Where there's smoke...

MAINS POWERED SMOKE ALARMS ARE MANDATORY IN ALL NEW RESIDENTIAL DWELLINGS IN AUSTRALIA, SO IT MAKES SENSE TO BRING THEM INTO YOUR CONTROL SYSTEM DESIGN. HARRY SIMIDIS REPORTS.

I've touched on the topic of smoke alarms in previous articles and have since been asked to elaborate on the interfacing aspects.

There are generally three types of smoke alarms:

- Self contained battery operated devices with replaceable batteries, typically 6V to 9V;
- Externally powered devices, usually with 12V DC and/or 24V DC input supplied using an external power supply or existing DC supply rail; and,
- Mains powered units.

All smoke alarms have a battery backup in case of a power failure (which is common during a fire), but this article will focus on mains powered units, in particular those that have the ability to be interconnected.

Although the relevant Standard, AS3786, allows for the connection of these smoke alarms to similar units or devices, it does not require such. Having said that, I don't recall ever coming across a mains powered smokie without this ability and, frankly, it beats me as to why you wouldn't include such a useful feature.

It's actually this feature alone that makes the interfacing of smokies possible with lighting control and security systems.

The most common type of smoke alarm is the ionisation type. These smoke alarms use a small ionisation chamber, which is open to the air in the room, together with a source of ionising radiation. The source of ionising radiation is typically americium-241 (in the order of a few micrograms), which produces a stream of alpha particles.

Now there's no need to freak out at the mention of nuclear radiation because the amounts are absolutely miniscule. You also need to note that alpha radiation is very weak, so much so that it can't penetrate a sheet of paper, let alone travel more than a few centimetres in the air. Besides, unless you tamper with the chamber and start inhaling these alpha radiation particles, there's really no need to worry.

These alpha particles ionise the oxygen and nitrogen atoms in the air. This means that the electrons are 'knocked off' the individual atoms to form positive and negative charges that ultimately generate a small current between the conducting plates within the ionisation chamber, as shown by the positively and negatively charged discs in Figure 1 (overleaf). When smoke particles enter the chamber, they neutralise some of these charged particles, effectively reducing the already small current flowing between the plates. The electronic circuitry within the smoke alarm then detects this drop below a nominated threshold and subsequently sounds the alarm. These types of smoke alarms are more common because they are cheaper to build and are generally considered to be better at detecting the invisible combustion by-products produced by flames.

Photoelectric smoke alarms use a beam of light and a photo sensor to detect the presence of smoke. The general operation of these smoke alarms is based on the principle that smoke scatters light beams.

A light source is placed in a tube through which air can circulate from the room into the smoke alarm. A light sensor is then placed around a corner at an appropriate scattering angle to the light beam inside the smoke alarm. If the air is clear of smoke, the light passes in a straight line unhindered and the light sensor detects no light (see Figure 2).

As soon as a small amounts of smoke is present in the air, light beams start to scatter and the light sensor will begin to detect some light rays. Once the number of light rays detected increases to a set level, the alarm is sounded (see Figure 3).

Photoelectric sensors are generally more expensive to build and are considered to be generally better at detecting the visible by-products of poor combustion, produced by smouldering fires (e.g. smoke).

Most mains powered smoke alarms allow the interconnection of similar devices. The benefit of interconnecting smoke alarms is that the fire alert can be sounded from all connected units if triggered by any single unit in the link. This interconnect signal is usually 9V DC between the interconnect (I) and neutral (N) lines, as shown in Figure 4.

This same interconnect line is what's used by lighting control and security systems to subsequently activate a series of programmed events or dial out to the monitoring station with the relevant fire alarm identification code. However, before using this signal, it's usually necessary to isolate it from any voltages through an isolation relay.

I've used the OMRON MY4N relay and accompanying PYF14A-N DIN plug-in base to isolate these types of signals in previous installations. These units are typically comprised of a coil with multiple contacts, such as 'normally open' and 'normally closed'.

Clipsal has actually developed a product specifically for this purpose in the 756 smoke alarm isolation unit (see Figure 5).

However it's done, the installer must ensure that no damaging voltages are allowed to cross over into the interfaced control system, potentially leading to serious damage, not to mention electrocution danger to the home owner. Once isolated, the dry contact can be fed to the adjoining third party system in a number of ways.

