Q & A

READERS' QUESTIONS, EDITORS' ANSWERS

CONDUCTED BY MICHAEL A. COVINGTON, N4TMI

Spam I Am—Not!

Q *You authored an article on Internet ethics in the September, 1997 issue of* **Electronics Now**, *so I am turning to you for advice: I want to make sure that if I open a business as an Internet bulk e-mailer, I'm not violating any laws. Can you help?—Name withheld, CA*

A By bulk e-mailing do you mean "spamming," *i.e.*, sending people advertising that they didn't request? If so, please don't, for two reasons: there's no money in it, and it's universally hated.

If spamming were a legitimate way to advertise, major corporations would be using it. They aren't. The spam we receive is almost invariably from people selling get-rich-quick schemes, pornography, or other dubious products, and 99% of it comes from forged (faked) e-mail addresses—which convinces us right away that the senders are not trustworthy. We see no evidence that any of these people are making money.

More importantly, the Internet community objects very strongly to spam because the costs are paid by the recipients, not the sender. Despite the name, e-mail is more like a collect phone call than a piece of ordinary mail. Spamming may be technically legal, but that doesn't make it popular. Do you really want a million people to consider you a pest? That would ruin your chances of future business success.

By the time you read this, Congress will probably have passed legislation to restrict spam in some way. But Congress is not all you have to fear. Lawyers in several state governments, federal agencies, and private organizations are looking at the spam problem from the standpoint of existing laws. Some common spamming tactics, such as forging e-mail addresses and "stealth mailing" (relaying through other people's computers without their consent), appear to violate existing laws and it's just a matter of time until spammers find themselves on the losing end of expensive lawsuits. What's more, the ads transmitted as spam are often deceptive, and the Federal Trade Commission is conducting a crackdown. See *http://www.ftc.gov* for more information.

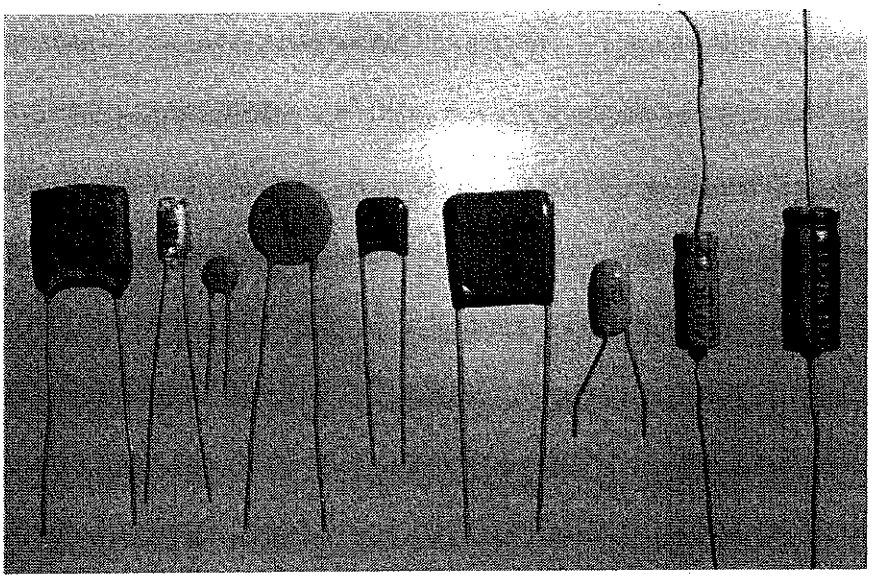

FIG. 1—LEFT TO RIGHT, THE CAPACITORS shown here are silver mica, polystyrene, ceramic disc (2), polyester (2), tantalum electrolytic, and aluminum electrolytic (2).

All Kinds Of Capacitors

Q *There are lots of kinds of capacitors (Mylar, silver mica, monolithic, etc.); how can I recognize them by looking at them, and what are the different types good for? On an electrolytic capacitor, does 16 WVDC mean the same as 16 VDC? What are low-ESR capacitors, and if one is specified, can I use a regular capacitor?—R. A., Toronto, Ontario, Canada*

A As you surmised, no capacitor is perfect, but different kinds have different imperfections. The most important of these are voltage limits, leakage (self-discharge), series resistance (like a resistor in series with the capacitor), and change of capacitance with temperature.

Capacitors are named for the insulating material used between their thin conductive layers. Figure 1 shows some common varieties; those are, from left to right, 330-pF silver mica, 150-pF polystyrene (shiny), 22-pF and 0.4-μF disc ceramic, 0.1-μF and 0.33-μF polyester (Mylar is a Du Pont's brand of polyester), 22-μF tantalum electrolytic, and 4.7- and 47-μF aluminum electrolytics. You can't always identify capacitors at sight; nowadays most of them look like plastic blobs or boxes regardless of internal composition. In older equipment you will find tubular paper capacitors (with a wax coating) and flat mica capacitors, often marked with six circles.

Capacitor values are sometimes marked directly in pF or μF, and sometimes indicated with a three digit code consisting of two digits and the number of zeroes to be added; thus 151 means 150 (15 and 1 zero), and 334 means 330,000 (33 and 4 zeroes). When the three-digit code is used, the value is always in pF (where 1 μF = 1,000,000 pF, so a 1-μF capacitor would be marked 105). In European schematics, you'll also see nanofarads (nF), where 1 nF = 1000 pF.

HOW TO GET INFORMATION ABOUT ELECTRONICS

On the Internet: See our Web site at http://www.gernsback.com for information and files relating to our magazines (**Electronics Now** and **Popular Electronics**) and links to other useful sites.

