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Australia's Top Selling Electronics Magazine

Electronics Australia

AUGUST 1987
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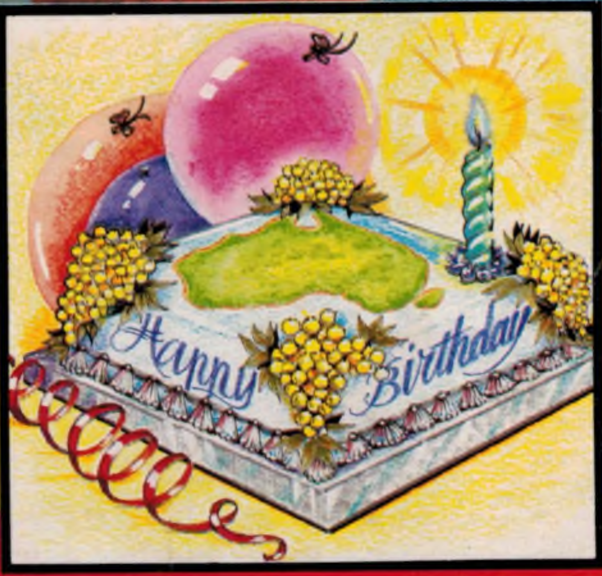
JVC's new camcorder

- DAT's the future of audio tape recording
- Computer strobe flash
- Low cost video movies



SPECIAL BIRTHDAY ISSUE!

Design in TI's new

The new IBM® Token-Ring Network promises to become the industry standard. And if you are wondering about the best and quickest way to tie your product into this new 4-Mb/sec LAN, here's your solution: **The TMS380 chip set from Texas Instruments.**

TI's TMS380 is the *only* commercial chip set tested — and system-verified — by IBM. It's *the* silicon standard for this new high-speed office-system LAN.

And for a sure, fast entry into this exciting new market, you can begin with TI's TMS380 *Design-in Accelerator Kit.*

Q. What kinds of products can communicate through the new LAN?

A. With the TMS380 chip set, almost any.

TI's new TMS380 chip set was developed jointly with IBM. Its general-purpose system interface allows many kinds of equipment from various manufacturers to communicate through the IBM Token-Ring Network. And since this is an open network, any product in which you use the TMS380 can communicate with any other, when common languages are used.

Q. Is expensive cabling required?

A. No.

Your customers have the option of using telephone twisted pair or shielded twisted pair. And the point-to-point topology of the token ring makes it ideal for fiber optics, since the taps that are necessary with bus topologies are not required.

Q. Where does TI's TMS380 chip set fit in?

A. It's the heart of your LAN adapter card or subsystem.

The TMS380 chip set is a complete solution for the physical interface and media-access control. Its integrated LAN-adapter architecture provides for efficient, transparent handling of the IEEE 802.5 protocols. TI's TMS380 in your product will give your customers freedom to choose the cabling system that best suits their needs. And the flexibility to interface with any of the popular logical-link-control and higher-layer protocols.

◀ **Everything you need** to begin designing your own IBM Token-Ring Network LAN adapter is included in your TI *Design-in Accelerator Kit:* Three TMS380 chip sets, comprehensive literature, and debug software.

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Volume 49, No.8

Electronics Australia

August 1987

AUSTRALIA'S LARGEST SELLING ELECTRONICS MAGAZINE — ESTABLISHED IN 1922

65 this month!

It's our 65th birthday this month! Read about the early days of the magazine in our feature starting on page 24 . . .

Strobe flash adapter

Need to stop moving objects? You can with a low cost electronic flash, using this strobe adapter. It hooks up to your Apple or Microbee. See page 82.

Digital audio tapes

Heard about the new DAT recorders that let you make home audio recordings with CD quality? The good news starts on page 10.

ON THE COVER

JVC's new GR-C9EA is claimed to be the smallest VHS-system video camcorder yet produced. It features a CCD pickup array and records on compact cassettes that play back in a standard VHS recorder, via an adapter — see page 6.

Features

Entertainment Electronics

Projects and Technical

News and Comment

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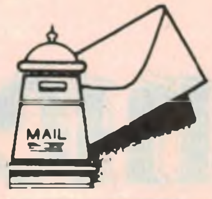


Letters to the editor

A bouquet

Congratulations on your return to the magazine! I'm sure that with you back in the driving seat, EA has a bright future.

I've enjoyed the time we worked together, both when you were still at EA the first time and then when you came to Dick Smith Electronics. You made an important contribution there as well, and we had a lot of fun. But I know your real love has always been writing and editing, and they're the things you do best. So it's great to see you and EA back together again — an ideal combination.

I expect to see some exciting things in EA soon, so get cracking. What about a few good stories on what Australians are doing in electronics, for a start. We have a lot to be proud of!

Anyhow, all the best for the future.
Dick Smith,
Australian Geographic,
Terrey Hills, NSW.

Comment: Thanks for the bouquet, Dick. You've done pretty well at publishing yourself, among other things! We've already got some stories on Aussie developments in the pipeline, too . . .

Vintage radios

Your articles by John Hill on vintage radios contain views with which I fully agree, bringing back memories of the good old days of the early 1930's when mains powered radios were taking over from the battery driven variety.

As an electrical apprentice at that time, and a subscriber to *Wireless Weekly*, I became a manufacturer in a very minor way (no licence, naturally!) for a limited circle of friends.

My interest lay in TRF receivers of better than average tonal quality, as against the hiss and background noise of the superheterodyne. Preferred circuits were for receivers of 5 to 8 valves, including rectifier, with two or three stages of RF tuning, which gave reasonable selectivity of the few broadcasting stations in operation at that time. Some of the models built incorporated push pull output and dual 8 or 10 inch speakers.

The quality of output was, as John Hill states, quite impressive, especially if the speakers were mounted in large cabinets. Rola was a popular choice of speaker. Jensen was another. Also impressive were the prices of components at that time. Mains transformers for push pull 5 watt output were rated at 150 watts, the HT secondary centre tapped winding giving 385 volts each side at 150mA. These transformers, made in Australia under the name "Radiokes" cost seven shillings and sixpence (75 cents). RCA valves could be purchased from the distributor at retail less 40, less 10, and a further 5% for cash. This brought the cost of a 280 rectifier to 28c.

Cabinets could be custom made by out of work cabinet makers, and the going price for a "mantel" cabinet was from 15 to 25 shillings. A 5-valve (including rectifier) TRF radio in plywood cabinet could be made and sold for a satisfactory profit at five pounds.

We (there were several of us) always waited eagerly for the *Wireless Weekly* to give us the latest circuits and tips. Unfortunately, unwelcome attention from radio inspectors who, rather unreasonably, we thought, required us to produce licences to manufacture, spelt the demise of our small circle of radio builders. Countless models of commercial makes were available from Europe, Australia and local sources.

There are still valve radios in operation — cowsheds are a favourite location — but real antiques, such as the German Loewe (a single large valve containing multiple stages) would be hard to come by now. Reconditioning of oldtimers as suggested by John Hill is certainly a hobby to be considered seriously, being relatively inexpensive and satisfying.

Ian Page,
Mangawhai, New Zealand.

Proclamation of "Declared Articles"

By order published in the Government Gazette No.60 of 27 March 1987, Electric Fence Energiser, Bayonet Cap Lampholder and Edison Screw Lampholder were proclaimed as declared articles effective from 1 July 1987. The earlier definition of Normal Bayonet Lampholder was also revoked.

Electric fence energisers and Edison screw lampholders which are within the declaring definition, will require certificates of approval from 1 July 1987.

Existing certificates of approval for bayonet cap lampholders (B14) and Edison screw lampholders will be cancelled from 1 July 1987, and it will be necessary for these certificates to be returned. Applications for replacement certificates of approval must therefore be initiated without delay.

The prescribed fee for applications for bayonet cap lampholder and Edison screw lampholder is $55.00. For electric fence energisers the application fee is $142.00.

Where guidance is required on whether a particular article falls within the scope of the definitions, advice may be obtained from the Energy Authority's Equipment Approvals Section.

N.C. Watson,
Energy Authority of NSW,
Sydney, NSW.

Vintage radios: sets & parts available

I have available an Airzone chassis circa 1935, including, handbook, a Ferguson Radio (1.4V valve type) circa 1947, and some sundry parts available "give away" to an interested party. My phone number (home) is (02) 451 9894.

Any assistance to avoid taking those items to the tip would be welcome.

Peter Grout,
Forestville, NSW.

Components for restoring vintage radios

Although I'm not into electronics (purely a hifi listener) I thought John Hill or your readers would be interested in the following information. I've recently received a catalogue from England put out by:

The Vintage Wireless Company, of
Tudor House, Cossham Street,
Mangotsfield, Bristol BS17 3EN,
England.