Some lighting control systems allow dry contact inputs to be connected directly to their controllers via their network terminals, as is the case with most Dynalite equipment, in addition to a range of devices dedicated to bringing environmental information in the form of dry contacts and analogue inputs. In this instance, the smoke sensor interconnect dry contact (normally open) would be connected between the AUX and GND terminals. Then, through the unit's internal programmable logic control facilities, the installer could program as intricate and elaborate a 'fire' scenario as desired by the home owner.

Other lighting control systems such as Clipsal's C-Bus have specialised units designed to bring in environmental information. One such device in the range is the bus coupler which is often used to sit behind conventional switch mechs and effectively make them 'smart'. In this instance, the smoke alarm interconnect dry contact would be connected into the 5014BCL C-Bus bus coupler, preferably via the Clipsal 756 isolation unit mentioned above.

Assuming you've got as far as this and your smokies are now well and truly interfaced to your lighting control system in the safest possible way, you can now add some real wow to your client's installation. One particular example that comes to mind is a project I was involved with recently where the home owner had very definite ideas about what he wanted his lighting control system to do in the event of an alarm condition. In this instance, the home's smoke alarms were interconnected and interfaced back to the security system, which would provide a dry contact closure to the lighting control system in the event of alarm. Further, the security system was programmed to send the same dry contact closure in the event of either a burglar or fire alarm. As a result, whenever the alarm was triggered, the lighting control system would flash all outside lights on and off. All inside thoroughfares would be illuminated to full brightness, clearly identifying egress paths within the home in addition to exposing any would be intruders.

Interfacing smoke alarms to lighting control systems is a relatively inexpensive, simple and easy process, provided you go about it sensibly and pay attention to important details such as signal isolation. Further, the same principles described here could also be used to interface with security systems.

Once interfaced, you can easily offer the home owner and their family improved safety by implementing basic scenarios to provide safe egress in the event of fire detection. If you're still not sure about it, get a specialist involved to assist with the planning, programming and design of the necessary equipment. CHA

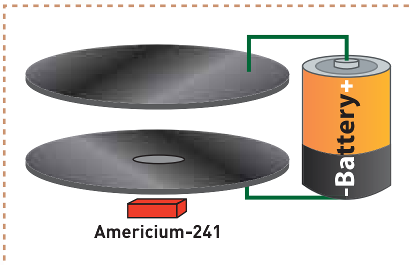

Figure 1.

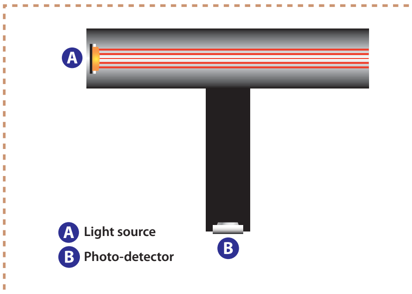

Figure 2.

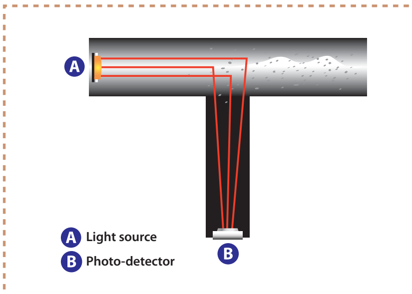

Figure 3.

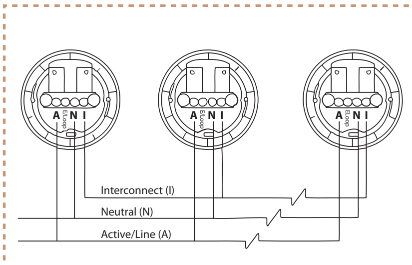

Figure 4.

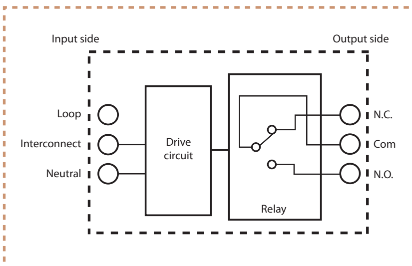

Figure 5.