Australia's Top Selling Electronics Magazine

Electronics Australia

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VCR THEFT ALARM

BUILD A TELETEXT DECODER

Hi-tech electronics in the new Holdens

Electronics Australia

Volume 46, No. 8,
August 1984

On the cover

You don't need a new TV set to receive teletext. Our new teletext decoder mates with your VCR and will set you back just $199 (see page 12).

Build a teletext decoder

Plug into teletext information services with our new teletext decoder. This month, we describe the main features and review the LSI chip set used in the design (see page 12).

What's coming?

Next month, we will present the full circuit diagram of the teletext decoder, describe a brilliant new train controller, and take a look at a low-cost CRO that comes as a kit of parts (see also page 106).

Sustain unit for guitars

Want guitar sustain but without the distortion you get with fuzz. With the new EA Guitar Sustain, that's just what you get. Details page 66.

Features

Hifi, Video and Reviews

Projects and Circuits

Personal Computers

Columns

Departments

Hi-tech electronics in the new Holden

GMH's new VK series Commodores are loaded with electronics. Our feature article beginning on page 36 has the details.

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Editorial Viewpoint

So you think you're an engineer, mate!

Engineers and technicians who don't read *Electronics Australia* regularly are not keeping up with the rising tide of electronics; in fact their degree or qualification is probably not worth the paper it is printed on! How can I make such an outrageous statement? Well that opinion has been growing for some time now but it has been crystallised by recent events as EA has attempted to hire new staff.

Recently EA advertised for new staff, both in the magazine and in the daily press. The response to these ads was quite gratifying and we had quite a few applicants who were either recently qualified engineers or part-way through a suitable degree course. This is ideal since it means that we would be hiring people who are right on top of the latest developments in new technology, or so you would hope.

When we came to interview the most suitable applicants, we were in for a shock; most of them didn't have a clue. Well perhaps that is a bit sweeping but they certainly did not have a good grounding in electronics. This was most surprising for us as some of these people were already holding down highly paid jobs. As far as we were concerned though, they were incompetent and not worthy of the title: engineer.

We make this drastic judgment on the basis of a simple knowledge test. Naturally we don't want to employ people as engineers who don't have a good grounding in the fundamentals. So we asked each and every applicant a series of four or five questions which they were expected to answer verbally and, if they wished to do so, with the aid of sketches. The questions were as follows:

1 (a) Give a simple outline of how a superheterodyne AM radio works.

1 (b) If you get this far, explain how a superheterodyne FM radio works. What is limiting and why is it important?

2. Give an outline of how a simple complementary-symmetry amplifier works. Include in your explanation the workings of the bias stabilisation of the output stage.

3. Explain how a phase-lock loop works.

4. Explain how a three-gate oscillator works? Ditto for a Schmitt trigger oscillator.

5. Explain how a multiplexed seven-segment display works and what are its advantages. Why aren't liquid crystal displays also multiplexed?

Now that is by no means an exhaustive survey of electronics; it does not even begin to scrape the surface of what a good all-round engineer would be expected to know. But it can give an indication of general knowledge.

Well, how did most of these recently qualified or soon-to-be-qualified engineers and technicians go? You would have to conclude that most were hopeless. Some could not even get to first base with question one. They did not know about mixers, IF amplifiers or detectors. Incredible.

Question two stumped most people when it came to explaining such things as Vbe multipliers and the purpose of emitter resistors in the output stages. Incredibly, some had not even heard of the advantages of power Mosfets in this respect. Where had they been?

continued on page 121

Big screamers!

Know what a crook hates most? Noise! Scare the pants off them with this high efficiency horn speaker. Connects to alarm speaker output. Really loud.
Cat C-2705

ONLY $10^25

Larger (127 x 200mm) horn with huge 15 watts rating. For the installations where a loud alarm is a must.
Cat C-2718

Also ideal for PA use

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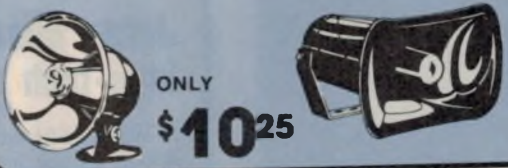

★ ★ ★ ★ *EXCLUSIVE* ★ ★ ★ ★ ★

Our step-by-step guide makes it so easy to install your own alarm system to fully professional standards! Everything you need to know – and it's only $1.95 or FREE with any alarm system from Dick Smith Electronics.

Features:

- Heavy duty steel case with security key lock and tamper protection.
- Internal mains power supply plus charger for (optional) back-up battery: room inside the case for battery.
- Latest 'wire-out-proof' sensor circuitry – suits both n/o and n/c sensors!
- Use with any type of intruder detection sensors.
- Isolate any sector(s) you wish: you can have alarm on in rest of house while you're asleep at night.
- Comprehensive installation manual supplied!

Cat L-5100

Give em the gong!

Ultra Loud Bell. A great new addition to our range. Huge 8 inch fire bell with massive gonger, 12 volts operate at 300mA. Suitable for most alarm systems.
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Cat L-7025

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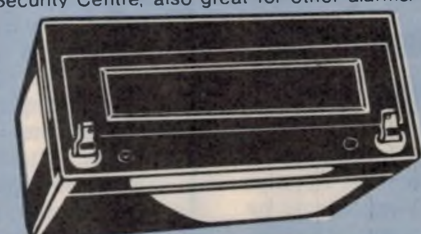
Battery Back-up

12V 2.6AH Rechargable Gell Cell. At last! A high current rechargable battery ideal for alarm use. Fits perfectly into our new Security Centre, also great for other alarms. Easy to keep trickle charged.

Cat S-3320



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One step — and they're gone . . .

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Cat L-5270

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Protect against fire!

Most alarms have provision for a fire sensor. Take advantage of it and protect your home and property! Use any number of sensors in likely 'hot spots'.
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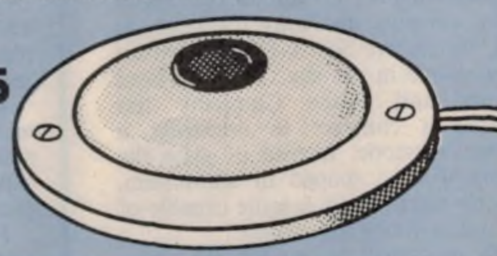

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See centre section for address details

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News Highlights

Aluminium replaces glass in X-ray telescope

X-ray telescopes are far more complex than their optical counterparts. Because one mirror can deflect X-ray energy by only a small amount, many reflecting surfaces are needed in order to focus the X-ray image. Using glass surfaces, ground in the same manner as for optical use, results in a very expensive and very heavy instrument.

NASA plans to launch an Aries rocket, carrying an X-ray telescope, in 1985, to observe Sco X-1, the brightest X-ray source in the sky. The Lockheed Missiles and Space Company has accepted a contract to construct a suitable telescope. Instead of glass the mirrors will be shaped in aluminium, using an ultra-precision lathe capable of working to 1/1000mm (1μm).

This work will be carried out under the direction of the Mullard Space Science Laboratory in Surrey, England. After turning, the Lockheed engineers will apply a fine coating of lacquer to provide the smooth surface needed to reflect the X-rays. The photo shows one of the six mirrors which will be used, and illustrates the strange optical results they produce. — Brian Dance.

Japan boosts high-tech spending

While IBM has announced that it will reduce its research in high speed Josephson junction devices, the Japanese Agency of Industrial Science and Technology says it has not altered its own plans to proceed with the devices.

The agency is the research arm of the Ministry of International Trade and Industry (MITI), who continue to regard Josephson junctions as the most important element in fifth generation computers, the spearhead of Japanese research in "artificial intelligence". MITI officials say that no satisfactory substitute has been found for the performance offered by Josephson junction circuits, even though they require cooling to sub-zero temperatures to function.

The continued research is just one small part of a major Japanese effort in new technology. A recent survey shows that while Japanese industry is planning less total investment spending in 1984 than last year, the amount to be spent on high technology will be considerably greater than in 1983.

The survey, by Japan's leading daily economic newspaper, the Nihon Keizai Shimbun, shows that although Japanese industry as a whole plans to invest 1.1% less in 1984, the electronics and computer industries plan to spend a massive 24% more on research this year and the robotics industry is planning to boost advanced technology spending by 20%.

Investment in advanced technology by the communications industry in 1984 is expected to be 54% ahead of last year's spending.

For its part, IBM has reduced its push into research into the Josephson junction because it can see the improvements in high speed bipolar technology are rapidly converging on Josephson junctions. And bipolar circuitry does not have to be cooled below zero to get those speed improvements.

New chip for colour TV

SGS-ATES has succeeded in integrating all three colour TV output stages on to a single IC which drives the cathodes of a colour TV tube. The new 7300 mil^2 chip operates from a 200V supply, boasts a 6MHz bandwidth, slew rate of 1000V/μs and features an output load of 15pF. SGE-ATES also claims that its product is "remarkably reliable" as it has operated for 1000 hours at 150°C.

New TV channels — but don't panic

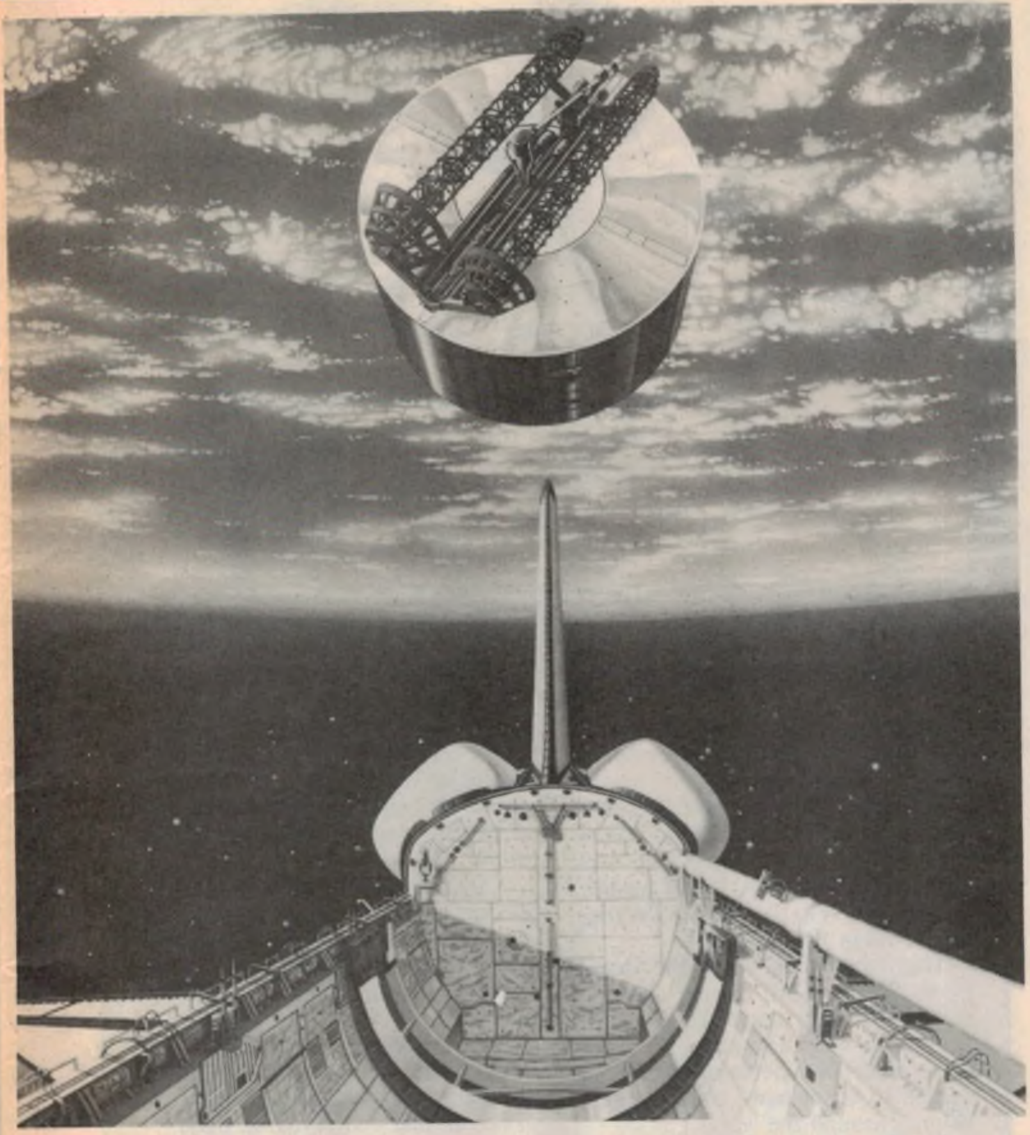
Twenty years ago the responsible authorities made a rash decision — severely criticised at the time — to put three TV channels (3, 4 and 5) into that portion of the VHF spectrum which, in other countries had been set aside for FM sound broadcasting. The result has been a severe restriction in the development of FM radio, as Department of Communication engineers struggled to fit a few FM channels into what little spectrum space remained.

But all this is to change — eventually. The Minister for Communications announced recently that a task force is to be established to develop a national VHF channel allocation plan. Its job will be to clear channels 3, 4 and 5 from the FM band, opening the way for expansion of the FM radio service. Another casualty will be channel 5A, again an ill-chosen frequency (137-144MHz) which is hard alongside the amateur 2m band, and also interferes with weather satellites and defence channels.

But don't hold your breath. It is estimated that it will take from 10 to 20 years to complete the job. One requirement is to give all concerned, industry, station managements and viewers, adequate warning and time to acquire suitable new equipment as current items come due for replacement.

The other problem is to find new channels for the displaced ones. The plan is to create two new VHF channels, 9A and 12, and to shift other services into the UHF band. However, the new VHF channels cannot be created until the aviation industry's DME system is moved from VHF to UHF.

So there's no need to panic. For the next few years things will roll along much as they are at present.



Hughes pioneers giant satellite

A Leasat communications satellite is ejected from the bay of a space shuttle in this artist's rendition. Built by Hughes Aircraft Company's Space and Communications Group, the first Leasat is scheduled for launch from the space shuttle Discovery.

Eventually, a four-satellite network will provide global communications on a lease basis to the US Armed Forces. The Leasat is 4.3m in diameter and only the space shuttle is capable of carrying it into orbit. A spring and pivot mechanism in a special launch cradle will eject the satellite with a spinning motion.

The satellites have a design life of 10 years and will operate in the UHF and SHF frequency bands. Each Leasat will receive and transmit communications over an area of one third of the earth.

Broke in Bourke? No worries mate

A young woman from Pine Bluff, Arkansas, USA, put her Visa card into an automatic teller in a Sydney shopping centre. Within eight seconds the computer at her bank in the US had debited her account and Mary Stone was collecting $20 from the Rediteller terminal. Miss Stone obtained her $20 in the first electronic funds transfer of its between the two countries.

She inserted her card into the automatic teller and typed in her Personal Identification Number (PIN), the same way locals make an after-hours bank transaction.

But in Miss Stone's case, her number was scrambled in an encrypter box and was transmitted from the terminal in Bondi Junction by Telecom landline to North Sydney and the offices of Austnet, the Australian company that provides the communications links for the financial institutions that use the electronic funds transfer system.

From there the signal went to Visa headquarters in central Sydney, then to the OTC at Martin Place, and then by satellite to the Visa centre in Singapore.

Miss Stone's message then travelled underwater by cable to California, by land line to West Virginia and then to Pine Bluff, about 25,000km from Sydney.

At the Simmons First National Bank in Pine Bluff, the computer unscrambled her code, checked to make sure it was correct, established that she had funds in her account to cover the transaction and then sent the go-ahead back through the same links to Bondi Junction where the money was released.

And all in eight seconds! ("Telecom News").

Joining optical fibres in the field

A machine capable of joining hair-thin optical fibres with high accuracy has won a British Telecom (BT) competition. A team of BT engineers has developed the device, which is said to be the telecommunications equivalent of micro-surgery. Optical fibres, known as lightlines, carry telecommunications by laser light.

The strands of glass carrying the laser light must be precisely aligned before they can be joined, which is no easy task when working underground. BT's new machine does this to an accuracy of one micron (one thousandth of a millimetre) before the fibres are fused together with a high voltage electric arc. The machine is completely portable and with battery power can be used down manholes as well as on the surface.

A BT spokesman said: "We are looking to the export market with this machine as well as to satisfying home demand. The machine has already been bought by both the Dutch and Italian communications authorities and we expect a good deal of interest from other countries."

News Highlights

Cable TV/satellites change viewing habits

Will the advent of domestic satellite circuits, coupled with the TV cable distribution concept, substantially alter the viewing habits of America's TV audience? Very definitely so, according to one US authority, International Resource Development Inc.

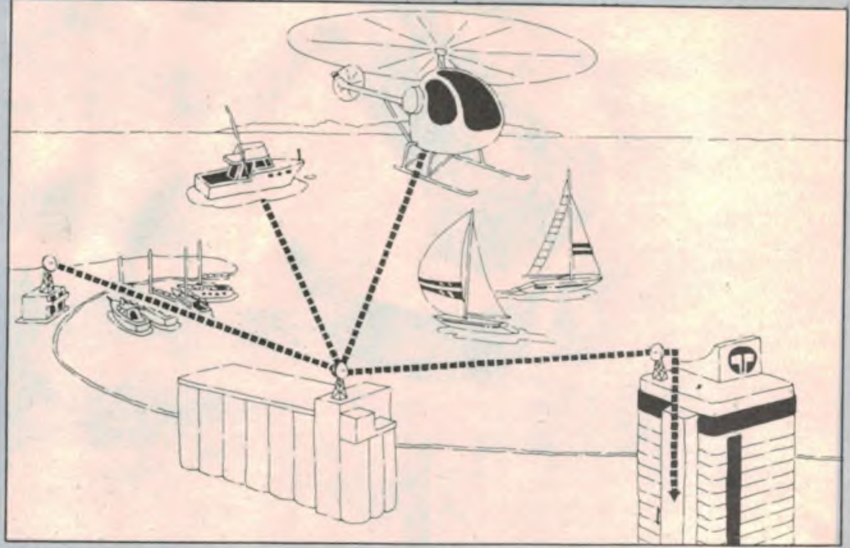
They predict that, by 1990, the dominance currently enjoyed by the big networks — ABC, CBS, and NBC — will have been substantially eroded by the cable system. They cite serious viewer dissatisfaction with present program standards and a demand for a greater variety of programs as the basis for these predictions.

They claim that the cable system will provide a far wider range of religious programs, children's programs, and top quality entertainment fare on the one hand, and, for those who want it, uncensored adult shows now available only via the video cassette.

Nor is the advertiser being left out of these calculations. It is predicted that, eventually, they will move from the conventional "broadcast" channels to the "narrow-casting" concept made possible by cable.

A major requirement to make this concept work is what is called the "magazine format"; the provision of a large number of channels with each channel dedicated to a particular subject. In this way the advertiser can be assured of a high order of penetration into a particular market.

Whether it will all work out this way remains to be seen. The general public has a nasty habit of not doing what the market research organisations predict — particularly in the field of entertainment.



America's Cup challenge to Telecom

Australia II's victory at Newport last year had many repercussions, many of them undreamed of by the general public. For example, the echo of champagne corks, the tumult and the shouting had barely faded when Telecom staff in WA began turning their attention to the return challenge to be held in Perth waters.

They knew that when the Royal Perth Yacht Club hosted its first defence of the America's Cup off Fremantle in 1986-87, a huge communications network would be needed to beam news and television pictures around the world.

As talk of the challenge grew and all eyes turned to the area between Fremantle and Swanbourne, Telecom began looking at putting a radio antenna on the Co-operative Bulk Handling Ltd's silo at North Mole in Fremantle.

The 58 metre silo, originally built in 1944, is in a commanding position and could receive uninterrupted signals from the race area.

These could be beamed back to the main Telecom communications centre in Wellington Street and from there through Telecom's normal network around Australia or the world.

Chief of the planning team, Brian Hume, said it was part of Telecom's function to plan up to 10 years ahead. In this case the planners have only three years to come up with the answers.

Brian said there was little doubt that there would be huge communications demands and Telecom had a vital role to play.

"We have the knowledge and the expertise and it will be our role not only to provide aspects of the communications needed but also to advise and help television and radio crews from Australia and overseas," he said. ("Telecom News").

CCTV for dam wall inspection

The Hunter District Water Board is using a miniature closed-circuit television system to examine the internal structure of the recently-built 200 metre-long Chichester Dam situated near Newcastle, just over 100km north of Sydney. Having decided that the wall of the dam should be inspected internally each year, the authority devised a method of using closed-circuit television (CCTV) to examine pipes, boreholes and other narrow channels.

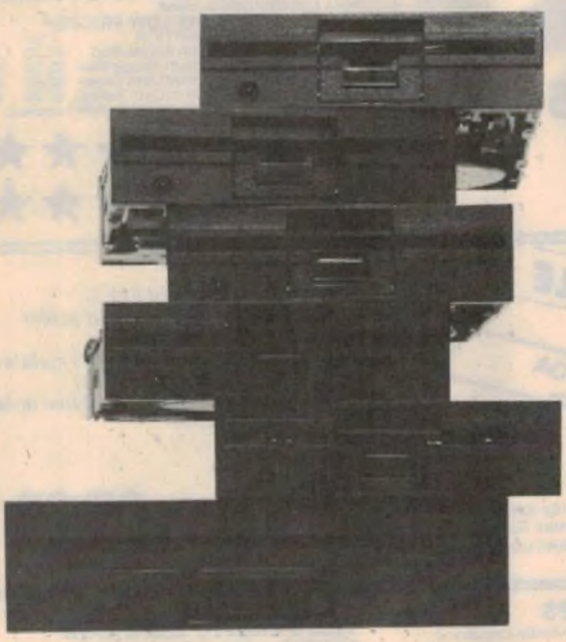
The equipment chosen is made by a British firm, Telespec Ltd, of Woking, near London. The Telespec inspection camera, in a 51mm diameter stainless-steel case, is lowered under its own weight into 300mm diameter inspection holes drilled vertically into the sloping part of the dam wall at intervals of 10m along its length. These are 80m deep and pass through the concrete structure into the natural rock on which the dam is built.

Lowering is controlled by the cable drum which pays out the camera cable and the cable is kept central in the holes by a centring device using a spring-loaded skid.

The camera is fully submersible and has a wide angle (110°) lens together with its own 50W quartz halogen lamp for lighting. On the associated television monitor it gives a sharp picture of any cracks or fissures which might be intercepted by the inspection hole and so be visible in its walls. Particularly critical is the interface between the concrete and the natural rock beneath it. Changes in strata can be clearly seen as the camera passes through the rock.

D is for Disk Drives

MITSUBISHI ELECTRIC



Our Flexible Disk Drives won't drive you 'round the twist.

They are faster, safer and priced to appeal.

And you can choose from three sizes.

Double sided, double density storage is available in 8", popular 5¼", or the newly developed 3½"; with storage from ½ Mbyte (unformatted) up to 2 Mbyte (unformatted).

The same high technology, safety and cost efficiency is yours, no matter which version you choose.

Bigger storage, faster start-up and access are coupled with safer operation. Data error is minimised by direct drive DC motors and precision head step positioning system. Media damage and disk expansion are prevented by factory calculated stepper motor location. So you can build a more reliable product.

And, late in 1984, a new range of Hard Disk Drives designed to complement our Flexible Disk Drives will broaden your scope of choice.

Find out more about how you can drive your way to better quality . . . with Mitsubishi Disk Drives. Call us today for the best value-for-money range of Disk Drives available in Australia.

3½" Flexible Disk Drives

Performance Specifications	MF351	MF353
Memory capacity		
Unformatted		
Disk (kilobytes)	500	1,000
Surface (kilobytes)	500	500
Track (kilobytes)	6.25	6.25
Formatted (256 bytes/track)		
Disk (kilobytes)	328	655
Surface (kilobytes)	328	328
Track (kilobytes)	4.1	4.1
Transfer rate (kilobits per second)	250	250
Mean latency time (milliseconds)	100	100
Access time (milliseconds)		
Track to track	3	3
Average	94	94
Setting time	15	15

8" (Half Height) Flexible Disk Drives

Performance Specifications		M2896-63
Memory capacity (kilobytes)		
Unformatted	Per Disk	1600
	Per Surface	800
	Per Track	10.4
Formatted	(256 bytes/track)	
	Per Disk	985
	Per Surface	492
	Per Track	6.66
Transfer rate (kilobits/sec)		500
Mean Latency Time (milliseconds)		83
Access Time (milliseconds)		
Track to track		3
Average		91
Setting time		15

5¼" (Half Height) Flexible Disk Drives

Performance Specifications	M4851	M4853	M4854	M4855
Memory capacity	500	1,000	1,600	2,000
Unformatted				
Disk (kilobytes)				
Surface (kilobytes)	250	500	800	1,000
Track (kilobytes)	6.25	6.25	10.4	12.5
Formatted (256 bytes/track)				
Disk (kilobytes)	328	655	985	1,310
Surface (kilobytes)	164	328	492	655
Track (kilobytes)	4.1	4.1	6.67	8.19
Transfer rate (kilobits per second)	250	250	500	500
Mean latency time (milliseconds)	100	100	83	100
Access time (milliseconds)				
Track to track	6	3	3	3
Average	94	94	91	94
Setting time	15	15	15	15

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SENSATIONAL DEALS ON 3-WAY SPEAKER SYSTEMS!!

A massive scoop purchase of factory distress stock has enabled us to pass on unbelievable prices on quality speaker systems. The component speakers in these systems are normally incorporated into cabinets for many well known national brand HI FI companies.

Each speaker is factory guaranteed for 90 days, however we doubt whether you will ever need to worry about it.

8" 3 WAY SYSTEM

Superb 8" woofer with foam surround suspension and heavy magnet assembly with sealed back midrange and tweeter. System impedance 8 ohms. Power handling 40 watts rms. Crossover capacitors and connecting diagram and recommended 8" cabinet detail drawing supplied.

Cat. CS-2453 (2 required for stereo)

$29.95/set

10" 3 WAY SYSTEM

Once again, a high quality 10" woofer with higher power, sealed back midrange and tweeter. System impedance 8 ohms. In addition a quality Pioneer 3-way crossover is provided at no extra charge. Connection instructions are also provided as well as recommended 10" cabinet plans.

Cat. CS-2454 (2 required for stereo)

INCLUDES PIONEER 3-WAY CROSSOVER!!

$39.95/set

JAYCAR - WELCOMES YOU TO A WONDERLAND OF ELECTRONICS

6" WIDERANGE

4 ohm impedance. Suitable for cars, or two in a box for extension speaker system. Very high quality curvelinear cone. Normally sells for **$6.95** each. Less than ½ normal cost!

Cat. AS-3011

$2.99 ea

10 up

$2.50 ea

PHILIPS 12" WOOFER

We have made a MASSIVE SCOOP purchase of genuine quality PHILIPS European made 12" HI FI woofers. These are used in the fabulous ETI4000 series kits. 100 watts rms power handling.

CATALOGUE PRICE $99.50

THIS MONTH ONLY $59.50

SAVE A WHOPPING $40.00!!

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$5 - $9.99	$1.50
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$25 - $49.99	$4.50
$50 - $99.99	$6.50
$100 - $199	$8.00
Over $199	$10.00

COMET ROAD FREIGHT ANYWHERE IN AUSTRALIA ONLY $12.00

SHOP HOURS CARLINGFORD, CONCORD & HURSTVILLE

Mon - Fri 9 am - 5.30 pm

Sat 9 am - 12 pm

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Will they ever be this cheap again?

SCOOP! WHAT PRICE US?

Once again - a massive scoop purchase with a difference. We have purchased a very large quantity of 'reject' grilles. They are rejects because they have small flaws in the mouldings. Most people however cannot pick the flaws if allowed to examine the grille. Imagine what the flaws look like 9 feet up on the ceiling! Naturally we are offering a massive saving over normal units which we also sell. Exactly the same units (sans flaws) have been sold throughout Australia in the 10's of 000's. The perfect ones sell for around $2.95 - at least one company sells them for well over $3.00.

Cat. AX-3560

P.A. INSTALLERS - GO FOR IT!

- 1-4 UNITS $1.50
- 5-19 UNITS $1.25
- 20-49 UNITS $1.15
- 50 + UNITS 99¢

PRICES INCLUDE TAX

10" ELECTRIC GUITAR SPEAKER

Quality Pioneer brand - check the specs! Check the price!! HURRY

Impedance	8 ohms
Voice Coil dia.	1½"
Power Rating	60W (RMS)
Resonant Frequency	80Hz
Sensitivity	98(dB/W)
Response	80Hz - 7,000Hz
Total Flux	61,100 Maxwell
Flux Density	8,300 Gauss
Net Weight	1,540 grams

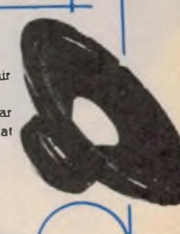
CATALOGUE PRICE $39.95

ONLY $29.95

ASK FOR A NEW CATALOGUE!!

Mail Order customers, if you have not seen our new catalogue, boy are you missing out! If, (or when) you next buy from us by mail order just ask for a catalogue. It will be sent FREE with your order! If you have one and want one for a friend, that's fine too! Just ask!

8" TWIN-CONE HI FI



20 watts rms with whizzer cone. Air suspension type. Low free air resonance.

Normally this speaker sells for around **$19.95.** The Jaycar massive scoop purchase enables you to buy them this month at only **$9.95.**

AN INCREDIBLE 50% SAVING!!

The stock WON'T LAST AT THIS PRICE - HURRY!!

Cat. CE-2330

NORMALLY $19.95

THIS MONTH $9.95

by LEO SIMPSON

Build a Teletext Decoder

Here's your chance to take advantage of Teletext services. If you already have a VCR you can add this Teletext decoder developed by Dick Smith Electronics for just $199.

Up till now, the major barrier facing anyone interested in the services offered by Teletext has been cost. There have been several ways to obtain Teletext services. First is the simplest and most expensive which involves going out and plonking down the dollars needed for a brand new set with Teletext included. At present prices this means a minimum investment of around $1000, with some large-screen sets costing considerably more.

It has also been possible to purchase an adapter such as the Radofin. This sells for around $500 which is not a small matter for an adapter. You can buy a new VCR for less.

The third possibility has been to have your existing TV set modified and an internal Teletext decoder fitted. This is really only a practical possibility for sets made in the last five years or so and even then there are exceptions. Some Philips sets are easily upgraded with the addition of plug-in boards. In the latter case the additional cost is about $200.

Now there is a fourth way of gaining Teletext: Build your own adapter which must be used in conjunction with a VCR (Beta or VHS) and your TV. If you don't have a VCR you won't get to first base. If you have, read on. Even if you don't possess a VCR now you should read how it is possible to use a VCR to gain Teletext facilities. After all, VCRs are becoming cheaper all the time.

Just as an aside, there are already about two million VCRs in use in Australia. This is expected to double in the next two years.

Teletext features

Before we go into the intricacies of how a VCR is teamed with a decoder to gain Teletext services, perhaps we should talk about Teletext facilities themselves.

For those who have not seen off-air Teletext displays, the illustrations on the cover of this issue and within this article show some of its capabilities. The screen format is up to 24 lines of 40 characters in upper and lower case. This is mixed with colour and graphics in almost any format. The displays are very bright and sharp, and easy to read.

If you are particularly short-sighted, there is the facility for blowing the display to twice normal size, in which case either the top or bottom half only is shown on the screen.

Every individual screen display has its own page number, and includes the day, date and precise time along the top line.

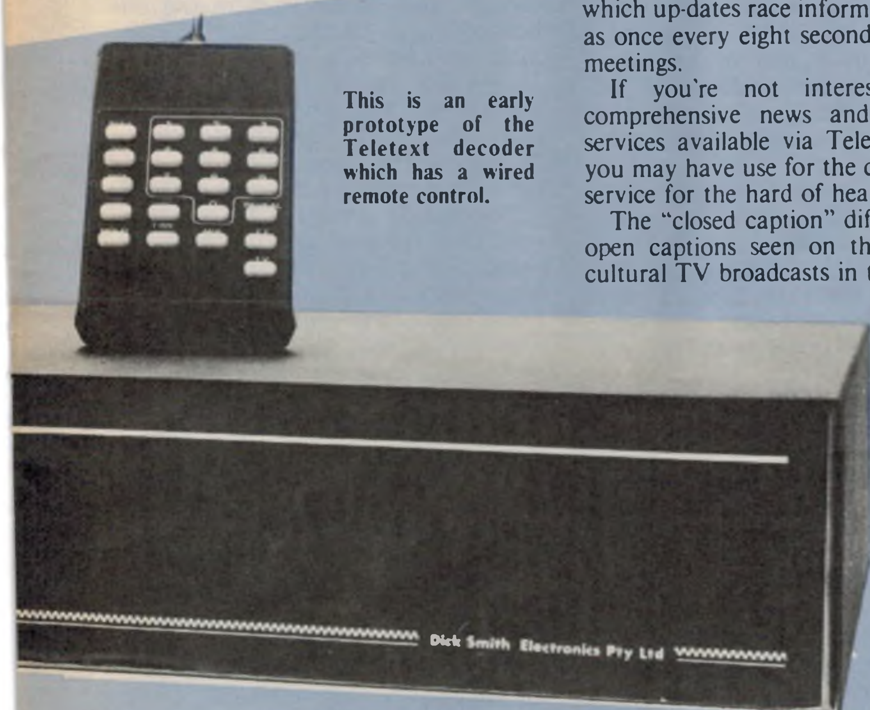
The total number of pages available at any one time varies with the channel selected but Sydney's Channel 7 probably has the most comprehensive facilities with 200 pages. It has on-line connection to the NSW TAB computer which up-dates race information as often as once every eight seconds during race meetings.

If you're not interested in the comprehensive news and information services available via Teletext, perhaps you may have use for the closed caption service for the hard of hearing.

The "closed caption" differs from the open captions seen on the SBS multicultural TV broadcasts in that you need a Teletext decoder to use them. The ABC currently broadcasts quite a few of its programs with Teletext captions (from the Caption Centre). These programs are designated at the start with a double-C symbol in a corner of the screen.

For the decoder under discussion, Teletext captions are displayed as two lines in a grey panel in the lower portion of the screen. (On TV sets with in-built decoders the captions can be displayed in colour with contrasting background.)

At present, commercial Teletext services are available in Sydney, Brisbane, Canberra, Newcastle, Wollongong, Wagga and Tamworth. At the same time, the ABC has closed captions via Teletext broadcasts from about 60% of the National network. So even if your town or city does not have commercial Teletext there is a fairly good chance that Teletext signals are already being broadcast, wherever you live in Australia.



This is an early prototype of the Teletext decoder which has a wired remote control.

How Teletext is broadcast

How can you mix a Teletext signal with a normal TV transmission and not get interference to the regular program? To understand the answer to that question, we need to back up a little and understand how a conventional TV picture is formed.

Briefly, conventional TV transmission relies on a technique called interlacing. What this means is that instead of 25 separate pictures of 625 lines each being traced out on a TV screen each second, each 625 lines is transmitted as two separate patterns (or fields) or 312½ lines. These two patterns are transmitted alternatively and provide the equivalent of 50 separate pictures per second, and thus flicker-free viewing.

At the conclusion of each field, the electron beam spot returns to its start position at the top of the screen ready to

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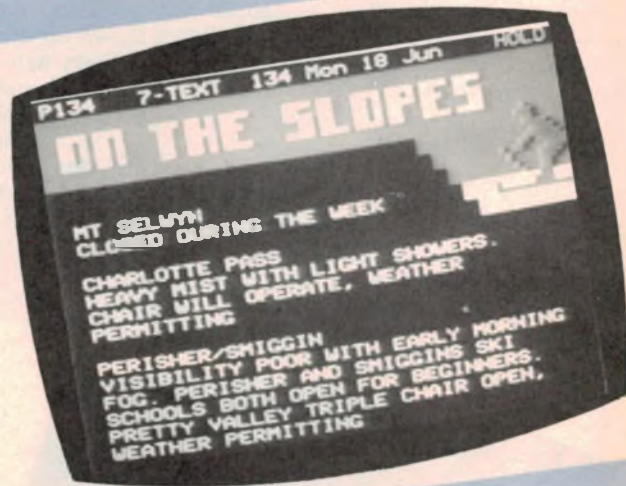


commence the next field. The time taken for the beam to return from the bottom to the top of the screen is known as the vertical blanking period and occupies some 25 lines. No program information is transmitted during this period.

The blanking period between successive fields is represented by the thick horizontal bar that you see when you deliberately mis-adjust the vertical hold control to roll the picture down.

Some of the lines in the vertical blanking period are used for test signal injection while others must be left blank otherwise they may interfere with the normal working of the receiver. However, at least some of the lines in the vertical blanking period are used for Teletext. They show up as white horizontal lines of moving dots within the blanking bar.

Originally Teletext used two of these lines, lines 19 and 20 for the first field and lines 332 and 333 on the next (interlaced) field.

Each of these two lines carries enough information to provide one 40 character line on the TV screen, and a full screen contains 24 such lines. Thus it requires 12 fields, and takes 0.24 seconds, to complete one page. Such a system could contain 100 pages and it would take 24 seconds to scan each one in turn.

At the receiver, which must be specially designed or adapted for Teletext, the user feeds the page number he wants into a keyboard and the system waits for this page number to come around. As already explained, this could take up to 24 seconds.

When the page number does appear the decoder recognises it, stores the information from the following fields until the full page has been presented then displays it on the TV screen. As an alternative to a full 24 lines, some pages may present only one or two lines superimposed on the bottom of the TV picture. This technique may be used for news flashes or obviously, a caption service.

(More recently, the Australian Teletext standsrds have been upgraded to four lines per field; lines 15, 16, 19, 20 for the first field, and 328 329, 332, 333 for the second field. This allows a much larger magazine for the same access time, or a shorter access time for the previous magazine size.)

In order to provide a caption service, one fundamental limitation of the Teletext system — access time — has to be overcome. While it is easy enough to dedicate one page of a complete magazine to the captions, the time needed to locate or update this page — more than 20 seconds — is quite unacceptable for a caption service, which requires a virtually instant response.

The answer to this problem (in Australia at least) is to provide an extra line per field; line 21 for the first field and line 334 for the second and these are used exclusively for the caption service. Thus the response is virtually instantaneous.

So much for what might be termed the logistics of the Teletext system. How does this new Teletext decoder extract the signal and display it on the screen.

Teletext decoder

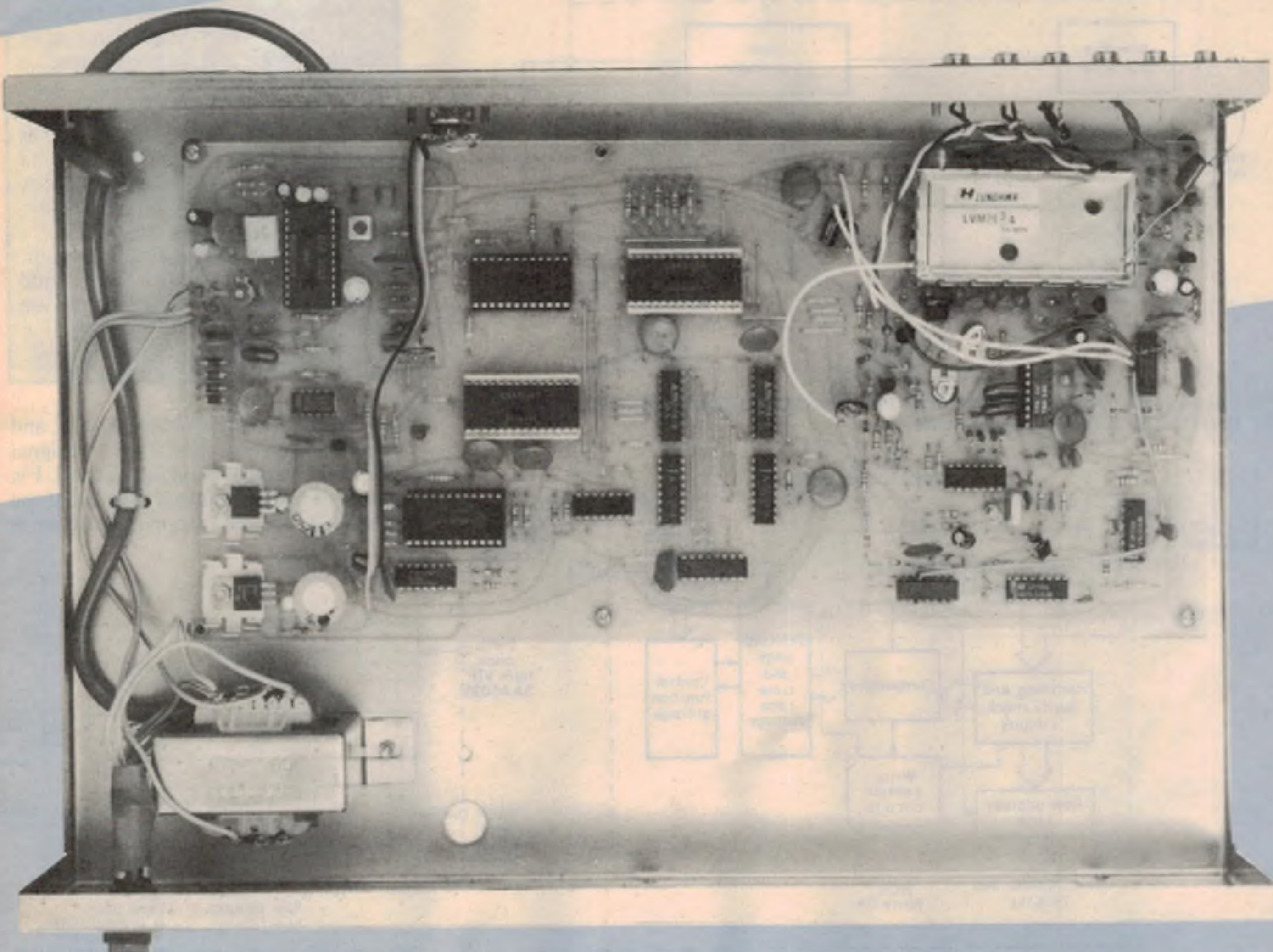
The difference between add-on decoders such as the Radofin and this build-it-yourself decoder is that this one must be used in conjunction with a VCR. The format of the VCR is unimportant; it may be Beta or VHS (or even one of the outmoded systems formats such as system 2000) but it must have video and audio outputs.

The decoder is used in the following way. The VCR is used to tune the wanted TV station. The video and audio outputs of the VCR are connected to the free-standing Teletext decoder which then produces its own Teletext video signals and feeds them to a modulator which is set to the Australian channel 0 or 1 and fed to the antenna terminals of your TV set.

Now, in response to commands from the wired remote keyboard, you can select either the normal station program or the Teletext picture (provided the station concerned has Teletext services).

Alternatively, you may elect to display both the Teletext and program video in which case you will have the pictures superimposed.

Below is a view inside the prototype showing the large single sided PC board. Very little wiring is required.



Other facilities include the display of digital time on the screen at the press of a button and the ability to revert to the program while waiting for a new Teletext page to be stored in the memory.

Some history

This is actually the second time that *Electronics Australia* has been involved in the development of a Teletext decoder. The first was some years ago and involved a Teletext chip set from the General Instrument Corporation. The approach was to use a proprietary printed circuit board with the GI chip set and adapt it to a standard TV receiver.

This was fraught with difficulties as there is hardly any TV set which could be called "standard". Sets with live chassis presented a serious problem as did older sets with insufficient video bandwidth. Ultimately we had to give the idea away as impractical.

For this reason we were very attracted to an idea put forward some months ago by Gary Crapp, the manager of research and development for Dick Smith Electronics. His idea was to use the tuner and IF stages of a conventional VCR to feed an add-on Teletext decoder.

On the face of it, this was a very good alternative to the concept of having to "break-into" the internal circuitry of a TV set to extract the video signal and then feed signals directly into the picture-tube guns. While the latter approach is ideal for manufacturers and gives the most sharply defined picture, the VCR/Teletext decoder can be applied to any TV set, old, new, live-chassis or otherwise.

And so it has come to pass. Dick Smith Electronics, in co-operation with the Radofin Electronics (FE) Ltd (who manufactured the commercial decoder mentioned above), have produced the Teletext decoder published here.

It is largely based on the Radofin design, minus the RF front end, IF stages and video detector. It is also fair to say that the Radofin design is based almost wholly on the original Mullard (UK) circuit, using the Mullard chip set. We are certainly glad that the design uses the Mullard chip set since it is acknowledged to be the best available for Teletext.

All the decoder circuitry is mounted on one large printed circuit board measuring 320 x 152mm. The board is single-sided and is easy to assemble. The total semiconductor complement is 19 ICs, two three-terminal regulators, nine transistors and nine diodes. The only component not accommodated on the PC board is the mains transformer.

Of the 19 ICs, five are part of the Mullard Teletext chip set. An additional IC is housed in the wired remote control (which will be supplied fully assembled) and is part of the set. Let us briefly

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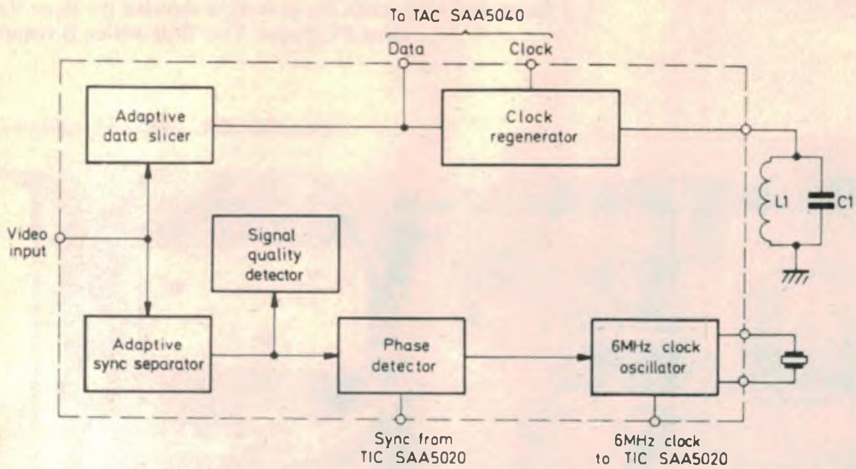
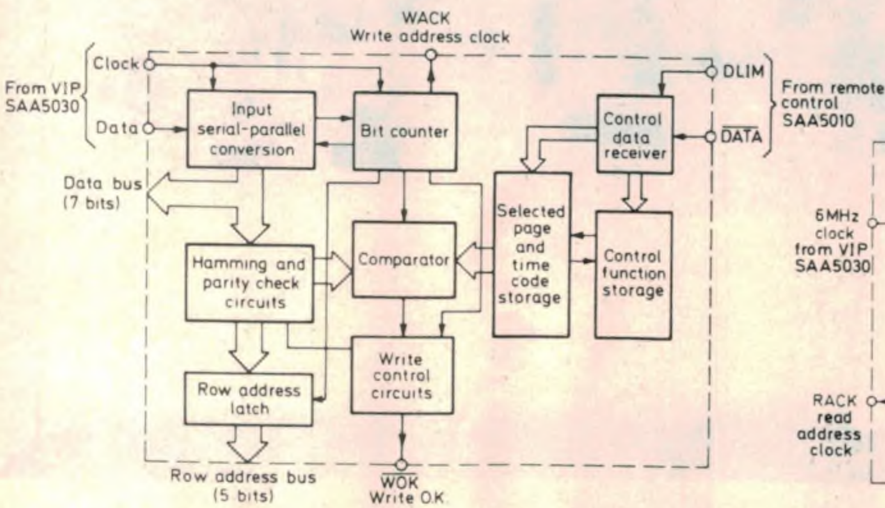


Fig. 1 above is the block diagram for the video input processor. Below is Fig. 2, block diagram for the Teletext data acquisition and control IC.

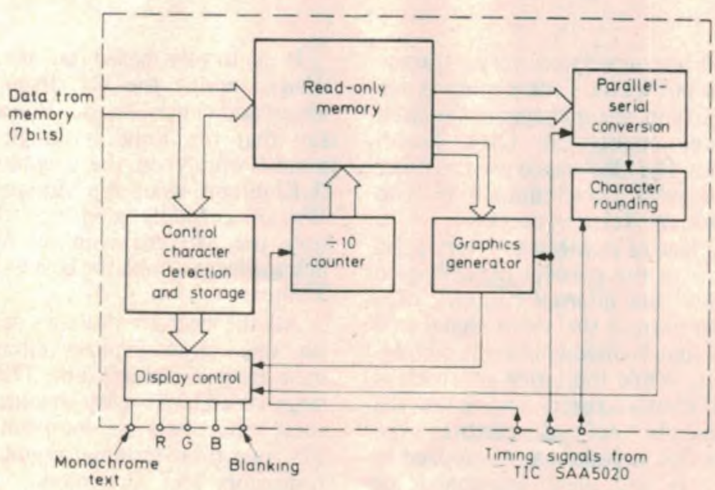


Signal quality

For Teletext reception you need a high quality signal. Teletext reception is badly affected by signal ghosting, both long and short duration. Random noise and impulsive noise on the signal is less of a problem but a strong signal is preferable.

Bad Teletext reception shows up as picture errors which may be wrong or missing alphanumeric characters, chunks missing from graphics displays or entire lines missing.

Accurate tuning is also important. When tuning is spot-on the digital clock display at the top of the picture will update continuously.



describe the functions of the six ICs of the Mullard set, which is distributed in Australia by the Electronic Components and Materials division of Philips.

Four of the chips have strange names, as follows: VIP, TIC, TAC and TROM. The other two provide the remote control transmitter and receiver functions but don't have the benefit of cryptic names. Weird!

VIP stands for Video Input Processor. It is the SAA5030 which takes the incoming video signal from the VCR and strips the Teletext data from the signal sent in the vertical blanking interval. Fig 1 shows a simplified block diagram of the SAA5030. The data stripping function is

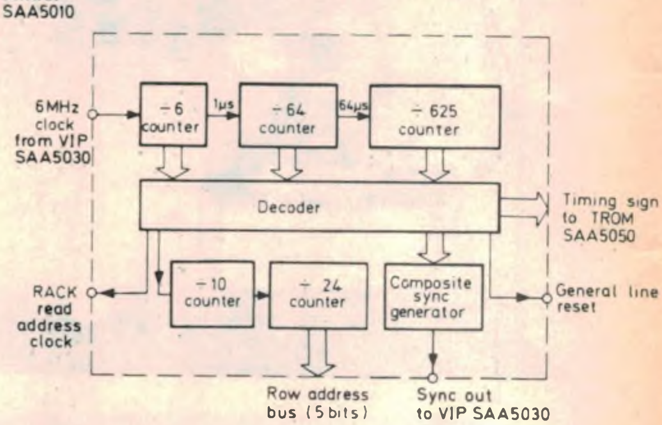


Fig. 3 above is the timing integrated circuit while below right is the Teletext ROM character generator.

performed by the "adaptive data slicer". This appears to be a fancy name for a circuit which sets the level at which it will switch to half the incoming data amplitude which thereby renders it less sensitive to noise.

A clock signal is generated from the sliced data by using an external tuned circuit, L1 and C1. The clock signal is locked to 6.937MHz and is used to clock the data from the VIP into the TAC (which we'll talk about next). The VIP also contains a 6MHz clock which is used to derive 64μs pulses which are compared with the incoming line sync signals. In this way the Teletext display is synchronised with the incoming television picture signal.