To discuss electronics with your fellow enthusiasts, visit the newsgroups sci.electronics.repair, sci.electronics.components, sci.electronics.design, and rec.radio.amateur.homebrew. "For sale" messages are permitted only in rec.radio.swap and misc.industry.electronics.marketplace.

Many electronic component manufacturers have Web pages; see the directory at http://www.hitex.com/chipdir/, or try addresses such as http://www.ti.com and http://www.motorola.com (substituting any company's name or abbreviation as appropriate). Many IC data sheets can be viewed online. Extensive information about how to repair consumer electronic devices and computers can be found at www.repairfaq.org.

Books: Several good introductory electronics books are available at RadioShack, including one on building power supplies.

An excellent general electronics textbook is *The Art of Electronics*, by Paul Horowitz and Winfield Hill, available from the publisher (Cambridge University Press, 1-800-872-7423) or on special order through any bookstore. Its 1125 pages are full of information on how to build working circuits, with a minimum of mathematics.

Also indispensable is *The ARRL Handbook for Radio Amateurs*, comprising 1000 pages of theory, radio circuits, and ready-to-build projects, available from the American Radio Relay League, Newington, CT 06111, and from ham-radio equipment dealers.

Copies of past articles: Copies of past articles in **Electronics Now** and **Popular Electronics** (post 1993 only) are available from our Claggk, Inc., Reprint Department, P.O Box 4099, Farmingdale, NY 11735; Tel: 516-293-3751.

Electronics Now and many other magazines are indexed in the *Reader's Guide to Periodical Literature*, available at your public library. Copies of articles in other magazines can be obtained through your public library's interlibrary loan service; expect to pay about 30 cents a page.

Service manuals: Manuals for radios, TVs, VCRs, audio equipment, and some computers are available from Howard W. Sams & Co., Indianapolis, IN 46214 (1-800-428-7267). The free Sams catalog also lists addresses of manufacturers and parts dealers. Even if an item isn't listed in the catalog, it pays to call Sams; they may have a schematic on file which they can copy for you.

Manuals for older test equipment and ham radio gear are available from Hi Manuals, PO Box 802, Council Bluffs, IA 51502, and Manuals Plus, PO Box 549, Tooele, UT 84074.

Replacement semiconductors: Replacement transistors, ICs, and other semiconductors, marketed by Philips ECG, NTE, and Thomson (SK), are available through most parts dealers (including RadioShack on special order). The ECG, NTE, and SK lines contain a few hundred parts that substitute for many thousands of others; a directory (supplied as a large book and on diskette) tells you which one to use. NTE numbers usually match ECG; SK numbers are different.

Remember that the "2S" in a Japanese type number is usually omitted; a transistor marked D945 is actually a 2SD945.

Hamfests (swap meets) and local organizations: These can be located by writing to the American Radio Relay League, Newington, CT 06111; (http://www.arrl.org). A hamfest is an excellent place to pick up used test equipment, older parts, and other items at bargain prices, as well as to meet your fellow electronics enthusiasts—both amateur and professional.

Millifarads (mF) are never used, but μF and pF were formerly abbreviated mF and mmF respectively. A letter indicates tolerance; J is 5% and K is 10%. The three-digit code is also used on resistors and inductors, with values in ohms and microhenries respectively.

The uses of different kinds of capacitors could fill a book. In the middle-value range (say 500 pF to 0.5 μF), polyester capacitors usually perform best, and polystyrene is better yet, but ceramic discs are cheaper and almost always acceptable. Below 500 pF, ceramic-disk, mica, or polystyrene capacitors are usually used, and some of them are marked with specific temperature characteristics, such as N750 (negative 750 parts per million per degree C) or NP0 (negative-positive zero, *i.e.*, as stable as possible).

Electrolytics are far worse; they have lots of leakage and series resistance, and they deteriorate with age, but their one redeeming virtue is that large values are practical. Polyester or ceramic disk capacitors larger than 0.5 μF are too bulky to use in modern miniature equipment, and above 3 μF or so they don't exist at all, but you can get electrolytics as large as several farads. So the 4700-μF filter capacitor in a power supply is sure to be electrolytic, and the 1-μF coupling capacitor in an audio amplifier is likely to be one. Tantalum electrolytics are more compact than conventional aluminum types.

As the name suggests, electrolytics rely on an action similar to electroplating to keep the insulating layer intact. That means they are polarity-sensitive; if you apply voltage backward, they suffer damage and can even explode. (Make sure the positive terminal is always positive.) Also, if you use too low a voltage—like 1 volt on a 35-volt electrolytic capacitor—or leave the capacitor on the shelf unused for several years, it eventually deteriorates. That's why DC working voltage (WVDC) is so important. And, yes, WVDC is the same thing as VDC. Don't run too close to the limit; we usually specify 16-volt capacitors for 5-volt circuits and 35-volt capacitors for 12-volt circuits.

If a project requires a particular kind of capacitor, the parts list will say so; otherwise, any capacitor with the correct capacitance and an adequate voltage rating will do. If a low-ESR capacitor is specified for a project, that's what you should use; in a pinch you can sometimes substitute a conventional electrolytic with a higher capacitance. You can always substitute low-ESR capacitors for regular ones.

Pushbutton Volume Control (Again)

Q *I'm looking for a circuit for a volume control where the volume is raised and lowered by pushing buttons. Can someone help me with this?—R. A., Toronto, Ontario, Canada*

A On pushbutton volume controls, see this column in the October, 1997 issue of **Electronics Now**. Since then, digital control of audio volume has gotten even easier because Philips has introduced a new amplifier chip, the TDA8551, with pushbutton volume control built in. A circuit based on Philips' published data is shown in Fig.