This catalogue has 166 pages and is full of the items which would seem impossible to obtain. There are 10 pages of new and boxed valves, several thousand in fact, from type A20B at 4 pounds to 829522. They keep just about everything: books, condensers, chokes, crystals, needles, gramophone parts,

continued on page 126

Editorial Viewpoint

Our 65th birthday issue!

This is a very special issue for us, because it marks the achievement of no less than 65 years of continuous publication.

August 1922 saw the first issue of *Wireless Weekly*, Australia's first magazine for enthusiasts working in the newly-discovered field of "wireless". It obviously met a need among both amateurs and the soon-to-emerge professionals, because it immediately took off and flourished along with the industry itself.

Over the years, as that industry changed and broadened in its scope, the magazine also adapted to those changes. In April 1939 it changed its name to *Radio & Hobbies*, to reflect the broader range of interests. At the same time it changed from a weekly into a monthly, to give more opportunity to deal with technical matters in more depth.

Since then, the magazine has changed its name twice more, each time to reflect the ever-broadening nature of its subject area. In the late 1950s, when television broadcasting began, it became *Radio, Television and Hobbies* (such a mouthful that everyone called it "R,TV & H" for short). Then in April 1965, it was changed to the present name, intended to convey what is still our ongoing aim: to project a uniquely Australian image in the exciting field of electronics, in all of its areas of application.

We're especially proud that this birthday issue carries a feature article on the early days of the magazine, written by my old boss Neville Williams. Our former Editor-in-Chief, Neville is the person with the longest-ever association with the magazine, and therefore ideally suited to write such a story. You'll find it makes fascinating reading — I certainly did!

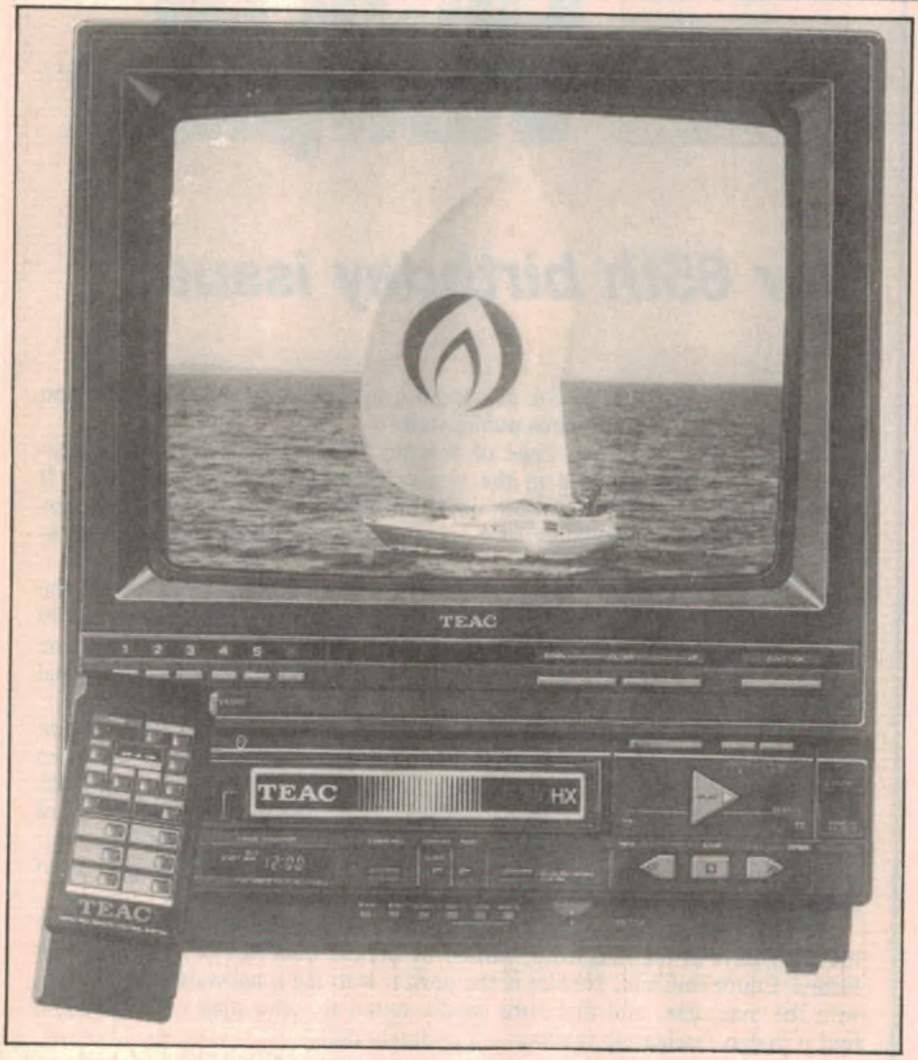
Needless to say, although the magazine may have turned 65, we have no intention of retiring. Quite the contrary: we now have our sights set firmly on the ton (tonne?).

Electronics is a fascinating activity, whether you're working in it for your living or pursuing it as a hobby. It now pervades so many areas of human activity, and progresses at such a rate, that we're never going to be short of interesting news, feature articles and try-it-yourself projects to bring to you each month in EA.

So stick with us, as we continue our tradition of bringing you the best of electronics in Australia.

Jim Rowe

What's New In Entertainment Electronics



TV-VCR combination from TEAC

Teac engineers have produced what could be the ultimate second TV set for the family.

The Teac Televideo is Australia's very first portable 34cm colour TV with its own inbuilt VHS video cassette recorder. In other words, a complete home video entertainment system made portable.

This new Teac unit is scarcely bigger than a conventional 34cm portable TV set. It weighs just 16.4kg and can be easily picked up — even by children — and moved from room to room, whether the bedroom or the family room. It has built-in antenna and merely needs to be plugged in to a power outlet. Naturally, for optimum tuning capability it is preferable to connect the unit to a video/TV cable in the room where it is being used.

Despite its compact size, Teac Televideo has many of the features of individual TV's and videos. For example, it has a 12-function cordless remote control, full timer recording, one-touch record, still frame with special noise cancel facility, picture search and automatic rewind. It also offers 4-hour recording/playback capability.

The recommended retail price is $1299 with a 12 month warranty or $1399 with a 5 year warranty.

New compact VHS mini camcorder

JVC has released what it claims is the smallest VHS camera recorder in the world.

Called GR-C9EA, the new mini VHS video movie illustrates just how advanced video technology has become. Upholding two fundamental policies — format perfection and compatibility — JVC has pursued a rigorous set of objectives for every camera recorder produced since the first relatively basic VCR. These include reduction of weight and size, further enhancement of picture quality, superior reliability, and utilisation of the latest video technology throughout.

The new GR-C9EA record-only model, which was released in Australia in June, achieves all these objectives, according to JVC.

The GR-C9EA's record-setting com-

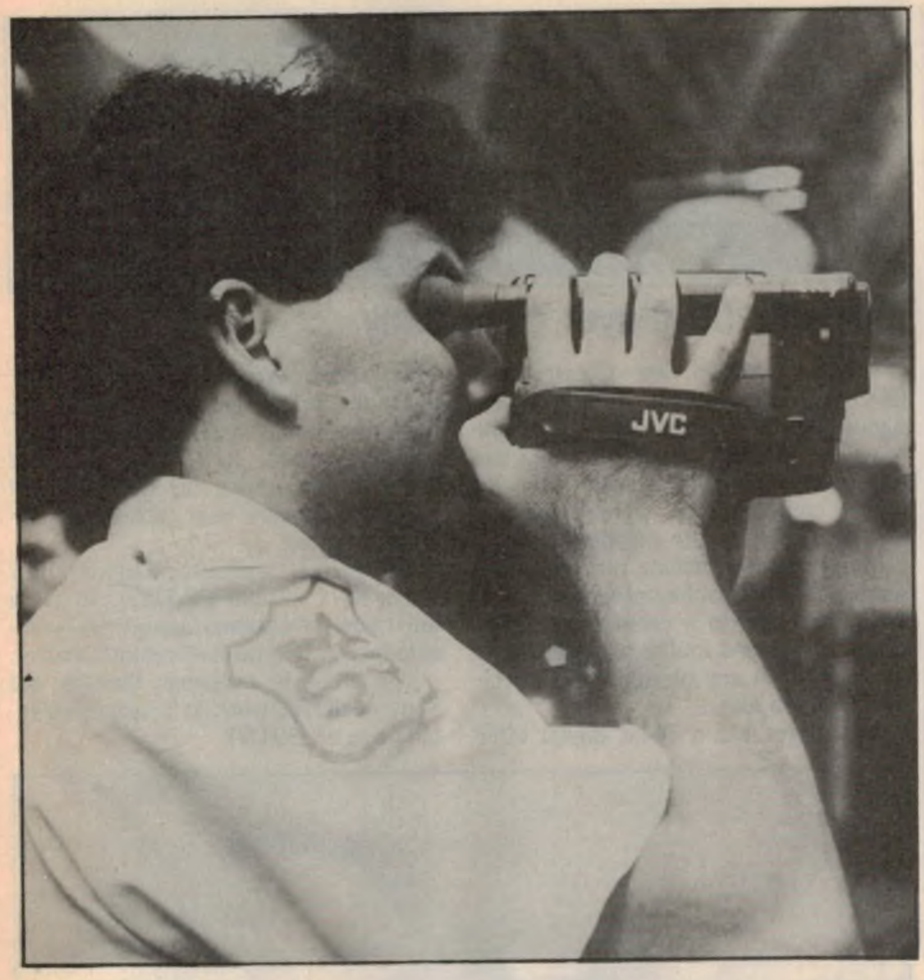
New TDK audio tape

TDK has releaed a new line-up of audio tapes, featuring improvements in formulation through to packaging.