Finally, the VIP has a signal quality circuit which acts to cut off the data to the TAC if it becomes excessively noisy. This prevents data which is already being

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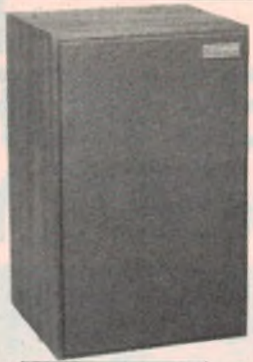

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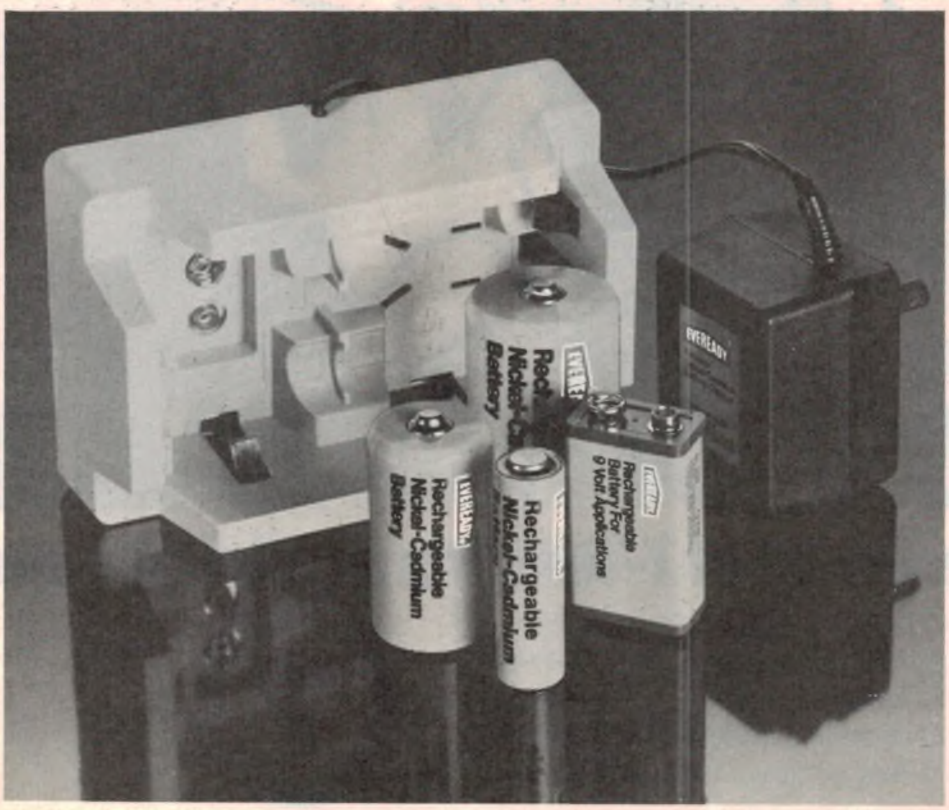

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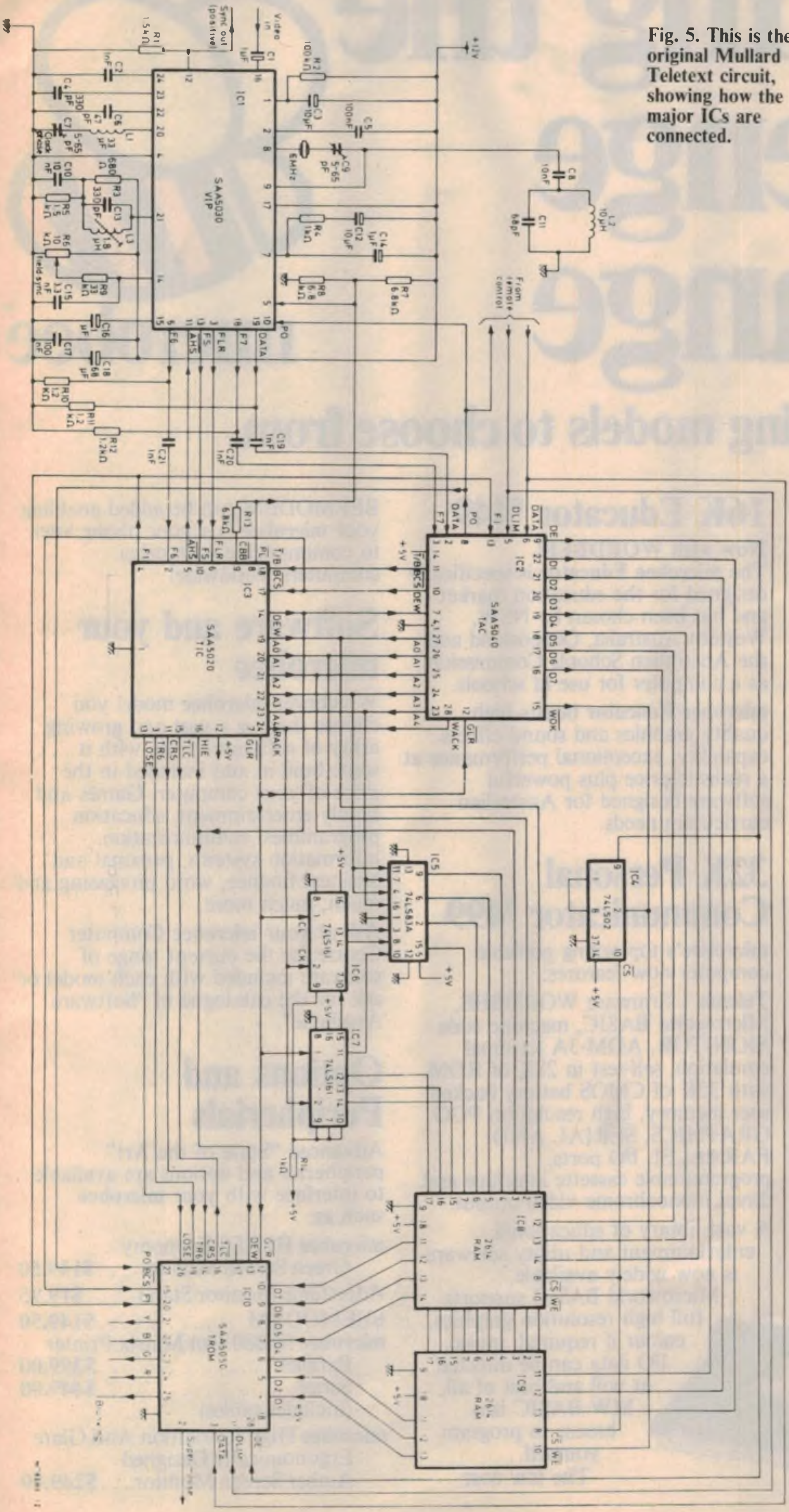

Fig. 5. This is the original Mullard Teletext circuit, showing how the major ICs are connected.

stored in the system for display from being corrupted by noise. This allows a stable display in the event of a momentary signal dropout.

Fig 5 shows how the Mullard chip set is linked together (this is the original Mullard circuit). Data from the VIP is fed to the TAC which stands for Teletext data acquisition and control. The block diagram for this chip, SAA 5040, is shown in Fig 2.

The main function of the TAC is to process the Teletext data so that it can be stored in the memory (IC8 and IC9 on Fig 5). It also processes the control data from the remote control transceiver and uses this information to provide the various display functions such as program select, page select, time display and so on.

The data acquisition section of the TAC divides the data into its component parts. The address words are checked for errors and those having two wrong bits are rejected. The row address (one of 24) is fed to the row address bus and the character data is fed to the memory as a sequence of forty 7-bit parallel words. Remember that each of the 24 lines in a Teletext display has a maximum of 40 characters.

An important function is performed by the TIC, as shown in Fig 3. TIC stands for timing integrated circuit (we think) and is the SAA 5020. This subdivides the 6MHz clock signal from the VIP to provide the 25Hz frame rate and all the timing signals for the Teletext display.

Finally, there is the TROM and as you might have deduced, this stands for Teletext read only memory. This is the SAA 5050 and is depicted in Fig 4. This device has a similar function to the character generator ROM in a personal computer.

The TROM also generates the graphics displays with the aid of its graphics characters. These take the form of rectangular bits which can be put together to form any pattern, albeit with fairly low resolution. All the other display functions such as subtitle display within boxes, flashing characters and concealed displays (used for quiz pages) are also provided by the TROM.

Next month we shall continue with a presentation of the full circuit diagram. Kitsets for the Teletext decoder will be available from Dick Smith Electronics at $199 during September.

Acknowledgement

Figs 1 to 5 in this article are reproduced from the Mullard Mutitext manual, 1978, with permission of the Electronics Components and Materials division of Philips.

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Direct metal mastering... A 'quantum jump' in analog disc recording?

At a time when it might have seemed that recording engineers had exhausted all possible refinements to the century-old analog system, they have come up with yet another one that streamlines processing and offers lower noise, lower distortion and a potential increase in playing time. I refer to the DMM (direct metal mastered) discs which have recently been released in Australia.

by NEVILLE WILLIAMS

Conventionally, analog master recordings have been inscribed in a layer of nitro-cellulose lacquer on the surface of an aluminium disc. The groove pattern is then transferred to a metal matrix by an electroplating process, with further processing to create a metal "mother" and, from it, "stampers" which are used to produce the final over-the-counter pressings.

By contrast, in the DMM system, the master recording is inscribed directly into a pure copper layer on a stainless steel substrate, producing the equivalent of the metal "mother" in a single step. It offers not only a better tape-to-disc transfer but also obviates the rather hazardous (to quality) step of having to electroplate a too-easily-damaged lacquer surface.

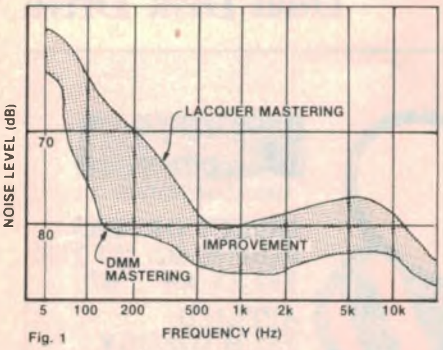


Fig. 1

Based on curves issued by Teldec, this diagram gives some idea of the reduction in noise level claimed for DMM. Measurement was with one-third octave filters, referred to an 0dB reference level of 10cm/sec for one groove wall.

Indeed, direct metal mastering would appear to have so much going for it that it is rather surprising that it was not taken up sooner. The truth probably is that lacquer mastering was an accessible and convenient option when it was adopted in the '40s and it is only now being displaced by reason of the challenge to quality from compact discs and video-based tape technology.

In the 78rpm era, master recordings were commonly made on a wax-coated glass disc, with the wax surface being notably temperature sensitive and physically quite frail.

By comparison, when lacquer-coated aluminium mastering discs became available, they seemed almost robust by comparison. In extreme circumstances, they could even be played with an ultra low mass cartridge to check on quality prior to further processing!

But while nitro-cellulose lacquer has been effective enough as a recording medium to have ensured its use for 40 years or more, it is not without its problems. It is regarded, for example, as a somewhat unstable material, subject to behavioural change with climatic conditions and the passage of time.

In the process of recording, minute tearing of the material can take place, resulting in a somewhat coarse — and noisy — groove surface. As well, some of the material can be displaced rather than parted cleanly, ending up as a slight ridge or "horn" along the top edges of the groove. These problems can be alleviated, at some cost in other respects,

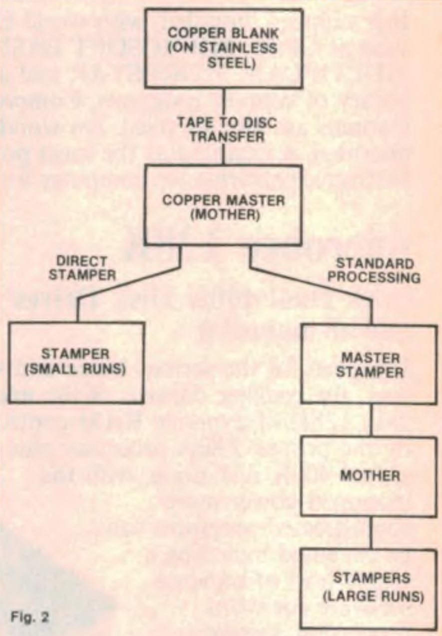


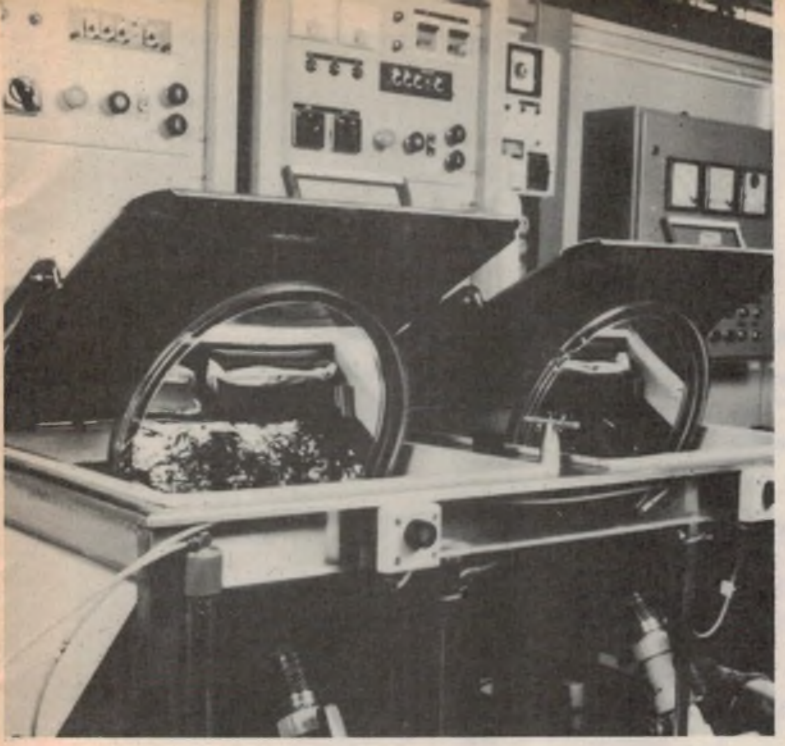
Fig. 2

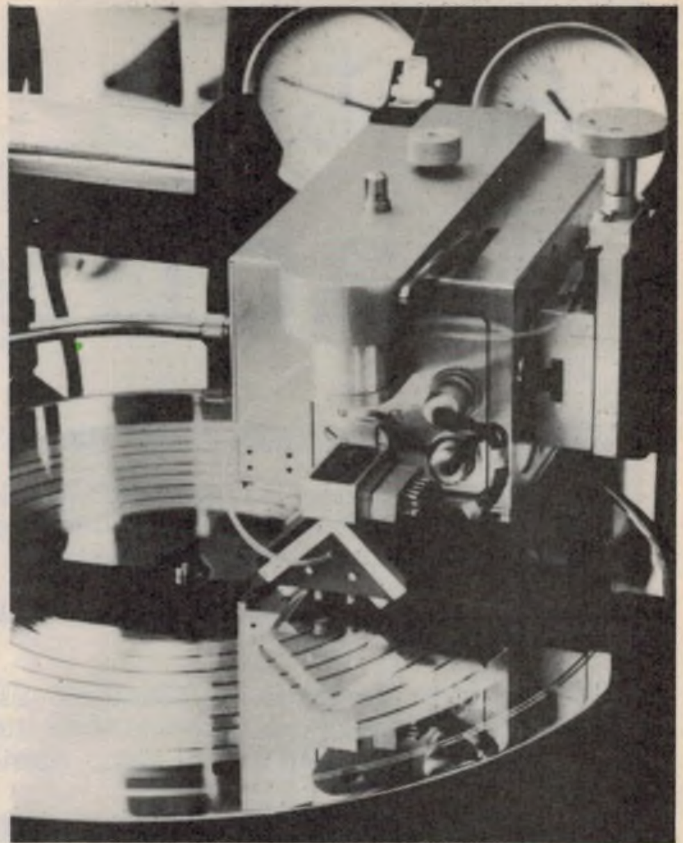
For small production runs, a single stamper can be made directly from the metal master/mother. Otherwise, multiple stampers can be generated by existing metal/metal duplication methods.

by heating the stylus and providing it with special "burnishing" facets adjacent to the cutting edge.

So-called "spring-back" is another potential problem and one that is both time and temperature sensitive. Because the lacquer is somewhat resilient, it tends to be compressed sideways as the cutter passes, leaving the "land" between the grooves under some stress. As the material "springs back" (flows?) to relieve that stress, it takes up a position mainly determined by the intended cut but slightly affected, nevertheless, by the modulation in the adjacent grooves. Sonically, it is said to carry a faint "echo" of those grooves.

Unfortunately, pre-echo and post-echo effects are all too familiar to record

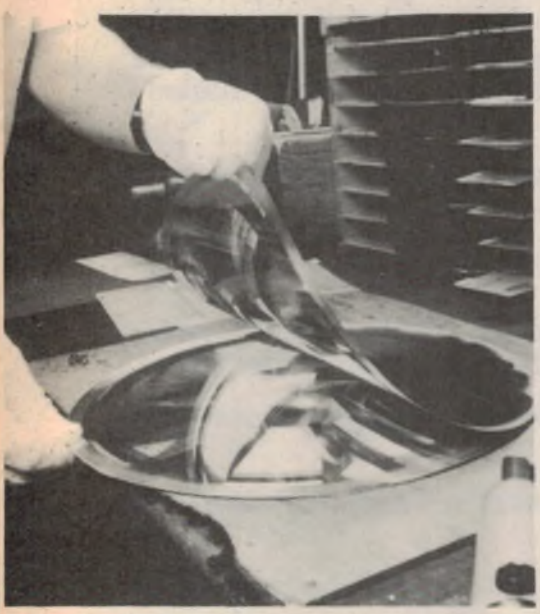




Above: The electroplating process used by Europafilm of Sweden to produce the 0.1mm copper layer on a stainless steel substrate.

Right: complicated by unavoidable reflections, this picture shows the metal master being cut by the new Neumann DMM lathe.

Below: Thanks to the use of a parting agent, the metal stamper can be stripped from the copper master after electroplating.



enthusiasts and, while they are most apparent in the run-in and run-out grooves immediately preceding and following the program proper, the unfortunate truth is that "echo" effects can be present all the way through as an extraneous component of the total sound.

Last but not least, the lacquer pre-plating process is extremely demanding, requiring that the lacquer be scrupulously cleaned, without suffering chemical or physical damage. It must be "sensitised" by depositing on it a very even layer of silver atoms, followed by an even, fine-grained layer of pure nickel to obtain an exact "negative" of the groove pattern. A complementary plating process is then necessary to create a metal "mother" from which the stampers can ultimately be made.

While Teldec of West Germany would be the first to concede that the various problems can be minimised with appropriate care, they also point out that they can now be circumvented by the DMM process which Teldec has developed in association with Neumann (who manufacture recording lathes), and Europafilm in Sweden for the actual discs.

The basic idea is scarcely new, having been patented in Germany by Rosenthal and Frank in November 1891! It was subsequently taken up by RCA for the production of their now discontinued capacitance video discs. It needed considerable further development, however, to permit its use for the 100-times larger grooves required in standard long-playing audio albums.

The "audio" metal blanks have a 0.1mm coating of pure electrolytic amorphous copper on a 0.8mm stainless steel substrate; "amorphous" in this context signifies unorganised, as distinct from crystalline.

Not surprisingly, the copper coating offers a much stiffer resistance to stylus movement than does the conventional lacquer, but three measures have been taken to ease matters:

- Because the copper cuts more cleanly, the stylus can operate without burnishing facets, making it a more effective "tool". Without the burnishing facets it can also inscribe finer waveforms (very short wavelengths) in the inner grooves, effectively offering improved high frequency response.
- The stylus has been re-aligned to operate at a cutting angle of 90° relative to the disc surface. Electronic compensation is provided to produce a waveshape compatible with phono cartridges designed to operate with a 15-20° vertical tracking angle, as from vinyl masters.
- Supersonic excitation is applied to the stylus along with the audio drive to mechanically "lubricate" its passage through the copper layer. The amplitude of the HF signal varies in proportion to the depth of cut, resulting in very smooth groove walls with a manageable amount of cutting power.

It would appear that current, generously rated recording amplifiers (eg 600W RMS per channel) will be adequate but a modified lathe is required as, for example, the Neumann VMS82 lathe and SX80CM cutting head.

The copper master disc can be used directly as a "mother", its metal surface

Direct metal mastering

being far less vulnerable than lacquer. It is simply coated with a molecular layer of a non-metallic parting agent and then plated to produce a single stamper for short production runs, or a master stamper and multiple working stampers for large runs.

Teldec claim that, although re-equipment costs are involved, savings accrue thereafter from a drastic reduction in the number of re-cuts required and, of course, in the associated processing steps. DMM-sourced discs are free from clicks and pops, they say, and curves suggest an improvement in background surface noise of up to 10dB.

In terms of quality, the elimination of lacquer "spring-back" obviates pre- and post-echo effects while, as already mentioned, the improved cutting action of the modified stylus in amorphous copper gives better transient response with "instruments rich in harmonics and sibilant voices being particularly free from colouration".

A further (and potential) advantage suggested by Teldec is that elimination of the spring-back effect makes it possible to take full advantage of Neumann's automatic pitch control facilities to reduce groove spacing, without running into problems of pre- and post echo. In practice, this could mean an increase of between 10% and 15% in playing time, without any sacrifice in recording quality or level.

Early last year, EMI Music in Britain signed a licensing agreement with Teldec on behalf of their international interests and, pursuant to that agreement have been distributing DMM-sourced recordings of the type currently on sale in Australia.

EMI have not done any DMM mastering in Australia as yet, although they are free to do so under the international agreement. A local engineer is currently in Europe studying the technology and equipment, and David Hudson, engineering manager of their Studio 301 in Sydney, says that it is only a matter of time before a DMM lathe will be added to their already impressive array of equipment.

While he has no direct experience with DMM as yet, he sees it as a "quantum jump" in analog disc quality which can only sustain their competitiveness against other sound sources. They will, of course, share the on-going benefits of more discrete microphone placement and acoustics, and digital master recording, demanded by compact disc.

David Hudson emphasises that, while EMI have taken up a licence for the DMM system, they are not in the business of pushing one system against another:

"We are into LP, tape and compact discs . . . all three of them. Our policy is to take advantage of new technology, wherever we can."

Nigel Wake, General Manager in Australia for Emidisc (EMI Music) sees DMM as very significant to the future of analog discs:

"People keep on saying that the 'black' disc will be dead in two years.

"I don't think so. There are far too many record players out there for it to happen that way.

"I believe that, with continuing technological support, like DMM, conventional discs will be around for a long time yet."

Stanton Epoch II phono cartridge

Stanton cartridges are widely used throughout the broadcasting industry where they have a reputation for reliability and consistency of performance. They have a similar standing among hifi enthusiasts and this can only be enhanced by these recently released models.

Stanton's new top-quality cartridge line-up is known as the Epoch II range. This embraces four cartridges, the LZ8S, HZ8S, LZ9S, and HZ9S. All are basically the same design and are referred to by Stanton as a Micro-fluxvalve. In practice, the Epoch II range is based on the moving magnet principle.

Actually, Stanton has a foot in both the moving magnet and the moving coil cartridge camps. Both the HZ9S and HZ8S cartridges are regular moving magnet cartridges intended for use with standard phono inputs on all stereo amplifiers. By contrast, the LZ8S and LZ9S are low impedance versions and are intended to be used with moving coil preamplifiers. Both the latter cartridges have a inductance of two millihenries and a series resistance of three ohms.

Together with their nominal output voltage of .04mV/cm/sec, these two are clearly suited to MC inputs. They have a rated load impedance of 100 ohms. Our review sample was the LZ8S.

All four cartridges share the same body construction which has a streamlined appearance about it. In fact it looks a little like a cross between the nose of a Concorde and the suspended jet engine pod on a Boeing jetliner. The cartridge body is very light, at only 3.8 grams, and has a removable stylus assembly as is customary for moving magnet cartridges.

The stylus itself is Stanton's "stereo-hedron" shape. While its dimensions of 0.2 × 0.3 mil class it is an elliptical type, it apparently it is designed after the Shibata philosophy which aims to maximise the line contact of the stylus with the groove. The object is to improve high frequency tracing ability and at the same time minimise stylus pressure on the record groove, thereby keeping wear as low as possible.

While the stylus profile is the same for all four cartridges there evidently are differences in the suspension system featured in the higher prices HZ9S and LZ9S models. For these two, Stanton claim a frequency response of 10Hz to 50kHz (with no limits) and a higher tracking ability. Both the higher priced cartridges are supplied with a factory calibration certificate.

These cartridges do not have a flip-down stylus guard as featured on some competing brands but they do have clip-on stylus guards which are fitted when the cartridge is not in use. Stanton make a feature of their V-guard system which allows the stylus to retract into the body in the event of the cartridge being dropped onto the record surface.

The frequency response of the LZ8S and HZ8S is rated at 10Hz to 40kHz but again, with no limits applied.

One point in favour of the suspended pod style of these cartridges is that they are relatively easy to mount in the arm headshell. Some cartridges are quite a curse to mount.

At first our tests were carried out with a load impedance of 100 ohms. This resulted in a frequency response which had quite a marked drop off above about 5kHz. When we consulted with the distributors over this matter, they recommended load impedances up to as much as 1kΩ.

With hindsight, this must be the case since the interaction of the cartridge's inductance of two millihenries with the load resistance of 100Ω would indeed cause a rolloff at aound 8kHz or so (-3dB point).

Accordingly, we subsequently carried out our tests with a cartridge load of 1kΩ, for both channels. The cartridge is claimed to be insensitive to capacitive load but since moving coil preamplifiers quite often have relatively large capacitors shunting the input this factor cannot be neglected.

Our tests showed that the LZ8S was within ±1dB from 20Hz to 18kHz and rolling off gently above that. Overall, the response characteristic is very smooth with no obvious peaks or dips. Square wave response is very good with just a slight overshoot on the leading edges and very slight rounding of the trailing edges.

Overall, the cartridge waveform was good.

Channel balance was well within the 2dB figure claimed for the whole range and we achieved a best figure of -40dB for separation between channels at 1kHz. The overall separation characteristic was not a symmetrical as we would have liked but it is clearly more than adequate.

Tracking ability was also very good. The LZ8S is one of the few cartridges around that will track the +15dB drum test tack of the W&G 25/2434 test disc at 1.5 grams. On the CBS STR110 it handled the +15dB 300Hz track although the 18dB track caused audible distortion. It also did quite well on the Shure Audio Obstacle Course, handling all five tests up level four (out of five) with no trouble.

As far as sound quality is concerned the Stanton LZ8S must be rated highly. Its smooth response and good tracking ability result in a completely trouble-free cartridge with a sweet but unobtrusive sound. This is exactly as it should be.

Recommended retail price of the HZ8S and LZ8S cartridges is $199 while the HZ9S and LZ9S models retail for $299. Further information can be obtained from high fidelity retailers or from the Australian distributors for Stanton products, Soundex Pty Ltd, 82 Colin St, West Perth 6005. Phone (02) 487 2543 or (09) 322 2854.

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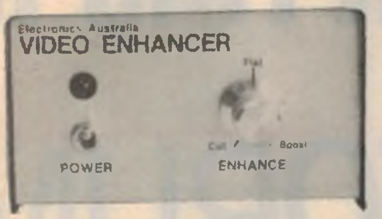

Like tone controls in a hifi amplifier, touch up the signal with this Video Enhancer.

EA OCTOBER 83

NAIL FINDER $10

Essential for the home handyman the Nail Finder will help locate timber studs behind Gyprock or plasterboard wall surfaces as well as locating pipes and wiring buried in walls.

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EA OCTOBER 83

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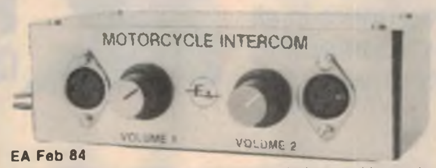
Have you ever desoldered a suspect transistor, only to find that it checks OK? Troubleshooting exercises are often hindered by this type of false alarm, but many of them could be avoided with an "in-circuit" component tester such as the EA Handy Tester.

EA SEPTEMBER 83

MOTORCYCLE INTERCOM $40



EA Feb 84

Motorcycling is fun but conversation between rider and passenger is usually just not possible. Build this intercom and you can converse with your passenger at any time while you are on the move.

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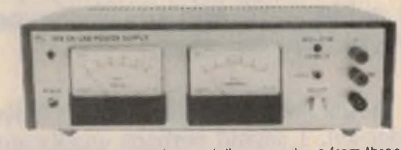

New switchmode supply can deliver anywhere from three to 50V DC and currents of 5A at 35V or lower. Highly efficient design

EA May, June 1983   82 PS5   **$140.00**

CAR ALARM

$29.00

This Car Alarm uses the battery earth strap as a sensor to detect when a "courtesy" light or other electrical load occurs when a thief enters a vehicle. The circuitry is simple and immune from false triggering problems. ETI July 81

SLIDE CROSS FADER $85.00

CAR IGNITION KILLER

kit includes the metal box   **$16.95**   EA Feb 84

Most car burglar alarms are easily circumvented, but not our cunning "Ignition Killer". This sneaky antitheft device uses a 555 timer to place an intermittent short circuit across the points. Until disabled by its hidden switch the circuit effectively makes the car undriveable — a sure deterrent to thieves!

PHONE MINDER $25

EA Feb 84

Dubbed the Phone Minder, this handy gadget functions as both a bell extender and paging unit, or can perform either function separately.

VIDEO AMPLIFIER $15

EA AUG 83

Bothered by smeary colours, signal beats and RF interference on your computer display? Throw away that cheap and nasty RF modulator and use a direct video connection instead. It's much better.

The Video Amplifier features adjustable gain and provides both normal and inverted outputs. Power is derived from a 12V DC plugpack supply.

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Electric fence $19.50

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SEPTEMBER EA 1982

Mains or battery powered, this electric fence controller is both inexpensive and versatile. Based on an automotive ignition coil, it should prove an adequate deterrent to all manner of livestock. Additionally, its operation conforms to the relevant clauses of Australian Standard 3129.

±12V RAILS FOR LAB POWER SUPPLY

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An inexpensive addition to the 50V 5A Lab Power Supply which should prove its worth many times over. It provides additonal fixed ±12V outputs for lower power applications.

LOW OHMS METER

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How many times have you cursed your Multimeter when you had to measure a low-value resistance. Well alas, with the "Low Ohms Meter" you can solve those old problems and in fact measure resistance from 100 Ohms down to 0.005 Ohms. **ETI 158 November 81**

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Activated by your car's headlights, the "Driveway Sentry" will turn on a driveway or garage light so that you can make a safe exit from your car on the darkest of nights. At the end of five minutes, it will automatically turn the light off again.

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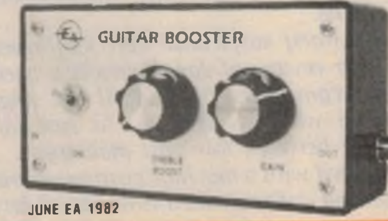

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An important role for

"If you're planning to invest in a computer, buy a real one, not a toy!" That's the kind of advice you're likely to get from a computer buff — but it may be a rather one-eyed opinion. The fact is that some of those "toys" can provide the means and the incentive for beginners in all age groups to learn the elements of computing in a pleasant and not-too-expensive way. It's worth thinking about.

FORUM

Conducted by Neville Williams

In the wake of that rather positive assertion, I should perhaps qualify my earlier remarks in "Forum" for November '83, under the heading: "Do computers really have a place in the home?" While it contained a passing reference to the tuitional value of a domestic computer, in the main, the article tended to question the relevance in the average home of a complete system: computer, monitor, printer, disk store and so on.

The message that came through was one of caution: think carefully before you talk yourself into spending a couple of thousand dollars; it could turn out to be a very poor investment, if you have no real use for it.

This time around, we are talking about a purely tuitional role for a small computer within the family unit and an outlay of between $100 and $200 — a tiny fraction of the earlier figure.

Much the same qualification would apply to Peter Vernon's article in the June '84 issue: "Buying your first computer". He talks at length about basic computers, monitors, printers, memory stores, software, etc — all of it directed at would-be computer buffs who intend, ultimately, to acquire a complete system costing thousands of dollars.

I repeat: that is not what I have in mind in this article.

What follows was prompted in part by a letter to hand from a reader in Willunga, South Australia. He says:

Dear Sir,

For some years I have been considering buying a personal computer, mainly so that my children can acquire some familiarity with this burgeoning discipline.

My worst suspicions were confirmed in your review of Ian Reinecke's book "Microcomputers" (EA April '84, page 110) in which I read . . . "a vast difference between low cost machines . . . compared with a machine costing several thousand dollars, which is needed if any real use is to be obtained". And later . . . "be better off (purchasing) a set of encyclopedias".

Contrast this with Dick Smith's latest catalog where the Editor of Personal Computer magazine is quoted as saying of Dick Smith's $169 VZ200 . . . "I'm certainly going to buy one".

Where then is the truth?

Are the cheap personal computers with, say, a 16K or 32K memory of any real use? How much use? Are people buying them only to play Pacman? Or are they a real instructional tool?

Your response will guide my buying decision.

A.T. (Willunga, SA).

Understandably, correspondent A.R. is worried by the apparently opposite opinions expressed by author Ian Reinecke and the editor of "Personal Computer" magazine. One talks about buying a computer which the other would apparently consider to be of no real use (hence the heading to this article).

Reportedly, Ian Reinecke makes two particular points:

- For most serious applications, forget about low-cost "machines", intended primarily for playing electronic games. To be of any real use, the equipment would be quite costly, eg "several thousand dollars".
- Appropriate educational software is very limited: "the whole subject is really a joke".

I am not in a position to debate his opinion of available software but his observation about equipment is not at variance with what was said in "Forum" or in Peter Vernon's article, mentioned earlier.

If parents want to set up a computerised educational system in the home, it will need to approximate the system which students encounter at school/college; that means at least MicroBee or Apple or other such equipment, costing two or three thousand dollars all up. It would have little in common with "low-cost machines . . . mainly intended for playing games".

If we thus appear to support Ian Reinecke's ideas about equipment, where does the humble VZ200 fit in? Is it indeed a toy; of little real use?

In reality, the DSE VZ200 may not have been considered when Ian Reinecke's book was written and it may be in a class somewhat above his despised games-type "machines". Even so, it may still not have earned his approval, being considered too far down-market to form the heart of a serious system.

Many would share that view.

In fact, the VZ200 is not primarily a games machine. For sure, one can set up and play games on it, as with most other micros, but beyond that if offers, in terms of our own review in the July '83 issue: "colour, a reasonable amount of memory and a powerful Basic interpreter".

We concluded our review in the following terms:

"If you want a computer to look after your share holdings, or for word processing, look elsewhere. If, on the other hand, you want a computer for playing games, for self-education, for learning about Basic and perhaps for writing your own programs, the VZ200 has one overwhelming advantage — the number of features for the price."

At the time, a practical computer for under $200 was a real price breakthrough comprising, as it did, the basic unit, power supply, cables and a comprehensive manual. Having in mind our own reaction, it is not really surprising that the Editor of "Personal Computer" should have decided that he had good use for just such an item — for the kind of secondary reason which we ourselves suggested.

If the reasons were valid at $199, they would be attractive at the subsequent price of $169 and positively compelling at the latest figure of $99.

As a matter of interest, I questioned

'useless' small computers!

From the Commonwealth Employment Service:

Dear Mr Simpson.

I was impressed by Neville Williams' "Forum" column in the April '84 issue of Electronics Australia: "What do you do when you can't find a job?" I would like to include the article in information available to clients of the Career Reference Centre.

The Centre, which is operated by the Commonwealth Department of Employment and Industrial Relations, provides a free occupational information and vocational training information service.

My intention is to include clearly sourced photocopies of the article in our job information folders on occupations related to electronics and job seeking skills.

I request your permission to photocopy the article for the purposes described.

Paul Mitchell,
Manager, Sydney
Career Reference Centre.

Ike Bain, Managing Director of Dick Smith Electronics, as to the reason for such a dramatic price reduction. He nominated two factors: economy of scale in manufacture and fierce worldwide competition between computer makers.

Hopefully, A.R. of Willunga should by now have glimpsed a glimmer of light at the end of the tunnel.

If he has in mind a complete computer educational system, comparable with those in schools and colleges, then it is going to cost him "X" thousand dollars, as per "Forum", Peter Vernon and Ian Reinecke.

But I don't really read that requirement into his words: *"so that my children can acquire some familiarity with this burgeoning discipline"*.

If his prime objective is to create a familiarity with computers at a family level, and to dispel the mystique which faces the uninitiated, young and old, then he can accomplish that and move on to a working knowledge of programming for a much more modest figure; like $99 for example!

In fact, that's exactly what I want to talk about from here on.

On two separate occasions, recently, I have been the involuntary witness to a family argument — sorry, discussion — during which the children were trying to convice their father that he should buy a computer for them to use at home:

"But, Dad, you can get one for less than $200 ... go on Dad!" (This was before the most recent price reductions.)

In both cases, the father insisted that there was more to it than that. You couldn't do much with just a keyboard and, by the time they had bought all the stuff to go with it, he'd be up for nearer $2000! Right now, he didn't have that sort of money to spare!

To see kids of high school age arguing for a computer was no surprise, because computers are now a part of the high school scene, but the 7/8-year-olds were joining in with hardly less conviction. Nor was there any special mention of electronic games. It was simply: "buy a computer, Dad!"

Watching the performance, I couldn't escape the impression that the kids were really asking for a contemporary learning tool, much as in other days, when we wanted our own slate and slate pencil (!), our own box of water colours, our own drawing instruments, our own slide rule, our own calculator. Now they want access to their own computer and the opportunity to gain an easy familiarity with the machine that, more than anything else, typifies their kind of world.

Perhaps they don't need to store or print out, to process words or to keep accounts; that can come later. Maybe their first and urgent requirement is to come to terms with the keyboard, with computer language and procedures; to do a few exercises, work out a few problems, observe some basic graphics and play a few games routines, all as part of the learning process.

Nor is the need to learn unique to children. Adults also must adapt to the world of keyboards which has been created by their own generation. Here I could quote Professor Brian Garner, head of computing at Deakin University in Geelong (Vic) and Chairman of the recent Computer Data 84 Conference in Sydney:

"Parents will have to learn about new technology and how to use it or they will be left behind by their children.

"Parents should spend more time with children and share their involvement with computers."

If they fail to do so, Professor Garner warned, stress will tend to develop between computer-literate children and parents who have no understanding of the new technology.

Seeking to probe the computer-awareness of present-day high school children, I have been asking a few questions on the subject lately, whenever the opportunity presented itself.

An English subject mistress professed to know little about computers but had her own reason to be impressed: students who had access to home computers, she said, and especially to word processing facilities, had re-developed the long-lost art of checking their work before handing it in!

"It has changed their attitude to detail. They hand in better work and are rewarded by higher marks."

A maths master from another high school said that students generally were aware of computers but actual knowledge of them ranged all the way from minimal to those who had earned the right of access to school computers without teacher supervision.

"Some of these kids are really good."

Could he see a role for a simple computer in the home, purely to allow children and parents alike to learn the rudiments of the subject?

"Most decidedly!"

Another high school maths teacher obviously shared these opinions but added that he did not much mind if students spent some of their free time setting up their own games routines. Games or no, they were still learning how to program, and doing so with added incentive and concentration.

The manager of an electronics store confirmed my teach-yourself ideas in a moment of personal frankness:

"When I accepted this job, I was literally scared of computers. But I took a small one home and spent a couple of weeks working through the manual. I'm still a beginner compared with some of the kids that come in here after school but, at least, I now understand what they're on about!"

As a matter of further interest, I posed the question to an executive of Dick Smith Electronics:

"Why do people buy your VZ200?"

"For all sorts of reasons", was the reply "but we tend to emphasise its value as a means of self tuition. Look at our catalog:

"Getting left behind in the computer race? Here's the solution ...

"Bring your kids into today's technology . . .
"Easy to read manuals . . .
"Learn fast . . . and so on".

Never a company to miss a trick, DSE responded further to my question with the invitation to try it for myself, and with a carton containing a VZ200 on loan, along with extra memory module, cassette recorder/player, printer, interface, typical software tapes and assorted manuals.

I was happy to take up the invitation but I left the peripherals in the box, primarily because I wanted to sample a tuitional exercise involving just the basic $99 computer and, at most, one or two of the supplementary manuals. Such an exercise would not be entirely fictional, because I had never before handled the VZ200 and literature and, unlike Peter Vernon and Co, I tend to get rather rusty between spaced-out exposures to computer whatnots.

What were my reactions?

While the VZ200 has a keyboard conforming nominally to QWERTY (typewriter) layout, it uses "rubber" pads rather than full-travel keys and provides for upper-case (capital) letters only. There is no space bar, as such, the function being handled by a space key at the lower right-hand corner.

> ***Teach yourself to drive the VZ200 and you'll have little difficulty in adapting to other Basic-language micros***

The pads present no great problem but one has to overcome the tendency to type as if normal lower and upper case letters were available — and in the process, tapping the lower lip of the case instead of the non-existent space bar!

While these very characteristics limit the potential use of the VZ200 with a full-scale system, they are of little consequence at a tuitional level. More importantly, the keys give user access to a powerful — and normal — programming facility in computer Basic language, plus colour graphics, and more, if advantage is taken of it. Teach yourself to drive the VZ200 and you'll have little difficulty in adapting to other Basic-language micros.

Packaged with the VZ200 is a small user manual, a booklet containing 20 programs, a demonstration cassette, and a 166-page instructional manual produced by the manufacturers in collaboration with Jamieson Rowe, the former editor of this magazine. The manual begins with the question "What is a computer?" and proceeds on a step-by-step learn-while-you-do-it basis to introduce simple calculator functions, a wide range of computer routines, colour graphics and "music", with appropriate references to the possible use of an ancillary cassette deck and printer.

Other instructional manuals available for the VZ200 include "Introduction to Computing" by Toni Louise Henson and "Getting Started" by Tim Hartnell and Neville Predebon. Both are written in friendly, casual style which helps turn the learning experience into relaxation rather than a chore. Either or both can be used in conjunction with the manufacturer's manual to pick one's way through the various keyboard routines.

If you ultimately decide to spend $99 and to repeat the exercise, your memory may or may not cooperate as you are introduced progressively to the special significance of certain punctuation marks, instructions like BREAK, RETURN, GOTO, GOSUB, etc, and to statements like IF-THEN, FOR-TO-NEXT and so on.

If you can remember them, fine! But don't get discouraged if you seem to keep on forgetting them; having to rely on the manuals or your own scribbled notes. It's not supposed to be a test of memory but an exercise in reading and doing — and seeing it happen for you, in your own home, on your own computer.

More importantly, as it does so, the "faze" and the mystique will begin to drain away and interest will quicken. You may even feel somewhat miffed when the family wants their TV set back to watch the news or "Country Practice". Maybe you will have just accomplished your first bit of solo programming by turning Toni Henson's "What Number" exercise into a genuine random number repetitive game!

If you want to pursue the exercises to a genuine facility at the keyboard, two complete books of programs are available for the VZ200, before venturing further afield. But, by this time, you may have developed into a computer nut, anyway!

You may never reach that stage but that's really of secondary importance in the present context. What matters is that, somewhere along the line, you will have ceased to be afraid of keyboards and computers. You will have had the experience of driving one and come to realise that the essential difference between fear and facility is time and practice.

For you, and possibly for other members of your family, the exercise will have been justified.

At least, that's the way I saw things, following my own simulated exercise.

Is the DSE VZ200 the only option by way of an inexpensive tuitional computer?

No it isn't.

While preparing this article, I paid a visit to the local Tandy store and posed the question:

"What's your answer to the Dick Smith VZ200 as a stand-alone tuitional computer?"

> ***What matters is that, somewhere along the line, you will have ceased to be afraid of keyboards and computers***

The attendant's reponse was to direct my attention to something I had already noticed on entering: a display featuring the Tandy TRS-80 MC-10 personal computer, marked down from its original price of $179.95 to $99.95.

Why the huge reduction? Is it being discontinued? A clearance sale?

No, I was told, that would be the continuing price, thanks to worldwide competition in the computer industry.

The Tandy MC-10 is physically smaller than the VZ200, with less memory (4K) and probably somewhat less versatile programming. But it does have a space bar and keypads with agreeable tactile response, plus output ports for tape deck and printer. It comes complete with mains power supply, cables and instruction manual and, while there is less other off-the-shelf literature, Tandy told us that is is supported by an independent users club.

From what we could judge by looking at the package in the store, it too would offer a useful tuitional facility for under $100.

In the same week that we visited the store, Tandy were offering $100 off the price of their standard keyboard models, bringing the price of their base model to a temporary $249. That would probably represent a greater outlay than many would be prepared to write off as a tuitional exercise but it does indicate the way that computer prices have fallen during the last 12 months.

Who knows what readers may be able to pick up by way of a tuitionalcomputer, over and above the VZ200 and the MC-10? Just make sure, however, that it offers adequate BASIC language facilities, certainly not less than 4K of built-in memory, a mains power supply, an RF converter to feed an Australian standard TV receiver, and a good tuitional manual appropriate for the particular model. Colour graphics and "music" are less important but, after all, they are part of the familiarisation process.

What of the peripherals you can buy to go with the VZ200 or MC-10: extra memory, B & W or colour monitor, cassette deck, printer etc? To this point, we have assumed that learners will use an available TV receiver as a monitor and, possibly, an available cassette deck, thus avoiding any extra outlay.

After a few weeks, or months, and having become familiar with the rudiments of computing, you will be in a better position to decide which way you want to go: avoid further expense, add elementary peripherals to an elementary keyboard, or plan towards a serious system for whatever purpose.

If the last named is your choice, then best you consider that your elementary lessons have come to an end. Turn back to Peter Vernon's article and start reading, thinking, acting and spending like a genuine computer buff!

Job opportunities

At this point, I would like to revert to the subject of job opportunities in the electronics industry for young people, as discussed in "Forum" for April '84. Perhaps it may not be as unrelated as it may seem, because we have just been discussing a way in which some young people may be able to add to their potential job skills.

Among the personal observations, phone calls and letters on the subject of youth unemployment, it was gratifying to receive the one in the accompanying panel, from the Sydney Career Reference Centre of the CES. It might suggest that some of the remarks in the April "Forum" were along helpful lines, criticism notwithstanding.

As might be imagined, Editor Leo Simpson was happy to grant permission for the article to be reprinted, with due acknowledgement to the source, and I guess that the same release of copyright would apply to other organisations or educational groups who may find the particular article helpful.

In fact, some correspondence on this subject is still outstanding but there is a limit to what can reasonably be accommodated in three pages or less, per month. Unfortunately, while the subject may become tedious, it certainly won't lose its topicality.

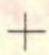
Even the most optimistic of politicians wouldn't try to tell us that!

Letters to the editor

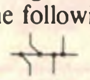
Draughting standards for circuit diagrams

I should like to bring to your attention a basic circuit drawing error committed by some of your contributors, and doubtless a host of readers. Although it may appear a minor offence it is, in fact, responsible for more circuit interpretation contretemps than all other errors combined. I refer to the matter of joined conductors versus crossing conductors with no connection.

British Standard BS 3939, adopted by most Commonwealth countries (eg, by NZ as NZSS 2186), and also in this case followed by IEC, lays down quite definitely that this

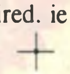


represents crossing conductors with no connection. The following:



represents joining conductors.

The presence or absence of a dot on the junction should not alter the meaning in any way, since some printing methods have difficulty in forming such a dot, whilst some draughting methods (eg, Indian ink) can cause one to form where not required. ie this symbol



will still mean "crossing conductors with no connection".

In the "good old days" the convention was either only loosely adhered to or was totally ignored. This caused no great problem for circuits were so basic and conventional that the reader found it obvious whether a conductor should in fact be joined or crossing. Unfortunately the complexity of modern circuitry, often involving IC's with anonymous interiors, make such logical reasoning impractical in many cases. The unintentional presence or absence of a "dot" on crossing lines can have embarrassing consequences, thus adherence to the standard is now of considerable importance.

I know that many well-known magazines and some otherwise excellent text books offend in this manner, but that does not excuse it or make it in any way acceptable. I believe that it is the responsibility of all reputable publications to monitor and correct if necessary all circuits appearing within their covers to inhibit the spread of this (or any other) error.

D. R. Muir, Senior Lecturer,
Auckland Technical Institute,
New Zealand.

About steel conduit

Reference Information Centre, June 1984, page 144.

Before I put in my two bob's worth I would like to point out that steel conduit is still used in the electrician's licensing examinations in New South Wales.

I have recently done these examinations, passed, paid my fee, and then been told I could not have a licence because the Government does not recognise their own electricity supply councils as being a proper place of electrical training. (Typical, isn't it, of Government departments?)

Being in the electrical (240V) trade for many years and working in a county council supply authority with an electrical inspector, as an assistant, I have torn flesh from my hands and knees on the useless stuff known as steel conduit (I am now a TV tech.) There are two types, split and solid.

In conclusion: Steel conduit? Only one word for it: "garbage".

R. S. Ward
Murwillumbah, NSW.

Venture capital for new companies

I refer to your article "Venture Capital for New Companies" by Michael Wilkins which featured in *Electronics Australia,* June 1984. I feel I should draw your attention to an error of fact which may mislead your readers.

Mr Wilkins indicates that the Industrial Research and Development Grant "provides up to $60,000 for eligible expenditure on research and development projects". As you will note form the pamphlet I have enclosed, this statement is, in fact, wrong.

Those eligible for commencement grants may receive an entitlement of up to $40,000 per annum. However, the Board may support companies undertaking specific IR&D projects, to a statutory limit of $750,000 per annum. This limit can be raised with the Minister's approval.

I would be grateful if you could please advise your readers of the error. The Board is concerned that a large number of companies have been misinformed about the scheme over the years.

Elenore Eriksson,
Australian Industrial Research and Development Incentives Board,
Belconnen, ACT.

Buying your first computer

I have just read Peter Vernon's article "Buying your first computer" in the June edition of "EA". My immediate thought was a letter of appreciation and I know if I do not put pen to paper now I shall forget to do so . . . such is life!

The article was most informative, being aimed at beginners. There was no silly jargon to hide any weakness in the author's talents. It was very smooth, very interesting. I should have written to you long before this because Peter Vernon's articles are always good.

N. Smillie,
Parkwood, W.A.

Comment on the June editorial

I have noted your June 1984 Editorial Viewpont "Anyone for a three-year battery?". I must question the basis for your conclusion that "they don't build 'em like they used to". From our own statistics and reliable industry data, it can be demonstrated quite clearly that the average battery life has extended quite considerably and that in real terms a battery is cheaper today than 10 years ago.

You are quite right that the electrical demand on batteries has increased and can be expected to increase. Such things as heated rear windows, air conditioners, trip computers, radios/cassette players, etc., are either reducing charging capacity during driving or increasing key-off loads such that the state of charge of the average battery is significantly lower at any point in time.

Despite this increased workload, and clear evidence of less regular water top-up with self-service service stations, the facts are still quite clear — average battery life in Australia is 42 months and extending each year. The public is not "being short-changed." It is getting a better life for less cost.

E. T. Smith, General Manager,
Dunlop Batteries,
Sandringham, Vic.

The audio giant scores 10 out of 10.

System 330 Hi-Fi Component System.

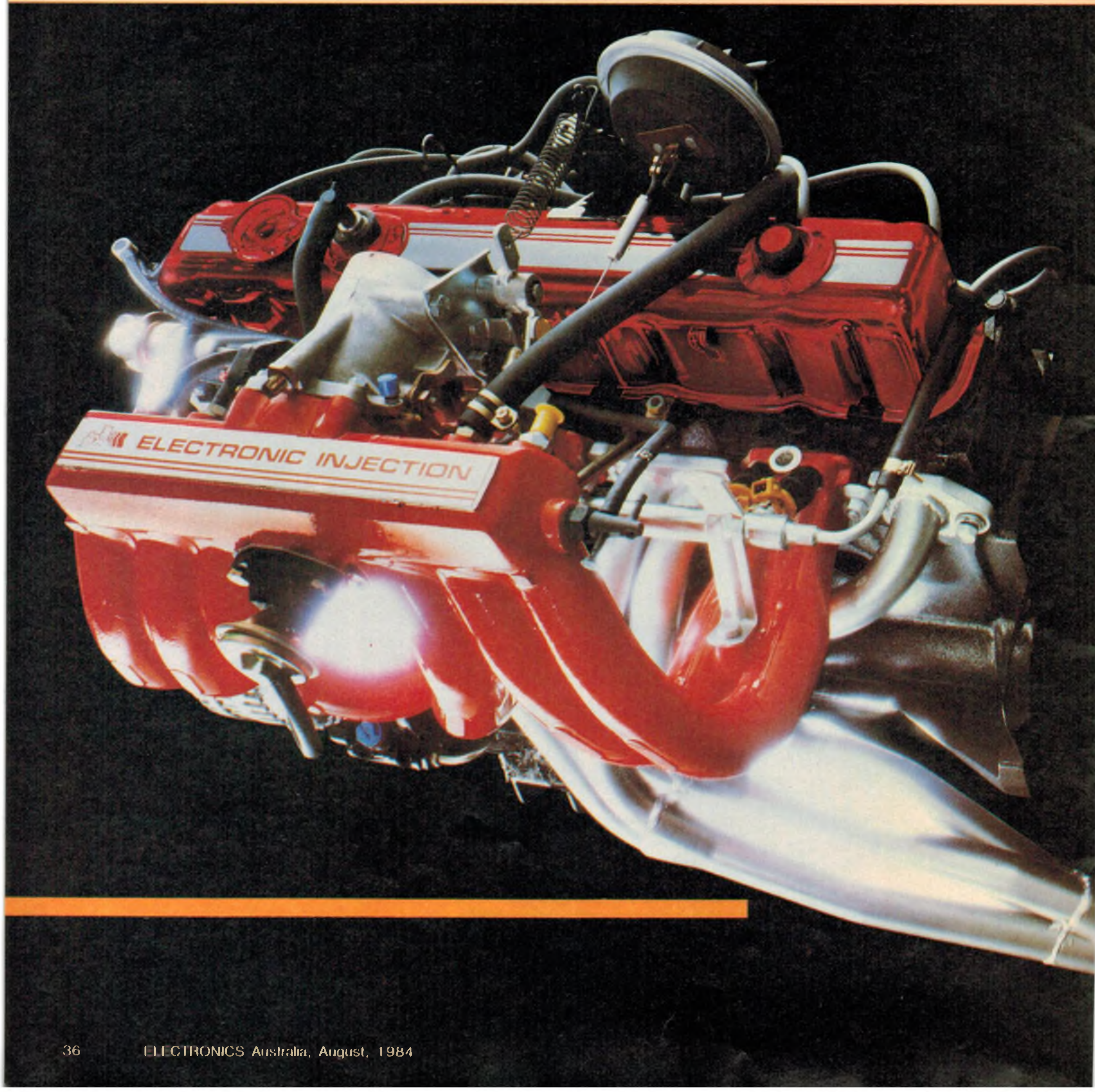
1. A full 35 watts RMS/channel power, drives the system's stereo units, delivering life-like sound through 3-way speakers.
2. Servo-controlled motor with belt drive assures constant, accurate speed. Cue control on turntable gently lowers tonearm into groove, preventing possible damage to the record or the stylus.
3. Built-in 5-band graphic equalizer enables you to custom contour the system's sound at 5 critical points along the audio spectrum by as much as 10dB.
4. A/B speaker switching enables you to connect two sets of speakers to your system and listen to them separately or together.
5. The tuner with its 3-segment LED signal strength indicator lets you know when you're receiving a weak or distant station.
6. Two 5-segment LED VU meters on the cassette deck provide precise, easy-to-read record levels and help to prevent distortion.
7. Dolby* noise reduction circuit minimises distracting tape hiss and allows you to record and playback crisp, clean sound.
8. 3-way, 3 speaker systems each containing 25cm woofer, 10cm midrange and a 2.5cm dome tweeter.
9. Audio component rack with attractive wood-grain finish includes record storage facility. Castors for easy mobility, glass door and hinged glass turntable dust cover.
10. The tenth feature is the price and Sanyo has taken care of that too, but that's life.

