FORUM

Conducted by Neville Williams

Static electricity and computers

If computer hackers want to conserve their chips (cash) they should be careful how they handle chips (ICs). But one of our correspondents is spitting chips (figuratively) about what he considers to be misinformation promulgated by a number of well known computer companies.

It so happens that the correspondent concerned is a former staff member, Stewart Fist, editor of our one-time associate magazine "Videomag". It also happens that, over and above his broad-ranging interest in video and film technology, he's something of a computer nut, freak or hacker — whatever the appropriate term, these days.

Being a freelance professional writer, he is well able to explain the reason for the chip on his shoulder.

Dear Neville,

It is now conventional wisdom in the hacker world that the way to prevent damage to chips, when handling plug-in boards, replacing RAM chips, etc, is to:

(a) Switch off the power at the computer;

(b) Leave the computer plugged into the power point; and

(c) Touch the casing of the power supply before handling any chips.

The theory is that, by leaving the computer plugged in, the earth lead will conduct away any static electricity when you touch the power supply box and therefore remove all risks of static damage.

I think this procedure is silly and dangerous and I've written to a number of computer manufacturers (who advocate it in their manuals) pointing out the danger — but to no avail. To date, they haven't even replied.

My argument is as follows:

(1) A high level of static charge is not, by itself, a problem. What must be avoided is a difference in electrostatic level between my body and the computer.

(2) This difference in potential is removed as soon as I touch the power supply case — whether the case is at earth potential or not.

(3) If the prevailing electrostatic potential in the room is high then, in fact, it is better for the computer to remain at the high level. Dropping the machine to earth potential increases the risk of an accidental discharge through the chips if I pick up extra charge from the room after having touched the power supply case — and this is possible, if not probable.

(4) Since the existence of an earth connection doesn't decrease (and can increase) the risk of potential difference, then leaving the computer plugged into a mains power point is a dangerous practice and should be discontinued.

I don't want to exaggerate the dangers — after all, the computer boards only have a few volts when everything is running okay, in store-bought computers, anyway. But houses are often incorrectly wired and power supplies get faulty. It's a bit like casual handling of a rifle or shotgun — its perfectly all right as long as it's unloaded. Unfortunately, people get themselves killed every year by 'unloaded' guns.

Since a large number of open-architecture computer owners are kids, I think it is pretty close to criminal negligence for computer companies to advocate poking around inside any piece of computer gear with the power cable still plugged into the power point.

Too many Australian houses are wired up with the switch in the neutral lead, and there are too many Taiwanese fans (with power switches) which effectively reverse the polarity of the plug. In my experience, many of these fans don't have a reliable earth connection anyway.

I'd like to stir this up if I can. I'm sure that I am right but I'd be interested to hear your (or any contrary) views.

Stewart Fist.

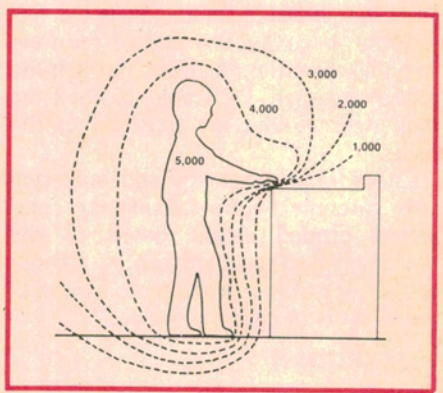
At first reading of Stewart's letter, one might jump to the conclusion that changing a computer board or RAM chip is a consistently hazardous procedure, if not to the actual chip(s), then to the individual involved, by reason of inadvertently exposed mains voltage.

Realistically, the chance of zapping either chips or chaps in the average Australian domestic hacker situation is probably fairly remote, but nevertheless sufficient to warrant the kind of commonsense that one should always exercise when probing the innards of any electronic equipment — especially if fragile and/or mains powered.

At the heart of the present matter is the risk of a person picking up an electrostatic charge from the room environment, sufficient to zap MOS chips if inadvertently applied to them. "Zap" may signify anything from total destruction to the creation of an obscure bug-size fault.

Some years ago, I recall a discussion in these columns of electrostatic charges of the "people" kind as evidenced, for example, by a shock when one touches a metal door knob, after walking across a nylon carpeted room.

The discussion served to underline the fact that the build-up of such charges varies enormously with the prevailing level of humidity in the atmosphere. It can be plainly apparent in artificially dehumidified (air-conditioned) situations, and in places like central Europe, cen-



Electrical field surrounding a statically charged person.