TDK's range now offers a total of eight audio tapes — two metal, three High Position or Type II, and three Normal Position or Type I tapes.

Outstanding in the new TDK range is type SF (Super Fidelity), a new High Position Type II tape designed to offer similar performance to the very famous SA tape (Super Avilyn). SA is famous for its acceptance by most leading cassette deck manufacturers, as the alignment tape for their cassette decks in the High or Type II position.

"The new SF audio tape is designed to very similar specifications as the



pactness and ultra-light weight (760 grams) were attained through a number of technological advancements and has resulted in further improved performance.

According to the managing director of Hagemeyer (Australasia), Mr Edwin Koemans, "The introduction of the GR-C9EA has been in response to market demands for an easy-to-use camcorder which does not compromise consumer needs when it comes to the two major priorities in portable equipment — size and weight."

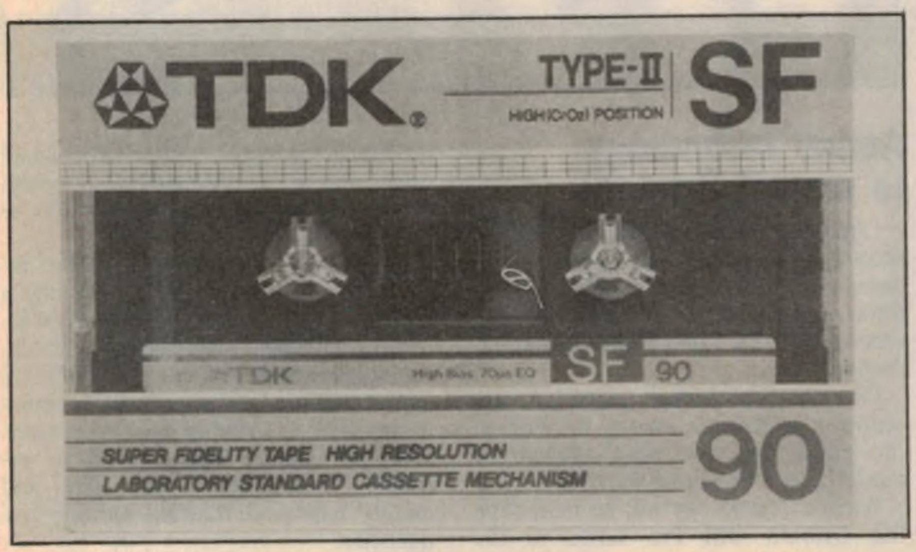
As the world's smallest and lightest VHS camera, the GR-C9EA is ideal for amateurs and professionals alike. Mr Koemans claims that even children will find it easy to use. It offers up to one hour of recording on its mini VHS cassette, with playback on any VHS deck using an adaptor cassette.

Unlike other mini camcorders that sacrifice features for small size, the new GR-C9EA record-only model has all the functions expected from top-line camcorders. It's the first video camera to reduce weight and size by shaping the battery so that it can double as the camera's hand-grip.

Other features includes a new zero frame editing feature, employing microcomputer control which ensures noise-free transition between paused recordings, HQ (High Quality) system circuitry and auto white balancing which responds automatically to changes in light source, producing balanced results both indoors and out.

Delivering pictures that offer high resolution even for rapidly moving subjects, the GR-VC9EA employs a new and very much improved high-performance CCD (Charge Coupled Device) that is fast, highly resistant to shock and vibrations, and less susceptible to image burn-in than conventional camera tubes

Recommended retail price in Australia is $2099.



previous SA, but with an economy price" said Mr Kihara, General Manager of TDK (Australia). SF is an extremely quiet tape, with bias noise a very low –61dB.

SF is well suited to most recording applications, particularly to classical and material with a wider dynamic range. The extended high frequency range to beyond 16kHz enables the higher order harmonics to be reproduced faithfully.

TDK has gone to considerable effort to improve the cassette housing of SF, housed in a new Laboratory Standard cassette mechanism. Recent research in cassette housing developments has shown that transport systems and housing are just as important as the magnetic material itself.

Economy CD player from Sony

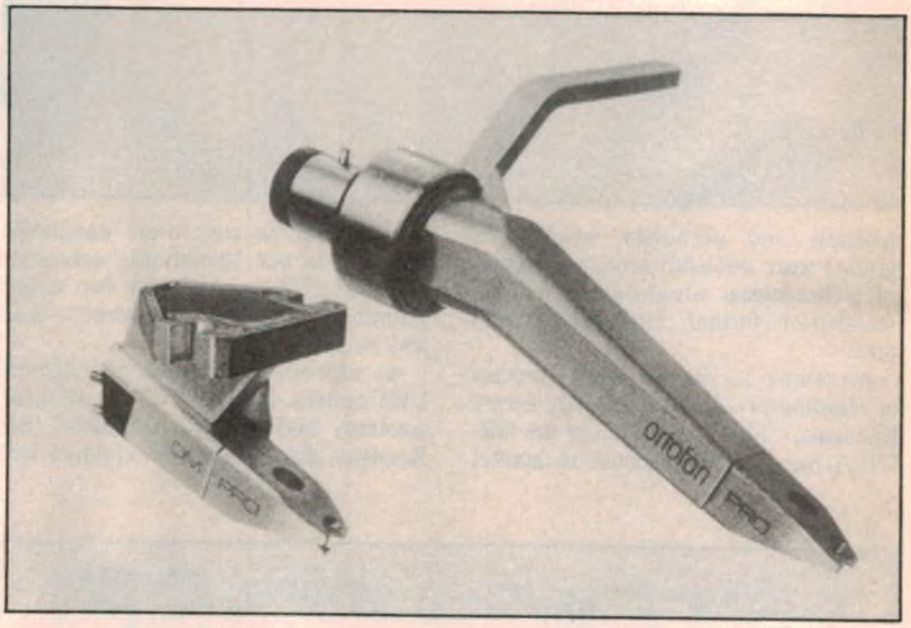
Sony Australia has released the CDP-M20, an economy CD player designed for the first time user. The unit provides features that research has shown are the most sought after by todays consumer, yet were previously only available in more expensive units.

Major features include random music search (RMS), enabling programming of up to 16 tracks in a pre-selected order of preference and shuffle play which lets the user select any playing order of the tracks on the disc.

The player has a 16-bit digital filter with 2-times over sampling, which reduces the digital signal's influence upon the analog audio signal resulting in crystal clear sound. It also has unilinear converter preventing the generation of jitter and 3-beam laser pick-up for superior tracking.

The M20 is compact, measuring only 355 x 80 x 272mm (W/H/D). It has a full range of optional accessories available including a wireless remote control.

The M20 is available through the Sony dealer network at a suggested retail price of $399.00.



Amber technology to market Ortofon

Amber Technology has concluded a special arrangement with Scan Audio, distributors for the Denmark-based Ortofon, to market Ortofon's professional cartridges to the radio and recording industries.

Ortofon professional cartridges are acknowledged to be among the best in the world, and have been adopted by the BBC as a broadcast standard.

Amber Technology will be marketing the Ortofon OM Pro series to the recording industry and professional users, and as an introductory offer will supply two units for the price of one, to the first one hundred purchasers.

Features of the Ortofon OM Pro include a full playback cue facility and a luminous tip, a more robust construction to withstand such rigours as backcueing (practised by all disc jockeys) and scratching, and superb sound quality because of a low tip mass that means very low surface noise (with an extremely high signal to noise ratio) and greatly improved tracking at high frequencies.

