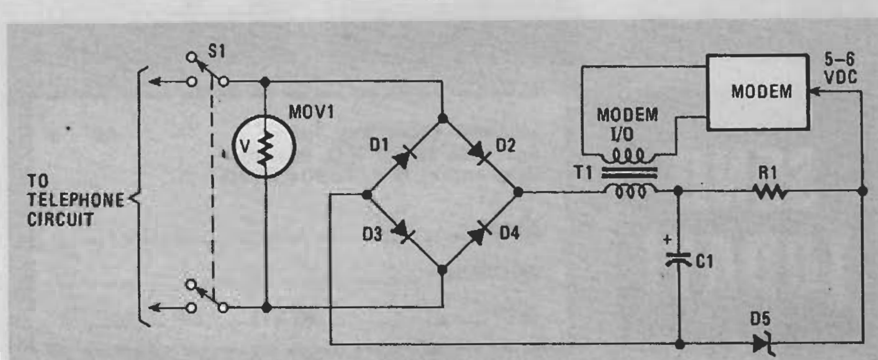

FIG. 3

Phantom-powered circuits

The phantom-power circuit used to light the signal lamp is shown in Fig. 1. It's almost a textbook circuit. Back then, though, it was "the cutting edge of technology." (Textbooks, however, forget to mention that between the transformer and the output lines, we usually place a resistive pad—the one I had to jumper.) Needless to say, the darn thing worked. And even though we had plenty of induced hum in the common-ground circuit, someone back at the studio was able to get rid of it with a notch filter.

In the years that followed, I've seen phantom power rediscovered to feed such devices as condenser microphones. If we were to look back and trace the history of phantom power, we would find that it originated with the telephone system (for their line amplifiers). Most of you are probably more familiar with phantom power for TV amplifiers and microwave converters.

Figure 2 shows the most common phantom-powered circuit that technicians are likely to run across: a mast-mounted TV "antenna amplifier." Of course, in such an application, you do not want to run both a power line and antenna feed to the amplifier. Phantom power lets the amplifier gets its supply voltage from the transmission line. At the receiver end, a DC voltage from the power supply is coupled to the coaxial cable through an RF choke, L1. The choke isolates the RF circuit from the power supply.

At the amplifier/converter end (on the antenna mast), the DC voltage is stripped off the coaxial cable by another RF choke, L2, to power the solid-state devices. As far as the RF signal is concerned, the choke impedance is so high that no RF appears on the DC side.

Phantom powered modems

One of the inconveniences of a modem is the power supply. It can be internal (which requires a fairly large cabinet) or external (which requires a wall-mounted AC adapter—always an inconvenience.) The modem may have to be plugged into the terminal or computer so it can tap the equipment's power supply; or the supply could be a battery, which is sure to fail when most needed.

The more modern (not really modern) way to get the power is the way it's done in the Universal Data Systems *1003LP* answer/originate modem, directly from the telephone system. The no-load voltage on a dial-up telephone line is 48-volts DC, which falls to nominally 6 volts when the handset is taken off hook, or any normal load is connected across the line.

Fortunately, micropowered solid-state devices—like modems—work very well on 5–6 volts, so we can phantom-power a complex active device directly from the telephone circuit. Figure 3 shows a simplified phantom-power source for a manual communications modem, therefore, no ring detector/automatic power circuits are shown.

Switch S1 connects the modem to the telephone line. The full-wave rectifier (consisting of diodes D1–D4) ensures against polarity problems with the telephone lines; regardless of the line connections, the rectifier's output polarity is unchanged. A metal-oxide varistor, MOV1, is inserted on the line side of the bridge rectifier to prevent transients that may be on the line from entering the modem.

The modem's I/O transformer, T1, is in series with the DC output of the rectifier. Capacitor C1 provides DC filtering and the AC return path for T1. (The signal current in T1 induces an input voltage to the modem, while the modem's output varies the DC current, hence the current in the telephone circuit.) Zener diode D5 is used to clamp the DC at 5 or 6 volts; however, it can be replaced by a voltage regulator.

While the circuit in Fig. 3 looks simple enough, it is not seen in general use because it takes a lot of hardware when a high supply-current is required. In such a case, it simply isn't cost effective. But if micropower devices are used, it's possible to sell a modem—such as Universal Data System's *103LP*—for a list price of $150. R-F