*Dolby is a registered trademark of Dolby Laboratories.

SANYO
That's Life!

7225

Hi-tech electronics in the new Holdens

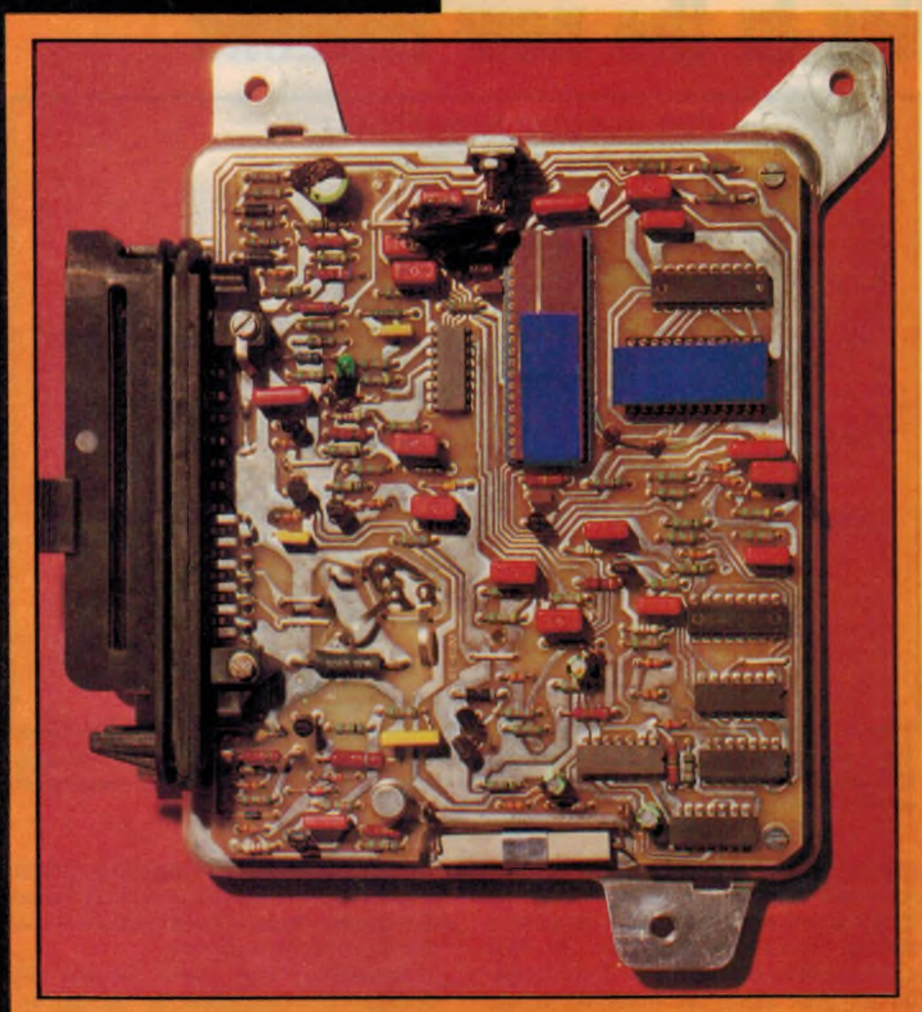


by NEVILLE WILLIAMS

When cars began to multiply on Australian roads, after the 1914-18 war, drivers were lucky to have electric headlights and an electric self-starter. Today, Australia's newest up-market vehicle, the Holden "Calais", is loaded with electronic gadgetry, making it a pleasure to drive and adding significantly to its on-road power and fuel efficiency.

Just how prominently electronics has figured in GMH planning for the new '84 VK series Commodore and Calais cars is evident from the handbook issued by the Company Service Department for dealers and the technical media.

Almost half the book is taken up by a discussion of Holden's new electronic spark timing system (EST), electronic fuel injection (EFI), electronic monitoring and instrumentation, trip computer and four-channel sound system. Routine electrical equipment has been relegated to a mere table of specifications at the back.



A close-up view of the central computer for the EST system (with chip type numbers covered). It is mounted in the passenger cab for protection against environmental extremes. At left is the new EFI engine.

According to C. S. (Chuck) Chapman, Managing Director of GMH:

"So much of the VK Commodore and Calais range centres on electronics that many buyers will see it as the car's most important change".

But, beyond the on-board equipment, it is evident that electronic research has played an important part in the development of the new VK series and especially in the up-graded 3.3-litre "L6" engines that will power most of the vehicles bought by the public. Indeed, the commercial success of the series will probably depend, as much as anything, on the performance and appeal of what rides under the bonnet.

GMH stress that the "potent, dynamic, race-proven 5-litre V8" is still available, substantially unchanged, as an option across the range but it is an option that will be exercised mainly by those who need a special-purpose vehicle: for pursuit, motor sports, heavy towing, etc.

Earlier, there had been much speculation by motoring writers as to whether Holden could any longer delay pensioning off their faithful old in-line six, in favour of a new-look engine from Europe or Japan. That may ultimately happen but it certainly seems not to have been necessary, this time around. GMH appear to be very pleased with what they now have.

Thanks largely to electronics, they have been able to announce two substantially up-graded versions of last year's 3.3:

- A base model carrying a number of mechanical modifications and fitted with a sophisticated engine management computer module providing electronic spark timing (EST). It offers smoother operation and up to 15% improvement in fuel economy, depending on driving conditions.
- A high performance version fitted with electronic fuel injection (EFI), "ram" effect intake manifold, high-lift camshaft and scavenger-type exhaust system. If offers traditional "V8" performance, with 27% more rated power and 15% greater torque, at about the same fuel economy or better than the original lower-powered VH model.

Computer-aided design

Traditionally, engine development — or redevelopment — has been a painstaking process, based on theory, GMH's new Holden "Calais" — fuel-injected and loaded with electronics

Hi-tech electronics in the new Holdens

observation and intuition, and verified at various stages by the production and testing of actual prototype components. It's a slow and costly procedure and one which which allows only very limited analysis of the many variables in practical engine design.

However, Holden engineers were able to make extensive use of CAD (computer-aided design) in the redevelopment of their 3.3-litre six, coming up with components and an order of performance which, in many respects, they claim as "state-of-the-art".

Suitably fed with data on bore, stroke, compression ratio, number of cylinders, valve area, camshaft profiles, fuel velocities and so on, GMH computers can respond with an accurate printout of engine horsepower and torque, plotted against RPM (revolutions per minute). By simply modifying the data relative to various parameters, it was possible to observe trends and results without the need to manufacture actual components — an especial advantage during design work on the high performance version.

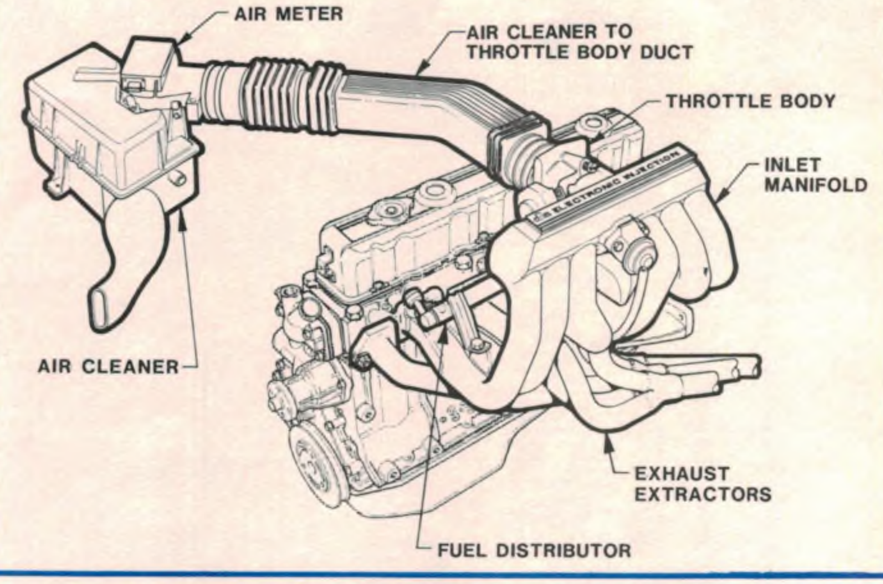
By way of example, Holden says that the computer design "model" can accept valve lift data for every two degrees of engine rotation. By progressively modifying the input data, engineers were able to simulate and assess the effect of changing the camshaft profile — this at the rate of three to four "camshafts" every day.

While so doing, they were looking at the so-called "ram" effect in the intake manifold. When the inlet valve opens, it creates an abrupt negative pressure change which travels, in the form of a sonic pulse, from the valve, along the intake manifold or pipe, to the plenum or air/fuel distribution chamber. In this region, reflection occurs and the pulse travels back along the manifold to the valve as a positive pressure surge, having undergone substantial phase rotation in the process.

In fact, it is an acoustic resonance effect and EA readers will see in it a parallel with what goes on in an organ pipe or in a vented loudspeaker system where, over a selected frequency range, substantial phase reversal occurs within the chamber/vent system.

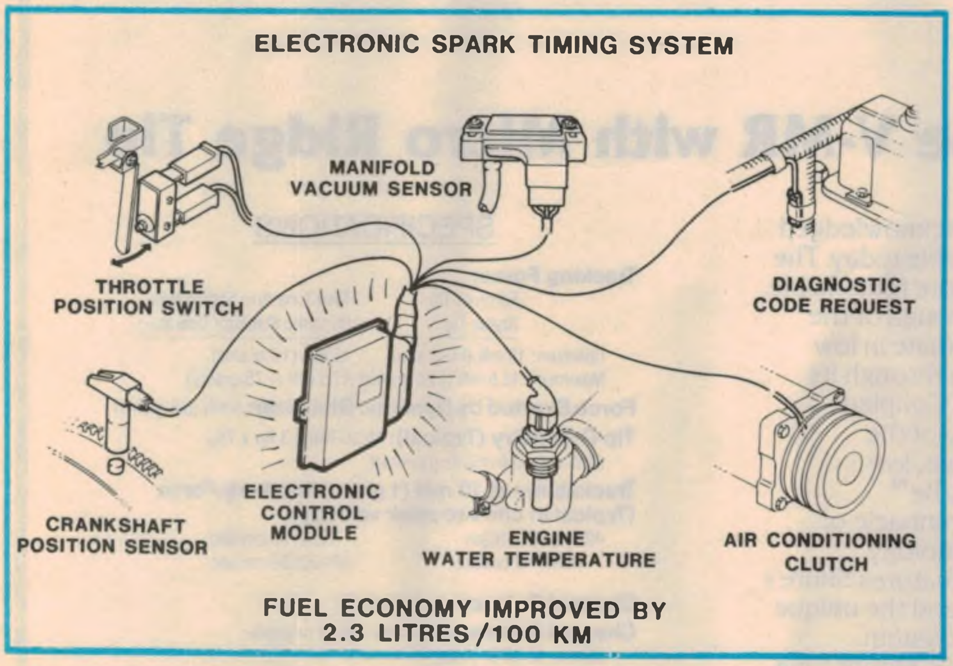
Speedboat fans have fiddled for decades with ram effect in "souped up" car engines, usually on a rather hit-or miss basis. By contrast, with the instrumentation available, GMH engineers were able to observe and plot the total pressure cycle adjacent to the inlet valve.

FUEL INJECTED POWER PLANT



The 3.3 Ei (electronic fuel injection) engine features a resonant "ram" type intake manifold, high-lift camshaft, air-feed system and scavenger type exhaust — all the subject of CAD (computer aided design) in GMH's own laboratories.

CAD or computer aided design was used extensively to optimise the design and performance of the fuel injected engine. The ram type intake manifold is depicted on the screen.



In the 3.3 EST (electronic spark timing) engine, a central computer correlates five operating parameters to optimise spark timing. The "Diagnostic Code Request" is a servicing aid to help identify any possible malfunction.

By selecting the length, diameter and contour of the intake manifold pipes feeding each cylinder, they were able to guide the resonance, or to "tune" the system, so that a significant positive pressure pulse would arrive back at each individual inlet valve precisely when it would do most good.

Measurement showed that, at mid-range engine speeds, the resonance effect would typically produce an increase in pressure at the inlet port of around 15kPa (+15% approx) at the time the valve would normally be closing. The computer model showed that, under these new conditions, the camshaft could be contoured, to advantage, so as to lift the inlet valves a little higher and to prolong their opening by about 11%.

As a result, the valve is still open when the piston commences its upward pressure stroke but, during the brief overlap, the extra momentum and pressure in the intake manifold can force a little more fuel/air mixture into the cylinder.

Holden credit accurate matching of the camshaft contour and intake manifold "ram" for most of the increase in torque of the high-performance engine, particularly at vital mid-range speeds. They point out, however, that accompanying improvements were made to the air cleaner, duct and throttle, and to the contours of the inlet valve head and cylinder head.

The engine simulation was also used to investigate the design of the exhaust system of the high-performance version. In the ultimate arrangement, each cylinder exhausts into individual stainless steel tubes, all of the same length and diameter. These merge into three secondary tubes using the equal length pairing of cylinders 1-6, 2-5, and 3-4. In turn, the secondary tubes merge into a single exhaust, the whole arrangement creating a scavenging effect, again contributing to performance.

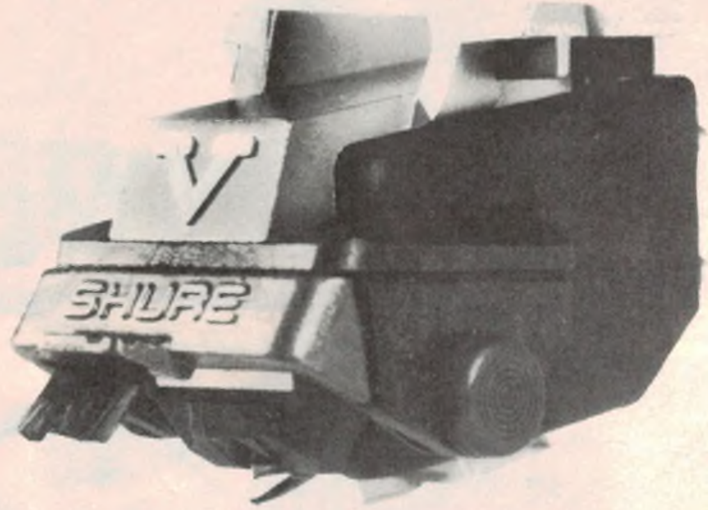
Engine electronics

While computer modelling and computer graphics have contributed in these and in other ways to the design of the VK series Holdens, what will concern drivers in the longer term is the actual on-board electronic equipment.

As with the earlier series, all VK models use electronic ignition to ensure a more powerful and consistent spark discharge and to obviate the need for frequent distributor maintenance. However, in the base model engine (which is standard fitment for all models other than Calais), electronic ignition is supplemented by an engine management computer module which takes over the job of spark timing.

(Technically inclined readers may care to compare the GMH approach with the

Shure's finest achievement in sound reproduction



The V15 Type V-MR with Micro Ridge Tip

The V15 Type V is already acknowledged to be the finest cartridge available today. The new V15 Type V-MR is even more remarkable.

The technological breakthrough of the Micro-Ridge Tip offers the ultimate in low distortion sound reproduction through its highly accurate tracing ability. Coupled with the incredible trackability of the revolutionary new high stiffness, low mass Beryllium MICROWALL/Be™ Stylus Shank, it produces the pinnacle of state-of-the-art cartridge technology.

The V15 Type V-MR also features Shure's exclusive Dynamic Stabilizer and the unique Side-Guard Stylus Protection System.

Designed for the standard ½" mount tone arm, the V15 Type V-MR brings together important new construction features, performance capabilities, and high technology instrumentation. It includes a Duo-Point Alignment Gauge, leveling-alignment stylus, data booklet, and an individual computer print-out which provides the exact tested response of your particular cartridge. A stylus cleaning brush, screwdriver and mounting hardware are included.

SPECIFICATIONS

Tracking Force:

	Force At The Stylus Tip	Total Tone Arm Setting With Dynamic Stabilizer Operating
Optimum:	10 mN (1.0 gram)	15 mN (1.5 grams)
Maximum:	12.5 mN (1.25 grams)	17.5 mN (1.75 grams)

Force Exerted by Dynamic Stabilizer: 5 mN (0.5 grams)

Tip Geometry (Typical): Micro-Ridge 3.8μ x 75μ (0.15 mil x 3.0 mil) long contact

Trackability at 10 mN (1 gram) Tracking Force (Typical in cm/sec peak velocity):

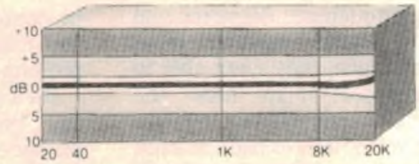
400 Hz: 30 cm/sec	5 kHz: 80 cm/sec
1 kHz: 46 cm/sec	10 kHz: 60 cm/sec

Channel Balance: Within 1.5 dB

Channel Separation: 1 kHz: 25 dB or greater, 10 kHz: 18 dB or greater

Output Voltage (Typical): 3.2 mV RMS at 1 kHz at 5 cm/sec peak velocity

Frequency Response Limits:



FREQUENCY IN HERTZ

Recommended Load: 47 kΩ in parallel with 250 pF.

Cartridge Weight: 6.6 grams

SHURE

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Hi-tech electronics in the new Holdens

"Chrysler Electronic Lean Burn System", described in detail in our March 1979 issue).

To date, the vast majority of road vehicles have relied on an intake manifold vacuum system, operating in conjunction with the distributor, to advance the spark when the engine is spinning freely under not-too-heavy load. It can provide only fairly coarse adjustment, based on engine speed and manifold vacuum level.

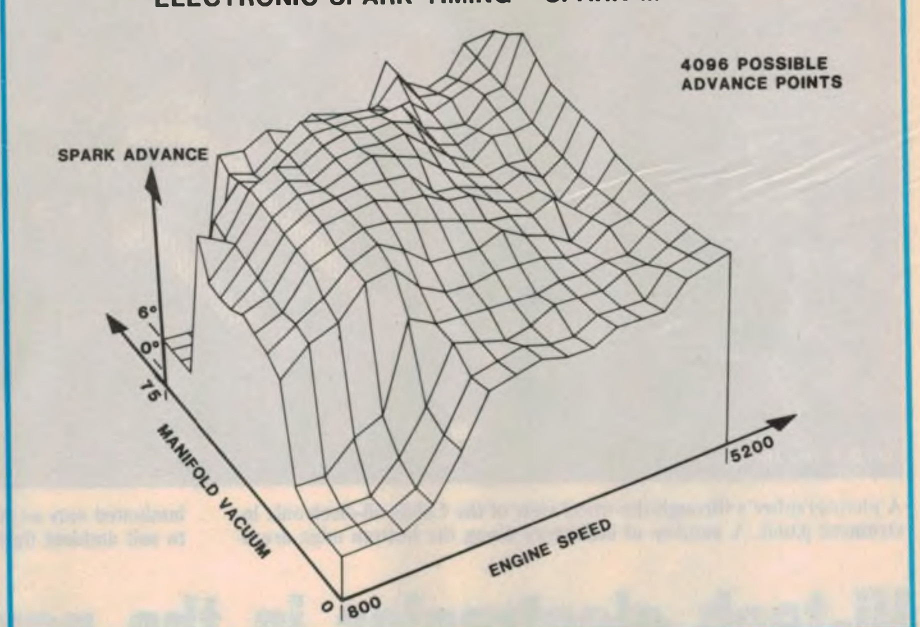
With the EST system, the distributor has a single, static setting with no provision for vacuum or centrifugal advance. However, the control computer module receives information about manifold vacuum from an analog sensor, and engine speed in digital form from a Hall-effect sensor and a magnet on the flywheel. In addition, there is a sensor for water jacket temperature, and switch-type sensors for throttle position and air conditioning clutch (see diagram).

The computer analyses this mix of analog, digital and switch-position information and decides whether the vehicle is being driven according to a city/suburban or a highway cruising pattern. Based on this decision, it selects the appropriate stored program and, according to that program, sets the spark advance to optimise engine behaviour (including emission) for four major modes: engine starting; engine idle; engine normal; coasting.

GMH claims that, along with improved carburettor design and modified anti-pollution provisions, "spark advance flexibility allows EST to match engine needs for best fuel consumption, response, power and emissions".

The control module, incidentally, has an inbuilt diagnostic program such that, when a system fault occurs, an "EST" warning flashes on the instrument panel, indicating a malfunction. This can normally be identified, in subsequent service, by grounding a diagnostic code sensor in the engine bay and noting the flashing sequence of the warning lamp.

Failure is not final, by the way, because, says the manual: "the system has the ability to provide a limp-home back up".



A typical simulated 3D computer map, made during the research program, showing spark advance plotted against manifold vacuum and engine speed.

Electronic fuel injection

As distinct from the base model or "3.3 EST" engine, the high performance motor uses straight long-dwell high-intensity electronic ignition, a vacuum advance distributor and electronic fuel injection (EFI).

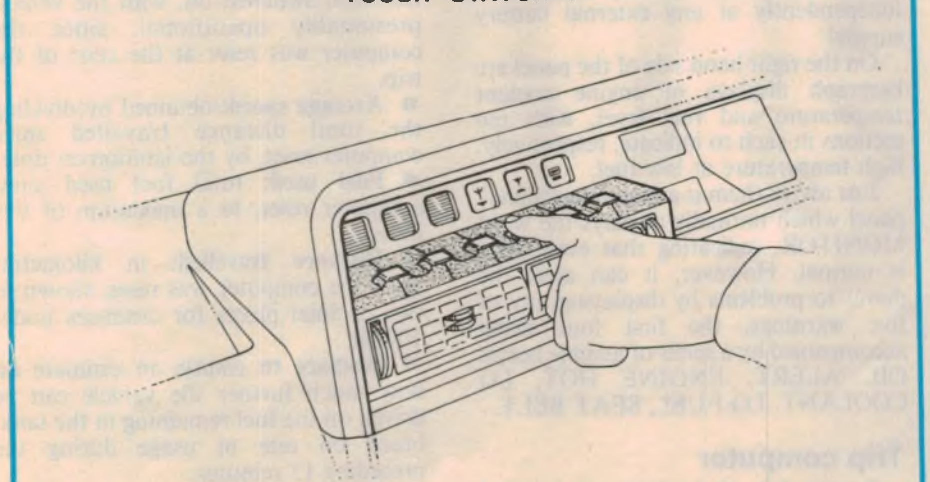
Why revert to a vacuum-advance ignition system? Why not include EST as well as EFI? The short answer is that GMH wanted to control costs and felt that the performance of the engine with EFI was more than adequate, without the need to include EST.

The 3.3 EFI or, more correctly, the 3.3 Ei engine, is mated with a recalibrated 3-speed automatic transmission and fitted as standard to the Calais. It is available, however, as an option on the other sedans but not on the station wagons.

The fuel injection system selected by GMH is identified as the "Bosh LE Jetronic" and described as "arguably the best injection system in the world," used by many of Europe's high-performance vehicle makers like BMW, Mercedes Benz, Porsche and by leading Grand Prix race teams.

(See also our September '83 issue for "Electronic Fuel Injection: How it Works", in relation to the Ford range).

The computer control module associated with the injection system senses and interprets information about



The influence of "electronic" thinking. In the VK series Holdens, automotive toggle-turn-push-pull switches have given place to a line of "touch" switches.

A photographer's through-the-wheel view of the Calais all-electronic instrument panel. A number of indicators along the bottom edge are illuminated only as necessary. A sensor sets the brightness automatically to suit ambient light conditions.

Hi-tech electronics in the new Holdens

air flow, engine RPM, engine temperature and throttle position, plus an engine "cranking" or starting signal. It controls the injector valves to provide the exact amount of fuel required for the full range of operating conditions.

At one extreme, it provides an enriched mixture to ensure a virtually instantaneous cold start, with immediate full — and smooth — drive away power. At the other, with the vehicle coasting and the engine spinning at above 1800rpm, the computer shuts off the flow of fuel altogether.

The end result, according to GMH sales literature, is: "signicantly better fuel economy — or outstanding fuel efficiency for the performance obtained, depending on your driving style."

Instrumentation

Instrumentation on all models other than the Calais is a mix of conventional indicator lamps and mechanical analog instruments, the exact complement and options depending on the model. A point of note, however, is the row of touch switches on the control panel which carries overtones of electronic equipment design (see diagram).

However, it is the instrumentation on the Calais (only) that must really catch the attention of an electronics buff, because it is entirely electronic in both its operation and display.

Looking at the mix of numerical readouts and coloured bargraphs, one can only be reminded of the panel of any modern piece of hifi or video equipment.

Centrepiece is a green bargraph depicting road speed in km/h; each bar represents an increment of 2.5km/h and calibration points are in multiples of 20. In addition to the graphic presentation, speed is also shown nearby as a direct numerical readout.

Directly below the speedometer is a matching tachometer showing engine rpm, calibrated in units 0 to 6 but red-lined at 5500rpm.

Below that again is a 4-digit trip meter and a 6-digit odometer, the latter showing the total distance which the vehicle has travelled since new. Of special interest is the fact that the odometer has a non-volatile memory and, according to a spokesman for GMH, will remember the figure last displayed for approximately eight years, independently of any external battery supply!

On the right-hand side of the panel are bargraph displays of engine coolant temperature and fuel level, with red sections in each to indicate, respectively, high temperature or low fuel.

Just above them is a matching "alpha" panel which normally displays the word MONITOR, indicating that everything is normal. However, it can alert the driver to problems by displaying any of five warnings, the first four being accompanied by a series of audible beeps: OIL ALERT, ENGINE HOT, LO COOLANT, LO FUEL, SEAT BELT.

Trip computer

On the left of the instrument panel, balancing the foregoing panels. are the readouts for the trip computer, with the operating buttons grouped in line on a sub-panel with turn signal lights, generator failure warning, parking brake warning, etc. A trip computer was available for the earlier VH Commodore and Camira but GMH say that the unit fitted to the Calais is a more sophisticated design.

The trip computer keeps track of time, distance travelled and fuel, inter-relating them by internal logic to provide eight separate pieces of information on demand:

- **Time of day:** a normal 12-hour digital readout.
- **Elapsed time:** up to 99 hours and 59 minutes: the total time that the ignition has been switched on, with the vehicle presumably operational, since the computer was reset at the start of the trip.
- **Average speed:** obtained by dividing the total distance travelled since computer reset, by the ignition-on time.
- **Fuel used:** total fuel used since computer reset, to a maximum of 999 litres.
- **Distance travelled:** in kilometres since the computer was reset; shown to two decimal places for distances under 100km.
- **Distance to empty:** an estimate on how much further the vehicle can be driven on the fuel remaining in the tank, based on rate of usage during the preceding 15 minutes.
- **Average fuel consumption:** obtained


MOST PEOPLE IN AUSTRALIA
DON'T KNOW THEIR OWN STRENGTH
Just because you don't see supersonic jets blazing across our skies everyday, doesn't mean that we don't have one of the most powerful Air Forces in our region.
A force of over 22,000 highly trained professionals operating a network of bases and facilities across the nation.
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Hi-tech electronics in the new Holdens

from the totals in memory since computer reset; updated at one minute intervals.

- **Instantaneous fuel consumption:** obtained from current vehicle speed and fuel consumption rate; updated at half-second intervals.

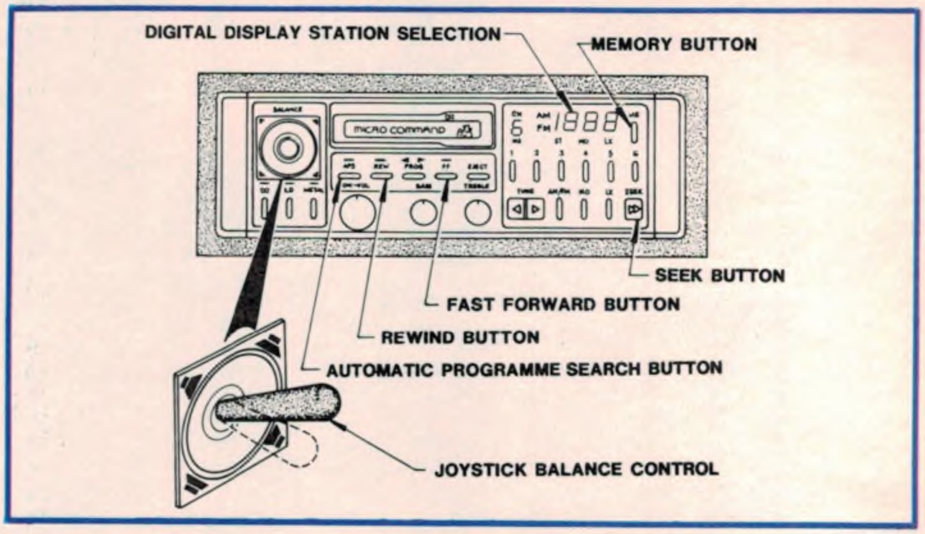
Data for the information display panel, including the trip computer, is obtained from sensors of the general type mentioned earlier in connection with EFI. The display system itself basically consists of three tiers:

- **The visible display,** as viewed by the driver. Holden describe it as a vacuum fluorescent system, controlled by an ambient light sensor so that the brightness changes at a controlled rate to take account of the ambient light level.
- **The computer logic** or "number crunching" system, which receives and interprets input data from the sensors and provides the drive required by the display module.
- **The power supply,** providing supply voltages for both the above.

In opting for a vacuum fluroescent display, GMH are simply reflecting the preference of many, if not most, big-name manufacturers of hifi and video equipment — even though their readouts are commonly, mistakenly, described as "LED" (light emitting diodes).

Individual electronic instruments and readouts have been used on cars prior to this but a complete electronic instrumentation package is a pioneering enterprise by GMH, with the assembly used on the Calais being unique in the world to Holden, Australia.

Cruise control, by the way, is also fitted as standard to the Calais and as an option on the other sedans.



Radio receivers in the VK series all use electronic tuning and readout, but the radio/cassette player in the Calais features a search and memory facility, plus four audio channels with joystick balance control.

Entertainment

And what do you listen to while all this is happening?

Certainly not to a mono radio with mechanical string-driven tuning dial!

The base model Commodore SL comes with an AM/FM stereo radio with electronic tuning, digital readout and pushbutton station selection. The mid-range Commodore Berlina provides cassette stereo, as well.

In the Calais, the receiver features automatic station search, automatic fine tune, memory function, digital frequency readout and pushbutton station selection. The cassette facility provides automatic program selection in addition to the usual controls, while the audio system features Dolby noise reduction, a loudness control and four separate 5-watt amplifiers with four loudspeakers, plus a 4-way joystick balance control.

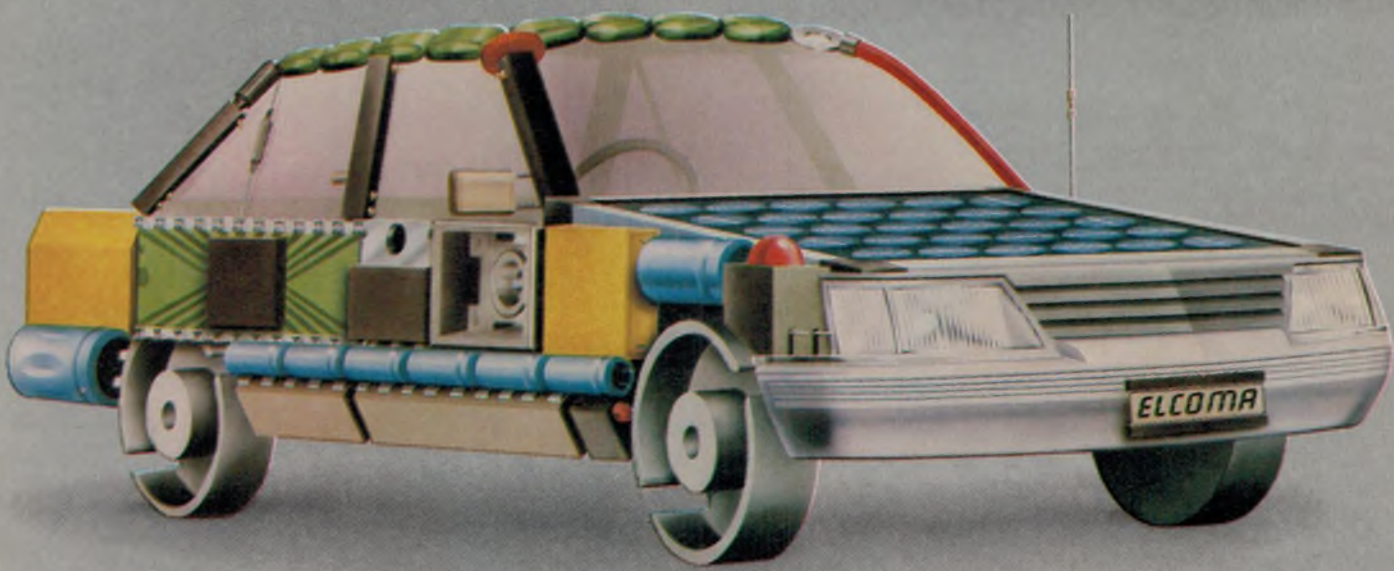
One final question: was the VK series of Holdens masterminded in Australia, using local initiative and local facilities?

The answer basically is: "Yes, involving GMH's own engineers in collaboration with suppliers based or represented in Australia."

Only in one major area did they have to invoke major overseas corporative assistance, in particular from the $10 million Electronic Compatibility Laboratory at GM's Milford Proving Ground in the USA. It was one thing for GMH to pack an array of new-look electronics into the new cars; it was quite another to be sure that they would not run into tortuous problems of mutual electrical interference.

That is where the Milford Laboratories came into the picture: to ensure that ... "the body wiring installation, shielding, location of controls, and the control systems and modules were all developed as part of an interference-free package" — a statement that should read like music to any old-time radio enthusiast!

"Can you see the changes Philips Components have made to car manufacturing?"



For something that has so radically changed our lifestyle, the motor car has undergone few really fundamental changes. Its faithful reciprocating combustion engine, for example, is mechanically the same as it was when man was first learning to fly.

Yet one true automotive breakthrough has been the application of modern electronics. Fuel injection systems that "read" the supply, the load and adjust to the demand. Engine management systems that continually monitor and rectify. Consoles that "speak up" about anything from brake failure to seatbelts not fastened.

And while it's true we once got by without this much help, it's amazing how quickly we come to rely on it. Which soon makes products without advanced electronics seem like something's missing.

As a car manufacturer or any "other" manufacturer, there's every chance your products or processes are already affected by the application of this modern technology. Or soon could be. So whether you do it first or second could have a lot to do with what you do next.

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Protect your most prized possession:

VCR Theft Alarm

That VCR sitting on top of your TV set is a very expensive appliance. It is also portable and marketable, which makes it a prime target for thieves. The simple alarm described here will sound off immediately the VCR is lifted — and it makes a lot of noise. The circuit could also form the basis of a burglar alarm for an entire house.

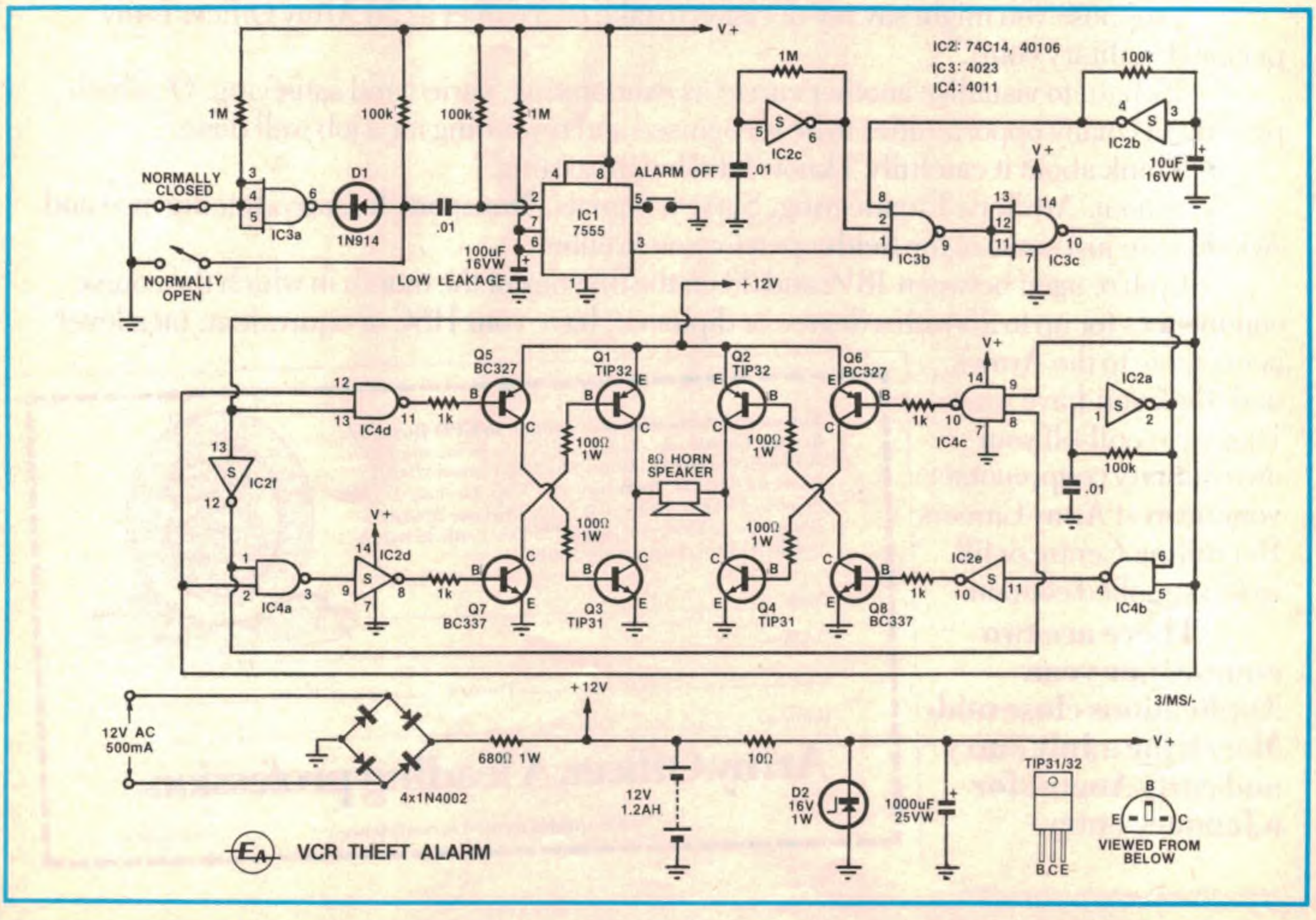
by JOHN CLARKE

Video cassette recorders or VCRs are constantly under the threat of being stolen. Recent figures indicate that VCRs are now the number one item on the burglar shopping list.

Unfortunately, they are all too readily disposed of, typically in the local pub on a Saturday afternoon ("It fell off the back of a truck, mate"). If genuine, there would have to be a lot of trucks running around with open backs, dropping VCRs every few kilometres! (Frankly, I wouldn't fancy a VCR which had really suffered such a fate.)

There are several ways to lower the chance of VCR theft. Foremost is not to advertise that you own a VCR. This includes being discrete in a room full of strangers or in any public place. An intending thief can quickly be aware of your VCR ownership by overhearing conversation about a video movie. In addition, it is preferable not to mention your address at the shop when the VCR is purchased. Hiring video cassettes presents a problem, since a name and address is normally required. The best that can be done is to deal only with reputable libraries.

At the risk of stating the obvious, the house itself should be made as secure as possible. Doors should be fitted with deadlocks, and windows secured with something better than the customary simple catches. Also, make sure that the



VCR THEFT ALARM

VCR is not readily visible from outside the house. Draw blinds or curtains as necessary.

But, even with all these precautions, a thief can still break into your home and remove the VCR. This is where our VCR Theft Alarm comes into play. The instant the thief lifts the VCR from its normal resting place, the alarm sounds, scaring the thief and, hopefully, alerting neighbours. The alarm sound is particularly vicious; a 1000Hz tone, modulated at 100Hz, and switched on and off at a 1Hz rate.

The system operates from its own battery, normally on trickle charge from the mains, so that even a thief who turns off the mains power will achieve nothing. The battery is a 12V, 1.2Ah sealed lead-acid gel battery, specially designed for such applications and which requires a minimum of maintenance. It is available from Arista Electronics Pty Ltd. Power to charge the battery and supply the system's standing current is provided by the mains, via a 12V AC 500mA plugpack.

Once activated, the alarm will sound for approximately two minutes, then shut down. This is normally long enough to scare a thief, but the time could be increased if desired, as will be explained later. However, be aware that legislation limits the time an alarm may sound, usually to 10 minutes. An Alarm Off switch is fitted to permit shutting it down at any time.

How it works

The alarm sensor is a membrane switch which needs to be kept closed in order to hold the alarm off. It is placed under one of the VCR's mounting feet, so that the weight of the machine holds it closed. Immediately the machine is lifted the circuit opens and the alarm sounds.

The membrane switch is of the type normally used for calculator and similar keyboards. They are supplied as a unit of four, fitted with an eight conductor ribbon and eight pin plug. Where only one switch is required, as in this case, it is a simple matter to cut off the unwanted pads. The one we used is a type K001, available from Hi-Com Unitronics International.

The alarm circuit itself provides two inputs, one for a "normally open" circuit, and one for a "normally closed" circuit. Both provide instant triggering of the alarm with only a momentary closing of the normally open input, or opening of the normally closed input. Only the normally closed input is used in this application, but there is no reason why the normally open input could not also be used, as a backup, in conjunction with a pressure mat or other suitable sensor.

In fact the circuit is quite versatile and there is no reason why it could not form the basis of complete house alarm system. It could be used in conjunction with conventional reed switch/magnet type door and window sensors, connected in series to the normally closed input. Again, the normally open input could serve as a backup.

Another use for pressure sensitive alarms of this kind is in shops where valuable items — including, perhaps, VCRs — need to be on display but present a very tempting target for a thief. Several pressure pads could be used, connected in series, each one protecting a separate item.

The horn is an 8Ω speaker unit with a 130mm diameter flare, and can make a lot of noise. The one we used is available from Dick Smith Electronics and is listed under catalog number C-2705.

The effectiveness of the alarm depends very largely on installation. Ideally the horn speaker should be mounted external to the house so that it will radiate as much sound as possible to the surrounding neighbourhood. The membrane switch and wires leading to and from the main alarm unit should be well concealed so that the thief cannot easily detect their presence and disable the alarm. Details of installation will be discussed later.

The circuit itself can be divided into three sections. Firstly, the inputs and timer comprising IC3a, diode D1 and IC1. The second section is the horn speaker driver circuitry, which uses the remaining ICs from IC2 to IC4 and transistors Q1 to Q8. The final section is the power supply comprising the battery, plugpack, bridge diodes, and the zener D2.

IC1 is the CMOS version of the familiar 555 timer. It is configured as a monostable so that once triggered, its output at pin 3 goes high for the monostable period. This period is nominally 110s, the time the alarm will operate after being triggered. It is determined by the time taken for the 100μF capacitor at pins 6 and 7 to charge via the 1MΩ resistor to two thirds the power supply voltage. This "on" time can be conveniently increased, if necessary, by increasing the value of the 1MΩ resistor.

The Alarm Off switch functions by pulling the threshold voltage at pin 5 low, thus resetting the timer and shutting off the alarm.

IC1 is triggered by a low going pulse at pin 2, which is normally held high with a 100kΩ pull up resistor. A .01μF capacitor AC couples the signals from the normally open and normally closed alarm inputs to pin 2.

The normally open input is held high

VCR Theft Alarm

by a 100kΩ resistor. When this input is closed, pin 2 of IC1 goes low until the .01μF capacitor charges via the 100kΩ pull up resistor at pin 2. The normally closed input is normally held low (by the membrane switch) and this is inverted by IC3a. As soon as this input goes open circuit, the output of IC3a goes low by virtue of the 1MΩ pull up resistor at its input. D1 conducts and transfers a low pulse to pin 2 of IC1.

The high output from IC1 is used to gate on the horn speaker driver circuit via pin 1 of IC3b, to sound the alarm. The remaining two inputs of IC3b are connected to the outputs of Schmitt trigger oscillators IC2c and IC2b. The first oscillator (IC2c) operates at about 100Hz while IC2b has a nominal frequency of 1Hz. With pin 1 of IC3b high, their outputs are gated through to the output of inverter IC3c and form the gating signal for the horn speaker driver circuit.

This gating signal is connected to one input of NAND gates IC4a, b, c, and d. When the gating signal is low, the NAND gate outputs are high and transistors Q5, Q6, Q3, and Q4 are off. IC2d and IC2e invert the outputs of IC4a and IC4b and so Q7, Q8, Q1, and Q2 are also off. In this state the circuit draws very little current.

A third oscillator, operating at 1kHz — the main alarm sound — is provided by IC2a in a Schmitt trigger configuration. When the gating signal goes high this 1kHz signal is gated through to the transistor driver stages by the IC4 NAND gates. In the case of IC4a and IC4c, the signal is inverted by IC2f before being applied.

The transistor driver stage operates in the push-pull mode. When the output of IC2a goes high, the output of IC2e also goes high and turns on transistors Q8 and Q2. At the same time, the output of IC4d goes low and turns on transistors Q5 and Q3. One side of the horn speaker thus goes to the positive supply rail while the other goes to the negative rail.

Similarly, when the output of IC2a goes low, Q8, Q2, Q5 and Q3 all turn off and Q6, Q4, Q7 and Q1 turn on. In this manner, each side of the horn speaker is switched at a 1kHz rate from one polarity to the other.

This 1kHz tone is modulated at 100Hz by IC2c, while IC2a switches the tone on and off at a 1Hz rate (ie, on for 0.5s and off for 0.5s). The result is an earpiercing alarm tone that is sure to attract attention.

Power for the alarm circuit comes, in the first instance, from the mains via a 12V AC plugpack. This 12V AC is rectified by a bridge rectifier and is then used to trickle charge the battery through a 680Ω limiting resistor. The charge rate is approximately 2mA when the battery is floating, rising somewhat if it is discharged, as by an activated alarm.

This same rail also supplies the quiescent current for the circuit, decoupled by a 10Ω resistor and a 1000μF capacitor. A 16V zener diode is included to protect the circuit from serious voltage rise should the battery be disconnected.

Construction

Construction of the VCR Theft Alarm is relatively straightforward. The parts are mounted on a PCB coded 84a18 and measuring 96 × 76mm. This, with the battery, is housed in a plastic utility case measuring 150 × 90 × 50mm. We used PC stakes for all external connections to the PCB since this facilitates wiring later on. These can be inserted onto the PCB first.

The actual component layout is clearly shown in the accompanying diagram, with the components superimposed on the printed pattern. Follow this carefully and it is difficult to make a mistake. Begin construction by installing the five links, then mount the diodes, resistors and capacitors. Note that the diodes and electrolytic capacitors must be mounted with correct polarity, so check carefully as you proceed. Check the diode type numbers also, to make sure the right ones go in the right place.

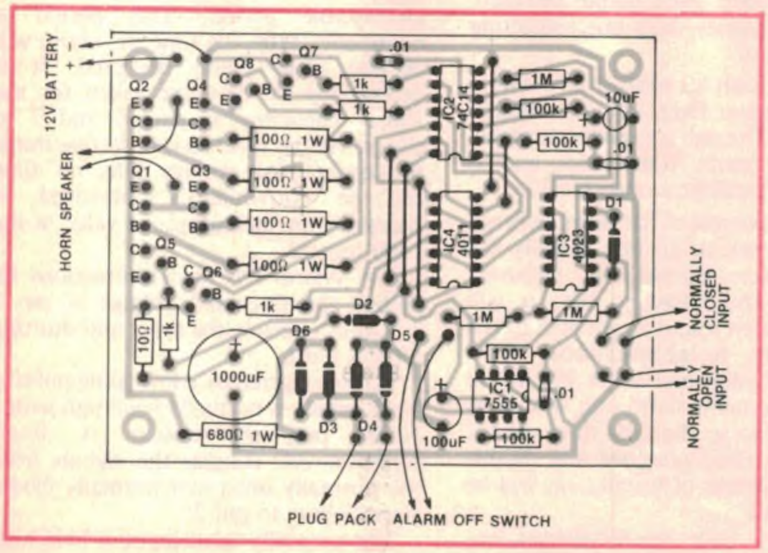
The transistors should be mounted next and should be pushed onto the PCB as far as they will go without stressing the leads. As with the diodes, you will need to refer to the circuit diagram for the type numbers. Make sure you install them the right way around. Assembly is completed by installing the CMOS ICs. When soldering the ICs, solder the power supply pins first to enable the static protection diodes.

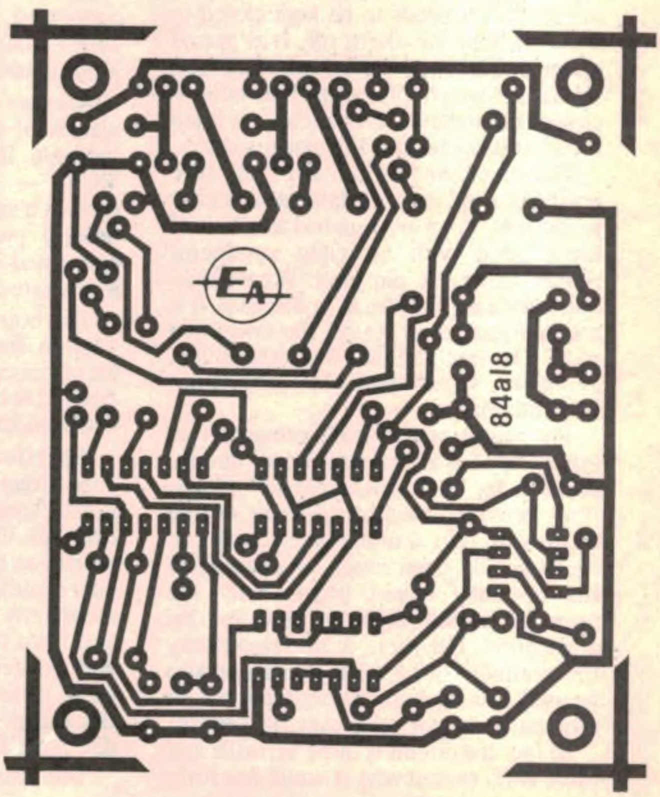
We estimate that the current cost of this project is

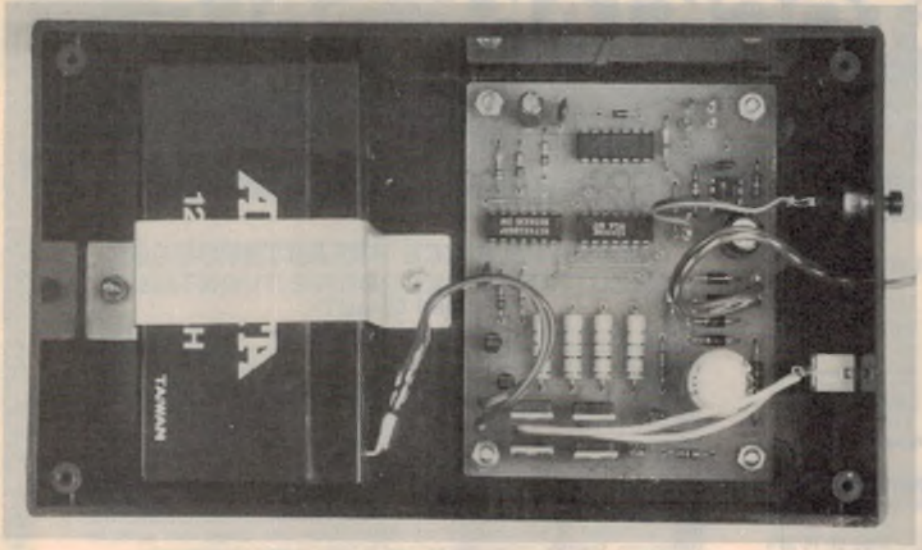
$70

This includes sales tax.