The next revolution in consumer electronics:

DAT's the future of audio tape recording

Imagine a home audio tape recorder with a performance as good as you get from your present CD player: flat response, excellent stereo separation and nasties like noise, distortion, wow and flutter all too small to measure. Sound incredible? They're already available in Japan, and you might well be able to buy one here before the end of the year.

by JIM ROWE

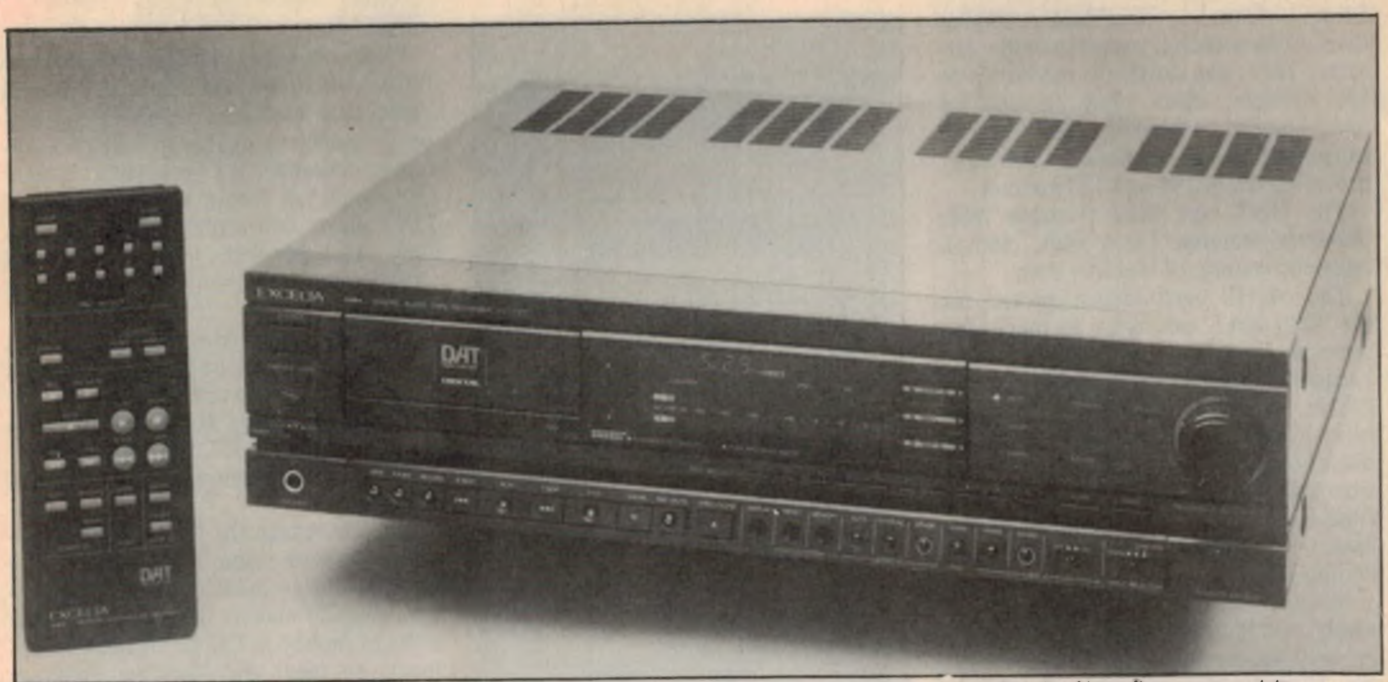
Just as you thought you had adjusted to the wonders of compact discs (CDs), there's a new revolution looming on the consumer electronics horizon: digital audio tape, or DAT. Over the last few months, the major Japanese audio equipment makers have been announcing the first of their new DAT recorders, and major tape manufacturers like TDK have announced DAT cassettes to go with them.

At this stage the new recorders have only been released on the domestic Japanese market, but it's almost certainly just a matter of time before we see them here. Already Aiwa's Australian distributor Mobex has demonstrated an advance sample to the technical press, while TDK's local advertising people have sent out preview samples of the company's new DAT cassettes.

So don't be at all surprised if you see the first DAT machines available here just before Christmas, or failing that early next year. They're that close.

Of course in itself, digital recording of audio is not new. The professional sound recording industry has been using it for years; all the master recordings for your "DDD" compact discs are made this way, using studio-type digital reel to reel recorders. But up until now, the technology has been too expensive to make it available as a consumer product.

At present, cassettes are available in four different playing times: 46, 60, 90 and 120 minutes. The prices currently range from about $A12 to $A20 each.



The Aiwa "Excelia" XD-001 DAT recorder, first to be released on the market in Japan, in March. Aiwa flew one out to Australia for a few days recently, for a series of demonstrations. As well as offering full CD-quality recording, it also provides an impressive range of operating functions: high speed track selection and skipping, random play programming and so on.

It was basically the tremendous success of CDs worldwide that started the Japanese audio equipment makers working on DAT in earnest. The CD boom showed that music lovers were eager for the vastly improved performance possible with digital recording: much lower noise and distortion levels, and virtually no wow and flutter at all. They also appreciated the greater operating convenience — no pickup arm to fiddle with (or drop!), the ability to find track selections automatically, and so on.

The manufacturers realised that as soon as people became used to this standard of reproduction and convenience, they were likely to want the same things from their home tape recorders. They certainly weren't likely to be willing to buy conventional analog recorders for much longer, so the market for these was obviously going to nosedive. The sooner the industry would be able to offer attractively priced DAT machines to take their place, the better.

In mid 1985, an industry conference was presented with the results of two investigations by working groups into possible DAT recording standards. One, called S-DAT, involved the use of a conventional stationary recording head system; the other, called R-DAT, employed a rotary head system very similar to that used in video recorders.

The conference chose the R-DAT system for immediate development of consumer DAT equipment, because it was based on existing technology and therefore closer to the marketing stage. Some 81 different recording hardware, media and software companies attended the conference, including 21 firms from outside Japan, such as Philips. Virtually all the major Japanese firms were represented, including Sony, National (Matsushita), Toshiba, JVC, Aiwa (as subsidiary of Sony), TDK and so on.

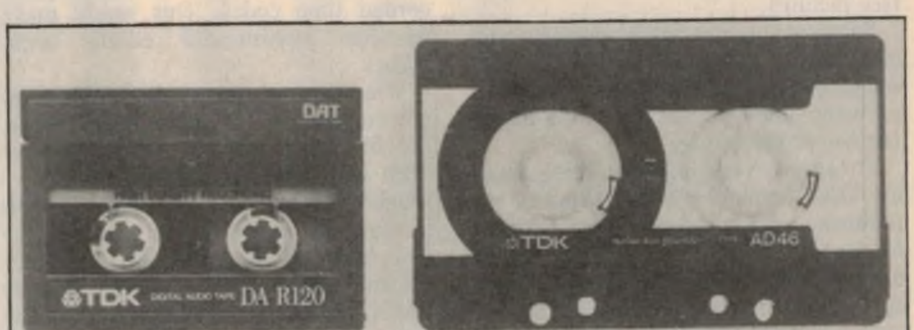
Apparently the S-DAT system hasn't been dropped altogether, but may be developed for semi-professional use.

So the machines that have been released in Japan this year are R-DAT machines, and these are the type you're likely to see here later this year.

One of the reasons why DAT technology has been developed fairly quickly is that it has been able to make use of various other recent developments: the digital audio processing chips and techniques developed for CDs, plus the precision rotary-head recording techniques and high performance metal particle recording tapes developed for the latest 8mm video recorders.

In fact there are a lot of similarities between DAT technology and 8mm video technology. Both use much the same kind of tape, in a compact cassette — although in the case of DAT the tape is only 3.81mm wide. And both use a helical-scan rotary head system, to achieve a suitably high head-to-tape scanning speed. In the case of DAT, the linear head-to-tape scanning speed is about 40 metres per second, although the tape moves at only 8.15mm/sec (the head drum rotates at approximately 2000rpm).

The DAT cassette measures only 73 x



Comparison of one of the new DAT cassettes against a conventional compact audio cassette. They are even more compact, as you can see. TDK's DAT tape uses a 2um metal-particle formulation, on a polyester base only 13um thick. The tape is 3.81mm wide and moves at 8.15mm per second.

54 x 10.5mm — significantly smaller than a conventional compact audio cassette. Yet it can currently record up to 120 minutes, more than enough for most domestic recording. Four cassette capacities have been announced to date, providing 46, 60, 90 and 120 minutes.

The DAT tape itself is made from polyester material 13um thick, with a magnetic coating of typically 2um.

The overall performance quoted for the first DAT machines is much the same as for CD, if not slightly better. Frequency response is typically 2Hz — 22kHz, within 0.5dB; signal to noise ratio better than 92dB; total harmonic distortion less than .005% at 1kHz; wow and flutter below measurable limits (that is, less than .001%). All machines have two channels, for stereo recording and playback.