Reproduced by courtesy of 3M and Circuit Components (A'Asia) Pty Ltd.

tral USA and inland Australia. It is less frequently evident in the relatively humid coastal areas where most Australians live.

That doesn't mean that most of us can ignore the problem; it simply signifies that the actual risk of zapping MOS chips varies widely with time, place and situation. The hazard can be consistently high — or negligible for much of the time.

Plastic parlour

I was told of one lady in this city who set up a small typesetting operation using a modern high-tech word processor in a modern air-conditioned office fitted out with modern moulded furnishings and modern nylon carpeting. In this "plastic" environment, wearing modern nylon under-garments, she was capable of unwittingly generating an electrostatic charge of many thousands of volts — sufficient, apparently, to scramble the memory banks in the new processor, merely by her presence at the keyboard!

It was an extreme case requiring antistatic precautions around the work station to overcome the problem. But, back to the original theme:

Leaving a computer plugged into a power point, as reportedly suggested by some suppliers, should keep the equipment itself at nominal earth potential, which is okay — provided the person needing to fiddle with its "works" remembers to discharge possible body potentials beforehand and at subsequent frequent intervals.

Stewart F. objects to this proposition, suggesting that the same objective could be achieved by having both person and equipment at a common ambient level. More to the point, disconnecting the computer from the mains would obviate the risk of accidental contact with mains voltage, arising from a faulty component or incorrect wiring.

What do I think?

Frankly, my own reaction is to be less than enthusiastic about either point of view. If protection is warranted, then it's better to do the job properly than by halves.

The metalwork of the computer should logically be maintained at earth potential, but independently of the mains chord, using a separate and permanent lead to the electrical wiring earth or a water pipe. (Please, not a spade connector pushed into a power point.) During service procedures, the mains cord would be plugged into the wall socket only when the computer needed to be powered up.

And, rather than relying on occasional contact with the power supply case, the person working on the computer should be electrically connected to it by an antistatic wrist strap and a flexible clip-lead exhibiting a DC resistance of at least 1MΩ. This should be sufficient to bleed away any charge that tends to accumulate, while also limiting current that might flow through the person's body in the event of accidental contact with a high voltage source.

To provide this kind of safeguard should not pose any great problem and, to me, it makes a lot more sense than the half-measures previously mentioned.

As an added precaution, "earthy" antistatic table and floor mats are commonly used in computer workstations — an observation which, for the writer, has its humourous side.

. . . the thunderstorms of the past summer had been "very good for business"

Back in the '60s, when we relocated the EA laboratory in the Jones St premises of our then parent company, we had the work benches covered with traditional brown industrial quality "lino" — appropriately tough and easy to keep clean.

We discovered later that it exhibited sufficient intrinsic conductivity to be quite a nuisance when checking out a "rats nest" of high impedance circuitry. Maybe Stewart F. and the hacker fraternity should keep an eye out for the odd square metre of the stuff to serve as an antistatic mat for their computer workspace. This, in addition to the aforementioned wrist strap and resistive lead.

[If you need information about commercial antistatic wrist straps and leads, antistatic workstation mats, etc, I suggest a letter or phone call to Circuit Components (A'Asia) Pty Ltd, 383 Forest Rd, Bexley, NSW 2207; phone (02) 59 6550 or 59 3720.]

Lightning also

In discussing this whole matter with various acquaintances, one of them came up with the observation that, over the past summer, computer MOS chips in the Sydney area, at least, were more likely to be zapped by lightning than by electrostatic discharges from the tips of hackers' fingers.

Ever a man for detail, he went on to suggest voltage, current and energy figures for typical lightning bolts, and related how one nearby strike had produced enough spatial magnetic induction to zap the input circuitry of an electrician's stud finder, lying on his workbench.

In addition to direct induction, numerous strikes on electricity supply mains have caused potentially damaging voltage spikes, along with actual dropouts and a consequent loss of data.

His observations led me to ring Clive Chamberlain of Promark Electronics at Crows Nest, in Sydney. Clive had recently attended a conference in Germany and remarked that the electrostatic charges evident in hotels, etc, during the European winter had to be experienced to be believed.

The problem was not nearly as acute in Sydney but he confirmed that, by way of compensation, the thunderstorms of the past summer had been "very good for business" — his business anyway!