Below: parts overlay diagram for the VCR Theft Alarm. Use PC stakes to terminate the external wiring connections. At right is an actual size artwork for the PCB.







View inside the prototype. The battery is secured using a bracket made from scrap aluminium.

PARTS LIST

1 PCB, 96 × 76mm, 84al8
1 plastic utility case, 150 × 90 × 50mm
1 12V 500mA plugpack
1 12V 1.2AH gel rechargeable battery
1 8Ω horn speaker
4 6mm PCB standoffs
12 PC stakes
1 4 key flat keyboard (K001 Hi-Com Unitronics International)
1 piece of aluminium sheet, 180 × 25mm
1 momentary pushbutton switch

Semiconductors
1 7555 CMOS timer
1 74C14, 40106 hex Schmitt trigger
1 4011 quad NAND gate
1 4023 triple NAND gate
2 BC337 NPN transistors
2 BC327 PNP transistors
2 TIP32 PNP transistors
2 TIP31 NPN transistors
4 1N4002 100V diodes
1 1N914, 1N4148 diode
1 16V 1W zener diode

Capacitors
1 1000μF/16VW PC electrolytic
1 100μF/25VW (low leakage) electrolytic
1 10μF/16VW PC electrolytic
3 .01μF metallised polyester

Resistors (¼W, 5% unless stated)
3 × 1MΩ, 4 × 100kΩ, 4 × 1kΩ, 1 680Ω 1W, 4 × 100Ω, 1 × 10Ω

Miscellaneous
Hookup wire, battery connectors, machine screws and nuts, solder etc.

Only a small amount of work is needed to prepare the case. The battery lies side on at one end, as shown in the photograph. We made an aluminium bracket to hold the battery securely in position. The PCB is supported on 6mm standoffs and held with machine screws and nuts. Holes must also be drilled for the Alarm Off switch, horn speaker socket, and the plugpack and membrane switch leads.

Any of the four switches of the membrane switch array can be used as the alarm switch. We used the switch nearest the wire exits, in which case pins 4 and 8 are the contact pins (counting from L to R). Peeling back the backing sheet reveals the connections. If this switch is used the remaining three switches can be cut off, leaving the single switch.

Connections to the plug pins are best made by simply soldering the wires directly to them. While this may look somewhat ungainly, and perhaps suggest that it could provide a ready means for a thief to recognise and disable the alarm, this can be avoided. The whole lead and plug assemby is easily hidden under the VCR, so that only a nondescript lead emerges. And if the thief lifts the VCR to investigate . . . . .

Standard hookup wire can be used for short connections, with light figure eight flex for the plugpack and horn connections. Automotive spade sockets can be used to terminate the battery leads. The length of wire required for the plugpack and membrane switch depends upon where the alarm unit is to be positioned in relation to a convenient power point and the VCR.

For the present, and providing the battery is charged, the unit can be tested without the plugpack. Operation of the alarm can be triggered by shorting the normally open and normally closed inputs with a screwdriver. Note that as soon as power is applied to the alarm the horn should sound for about two minutes. The Alarm Off switch can stop this. Test each input for correct operation of the alarm.

Installation

The alarm unit is best installed in a well hidden position at a distance from the VCR. The leads from the alarm unit to the VCR can then run under the carpet and up to the membrane switch. The mounting feet of the VCR are the logical projections to hold the membrane switch closed, but the membrane switch will only close if pressed within the switch pad area. With some VCRs the mounting feet may be too large. By cutting out a small piece of cardboard, smaller than the switch pad area, the mounting feet can be used to press onto this and thence onto the membrane switch.

Ideally, the speaker should be mounted outside the house, but this can present problems. If it can be seen, and reached reasonably easily, an ingenious thief may be able to reach it and disable it. It will be up to the individual to find the best compromise between these conflicting factors. Depending on the construction of the house it may be possible to mount it so that it looks out from under the eaves, without being too obvious, or the leads being accessible. Painting can also help to disguise it. In short, it should be heard but not seen.

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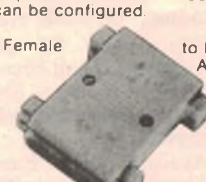

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- Dimensions 330 (W) x 285 (D) x 60 (H) mm overall.
- Platter Diameter 280 mm.
- 2 speed 33 and 45 rpm.
- Pick up Arm Counter balanced type with cueing facility.
- Pick-up ceramic stereo with diamond stylus.
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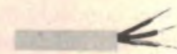

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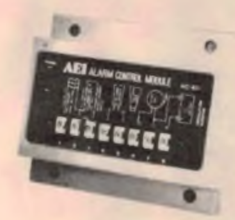

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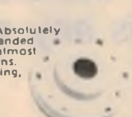

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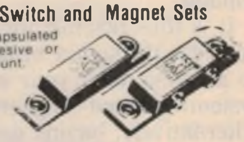

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Ultrasonic movement detector

for the Car Burglar Alarm

Designed to mate with our new Car Burglar Alarm (May '84), this ultrasonic movement detector provides added protection against illegal entry. It will trigger the alarm if a window is broken or if there is any movement inside the vehicle.

by JOHN CLARKE

Judging by the interest shown in the Car Burglar Alarm, this ultrasonic movement detector is sure to be popular. While the alarm, in its original form, will guard against entry via a door or interference to the ignition, it cannot protect against entry through a broken window.

It is thus possible for a thief to enter your car through a broken window and to abscond with your expensive sound system without triggering the alarm. Alternatively, having gained access, the thief could possibly disable the alarm and disappear with the vehicle. This circuit overcomes those problems.

In fact, when you think about it, an ultrasonic movement detector is an ideal add-on for a car burglar alarm. The metal and glass construction of a car means that the ultrasound is kept within the confines of the vehicle. The detector is thus unaffected by external movements and sounds.

Reference to the May '84 circuit will show that we made provision for this latest unit by including a second delayed entry (the first monitors the doors). This means that the alarm will not sound until 10s after movement has been detected, a necessary feature to allow for authorised entry to the vehicle.

A feature of the circuit is that it is very easy to build. Apart from two ultrasonic transducers, the circuit uses just two ICs, three transistors and a handful of other parts. These are mounted on a small printed circuit board (PCB) and accommodated in a plastic zippy case which mounts out of sight under the dash.

A small red LED on the front of the plastic case flashes on and off when movement is detected. This is used during the setting up procedure and allows the circuit to be adjusted for correct operation without actually setting off the alarm (which makes an unholy ruckus).

How it works

The basic concept is really very simple. Essentially, we have two ultrasonic transducers, a receiver and a transmitter. The latter emits a continuous 40kHz signal which is reflected from surfaces inside the car and picked up by the receiver.

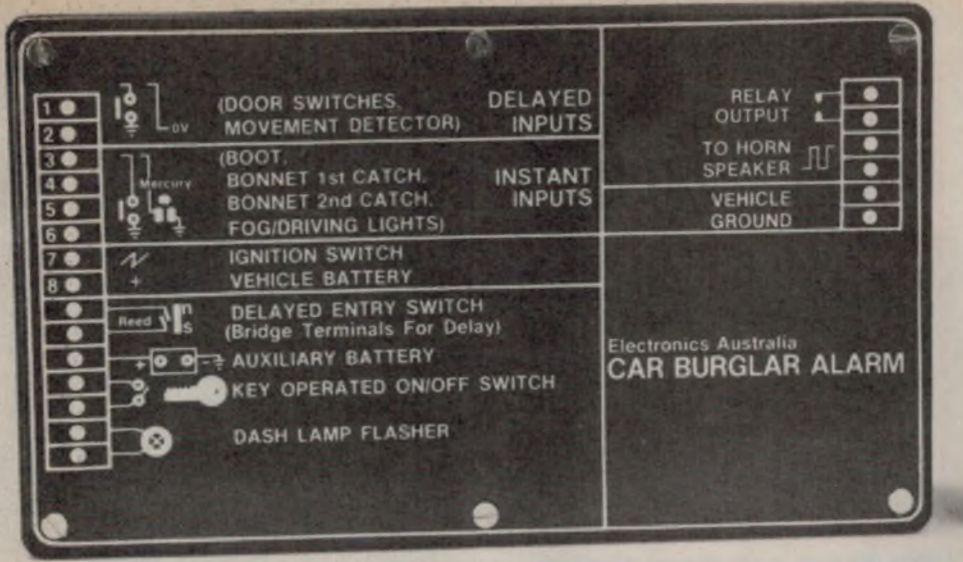
Provided all reflecting surfaces are stationary, the phase of the received signal will remain constant with respect to the transmitted signal. However, as soon as one of the reflecting surfaces moves, or a new surface is introduced, the phase of the received signal will change. This phase change is detected by the circuit and used to trigger the main alarm.

At the heart of the circuit is IC1 which is a 4046 phase lock loop (or PLL for short). Among other things, this IC contains a voltage controlled oscillator (VCO) and a phase comparator. The phase comparator compares the incoming signal frequency (on pin 14) with the VCO signals and produces a square wave output at pin 1, the duty cycle of which is dependent upon the degree of phase mismatch.

When the signals are in phase, the output of pin 1 is permanently low (ie, zero duty cycle). When the signals are 180° out of phase the output is high. If the signals are 90° or 270° out of phase, the duty cycle is 50%.

VR1 and the .001μF capacitor on pins 6 and 7 set the internal VCO to 40kHz. Note that the VCO input is permanently tied low so that it operates simply as a fixed oscillator. The output appears at pin 4 and drives the ultrasonic transmitter via inverters IC2f and IC2e.

The two inverters provide complementary outputs to the transmitter. This technique ensures that the transmitter is driven by the full supply voltage during each half cycle of the 40kHz signal and



The Ultrasonic Movement Detector mates with the EA Car Burglar Alarm at left. It can also be used with some commercial alarms.

thus increases the output power. The 1.2kΩ resistor limits the surge current through the transmitter when the inverter outputs change state.

Note that the VCO output of IC1 is also connected to the pin 3 comparator input. This enables the phase comparator to compare the VCO signal with the received (reflected) signal.

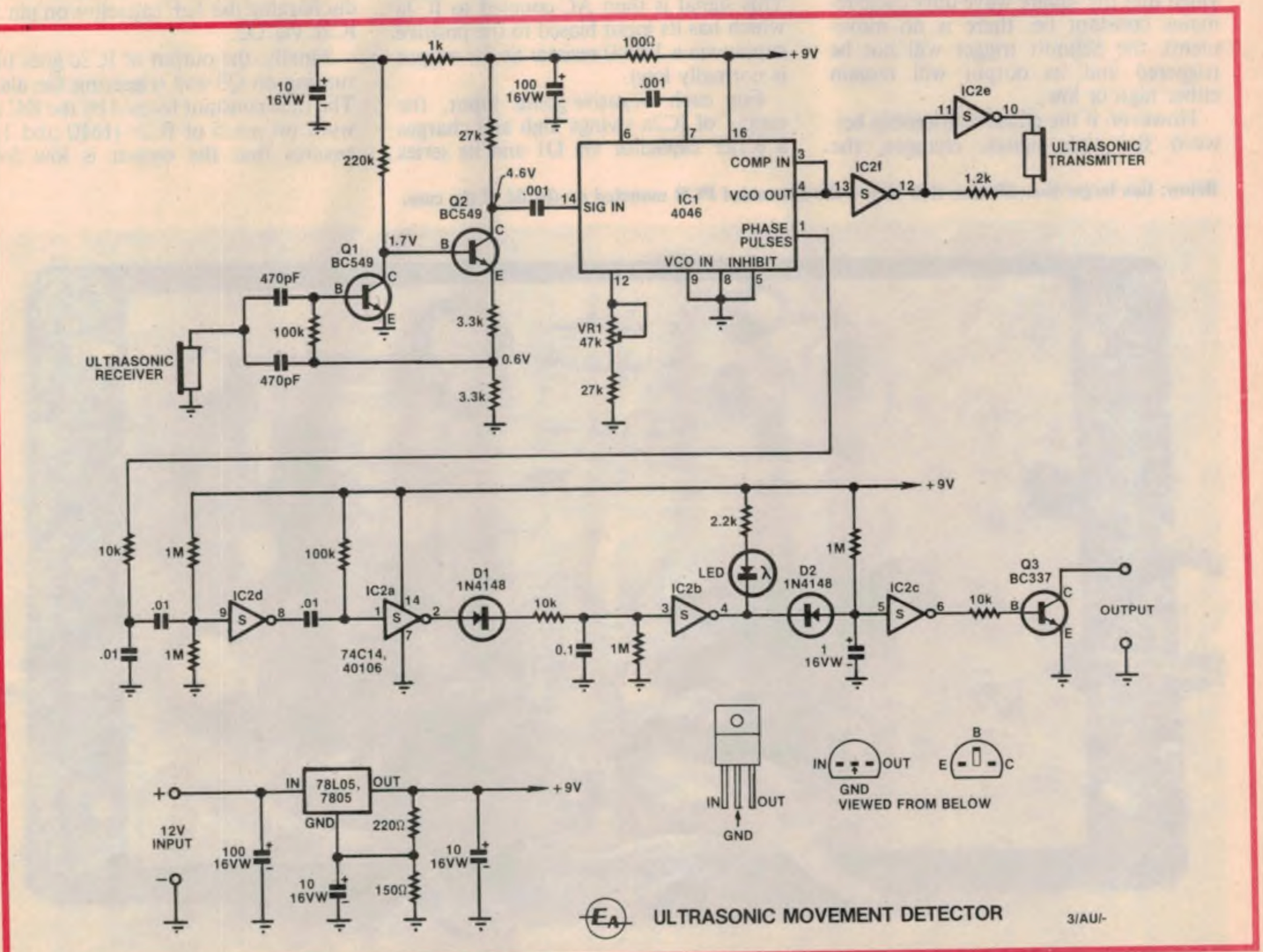
The receiver

The reflected signal is picked up by the ultrasonic receiver and fed via a 470pF capacitor to a two-stage amplifier consisting of transistors Q1 and Q2. These transistors operate as common emitter amplifiers and provide an overall gain of 100. The output is taken from the collector of Q2 and AC-coupled to the PLL via a .001μF capacitor.

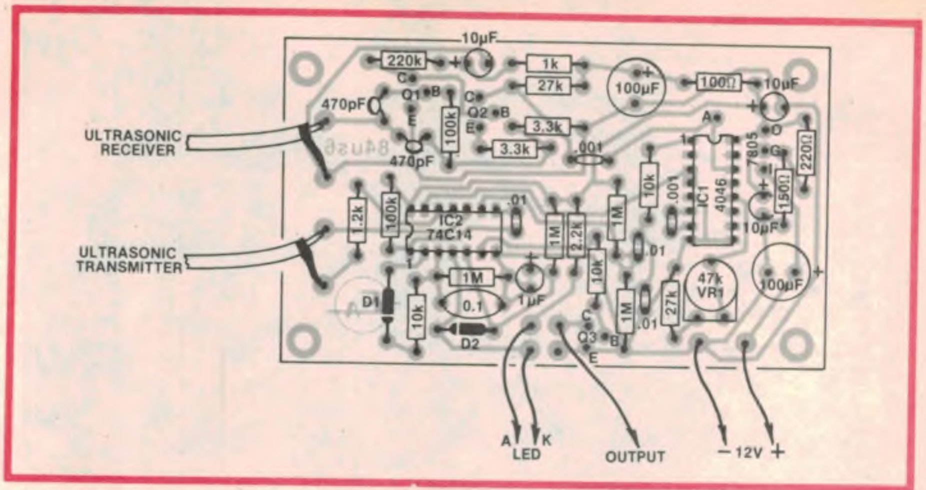
As well as providing signal gain, Q1 and Q2 also function as a bandpass filter. If you look closely at the circuit, you will notice that DC bias for Q1 is derived from a voltage divider network (2 x 3.3kΩ) at the emitter of Q2. At the same time, part of Q2's emitter signal is fed back to the input via a second 470pF capacitor.

So the circuit has two feedback paths: a DC feedback path which provides bias for Q1, and an AC negative feedback path which feeds part of Q2's emitter signal back to the input.

In greater detail, the upper 470pF capacitor on Q1's input functions as a high pass filter which progressively attenuates all signals below 40kHz. Signals above 40kHz are similarly attenuated by reason of the AC-feedback path via the lower 470pF capacitor, the amount of



Ultrasonic movement detector



Follow this parts layout diagram when wiring up the unit. Note the use of shielded cable for the connections to the transducers.

feedback increasing with rising frequency.

Because of the high sensitivity of the amplifier, it is necessary to decouple the power supply to each transistor. A 10µF capacitor and 1kΩ resistor decouple Q1, while a 100µF capacitor and 100Ω resistor decouple Q2.

The amplified signal at Q2's collector is AC-coupled to pin 14 of the PLL and compared with the VCO signal. As previously mentioned, this comparison results in a square wave signal output from pin 1, the duty cycle depending upon the degree of phase mismatch. These phase pulses are then filtered to a DC level and AC-coupled to the input of Schmitt trigger IC2d.

In this case, the input of IC2d is biased to half supply by two 1MΩ resistors. Provided that the square wave duty cycle remains constant (ie, there is no movement), the Schmitt trigger will not be triggered and its output will remain either high or low.

However, if the phase relationship between the two signals changes, the filtered DC level shifts and a pulse is applied to the input of IC2d. The greater the phase change, the greater the voltage pulse applied to the Schmitt trigger.

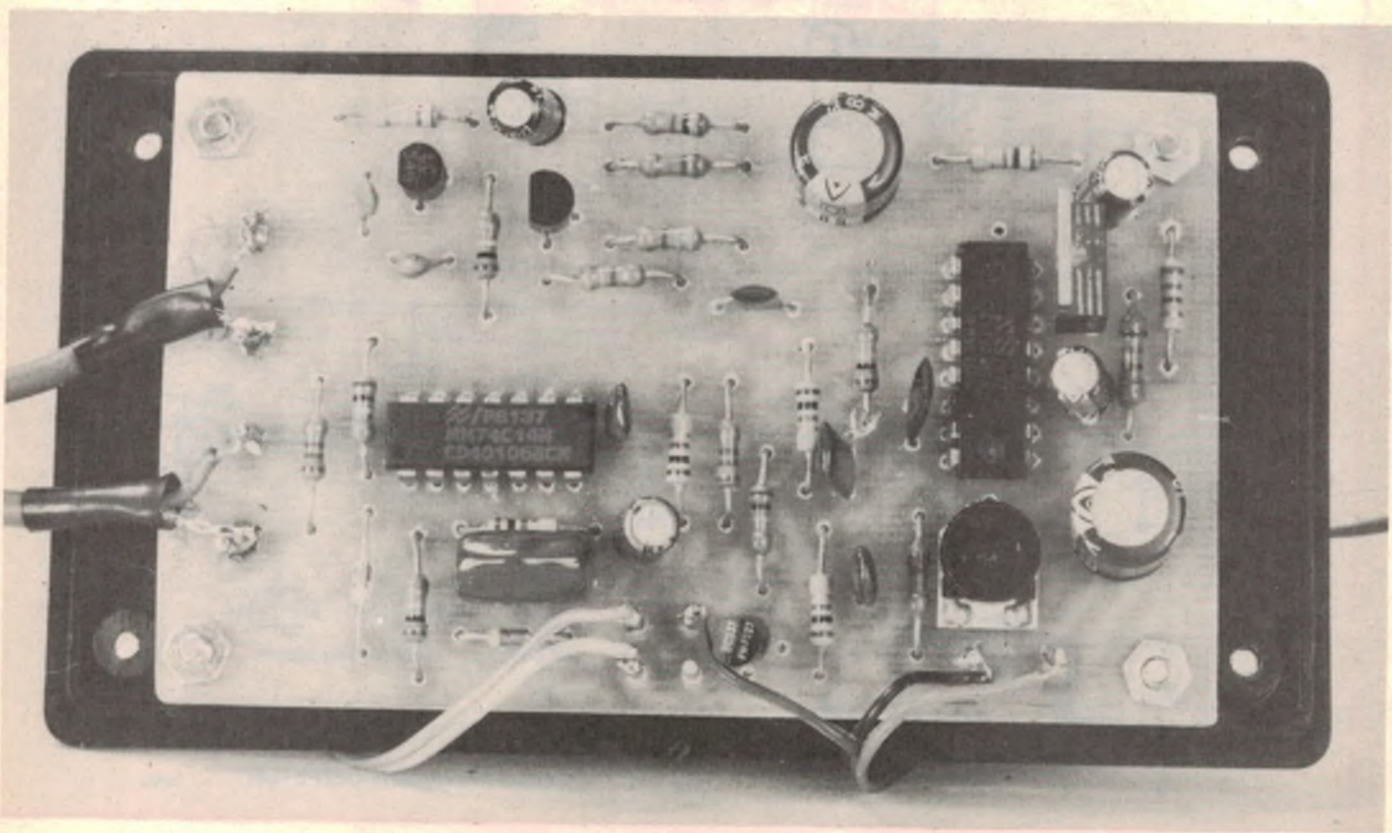
When this pulse exceeds the hysteresis level of the Schmitt trigger its output will change state. Note that if a continuous movement is detected, the output of IC2d will be a continuous pulse train. This signal is then AC-coupled to IC2a which has its input biased to the positive supply via a 100kΩ resistor (ie, its output is normally low).

For each negative-going input, the output of IC2a swings high and charges a 0.1µF capacitor via D1 and its series 10kΩ resistor. Note that D1 is reversed biased when the output of IC2a is low; the only discharge path for the capacitor is via the parallel 1MΩ resistor.

Provided it receives sufficient pulses from IC2a, the 0.1µF capacitor quickly charges to the upper trigger voltage of IC2b. The output of IC2b then switches low, lighting the indicator LED and discharging the 1µF capacitor on pin 5 of IC2c via D2.

Finally, the output of IC2c goes high, turning on Q3 and triggering the alarm. The time constant formed by the RC network on pin 5 of IC2c (1MΩ and 1µF) ensures that the output is low for a

Below: this larger-than-life-size view shows the assembled PCB mounted on the lid of the case.



minimum 1s period.

Power for the circuit is derived from the vehicle battery (see construction) and regulated to +9V using a 5V 3-terminal regulator. That's not quite as silly as it sounds.

In this circuit, the GND terminal of the regulator is connected to a voltage multiplier network consisting of 220Ω and 150Ω resistors. Because the regulator produces 5V between its OUT and GND terminals, it follows that the current through the 220Ω resistor will be 23mA or thereabouts. Both this current and a 6mA current from the GND terminal flow through the 150Ω resistor which "jacks up" the GND terminal by about 4V.

Thus, the output voltage is set to around 9V. The 100μF capacitor filters the supply line while the 10μF capacitors provide decoupling to improve the transient response of the regulator.

Construction

The Ultrasonic Movement Detector is housed in a plastic case measuring 120 x 65 x 39mm, while most of the components are mounted on a PCB coded 84us6 and measuring 97 x 57mm.

Begin construction by installing the parts on the PCB according to the overlay diagram. Take extra care with the semiconductors and the electrolytic capacitors since these must be fitted with due regard to polarity. We used PC stakes to facilitate the external connections.

Once the PCB had been completed, it can be mounted on the lid of the case on 6mm spacers. The hole for the indicating LED is centrally located on one side of the case, while the external wiring passes through a grommeted hole in the opposite side of the case.

Rainbow cable can be used for the connections to the LED, while the power supply and output connections should be run using light duty hook-up wire. Connections to the ultrasonic transducers must be run in shielded cable.

The two ultrasonic transducers are housed in rightangle sparkplug covers. Feed the connecting cable through the cover first, then solder the leads to the transducer with the shield connected to the earth pin. The transducer can then be pushed into the cover to provide a neat assembly.

The ultrasonic transducers are positioned above the front windscreen, one on each side of the vehicle. Each transducer is supported by a nylon cable clamp which is wrapped around the lead exit of the sparkplug cover, which in turn is held by one of the screws that locate the sun visor.

Be careful not to get the two transducers mixed up. The transmitter is labelled SCS401A while the receiver is labelled SCM401A. The two should be mounted as far apart as possible (to avoid interference) and pointed towards the rear of the vehicle.

The ground wire for the circuit can terminate at a convenient chassis point while the positive supply lead goes to the switched side of the key operated on/off switch. The output lead goes to the spare delayed entry input, but don't make this connection until after the setting up procedure has been carried out.

Setting up

Before making any adjustments, first check that the transducers point towards the rear of the vehicle and are reasonably parallel. This done, set your multimeter to read low AC volts and connect it to the test point marked "A" on the parts layout diagram (pin 14 of IC1). Apply power and adjust VR1 for maximum reading (typically 0.5-0.6V).

There's just one hassle here — you will have to keep quite still while you make this adjustment, otherwise the reading will fluctuate.

This done, check that the LED flashes whenever there is movement in the vehicle. If the unit displays a tendency to false trigger, rotate the trimpot (either way will do) to reduce the sensitivity.

Finally, the output lead can be connected to the delayed entry input of the alarm and the unit mounted permanently under the dashboard. The leads from the transducers run down the windscreen pillars and can be fixed with contact adhesive.

That's it. If a thief can get past that lot, there's always the insurance!

We estimate the current cost of parts for this project to be approximately

$30

This includes sales tax.

PARTS LIST

- 1 PCB, 84us6, 97 x 57mm
- 1 plastic case, 120 x 65 x 39mm
- 1 ultrasonic transmitter, SCS401A (Dick Smith Electronics)
- 1 ultrasonic receiver, SCM401A (Dick Smith Electronics)
- 4 6mm standoffs
- 2 right angle spark plug covers (for lawnmowers and motor bikes)
- 1 5.5mm grommet
- 1 4-metre length of screened cable
- 2 cable clamps

Semiconductors

- 1 4046 phase lock loop
- 1 74C14/40106 hex Schmitt trigger
- 2 BC549 NPN transistors
- 1 BC337 NPN transistor
- 1 7805 5V 3-terminal regulator
- 2 1N4148/1N914 small signal diodes
- 1 3mm red LED

Capacitors

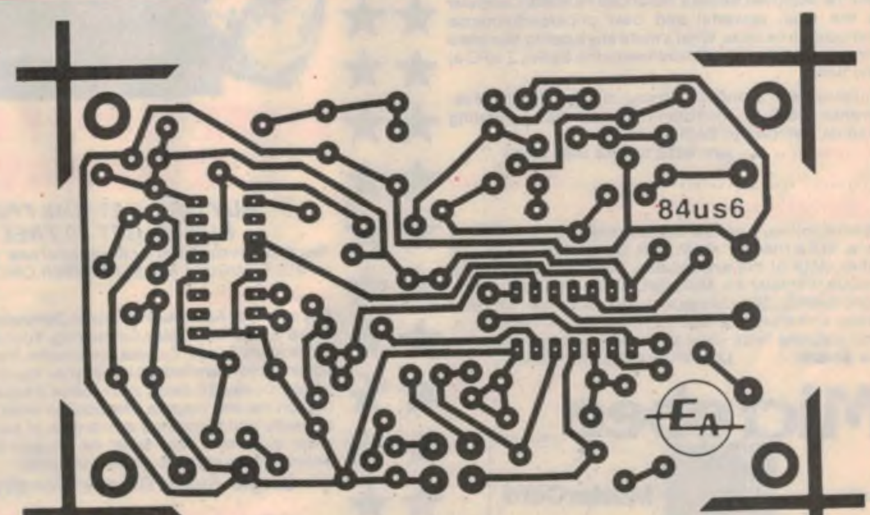
- 2 100μF/16VW PC electrolytic
- 3 10μF/16VW PC electrolytic
- 1 1μF/16VW PC electrolytic
- 1 0.1μF metallised polyester
- 3 .01μF metallised polyester
- 2 .001μF metallised polyester
- 2 470pF ceramic

Resistors (¼W, 5%)

4 x1MΩ, 1 x 220kΩ, 2 x 100kΩ, 2 x 27kΩ, 3 x 10kΩ, 2 x 3.3kΩ, 1 x 2.2kΩ, 1 x 1.2kΩ, 1 x 1kΩ, 1 x 220Ω, 1 x 150Ω, 1 x 100Ω, 1 x 47kΩ miniature horizontal trimpot.

Miscellaneous

Machine screws and nuts, rainbow cable, hook-up wire, PC stakes.



Here is an actual-size reproduction of the PC artwork.

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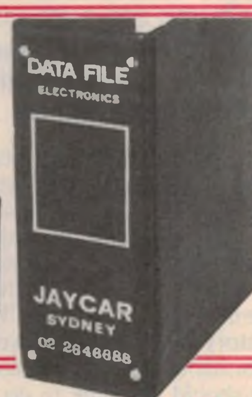

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The "Arrowhead" is the latest of a series of IR detectors that we have sold. It represents the latest developments.

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The Serviceman

The fishing trawler that bounced!

We are all familiar with the service job that bounces; the tricky set which you are sure you have fixed — usually after a long tussle — which turns up a couple of weeks later with the same fault still in evidence. It's one of those things we learn to live with. But a fishing trawler that bounces . . .!

Readers will doubtless recall the story; it was in the April issue, and was from my colleague on the NSW south coast. It told of the many hazards, including other servicemen, encountered by TV sets installed on a fishing trawler. They were many and varied but, by the end of the story, both sets were working at top performance and he was confident that they should continue to do so well into the future

Alas, it was not to be. The last story ended about six or eight months before it appeared in print, and shortly before the trawler set off on its regular tuna fishing season. This is where my colleague takes up the story again.

The tuna season follows a fairly standard pattern. The trawler goes south to Eden where it establishes a base and fishes out of Eden for as long as the catch is profitable. Then it goes south into Bass Strait, gradually making its way to Port Lincoln in South Australia and bases itself there for as long as necessary.

Unfortunately, it wasn't a very good season. The catch out of Eden was very poor, and the results from Port Lincoln and points in between, while better, were well down on average. As a result, the trawler was back in its home port shortly after I had written the story which appeared in the April issue.

Unfortunately for me, it wasn't only the fishing which had gone wrong. It came as a nasty shock to my ego to learn that the system had held up only until they reached Eden and had failed while they were based there, with no picture of any kind on either set. This time the skipper decided against calling in a local serviceman, remembering the complications which had resulted from previous service jobs away from the home port.

This meant, of course, no TV for the crew for the rest of the voyage. Depriving a crew of entertainment which they regard as rightfully theirs has had serious repercussions in the past; witness what happened to Captain Bligh when he decreed that Fletcher Christian and his mates were having too much fun and enjoying too many coconuts, bananas, and — er — other things. They sent him packing, without even a book of poems to while away the lonely hours.

Fortunately, this skipper had made provision for just such a contingency; the trawler also boasts a video cassette player together with a good stock of tapes, so the crew still had some entertainment during their off duty periods. The main loss was the news sessions and, more seriously, the weather reports.

By the time the trawler arrived back in its home port I had already received a message via the skipper's wife that all was not well. Naturally, I was concerned over what had happened. I had felt sure that I had allowed for every contingency as far as the antenna system was concerned, yet the failure of both sets, as reported, could only mean that it was this which had failed.

So, just as soon as it was mutually convenient, I went aboard. I went straight to the skipper's cabin and the masthead amplifier power pack. If it was an antenna system failure, this was a logical place to start. The only bright spot was that no one else had worked on the system this time, so the reason for any defects should be easier to pinpoint.

The first thing I did was to check the power pack voltage as being applied to the coax cable. If this was down it could be the fault or it could be a symptom of a fault in the amplifier itself. At the same time I was puzzled as to system's behaviour. It was completely dead, with no picture and not even a suggestion of sound.

I wasn't altogether surprised, therefore, when the meter showed absolutely no voltage at all across the coax. My immediate reaction was to

The *Angelica* in Ulladulla Harbour last April. Note the 90° bend in the exhaust.

suspect the power pack, so I disconnected the coax and tried again. Now it was a different story; the power pack came good, delivering about 25V, which meant that the fault was somewhere up the mast, probably in the masthead amplifier. (An ohmmeter check across the coax showed a dead short.)

So it was back to the acrobatic tricks; up the ratlines and various gymnastics to diconnect the coax from the amplifier. And, mainly because it was the easiest thing to do, I put the ohmmeter leads across the coax, not really expecting to find a fault there, seeing that it was a new run of cable.

Imagine how I felt when the ohmmeter showed a dead short. Any satisfaction I might have experienced at finding the fault was completely overshadowed by my bewilderment at the nature of it and the natural apprehension that it was due to some fault of mine during the installation.

Actual physical damage to the cable was the only other possibility. It's a pretty rough environment on a trawler and I wondered whether there had been any kind of an incident where something had broken loose or been manhandled in a manner which could have damaged the cable. Unfortunately, no one could recall any such situation.

Nevertheless, I made my first examination at around the deck level, but could find nothing to suggest that the coax in this area had been damaged in any way. To be honest, I wasn't quite sure what I expected to find. Just what kind of physical damage would create such a positive short circuit, rather than an open circuit? Whatever it was, it would have to be pretty drastic.

Installation details

At this point it may help if I describe the antenna installation and cable run in greater detail. The cable runs up the main mast — a metal structure about 30cm square — for about 9m to where there is a small working platform attached to the mast and extending forward from it for about 2m.

This platform carries an auxiliary mast on which is mounted the TV antenna, and so the coax leaves the main mast, runs along the edge of the platform, then up the auxiliary mast to the antenna. As my eye followed this run of the cable I became aware that, where it left the main mast, it seemed to have come loose. I imagined, at this stage, that some heavy handed deck hand had probably been responsible.

Closer examination confirmed the loose cable, but suggested a quite different reason why it had come loose. The main diesel exhaust emerges from the top of the main cabin just forward of the main mast, almost directly underneath this platform, and extends vertically to within about 70cm of it. Here it goes through a right angle bend and extends another 60cm or so towards the stern, bringing it to within about 60cm of the mast, but slightly to one side of it.

It is also rather larger than the exhaust on the family car. The main diesel is a 750hp unit and the exhaust pipe would be well over 30cm in diameter. And, as can be imagined, it choofs out a lot of heat when it is running full ahead. Which was the reason for the loose cable; the heat had simply melted the insulation tape holding it in place. But it had done a lot more than that, as became apparent when I looked around.

There are two other cables running the full length of the main mast, on the same side. One is a 240V AC line feeding floodlights at the top of the mast, for working on deck at night, and the other was another coax cable from one of the navigation antennas. Both are run in plastic conduit. The effect of the heat was obvious; the conduit had become hard and brittle, had cracked, and fallen away, revealing the cables inside. It would be only a matter of time before these cables also failed, with potentially serious consequences.

Another victim had been a plastic flare on a small public address speaker mounted on the side of a platform near the mast, which had started to curl at its edges. And the TV coax had been well and truly cooked. In fact it was baked hard, as rigid as a piece of metal tubing. There seemed little doubt that this was where the short had occurred.

Now that the evidence was staring me in the face I realised that I should have seen the danger earlier. But it must be realised that the main diesel had never been running when the trawler was tied up and I was working on it, and I simply followed the original cable run which, initially at least, had seemed to be satisfactory. But there was more to it than that, as I will explain shortly.

In fact, something that puzzled me was the sequence of cable failures. The original cable, fitted when the trawler was commissioned and using exactly the same run, had lasted for something like two years before it failed. It had been replaced, by another serviceman, as I mentioned in the April story.

The replacement cable had also shorted, though it is not clear exactly how long it had lasted because someone had made the system work, in a fashion, by insulating the outer braid from the the earthing clamp. The third run of cable was the one I had fitted and this had lasted only a few weeks once the trawler was working, and now I was having to fit a fourth run. Why had the first cable lasted so long and the subsequent ones failed in short order?

There followed a long discussion with the skipper. Not only did I have to explain why the TV coax had failed, but I also had to warn him of the damage to the other conduits and the likely failure of their cables. And, to convince him as to how serious it was I took him and showed him the evidence I have described.

I thought he seemed rather quiet while I was explaining all this, and imagined it was lack of conviction on my part. But it wasn't. The skipper had been preoccupied turning something over in his mind and he finally came out with it. It seems that the engineer in charge of the diesel was not completely happy with the behaviour of the exhaust during the first 18 months or so of the trawler's operation, although the skipper couldn't follow or remember the exact technicalities of it.

Anyway, the gist of it was that the exhaust as originally fitted was terminated at the bend, a good 1.2m away from the critical area. But after the first 18 months the engineer decided he needed to extend it so, at the next overhaul and refit, he had arranged to have the present 60cm added to the bend, bringing the outlet to within 60cm of the mast.

The last straw

And that, apparently, was the last straw that sank the camel's hump. I imagine that, with the original exhaust, it was touch and go; they were just getting away with it. More likely, it may simply have taken a lot longer for the same thing to happen. With the gap closed, things began happening in a hurry.

I left it to the skipper to make the necessary arrangements regarding the other two cables, and concentrated on the TV coax. In fact the solution turned out to be quite simple. There were several other cable runs up the mast, on the opposite side, and these showed no signs of distress whatever. So, I simply ran my coax up this side instead.

When it was all fitted I fired it up from the skipper's cabin and was greeted with a first class picture. So that was that, at least as far as that part of the story goes. But it wasn't the end of the problems. There had been a complaint about the set in the crew's quarters which, even when working from video tapes, was producing a very poor picture.

A quick check confirmed this; the picture was so dark as to be unwatchable. More exactly, there appeared to be virtually no luminance and only a low level chominance image visible. It was clearly not a job to be done on the spot so I pulled it out and took it back to the shop.

Switching it on again on the bench it seemed to work somewhat better, though still far from right, so I opened it up to come to grips with it. And what a sight met my gaze; a beautiful brown and green motif. In more practical terms the brown was rust on virtually every mild steel or tinned plate piece of metal, while the green was verdigris on every area of unprotected brass or copper.

It was so bad that I gained the distinct impression that it had been doused in salt water. Yet I found this difficult to explain. It was working in a salt atmosphere, to be sure, but so was the identical set in the skipper's cabin and it had suffered no such fate. And the trawler is no weekend runabout which takes water over the bows in a slight sea.

On the contrary, it is a large ship (over 30m long) with comfortable crew's quarters, double berth cabins for about 10 crew members, large dining area, full scale galley and so on. Not the kind of vessel where you would expect to find sea water sloshing around at any time.

So what had happened? The set is mounted in what is virtually a wall facing into the dining cum recreation area. And on the other side of the wall are some of the crew cabins, with lockers backing onto this wall. In fact the wall forms the back of the lockers, so that the back of the set is visible in the back of one of these lockers.

From this point on no prizes for guessing my theory. It would be easy to imagine a hand coming off duty after a rough turn on deck, his clothes soaked in sea water, and him peeling them off and shoving them in his locker until he had time to attend to them properly. It would be almost as bad as heaving a bucket of salt water over the set.

I mentioned my theory to the skipper and he agreed that it was a highly likely situation. On the other hand he doubted whether there was much he could do to prevent it. So we agreed that when this set finally gives it away, a better place should be found for the new one.

As for the set itself — well, drastic problems need drastic cures. I pulled the chassis out and attacked it and the printed board with an aerosol of de-watering fluid. These are readily available at garages and auto suppliers, in a number of brands, all of which appear to be pretty much the same. The one I used is marketed by Caltex under the name "Aquatec".

I didn't muck about either. I sprayed the whole thing until it was literally dripping wet. Then I propped it up so that it could drain, left it like that overnight, then re-assembled it and fired it up. And somewhat to my surprise, it came good immediately; I had expected that at least I would have to seek out and replace some components.

I let it run for a few days on the bench, during which time it behaved faultlessly, then took it back and re-fitted it in its place in the trawler. And that produced another surprise; the set was again suffering from purity error due, as on the previous occasion, to magnetisation of the surrounding metal work.

It was easy enough to fix with the degauss coil, but I am still puzzled as to why this happens. It has never happened to the skipper's set, which is mounted in almost exactly the same way, nor can I find any DC cables in the vicinity which might create such a problem. The truth is, there is very little DC circuitry on the vessel, apart from starting batteries etc, all lighting and other circuits being 240V AC. (When tied up at a wharf they simply plug in to the commercial supply.)

Regarding the set itself, I warned the skipper that it may not have a very long life. If the salt contamination has penetrated vital components, particularly windings, my best efforts may not have been good enough. So he is not expecting too much. Fortunately, they plan to fish out of this port for the next few months, which will provide an opportunity to keep an eye on this set and the installation in general.

Well, that's my colleague's story, and a most interesting one too. He would be the first to admit that he has learnt a lot from the experience, and I hope its retelling may help someone else with similar problems.

Omnidirectional antennas

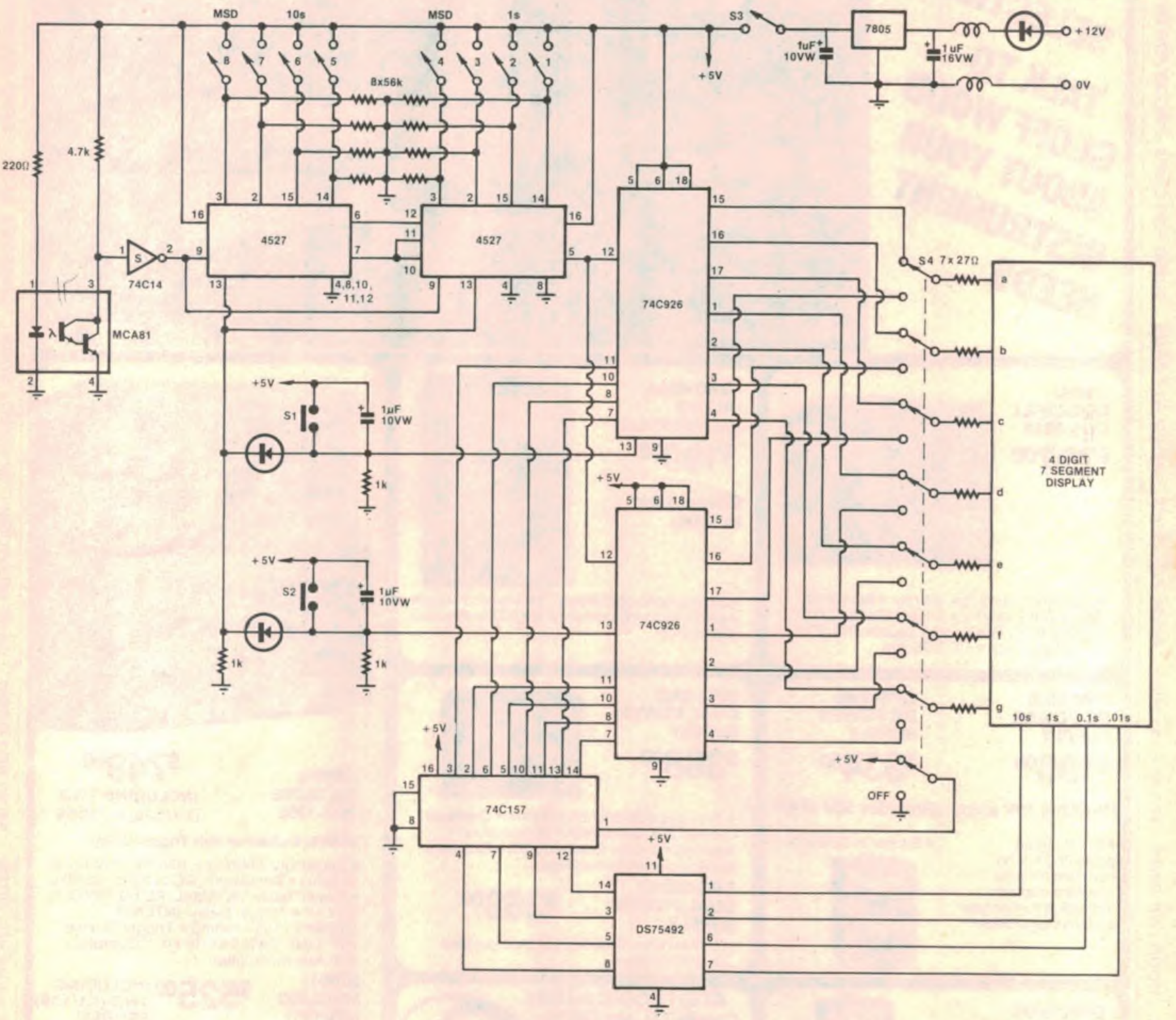
While on this same subject, and following the first part of the story in the April issue, I received an interesting technical brochure from a Tasmanian firm, Moonraker Australia Pty Ltd. The brochure describes two omnidirectional TV/FM antennas, designed primarily for shipboard operation.

One is a halo type passive antenna, covering from Channel 0 to Channel 10, constructed from marine grade corrosion resistant aluminium alloy tubing, with nylon and stainless steel fittings. The other is an active antenna enclosed in a fibreglass radome. It can operate from either 12V or 24V and has an amplifier gain of 20dB from 40 to 850MHz.

Anyone interested in this type of equipment can obtain further information from the makers at 28 Wellington Rd, Lindisfarne, Tasmania, 7015.

Circuit & Design Ideas

Interesting circuit ideas from readers and technical literature. While this material has been checked as far as possible for feasibility, the circuits have not been built and tested by us. As a consequence, we cannot accept responsibility, enter into correspondence or provide constructional details.



Dual Counter Trip Meter

This circuit provides two individually resettable counters driving a common 4-digit 7-segment LED display. The counters are the familiar 74C926 with the digit outputs connected via a 74C157 quad 2-input multiplexer which feeds a DS75492 hex digit driver. This latter device could be replaced by four BC338 transistors.

Distance pulses are obtained using a Motorola MCA81 optical switch linked to the speedo cable via a commercially available T-junction. Alternatively, you could use the in-cable sensor or the magnetic pickup sensor used in the EA Car Computer (see also Speed Sentry, October 1983). The distance pulses are squared up by a Schmitt trigger (74C14) and fed to two 4527 BCD rate multipliers which multiply the input clock pulse rate by 1/10 times the BCD input number.

For example, if five is the BCD input number, there will be five output pulses for every 10 clock pulses. The correct BCD number is determined experimentally by driving the car over a known test distance.

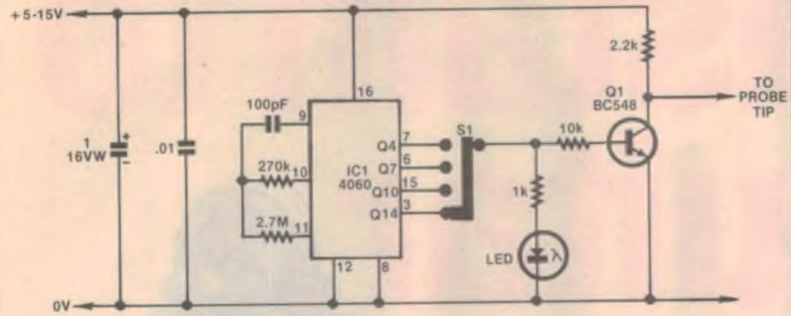
The pin 5 output of the second 4527 drives the two 74C926 counters in parallel. Switches S1 and S2 independently reset the counters, while S3 switches the supply line. S4, an 8-pole 2-position switch (from a telephone switchboard), selects the required counter.

Note that the author found it necessary to incorporate two DC smoothing chokes in the supply lines (eg, DSE Cat L-1900).

D. J. Preston,
Papakura, NZ.

$35

Circuit & Design Ideas



Logic pulser probe

This simple pulser probe makes it easy to troubleshoot digital logic circuitry. The heart of the circuit is a 4060 14-stage ripple carry binary counter IC1, which incorporates an on-chip oscillator and a multistage divider circuit.

The 100pF capacitor and the 2.7MΩ and 270kΩ resistors set the oscillator frequency to a nominal 16.8kHz. Switch S1 selects the Q4, Q7, Q10 and Q14 outputs of the 4060 to derive frequencies of 1.05kHz, 131Hz, 16.4Hz and 1.03Hz respectively. The selected output is then buffered by transistor Q1 which has its collector connected directly to the probe tip.

The selected Q output is also used to drive a red indicator LED. This LED will pulse at the two lower frequencies, and will appear continuously lit at the two higher frequencies.

The prototype was built on a small PC board and mounted inside a Jabel plastic probe case. The layout is not critical however, and other construction techniques (eg, stripboard) could also be used.

C. Syms,
Flynn, ACT. **$12**

Improved graphics for VZ200 Computer

Want a 50% improvement to the graphics resolution of your VZ200 computer? Here's how you do it.

Inside the VZ200 is Motorola's MC6847 video display generator (VDG) chip. This is an easily programmed yet highly versatile device offering several text, mixed text/graphic and graphic modes.

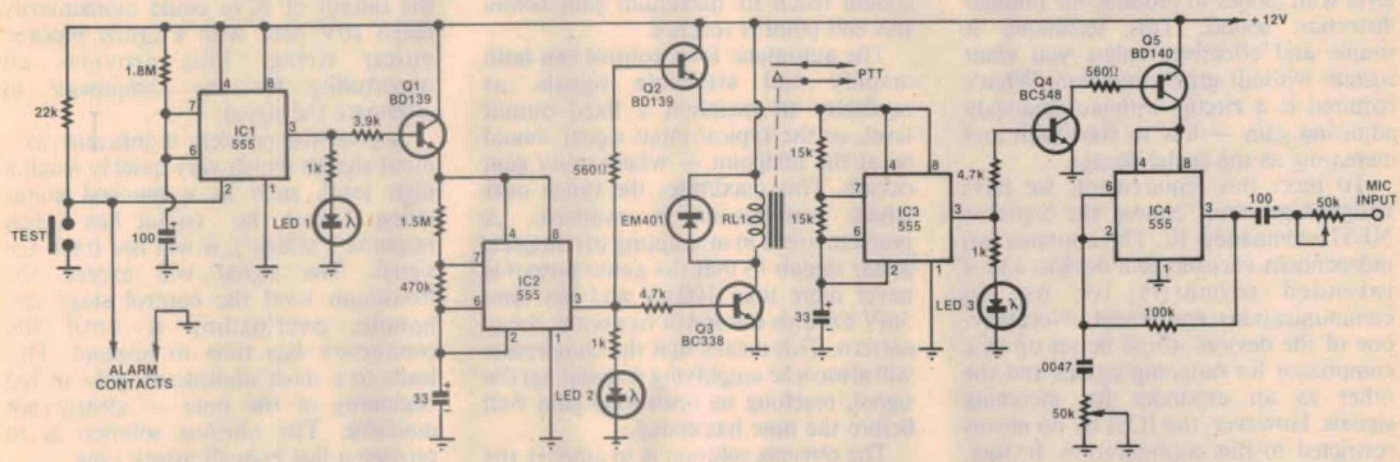
As standard, the VZ200 comes with a 128 × 64 dot 4-colour graphic mode. In this mode, each display byte is split into four dots, each occupying two bits. The two bits specify which of four colours the dot is in one of two 4-colour sets — making eight colours available in all.

This requires all 2K of video RAM.

By cutting the track linking pin 30 of U15 (the VDG) to ground and then connecting this pin to +5V (pin 17), a new graphics mode is derived. This mode offers 128 × 96 dot monochrome (ie, two-colour) graphics, where each bit specifies one dot and requires 1.5K of RAM. The advantage of this mode is that the dots are square which improves plot appearance.

A single-pole 2-position switch can be used to switch between one mode and the other. This switch can be mounted on the side of the case.

P. Dimond,
Lidcombe, NSW. **$10**



Two-way radio alarm tone generator

There is sometimes a need for an alarm tripped tone to be transmitted via radio to a receiver or paging unit. This circuit uses just four ICs, five transistors and a handful of other components.

IC1 is wired as a one shot monostable, being triggered by PB1, a test button, or the alarm contacts in parallel with it. This switches high at its output, pin 3, for approximately three minutes with the values shown. This turns on Q1 via its 3.9kΩ base resistor and also LED 1.

When Q1 turns on it connects the 12V rail to IC2, which is wired as a square wave generator with an "on" time of approximately 45s and an "off" time of 10s. When IC2's output (pin 3) goes high, it turns on Q2, Q3 and LED 2.

When Q2 turns on it connects the 12V rail to IC3, while Q3 activates the PTT relay RL1. IC3 operates at approximately 1Hz and, when its pin 3 output goes high, turns on Q4, Q5 and LED 3.

When Q5 turns on it connects the 12V rail to IC4, which is wired as an audio oscillator. Its output from pin 3, is fed to the radio transmitter microphone circuit via a 50kΩ trimpot which controls the level. A second 50kΩ variable resistor, in conjunction with the .0047μF capacitor, controls the oscillator frequency.

In summary, activating the alarm turns the circuit on for three minutes, during which time IC2 turns the transmitter on for 45s periods with 10s intervals in between. At the same time, IC3 and IC4 apply a 1Hz modulated audio tone to the microphone input to produce a siren-like effect.

P. Howarth,
Gunnedah, NSW. **$20**

Add sustain to your guitar

So you've built a guitar "fuzz box" but you've had just about enough of Jimmi Hendrix impersonations. Trouble is, most of us get bored with fuzz in short order. But what about the sustain effect without the distortion? With the new EA Guitar Sustain, that's just what you get.

by COLIN DAWSON

Fuzz circuits achieve sustain simply by virtue of their vast amounts of gain. The signal is then clipped down to a fixed level with diodes to produce the familiar distortion sound. This technique is simple and effective, unless you want sustain without gross distortion. What's required is a circuit with automaticaly adjusting gain — low to start with and increasing as the signal decays.