In short, the advent of DAT means a whole new ballgame in terms of domestic or "non-professional" audio recording. Virtually anyone with a DAT machine will have the potential to make recordings of a quality which up until now, could only be made using the most expensive studio equipment.

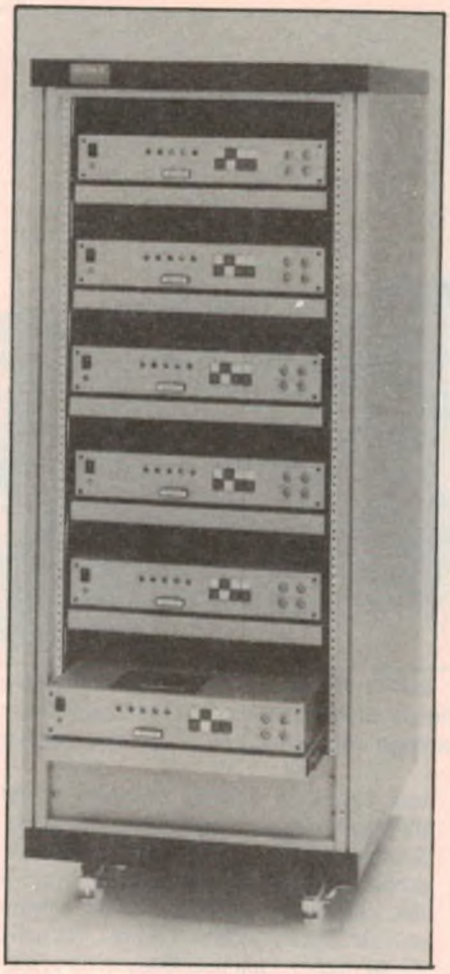
For the technical reader, DAT uses 16-bit linear sampling at a rate of 48kHz. This has been deliberately chosen to be different from, and incompatible with, the 44.1kHz sampling rate used by CDs — to prevent direct digital dubbing of CDs.

Many of the DAT recorders will also replay tapes recorded at the 44.1kHz sampling rate, however, allowing the possibility of pre-recorded DAT tapes produced from CD master recordings. However at present the world's recording software companies do not appear too keen on producing such tapes, because they have invested a lot of capital in expensive CD production plant.

Despite this, Japanese firms like Sony have already developed systems for duplicating pre-recorded DAT cassettes (see picture).

Some of the new DAT machines will also record and play back at a third sampling rate, 32kHz. This is described as being intended for use with future satellite broadcasting.

To ensure very high recording quality, DAT employs the same kind of sophisticated digital error correction techniques as CD. The Sony DTC-1000ES machine uses "feed forward super strategy" error correction, based on double encoded Reed-Solomon coding. It also uses four times over-sampling frequency digital filtering, and the same kind of dual D/A (and A/D) conversion used in the higher quality CD players.



Looking ahead, Sony has produced this DAT software duplication system — for when the world's software publishers finally acknowledge the inevitability of DAT, and agree to play ball.

On the operating side, the new DAT players offer the same kind of random track selection, high speed searching (about 200 times normal speed) and function display facilities as modern CD players. Some of them also provide for random replay programming, using recorded time codes. This would make possible sophisticated editing techniques.

What kind of money do you have to pay to get all of these wonders? Well, the first units released in Japan have been selling for around 200,000 yen — roughly the equivalent of $A2000. This is much the same as the price of the first home VCRs, allowing a bit for inflation. It's almost certain that the prices of DAT machines will gradually fall, like those of VCRs and CD players.

The cost of DAT cassettes currently ranges from about $A12 for the 46-minute size to around $A20 for the 120-minute size.

Fairly obviously, DAT represents the future for home and semi-professional audio tape recording. Even the professional market is eyeing it with great interest, because the recording quality they could get with a $2000 "domestic" DAT player will actually be better than they can get with most professional studio recorders costing up to 10 times as much.

The only query over DAT at present is just when it will be marketed outside Japan. Needless to say the Japanese industry is champing at the bit, because they sense that DAT will be a winner. They're not delaying export business willingly.

No, the reason for the delay is essentially pressure from the world's CD makers and recorded software publishers. The CD makers have invested huge sums of money in CD production equipment, to meet the booming demand. Needless to say, they'd like to get a little return on their investments before DAT could (possibly) affect CD sales.

The software publishers are also worried about people using DAT recorders to copy recordings from CDs, off air and even from conventional LPs. Although the DAT makers have given their machines a different sampling rate from CDs, to prevent direct digital copying, and have built in all sorts of circuitry to detect copy-protection codes (which are easy to build into digital recordings), the software people still aren't happy. At present they have imposed a virtual boycott on DAT, and it is apparently this kind of pressure which is largely responsible for the delays in marketing DAT outside Japan.

It seems to me that just as LPs and conventional audio cassettes have shared the audio recording market for years, CD and DAT will be able to do likewise. In fact I believe if anything, DAT is likely to give CDs a boost — by helping to raise everyone's standards and expectations concerning audio recording quality.

Like LPs and audio cassettes, CD and DAT have complementary roles. One is ideal for publishing pre-recorded music, on a virtually permanent medium, and for listening to that music with a maximum of convenience. The other is going to be excellent for making your own recordings, with the same kind of performance.

Frankly, I can't wait until we get our first DAT recorder for evaluation and review, so I can try one out and tell you all about them from first-hand experience! EA

X-wing helicopters

Helicopters are unsurpassed in their ability to hover, but their forward flight speed is limited to about 200km/h. Now that limitation seems likely to be overcome with the development of the X-wing helicopter, which uses a very unconventional rotor.

by IAN GRAHAM

Ever since Igor Sikorsky flew the prototype of his first helicopter in 1940, plane-makers have striven to build the helicopter's vertical take-off and hover performance into a fixed wing aeroplane.

One solution is to deflect a jet engine's exhaust downwards (called vectored thrust). Using this, an aircraft like the Harrier can be made to hover, but at a very high price in terms of fuel consumption. Helicopter designers approached the problem from the opposite direction. They attempted to increase the helicopter's comparatively low cruising speed by adding wings and extra engines.

Both approaches have met with limited success. Fixed wing VTOL (Vertical Take-Off and Landing) aircraft produce about a pound of lift per horsepower, while consuming about 40% of the aircraft's weight in fuel per hour. By contrast, a helicopter generates up to 12 pounds of lift per horsepower (about 7kg per kilowatt), while consuming only 2% of its weight in fuel per hour.

Although the helicopter is much more efficient at hovering, it can't approach the cruising speeds of fixed wing aircraft. A helicopter's forward speed is limited to about 200 knots, or perhaps as much as 350 knots with added wings and extra engines. To compete with fixed wing aircraft, helicopters have to increase their cruising speed to around 500 knots.

Why not simply build a rotor system onto a conventional fixed wing plane? It's been done, but the extra hydraulics and mechanical hardware make this hybrid aircraft or "compound helicopter" so heavy that it can only operate by dispensing with most of its fuel and payload! Even then, its speed is limited to about 250 knots. Not a very practical solution.

A revolutionary new breed of aircraft is taking shape now in wind tunnels and on computer screens. The new breed will be capable of combining the fuel-efficient hovering performance of a helicopter with the high cruising speeds of a fixed wing plane, without having to leave its fuel and payload behind. Advances in computers, new materials and air flow control science have made it possible to design rotor blades capable of doing things that would tear the rotors off any normal helicopter.

Coanda effect

In the mid-1960s, Dr Ian Cheeseman of Southampton University in England was experimenting with a phenomenon called the Coanda Effect. If a stream of air is blown over a smooth, curved surface, it tends to follow the shape of the surface. If the air stream is blown at a high enough pressure, it also tends to drag the surrounding air with it. This is the Coanda Effect, discovered by Romanian-born scientist Dr Henri Coanda in 1910.

Dr Cheeseman suggested that cylindrical rotors fitted to fixed wing aircraft could use the Coanda effect to generate lift for take-off and landing. The rotors would then be stopped during forward flight. The rotors now under development have evolved from cylinders into broad, wing-like structures.

Indeed, the broad, flat appearance of the vehicle's four rotors gives this propulsion system its popular name, X-wing.

