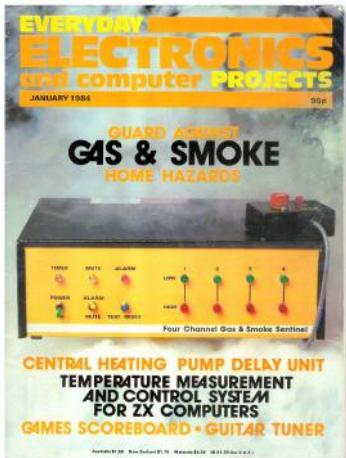


Four Channel Gas Sentinel

Completed January 1982 and published in January 1984 *Everyday Electronics and Computer Projects*



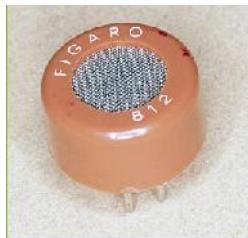
This early 1980's design was a seminal constructional project in my modest amateur electronics career, and the project was quite significant at the time. A ton of correspondence passed between EE and me, and the old file makes for excruciating reading as tortuous letters flooded back and forth. In between times I was being pressured for other prototypes and our letters reflected the hectic routine of putting a monthly magazine together. It was a totally mad way of doing things really, but there was no fax, email or digital photography, I couldn't reach them on the phone as I had a day job (though I sent a telex, once!) but that's how it was done in those days. Everything was typed, drawn, posted, photographed and put together by hand, letters were posted and prototypes parceled up. It would be totally impossible to work like that today.

I found the prototype Four-Channel Gas Sentinel at the bottom of a storage box underneath my Teach-In 93 Mini Lab/ MicroLab and PhizzyB (more of those another day!). It was built into a generously sized 'Norman' case with aluminium chassis and heavy galvanized steel cover that was as tough as old boots. I'd used the same type of case on my earlier Bench Power Supply (EE March 1981).

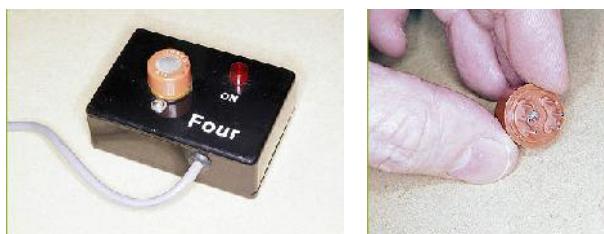
The prototype almost seems incomplete inside, looking like a half-finished working prototype cobbled together on stripboard and not up to my usual (probably over-elaborate) standard of construction. However it was fully functional and looked purposeful on the outside.



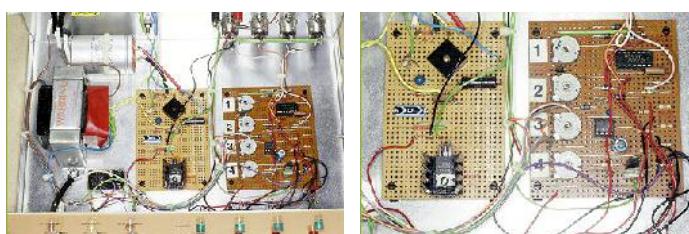
The electronics was based on my original Gas Sentinel (EE April 1980) and it simply duplicated four comparators feeding into a thyristor alarm circuit once again. The TGS sensors were again supplied by Watford Electronics (see Part 3 to learn more). The power supply was beefed up to provide 5V for four sensor heaters and a 12V regulated rail for the main alarm system. This time, a warm-up timer disabled the alarm for a few minutes after powering up – otherwise the sensors when warming up might trigger the alarm straight away!



The main system's party trick, then, was for the warm-up timer I.e.d. to light immediately (timing initiated/ alarm disabled) and each channel would start as green (normal), change to red (danger) during warming up, and then change back to green. Once the timer I.e.d. extinguished, the system was primed. There was no fail-safe mechanism to only "arm" once all the channels had warmed up; the routine was just based on a timer and the alarm section was turned on blindly after a period, regardless of sensor status. Nor was there a fail-safe in case a wire was damaged or a sensor was disconnected or removed! A dual-function switch was labelled Test/ Reset for the alarm network. Just to round it off, the design wasn't "intrinsically safe" either, as such sophistication would be impossible at this kind of level. Basically, it did what it did, and there was plenty of scope for customizing or enhancing it.



Everything seemed in order in my prototype but a spaghetti-like mass of 3-core wire connected the four TGS gas sensors. The wire, as I recall, came from the drum of 3A flex left over from a late 1970's failed *multi-station intercom* that had bombed entirely and was never published (I was too young, too ambitious, too soon, I guess, and *Practical Electronics* expected too much). I'd scrapped the thing in despair if not disgust but had a drum of wire left which I was glad to put to good use here. Each gas sensor was surface-mounted on its own plastic box (which I punched with a chassis cutter), with I.e.d. to show power was present. My prototype has two Figaro TGS812 and two TGS813 sensors which are in good clean condition.