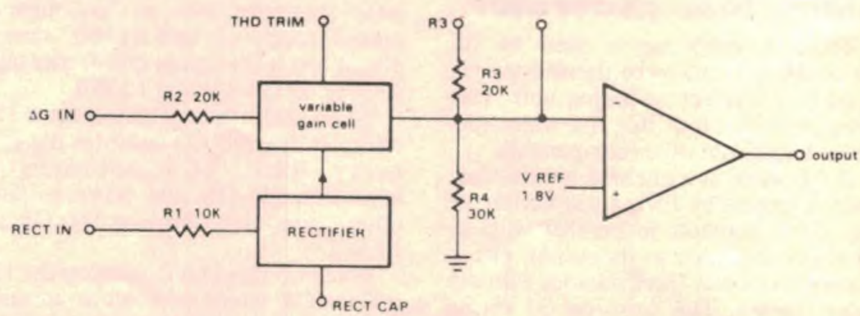
To meet this requirement, we have designed a circuit around the Signetics NE571 compander IC. This contains two independent variable gain devices and is intended primarily for use in communications equipment. Normally, one of the devices would be set up as a compressor for outgoing signals and the other as an expander for incoming signals. However, the IC is by no means restricted to this configuration. In fact, we have used one of the devices as a normal preamplifier and the other as an automatic level control.

Basically, the Sustain operates as a compressor with a very high compression ratio. This enables it to maintain a very nearly constant output level for a wide range of input levels — an automatic level control. There are, of course, limitations. The circuit cannot increase its gain indefinitely to compensate for a decaying input. Eventually, its maximum gain will be reached.

Even if infinite gain was available, each guitar note eventually reaches a practical end-point — it becomes submerged in the inherent noise of the pick-up. Beyond this point, amplification is pointless. Ideally, the compressor should reach its maximum gain before this end point is reached.

The automatic level control can both amplify and attenuate signals, as necessary to maintain a fixed output level, so the typical input signal should be at the midpoint — where unity gain occurs. This maximises the range over which compression is available. A problem arises in attempting to compress guitar signals in that the guitar output is never more than 100mV and less than 5mV towards the end of its normal decay pattern. This means that the compressor will always be amplifying (expanding) the signal, reaching its open loop gain well before the note has ended.

The obvious solution is to amplify the guitar output before compression occurs and this is exactly what our circuit does.



The NE571 has three functional blocks.

IC1a forms a preamplifier with a maximum gain of 100. This brings the guitar output up to several volts. In fact, the output of IC1a could momentarily reach 10V peak with a firmly plucked guitar string. This provides an opportunity for the compressor to attenuate the signal.

A potential problem is inherent with input signals which very quickly reach a high level, such as a plucked guitar string. Unless the circuit has a fast response ("attack"), it will not track the signal. The signal will exceed the maximum level the control stage can handle, overloading it until the compressor has time to respond. This leads to a most unpleasant spike at the beginning of the note — clearly not desirable. The obvious solution is to provide a fast enough attack time.

Unfortunately, there is a conflicting requirement that has to be satisfied. If

the attack time is made too fast the compressor sees low frequencies as a variation in level, and attempts to smooth them out. This creates a particularly unpleasant form of distortion within the compressor.

In practice we have been able to select a compromise value which permits a minimum, and acceptable, distortion level due to either cause. We found that an attack time of around 1.2ms gave the best results, at least for the instrument we were using. Other instruments, or different playing styles, may call for some modification, and this is easy enough to provide.

Looking more closely at the NE571 IC we find that each section contains three main functional blocks: an op-amp, a precision rectifier, and a variable gain cell. Each of these blocks can be accessed individually, which greatly enhances the versatility of the IC.

In the control mode the variable gain cell is used as a feedback path for the op-amp. The gain cell is controlled by an input voltage derived from the rectifier output. The rectifier, in turn, may derive its input voltage from either the op-amp input or output, depending on the mode of operation.

Output from the rectifier must be filtered before being fed to the gain cell, otherwise extreme "fuzz" will result (no, that's not what we want, Jimmi). The filter capacitor to provide this is connected to pin 16 and is identified as "C Rect". Its value also controls the attack rate, as already discussed.

Actually, the attack time is determined not only by C Rect, but also an internal 10kΩ resistor. Note that the value of C Rect may need to be altered to optimize the performance for any given situation. Where the style of guitar playing is not particularly "aggro", C Rect could be increased to reduce the risk of low frequency distortion.

A foot operated bypass switch can be included in the project. This selects between sustain and non-sustain. Note that in the bypass position, the circuit is not entirely bypassed — the preamplifier is still used. Otherwise, the output level would drop from 2V to about 20mV when changing from sustain to bypass. As it is, the average level will stay at about 2V, although the peak level will be somewhat higher.

The guitar signal is capacitively coupled to the input (pin 6) of IC1a. This feeds into the inverting input of the op amp via an internal resistor. The non-inverting input is internally referenced to a fixed voltage and cannot be accessed. Feedback for this stage can occur via three different paths — one purely for DC (this provides the bias for the inverting input), one for audio frequency AC, and another for supersonic AC.

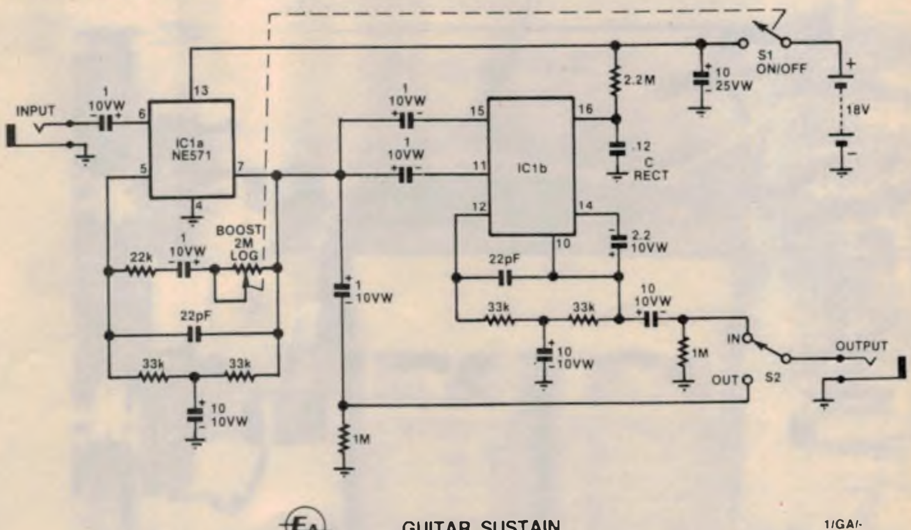
The 2MΩ potentiometer is included in the audio AC feedback path and functions as a gain control. Only AC can be controlled via this path, otherwise noisy potentiometer operation will result (hence the inclusion of the 1μF DC blocking capacitor).

DC feedback is provided by the filter consisting of two 33kΩ resistors and 10μF capacitor (negligible audio feedback occurs through this path). The 22pF ceramic capacitor provides a safeguard against high frequency oscillation.

Output from IC1a is taken from pin 7. This is connected to both the input (pin 11) and the rectifier input (pin 15) of IC1b. Additionally, the output of IC1a is available at the output socket of the project when sustain "OUT" is selected.

IC1b has the same DC and high frequency feedback arrangements as IC1a, but there is no external audio feedback circuit, as for IC1a. Audio frequency feedback (and hence volume control) is provided internally by the variable gain cell. The control voltage for

Circuit diagram for the sustain unit. IC1a is used as a preamplifier and IC1b as a compressor. S2 selects between normal and sustain modes.



Add sustain to your guitar

the variable gain cell is derived from the filtered output of the rectifier, fed with audio signal via pin 15. Output from IC1b is via pin 10 and goes to the ouptut socket via S2 when in the "IN" position.

The value of C Rect is shown as 0.12μF, the value we found to be the best compromise. However, the constructor can experiment with this value, in either direction, according to his taste and the requirements of his instrument.

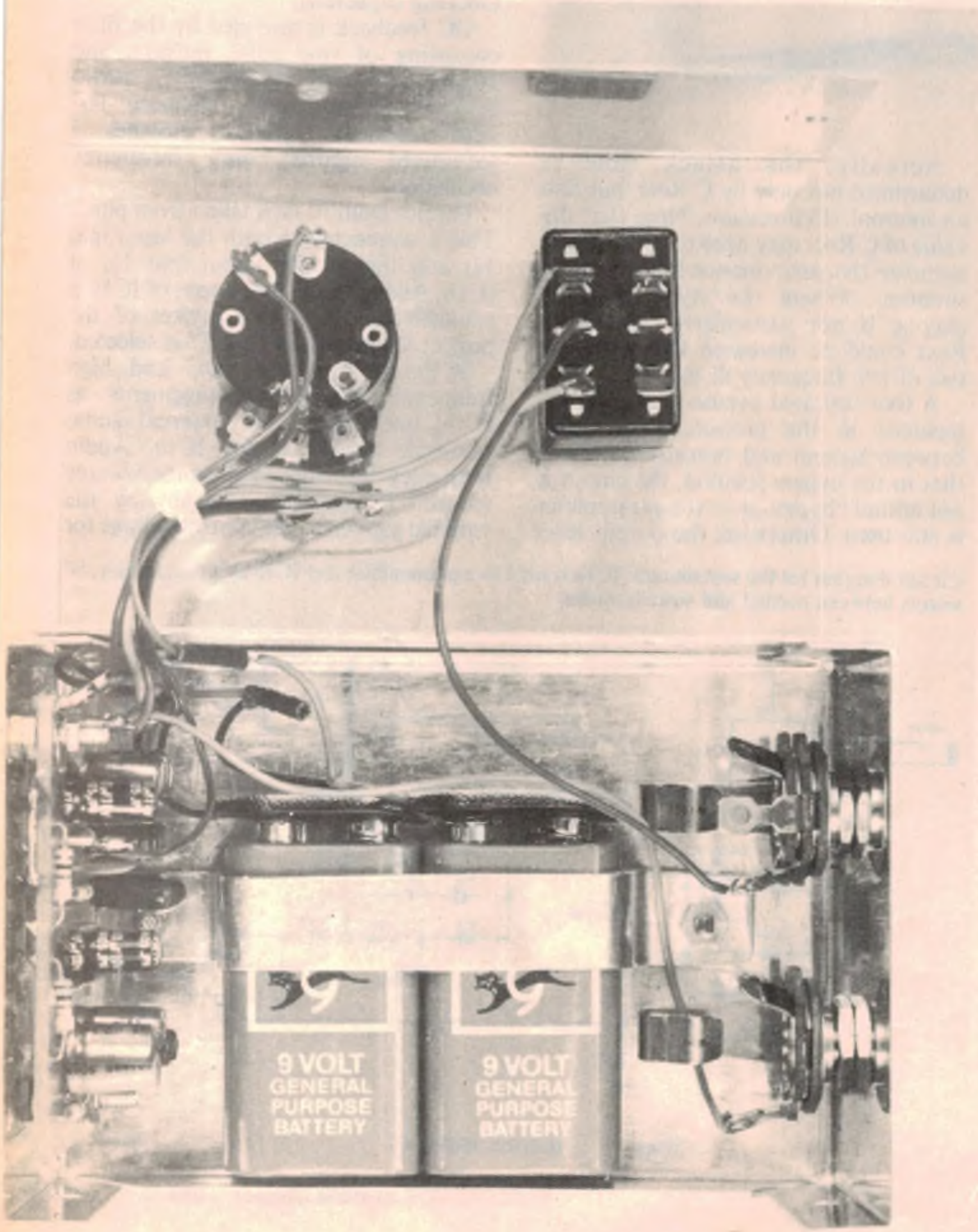
The 2.2MΩ resistor connected between the C Rect output and the positive supply line reduces the gain of IC1b when no signal is present. This helps to eliminate the transient response problems of IC1b. When signal is present at normal levels, this 2.2MΩ resistor has little effect on the circuit (note that decreasing this resistance will provide better transient response but will also tend to reduce the overall gain).

Specifications for the NE571 indicate that it will operate on a single supply of between 6 and 18V. However, in this circuit we found performance lacking for any supply less than 7V. Although the circuit draws only about 3.5mA, a single 9V battery would not have a very long life with a 7V cut off. For this reason we suggest the use of two 9V batteries connected in series.

Construction

We chose an inexpensive folded aluminium project box to house our Sustain unit. This measures 107 × 72 × 51mm and is available from Dick Smith

Inside view, showing the vertically mounted PCB at left.



We estimate that the current cost of parts for this project is approximately

$24

This includes sales tax, but not the cost of batteries.

Electronics, although several other project boxes could be used. If the foot-operated bypass switch is not used a smaller box could be selected.

A Scotchcal front panel label, measuring 67 × 102mm, is available for this project. If you are using this, apply it first so that it can be used as a template for drilling the front panel. The "INPUT" and "OUTPUT" labels can be trimmed off the side of the Scotchcal and stuck near the appropriate sockets.

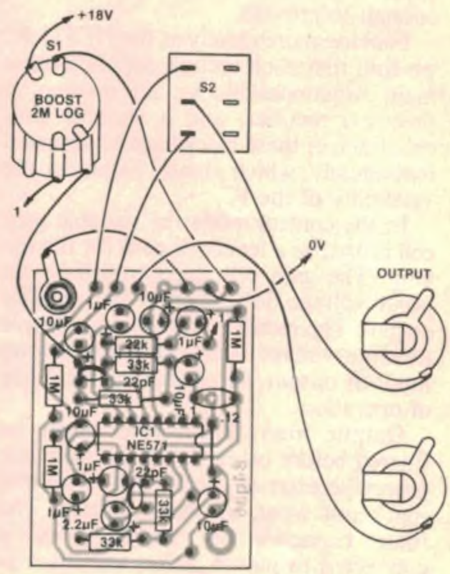
The printed circuit board (PCB) is coded 84ga6 and measures 42 × 58mm. Where PCB pins are to be used, these should be installed first.

A battery holder will be needed — we made one from a piece of scrap aluminium measuring 105 × 13mm.

Where a metal project box is used, no earth connection between the sockets and PCB need be made, but the box itself must be earthed to the PCB at some point. For plastic project boxes, use shielded hook-up wire to provide the earth for the sockets.

Testing, testing

To test the unit, first select sustain "OUT" and set the boost to minimum. Set the amplifier volume control to a fairly low point, then switch the Sustain on. Gradually increase the boost until the amplifier output is at an acceptable level. Now select sustain "IN". The average level of any note should now be about the same, with the initial peak



Install the parts as shown in this overlay diagram.

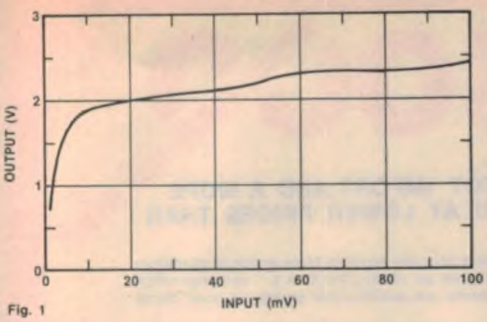


Fig. 1: response curve of the Guitar Sustain (500Hz input).

lower and sustain time much longer.

The Guitar Sustain unit can maintain a reasonably constant output level with inputs down to 10mV. With input impedance of 50kΩ and output impedance of 300Ω, it can be patched into the circuit between the guitar and preamplifier, or used to replace the preamplifier entirely.

Parts List

- 1 NE571 Compander IC
- 1 Aluminium project box, 72 × 107 × 51mm (or similar)
- 1 PCB, 42 × 58mm, code 84ga6
- 1 Scotchcal adhesive label, 67 x 102mm
- 1 Single pole, single throw (SPST) foot operated switch
- 2 6.5mm jack sockets (mono)
- 2 9V batteries, Eveready 216 or equiv.
- 2 Battery connectors
- 4 Rubber feet for box
- 1 Battery holder (13 × 105mm scrap aluminium or similar)

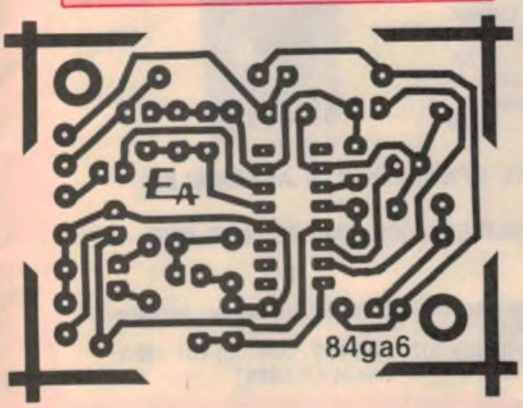
Screws, nuts, hook-up wire

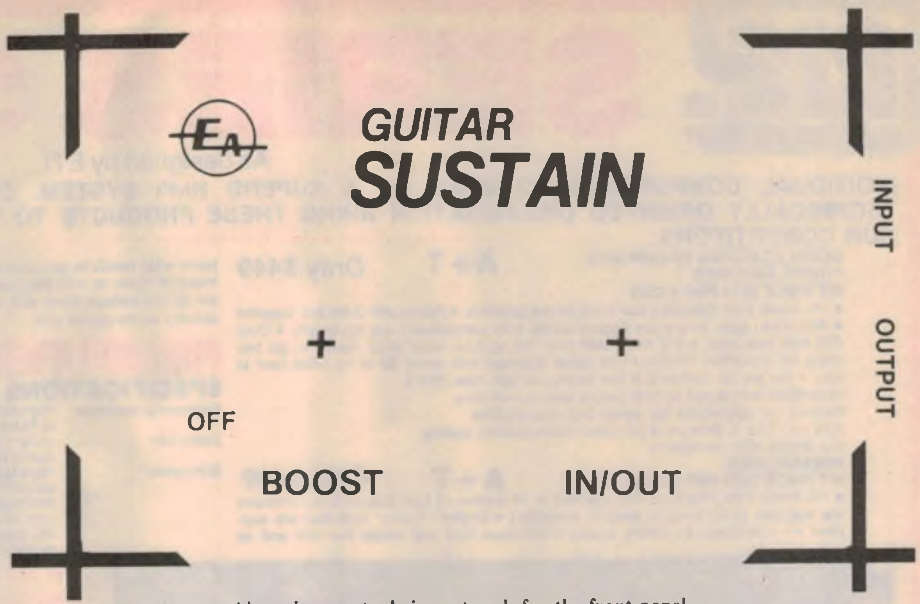
Capacitors

- 1 10μF/25VW electrolytic
- 4 10μF/10VW electrolytic
- 4 1μF/10VW electrolytic
- 1 0.12μF metallised polyester (greencap)
- 2 22pF ceramics

Resistors (¼W, 5%)

1 × 2.2MΩ, 2 × 1MΩ, 4 × 33kΩ, 1 × 22kΩ, 1 × 2MΩ log potentiometer.





Above is an actual size artwork for the front panel.

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SPECIFICATIONS

Frequency response:	High-level input: 15Hz-130 kHz, +0, −1 db Low-level input — conforms to RIAA equalisation, ±0.2 dB
Distortion:	1kHz <0.003% on all inputs (limit of resolution on measuring equipment due to noise limitation)
S/N noise:	High-level input, master full, with respect to 300 mV input signal at full output (1.2V): >92 dB flat >100 dB A-weighted MM input, master full, with respect to full output (1.2V) at 5 mV input, 50 ohm source resistance connected: >86 dB flat >92 dB A-weighted. MC input, master full, with respect to full output (1.2V) and 200 μV input signal: >71 dB flat >75 dB A-weighted.

On Special at $259
Normally $289

*All parts available separately for both kits.

POWER AMPLIFIER

On special this month **$299.00**

SPECIFICATIONS 150W RMS into 4 ohms

Power output:	100W RMS into 8 ohms (±55 V supply)
Frequency response:	8 Hz to 20 kHz, +0 −0.4 dB 2.8 Hz to 65 kHz, +0 −3 dB. NOTE: These figures are determined solely by passive filters
Input sensitivity:	1V RMS for 100W output
Hum:	−100dB below full output (flat).
Noise:	−116 dB below full output (flat, 20 kHz bandwidth)
2nd harmonic distortion:	<0.001% at 1 kHz (0.0007% on prototypes) at 100 W output using a ±56 V supply rated at 4 A continuous. <0.003% at 10 kHz and 100 W
3rd harmonic distortion:	<0.0003% for all frequencies less than 10 kHz and all powers below clipping.
Total harmonic distortion:	Determined by 2nd harmonic distortion (see above).
Intermodulation distortion:	<0.003% at 100 W (50 Hz and 7 kHz mixed 4:1)
Stability:	Unconditional

Please note that the "Superb Quality" Heatsink for the power amp was designed and developed by Rod Irving Electronics and is being supplied to other kit suppliers. This product cost $1,200 to develop so that your amplifier kit would have a professional finish as well as sound.

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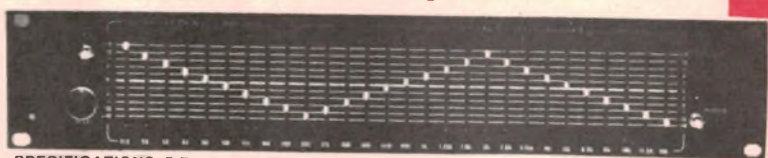
SPECIFICATIONS
INPUTS
Level Impedance Mic 46 db 1K
Line 22 db 18K x 12
Phono 52 db 50K STEREO x 2 (2mv) at 1KHz
Effect Return (Aux) 20 db 50K x 1
OUTPUTS
Level Impedance L & R 0 db 2K
Effect Send 0 db 2K F B Out 0 db 2K
Head phone Stereo +10 db 600 (100 1K)
EQUALISATION
Channel
Bass ±15db
Treble ±15db
Master
Bass ±12db
Treble ±10db
Middle ±12db

FADER & CONTROLLERS
12 channel fader Slide 60mm LOG 25%
2 Master fader Slide 60mm LOG 15%
12 F B Volume 300 LIN
1 F B Master level 300 LIN
12 Effect Send 300 LIN
1 Effect Return 300 LOG 15%
2 Phono 300 LOG 15%
1 Head Phone 300 LOG 15%
S/N 580B
FREQUENCY RESPONSE 20-20 KHz
TOTAL HARMONIC DISTORTION Less than 0.1%
METER 2 illuminated VU Meters 0db = 0.775V
PEAK INDICATOR 12 LED Peak Indicators
VOLTAGE 240 VAL 50Hz
POWER CONSUMPTION 7.2 watts
DIMENSIONS 620 (W) x 388 (D) x 108 (H) mm
(supplied complete with carrying case)

NB — THIS UNIT IS BUILT AND TESTED NOT A KITSET

NORMALLY $799

THIRD OCTAVE GRAPHIC EQUALIZER



SPECIFICATIONS E.T.I. Dec. 1982

Bands:	28 Bands from 31.5 Hz to 16 kHz
Noise: 20 kHz bandwidth	<0.008 mV, sliders at 0, gain at 0 (−102 dB).
Distortion:	0.007% at 300 mV signal, sliders at 0, gain at 0; max 0.01%, sliders at minimum.
Frequency Response:	12 Hz-105 kHz, +0, −1 dB, all controls flat
Boost & Cut:	14 dB

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Simple low-cost data recorder

Anyone contemplating the installation of a wind generator needs something more than casual observation in order to assess the suitability of a suggested site. The system described here provides a simple, low cost method of recording wind speeds, on an hourly basis, over long unattended periods.

by BARRY DANIEL & NEVILLE JONES*

*Lecturer in mechanical engineering, University of Queensland.

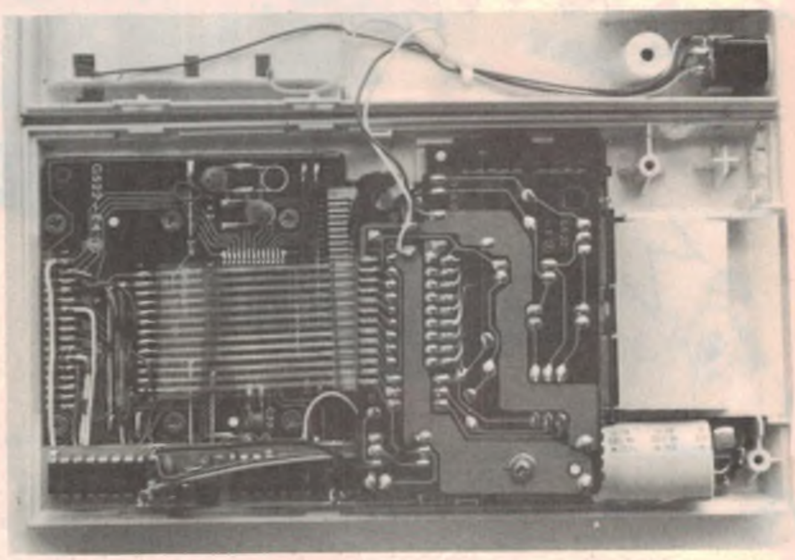
This project provides a printed record of hourly-mean wind speeds over several weeks of unattended operation, at considerably less cost than currently available commercial equipment. It provides a record which is essential for those who are interested in selecting the best site for a wind-operated electric generator, and equally useful for those who are operating their own weather stations. It can also, more generally, be used for any purpose which requires a record to be kept of the number of times an event occcurs in each hour.

In two recent articles (Further Thoughts on Wind-powered Generators, EA April 1983 and May 1983) T.C. Thrum discussed the design and construction of a wind-powered electric generator. He emphasised the importance of carefully selecting the site, as the difference of a few kilometres per hour in wind speed can make a big difference in output power. In fact, the energy in the wind varies as the cube of its speed, so that double the wind speed produces eight times the available energy.

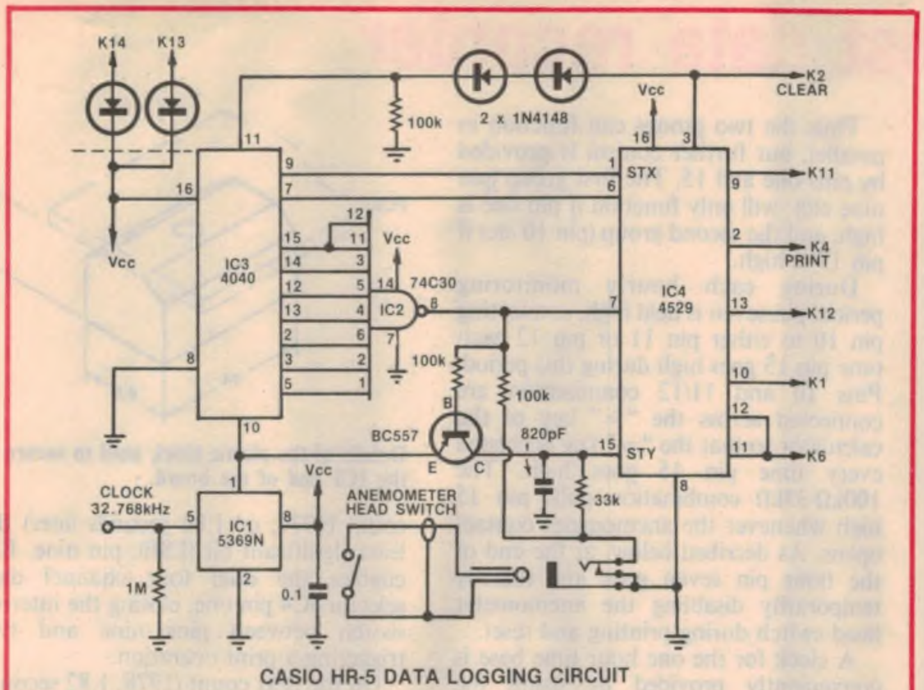
We therefore need to know as accurately as possible the wind speed patterns at a proposed site, not only to ensure that there will be enough energy available during the year but also so that we can assess the likely duration and frequency of the inevitable periods of calm, and make appropriate provision in the way of battery storage capacity.

A large number of commercial wind speed indicators (anemometers) are on the market. Most are of the cup type in which a rotor with cup shaped vanes, driven by the wind, is allowed to spin freely about a vertical axis. The shaft speed can then be measured by various means and calibrated in terms of wind speed. A simple, low-cost instrument of

The complete data logger, comprising commercial anemometer and modified Casio printing calculator.



Interior of the calculator, as modified. The additional board is at the bottom, with IC4 in the bottom left hand corner. IC1 is hidden.



CASIO HR-5 DATA LOGGING CIRCUIT

this type was described by John Clarke ("Wind Speed Indicator", EA October 1981).

A continous record of the wind-speed as it varies over a prolonged period requires expensive equipment and provides far more information than we need. However, if we provide a counter to record the number of revolutions of the rotor, rather than its speed, then the difference between two consecutive readings will give the amount of wind which has passed the rotor, and therefore mean wind speed over the period between these readings. A convenient period is one hour; and a record of the hourly-mean wind-speeds over a long period gives a characteristic wind-pattern signature for a given site.

However, hourly readings (particularly at a remote site, and at night!) are seldom convenient to make, and some form of recorder is called for. There are a number of devices, manufactured in Switzerland, USA and Australia, on the market, but this project describes a low-cost approach, using a commercial printing pocket calculator which automatically prints the hourly-mean wind-speed values for several weeks of continuous unattended operation.

The calculator/anemometer combination must satisfy the following requirements:

1. The calculator must possess at least one memory, to store the calibration factor.

2. It must be able to increment the display by the contents of memory each time a single key is operated.

3. It must contain a suitable internal oscillator to operate the printing and resetting function at hourly intervals, within the closest possible limits.

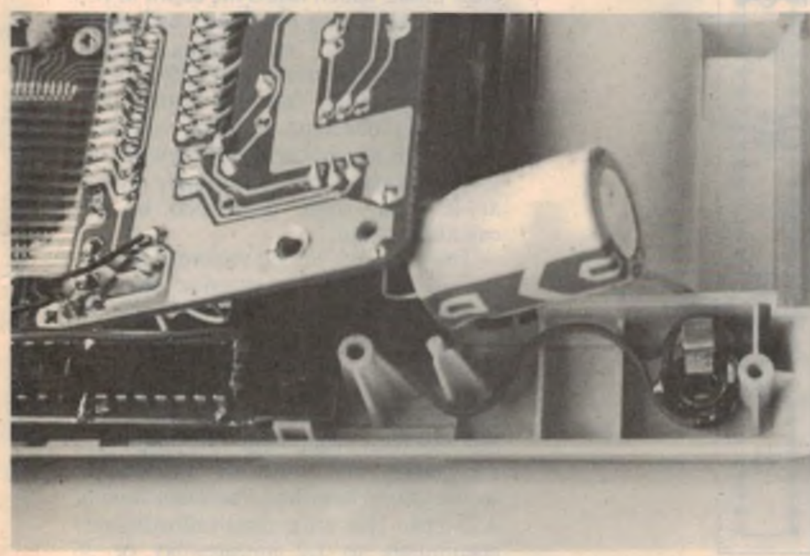
4. It must use thermal printing, to avoid problems caused by drying-out of the ink roller over prolonged operation in dry weather.

5. The cup anemometer must close a switch at intervals of a given number of shaft rotations (not at every revolution) so that the time interval between switch closures at high wind speeds is never too short for the calculator to resolve.

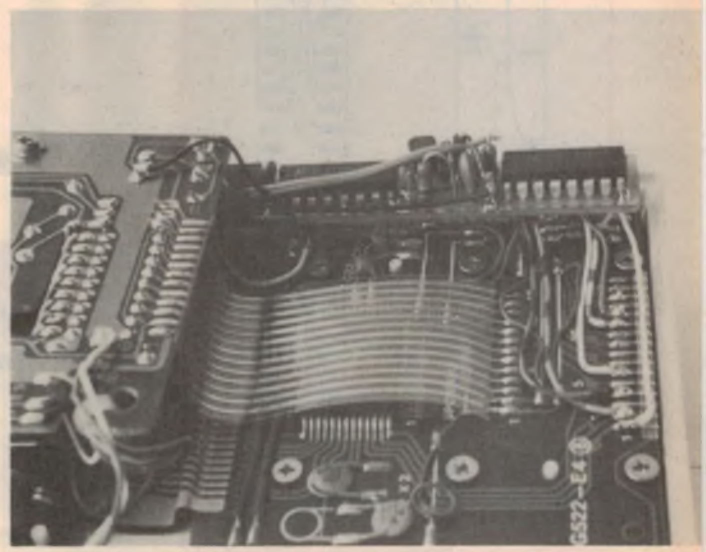
In the event, we used a Casio HR-5 printing calculator, coupled to a low-cost commercial cup anemometer available direct from the manufacturers, H.C. Stewart, Weatherworks, Ashburnham, Mass. U.S.A. 01430. This uses a simple worm and worm-wheel reduction to close a magnetically activated reed-switch every 1/60 mile (26.822 metres) of wind run.

On this basis a hypothetical situation of one closure in an hour (3600 seconds) represents a mean wind speed over the hour of 26.822/3600 = 0.00745 metres/second. By entering this constant (00745) in the calculator at the beginning of the logging operation, and arranging to increment the display number by this amount on each contact closure, the average speed (in metres/sec) will be shown at the end of the hour.

For example, and rather more realistically, 360 closures in one hour (one every 10 seconds average) would indicate a mean speed of 2.682 metres/sec., or 9.6km/h. At 3600 closures in one hour (average, one per second) it



Closeup of right hand corner showing calculator capacitor lifted to reveal 3.5mm input plug. The socket for IC1 is on the left of the pillar.



Closeup from opposite side, showing IC4 in top right corner and various interconnecting leads between the calculator and the auxiliary board.

Simple low-cost data recorder

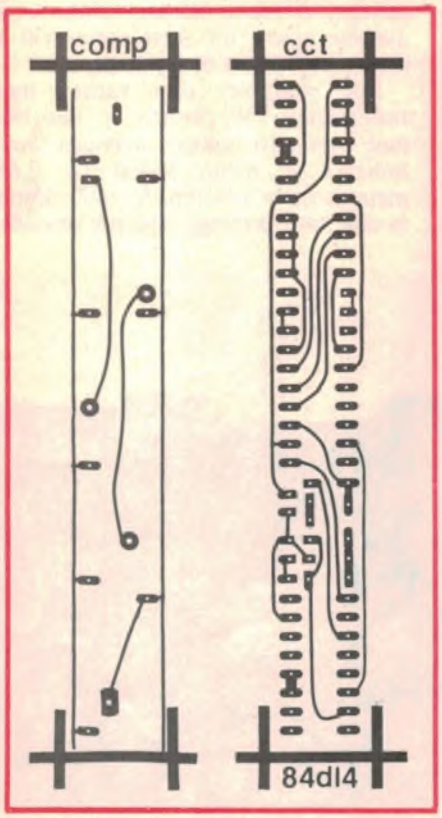
would indicate 26.82 metres/sec., or 96km/h.

The timing circuit

The various required functions of resetting, incrementing, printing, and clearing are performed by electronically shorting the various key switches of the multiplexed calculator keyboard. IC4, a dual 4-channel analog multi-plexer (4529), contains eight CMOS switches. Some of these switches are connected across the "clear," "=," "print" and "0" keys and are closed automatically in the correct sequence each hour.

In greater detail the switches actually used involve pins two, three, four, five, and nine as one group, and pins 10, 11, 12, 13, and 14 as a second group, even though we do not use all these pins. Each of these groups is, in effect, a single pole, four position switch, pin nine being the moving arm in the first group and pin 10 the moving arm in the second group.

Thus pin nine may be connected successively to pins two, three, four, or five according to a binary code fed to pins six and seven (eg, both low, both high, one high one low, etc). Similarly, pin 10 may be connected to 11, 12, 13, or 14 and, in fact, this group is instructed by the same code at pins six and seven.



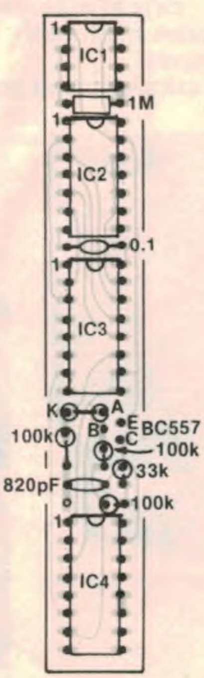
Exact size patterns for the double sided board, both viewed from the copper side.

Thus the two groups can function in parallel, but further control is provided by pins one and 15. The first group (pin nine etc) will only function if pin one is high, and the second group (pin 10 etc) if pin 15 is high.

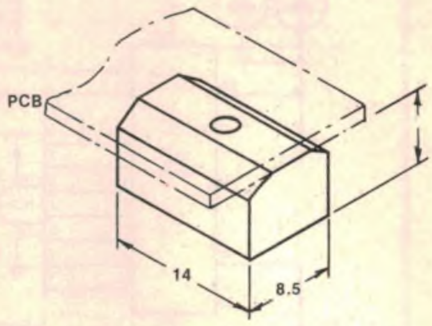
During each hourly monitoring period, pin seven is held high, connecting pin 10 to either pin 11 or pin 12 each time pin 15 goes high during this period. Pins 10 and 11/12 combination are connected across the "=" key of the calculator so that the "=" key is pressed every time pin 15 goes high. The 100kΩ-33kΩ combination pulls pin 15 high whenever the anemometer contact opens. As decribed below, at the end of the hour pin seven goes low thereby temporarily disabling the anemometer head switch during printing and reset.

A clock for the one hour time base is conveniently provided by using the calculator's own 32.768kHz crystal oscillator. The oscillator output is divided by 59659 by IC1, giving a 0.5493Hz (1.82 second) pulse into the binary counter IC3. As the voltage levels from the calculator clock are not standard, the 1MΩ load resistor was found to be necessary to ensure adequate operation over a wide battery voltage range.

IC3 counts off the number of 1.82 second periods from ICI and when a count of 1976 is achieved (ie, 3596 seconds), the NAND gate IC2 produces a low input to IC4 pin seven. On the next



Parts layout superimposed on the board pattern. Note that IC1 uses a socket.



Details of the plastic block used to secure the IC1 end of the board.

count (1977, or 1.82 seconds later) the least significant bit (LSB), pin nine, IC3 enables the dual four channel data selector IC4 pin one, closing the internal switch between pins nine and two triggering a print operation.

On the next count (1978, 1.82 seconds later again) the print enable pulse from pin nine IC3 is removed and IC4 pin six goes high. This pre-selects two switches, the one between pins 10 and 13 and the one between nine and three. Initially, this latter switch remains inactive, lacking the necessary pulse on pin one. At the same time the output from IC1 goes high for 0.91 seconds, turns on the BC557 transistor, and pulls IC4 pin 15 high. This closes the 10/13 switch, across the calculator "0" key, so resetting the displayed count to zero.

When the output from ICI falls a count of 1979 results. The least significant bit now enables IC4 pin 1, closing the 9/3 switch. Pin 9, by reason of its connection to the calculator, is normally high so pin three goes high. This signal is fed back to IC2 pin 11, the clear input, which resets the count in IC3 to zero, removing the "hour up" signal from IC2, and reactivating normal anemometer operation by setting IC4 pin seven high. The feedback signal path uses two diodes and a 100kΩ resistor to correct for an unacceptably high (2 volt) low logic level which is normally present at IC4 pin three (generated by the calculator chip).

The one hour timing sequence may be started manually by pressing any key that is multiplexed to IC4 pin three (ie, C,1 2, 3, -, M-). The time between resets is 1979 × 1.82065 seconds or 3603 seconds. The three second error is unavoidable with this circuit since the best resolution obtainable with the IC2/3 combination is 4 × 1.82 or 7.28 seconds, so the choice is either 3 seconds slow or 4.28 fast. This error does unfortunately accumulate to 1.2 minutes/day or 36 minutes/month. For most applications this is of little significance.

Parts List

1 Printed board, 91mm × 13mm, code
1 8-pin IC socket (low profile)
1 3.5mm panel socket (shorting type)
1 0.1uF ceramic
1 82pF ceramic
1 1MΩ, 1 100kΩ, 1 33kΩ

Semiconductors
1 MM5369AA/N 17 stage divider
1 74C30 8 input NAND
1 4040 12 stage binary counter
1 4529 dual analog data selector
1 BC557 PNP transistor
2 1N914 diodes

Printing at greater or lesser time increments can be achieved by altering the wiring between IC's 2 and 3 to trigger at a different count (eg, for 15 minute records, use 492 (binary 111101100), giving a 1.22 second error).

One further note. The circuit enables the "=" key when the head connector is open. While any key is held pressed all other keys become inoperative. Therefore if the head connector is disconnected (unplugged) the keyboard will be locked. To permit normal calculator functions to proceed, a conector with a normally closed contact was fitted, and is shown in the circuit.

The physical constraints on the board size have led to some compromises in the circuit design (eg, the three second per hour timing error) and the use of a double sided PC board. A single sided board could probably be used if one were prepared to replace the tracks on the component side with wire links.

Mounting the board within the calculator presented some difficulties, and the following method was used. IC1 was mounted in a low profile IC socket which, with the IC removed, gave access to a screw hole at one end of the board. A small block of plastic was shaped as per the sketch and attached to the board by the screw. The block was a snug fit into the calculator case recess where it could be glued, although we didn't bother to do so with the prototype.

The other end of the board was more difficult and resulted in a "Vero" pin being inserted firmly in the board, bent and trimmed to appropriate length, and soldered to the calculator PCB pads below. This then formed both a structural member and the positive supply connection to the diodes on the calculator PCB.

Electrical connections to the board were made by long individual insulated wires soldered to the appropriate IC pad under the board before mounting it in the calculator. After mounting, the wires were trimmed to length and soldered to the appropriate position on the calculator keyboard connector or other PC pads as appropriate.

Care needs to be taken to ensure that the wires sit flat against the calculator PC board as very little clearance exists between board and case once assembled. The clock signal was taken from the "C22" capacitior solder pad between the mounting screw and the crystal. The V- or "ground" connection was taken to the negative "ground plane" on the printer PCB.

Initialisation

(a) To initialise the calculator:
1. Enter scale factor (here 0.00745 when used as an anemometer data logger as described above).
2. Press + twice
3. Press C to reset hour counter
(b) Plug in anemometer head
(c) (Optional) Repeatedly press 0 until display clears zero (the head contact must be closed for this to register).

Final comments

1. The circuit will continue to operate down to a battery supply level of 4.0V.
2. The head switch *must* be shorted before the calculator can be used for manual calculations. This is done automatically by the connector socket shown.
3. Keys C, 1, 2, 3, - and M- all clear the hour counter within the calculator. These keys are active at all times, although they may not affect the display; therefore *do not touch keyboard* during operation as data logger!

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The Turntable features quality Belt Drive operation, lightweight Transcription type arm, Cueing facility and Stereo Ceramic cartridge with Diamond Stylus.
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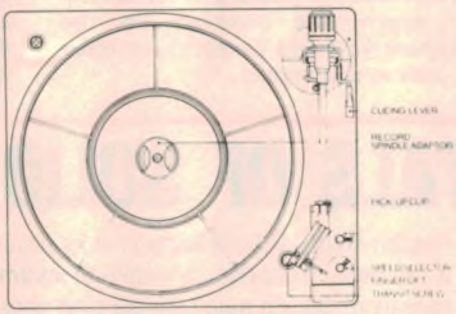
Quantity limited! You will have to hurry to avoid disappointment.

SPECIFICATIONS:

- ★ Dimensions 330(W) x 285(D) x 60(H)mm overall
- ★ Platter diameter 280mm
- ★ 2 speed - 33 & 45 rpm (internally adjustable)
- ★ Pick-up arm counterbalanced type with cueing facility
- ★ Pick-up ceramic (stereo) with diamond stylus
- ★ Turntable operation - auto stop, will return to rest automatically. Turntable chassis is sprung on all corners with transit screws & clips ★ Weight 1.5kg
- ★ Output stereo RCA sockets underneath unit



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Ref: ETI October 1983

Allows you to connect your Microbee to a printer having "Parallel" or "Centronics" input. Kit includes R/angle DB15 plug.

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Ref: ETI 760 October 1981

High stability (low drift) unit designed to give good RF drive to colour TV's. A must if you're using your colour TV with a computer.

Cat. KE-4554 .... **$17.95**

PREAMPLIFIER

Ref: ETI 471 June 1979

The heart of the ETI4000 system. High performance stereo unit with 4 inputs, filters, mute, loudness, stereo mono and tape monitor switches; bass, treble, volume and balance controls.

Cat. KE-4022 .... **$47.90**

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Ref: ETI 494 October 1982

Single channel unit powered by the signal to your speakers. Prevent damage to your expensive speakers.

Cat. KE-4023 .... **$18.50**

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A 10 band equaliser, rack mounted for your Hi Fi system. Improves the sound of your system in relation to room acoustics. See the Jaycar catalogue for more detailed description of this unit.

Cat. KJ-6535 .... **$139.00**

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Ref: EA June 1982

Inexpensive preamplifier enables you to use your guitar with your own home Hi Fi system. Complete kit supplied and it runs on a safe 9V battery.

Cat. KA-1450 .... **$17.50**

FLUORESCENT LAMP STARTER

Ref: EA October 1982

This kit replaces the starter in your fluoro lamp. Eliminates flicker and improves lamp life. Does not include starter case.

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Ref: EA Dec/Jan 1982/1983

The Playmaster AM Tuner is a true broad bandwidth superhet design kit. Excellent performance plus Jaycar's usual excellence in kit presentation.

Cat. KA-1498 .... **$249.00**

ALIGNMENT KIT FOR ABOVE TUNER

Ref: EA February 1983

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Ref: EA July 1982

100W rms drive capability coupled with low-pass filter and MOSFET technology. Amp will take line level (1V) or can be connected directly to sub-woofer speaker.

Cat. KA-1452 .... **$79.00**

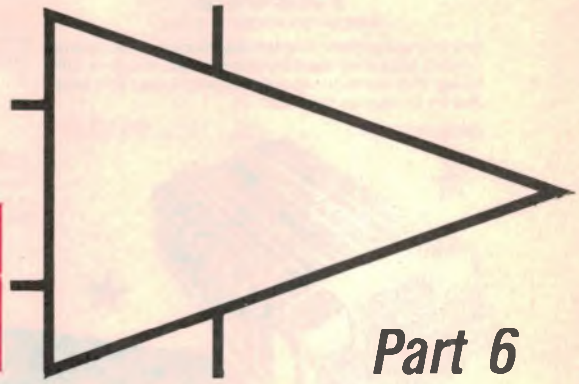
"VOX RELAY"

Ref: EA April 1982

This voice operated relay (VOX) can be used to turn on tape recorders or transmitters and of course turn them off. Use with high or low impedance microphone or high level line input.

Cat. KA-1432 .... **$14.50** by BRYAN MAHER

OP AMPS Explained



Part 6

Operational amplifiers can perform many mathematical functions such as addition, subtraction and integration. That is the reason they are called "operational amplifiers".

In the beginning electronic amplifiers did nice respectable things like amplifying music, distortion and other errors. Then came negative feedback, together with high open loop gain; distortion and errors were impolitely shoved way into the background. Operational amplifiers were born.

Astute workers in this new and fertile field quickly observed that the "virtual earth" concept (which we now know so well), together with Ri, formed a beautiful isolation mechanism, isolating the integrated amplifier from the outside world. Also, as almost no voltage exists at X, Fig. 1, the thing appears to be current operated, because current is about all that's left. So why can't we add a second current to X via a second Ri? In truth we can, as Fig. 2 shows.

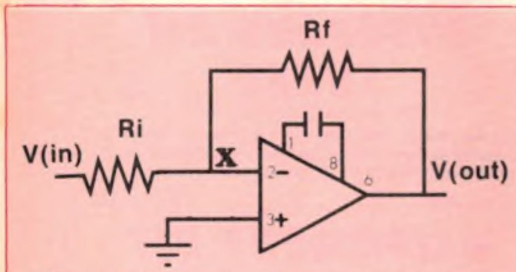


Fig. 1: standard inverting op amp circuit with virtual earth at X.

Addition

V(in1) causes some current i1 to flow down Ri1 to the virtual earth at X. Because there is almost no voltage at X, V(in1) is entirely a voltage drop across Ri1. So:

i1 = V(in1)/Ri1

Similarly V(in2) produces current i2 down Ri2 to the virtual earth and:

i2 = V(in2)/Ri2

Both currents now combine (add together) to flow via Rf to the output point Y, simply because there is nowhere else for them to go. As the voltage at X is almost zero, and the voltage at Y is the output voltage V(out) provided by the amplifier, equilibrium demands that V(out) is the same as the voltage drop across Rf. But this is simply equal to −(i1 + i2). Rf (remember that the amplifier is phase reversing). So the result is:

$$V(out) = -(i1 + i2).\, Rf$$

$$V(out) = -\left(\frac{V(in1)}{Ri1} + \frac{V(in2)}{Ri2}\right).\, Rf$$

This gives us a value for the output for any values of Ri1, Ri2 and Rf. If we wish we could choose to make Ri1 = Ri2. Then our equation for output voltage simplifies to:

$$V(out) = -\left(\frac{V(in1)}{Ri} + \frac{V(in2)}{Ri}\right).\, Rf$$

$$V(out) = \left(-\frac{Rf}{Ri}\right)(V(in1) + V(in2))$$

So we have a circuit capable of addition of voltages. This addition is a continuous analog function, very different from the method used by digital computers or calculators. The voltages we have added, V(in1) and V(in2), can be any values (within the limits of the amplifier rail voltages). And they may be constants, or pulses, or sinewaves, or any waveforms, same or mixed.

Mixing

Before we had op amps we always had some trouble mixing signals, the commonest problem being with

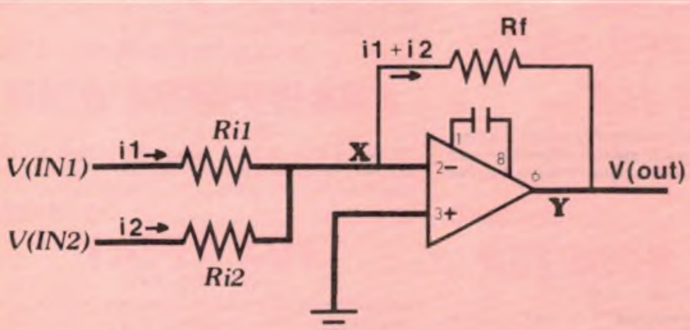


Fig. 2: basic addition circuit. V(out) is the sum of the two inputs, each weighted by the conductance of their respective Ri's.

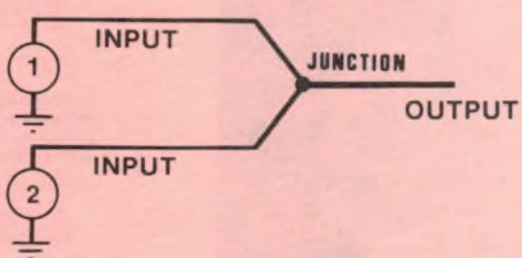


Fig. 3: without op amps, mixing signals could lead to unwanted backfeed from source 1 to source 2, perhaps causing damage (eg, if source 1 was a high voltage).

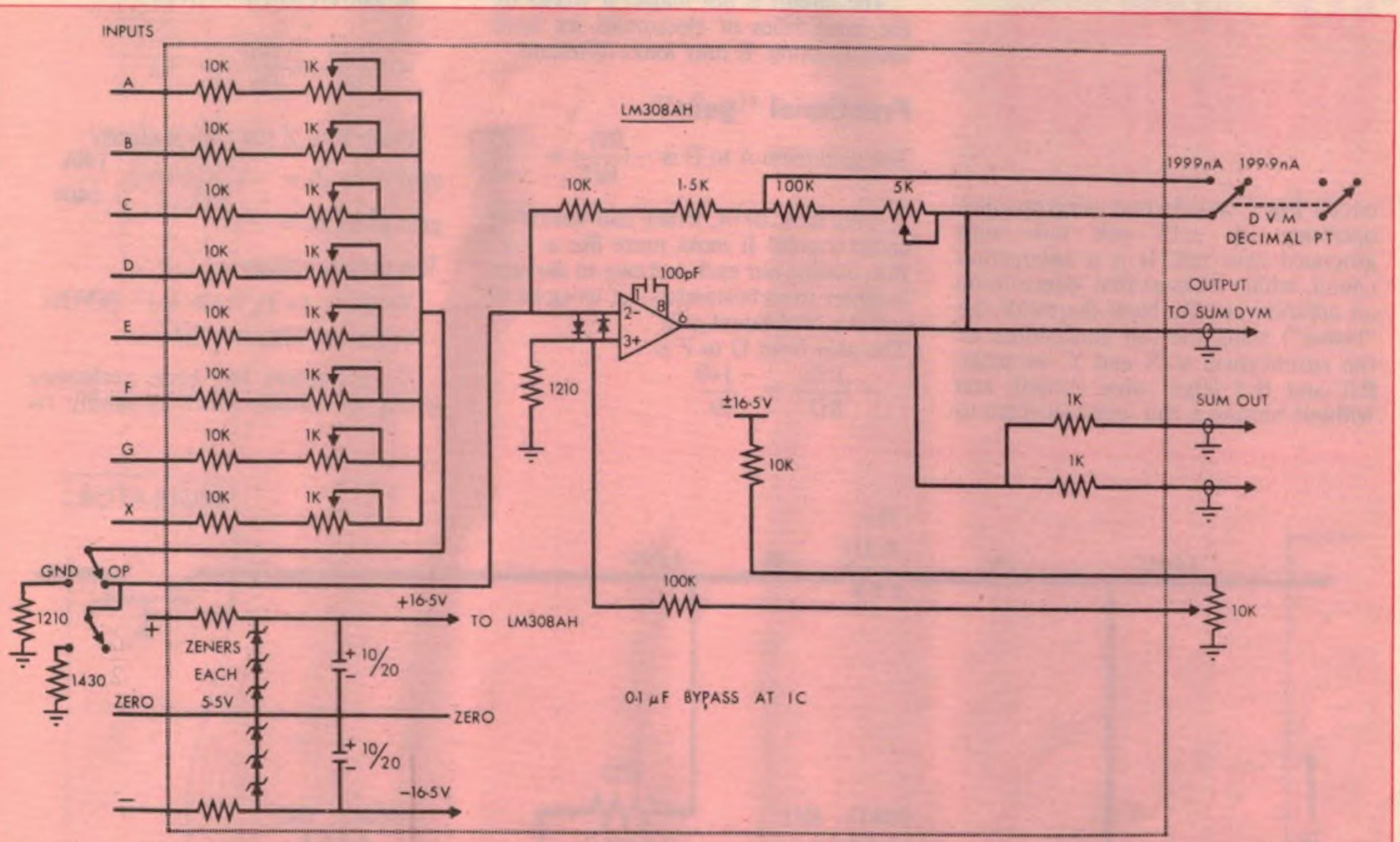


Fig. 4: practical eight-stage summing circuit. The switch in the feedback loop sets the gain to one or 10.

microphone mixers. The block diagram Fig. 3 shows that if two signals (1) and (2) are joined at a junction then there is always the possibility of backfeed of signal (1) to source (2), which could be harmful if signal (1) was a high voltage.

