

A few months ago, a client called with an unusual problem. They were in the process of adding a new radio system to their dispatch operation.

Their radio tower was a few hundred feet from the 911 center and was connected via private telephone cable we had engineered a number of years ago. The problem was they had run out of cable pairs in the telephone cable. Their growth over the last few years as they had gone to county wide dispatch had taken all future growth we had allowed in our planning.

The radio system was a simple simplex system with tone remote control. The cost estimate to add a new telephone cable was not in this year's budget. The administrator came to us and asked what other alternatives do we have? The service shop had offered a number of high tech solutions including adding digital multiplexing to the cable to derive the needed circuit. This was also cost prohibitive. We offered to solve the problem for only a few hundred dollars plus our hourly fees.

In years past, the telephone company derived "phantom circuits" on physical copper cable pairs by the use of transformers (in telephone parlance, they are called repeat coils). This method is still a viable solution as it can give a third audio circuit for every 2 copper cable pairs and the use of six 600 ohm center tapped transformers which are still readily available.

We made up a drawing and an equipment list for the local radio shop to order and install. When it was completed we were able to take the new radio system and apply it to the phantom circuit that was derived and the system was made operational without the expense of additional cable or multiplex equipment.

The explanation of how this works is as follows:

Both wires of the circuit labeled Circuit A in Figure 1 become one conductor of the phantom circuit. As the current flow in these two wires is identical and in phase there is no voltage differential across the pairs and no audio is heard in the Circuit A audio circuit. The two pairs of the Circuit B audio circuit work in an identical manner. By taking the center taps of the two transformers and using them as the conductors for the phantom transformer a third audio channel is derived that is not heard in either Circuit A or Circuit B audio paths. Note: it is necessary that the conductors themselves for each of the two side circuits must be within 2 ohms of each other and ideally below 0.5 ohm of each other. If this is not the case, the side circuit audio and phantom circuit audio will crosstalk.

There is even one more circuit that can be derived. By the addition of an additional set of transformers, connected between the center tap of the phantom transformer and ground and additional audio circuit can be derived. This circuit is unbalanced and can be susceptible to audio hum however this circuit can be used as an intercom circuit between the radio equipment building and the dispatch center. This gives four separate voice circuits over 2 copper cable pairs and some inexpensive center tapped audio transformers.

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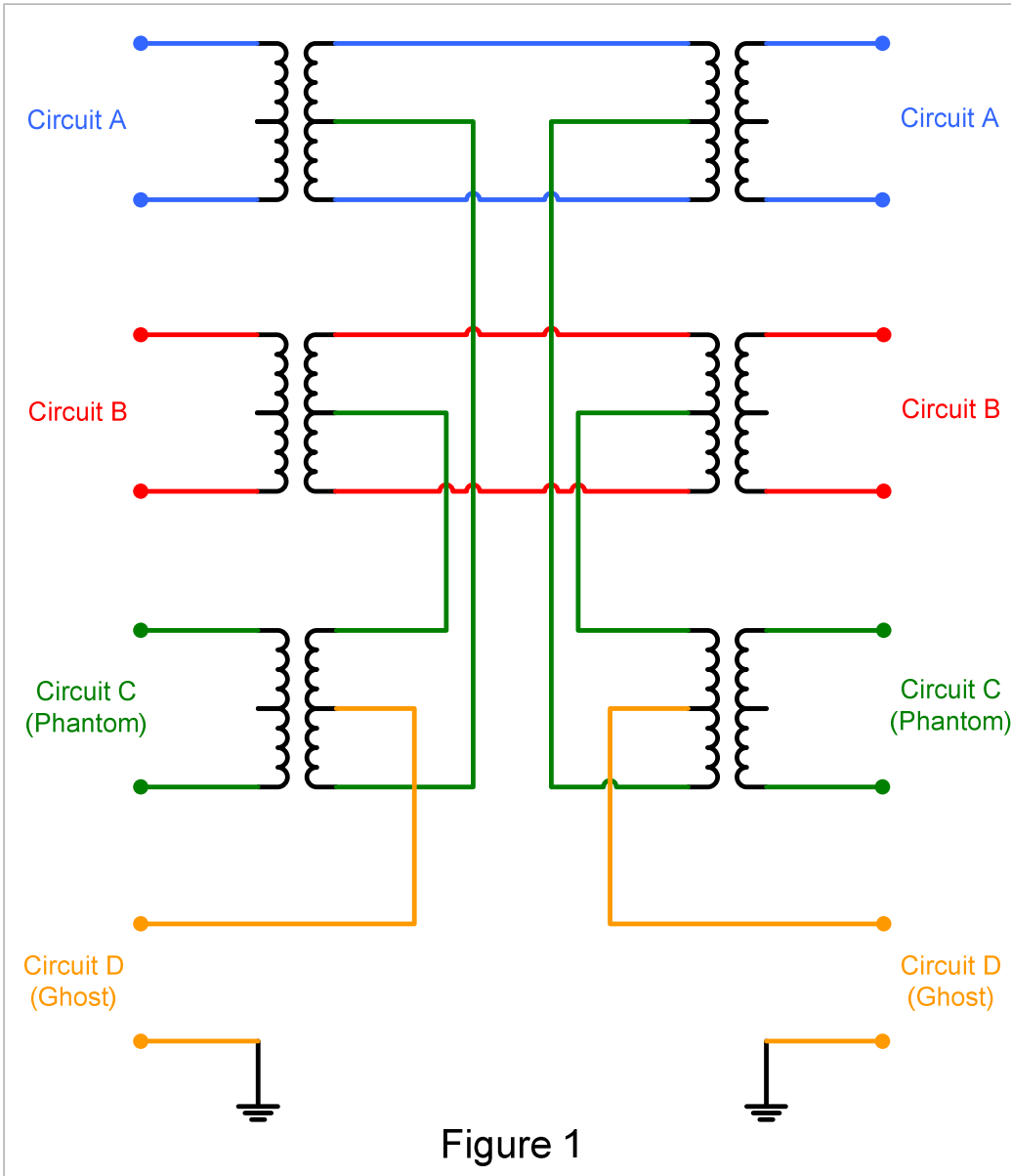


Figure 1