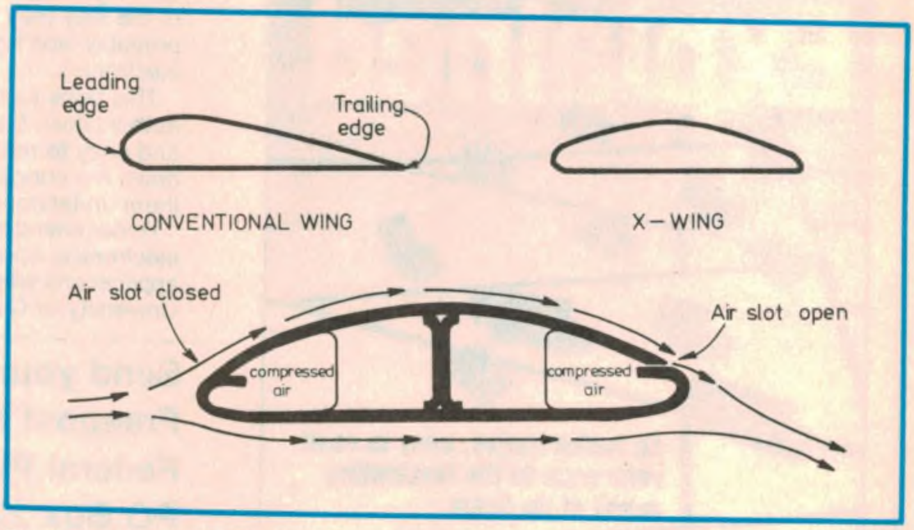
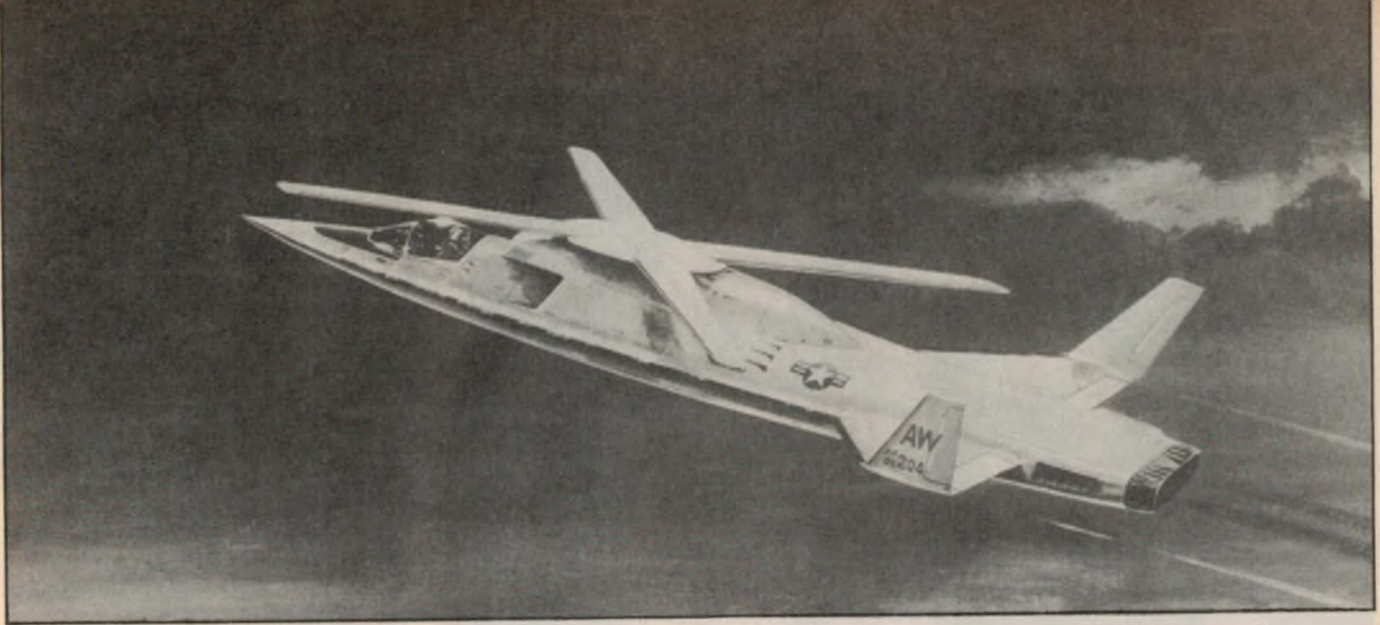


Fig.1: A normal aircraft wing has a leading edge and trailing edge (top left). An X-wing (top right) must be symmetrical. By blowing air through slots in the wing edge (above), the air flow can be changed to create a trailing edge effect. Either edge can be turned into a trailing edge in this way.



An artist's impression of a future X-wing jet aircraft, shown here in forward flight with stationary rotor/wings.

An X-wing aircraft takes off vertically like a conventional helicopter, by spinning its rotors. But in forward flight the rotors stop spinning and behave like two pairs of wings — one pair swept forward and the other swept back. It takes between 15 and 30 seconds to brake the rotors from take-off speed to a dead stop. Loss of lift during this time makes the aircraft very unstable and it might roll over in the air, but for something that goes by the horrendous name of "circulation control aerodynamics" allied to a powerful on-board computer system.

Two-way wings

Conventional aircraft always fly in the same direction (i.e., forward), and so their wings are shaped asymmetrically with a leading edge and a trailing edge. At take-off and landing some aircraft can produce more lift by extending flaps from the trailing edges of the wings.

X-wing aircraft can't do this, because as the rotors slow down, the trailing edge of a rotor blade on one half of a revolution becomes the leading edge on the other half. And when the rotors stop, a blade edge could be either a leading edge or a trailing edge, depending on where it stops. X-wing rotors must therefore be able to generate lift even when the airflow across them reverses.

Conventional, hydraulically operated flaps on both blade edges simply couldn't be extended and withdrawn quickly enough as each blade edge switched from leading edge to trailing edge. Even if they could, the resulting vibration would probably tear the aircraft apart.

This is where the Coanda effect comes into play. By forcing air out of slots in the edges of an X-wing rotor blade, the air-flow around the rotor can be made to behave exactly as if the symmetrical blade was actually a normal wing with leading and trailing edges. If the edge of the blade has air blown through it, it becomes a trailing edge and when the air supply is switched off, it becomes a leading edge again.

A bewilderingly complicated system of 48 valves in the central hub switches a high-pressure air supply from one edge of each blade to the other edge. This is done rapidly enough to achieve the desired effect and solve the problems of instability and loss of lift as the four rotor/wings slow down and stop.

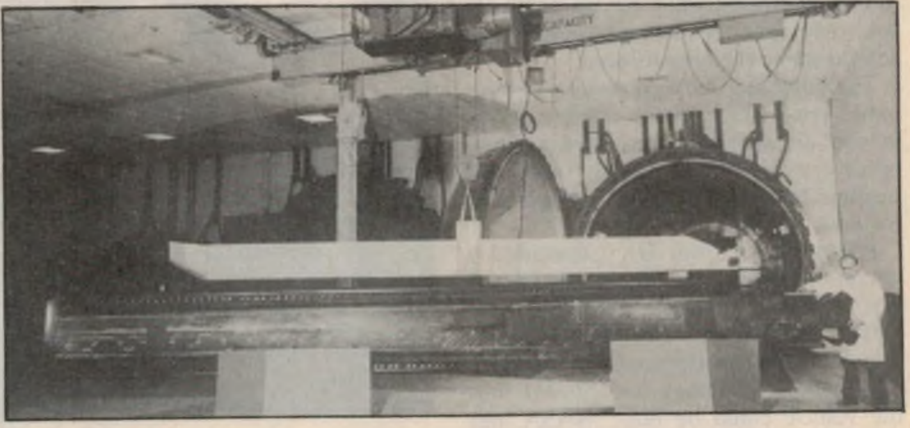
A normal helicopter controls its pitch and roll by tilting its rotor blades or the whole rotor hub. Fixed wing aircraft control pitch and roll by means of moveable control surfaces on the wings. X-wing aircraft can't do either of these, because each X-wing must be rigidly connected to the central hub due to the complicated nature of the high pressure air supply to the rotors.

Helicopter rotor blades, which are so flexible that they droop down when stationary on the ground, become stiffer when they spin — in the same way as a floppy string with a weight on the end becomes rigid when the weight is whirled round. But when an X-wing aircraft stops its rotors in the air to convert to forward flight, these strengthening "spinning forces" disappear.

In addition, unlike the wings of a normal fixed wing aircraft, two of the X-wing aircraft's rotor/wings are swept forward. To resist the forces that tend to bend the wing tips up or down, X-wings have to be made even stiffer than normal aeroplane wings.

Rock and roll

X-wing aircraft can control pitch and



This comparison of a conventional helicopter rotor blade (top) and an X-wing rotor/wing (bottom) gives some idea of its size and substantial construction. Without its final aerodynamic skin in place, the air slots are clearly visible along each edge of the rotor/wing.