Here is the big advantage of op amps used as adders: when that junction is the virtual earth point X of an op amp, almost no voltage exists at X and there is no possibility of backfeed of signal V(in1) back to the source of V(in2). This safeguard still applies even if one input is much larger than the other. There is no reason why we should stop at two signals being added. We can add any number of inputs, simply by providing as many Ri's as we have inputs. All the Ri's can be equal, or different, as we choose.

Multiple sum

The general gain expression for any number J of inputs, each with its own Ri is:

$$V(out) = -Rf\left(\frac{V(in.1)}{Ri1} + \frac{V(in.2)}{Ri2} + \ldots + \frac{V(in.J)}{RiJ}\right)$$

Fig. 4 shows an application where the output is required to be the sum of eight input voltages. Each input, A,B,C,D,E,F,G,X, is applied through equal value Ri's, each Ri consisting of a 10kΩ resistor plus a 1kΩ trimpot. Input calibration consists of setting all Ri's to precisely the same value.

By using a switch in the feedback loop two values of gain are provided, with Rf = 10kΩ + 1.5kΩ or Rf = (10kΩ + 1.5kΩ + 100kΩ + 5kΩ adj). Thus gain is approximately one or 10 from any input to output. This circuit was designed to read on a digital voltmeter the sum of the eight input voltages. The 1210Ω resistor from LM308 AH pin 3 to ground is the parallel resultant of all Ri's and Rf and is inserted to reduce drift by compensating for input current. The 100kΩ resistor to pin 3 provides a very small DC voltage to compensate for the LM308AH input offset voltage.

Power rails are ±16.5 volts provided by two groups of three zeners (each 5.5 volts). This makes use of the fact that 5.5 volts is the most stable zener voltage.

Subtraction

Any differential operational amplifier provides an output equal to the difference of two inputs:

V(out) = (gain) (V(in1) − V(in2)

This is in fact a subtraction circuit.

But this month let us look at subtraction from another viewpoint. We have consistently believed that always the input voltages to any amplifier must be less than the supply rail voltages. Now readers (both of you), sit down in a chair as your author (dear chap) is about to speak apparent heresy! You are to be shown an example where op amps operating on ±15 volt rails can measure a voltage drop in a circuit up at 140 volts!

Now that we have learned to add two voltages, we could always put one voltage through a phase reversal before addition. The result would be a subtraction, wouldn't it?

In a certain design for a +120 volt 10-amp regulated power supply, the designer wanted a sampling resistor R(s) = 0.1 ohms to be placed in series with the load current to produce a voltage drop up to one volt, at full current, for control purposes. Because of other complications, R(s) could not be placed down in the zero line, so had to be up in the 140 volt line. Now a differential amplifier sensing the 1.0 volt drop across R(s) would be subjected to a common mode voltage of 140 volts and must therefore operate on rails of 150 volts or more.

Such a prospect, though possible, would be expensive and awkward. Therefore the simple, wholly likeable

OP AMPS Explained

circuit Fig. 5 was devised using op amps operating on ±15 volt rails with grounded zero rail. It is *a subtraction* circuit, which looks at first glance to be an addition circuit. Now (herewith the "heresy") using the full implications of the virtual earth at X and Y, we make Ri1 and Ri3 large value (140kΩ) and without turning a hair, connect them to the 140 volt circuit!

The circuit is not magic; it works by the same rules of electronics we have used all along. It only looks different!

Fractional "gain"

The gain from A to D is $-(\frac{Rf1}{Ri1}) = \frac{-10}{140}$

This is −.0714, which can hardly be called a gain! It looks more like a loss! But, closing our eyes and ears to derisive laughter from bystanders, let us agree to call it a "fractional gain".
The gain from D to Z is

$$-(\frac{Rf2}{Ri2}) = \frac{-140}{10}$$

Thus gain from (A to Z)
= gain (A to D) (D to Z)

$$= (\frac{-10}{140})(\frac{-140}{10}) = +1$$

From B to Z the gain is clearly

$$\text{gain (B to Z)} = -(\frac{Rf2}{Ri3}) = -\frac{140k}{140k}$$

$$\text{gain (B to Z)} = -1$$

The output voltage is

$$V(out) = (+1)(V(A)) + (-1)(V(B))$$

$$V(out) = V(A) - V(B)$$

A subtraction has been performed, giving an output which is simply the

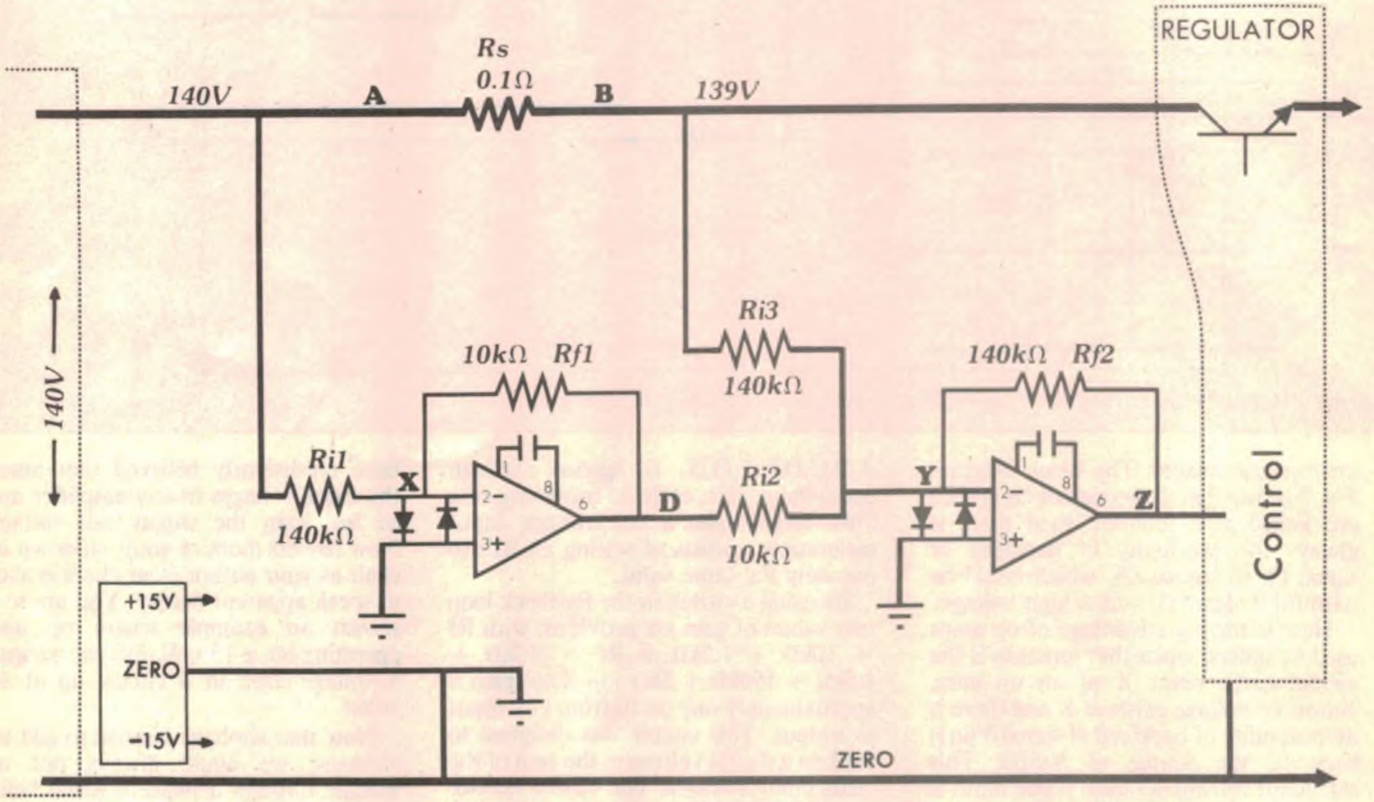


Fig. 5: high voltage subtraction circuit. The circuit allows low voltage op amps working on ±15V rails to do the job but accurate components are essential.

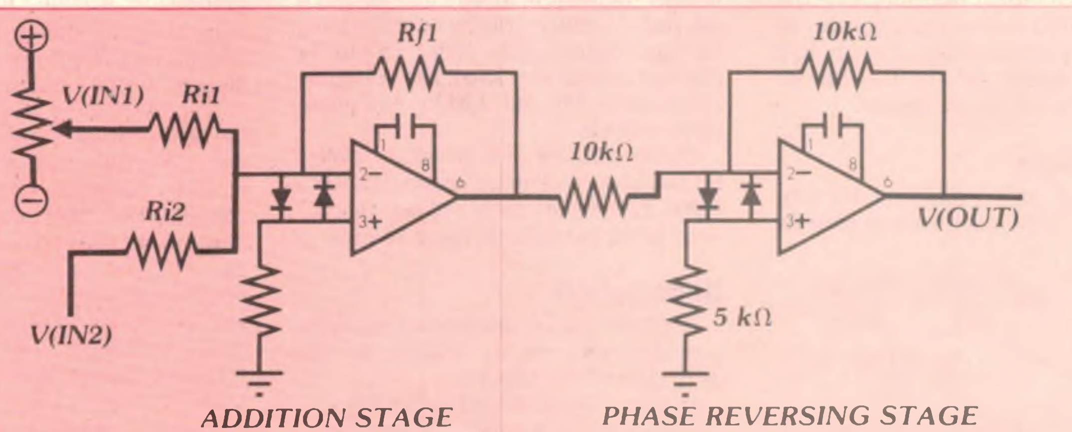


Fig. 6a: basic level shifter circuit. The first stage is an adder which adds the adjustable input V(in1) to V(in2). The phase change in the adder is cancelled by the second stage which has a gain of −1.

OP AMPS Explained

voltage drop across R(s). We did it using summing op amps, but one input has one more reversal than the other. Despite the high voltage present at both A and B, our op amps are working from ± 15 volt rails. Notice that the scheme works only because both voltage V(A) and V(B) are simultaneously present, their balancing act being used to good effect to keep the current through Rf2 small.

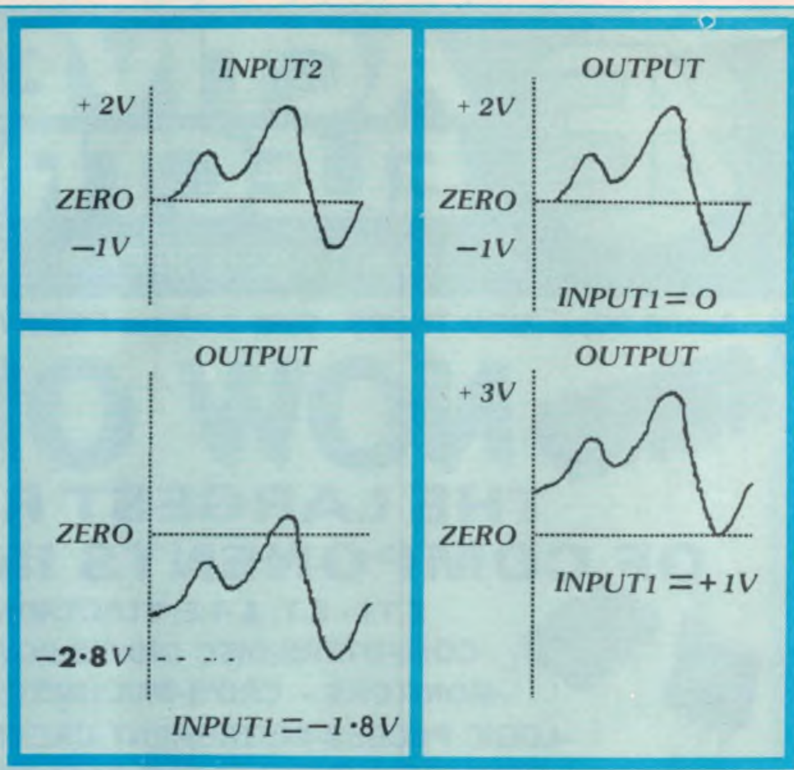


Fig. 6b: input and output waveforms for Fig. 6a

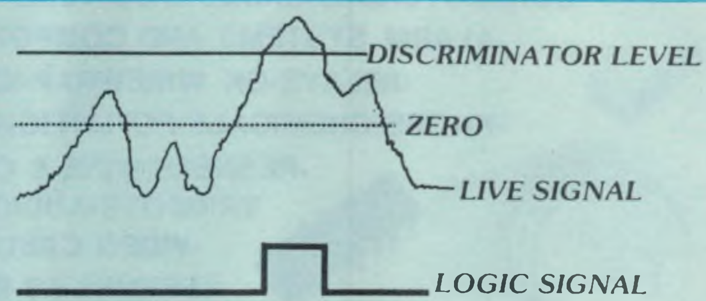


Fig. 7: this diagram illustrates a common industrial problem. We want to produce a logic signal every time a linear voltage waveform exceeds some nominated value (the discriminator level). Fig. 8 shows how it is done.

High voltage protection

If for any reason one input voltage should be absent then the other alone would be an over-voltage input. This would immediately drive the output to saturation, to either + 15 volts or − 15 volts. We now become aware of an essential aspect of op amps.

The virtual earth is a result of dynamic equilibrium wrought by the feedback action of a linear amplifier. An amplifier in saturation is not linear, therefore in saturation no virtual earth exists.

So hold it Brethren! If suddenly no virtual earth existed at Y for any reason (say Ri2 were to fail) what voltage would exist at Y? Would you believe 139 volts! Now you see why the pair of diodes are connected back-to-back from Y to ground and also from X to ground. They are high voltage protection against such an accident and also against imbalance during switch-on surges. Note that for the same reason, each integrated circuit pin 3 input must be connected directly to ground.

Level shifting

The ability to take any voltage signal and accurately shift its zero line up or down is an important example of linear addition or subtraction. Variously known by alternative names "zero shifting" or "level translation", this practice is essential in many scientific and industrial processes.

It consists simply of an operational adder circuit having two inputs, one the signal to be "shifted" and the other a calibrated accurate DC voltage as in Fig. 6. Phase change in the adder is necessary and may be cancelled by a second stage having gain of − 1. Linear electronics has many uses for such a process, one being "signal discrimination".

Level discrimination

A common industrial problem illustrated in Fig. 7 is the requirement to produce a logic signal every time a linear voltage waveform exceeds some nominated value, either in the positive or the negative direction or both. Fig. 8 shows a suitable circuit with light emitting diode outputs. LED 1 is illuminated whenever the input signal exceeds + 320 millivolts while LED 2 is illuminated whenever the input signal exceeds − 320 millivolts.

Individual 10kΩ potentiometers set these two discriminator levels, which may be the same absolute value or different. The circuit portion driving LED 1 is almost identical to the portion driving LED 2 except for necessary polarity changes in the 10kΩ potentiometer supply and the phasing of the output transistors.

Circuit action

Each half of the circuit consists of three sections. First, we have Q1, an LM301AH unity gain adder which adds the input to an accurate − 320mV DC level selected by the 10kΩ potentiometer. The output is the phase reversed image of the input shown as (c) in the timing diagram Fig. 9. This inverted shifted signal (c) is positive at all times except when the original input exceeds + 320mV.

Signal (c) is then fed through a current limiting 10kΩ resistor to pin (2 −) of Q2, a second LM301AH operating "open loop" ie, without any negative feedback at all. Under this condition Q2 is not an operational amplifier but is simply acting as a very high gain amplifier which switches to the + 15V rail level whenever the voltage applied to pin 2 is the slightest amount negative. Conversely, whenever the input is the slightest amount positive, the amplifier switches to the negative 15V rail.

From the output at pin 6 of this second stage a very small amount of positive feedback is provided by the

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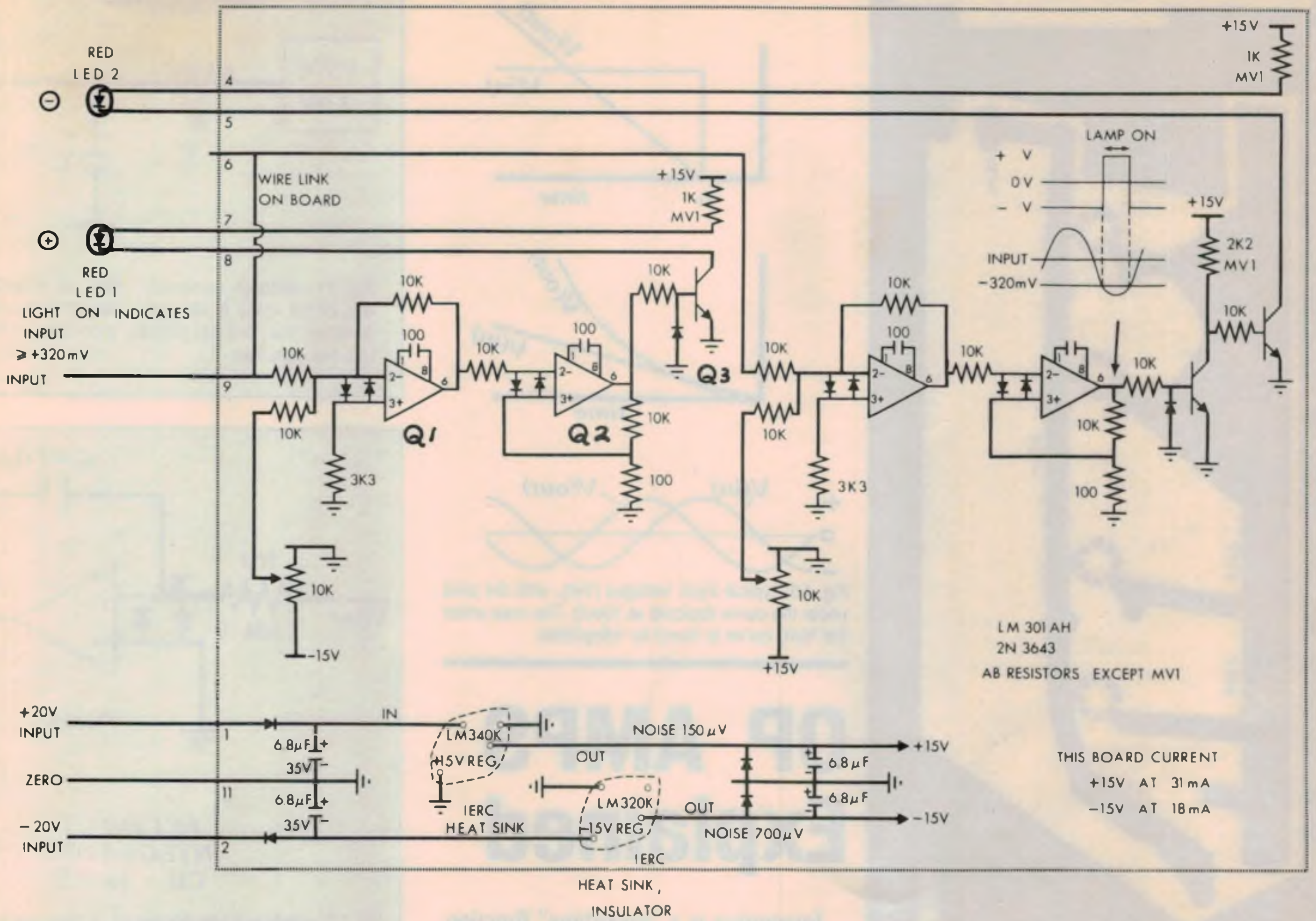


Fig. 8: double-sided level discriminator circuit. The two 10kΩ trimpots set the two discriminator levels which may be the same absolute value or different.

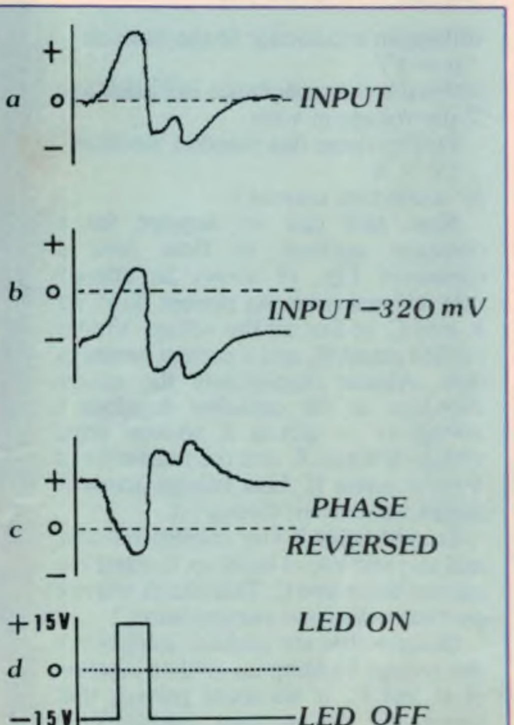


Fig. 9: timing diagram for the left "positive" side of Fig. 8.

OP AMPS Explained

voltage divider (10k:100) and fed back to pin 3, the positive input terminal. This gives the open loop stage an electrical "hysteresis", preventing indecisive action in the event of noise or inputs very close to zero. The second stage constitutes a high gain Schmitt trigger circuit. Its output is always either +15 volts or −15 volts. No other is possible, as shown in the timing diagram Fig. 9.

The Schmitt trigger stage output is fed via a 10kΩ resistor to the base of Q3, a 2N3643 NPN transistor which has the output LED in its collector load. A positive output from the Schmitt turns this transistor on, illuminating the LED. On the other hand, the negative swing from the Schmitt output is safely shunted to ground by the diode at the base of Q3 and the LED remains off.

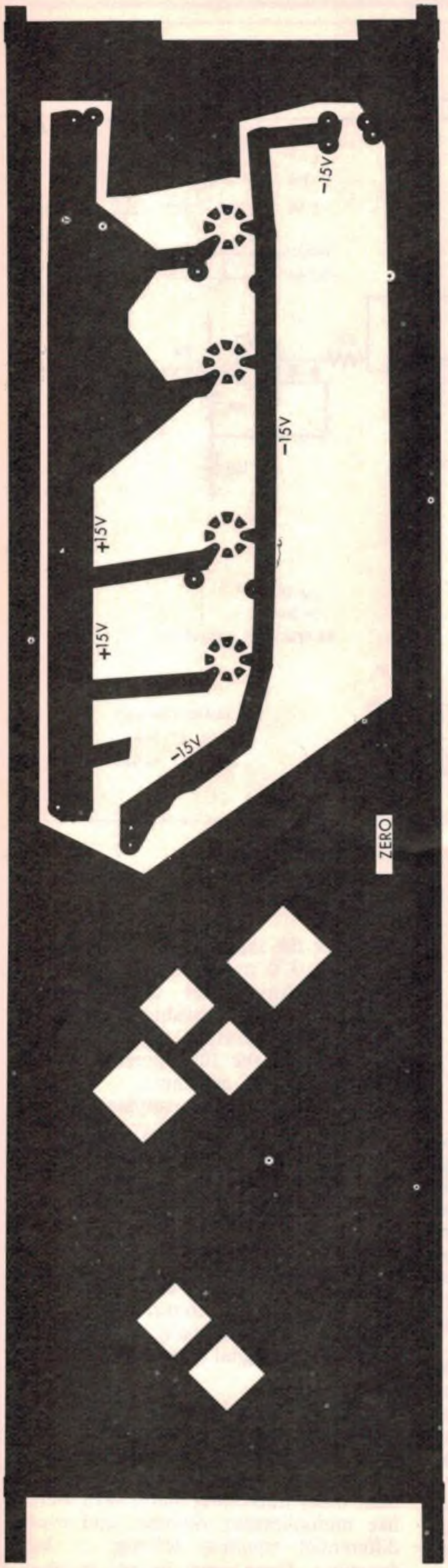
Thus LED 1 or LED 2 is illuminated whenever the input signal exceeds plus or minus 320 millivolts as the design required. Any other discrimination voltage (within the available range) could be selected simply by accurate adjustment of the 10kΩ potentiometers providing the DC constants.

Tests on the accompanying printed board show that discrimination resolution and repeatability is better than 1.0 millivolt on a noise free signal.

In this one circuit we have used a variety of electronic ideas: linear operational adders, non-linear analog amplifiers, Schmitt triggers, positive feedback, and negative feedback. Most importantly, our continuous linear voltage input signal finally produced the required logic signal output.

Integration

Now don't go and hide under the bed at the mention of this mathematical term. Later, in a future episode, we will treat other interesting maths operations like multiplication, division, and even differential equation solving, or log functions. There seems no end to what we can do using our beautiful op amps!



Actual-size PC artwork for Fig. 8 (top of double-sided board)

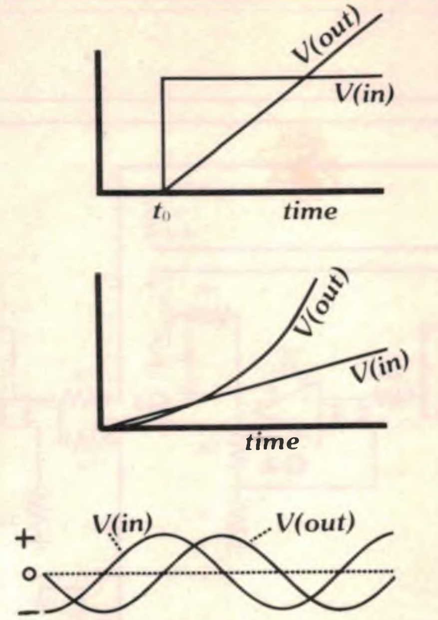


Fig. 10: typical input voltages (Vin), with the area under the curve depicted as V(out). The area under the V(in) curve is found by integration.

OP AMPS Explained

Integration is a "smoothing" function which is not hard to understand. Mathematically, it was invented by Archimedes about 300BC. Very sadly he was killed by invading Roman soldiers while working out a maths problem in the sand on a beach. The Roman general wept when he saw whom his men had killed. Archimedes used integration to find the area under a curve by the limit of a summing process.

Given a voltage V(in) as a function of time, we often find it useful to be able to produce another voltage V(out) which is proportional to the area under the curve depicting V(in). Fig. 10 shows some common examples.

How do we produce such V(out)? Easy! We use the properties of a capacitor, which can be charged by a current. The voltage on the capacitor represents some sort of product of the charging current and the time it flows. Let us look at the simplest case first. Everybody knows that if we push a steady current into a capacitor, the charge on it will rise steadily, obeying the simple equation:

$q = it$

where q is the charge in coulombs, i is the current in amps and t is the time in seconds. Then we dimly recall from our school days something about charge and

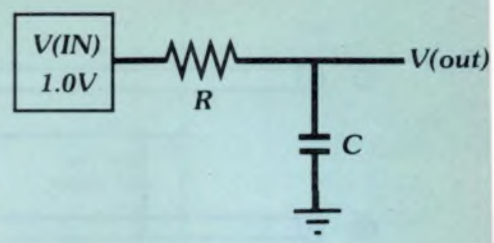


Fig. 11: although commonly called an integrator, this circuit really is not. As explained in the text, constant V(in) will not produce a constant current into the capacitor.

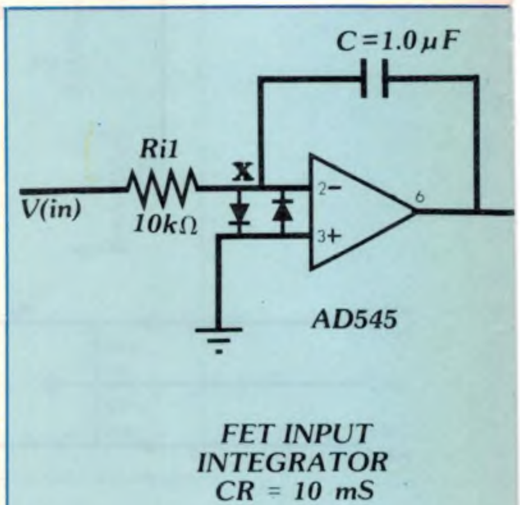


Fig. 13: practical integrator circuit. In this example, with Ri1 = 10kΩ and C = 1μF, the time constant

voltage on a capacitor to the tune of:

$q = cV$

where c is the capacitance in Farads and V the voltage in volts.

Putting those two together we have:

$cV = it$

for a constant current i.

Now how can we arrange for a constant current to flow into a capacitor? Fig. 11 shows an attempt that *will not work.* As current flows via R into C, at first all the voltage V(in) is applied across R, and a current begins to flow. Almost immediately the charge deposited in the capacitor develops a voltage (V = q/c) in it, so now some voltage is across C and the remainder of V(in) is across R. Less voltage across R means less current through it.

Lo and behold! Our current reduces, and as q and V(out) build up, less and less current flows into C. This circuit will *not* produce a constant current into C!

Observe that the problem stems from the voltage building up at that junction of R and C. If we could prevent that happening, the constant voltage V(in) would truly produce a constant current into the capacitor, as all of V(in) would

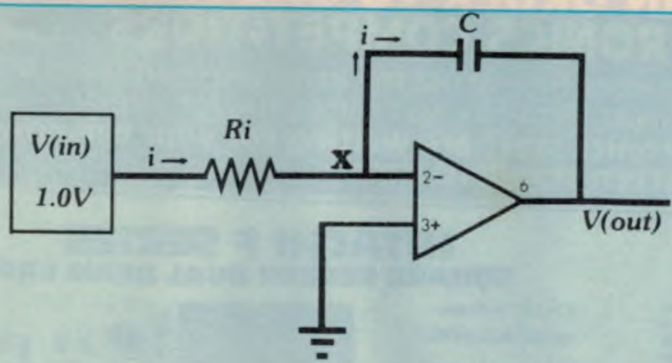
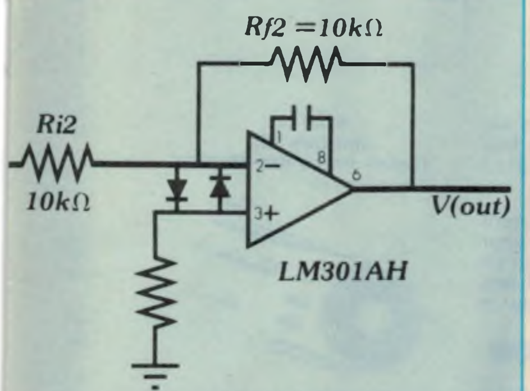


Fig. 12: a true integrator. This circuit does produce a constant current into C when V(in) is constant because of the virtual earth at X. V(out) is proportional to (minus) the area under the waveform V(in).



PHASE REVERSING STAGE

is 10ms. Many other values could be chosen to give different time constants.

be exerted across R. And we all know what a constant voltage across a constant resistance means, don't we? A constant current of course; by that most fundamental of formulas: i = V/R

So how do we arrange a circuit where current can flow into a junction *without* any voltage build-up? Yes, of course, we need a virtual earth at that junction!

Fig. 12 shows the solution to our problem. Our beloved virtual earth at X will ensure almost no voltage there, so at all times the constant voltage V(in) is wholly applied across Ri: a constant current i through Ri is achieved! Whoopee! And because the integrated amplifier will be chosen such that the amplifier's input current is very very small, we can safely say that constant current i is flowing into capacitor C, simply because there is nowhere else for it to go. And of course that constant current i will produce a steady increasing voltage across the capacitor.

But no voltage at X and a steadily increasing voltage across the capacitor can only mean one thing: the other side of the capacitor must be going down in voltage. This is consistent with the fact that the integrated amplifier is phase reversing.

Alright! We have produced a negative or inverted version of our desired waveform. No hassle! Op amps are so easy that we just add a simple operational amplifier with gain (−1) to put things right. Fig. 13 shows the finished product. We have produced a linear integrator. Furthermore our circuit is actually capable of performing the mathematical operation "integration" upon any input voltage V(in) we care to apply. (Proof of that last statement we will not go into as it requires a little calculus.)

Volts per second

But there may be a few things we have not considered! V(in) is a constant DC voltage, for example +1.0 volt (that's nice and tame and harmless isn't it?). So we connect that to our new-found-toy, our integrator of Fig. 13. What happens?

Well, V(in) provides a +1.0 volt input always. Ri1 lets flow a current i = (+1.0V)/Ri1 = 100 microamps always, (because the other end of Ri1 is at X, the almost zero voltage virtual earth). Capacitor C is being charged at the rate q = it and its voltage is increasing at a rate:

V(out) = (q/c) volts = (i/c) volts per second

In this example the rate of increase of voltage is fast; in fact it is

$$V(out) = \left(\frac{100}{1,000,000}\right)\left(\frac{1,000,000}{1.0}\right)$$

V(out) = 100 volts per second

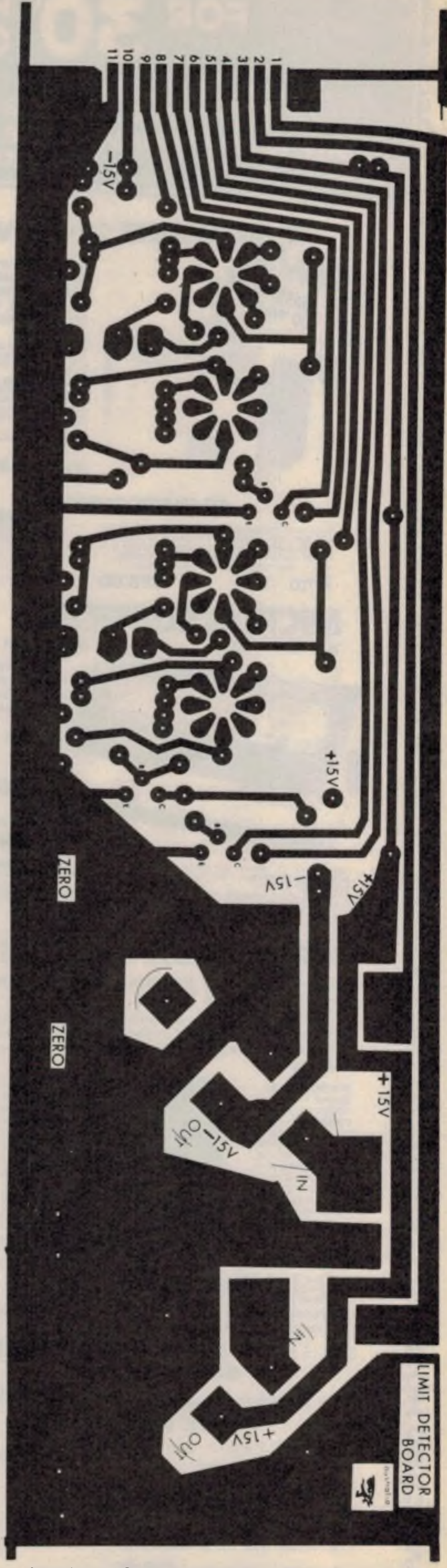
or

V(out) = 100 millivolts per millisecond

or

V(out) = 100 microvolts per microsecond

We have written V(out) three ways to emphasise that it is more correctly regarded as a "rate of increase of voltage". Of course after any length of time it will have some value in volts. For



Actual-size PC artwork for Fig. 8 (bottom of double-sided board).

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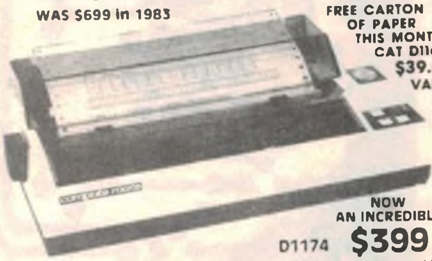

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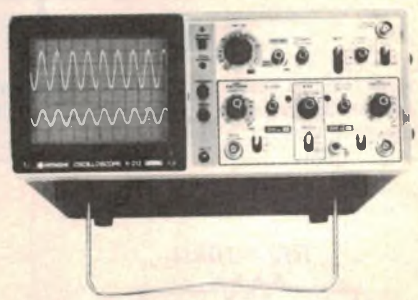

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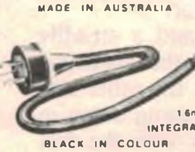

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OP AMPS Explained

example, after 1.0 millisecond it will be 100 millivolts. After 120 milliseconds it will have increased to (100)(120) = 12,000 millivolts = 12 volts!

Whoa! But we only put in 1.0 volt! Where did that 12 volts come from? The amplifier generated that 12 volts to obtain equilibrium so that the voltage at the virtual earth could remain nearly zero while we continue to push that 100 microamp current down Ril into the capacitor. That is the essential action of any operational integrator. That is where Fig. 12 differs fundamentally from Fig. 11, even though both are called "integrating circuits".

Saturation

If that 1.0 volt input is left on indefinitely, what happens? As the 100 microamps continues to flow into the capacitor, sooner or later the output voltage will climb up to almost the rail voltage. What then? Well, if left on the integrated amplifier will go into the over-voltage condition we call "saturation", ie it cannot go on increasing its output voltage any more.

The amplifier ceases to act as "operational", the virtual earth ceases to exist, the voltage at X rises until one of the diodes at X begins to conduct at 0.6 volt. The thing can sit there all day in that condition but it's not much use to us in saturation. Also the amplifier transistors might be warming up somewhat. We could agree to remove V(in) before saturation occurs, to keep everyone happy. But we have learnt something important: integrators, by their very nature, tend to race off into saturation in response to a constant input. We must watch it.

Holding

Consider now, if you will, Fig. 14 where input V(in) is zero until switched on at time t_0 and held at constant value 10 millivolts for 2.5 seconds until returned to zero at time t_1. From t_0 to t_1 V(out) will rise at 1.0 volt per second, reaching 2.5 volts at time t_1. Now V(in) is switched off, ie, V(in) = zero from time t_1 onwards. Question: what happens to V(out) then? Answer: Nothing happens to V(out) after time t_1. It just sits there forever at 2.5 volts. (This is the basis of sample and hold circuits).

Remember it is the slope or rate of increase of V(out) that is proportional to V(in). No V(in), then no increase in V(out). It just holds its last value.

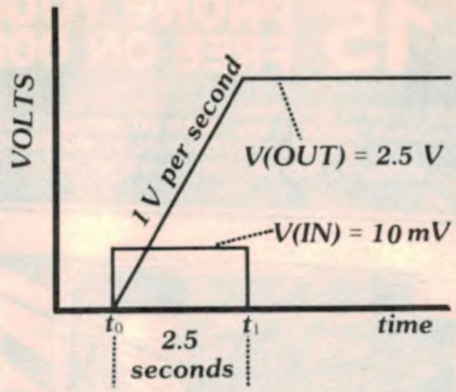


Fig. 14a: integrator output. Here, V(in) = 10mV (t_0 to t_1) and RC = 10ms, so V(out) = 1V/s. After time t_1, V(out) remains at 2.5V.

That is true in principle but is optimistic in real circuits as capacitor circuits do leak a little due to both capacitor leakage current and the tiny integrated amplifier input current. So we choose a polystyrene dielectric capacitor for minimum leakage and a FET-input integrated circuit for minimum input current, to make our circuit as accurate as possible.

So how do we ever get V(out) back down again? Remember, it is sitting up at +2.5 volts because the capacitor is holding a charge. Just remove that charge and V(out) will come back down to zero. There are two ways to do that: First the brute force way would be to arrange a switch to close straight across C, discharging it. This could be an ordinary switch or a fancy electronic switch. Either must be low leakage.

A more sophisticated method is to apply any negative DC voltage at circuit input. Say we apply V(in) = −20 millivolts. This will cause the slope of V(out) to be negative and twice as great as before. We emphasise that it is the slope of V(out) which must be negative. Initially, the value of V(out) is, of course, positive. Negative slope means a positive value is decreasing from +2.5 volts downwards, ever downwards. And at twice the slope too, as now V(in) = −20 millivolts.

What value V(out) will stop at depends on how long we leave that V(in) = −20mV switched on. Whenever we decide to switch V(in) off, then V(out) will stop wherever it is, and stay there indefinitely, unless we take some further action. Only by timing V(in) just right will we get V(out) to stop at zero. Lots of fun and games.

Time constant

The product RiC) in an integrator is called the *time constant*. When Ri is expressed in ohms and C in Farads, the product (RiC) is seconds of real time. In Fig. 13, Ri = 10kΩ and C = 10^{-6} Farads so their product (RiC) = (10,000) (10^{-6}) = 10^{-2} = 1/100 seconds or 10 milliseconds.

This enters into the true description of Fig. 13 is the integral equation:

$$V(out) = \frac{1}{RiC}\int_{t_0}^{t} V(in).\,dt$$

for any input V(in). This is a mathematical expression for the fact that the slope of the output is proportional to the value of the input.

The input is not limited to the simple case of V(in) = a constant. Indeed V(in) can be any voltage waveform at all. Fig. 10 shows a few examples of various V(in)'s and corresponding V(out)'s.

Using all kinds of input waveforms, integrators perform many useful jobs in electronics: TV receivers and transmitters, all kinds of waveform generation systems, timing circuits, SCR trigger circuits for motor control, solution of differential equations and radioactivity measurements, to mention but a few.

Next month we will investigate op amps in some converter circuits, such as voltage-to-current, voltage-to-frequency and their inverses.

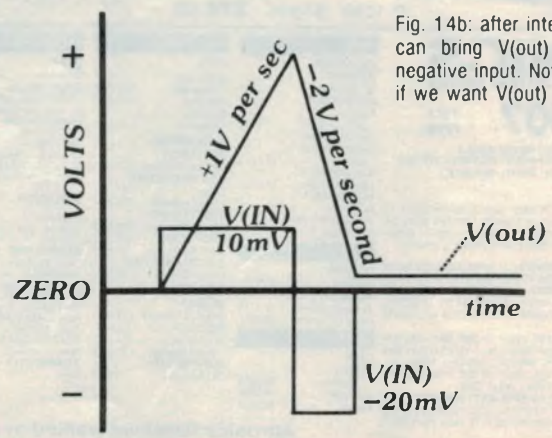
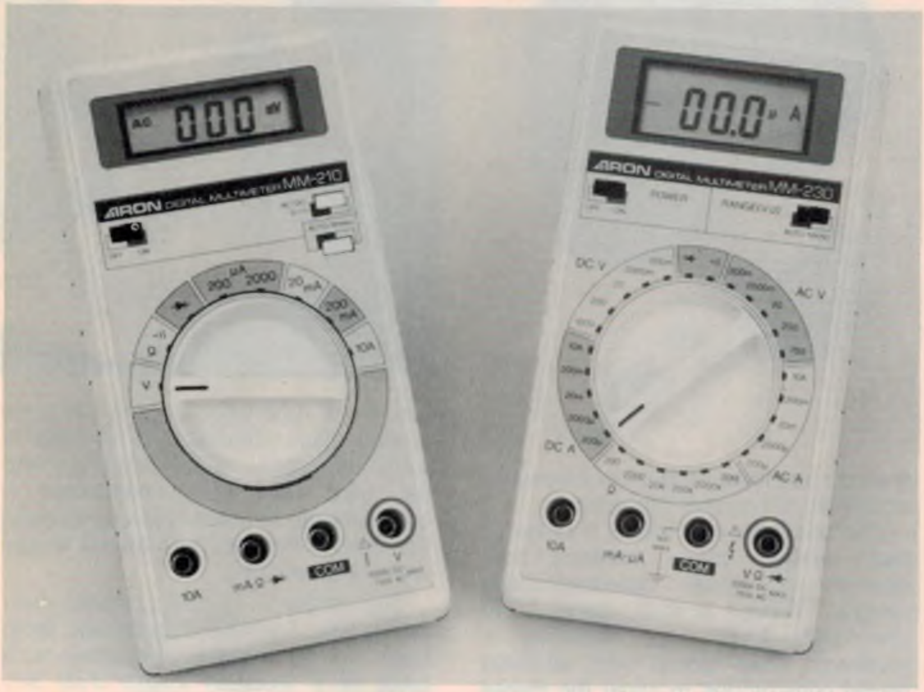


Fig. 14b: after integrating some positive input, we can bring V(out) back down by integrating a negative input. Note that the timing must be exact if we want V(out) = 0V.

New Products...

Product reviews, releases & services



Aaron multimeters from Neotronics

The Sydney firm of Neotronics now have available two digital multimeters made by the Aaron Corporation of Japan. Both are sturdy compact instruments which should appeal to the casual and professional worker alike. One is the model MM-230 and the other the model MM-210.

● The two instruments are similar in many respects. Both use a 3½-digit LCD, both have auto ranging facilities, both cover similar ranges, are built in the same size and style of case, and are supplied with the same type of test leads.

The case is plastic, in brown and white, and measures 167 × 88 × 38mm. It is equipped with a fold away stand or, when flat on the bench, rests on two non-skid pads. All input terminals are recessed.

The test leads are equipped with shrouded plugs which, in conjunction with the recessed instrument terminals, ensure that there are no bare surfaces which might be at dangerous voltages. The test prods are fitted with finger guards to minimise the risk of accidental contact.

The MM-230 uses a 28-position selector switch giving five DC volts ranges (200mV to 1000V), five AC volts ranges (200mV to 750V), five DC current ranges (200μA to 200mA and 10A), five AC current ranges (200μA to 200mA and 10A), six resistance ranges (200Ω to 20MΩ), plus a diode test and an audible continuity test. In the auto range mode this model selects the correct range for voltage or resistance measurements.

The model MM-210 features an eight position selector switch, voltage and resistance ranges being selected automatically. However, a form of manual selection is provided, in the form of a stepping mode, for special applications. Coverage is from 200mV to 1000V DC, 200mV to 750V AC, 200μA to 200mA and 10A, DC and AC, and 200Ω to 20MΩ in six resistance ranges. An audible continuity and diode test are also provided.

Both models feature high input impedence on the voltage ranges, being 1000MΩ on the 200mV range, 11MΔ on the 2000mV range, and 10MΩ on all other ranges. Both are fitted with overload protection and have a response time of 1s maximum. Both operate from two "AA" size cells giving a claimed life of 500 hours. Basic accuracy for (DC volts and Ω) for the MM-230 is 0.25% and for the MM-210 0.75%.

For further informatin contact Neotronics, 314 Lower Plateau Rd, Avalon, NSW 2106. Phone (02) 918 8220.

Light box and timer for home constructors

A problem which plagues the home electronics designer is the lack of "professional" appearance in the finished job. The development of the printed circuit board had greatly simplified the problem of internal appearance while external appearance can also be greatly enhanced by using Scotchcal and Image'n Transfer labels to create unique dials and labels in a variety of colours and materials.

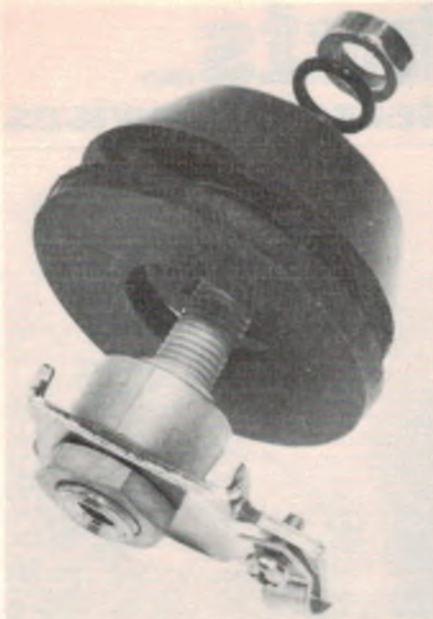
However, producing these items has been no easy task for the home constructor, mainly because an ultraviolet light source has not been available at a reasonable price. A new piece of equipment has now put these techniques within reach of the hobbyist. Melbourne manufacturer Sesame Electronics is producing a UV lightbox, suitable for the prototyper who wants to produce printed circuits and labels one at a time, without paying hundreds of dollars for a machine capable of producing many copies at once.

Called the "Minilight" it is supplied as a complete kit by Sesame for the comparatively low price of $74.95. The kit includes all necessary parts for assembly, and all holes have been drilled by the manufacturer. The unit has a bell timer and two 4 watt blacklight tubes. The output of these is enhanced by reflectors which also spread the illumination evenly. The unit will handle artwork up to 157 × 88mm.

The "Minilight" is available from Sesame Electronics, Box 452, Prahran, Vic. 3181. Telephone (03) 527 8807.

New Products...

Adjustable marine antenna mount



Ease of installation and reliability are all-important in any marine radio installation and the weak link proves to be the antenna mount. To counter this problem the NSW firm of Benelec Pty Ltd offer their new model 2-735 marine antenna mount.

The 2-735 is wholly Australian manufactured of strong white polycarbonate to meet tough local conditions. It features a strengthened mounting base and pillar, strengthened antenna mount, and a special cam-operated lock/unlock lever. This has a positive action and when it locks, it stays locked. It requires only a quarter-turn for locking and unlocking and the lever locks in the down position, preventing accidental unlocking and subequent collapse of the antenna.

The mounting arrangement permits installation of the base on any sloping surface and the range of adjustment always allows the whip to be set in the vertical position. The locking lever does not rotate far enough to hit the supporting surface — a common, and annoying, problem with many marine antenna mounts. All the metal parts are made from stainless steel, preventing corrosion problems. The threaded whip mount is reinforced and takes a standard whip base of one-inch diameter.

The company also stocks a range of high quality vehicle antenna base mounts for mobile communications systems. Typical is their model 2-740 low-profile UHF type featuring a reinforced whip mount with all-metal thread construction to avoid the thread stripping problems encountered with plastic thread construction.

The mounting plate for the 2-740 features four claws for positive vehicle chassis contact and mechanical rigidity. This plate can be removed enabling the base to be used with a general purpose ground plane eliminator. The cable is easily terminated, simply screwing into the base. The outer conductor is automatically terminated in this way and the inner conductor is soldered to the centre whip mount.

The model 2-720 is a similar low-profile type, for VHF installations. Both bases can be supplied terminated with cable of a specified length with any specified coax connector attached at the free end.

For more information, contact Benelec Pty Ltd, PO Box 21, Bondi Beach, NSW 2026. Phone (02) 665 8211.

Professional receivers from Electronic Imports

Vigilant Communications Ltd of the UK recently released a new range of microprocessor controlled professional/military/marine communications receivers through their Australian agents GFS Electronic Imports of Mitcham, Victoria.

This new Micon range of receivers is designed to meet and exceed the very stringent 1983 CEPT (Conference of European Post and Telegraphs) Specification for HF Communication Receivers.

