COMMUNICATIONS CORNER

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Think ferrite

THE MOST DEVILISH FORM OF RFI (*RA*dio *f*requency *i*nterference) is not what we do to others, but what we do to ourselves. I have probably spent more time filtering my own transmitter out of my own receiving and high-fidelity equipment than I have spent filtering RF from an FM-broadcast transmitter out of the local hospital's EKG machine. I have also spent, and wasted, many an hour trying to get my computer's *bleeps* and *bloops* out of my telephone.

The problem itself has a very reasonable explanation: Each wire external to the shielding of a metal equipment cabinet or a chassis functions as an antenna. If the local transmitter is a low-power unit in your backyard, every wire in the house, even shielded wires, will receive some part of the radiated signal. If anything causes the RF to be detected, you have RF interference.

Shielded wires in themselves are often no solution because rarely is the shield totally effective at RF frequencies. Depending on the overall length of the wire, one end of the shield might be grounded for RF while the opposite end, which indicates ground when checked with an ohmmeter, is actually "hot" to RF. We'll show you why that is so in a future column.

Move the same transmitter and its antenna a few hundred feet away and the RFI is eliminated because the signal received by the wiring is simply too weak to do any damage. On the other hand, a 50,000-watt broadcast station a mile or so away can radiate so much RF into the wiring that we can consider the station to be a local transmitter, capable of interfering with receivers, high-fidelity gear, telephones, and even computers. As a general rule, the four consumer-equipment wires most sensitive to RFI from local transmitters are the AC line cord, coaxial-cable antenna connections, microphone cable, and audio and video line-level cables.

The ferrite ring

Virtually any external wire, shielded or not, can be RFI suppressed by using a ferrite choke; all that's required is to loop the wire around a ferrite ring.

Perhaps the easiest filter to make, yet one of the most effective, is the line-cord filter shown in Fig. 1. It is simply a ferrite ring through which the line cord is wrapped as many as seven times. The filter is equally effective with either conventional two-wire zip cord or three-wire-with-ground line. To provide clearance for the seven turns of line cord, as well as for heat dissipation, the ring must be almost 2.5 inches in diameter, and a little more than 0.5-inch thick. It must also be effective over a rather broad frequency range. An Amidon type FT-240-75 ring meets those requirements. The 240 part of the specification means the ring is 2.4 inches in diameter. The 75 means that the ring is made of a type 75 material; the characteristics of that material allow the resulting filter to have maximum effect over a 1-MHz through 50-MHz range, but the filter will attenuate noise to 200 MHz.

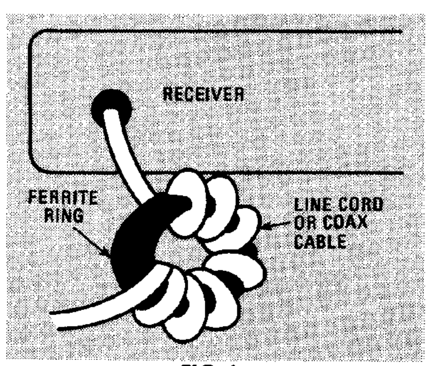

FIG. 1

To prevent capacitive coupling between the input and output leads, push the turns close together so there is as much space as is possible between the first and last turns. Then tape the turns down with common plastic tape so they can't change position.

The scheme can also be used with coax antenna lead, or even a shielded microphone lead. Simply wrap seven turns around an FT-240-75 ring and tape the turns to keep the input and output separated. The ferrite choke will keep RFI from traveling down the shield of the coax or microphone cable into the receiving or the amplifying equipment.

If the interference comes from radio frequencies below 1 MHz it might be necessary to use two chokes in series. As that arrangement can get very bulky, first try adding two turns per ring, for a total of nine.

When dealing with audio cables and thin microphone wire, it isn't necessary to use a large ring because there's no dissipation to worry about; all you need is a ring large enough to allow you to wind up to seven turns. For conventional microphone and audio cables, you could try a ring with a 1.4-inch diameter.

Actually, for audio circuits you might even get by with a single turn, as shown in Fig. 2. But it pays to use extra turns. If a single turn

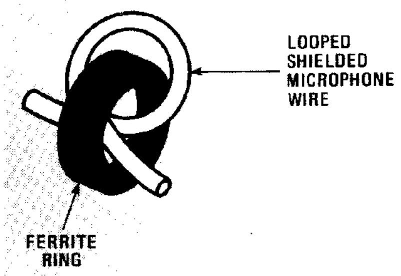

FIG. 2

suppresses, but doesn't eliminate the interference, keep adding turns. Just keep in mind that there must be some separation between the input and output leads.

Ferrite rings are reasonably priced. The FT-240 is $8, while the FT-140 is only $3. You can get a complete price list along with a ferrite coil-form catalog by writing to Amidon Associates, Inc., 12033 Otsego St., North Hollywood, CA 91607. **R-E**

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you'll have to pay attention to the polarity of the pulses. If necessary, you can use a small-signal transistor as a flip-flop to convert positive pulses to negative.

When you're working with a complex design, you should pay as much attention to the reset as you do to any other part of the circuit. Its timing can be very critical, and if it's off the mark you may get intermittent operation.

More complex reset problems require more complex solutions. You can find dedicated IC's that are designed specifically to generate pulses of one kind or another, but they are often expensive, hard to find, and difficult to use. Half-monostables are simple, cheap, and easy to use. The next time you find yourself looking for some way of generating a variety of pulses, use a hex inverter and wire up a couple of half-monostables. Chances are they'll do the job with a minimum of fuss and bother. **R-E**