A one-sixth scale model of the Rotor Systems Research Aircraft that will test-fly X-wing, being prepared for wind-tunnel tests.

roll by regulating the air blowing through the wing edges. Although X-wings are extremely stiff and resistant to bending up and down, they have some flexibility when it comes to twisting. Blowing air through one wing edge and not the other makes the wing twist and changes the amount of lift it generates. By creating more lift in one part of the X-wing's rotation than in other places, pitch and roll can be controlled very accurately indeed. Shaping the airflow like this is called Circulation Control Aerodynamics or "Pneumodynamics".

It is such a complicated control technique that a pilot could not possibly handle it manually. As a result, an X-wing aircraft must be flown "by-wire". The pilot's movements of the control column are fed into a computer, which interprets what he wants to do and then uses the pneumodynamic system to make the aircraft do it.

The computerised system also detects unwelcome vibrations or other motions in the aircraft — almost before they occur — and automatically uses the pneumodynamic system to compensate for them.

Following on from Dr. Cheeseman's pioneering work, the X-wing technique was further developed at the US Navy's David Taylor Ship Research and Development Centre in Bethesda, Maryland.

In 1983, when they had proved that the vehicle could be built, NASA and the Defence Advanced Research Projects Agency contracted with Sikorsky to design, build and test-fly a full scale X-wing aircraft.

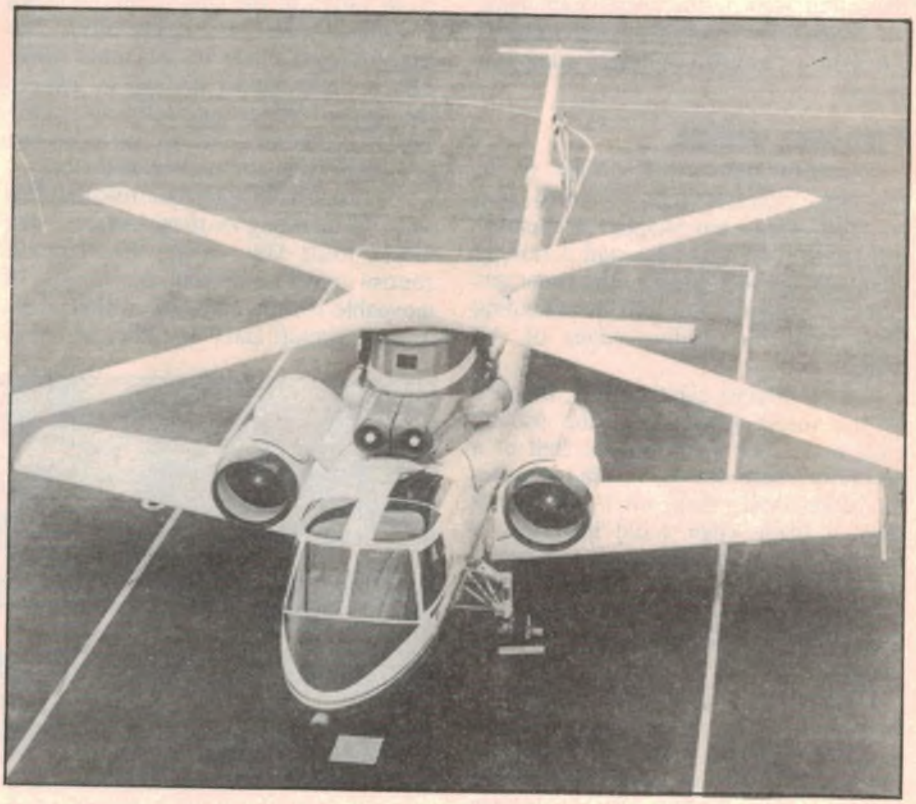
Flight testing

Sikorsky has built an X-wing rotorhead onto one of the Rotor Systems Research Aircraft (RSRA) that they supplied to the US government ten years ago. Its extra wings and engines allow the X-wing stop-start procedures and performance to be tested safely. If lift from the X-wings is lost at any time, the aircraft can switch to conventional fixed wing flight.

The RSRA has a unique crew escape system, the only operational crew escape system in use in a helicopter. The problems of ejecting upwards from a helicopter with sword-like blades spinning directly above the crew must be obvious. In an emergency, the RSRA crew can fire explosive charges to blow the blades off and away from the aircraft, blow the cockpit roof apart and then eject the crew safely.

The modified RSRA will be flight tested throughout 1987 at NASA's Dryden Flight Research Facility at Edwards, California.

When X-wing aircraft eventually come into service, they will most likely be used for missions which neither helicopters nor fixed wing planes are presently capable of accomplishing efficiently — missions where it is vital to get to a location swiftly and then stay there for long periods. Air/sea rescue, anti-submarine sonar dipping and electronic intelligence all require this versatility and should benefit from X-wing technology at the beginning of the next century.



The full-size X-wing Rotor Systems Research Aircraft. Once the RSRA proves X-wing to be technically feasible and safe, the next aircraft, a technology demonstrator, will dispense with unnecessary wings and engines and rely totally on the X-wing for lift in the hover and forward flight modes.

FORUM

Conducted by Neville Williams

Gilding the lily: is it worthwhile?

A reference in the December issue to the possible up-dating of old valve amplifiers seems to have prompted correspondence not just on the original subject, but on "improving" hifi equipment generally, including near-new compact disc players. While I don't wish to be totally negative, I do have more than a few misgivings about the idea.

The urge to "improve" the performance of consumer audio/radio equipment is at least as old as my own awakening interest in what was then called "wireless".

Back in the 1920s, the popular choice, for those who could afford it, was a "neutrodyne" type receiver, featuring provision to neutralise the grid-plate capacitance of the triode RF amplifier stages, in the interests of stability.

The setting-up procedure involved disabling each RF amplifier valve in turn, by disconnecting one side of the filament and then, with the receiver tuned to a strong local station, carefully adjusting the associated neutralising condenser (capacitor) for minimum signal feedthrough.

Heaven alone knows how many such receivers were subsequently de-stabilised by owners who couldn't resist the temptation to screw the neutralising condensers this way and that in a quest for improved performance.

Which reminds me of a brand new superhet receiver, returned for service to the factory where I worked in the early '30's. On taking delivery, the purchaser had apparently checked it over to see that everything was firm and shipshape. And, sure enough, he found it necessary to tighten quite a few "loose screws" (trimmer, &c) visible on the tuning gang and IF transformers!

Then there was the manager of a company handling a leading line of imported hifi loudspeakers. He was still muttering into his glass when I encountered him at a trade function during the '70's. It seems that a customer had just returned one of their systems for service, from which the original wiring had been removed and replaced with bits of gargantuan cable.

Apart from the fact that it involved an 8Ω circuit anyway, the exercise had been rendered all the more ridiculous because the oversize cable could not be attached directly to the various lugs and terminals — so the connections had been made with bits of thin wire wrapped around its bared ends!

Those 17W Playmasters

But enough of that. A reader, B.A. (Ivanhoe, Vic), writes to say that, based on his own experience with yesterday's "valved" amplifiers, he heartily supports our remarks in the December issue, particularly in regard to their performance limitations and cost effectiveness, by today's standards.

Even so, for those who may already have such an amplifier, he stresses that yesterday's output transformers often had twin secondary windings which, instead of being connected in series for 15Ω output, can be rewired in parallel (in phase, of course) to match 3.75Ω. This is fine for 4Ω systems and both safe and usable with 8Ω loads.

If such a change is made, however, the feedback series resistor must be reduced by about 2:1 to maintain the feedback factor and gain at the original level. But, he says, when using a modern preamplifier, it is often possible to further reduce the power amp gain by suitably modifying the input stage, with a view to improving the noise characteristic, stability and bandwidth.

The once popular EL37 output valves are now in very short supply but he finds that the EL34/6CA7 is an available and practical substitute.

A Playmaster/LEAK?

It's all very matter-of-fact but, at that point in his letter, B.A. the pragmatist becomes B.A. the enthusiast, with cost effectiveness thrust aside. I quote:

"Since most component parts in an old Playmaster are bound to be suspect, a complete rebuild/redesign project in the context of the December 1986 article may be worthwhile for valve enthusiasts, collectors or just plain hobbyists".

He goes on to say that, some years ago, he had to update a couple of LEAK TL12 class-A mono amplifiers — a project that involved changing the power stage over to class-AB ultralinear, for increased power, and replacing the original 12W output transformers with larger Australian A&R/Playmaster types. I quote again:

"Overall, the final circuit addresses problems of bandwidth and phase splitter balance as described by J. Somerset Murray (Hifi News, Sept. 1959) and differs from early amplifier topology in that the output stage is used as the narrow band stage rather than the input stage. Fixed bias is used throughout, so that all stages can be optimally set".

(Because of pressure on space and draftsman's time, it was not practical to include the actual circuit, so that discussion can only be of a general nature).