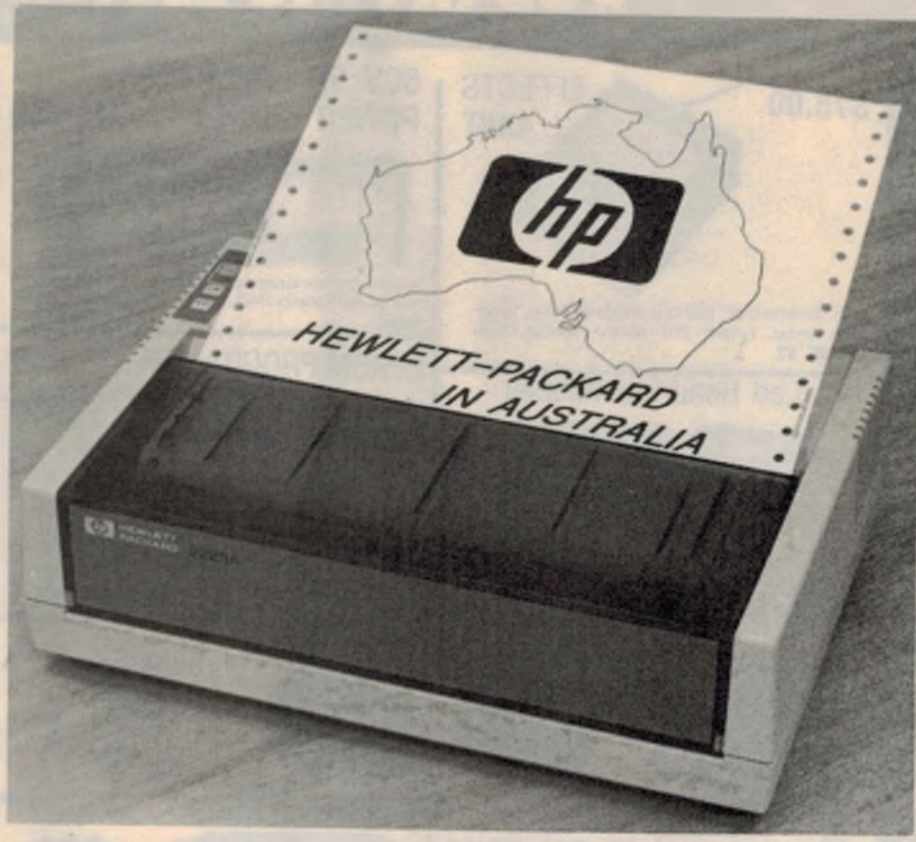
Two versions are available, the Type SR-530 marine communications receiver for type approved marine use providing USB/CW/AM/Telex. It is type approved to British Government specification MPT-1201 February, 1983. The second version, type SR-532 is a professional communications receiver designed for high performance static or transportable use providing LSB/USB/CW/AM and FSK with a teleprinter drive unit. The two versions are identical in all other respects.

Both keypad or dual speed spin wheel tuning are provided for frequency coverage of 50kHz to 29.999MHz. Keypad selection of both mode and filter bandwidth is provided. Filters have –6dB BW's of ± 2.7kHz (wide), ± 1kHz (intermediate) and ± 250Hz (narrow) (optional on SR-532). The Micon range also features a 200 channel non-volatile memory which maintains frequency, mode and filter bandwidth information for each channel. Automatic scanning of any section or the entire 200 memory channels is provided.

For further information contact GFS Electronic Imports, 17 McKeon Road, (PO Box 97), Mitcham, 3132 Victoria. Phone (03) 873 3777, Telex: 38053 GFS.

New Products...

Disposable printhead cartridge from Hewlett-Packard



Hewlett-Packard has introduced a new family of ink-jet printers for use with personal computers which are fast, compatible, clean and quiet. Called ThinkJet, they use a disposable printhead cartridge that takes only a few seconds to replace. The printhead is made up of a liquid ink supply and 12 microscopic nozzles. Each nozzle can supply a drop of ink on demand from the printer as the printhead scans across the paper.

As the ink is used up, the thimble-shaped rubber bladder collapses, providing both a constant back pressure and a way to see how much ink remains in the system. The printhead, which sells for under $12 contains approximately 3ml of usable ink, which is sufficient to print 500 pages of text.

Print quality is enhanced by an 11 × 12 dot character matrix, which provides high-resolution characters in boldface or underlined. ThinkJet prints at 150 characters per second — about 1300 words per minute and has four print pitches.

Graphics resolution is either 96 × 96 dots per inch or 192 × 96 dots per inch and both standard raster or column graphics are available. The unit uses fanfold paper or single sheets. A pin feed mechanism is adjustable to two sizes of paper, American quarto and A4.

For further information contact Hewlett-Packard Australia Ltd, 31 Joseph St, Blackburn, Victoria 3130. Phone (03) 895 2895.

IFR multi-function communications monitor

Vicom Australia Pty Limited has announced the release of a new multi-function, microprocessor controlled communications service monitor produced by IFR Inc USA. Fully portable, the FM1200 covers the range 250kHz to 1GHz with many features and special functions.

Special functions available include: generator/receiver scan, RF memory, tone memory and programmable display intensity. With a microprocessor-based system it has been possible to display analog test responses digitally. The internal non-volatile memories extend the monitoring and automatic testing capabilities to display frequency, frequency error to 1Hz resolution, modulation (both AM and FM), RF power, SINAD, distortion, signal strength, duplex offset and a variety of pulse, tone and tone sequence formats.

Audio generators — one fixed, one variable — generate from 10Hz to 30kHz in sine, ramp, square or triangle wave forms and special functions include encode and decode capabilities for DCS (digital coded squelch).

The spectrum analyser is a versatile 1Hz-1GHz unit with 10 calibrated dispersion selections from 1kHz per division and 300Hz bandwidth up to 1MHz per division and 30kHz bandwidth. The receiver is fully operational during spectrum analyser operation.

Further details from Vicom Australia, 57 City Road, South Melbourne, Victoria 3205. Telephone (03) 62 6931.

ROD IRVING ELECTRONICS

425 HIGH ST, NORTHCOTE 3070 VIC **PHONE (03) 489 8866**

EFFECTS UNIT

$75.00

An "Effects Unit" that can create phasing, flanging, echo, reverb and vibrato effects. **E.A. JUNE '83**

Led Head Lightchaser

(Battery and headband extra)

$12

REMOTE INFRARED TV SOUND CONTROL

$40

Designed to relieve the long-suffering TV viewer from painful, brain-killing advertisements, our TV Sound Control provides remote control of volume. It gives eight steps of control, including full off, when total silence is called for. Give yourself a break and relieve advertising tedium today.

E.A. JANUARY "83".

EA POWER UP

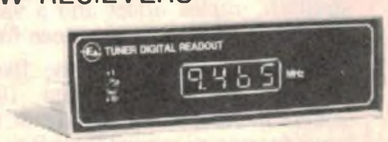
$38.50

EA NOV 1982

EA DIGITAL READOUT FOR SW RECIEVERS

$72.00 COMPLETE

OCTOBER EA 1982



Want to add digital frequency readout to an AM radio or shortwave communications receiver that uses an old-fashioned analog dial? This unit features a bright four digit LED display, 1kHz resolution, and a 0.2s update time that's fast enough to follow the tuning knob.

SPECIFICATIONS

Ranges (full scale): 0-10MHz and 10-30MHz (optional)

Display: Four digit

Resolution: 1kHz with division switch set to divide by one; 10kHz with division switch set to divide by 10

Sensitivity: Less than 100mV from 500kHz to 30MHz

Offset frequency: Prototype set to 455kHz, but any offset frequency can be programmed

50V 5A LABORATORY POWER SUPPLY $140.00

New switchmode supply can deliver anywhere from three to 50V DC and currents of 5A at 35V or lower. Highly efficient design.

EA May, June 1983

EPROM PROGRAMMER $43

No need for a Micro with EA's great Eprom Programmer suitable for 2716/2758 Eproms.

With Textool Sockets $55.00

EA January 82

PH METER

$135

with probes

12/240 volt Inverter 40 WATTS

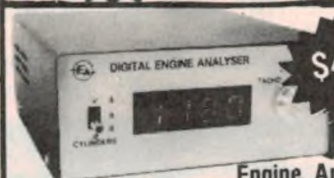
$49.50

MAY EA 1982

BOGGLE GOGGLES

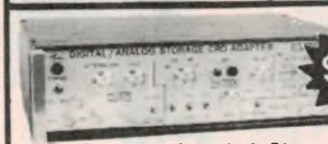
$9.60

Short form



$48.50

Engine Analyser Kit



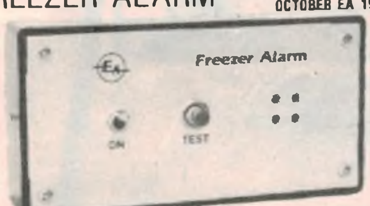
$189.00

Analogue and Digital Storage CRO Kit

EA EASY-TO-BUILD FREEZER ALARM

$21

OCTOBER EA 1982



$89.00

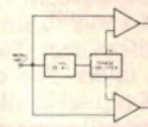
ETI-669 PANGALACTIC EPROM ERASER

If you walk into the restaurant at the end of the universe and tell the bartender you're confused, he'll say "don't panic!, have a pangalactic gargleblaster. It will erase your current existence allowing The Master to reprogram you for another time and space". Well, our little EPROM eraser does a similar job for your 2716s, 2732s, 2764s ... et al. Parts list attached.

$55.00

STEREO SYNTHESISER FOR TUNERS AND VCRs

Enjoy the benefits of stereo sound from your video cassette recorder, TV or AM tuner with this Stereo Synthesiser. The circuit uses just four ICs and is easy to build.



EA ELECTRONIC STARTER FOR FLUORESCENT LAMPS

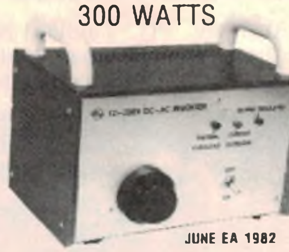
$4.95

OCTOBER EA 1982

OVER 200 NOW SOLD

EA INVERTER INCLUDING TRANSFORMER 300 WATTS

$195



P & P $10.00 Anywhere in Australia

JUNE EA 1982

SPECIFICATIONS FOR 300W INVERTER

Nominal Supply Voltage	12V DC
Output voltage	see table
Frequency	50Hz ± .005%
Regulation	see table
Maximum Load	300VA
Current Limiting	30A (primary)
Efficiency	see table

Resistive load W	Output voltage (RMS)	Input current (A)	Efficiency (%)	Battery life 40Ah/20h rate (minutes)
no load	210	1.2	0	—
40	235	4.5	60	240
100	240	11.3	62	80
140	240	15.0	69	60
200	240	20.1	78	50
240	240	24.0	79	32
300	235	29.6	82	28

48-50 A'BECKETT ST, MELBOURNE 3000 VIC **PHONE (03) 347 9251**

Mail Order Delivery Instructions: Minimum Pack and Post $3.00 for Australia Post. Please allow extra for bigger orders and Certified, Airmail or Registered Post. Minimum order is $5.00. Please address orders to Mail Order Department, PO BOX 235, NORTHCOTE, 3070, VICTORIA. PHONE (03) 481 1436.

New Products...

Silent pager from Motorola

For the businessman in conference, the doctor in consultation and the attorney in court, a "beeping" pager can be embarrassing. To solve this problem Motorola Electronics Australia Pty Ltd has released the Envoy, a tone and visual alert pager with optional vibrating capability.

When in the beeper mode, the Envoy pager emits a loud, clear tone with simultaneously flashing light indictor. In the vibrating mode, only the light indicator is generated.

The Envoy provides two distinct paging alerts when operating through the Telecom Telefinder System and four separate paging alerts when using the facilities of radio common carriers (RCC's). If the page is received while the pager is in the vibrating mode, it will immediately emit a vibrating alert for 10 seconds and then store the message.

Additional information from Motorola Australia Pty Ltd, 666 Wellington Road, Melbourne, VIC 3170 and can be purchased or rented from Motorola offices throughout Australia.

Slim line hand held two-way radio

Robert Bosch (Australia) Pty Ltd has launched a new range of hand held two-way radios. Designated as types HFG 84 and HFT 164, they are multi channel frequency synthesised radios for the VHF low and high bands. They are slim line, dust and splash proof. The frequency synthesiser provides 32 channels, and can be used in simplex and semi-duplex communication networks.

Frequencies are programmed via a flexible EPROM. The HFG 84 operates in the VHF low band (68-87.5MHz), the HFG 164 in the VHF high band (148-174MHz). Transmitter power is internally adjustable between 0.1-1W or 1-2.5W. Five tone selective calling is available as an option and can be internally field programmed for either ZVEI or CCIR tone groups.

A comprehensive range of accessories allows the radio to be used in a variety of systems. The following accessories are available: 800mAh rapid charge NiCd battery; automatic rapid charger units; battery adapters; vehicle mounting charging; carrying cases; carrying straps and harnesses.

For further information, contact: Weston Communications Group Pty. Ltd, 31 Coventry Street, South Melbourne, Victoria 3205. Telephone (03) 690 7233.

High contrast liquid crystal displays

Promark Electronics has released a new, high contrast liquid crystal display range previously unavailable in Australia.

In addition to the increase in contrast, these displays feature special seals to resist high humidity levels, and a range of fluid types, suitable for a wide range of operating temperatures both above and below previous limits. Dichroic displays are available, offering designers a wide range of colours. A variety of reflectors or transflectors are also available.

The displays are available in both static-driven and multiplexed form, featuring many wanted symbols such as "Lo Batt" and over-range indicators.

Custom designs are readily achievable, with three weeks turn-around-time offered. A comprehensive range of compatible driver ICs is also available.

Further details from Promark Electronics Pty Ltd, PO Box 115 Nunawading, Victoria 3131. Phone (03) 878 1255.

Ready for a new challenge?

Build yourself a 2m transceiver

So many amateurs who built our UHF 'Explorer' kit have written in and asked us for more. They were delighted to be able to build something again – instead of buying a 'black box'! But they wanted more . . .

Here it is: A brand new all-Australian designed 144-148 MHz build-it-yourself transceiver: the VHF Commander from Dick Smith Electronics.

Featuring . . .

- 10W minimum output (typically 15W)
- 400 channels between 144 and 148MHz plus a +5kHz switch
- Standard repeater splits built in plus "anti" switch
- Direct frequency readout from thumbwheel switches (no difficult-to-read LEDs!)
- Built-in S & power meter
- Complete kit including deluxe case, screened front panel plus solder masked pcb with component overlay.
- And just in case you get into trouble: our exclusive 'Sorry Dick, it doesn't work' service for one fixed fee.

Go on – give it a go: there's no better way to get on to 2 metres. Learn while you build!

Have you ever heard anyone say they're operating 'home brew' on 2? Here's your chance!

Brief Specifications

Coverage:	144-148MHz in 10/5kHz steps
Mode:	F3, up to 10kHz deviation (normal operation 5kHz)
Supply:	12-15V DC, 110mA-300mA receive, 2.5A transmit
Power output:	10W minimum, typical 15W or more
Protection:	3A in-line fuse, reverse polarity protection. Can withstand 5:1 VSWR (inc short/open circ) for 2 minutes; audio can withstand open circuit indefinitely and momentary short circuit.
Transmitter	
Distortion:	Less than 10% at 3kHz deviation
Spurious:	Better than 60dB below carrier.
Harmonics:	−60dB
Receiver	
Sensitivity:	Max 0.5uV for 12dB SINAD (typically 0.4uV)
Selectivity:	60dB at ±25kHz
Audio:	1 watt output into 8 ohms response 6dB/octave, de-emphasis from 1kHz

Cat K-6308

BUILD IT YOURSELF AND SAVE!!!

Includes comprehensive instruction manual plus mounting hardware.

All this for only . . .

$199.00

As described in Electronics Australia, June 1984 issue

DICK SMITH ELECTRONICS

A764/KT

New Products...

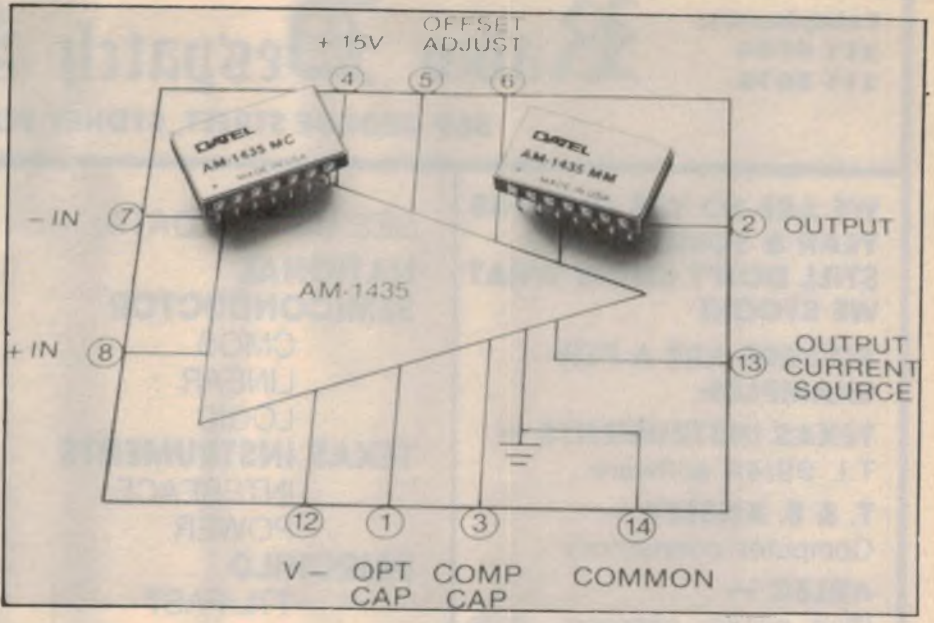
Automatic IC tester from Elmeasco Instruments

Elmeasco Instruments Pty Ltd has released a new automatic digital IC tester. Designated the MATE TC2000 it is an automatic functional tester programmed to test about 1600 devices including: 54/74 series (TTL and high speed CMOS), 1800/4000 series CMOS, 55/75 series TTL.

A simple alphanumeric keyboard allows selection of devices to be tested, test mode and device key-in. To test requires pressing at the most five keys on the console, eliminating the need for plug-in test modules, adapters, complex programming, device cross referencing etc.

The Mate TC2000 will test 8, 14, 16, 18 and 20 pin DIL ICs. Complete truth table functions are automatically performed. The unit incorporates self-test circuitry which operates on power up, plus an "auto-search" function to identify unknown or otherwise unidentifiable devices. For high volume, fast throughput the MATE TC2000 is provided with an interface cable to connect to an automatic handler.

Elmeasco has also announced the availability of an ultra-high speed wideband operational amplifier from Datel. Designated AM-1435 it is an ultra-fast settling wideband operational amplifier that is directly interchangeable

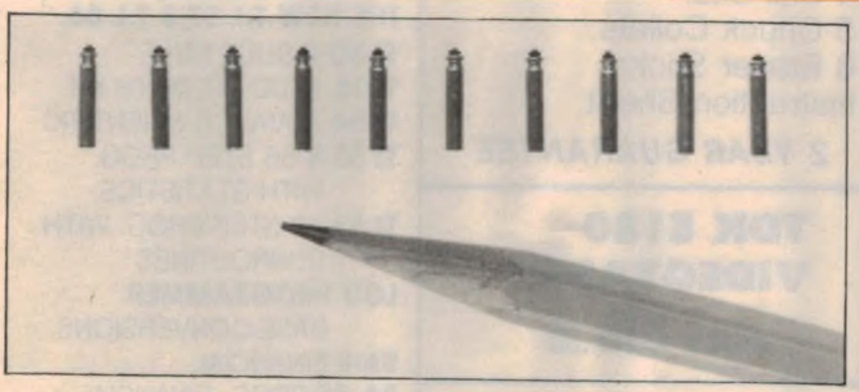


with competing devices of the same type. It provides high open loop gain (100dB), flat frequency response beyond 10kHz and a 6dB/octave roll-off to beyond 100MHz. Gain bandwidth product is typically 1GHz and slew rate is 300V/μs.

DC characteristics include 1MΩ input impedance, initial offset voltage of only ±2mV and an input offset voltage drift of ±5μV/°C. Minimum common mode rejection ratio is better than 80dB and full power frequency is 8MHz minimum. Output voltage swing is ±5V minimum at 10mA load current and the AM-1435 is stable with capactive loads up to 1000pF.

The AM-1435 is an ideal choice for applications requiring high accuracy in the amplification of complex, wideband waveforms. Typical applications include radar and sonar signal processing, video instrumention and ultra-fast data acquisition systems.

Further information is available from Elmeasco Instruments Pty Ltd, 15 McDonald St, Mortlake, NSW, 2137. Telephone (02) 736 2888.



Pin-type battery from Matsushita

Matsushita announced recently that it had begun production of what it claims is the world's smallest pin-type lithium battery, just 2.2mm in diameter and 11mm long. The 3V battery is designed for use in wrist watches, calculators, toys, and possibly "smart cards" plastic credit cards with on-board electronic memory.

The first use of the miniature battery, however, is likely to be in small fishing floats for use at night. The floats with a LED and battery, make it easier to detect movements of the fishing line.

Electronics Australia reviews the

LEADER LSG-216 RF Signal Generator

RF signal generators certainly don't look like the instruments of yesteryear. Here we review the Leader LSG-216 which is digitally controlled and fully programmable.

The LSG-216 is a smart looking RF signal generator produced by the Leader Electronics Corporation of Japan. The LSG-216 is capable of producing AM, FM and CW test signals over the ranges 100kHz to 30MHz and 75MHz to 115MHz. Most of the readouts are digital and virtually all the controls act through logic circuits rather than directly.

The front panel is finished in a cream colour with black lettering for the control legends and grey reverse lettering for control highlighting. The case is made completely from metal and is very solidly constructed which will allow other equipment to be stacked on top if necessary.

Basic physical parameters are; dimensions of 400 × 300 × 100mm (W × D × H), a weight of 7kg and a power consumption of around 25W.

The front panel of the LSG-216 is divided roughly into two sections — upper and lower. Front panel controls and indicators along the upper section (from left to right) are: power on-off switch, a small meter and associated range switch which indicates modulation depth (for AM outputs) or frequency deviation (for FM outputs) and a large darkened plastic panel behind which are green seven segment LED displays for address indication (more about this later), output frequency and output voltage (in dBμ).

The lower section of the front panel is grouped into four smaller sections which are titled: Modulation, Program, Freq Up/Down and Output.

The modulation section contains (as would be expected) controls for applying modulation to the output signal of the LSG-216. Both amplitude modulation (AM) and frequency modulation (FM) may be applied to either frequency band. There are 10 pushbutton switches and two screwdriver presets. The presets control the amount of modulation applied in either AM or FM modes and are usually set to provide standard modulated outputs from the generator (eg 75kHz deviation for FM or 30% modulation for AM).

Each pushbutton switch has an associated LED which illuminates when the switch is activated. Six of the pushbuttons control modulation of FM signals. They allow either a mono or stereo signal to be generated, a 19kHz pilot to be added or removed and modulation to be applied to either the left channel, right channel or the Main signal or Sub signal.

Of the remaining four pushbuttons, two select between AM, FM and CW (continuous wave or no modulation) while the third selects an external modulation source. The fourth pushbutton changes the internal modulation source between frequencies of 400Hz and 1kHz. External modulating inputs are applied via two BNC sockets mounted on the left hand side of the modulation section.

The upper socket is used to apply external modulation to AM signals, mono FM signals for the left channel of a stereo FM signal. The lower socket is used to apply external modulation to the right channel for stereo FM signals. The maximum external modulation voltage is 5V peak-to-peak and the modulation frequency range is 20Hz to 100kHz (with carriers more than 1MHz) for FM signals and 20Hz to 10kHz for AM signals.

The Freq Up/Down section has two controls only, a pushbutton "digit select" and a rotary "Up/Down" control. These controls work in a fairly novel way to change the output frequency of the LSG-216. The output frequency is displayed by six seven-segment displays. At the top right hand side of the five least significant digits of the frequency display are small green LEDs. The LEDs are activated in turn by touches of the digit select button, each touch moving the LED activation one step to the right.

When the LED adjacent to a particular digit is activated, that digit may be altered by rotating the Up/Down rotary control. Rotating the control clockwise causes the digit to increment while rotating the control anticlockwise decrements it. Incrementing the digit past nine or decrementing it past zero affects the digits leading the one being changed. This is an advantage for it often saves time when making small changes in frequency.

As an example say we were on 2.00MHz and wished to go to 1.98MHz. We would simply select the second zero in the 2.00MHz reading with the digit select button, then decrement it by two with the rotary Up/Down control. The display (and output frequency) would then automatically change to 1.98MHz. This is much faster than having to change each digit one by one.

The output level of the LSG-216 is controlled by two pushbuttons and a single rotary control grouped in the extreme righthand section labelled "output". The pushbuttons are labelled "10dB" with arrows to indicate whether it is an increase or decrease. The rotary control is indented with each step giving a change in level by 1dB.

The output level is indicated on a two digit LED display. The output range is $-9dB\mu$ to $99dB\mu$ ($0dB\mu = 1\mu V$) which correspond to open circuit output voltages of $0.35\mu V$ to 89.1mV respectively. To set a particular output level, the 10dB buttons are pushed until the output is in the correct decade, then the rotary control is used to set the exact level.

Because the output of the LSG-216 is specified into an open circuit, the actual output level will not correspond to the indicated output level. Since it is usual to terminate the signal generator output with a 50Ω load, the signal generator output will normally be six decibels lower than the display indication.

The program section takes up most of the centre area of the front panel and contains two "thumbwheel" type address switches, a large, rotary address increment/decrement control, a pushbutton numerical keypad and eight pushbutton function switches.

Both the output frequency and the output level may be altered using the program controls. When the level or freq buttons are activated, the numerical keypad may be used to enter a required output level or frequency. This feature is very useful and in practice was generally the quickest way to change both output level and frequency.

The program section is equipped with 100 memory locations which may be used to store control settings used during a particular measurement. One memory location can store full details of LSG-216 control settings including the output frequency, output level and modulation so up to 100 test setups may be stored.

The thumbwheel switches are used to set the particular memory location (or address) at which the control settings are to be stored. Once the thumbwheels are set, the local, set, address reset and store keys are operated in that order and the present control settings or the LSG-216 are stored in memory. If another control setup is to be stored, the thumbwheels are set to the new memory address, the LSG-216 controls altered to the new settings, then the local, set, address reset and store keys operated. The above procedure is repeated until as many control setups as required are stored.

To recall control setups from memory, the recall key is first pressed then the rotary, address increment/decrement control is adjusted until the LED address indicator shows the address at which the required control settings are stored. The LSG-216 automatically sets its output controls to match the settings stored at the address shown by the LED address indicator.

The speed at which complete control setups may be recalled makes the program feature very attractive for factory or laboratory situations where it may be necessary to perform the same sequence of tests on many pieces of equipment. The generator outputs for each test may be programmed into the LSG-216 and recalled when desired with no possibility of mistakes. A rechargeable battery inside the LSG-216 maintains power to the memory when the LSG-216 is disconnected from the mains. According to the handbook, the battery will protect the memory from erasure for a month.

The rear panel of the LSG-216 holds sockets for a range output, a ROM (read only memory), a remote control and a ground connection.

The range output is an RCA socket at which a high (5V) logic level appears when the LSG-216 is switched to the 75MHz to 115MHz band and a low (OV) logic level appears when the LSG-216 is switched to the 100kHz to 30MHz band. This output may be used to control other equipment such as a signal selector (or RF switch).

The ROM socket allows an externally programmed EPROM to be plugged into the LSG-216 and this used to control the output. The handbook is not too specific on the purpose of the ROM, however since it cannot be erased or altered by the LSG-216 we imagine one use could be to hold long test sequences so that they are safe from accidental erasure or change.

An Amphenol socket is provided for connection of a remote control unit. The remote control unit is available as an optional extra from Leader however connection details and timing diagrams for the remote control are given in the handbook so it would be quite possible for someone with a knowledge of electronics to duplicate the remote control.

Several optional accessories are available for the LSG-216 (in addition to the remote control and ROM mentioned earlier) and these are a dummy antenna, a loop antenna, a band splitting filter and signal selector.

During our tests we found the LSG-216 an extremely easy instrument to use. The output frequency proved to be very accurate as did the output attenuator. Long term drift was very low and changes in frequency were made quite quickly with no amplitude "bounce".

In summary, we are sure that the Leader LSG-216 will find many applications in the testing and repair of commercial communications equipment. It has less application as far as hifi FM stereo receivers are concerned as these generally have a performance specification which exceeds that of the LSG-216. With that proviso, the LSG-216 is a fine instrument which is well priced at $1902 plus sales tax where applicable.

Further information on the LSG-216 signal generator can be obtained from the Australian distributors of leader equipment, Amalgamated Wireless (Australasia) Limited, 422 Lane Cove Rd, North Ryde 2113, NSW.

Books & Literature

Analog electronics for microcomputers

ANALOG ELECTRONICS FOR MICROCOMPUTER SYSTEMS: by Paul Goldsbrough, Trevor Lund and John Rayner. Published by Prentice-Hall of Australia Pty Ltd, 1983. Soft covers, 136 × 214mm, 438 pages, illustrated with diagrams. ISBN 0 672 21821 6. Recommended retail price $31.50.

Part of the Blacksburg education series, this book covers the analog electronics principles involved in interfacing microcomputers for applications in control and monitoring of a variety of processes. Analog input systems, analog components of microcomputers and power supplies are described in three "modules", with basic theory and practical circuits fully explained and illustrated.

Analog input systems are covered in the first seven chapters, with topics such as data acquisition, the principles of transducers, signals and noise, signal conditioning, signal processing and analog to digital conversion. Each chapter begins with an overview of the topic and concludes with a list of references for further reading.

The second section of the book deals with the AC characteristics of microcomputer systems, with chapters covering the electrical properties of microcomputer ICs, bus systems and analog components. Topics include microprocessor timing conflicts, bus transmission effects and the design of crystal controlled clock oscillators and reset circuits.

Part three of the book concerns power supplies for microcomputers and voltage reference sources, with specifications and complete design criteria provided.

Three appendices reinforce the main text, with details of unusual transducers, the theory and design of switch mode power supplies and voltage and current specifications of digital ICs.

Overall, Analog Electronics for Microcomputer Systems is a useful book for the hobbyist or student. It brings together in one place material which previously could only be found scattered through textbooks, data sheets and manufacturers' application notes. Recommended for anyone involved in the design or construction of microcomputer systems or control interfaces.

Our review copy came direct from the publisher. (P.V.)

The Penguin book of MicroBee games

THE PENGUIN BOOK OF ... MICROBEE GAMES by David Johns and Tim Hartnell ISBN 0-14-007891-6
COMMODORE 64 GAMES by Robert Young and Paul Copeland ISBN 0-14-007890-8
VIC 20 GAMES by Paul Copeland ISBN 0-14-007888-6
APPLE GAMES by Rohan Cook and Tim Hartnell ISBN 0-14-007889-4
Published by Penguin Books Australia Ltd, 1983. Soft covers, 188 × 245mm, average 130 pages each, with program listings reproduced from dot matrix print out, $12.95.

These books mark the start of a new publishing venture from Penguin Books in conjunction with Tim Hartnell, perhaps the most prolific writer on microcomputers. Each volume contains from 16 to 27 program listings accompanied by a brief introduction to each particular game, plus some useful utility programs and a section on how to write your own games programs.

The MicroBee book, for instance, provides 26 program listings, divided into space battles, adventure type games, novelty programs, gambling games and simulations. The book for the Commodore 64 has listings for 17 games programs, including "Gamblers Delight", "Magic Square", "Red Alert" and "Noughts and Crosses" plus appendices with programs for setting up menu selections, cursor positioning and creating your own games programs.

We haven't tried out any of the programs so we can't report on this aspect. Each book is written by an experienced user of the particular computer and all are edited by Tim Hartnell. At $12.95 each, they represent good value if you're prepared to put in the effort of typing in the program listings.

If you have the computer covered by a particular book these volumes seem like a low cost way of building up a collection of games and perhaps learning a little about how programs are written. All review copies came direct from the publisher, Penguin Books Australia Ltd, PO Box 257, Ringwood, Vic. 3134. (P.V.)

Amateur satellite handbook

THE SATELLITE EXPERIMENTER'S HANDBOOK: by Martin R. Davidoff, K2UBC. Published by the American Radio Relay League, 1984. Soft covers, 208 × 276mm, 207 pages, copiously illustrated with photographs, diagrams, and maps. IBSN 0 87259 004 6. Recommended Australian price, $18.15.

This book is aimed primarily at the radio amateur, and specifically at those amateurs who are interested in listening to, or communicating through amateur sponsored satellites.

According to the jacket notes the book provides ". . . under one cover, all you need to know to communicate through or pick up signals from orbiting satellites. Whether your interest is in amateur radio, weather, or TV broadcast spacecraft, you'll find what you're looking for . . ."

While the "all you need to know" may sound a little boastful, the truth is that the book does contain a vast amount of satellite data. And, while much of it may have been covered before in individual articles, this is the first time we have seen it all assembled in one volume.

The chapter headings give some idea of the contents. 1, Some Preliminaries; 2, The Early days; 3, Past/Present/Future; 4, Getting Started; 5, Tracking Basics; 6, Ground Station Antennas; 7, Receiving and Transmitting; 8, Satellite Orbits; 9, Tracking Orbits; 10, Satellite Radio Links; 11, Weather, TV, and Other Satellites; 12, Satellite Systems; 13, So You Want to Build a Satellite. There are also several extensive appendices.

Quite apart from the rest of the book, the first three chapters provide a most interesting history of artificial satellites, starting with Russia's Sputnik I in 1957. The history of the amateur satellites, which started as an impossible dream, is no less intriguing.

The Australian reader must appreciate that the book is written for the American scene and that some things, such as specific tracking data, locator maps, etc, are of little value in this country. Allowing for this, the book would still appear to be an extremely useful one and, at the price quoted, very good value.

Our copy from Technical Book and Magazine Company Pty Ltd, 289, Swanston St, Melbourne Victoria, 3000. (P.G.W.)

UHF/VHF manual

VHF/UHF MANUAL: Edited by G. R. Jessop, G6JP. Published by the Radio Society of Great Britain, Hertfordshire, England. Hard covers, 528 pages, 246 × 184mm. Illustrated with circuits, line drawings, and photographs. ISBN 0 900612 63 0. Recommended Australian price $24.95.

This is the latest (1983) edition of the RSGB's VHF/UHF Manual, the fourth since its introduction in 1969, and the first since 1976. The RSGB manuals in general, and this one in particular, have always been regarded as technical reference books of very high standing, and this latest one would appear to uphold, and possibly enhance, this reputation.

While all the traditional basic material and theory has been retained, the text has been extensively updated to take into account the latest technology and hardware, available to the amateur, particularly solid state devices.

The chapter on receivers is quite extensive and, while commercial units tend to predominate on VHF these days, there is a constructional article of a 144MHz receiver incorporating a phase-locked loop local oscillator, incremental tuning, and a digital frequency display.

At a lesser level there are a number of interesting circuits for converters, RF amplifiers and similar ancillary devices well within the constructional capabilities of most amateurs.

Much the same applies to the chapter on transmitters, with a wide range of power amplifier circuits both valve and transistor, to tempt the home builder. Some designs include full size printed board patterns. There is also a section on amateur TV.

There is too much to review in detail, but the chapter headings will give some idea of the book's scope. (1) Historical perspectives. (2) Propagation. (3) Tuned circuits. (4) Receivers. (5) Transmitters. (6) Integrated equipment. (7) Filters. (8) Antennas. (9) Microwaves. (10) Space communications. (11) Test equipment. There is also a copious data appendix.

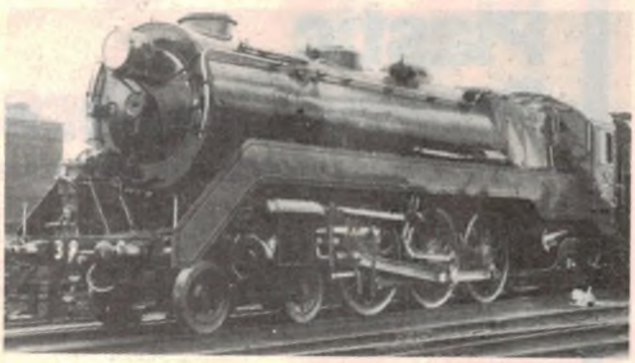
Of these chapters, those on filters, antennas, and test equipment provide particularly interesting reading, while the data section will prove invaluable as a source of formulas, codes, graphs, plug and socket dimensions, etc.

In summary this is a first class technical text book which should form a part of every serious amateur's library. And for those still studying for their ticket, this will prove an invaluable reference book to supplement your study course.

Highly recommended.

Our copy direct from the publishers, but is available in Australia from Dick Smith Electronics and other technical bookstalls. (P.G.W.)

Next month in Electronics Australia*



No-holds-barred model train controller

If you fancy building a no-holds-barred train controller, September Electronics Australia has the ideal circuit.

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● pulse power for reliable running ● excellent speed regulation ● full short circuit protection with visible indicators ● variable inertia and braking plus direct drive for shunting ● provision for walk-around throttle ● adequate power for double and triple heading ● fixed 15VAC and 12VDC for lighting and accessories.

Teletext decoder

Next month, we intend to publish the complete circuit diagram of our new Teletext Decoder and give you a close look at the final version. In the meantime, you can order your kit from Dick Smith Electronics so that you will be ready to begin construction.

Electronic ignition system

Our latest electronic ignition uses a Siemens Hall Effect device and a rotating vane assembly from Bosch. The system is easy to install and is especially suitable for Australian 6 and 8-cylinder cars.

Sanyo CP-400 CD player

New from Sanyo, the CP-400 is a fully-featured compact disc player with infrared remote control. We review this interesting newcomer in September Electronics Australia.

* Although these articles have been prepared for publication, circumstances may change the final content. However, we will make every attempt to include the articles featured here.

50 and 25 years ago...

"Electronics Australia" is one of the longest running technical publications in the world. We started as "Wireless Weekly" in August 1922 and became "Radio and Hobbies in Australia" in April 1939. The title was changed to "Radio, Television and Hobbies" in February 1955 and finally, to "Electronics Australia" in April 1965. Below we feature some items from past issues.

Wireless Weekly 3d

August, 1934

Listeners fight interference: With encouragement from "Wireless Weekly" and the enthusiasm of Mr W. Showell, a Radio Listeners' League has been formed in Wollongong. At the initial meeting, a surprising amount of work was done toward the eliminating of interference, which is as bad in Wollongong as in most other places. So that all might enjoy the benefits of membership, the fee has been fixed at 2/- per annum. Local municipal council and the railway authorities have been communicated with to assist the league in its endeavour to locate the causes of interference.

Ship launched by wireless: The launching of a 17,000-ton motor vessel, "Bloemfontein," for South African trade, at Amsterdam, was done by wireless by the Prime Minister of the South African Union, General Hertzog, from Pretoria.

For this event Philips had installed at Pretoria a line leading to the Post Office at Pretoria, where it was in radiotelephonic communication with England. From there communication was established with Amsterdam.

At about midday, General Hertzog pressed a button, which caused a gramophone record to reproduce a certain note. A relay responded to the note causing a bottle of champagne to be smashed against the ship's side and removing the last obstacles to the slipping-down of the ship.

Polar explorers: Quite a number of our readers have experienced the thrill of listening on their shortwave receivers to the interesting broadcasts originating with the Byrd Expedition now at Little America, in the South Polar regions, but few realise that in that far-away land of perpetual snow, Admiral Byrd and his valorous assistants are constantly in touch with the outside world by shortwave wireless. Regular broadcasts are exchanged between Admiral Byrd's transmitter and several American stations, whilst the AWA station at Sydney is also in constant touch.

Wot, no VCR? Invited by an American journal to say what broadcasting would be like in a hundred years, Dr Alfred N. Goldsmith, former Chief Engineer of the RCA, said: "Rising from my breakfast in June, 2034, I saw a pile of paper sheets, beautifully printed in colour. These were the radio facsimile-recorded summaries of television-scenes. If I miss events of the day by television, I can review them in facsimile."

Ultra-short waves in the air: At the Orly Flying School, France pupils communicate by telephony on ultra-short waves with the ground or other 'planes in the air at ranges from 15 to 50 miles; in the concluding stages of a flying course, the instructor directs his pupil by radio from the ground.

RADIO TELEVISION AND HOBBIES 2/6

August, 1959

First British nuclear sub: The first British nuclear-powered submarine has commenced construction, and the "keel" was officially laid by the Duke of Edinburgh on June 12 at the Barrow-in-Furness yards of Vickers Armstrong (Shipbuilders) Ltd.

The submarine will be fitted with a nuclear power plant similar in design to that now used in the latest American submarines of the "Skipjack" class.

Valves still needed for some jobs: International General Electric Company has unveiled an advance design of transistorised two-way radio equipment which it claims contains the highest powered transistorised models, the smallest sizes and the lowest battery drain ever to be made commercially available in the mobile communications field. The equipment will be available in units up to 75 watts. From the 75 watt category, the line ranges downward to 30 and 10 watt units in sizes as small as $8^{5}/_{8}$in wide, 12in long and 4in high.

The new line contains the fewest valves of any mobile radio equipment now marketed. Only three are used in lower wattage categories and four in 30 and 75 watt models.

The first units to come off the production line will be manufactured for use in the 150-174Mc band.

Preparing for the space age: Among the frequency allocations to be debated at the ITU conference in Geneva later this year are those set down for communicaton to space ships and satellites.

The frequency allocations under discussion will be valid for the next 11 years, during which time it is expected that they will be required for this new service.

The channels will allow for communication both between the earth and space ships, and between the ships themselves.

They are mostly at very high frequencies where no difficulty is anticipated in covering considerable distances with low power.

Proximity warning for cars: Information on an experimental proximity warning radar for use in cars appears in a recent issue of "Electronics". The unit transmits a narrow unswept CW beam in front of the car. The beam is reflected by any solid object in the car's path. Warning signals can be conveyed to the driver either aurally or by indicator lights — green for clear, flashing red for danger.

It is believed that the system will be valuable in preventing accidents on turnpikes, super highways and expressways, where it would warn a driver when he is approaching a car or object too closely or too rapidly.

The doppler radar is sensitive to objects up to 1000ft ahead of the car. A reflex klystron is used to generate power at 16,140Mc, which is piped through wave guides to the feed horn of the transmitting antenna.

REVIEWS OF RECENT

Records & Tapes

CLASSICAL • POPULAR • SPECIAL INTEREST

RACHMANINOV

Piano Concerto No. 2 in C minor. Vladimir Ashkenazy (piano) and the Moscow Philharmonic Orchestra conducted by the late Kyril Kondrashin. Decca jubilee Stereo Analog disc JB 52.

It sometimes happens that an artist interprets a work well-known to his listener with details so different from those he — the listener — expects that he disapproves here and there, yet finishes by finding the piece enjoyable just the same.

This reissued Ashkenazy doesn't quite fill this function but it has its eccentricities in plenty. Chiefly these are a matter of unusually slow tempos, occasionally so slow that one finds oneself muttering "for heavens's sake get on with it".

This concerto, of course, gives the soloist plenty of opportunities to display some brilliant virtuosity — never overlooked by Ashkenazy here! There are also some breath-taking climaxes. But generally speaking Ashkenazy's performance lacks the panache expected from this so often recorded work.

It has been performed and recorded so often that it has had time to develop a style of its own to which most performers conform, but this is certainly not the case here. In contrast to the slow passages the fast ones seem to be rushed, and vice versa. Both are impressive but together they just don't make sense.

Rubatos abound but I must admit they are never made in a way that distorts the composer's line of thought. And doubtless due to the age of the original issue the sound tends to be a little archaic by modern standards. And when Ashkenazy is not dazzling us with his technical brilliance he reverts to a kind of melancholy that is peculiarly Russian. This mood is hard to describe but you will recognise it as soon as you hear it.

After the disastrous premiere of Rachmaninov's First Piano Concerto due to an outrageous performance by Glazounov who, Rachmaninov declared was drunk in charge of the orchestra, this Second Concerto, composed some three years later, acted as an introduction of the young Rachmaninov to the west. But not quite in the way Ashkenazy plays it here.

One feels that his interpretation is part of a well-considered plan and not just a matter of a stray bar here and there. And I'm afraid he goes further in his own strictly personal way than I am prepared to accept, especially when some better rival performances are remembered. (J.R.)

SCHUMANN

Piano Concerto in A minor. Sviatoslav Richter (piano) and the National Philharmonic Symphony Orchestra of Warsaw conducted by Witold Rowicki. Introduction and Allegro Appasionato in G Major, Op. 92 played by the same artists. Novelette in F Major; Toccato in C Major (Richter/piano). DGG Resonance 2535 181.

I can't remember just what recording introduced the Russian pianist to the west but I do recall that all who heard it realised that another bright star had risen in the east and the west was stunned with admiration.

All this happened back in the late 1950s or early '60s and since then Richter has made many recordings of various composers, some superb, some occasionally not quite up to his best standard but, generally speaking, all of a consistently high standard. He has emerged with one fact firmly etched on to the world's musical consciousness, that he is a peerless interpretor of Robert Schumann's music.

A confirmation of this large-sounding statement is to be found in his performance of the main work in this recital. The concerto is not a difficult work technically but the music's texture is so responsive to the slightest variation in the way of a modification, however light, that it is immediately appreciable.

It is in these tiny personal touches and general appreciation of the whole that Richter's smallest nuance is not only elegant: it fits seamlessly into place.

The whole performance is a masterpiece of style. Its generous romanticism is never allowed to become tediously sentimental. Nowhere will you find any excess. The slow movement never loses its dignity: the Finale is a joyous romp. And everything is in the most beautiful proportions.

The Warsaw's contribution gives the soloist exactly what he needs. The engineering is old but I wouldn't change it in favour of the finest sound recorded nowadays. (J.R.)

STRAUSS

Four Last Songs together with six other less important lieder. Jessye Norman (soprano) with the Gewandhaus Orchestra of Leipzig conducted by Kurt Masur. Philips Stereo Analog Disc 6514 322.

Among the fairly recent of the many recordings of these songs to come my way, my favourite has been the Schwarzkopf. The quality of her voice remains as pure as ever, her wide range still immaculately and effortlessly covered.

Now another has come along that I

enjoy much more. The newcomer is this Jessye Norman disc backed by the Gewandhaus Orchestra of Leizpig.

My preference has nothing to do with technique: my homage goes to the sheer nobility of Norman's voice, unmatched since the old recording of the songs by Flagstad so many years ago. Norman seems to capture so persuavily the autumnal quality of the pieces.

Here is no handshake of farewell but the warmest of embraces. I am not exaggerating when I write that I was completely entranced when I listened for the first time and my enjoyment has remained unaffected at every repetition.

I will not comment on the four songs separately. For me there is only one word to describe them — perfect. A word of the highest praise, too, for the support afforded Norman by the Gewandhaus Orchestra under Kurt Masur. No one could desire better. Importantly, the balance between voice and orchestra is impeccably sustained throughout.

In addition to the Four Last Songs equally enjoyable performances of the other lieder are also provided: Cecile, Morgan, Wiegenlied, Ruhe Meine Seele, Meinem Kinder and Zueignung. The accompaniments to these were arranged for orchestra by Robert Hegger. (J.R.)

ELGAR

Violin Concerto in B Minor. Ytzhak Perlman (Violin) with the Chicago Symphony Orchestra conducted by Daniel Barenboim. DGG Digital Analog Disc 2532 035.

Here again, as in the case of Jessye Norman, we have to go back to the early days of LP to find a comparison with a present day performance. I am, of course referring to the great performance of this work recorded so many years ago by the boy Menuhin and its elderly composer Elgar.

It has been splendidly recorded many times since but I am always drawn to the Menuhin/Elgar disc despite its somewhat archaic sound nowadays. I have given much thought to what makes Perlman's version differ so much from all his competitors'. Here is the result for what it is worth.

The Perlman reading is essentially a happy one. So was Menuhin's. It also established the concerto as a work of world standard proportions. So does Perlman's. Dazzling as is Zuckerman's technique on another disc, Perlman's is still more blinding. Add to this the bonhomie of Kreisler — to whom the concerto was dedicated — and an overall sweetness of tone and you have the Perlman as I see — or rather — hear it.

When a critic finds himself up in the rarefied air of comparision between such great violinists as Perlman and Zuckerman he is in danger of being challenged to compare bar by bar his reasons for preferences. In this case my answer would be that Perlman's technique enables him to play even the most difficult bars with an insouciance unmatched by any of his rivals. Any of them.

He flings multiple stoppings around with the ease of a C Major scale. Then there is the quality of the recorded sound. True, the original Elgar/Menuhin engineering is right out of the running here. But despite the Elgarian lusciousness of some of the previous recordings, in terms of that under review — the first digital — the Perlman responds gratefully to the digital's clarity.

I would however have preferred the soloist to have been placed ever so slightly further away from the mike so that some of Elgar's inspired scoring might have been heard better.

I feel that whenever there is a Zuckerman/Perlman contest, Perlman's will always have the weight of greater approval. I'd have to listen to the Zuckerman again to make up my mind but I'd still hang on the the Perlman. (J.R.)

GRAND OLE OPRY

In Concert. Tom T. Hall Recorded live at the Grand Ole Opry House. Stereo LP. RCA APL1-4749.

If you're in the mood for 22 minutes of American style country and western music, along with some joshin' and some spirited pickin', this recently released LP could be for you. Back home in Tennessee after a tour of Australia and New Zealand, Tom T. Hall is in fine voice and is backed by an enthusiastic group of Nashville musicians.

The audience, too, is determined to have a ball and to make its presence felt in this "in concert" recording.

To judge by the patter and the applause, the numbers are favourites both with the performer and the audience: Country Is — Ballad of the Forty Dollars — The Year That Clayton Delaney Died — Foggy Mountain Breakdown — I Know You're Married — Don't Tell Ruby Where I'm At — Your Man Loves You, Honey — I Like Beer — I Took a Memory to Lunch — Sneaky Snake — I Love — Old Dogs, Children and Watermelon Wine.

It's a fun occasion and the engineers have done a good job in capturing the artist, lead instruments, orchestra and audience without problems and without mishap. It may be American and it may be "commercial" C&W but it's easier on the ears than a lot of Australian bush ballads and balladeers "in concert". (W.N.W.)

MANCINI MUSIC

Award-Winning Hits; Henry Mancini Vol 2. 20 Fabulous Hits. Stereo LP, RCA, SP-151.

I'm not sure whether there's supposed to be any distinction between "Award-winning hits", "The best of . . .", "The very best of . . ." or simply "An hour of . . .". RCA certainly don't offer any jacket notes to relieve your suspense: just the title, the track list and the playing times. Oh yes, there's a copyright note that simply says "1974,1983".

That aside, you do get close to an hour of pleasant music from "Henry Mancini, His Piano, His Orchestra and Chorus", some of it his own but most of it from a variety of other composers. All told, there are 20 "Fabulous Hits" but, as a guide, we list the contents of side one:

"Theme from 'A Fistful of Dollars' — Patricia — Ludmilla's Theme — Till There Was You — Tequila — I Can't Stop Loving You — Didn't We — Delta Dawn — For The Good Times — Last Date — Theme from 'Hatari'."

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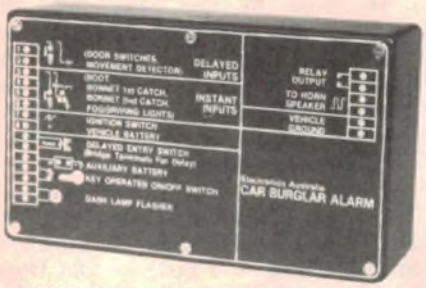
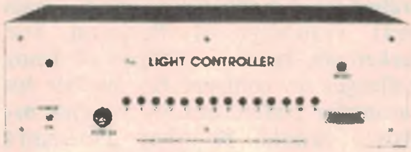
CAR BURGLAR ALARM $70



EA MAY 84

PROGRAMMABLE LIGHT CONTROLLER $180

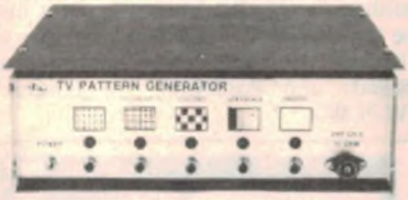


EA MAY 84

STRESS METER $29
BATTERY EXTRA

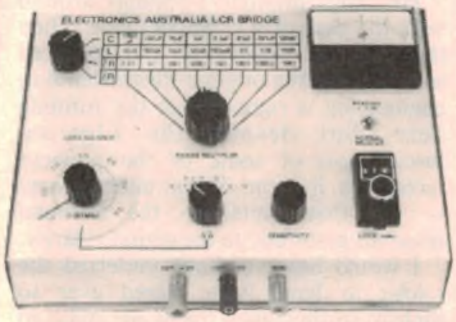
EA MAY 84

TV PATTERN GENERATOR
$67.50



Anyone wishing to obtain the maximum performance from a colour TV receiver needs a pattern generator. Why not build this completely new design which provides five separate patterns: dot, crosshatch, checkerboard, grey scale and white raster.

LCR BRIDGE $169



EA APRIL 84

HEADPHONE AMPLIFIER

$28

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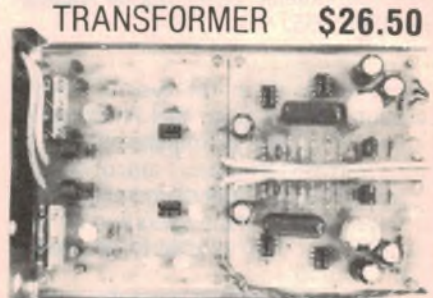

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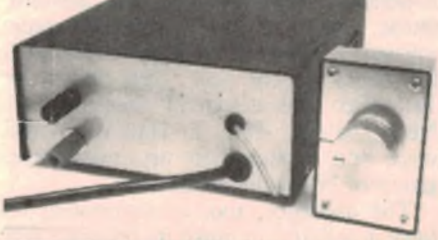

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Records & Tapes

to track, there is no risk of monotony in the sound. The tracks obviously come from RCA's stock of Mancini master recordings but are faded out, in this case, at between two and three minutes apiece. It would certainly make for convenience in the cassette version, with the two sides coming out to within a few seconds of 28 minutes each.

In fact, with generous playing time, limited dynamic range and a variety of numbers, the album would be a natural choice for music-while-you-drive, or as an accompaniment to everyday tasks in the house or workshop. That's provided you're not put off by "Theme from Mission Impossible" or "I Can't Get Started" on side two! (W.N.W.)