Among the lines carried by Promark is a range of zener-like devices to clamp or short supply lines in the event of potentially destructive voltage surges, along with gas-filled arresters, comprehensive line filters, etc.

I was left with the distinct impression that, over and above concern about electrostatic charges, hackers might do well to give some thought to the thunderstorms that might be awaiting them next summer.

[To anticipate another likely question, Promark Electronics is at 6 Clark St, Crows Nest, NSW 2065. Phone (02) 439 6477. Promark can provide data but actual distribution is being arranged through selected suppliers.]

"Wireless" microphones

By way of a complete change of subject, we carried a letter from R.B. of Canberra in our February '86 issue, detailing problems he had experienced with an FM "wireless" microphone in a public address situation. Although the system had operated satisfactorily when checked out beforehand, it had suffered disconcerting variations in level and even complete dropouts when an audience was present.

R.B. suggested that it probably had something to do with peaks and nulls in the signal strength, related to the wavelength of the FM carrier.

By way of comment, we said that we had not observed problems, in similar situations, of the magnitude of those described and felt that they were possibly indicative of inadequate signal strength, causing the FM receiver to operate under the equivalent of "fringe" conditions — in the region below limiting and into muting.

The guest speakers, on the occasion, may possibly have aggravated the variations in speech level by inadvertently turning the head away from the lapel microphone.

In a letter to hand, a reader from Victoria reports that he had also experienced problems with wireless microphones similar to those described by R.B. but had the facilities to analyse what was going on.

He had checked the frequency of the respective transmitters and receivers and found everything to be in order, the sensitivity of the receivers being measured at around 2μV.

He had also taken note of the signal strength reaching the receivers in typical situations and this proved to be a most revealing exercise. I quote from his letter:

Signal levels of several millivolts were evident with the transmitter in some locations but movement of even a few centimetres could cause the received signal to drop to as little as one or two microvolts. In such circumstances, I had to shift the radio microphone receiver aerial to some other position where the variations in signal level were less severe.

The receivers we use have hard limiting and the level does not drop before the mute operates, although the signal does become quite noisy. If R.B.'s receiver does not hard-limit, he will certainly experience trouble with variations in output level.

R. C. (Benalla, Vic.)

The above letter, reflecting the voice of practical experience, tends to support our own observations in the February issue.

So also does a letter from A.H., reproduced in the accompanying panel, although his emphasis is on the "dress" of the transmitting antenna. If it is to radiate an effective signal, it should be as uncluttered as possible, preferably not associated with microphone audio leads and certainly not bunched up, as can easily happen.

Overall, the message for volunteer, non-professional P.A. operators is clear enough: to ensure a good, reliable signal from a wireless microphone, keep the transmitting antenna as far away as possible from other leads and from the performer's body. Radiate a good signal, place the receiver and antenna in a suitably advantageous position and, as A.H. suggests, even stone walls won't stop it!

Thank you for your respective contributions.

"Wireless" microphones, good and bad

Dear Mr Williams,

I followed with interest your articles on public address systems. The letter in the Feb. '86 issue from R.B. of Canberra, regarding wireless microphones, posed an unusual problem but I doubt that his theory about wavelength, etc, had much to do with it.

In our church (Anglican), we use two FM radio mics with the P.A. system, each operating on a different frequency. Erected in 1850, with stone walls 60cm or more thick, the church is in the form of a crucifix, with the amplifier and FM receivers in one of the side chambers.

Rectors using the FM mics can walk all around the church, even when full of people, and out through the front entrnace, which puts four 60cm stone walls between the transmitters and receivers. The volume remains the same up to about six metres beyond the entrance, beyond which it dies away — apparently the limit of the transmitting range.

Both units use a lapel microphone, with the transmitter clipped to the wearer's belt and an antenna dangling nearly to the ground.

At a club I attend, the FM mic unit has the antenna incorporated in the lead from microphone to transmitter. That causes a lot of trouble when mic and transmitter are brought too close together (to within 30cm or so) and the lead becomes twisted or bunched up. They now run the lead up over the user's shoulder to the lapel mic but, while this helps, it is still not entirely satisfactory.

At another club, to which my son-in-law belongs, they use a hand-held microphone with the FM transmitter built-in, and a trailing antenna about a metre long. That works perfectly.

I thought that perhaps those examples might be of interest and may shed some light on R.B.'s problems. Thanks again for the interesting articles in EA, which I first started reading back in the early R&H era.

A. H., Evanston, SA.