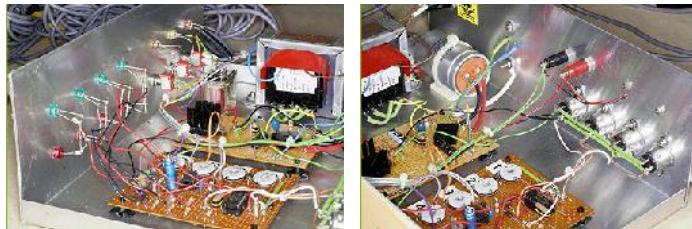


Inside the main unit, the two stripboard panels are perfectly intact (helped by the fact that I'd spray-lacquered them after I made them). I'd mounted them with new quick-release plastic posts (Maplin) and everything seems fresh like the day it was made 30+ years ago.



A TO-3 regulator was fitted on the rear; I always worried about insulating these things properly and didn't want swarf or sharp edges to puncture the insulating washer. I added a TO-3 cover too. I

found TO-3s were a pain to use in every respect as they needed careful and accurate drilling, de-burring, finishing and insulating. Also on the rear panel I'd used a Q-Max chassis punch for the four DIN sockets. These should have been locking types for improved security: you can unplug them and the main unit would never know! I found the metal-bashing was pretty onerous at the time. Nevertheless thanks to projects like this I'd taught myself to design and mark out panels with a scribe, centre-punch, drill pilot holes, use a chassis cutter and de-burr rough edges, all on my Dad's old workbench.



A smaller regulator was on a (scorched!) stripboard. The main smoothing capacitor was mounted off-board (!) using thick tinned copper wires. I still had no heat gun for heatshrink sleeving, so I used PVC sleeving once again but at least nylon tie-wraps tidied the wires into small looms. I'd say this project was a bit 'belt & braces' in functionality but it worked well enough.



EE graphic artists had spent time re-doing my front panel entirely, adding some coloured film and doing a proper job of Letraset and shiny laminate. Nice work. I used I.e.d. lens-clips as usual: red & green for the channels, and clear ones for everything else which magically changed colour when active. The clips were a bit wobbly though.

Once again, panel dress-butts were used on the miniature toggle switches along with coloured covers for the switch 'tangs'. I thought it looked pretty smart for a primitive but effective sort of circuit. You can imagine how proud I was when I saw that the cover of the January 1984 issue was devoted to my Four Channel Gas & Smoke Sentinel. After a lot of procrastination the folks at EE did me proud.

Anyway, checking my prototype, I unscrambled the rat's nest of wires and hooked everything together on the neatly labeled DIN sockets. After checking it inside to make sure nothing was amiss, I plugged it in...

Lo and behold the Timer I.e.d. lit up... and stayed lit for a good fifteen minutes or more! I guessed the timing capacitor had leaked but it then suddenly timed out. All four channels changed from green – red – green again as I hoped they would, and the system was now armed. (The Timer function now works properly with no undue delay.) Surprisingly for 30 year old devices, the TGS sensors themselves were responding well so far.

The Test/ Reset switch also worked and the buzzer on the rear panel buzzed in a forlorn sort of way. After a while the whole unit became pretty warm, as those four 5V heaters consume quite a lot and each sensor becomes noticeably hotter.

The TGS sensors react to many organic gases as well as smoke (or the carbon monoxide that it contains) – a combined smoke alarm and gas leak detector in one. How would the prototype respond after three decades of disuse? On my desk I had a Sharpie felt-tip pen which was a smelly,

alcohol-based thing so I placed it a few cms. away from each sensor in turn, and each channel responded within seconds and sounded the alarm. I could mute the alarm and reset it. So everything seemed to be functioning and I was really delighted to see the I.e.d.s changing back and forth as I wafted a Sharpie past each sensor. It was indeed quite a 'blast' to see the prototype working once again.

Whether anyone actually built the whole kit and caboodle back in 1984, I never got to know. Maybe the hassles of stripboard put people off. Today I would use multi-colour I.e.d.s and add better fail-safe protection, along with a more intelligent warm-up timer, but it could never be industrial-standard spark-proof (intrinsically safe). I'd also refine the circuit and maybe reduce the gain of the op.amps with feedback rather than using them simply as on-off comparators. People who are cleverer than me would use a PIC microcontroller instead.

There is plenty of room for experimentation, and who knows, one day I might revisit my 30-year old prototype and bring it into the 21st century!

You can download the original constructional article as a PDF from www.alanwinstanley.com.

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