STRAVINSKY, BORODIN

Stravinsky — The Firebird. Borodin — Music from Prince Igor. Robert Shaw conducting the Atlanta Symphony Orchestra and Chorus. Telarc compact disc CD-80039. (From PC Stereo, PO Box 272, Mt Gravatt, Qld 4122).

This is from a quite historic master, made in June 1978, and one which confirmed Telarc's pioneering decision to standardise on digital masters for all future major recordings. Since then, the list has grown from two to around 50.

Conductor for the performance was Robert Shaw, born in 1916 and destined for the clergy, but later to become widely known as conductor of the Robert Shaw Chorale. He moved to symphonic work in the '50s, assumed responsibility for the Atlanta Orchestra during the '60s and later founded the Atlanta Symphony Orchestra Chorus.

For this recording he used a shortened version of the original 1910 ballet suite, rearranged by Stravinsky himself in 1919. Based on the legend of Zhar-Ptitsa, a magical bird with wings of flame, the ballet tells how, in gratitude for being spared during the hunt, the magical Firebird intervenes in the affairs of Prince Ivan — son of the Czar — to bring him his heart's desire.

Playing for 20 minutes 39 seconds, the suite divides into: Introduction — The Firebird and Her Dance — Round Dance of the Princesses — Infernal Dance of King Kastchei — Berceuse — Finale.

The second item, "Music from Prince Igor", is from an opera written by Alexander Borodin in 1871. It relates to a 12th century campaign by the Russians against the nomadic Polovetsians (more correctly the Polovtsy). A doctor and a scientist, Borodin described himself as a "Sunday composer" — gifted but not very methodical in preserving his work. This one survives only because Glazounov and Rimsky-Korsakov reconstructed it mainly from memory!

Included here are Overture (10 minutes 30 seconds) and Polovetsian Dancers (11 minutes 38 seconds). The scintillating choruses for the dances are sung in original Russian by the chorus and, for your guidance, an English translation is included in the accompanying booklet.

All told, it's a vital performance and one that has stood the test of time during the five years or more that it has been on the world hifi market as a digitally-sourced LP.

Technically, the dynamic range is very wide, with the Firebird introduction in particular creeping into audibility as stealthily as a hunter moving through the forest. But there is certainly no stealth about the drums or the praise for the Khan in the final choruses. The tiny sounds emerge from silence and the compact disc is untroubled by the climaxes but I did sense some slight coarseness in the most complex mid-level orchestral passages. It could be acoustic in origin but check it for yourself if you have occasion to audition the record. (W.N.W.)

DEVOTIONAL

Evie: Hymns, Yesterday, Today and Forever. Stereo LP, Word 7-01-891910. [From Word Records Aust, 18-26 Canterbury Rd, Heathmont, Vic 3135. Phone (03) 729 3777.]

A very familiar face on the devotional record stands since the last Billy Graham Crusade in Australia, Evie maintains a

continuing appeal to teenagers and younger adults, with her style, her evident sincerity and the quality of the musical back-up normally provided.

Her appeal to the greying generation has been somewhat less because, while they acknowledge her appeal, there isn't the same empathy with her repertoire of predominantly new Gospel songs. ("They don't write 'em like they used to!")

In this new album, produced by her husband Pelle Karlsson, Evie does something about that, with a program of traditional hymns with only modestly up-dated arrangements.

The opening track "The Old Rugged Cross" is fairly straight down the line, as if by way of assurance but, as the sequence progresses, so do the arrangements. If the hymns appeal to the older members of the family, the younger generation will be left in little doubt that they are listening to Evie so that, all told, it should add up to a very popular album.

Backing is varied but always good, involving keyboards, guitars, bass, drums, percussion, strings and vocal harmony. The track list: The Old Rugged Cross — He the Pearly Gates Will Open — All Hail the Power — A Christian Home — How Great Thou Art — Day by Day — Near to the Heart of God — He Hideth My Soul — Give to the Lord — Lead Me to Calvary — Doxology.

Playing time is just over 38 minutes and the sound quality is good. In short, an album that should make for pleasant family listening. (W.N.W.)

SOCIAL COMMENT

Equator. Randy Stonehill. Stereo LP. Myrrh/Powderworks POW-4031. Distributed by RCA.

The only words on the front of this album are: Randy Stonehill, Equator and Myrrh — the last being familiar to this reviewer as the source of many

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FOR DESPATCH P&P CHARGES AND ADDRESS DETAILS PLEASE REFER TO OUR AD. ON PAGE 89

Records & Tapes

devotional albums distributed through Word Records, Australia. Sure enough, the copyright notice on the label indicates Word Inc 1983, but it is a "Powderworks" label, and distribution is through RCA.

Perhaps it's not surprising, because it certainly doesn't fit the established Myrrh/Word image for devotional records. The first track "Light of the World" has a Christian connotation and "Shut De Do" is an up-tempo "spiritual" but most of the other numbers are social comment of one kind and another.

Perhaps I should quality this remark: that's what they seem like from the title and what you can make of the words if you don the headphones with that in mind. The titles of the remaining tracks, most of them original to Stonehill are:

Big Ideas — Even the Best of Friends — American Fast Food — China — Cosmetic Fixation — Turning Thirty — Hide Them In Your Love — World Without Pain.

It's very much an album for rock fans — or at least those who like the beat, the noise and the electronics, without too much regard for what it's all about.

As for quality: superficially it's okay as far as that kind of sound goes but, if you listen critically through the quieter bits (eg, the space between tracks one and two) you'll hear the dull rumblings and scratchings of noisy equipment.

It didn't exactly turn me on. (W.N.W.)

VIVALDI

The Four Seasons. Gerard Schwarz and the Los Angeles Chamber Orchestra. Elmar Oliveira, violin. Delos compact disc D/CD 3007. [From PC Stereo, PO Box 272, Mt Gravatt, Qld 4122. Phone (07) 343 1612].

This is one of the recordings which, around about 1980, helped to bring Delos Records to the attention of hifi enthusiasts. It features the young virtuoso violinist, Elmar Oliveira who, two years before, had won the Gold Medal in the Tchaikovsky International Violin competition in Moscow — the first American ever to do so.

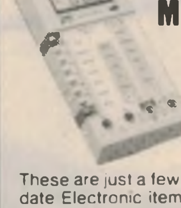
Oliveira has the support here of the very competant Los Angeles Chamber Orchestra, which was founded by Neville Marriner but which later came under the directorship of Gerard Schwarz. At the time, Schwarz was in the process of laying aside his own virtuoso trumpet to take up the conductor's baton full time — a transition which he now appears to have completed very successfully.

Not surprisingly, it emerges as a very modern performance, with the soloist in a virtuoso role, but beautifully balanced against the polished playing of the orchestra. As such, I enjoyed it immensely and I feel that most prospective purchasers will react in the same way.

The sound quality is also quite outstanding, with a transparency and an intimacy in the listening room that could scarcely be bettered. More than that, there is a delicious quality to the tone of Oliveira's 1731 Stradivarius that is unspoiled by any artificial "edginess" from the recording system.

The disc itself is encoded into 12 tracks, giving instant access to each of the three movements of the Four Seasons. The booklet, prepared by Delos executive Amelia Haygood, provides the usual background to the Composer and his work, but adds the original sonnets which inspired it and key phrases from the score. Each of these is identified in terms of playing time in minutes and seconds. What a boon to students or to those who merely want to learn while they listen!

Recommended. (W.N.W.)



OH BROTHER:

by NEVILLE WILLIAMS

Look what they've done to the typewriter!

Meet the Brother EP-44, a mains/battery portable electric typewriter, a text editor (or mini word processor), a high quality 80-column printer, and a four-function calculator with print-out facilities — all in one unit and at an affordable price: $399 plus $20 for a 6V 1A mains supply.

The EP-44 is certainly portable, weighing 2.5kg (including batteries) and measuring 331(W) x 262(D) x 55(H)mm — small enough to be carried in a brief-case. It is quiet in operation, even when printing but, when typing into memory, the only sound to be heard is the contact between fingers and keyboard. Brother claim that it is quiet enough to be used in lecture situations, in libraries or in passenger aircraft. But more of that later.

Basically, our involvement with the EP-44 followed on from a situation which arose part way through last year. In rapid succession, the writer had met up with a number of friends and relatives who were planning to buy a personal computer, apparently with very little idea as to why they needed one or what form it should take. It just seemed the right thing to do!

Reacting to this, I prepared the "Forum" article which appeared in November last under the heading: "Do microcomputers really have a place in your home?". I expressed the conviction that, for many people, the answer could only be "No" — at least in terms of currently available equipment. However, I went on to suggest that a valid domestic role for computer type equipment would be as a word processor, able to cope with letters, lecture notes, essays, etc.

For this purpose, a normal microcomputer, optioned up to a full-scale word processor, was really too bulky and too expensive. I reasoned that there was a case for something much simpler and cheaper:

"Let's envisage a computer type keyboard and circuitry, with an integral printer of one kind or another, styled externally like a typewriter.

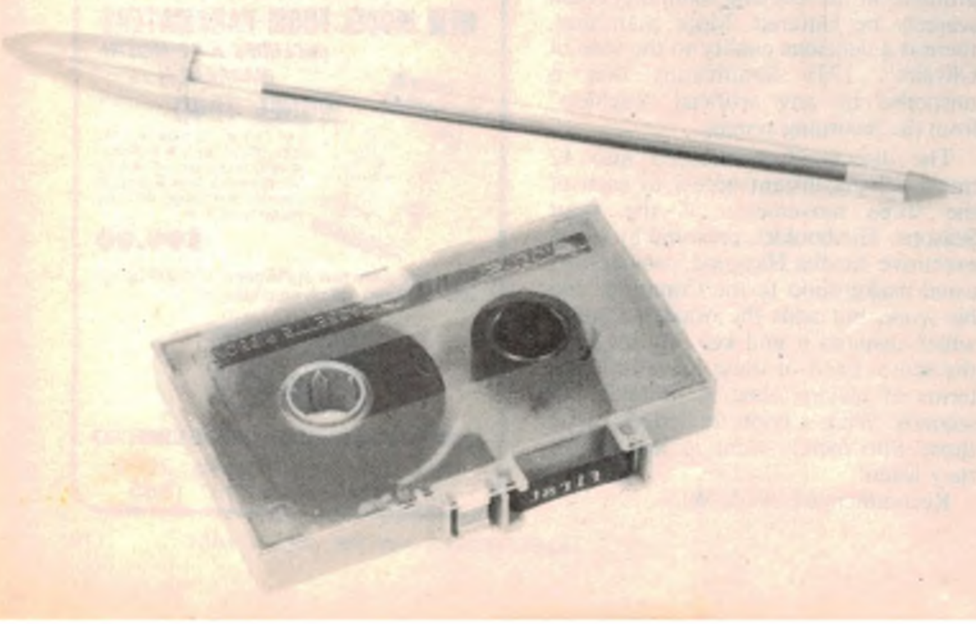
"In the MANUAL mode, it might operate in the manner of an electric typewriter ... in the PROCESSOR mode, operation would be controlled by a word processing program ... the text would be displayed, one or more lines at a time, on a liquid crystal display ... it would be stored in RAM (with battery back-up) sufficiently capacious to accommodate the contents of a typical letter or a useful segment of an article."

Having written that around Aug/Sept '83, we were naturally intrigued to see an advertisement in the Sydney Morning Herald (28/2/84) for the "New Brother EP-84". Under the slogan "It does everything but make the tea", it was credited with letter-quality printing, memory store for up to three pages of copy, text editing facilities, a calculator function with printout, and the ability to function as an on-line printer for typical microcomputers. We had to know more!

Enquiry at Brother Industries in Sydney established that the EP-44 was the latest in a series of "personal electronic printers" which the company had developed and marketed during the past couple of years. Even those earlier models, they said, had cut deeply into the sales of conventional portable electric typewriters which, by nature, were heavier, more bulky, more noisy and less versatile than the new electronic printers. The EP-44, with its extended facilities and much-improved printing quality, should prove even more attractive.

It does not match up in every respect to our suggestions in the November issue; it would be surprising if it did. However, it is aimed at the same market sector and represents what Brother Industries considers to be a practical and affordable product. So let's have a closer look at it.

Below: the clip-in ribbon cartridge is good for about 40,000 characters.

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This is a sample of the print quality of the new
Brother EP-44 using plain paper:
the quick brown fox jumped over the lazy dog.
THE QUICK BROWN FOX JUMPED OVER THE LAZY DOG.

This is a sample of the print quality of the new
Brother EP-44 using plain paper:
the quick brown fox jumped over the lazy dog.
THE QUICK BROWN FOX JUMPED OVER THE LAZY DOG.
```

The print quality compares favourably with that produced by an electric typewriter.

The EP-44 has a rectangular body shell of grey plastic, with removable keyboard cover, a lift-up flap over the paper feed and printing mechanism, and a fold-away carry handle. The unit is readily portable in this form although, for longer journeys, one would normally carry it in a satchel or brief-case.

The inclined keyboard has a normal QWERTY (typewriter) layout, with soft-touch calculator type key pads. It provides numerals, letters in upper and lower case, space bar, shift keys and lock, back space, carriage return and a full complement of signs and punctuation marks — all aimed at simplifying user adaption to the electronic keyboard. And it certainly achieves that.

However, unlike an ordinary typewriter, each pad has a supplementary function, as marked on the panel immediately above it. Some of these functions, printed in blue and controlled by a blue "CODE" pad, have to do with the text editing and printing functions. Others, controlled by a green "2nd SHIFT" tab, provide 40 or more additional print symbols — a handy mix of mathematical signs, Greek letters, French accents, diphthongs and even the symbol for the Japanese Yen.

On the left-hand side of the keyboard are pads to do with tab and margin positions while, at the top left, are pads and switches for memory and printing control. Some of those at the top right have a similar role, while others relate to the calculator function.

The only display available on the EP-44 is a liquid crystal panel which normally shows the last 15 characters to have been typed. However, the display can be shuffled or cycled back along the line, or back through the memory, to examine its contents. It also provides a means for the system to "talk back" to the operator, both directly and by way of coded status signals.

The EP-44 is equipped with an 18x24 dot matrix print head which can produce type quality virtually indistinguishable from a quality electric typewriter. The letters have curved serifs and vertical strokes of graded thickness, the matrix structure becoming apparent only under inspection with a reading glass.

For printout, it is possible to use either thermal paper (up to A4 size) or plain paper. For the latter purpose, a clip-in cartridge is provided containing what Brother Industries describe as a "one-time heat transfer ribbon" — with a life of about 40,000 characters. For good letter formation, the paper must be fairly smooth, although we got good results with ordinary magazine offset stock. Carbon copies are not possible.

The EP-44 provides for three distinct print modes, selectable by a small slide switch. In the "DP" (Direct Print) mode, it operates more or less as a straight typewriter, printing characters as they are input from the keyboard. The characters appear in the readout but they cannot be corrected in this mode because they have already been printed. The manual suggests that the DP mode is mainly useful for setting margins and tabs, although we used it also for making last-minute amendments to finished copy.

In the "CP" (Correction Print) mode, characters are printed only as they emerge from the display, giving the operator the opportunity to correct typing or spelling errors before they

Look what they've done to the typewriter

Specifications

Number of keys	44
Printing speed	16 characters/sec
Paper width	220mm maximum
Printing width	203.2mm maximum
Characters/line	80
Printing method	24x18 thermal dot matrix
Ribbon	Cassette
Display	15-digit LCD (7x5 dot matrix)
Calculator	4-function with percentage
Interface	Conforms to RS-232C
Paper	Smooth plain or thermal
Power source	4 size D cells or mains adapter
Dimensions	331(W) x 262(D) x 55.2(H)mm
Weight	2.5kg (incl batteries)

become hard copy. Where a near-simultaneous printout is required, the correction facility is a boon to an error-prone operator.

Our tip, however, is that the "NP" (Non Print) mode will be the one preferred on most occasions. Certainly, it would be the one to use for jotting down notes in lecture, library or travel situations. Provided the batteries are left in place, the contents of the memory can be retained indefinitely for later printout.

However, even for normal typing — letters, instructions, assignments, magazine articles, &c — there is everything to be said for making full use of the memory, before anything at all is committed to paper. As in the CP mode, it is possible to correct typing errors as they occur but, in addition, other text in the memory can be corrected or revised.

In this respect, the EP-44 is less versatile than a full-scale word processor because the text is formatted in memory as lines of text, corresponding to the original typing procedure. The content of lines can be changed within the limits of the predetermined line length; unwanted lines can be deleted and new lines inserted. The text will contract or expand to accommodate such changes but there is no provision to shuffle words within the memory from line to line.

In practice, the line-by-line memory format is quite manageable for text which can be broken up naturally into short paragraphs such as a letter, for example, or the text of this very article. In these circumstances, it is no great hassle to re-type portion of a paragraph or even a whole paragraph, where extensive revision is necessary.

As with a normal typewriter, the EP-44 can type or print with 1-line, 1½-line or 2-line spacing, pre-selected by a slide switch. However, it is possible to program additional spacing between, say, heading and text or between paragraphs, by inserting blank lines, as required. Provision is also made to program half-line shifts to provide superscript or subscript characters, or to have selected lines (or words) print against the right-hand margin, or centrally between margins.

Practical experience

How does the newcomer get to cope with these and other tricks? I decided to find out the hard way by refusing on-the-spot instruction from a Brother Industries executive, deciding instead to rely solely on the Instruction Manual, as supplied. Accordingly, I spent an hour or so reading as much as seemed appropriate, before addressing myself to the keyboard.

It would be nice to be able to suggest that everything went smoothly but such was not the case. As with most keyboard devices, all the wonderful things you can do become things that go wrong when you don't do them correctly! It was some hours later, after many attempts, many errors and much searching through the manual that the EP-44 began to respond in a reasonably predictable manner.

You can teach yourself but it does involve a certain amount of time and patience.

In fairness, Brother Industries' have put a lot of effort into preparation of the Instruction Manual and most of the information required can be found, when you go searching for it. The problem is that so much has to be taken in at first reading that essential clues to correct operation are not recognised as such in the 24-odd pages of how-to-type instructions.

Our firm conviction is that, next time

around, Brother Industries could make it much easier for new buyers if they were to re-design their manual along more tuitional lines. In short, after a survey of the physical features — keyboard, batteries, mains supply, paper feed, etc — the newcomer could be taken through a basic exercise in, say, direct printing of straight text.

This could be followed by exercises in Correction Print mode and No Print mode, each a little more advanced than the last. Against this background, it would be possible to introduce the more specialised facilities with minimal risk of confusion.

No less important, any such manual should be tested with novices rather than simply being approved by experts, who know all the answers anyway!

Getting back to the EP-44 itself, our impression of the four-function calculator facility is that, for most users, it will be a bonus rather than a real feature. It uses figures from the main QWERTY keyboard in conjunction with a separate row of mathematical symbols at the top right of the panel — an arrangement that takes some getting used to. The calculator can be used in either Correction Print or Non Print mode but it cannot be stored in memory for subsequent printout.

Most of the time it would be simpler to use a separate pocket calculator and type the figures into memory using the normal keyboard, which has all the necessary signs and brackets, anyway.

Although our prime purpose was to evaluate the EP-44 as a desk-top typewriter with memory, it can fill another role, as mentioned earlier, of prime interest to computer buffs. To quote Brother Industries' own brochure:

"Since the Brother EP-44 has a built-in RS-232C serial interface, it can be used as an I/O printer, able to print out text or command lists from your small computer, in addition to being able to print out through applicable daisy wheel units via an optional interface adapter. The EP-44 can also be hooked up with a telephone coupler and be used as a communications terminal."

Unfortunately, lack of time prevented us from putting these statements to a practical test but we did discuss the matter with staff member Peter Vernon, on the basis of the specifications, which conform to EIA and JIS standards. We also made contact with another enthusiast, who had checked out the EP-44 with several typical micros. Indications are that it should compare favourably with other small printers in terms of versatility, and more than favourably in respect to print quality and price.

In fact, at the time of writing, Brother Industries have just released a separate printer which is virtually the rear section of the EP-44. Designated as the HR-5 printer, it will retail for a modest $299, although we imagine that many buyers will prefer to pay $399 for the printer plus keyboard. Logically, the HR-5 and EP-44 printer could form the subject of a separate review.

Conclusions

In the meantime, what was our reaction to the EP-44 as an intelligent typewriter, a mini word processor, or a text editor — call it what you like?

Well, if you really want and really need a full-scale word processor, the EP-44 "personal electronic printer" would be a disappointment. It has a limited memory and it can't manipulate text to anything like the same extent.

But a full-scale word processor, involving a keyboard, a VDU and a printer, can clutter a limited workspace with mains-operated equipment costing anything up to "a couple of grand" — a prospect that will not appeal to a lot of people. Thats where the EP-44 fits in: it is compact, portable, mains/battery powered, usefully versatile and it carries a price tag of $419 including power supply. For many, it could be an eminently practical compromise.

Like any other "intelligent" keyboard, you do need to learn how to "drive" it and, like other printers, there is a running cost occasioned by the need for special paper or a special ribbon. This needs to be taken into account.

On the other hand, with a unit as compact as this, it is a luxury to be able to correct typing errors as they occur and to revise things that could have been better said. Then to press the "Print" tab and have it appear, line by line, free of errors and so cleanly printed.

After having used the EP-44 to prepare this review, I felt quite cheated when Brother Industries rang to inquire whether I had finished with it. They needed it for some exhibition or other.

Suddenly, my faithful old portable had begun to look positively archaic! (W.N.W.)

SWIVEL BASE MONITORS FROM $179 THIS MONTH

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AVAILABILITY: Green Phosphor in Stock **$179.00**
Amber Phosophor **$199.00**

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APPLE™ COMPATIBLE DISK DRIVE

TM *Registered trade mark Apple Corporation*

SPECIFICATIONS

HIGH-SPEED ACCESS, HIGH ACCURACY POSITIONING instead of plastic CAM positioner or lead screws positioner, a high microprecision metal band positioner is adopted in the mechanism to position the head.
BRUSHLESS DC DIRECT-DRIVE MOTOR Direct drive means that there is no improper belt seating, so the variations in speed and friction-producing side loading can be eliminated, which allows motor running lifetime to be over 10,000 hours.
MOTOR CLOSED LOOP SERVO Hall effect devices are utilized as speed control sensor in DC motor system, so motor can run stably and accurately.
SLIM, HALF-HEIGHT DRIVE The disk drive is only 41mm high. It is only half the size of conventional models.
NO CONTACT WRITE-PROTECTED SENSOR Photo coupler is used as write-protected sensor. It means no damage, long lifetime and good reliability for disk media.

GENERAL SPECIFICATIONS

Capacity (formatted)	163K (20K bytes more than the original)
No. of tracks	40 tracks (5 tracks more)
No. of sectors track	13 to 16 sectors
Disk rotation speed	300 rpm
Track density	48TPI
Track to track time	Less than 6 msec

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Box	450mm	295mm	110mm

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	W	D	H
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K/B Cat. No. X11081

ERRORS AND OMISSIONS EXCEPTED

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Orange Phosphor **$199** ($179 Exempt)

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'THE PRINTER PEOPLE' SPECIALS

AS REVIEWED BY EA NOVEMBER '83

THESE ARE THE REAL THING. NOT A CHEAP SUBSTITUTE.

NEW DELUXE PRINTER NOW SUPPLIED

A NEW PRINTER NOW!

CP-80/I, 80-COLUMN IMPACT PRINTER

SPECIFICATIONS
Functional Specifications
Printing method — Serial impact dot matrix. Printing format — Alpha-numeric — 7 x 8 in 8 x 9 dot matrix field. Semi-graphic (character graphic) — 7 x 8 dot matrix. Bit image graphic — Vertical 8 dots parallel horizontal 640 dots serial line.
Character size — 21mm (0.083")-W x 2.4mm (0.09")-H 7 x 8 dot matrix.
Character set — 228 ASCII characters. Normal and italic alpha-numeric fonts, symbols and semi-graphics.
Printing speed — 80 CPS 640 dots/lines per second.
Line feed time — approximately 200 msec at 4.23mm (1/6") line feed.
Printing direction — Normal — Bidirectional logic seeking. Superscript and bit image graphics — Unidirectional left to right.
Dot graphic intensity — Normal — 640 dots 190.5mm (7.5") line horizontal. Compressed characters — 1,280 dots/190.5mm (7.5in) line horizontal. Line spacing — Normal — 4.23mm (1/6"). Programmable in increments of 0.35mm (1/72") and 0.118mm (1/216").
Columns/line — Normal size — 80 columns. Double width — 40 columns. Compressed print — 142 columns. Compressed double width — 71 columns. The above can be mixed in a line.
Paper feed — Adjustable sprocket feed and friction feed.
Paper type — Fanfold Single sheet. Thickness — 0.05mm (0.002") to 0.25mm (0.01"). Paper width — 101.6mm (4") to 254mm (10").
Number of copies — Original plus 3 copies by normal thickness paper.
Mechanical Specifications
Ribbon — Cartridge ribbon (exclusive use), black.
MTBF — 5 million lines (exclusing print head life).
Print head life — Approximately 30 million characters (replaceable).
Dimensions — 377mm (14.8")—W x 295mm (11.6")-D 125mm (4.9")-H incl sprocket cover.

Parallel CP 80 **$339** ***Serial CP80*** **$559**

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PL18/20VA	$14.75	PL18/60VA	$21.50	PL40/40VA	$16.50
PL24/20VA	$14.75	PL24/60VA	$21.50	PL30-9/40VA	$23.50
PL30/20VA	$14.75	PL12/40VA	$16.50		
PL40/20VA	$14.75	PL15/40VA	$16.50	PL30/60VA	$21.50
PL1.5-18/20VA	$23.50	PL18/40VA	$16.50	PL30-9/60VA	$25.50

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PF3788	$43.50	PF4361/1	$49.50		

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10 TURN POTENTIOMETERS

Stock resistance values
50R 100R 200R
500R 1K 2K 5K
10K 20K 50K
100k

Spectrol model 534 ¼ shaft
Price 1 9 **$9.50**
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- Good regulation electrostatic shield
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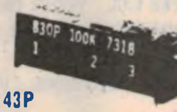
20 TURN CERMET TRIM POT



SPECTROL 43P ACTUAL SIZE

STOCK RESISTANCE VALUES
10R 20R 50R 100R 200R 500R 1K
2K 5K 10K 20K 50K 100K 200K
500K 1M 2M

1-9	10-99	100+
$1.40	$1.30	$1.00

Values may be mixed

Hexadecimal Keypad

$42.50

19 key pad includes 1 10 keys ABCDEF and 2 optional keys and a shift key

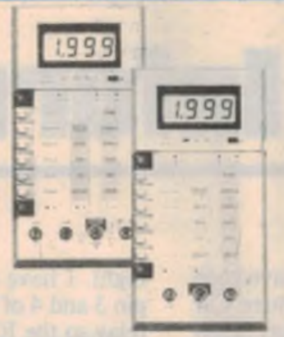
Ideal for dream project

MULTIDIALS

Dials to suit 10 T Pots

Model 21 1 8 dia	$24.50
Model 16 9 dia	$19.50
Model 18 1 x 1.75 dia	$27.50

RITRON DIGITAL MULTIMETERS



- 28 Ranges
- Push Button Operation
- Auto Polarity
- Low Battery Indicator
- Full Overload Protection
- Finger Guards on Probes and Shrouded Plugs for Safety
- Accuracy: 1 year 18°C to 28°C (+ % of reading + No. of Digits)

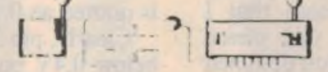
200 hour battery life

Q16010 specifications

1-4	5+
$57.50	$55.00

Q17040 specifications

1-4	5+
$87.50	$83.50



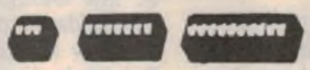
16 Pin Zip* Dip 11	$11.50
24 Pin Zip* Dip 11	12.50
40 Pin Zip* Dip 11	17.50

*Zero Insertion Pressure

DIP SWITCHES SPST

P N	No. of Switches	Price
SD3	3	$1.60
SD4	4	1.70
SD5	5	1.90
SD6	6	2.30
SD7	7	2.40
SD8	8	2.50
SD9	9	2.70
SD10	10	3.00

DIP SWITCHES SPST



cermet single TURN TRIM POT

Spectrol model 63P ACTUAL SIZE

STOCK VALUES
10R 20R 50R 100R 200R 500R 1K
2K 5K 10K 20K 50K 200K 500K
1M 2M

1 9	$1.20
10 99	$1.00
100	$0.90

Values may be mixed

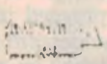
HEATSINKS

High Thermal Capacity Black Anodised

	1-4 $	5-9 $	10-49 $	50-99 $	100-499 $	500 plus $
HS1 — 38mm	1.85	1.75	1.50	1.35	1.00	0.90
HS2 — 75mm	3.00	2.90	2.50	2.00	2.00	1.50
HS3 — 150mm	5.80	5.40	4.90	3.80	2.90	2.70
HS4 — 225mm	8.10	7.60	7.10	5.90	4.50	4.30
HS5 — 300mm	8.90	8.40	7.90	6.50	4.90	4.60
Unanodised						
HS11 — 38mm	1.40	1.20	1.00	0.90	0.80	0.70
HS12 — 75mm	2.50	2.20	1.90	1.60	1.25	1.20
HS13 — 150mm	4.90	4.50	4.00	3.20	2.45	2.40

RS232 & "D" TYPE CONNECTORS

½ PRICE THIS MONTH



PART NO.	DESCRIPTION	1-9	10-25
DE 9P	9 PIN MALE	$1.75	$1.60
DE 9S	9 PIN FEMALE	2.25	2.10
DE 9C	9 PIN COVER	1.25	1.10
DA 15P	13 PIN MALE	1.10	1.05
DA 15S	15 PIN FEMALE	2.25	2.10
DA 15C	15 PIN COVER	1.15	1.05
DB 25P	25 PIN MALE	2.95	2.80
DB 25S	25 PIN FEMALE	3.45	3.30
DB 25C	1 pc Grey Hood	1.20	1.10
DB 25C2B	2 pc Black Hood	1.40	1.35
DB 25C2G	2 pc Grey Hood	1.35	1.25
DC 37P	37 PIN MALE	3.95	3.75
DC 37S	37 PIN FEMALE	5.45	4.95
DC 37C	37 PIN COVER	2.45	2.25
DH S	Hardware Set (2 Pairs)	1.05	0.95

BLANK CASSETTES T.D.K.

TDK ADC60	1 for $3.99	10 for $28.60
TDK DC60	1 for $2.30	10 for $19.99
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TDK SAC60	1 for $3.85	10 for $34.10
TDK SAXC60	1 for $6.30	10 for $50.60
TDK DC90	1 for $2.60	10 for $22.10
TDK ADC 90	1 for $3.85	10 for $33.00
TDK SAC90	1 for $4.65	10 for $42.90
TDK ODC90	1 for $5.20	10 for $59.50
TDK SAXC90	1 for $5.99	10 for $59.99
TDK DC120	1 for $4.99	10 for $40.70
TDK ADC120	1 for $5.99	10 for $53.00

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BE QUICK, STOCK UP NOW

Information centre

CAR BURGLAR ALARM: I have been reading your feature on the Deluxe Car Burglar Alarm described in May 1984 and it seems to me to be an excellent system and would also have a much wider application as a house burglar alarm control unit. The only drawback I can see is that the entry/exit times would need to be longer or adjustable.

Also, a 4 or 6-digit preset sequence on-off switch would be a neat and convenient addition instead of one more key on my bulging keyring. However, being an amateur there may be many other drawbacks to the design that I have not foreseen. Could you please offer advice on this or have you designed a house alarm in the past that would be better suited. (D.C., West Hindmarsh, 5007).

● There is no reason why the Car Burglar Alarm could not be modified for use as a house alarm. You would probably want more inputs though which would have to be added by having a subsidiary PC board.

The entry delay is easily increased by increasing the value of R1 or C1 (or both) in the entry delay timer associated with IC3b.

Burglar alarms that we have published in the past do not have all the features of the Car Burglar Alarm. We do have it in mind to publish an up-to-date house alarm. See also our VCR Burglar Alarm in this issue.

DRIVEWAY SENTRY: I recently purchased two Driveway Sentries as detailed in EA December 1982. My problem is that the light comes on whenever it gets daylight and stays on until someone turns it off manually.

I have tried a number of things to prevent this happening, which have all failed: (i) altering the position of the ambient LDR, so it sees daylight conditions before the headlight LDR; (ii) putting tape over the headlight LDR; so it saw less light; (iii) switching LDRs about. Finally I attached a 4.7kΩ resistor in series with the headlight LDR to reduce the amount of light and this seemed to inhibit the light, however the car headlights need to be very close (ie, a few centimetres) to trigger the light.

So at the moment I have opted for a timer switch which switches the unit off just before daylight and on again at night. I have put a 220Ω resistor across pin 3 and 4 of the IC and this inhibits the relay so the IC works OK. What puzzles me is that both sentries have the same fault, even though they have been installed at different addresses. (G.B., Millpark, 3082).

● As you have already determined, the IC in each unit appears to be OK. Let us define the problem: For the reset, pin 4, to be effective, it must be pulled below 0.7V for the typical case and below 0.4V in the worst case while the current pulled from the reset pin under these conditions is quoted as 0.1 milliamp (typically).

Clearly, pin 3 has no trouble in pulling below 0.4V but the voltage drop across the ambient LDR due to the reset pin current may be too high to let pin 4 go low enough. So, as far as your circuits are concerned, the ambient LDRs are either not being exposed to enough light or they do not have sufficiently low resistance. The latter reason seems the most likely.

Short of trying other LDRs, the solution is not to desensitise the headlight LDR but to shunt the ambient LDR with a suitable resistor. This should be low enough to turn off the circuit during daylight hours but high enought to allow the circuit to work after dark. Bearing in mind the value of the reset pin current noted above, we suggest trying a value of around 1kΩ across the ambient LDR.

TOUCH LAMP DIMMER: I have recently purchased a kit for the Touch Lamp Dimmer described in April 1983. Unfortunately the kit does not operate properly. I have modified the kit so it can be plugged into a power point and any incandescent lamp can be connected and switched on and off or dimmed using the Touch Lamp Dimmer. However, there are some problems with the operation of the dimmer.

The dimmer operates perfectly for approximately 10 minutes. If the dimmer is off and has been used previously it is very difficult to switch the lamp on using the dimmer. Occasionally, when the dimmer can be switched on with a lot of effort and frustration, which involves touching the plate several times, the dimmer does not function properly.

When the lamp is brought to a slight dim using the dimmer it starts to flicker then resets itself to full brightness and dims again. It repeats this process continuously. Jaycar suggested that the plate must be dirty. Could you please suggest what the problem is. (E.J., Semaphore South, 5019).

● As designed, the Touch Lamp Dimmer was intended to be installed in a wall cavity. We did not envisage it being used in the free-standing mode as you have built it. It seems likely that your unit may be insensitive as well as being subject to interference.

Is it installed in an earthed metal box? This may be necessary to render the unit less prone to interference but it may cause a problem in that the unit could cycle on and off by itself.

If that happens it may be necessary to reduce the value of the 1MΩ resistor connected to pin 5 of the S576A.

12/230V INVERTER: I am building the unit described in June 1982 but I am unable to obtain the 24-way edge connector, Swann Redline 3.8mm (0.15-in) with one open and one closed mounting bracket, No 1333-13-9. I would be grateful if you could tell me where they are obtained from. I have all the other parts.

Would it be possible to use this circuit on 84V DC without much modification. I will be living in the country soon and electricity is too expensive ($9,000 to $12,000 to have it connected). Have you knowledge of larger outputs around 1,000VA/15,000VA that could be built by me. (G.P., Narrabundal, 2604).

● The particular edge connector you want is listed in the Jaycar catalog as part number HP-8662 and is priced at $4.95. You can get it by mail order from Jaycar at PO Box 185, Concord 2137.

It would not be possible to run the inverter with an input of 84 volts DC as neither the transformer nor the output transistors would be suitable for this voltage. Unfortunately we have no information on higher-powered units.

BREAKERLESS IGNITION: I recently purchased from Jaycar an optoelectronic trigger kit for the transistor-assisted ignition, both as featured in the February 1983 issue of *Electronics Australia.*

My problem is the trigger will work with a light bulb on the output lead, but once I hook up the TAI, it will give only one spark if the beam is broken. To get another spark I must turn off the ignition and turn it on again to repeat the one-spark performance.

The kit included one 100μF capacitor but this is not shown on the circuit or in the parts list. I suspect the proper placement of this component will remedy the trouble, I have mounted the PC board in a metal box beside the distributor, and fabricated a mounting bracket in the points position for the diode and transistor and am using a Bosch chopper disc. This makes points replacement extremely simple if required.

The condenser is removed from the distributor and this I believe is why the capacitor is supplied. I have thought to place it in the TAI between the points outlet and chassis or between the collector lead and chassis on the switching transistor MJE340 in the opto trigger.

Any advice you could give me would be appreciated. (R.W., Goulburn, 2580).

● The original version of the optoelectronic trigger was published in our June 1981 article and carried a suggestion that a 100μF 16VW electrolytic capacitor should be connected across the 5.6V zener diode. This was a conservative protection measure which we did not find necessary to repeat in the February 1983 article. Therefore, as far as you are concerned, it is surplus and may be consigned to your treasury of unused parts.

There was an error in the printed circuit overlay of the later article by the way, which showed the zener diode

Electronics Australia Reader Service

"Electronics Australia" provides the following services:

PHOTOSTAT COPIES: $3 per project, or $6 where a project spreads over multiple issues (price includes postage). Requests can be handled more speedily if projects are positively identified, and if not accompanied by technical queries. We reserve the right to supply complete back issues instead of photostats, where these are available.

CHASSIS DIAGRAMS: For the few projects which require a custom metal chassis (as distinct from standard cases) dyeline plans showing dimensions are normally available. $3 including postage.

PC BOARD PATTERNS: High contrast, actual size transparencies: $3, including postage. Please specify positive or negative.

PROJECT QUERIES: Members of our technical staff are not normally available to discuss individual projects, either in person at our office, or by telephone.

REPLIES BY POST: Limited to advice concerning projects published within the last three years. Charge $3. We cannot provide lengthy answers, undertake special research, or discuss design changes. Nor can we provide any information on commercial equipment.

OTHER QUERIES: Technical queries outside the scope of "Replies by Post" or submitted without fee may be answered in the "Information Centre" pages, at the discretion of the Editor.

COMPONENTS: We do not sell electronic components. Prices and specifications should be sought from advertisers or agents.

BACK ISSUES: Available only until our stocks are exhausted: $3 (includes post and packing and storage fee).

REMITTANCES: Must be negotiable in Australia and made payable to "Electronics Australia". Where the exact charge may be in doubt, we recommend submitting an open cheque endorsed with a suitable limitation.

ADDRESS: All requests to the Assistant Editor, "Electronics Australia", Box 163, Chippendale, 2008.

So you think you're an engineer, mate!

. . .continued from page 3

On question three, we got some blank looks. One sensed they had not even heard of a PLL let alone be able to explain what it might do. Some knew that a PLL had a VCO but hadn't the foggiest notion of how it might work.

Question four was the same story. Some of these blokes could not even draw a three-inverter oscillator or Schmitt trigger oscillator let alone explain how it might work. And it got worse. The deeper we prodded, the less fundamental knowledge they appeared to have!

Question five about multiplexing was probably handled the best of all although quite a few people had to be prompted to get the answers.

Frankly, we were astonished. No, that's not strong enough. We were absolutely flabbergasted! These guys thought of themselves as engineers or they aspired to be the same. They regarded themselves as being up with the latest technology but, on the face of it, they were considerably less well-informed than the typical hobbyist with no formal engineering background but who reads EA and other magazines avidly every month!

These guys also know nothing or almost next to nothing about the latest developments in audio, VCRs, hifi VCRs, television, satellite broadcasting or for that matter, any of the many fields related to electronics. In short, they've gone to sleep and the world is passing them by!

Some of the people complained that we were emphasising audio while they were more interested in digital circuitry. Our response to that is that if you don't understand analog circuitry then ultimately, you don't understand digital circuitry either.

Oh sure. Almost every applicant claimed to be familiar with computers. They could program in Basic (who can't?), Pascal, C and other high-falutin' languages but if we asked questions about hardware they were not nearly so confident. In fact, we are rapidly coming to the conclusion that anyone taking an interest in computers is running up a blind alley; you'll spend a hell of a lot of time familiarising yourself with the beasts but you won't learn anything about electronics.

Learning to use and program a computer is pretty much like learning to drive a car except that there are a lot more rules to follow. But learning to drive a car will give no understanding of automotive engineering; nor will driving a computer give any understanding of computer hardware. At least being able to drive a car is a useful attribute for most of the population. We're not so sure that being able to program a computer is a useful ability for an engineer; at least not if it's at the expense of basic engineering knowledge.

What is going wrong with engineers? We are reluctant to conclude that they are not being taught the right topics. Of necessity, a formal engineering course must concentrate on a lot of theory. Practical applications would get less emphasis. In this respect engineering courses are probably no better and no worse than they ever were.

No. We have to conclude that many engineers, whether recently qualified or not, do not take an active interest in electronics. They don't read about it. Sure, most of them see *Electronics Australia* every month because it is on their company's circulation list but few take the trouble to read it.

We have been aware of this attitude on the part of engineers for some time. They tend to take a patronising attitude to EA as a "hobbyist" magazine. But perhaps it is they who should be patronised — they are not even familiar with the technology featured in a "hobby" magazine.

Anyone who has been a regular reader of *Electronics Australia* over the last few years would have had little difficulty handling the questions listed above.

If you are a practising engineer or even a non-practising engineer, ask yourself honestly, "Could I answer those questions?" If not, you owe it to yourself and to your employer, to catch up on a lot of ground. You can start by buying and reading *Electronics Australia*, every month.

And don't worry about the cost. Anyone who begrudges the price of this magazine is just not interested in electronics!

Leo Simpson

installed the wrong way around.

Assuming that the supply voltage to the 5401 is correct at close to 5V we think that the optoelectronic trigger may be operating and the transistor-assisted ignition may be malfunctioning. Have you tested it separately?

You can test the TAI with a jumper lead connected between the anode of D1 and OV. Every time you break this connection a spark should occur.

If this checks out OK then it is possible the optoelectronic trigger circuit is indeed faulty and the most likely suspect is the 5401.

There is no need to have a substitute for the points condenser.

PHONE MINDER: I would like your help if possible, on a way to increase the loudspeaker volume of the "phone minder". I have set up an efficient 6-inch speaker with low loss speaker cable. The extra volume is needed because we are on a farm and my mother is hard of hearing. (J.C., ACT).

● There are two ways to increase the loudness from your Phone Minder. First, you could try using a horn-type speaker instead of conventional loudspeaker (eg, DSE Cat. No. C-2705). This will give an increase in efficiency, although its output may be somewhat more directional.

The alternative is to use a much bigger amplifier and speaker combination. For example, you could feed the signal at the wiper of the volume control (VR2) into a 25W (or larger) amplifier module and couple the output into (a) 10-inch or 12-inch loudspeaker. Again, you could also try using an appropriately rated horn type loudspeaker (eg, DSE Cat C-2718).

There's one other possibility and that's to use the Phone Minder with the horn speaker driver circuit published in our May issue. All you have to do is disconnect pin 3 of IC3a in the Phone Minder and connect it instead to pin 1 of IC8a in the Car Burglar Alarm. Note that Schmitt trigger oscillators IC6a,b,c in the Car Burglar Alarm must be retained for the horn speaker driver circuit to function correctly.

AUTOMOTIVE CIRCUITS: I would like to know where I could find the following circuits for a car. They are:

1. Digital speedo, distance meter.
2. Electronic ignition (optical).
3. Would a transistor assisted ignition work and/or be of any use with this type of electronic ignition?
4. Would any tachometers work with this type of ignition (digital or LED bar). Do you know of any digital tachos?
5. Would a light delay circuit (interior & headlights) trigger off a car alarm.
6. Exhaust gas analyser.
7. Electronic fuel gauge.

Also are there any other circuits which could be used to monitor the car's performance and/or help to tune it. (D.B., Parafield, 5017).

● Taking your points in order, we have not published a digital speedo although we did publish a series of articles on a Car Computer which included that function in July, August, September and October 1982 (File 3/AU/30-33).

A transistor-assisted ignition with optoelectronic trigger was published in February 1983 (File 3/TI/17-18). This circuit will work with most tachometers.

Whether or not a courtesy light delay would trigger a car alarm depends on the design of the two circuits. However, you could use one of the courtesy light delay circuits published in the May 1980 issue with our Car Burglar Alarm published in May 1984. We can't help you with a design of an exhaust gas analyser or an electronic fuel gauge.

Other automotive circuits which may be of interest to you are as follows: Ignition Killer, February 1984; Speed Sentry, October 1983; Fuel Consumption Meter, March 1983; Low Fuel Indicator, March 1982; Battery Monitor, October 1980; Audible Turn Signal Monitor, November 1981; Windscreen Wiper Delay, September 1979.

Notes & Errata

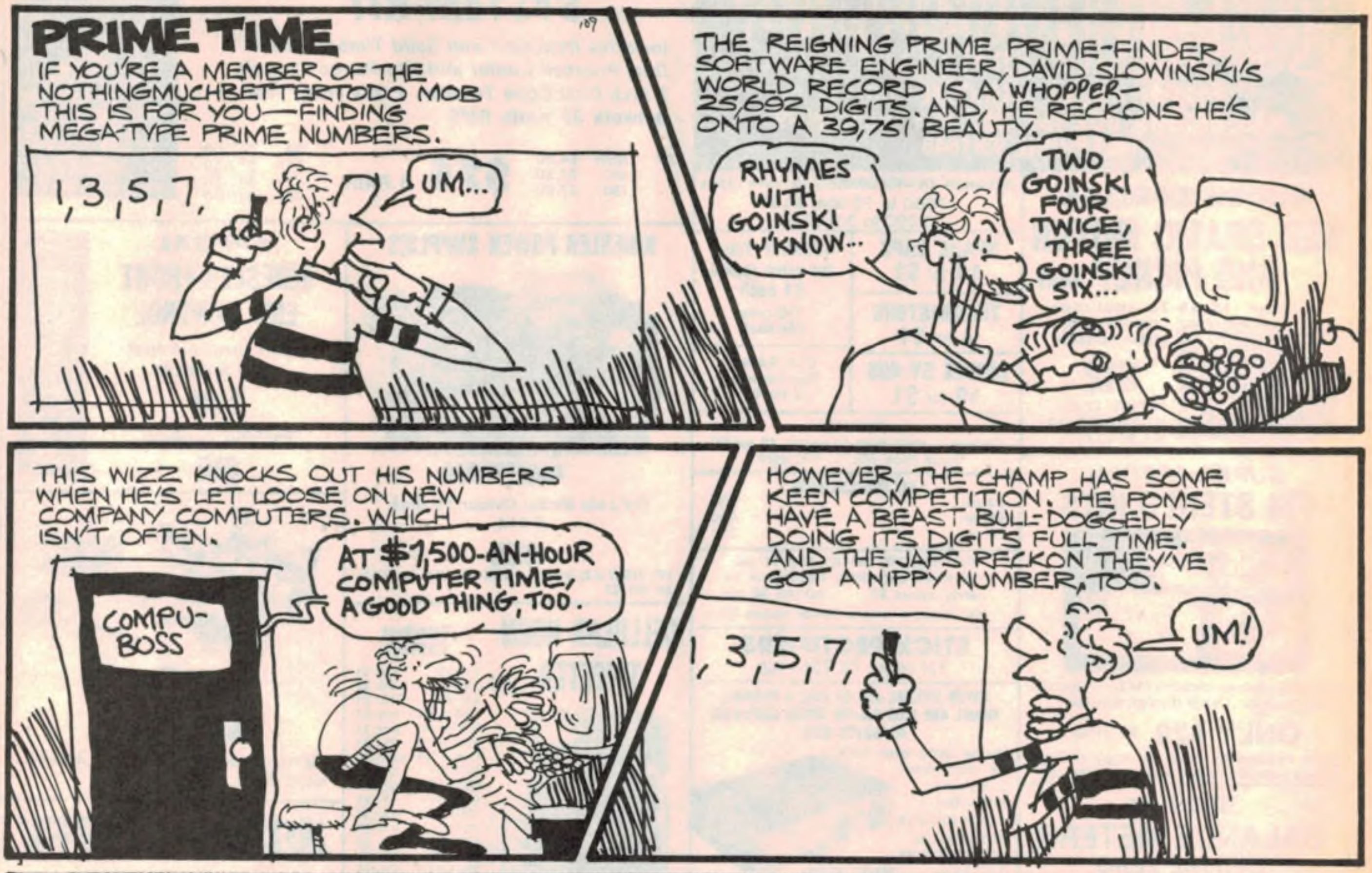
CAR BURGLAR ALARM: (May 1984, File 3/AU/39). Constructors may find that the alarm duration is considerably longer than two minutes. This can be due to leakage in the phenolic PCB and may be corrected by altering the value of R3 to 470kΩ or thereabouts to provide the correct time.

HEAT CONTROLLER (July 1984, File 2/PC/42): It is possible that the relatively slow cycling of this circuit may lead to premature failure of radiator elements as they repeatedly heat and cool. We suggest reducing the 1μF timing capacitor at pin 1 of IC1a to 0.33μF eliminate the problem.

CRUISE CONTROL (June 1984, File 3/AU/40): Under worst case conditions the bias currents into IC2d will cause a significant DC offset at the output which can lead to an erroneous result. The solution is the insert of a 1MΩ resistor, in series with pin 12 of IC2d.

Also, at high battery voltage, the continous current ratings of Q8, Q9, Q10 and Q19 may be exceeded. We suggest the use of BC337 for Q8 and Q9 and BC327 for Q10 and Q19 to avoid this possibility.

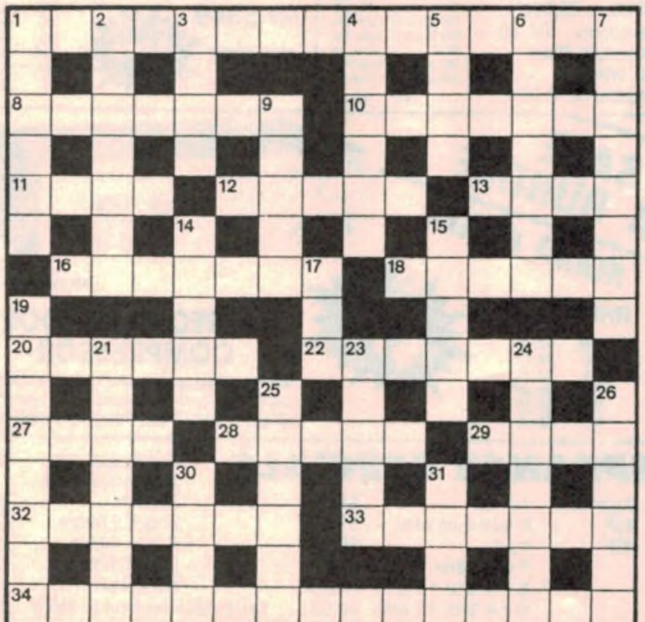
emerson's out of this world



AUGUST CROSSWORD

ACROSS

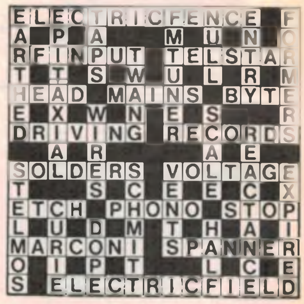
1. Device for the input of waves. (6,9)
8. Typical structure of many electronic components. (7)
10. Type of coil (7)
11. Basis of many ICs. (4)
12. Source of coherent microwaves. (5)
13. Inductor. (4)
16. TV picture fault. (7)
18. Name of local communication satellite. (6)
20. Perfect partner for a plug. (6)
22. A mains wire. (7)
27. Electromagnetic units of the cgs system. (4)
28. Portion of an amplifying system. (5)
29. What the electric fan did to its fuse? (4)
32. Type of transistor. (7)
33. Kind of battery. (7)
34. The movement of colloidal particles in an electric field. (15)



DOWN

1. Silicon dioxide. (6)
2. Antenna support. (3-4)
3. Tunes! (4)
4. Element present in certain cells. (6)
5. What is initially expressed in r.m.s.? (4)
6. Each of these stands about three feet! (7)
7. A zener diode can do it. (8)
9. Current drawn from a battery, etc. (5)
14. Resistor colour code for five. (5)
15. Varies a setting through overcorrection. (5)
17. CRO component. (3)
19. Put together an *Electronics Australia* project kit. (8)
21. Crimp. (7)
23. Where connections are made to PCBs. (5)
24. Kind of network which attenuates all frequencies equally. (3-4)
25. Sound imaging system. (6)
26. What an oscilloscope spot usually does. (6)
30. Tone setting between bass and treble. (4)
31. Surname of a brilliant atomic physicist. (4)

SOLUTION FOR JULY



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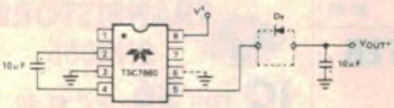

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