In respect to the 6CA7/EL34 output valves, there is no special cause for argument. While cathode bias is simple and automatic, valve application data clearly indicates that, in the quest for maximum power output from a push-pull class AB stage, separate fixed bias has the edge — assuming that the power supply can provide the requisite HT voltage and peak current.

Moreover, with cheap and reliable solid state rectifiers at hand, it is no great hassle, these days, to derive a supplementary negative potential from an existing power transformer.

But he doesn't stop there. To counter Miller effect capacitance losses, along with possible grid blocking effects — "a bane in fixed-bias output stages", he says — B.A. adds a pair of cathode followers (a 12AX7/ECC83) ahead of the output valves, DC coupled to the grids. Presets in the 12AX7 grid returns determine the voltage and current levels in the now composite stage.

RC coupling is used between the cathode followers and the 12AX7 long-tailed phase inverter that precedes them but the phase inverter itself is DC coupled to the input voltage amplifier, a parallel connected 12AT7/ECC81, again with external adjustable bias.

I wondered about his choice of a 12AT7 for the input stage. In the days when I used to be involved with valves, we avoided recommending the 12AT7 for low-level audio amplification like the plague. Being intended initially for RF service, it lacked the special anti-microphonic construction used for its 12AU/AX/AY7 contemporaries.

That aside, B.A. says that the addition of the cathode followers, along with the use of DC coupling and externally applied bias, was aimed at extending the front-end bandpass to 200-odd kHz and minimising low-end phase rotation. The approach reflects modern solid-state design thinking but one can argue that it offers less advantage in a valve type amplifier, where a multi-wound output transformer remains as the dominant and limiting component in the signal/feedback path.

(Perhaps I should add that B.A. claims also to have taken considerable care in selecting the small components used throughout, and in the provision of a 30-second time delay for the HT circuitry, to minimise stress on the EL34 cathodes during the warm-up period).

Was it worthwhile

Clearly, an exercise of this magnitude would add up to a complete strip, refurbish and rebuild, complicated by a possible difficulty in accommodating the extra components in an existing stereo chassis. Add to this the need to set up or check voltage and current levels initially, occasionally and each time a valve is changed.

Personally, I'm not convinced about the importance of fixed bias in other than the output stage but, overall, B.A. appears to have handled the assignment with as much attention to circuit detail as one could wish for, ending up with 35W (per channel) of clean power up to 20kHz, although diminishing through 20W at 25Hz — a limit attributable to the output transformers.

But was the effort to "gild the lily" worthwhile? Decide for yourself. Here's how the result was summed up by the man who did all the work.

"For what matters to most people, a listening test against a similar power solid-state amplifier revealed very little difference in overall sound, when fed from the same preamplifier with levels set precisely to be identical. (Monitoring via very high quality 3-way loudspeakers).

"The only area where the solid-state amplifier was marginally superior was in the bass attack, control, extension and clarity. Anyone surprised?

"In passing, I must remark that I have had some recent valve amps for auditioning which sounded hard and glassy by comparison".

I'm afraid that B.A.'s verdict doesn't provide much incentive to get on with what we proposed last December; dust off one of the old Playmasters . . . &c.

The current scene

A couple of rather lengthy letters, one from NSW, the other from Victoria, express curiously parallel opinions — this time about present-day components and CD players, inspired, I rather imagine, by parallel reading.

A.K. of Turramurra, NSW leads off with the contention that consumer audio equipment stands to benefit considerably by the substitution of more suitable capacitors, most obviously: "styroseals in lieu of greencaps or ceramics". To support his findings, he refers to work by Walter Jung and Richard March reported some years ago in *Audio* magazine.

Yes, Jung and Marsh did devise a test set-up capable of demonstrating behavioural differences between capacitors of various kinds but it does not follow that all such differences will show up in routine audio circuits. The matter was subsequently checked out in the EA lab, the chief practical observation at the time being the need for discretion in the use of electrolytic types and, most certainly, ceramics.

By way of contrast, A.K. then details an "improvement" that didn't work out in his case, arising from the substitution of 120-strand cable for the 79-strand type supplied with a pair of loudspeakers. Far from improving matters, he says, (gilding the lily?) the heavier cable over-damped the drivers, causing an apparent and unacceptable increase in brightness.

This rather surprising result seemed, however, to be consistent with a statement which he came across in a QED loudspeaker brochure (enclosed) to the effect that:

"QED's are designed to be properly damped with 0.25Ω resistance in the speaker wire between them and the amplifier."

Something doesn't add up, A.K., because loudspeaker damping is a function of the circulating current when the voice coil tends to behave independently of the drive, effectively acting as a generator. Assuming that the voice coil itself has a resistance of 4Ω or more, even the complete elimination of 0.25Ω cable resistance would not markedly affect the damping — predominantly a bass-end phenomenon, anyway.

It seems to me that you have misunderstood the QED brochure, because it goes on to say:

"Using heavier wire will not significantly overdamp the woofers and can, of course, increase the power delivered to the speakers by as much as 5%".

We would interpret that to mean that QED loudspeakers will be adequately damped provided the cable resistance is not greater than 0.25Ω. A 5% difference in power, by the way, is very small in decibel terms.

If your observation about "an apparent increase in brightness" is correct, the more likely explanation is a rather nasty one, namely that there is a region in the top end where the system impedance falls well below the rated figure — a not unusual occurrence. A reduction in lead resistance might then show up as increased output and added brightness.

The "nasty" part is that, under high drive conditions, the resulting peak current could wreck the output stage.

That aside, in the area of amplifier interconnecting leads, A.K. is an uncompromising supporter of the heavy duty, low capacitance shielded cable sold by Tandy, as distinct from (I quote) "the 100pF-per-foot rubbish" often supplied and currently sold by most electronic retailers.

FORUM – continued

Fair enough, A.K. If you don't mind the extra cost and bulk, reduced cable capacitance is a commendable quality. Whether it confers a practical advantage, however, depends on the length of the interconnect and the impedance of the particular circuit.

Operational amplifiers

That brings A.K. to "the replacement of operational amplifiers such as 4558s, &c, by TL072/LF353 in cassette decks and CD players (Nakamichi BX1, BX2, Dragon; also TEAC PD230 CD player, and the Marantz CD65 CD player's headphone amplifier section)". He adds:

These are only a few examples. I do not claim to have "golden ears" (I suffer from industry related loss in my left ear) but I, along with most of my workmates and acquaintances, have been able to hear most of these changes. In many cases, they have modified their own equipment accordingly (often with readily measured improvements).

The Victorian reader mentioned above, P.R. of Puckapunyal takes up much the same theme. He owns a Marantz CD-65 CD player and considers that, even though it is "designed to a price", it achieves "much better than average (audible) performance by attention to component quality and power supply design".

But that's still not good enough for P.R.:

"It can be and will be improved by the substitution of a different dual op amp in the analog stage, by further attention to component quality and to power supply design".

If P.R. is confident that he can show Marantz/Philips engineers a thing or two, so be it, but I would hesitate to encourage readers generally to dive into commercial consumer equipment with a hot soldering iron — especially readers without a service manual, without adequate test equipment and without sufficient experience or knowledge of what it's all about.

In the early days of compact disc, it was noticeable that most of the actual circuit criticism was foscussed on the analog bit at the output end — the one bit, I would venture to suggest, that most critics could comprehend at the time. This was despite the fact that the signal being delivered through the analog output stage was way ahead in measured quality of any signal source they'd previously had access to.

It was almost as if, faced with an electronic lily, they felt duty bound either to ridicule it or gild it!

I do not deny that it may be possible to nominate new operational amplifiers or other small components which, on paper, have somewhat better performance parameters than those found in last year's CD player. But it does not follow that the differences will show up in existing adequately designed circuitry, especially if the said components operate inside a feedback loop.

Really, with a flat frequency response, a rated THD through the entire system of 0.01% or less, and an S/N ratio of 90dB or more, there isn't a lot of scope in a CD player for gee-whiz improvement — not from fiddling with the analog bit, anyway.

Justified or not, speculation and criticism, these days, has focussed on less accessable areas like data errors, correction, concealment, sample and hold, and filters.

As far as cassette decks are concerned, they have been around for a longer period and it is more likely that some at least could benefit from a revamp. Whether that would apply to the Nakamichi models mentioned, I am not able to say. Frankly, I doubt it.

Warranty and service

When preparing this article, I made a point of talking to the service managers for a couple of the companies concerned. Perhaps predictably they assured me that there was no pattern of complaint, or of manufacturer's modification notes, that would support the need for anything other than the direct replacement of failed components.

They emphasised, however, that any modification to new equipment would automatically invalidate the manufacturer's warranty.

After the warranty period, owners could obviously make whatever changes they like at their own risk but, if a modified unit had to be returned for service, the repair bill could well be higher, especially if the changes were not properly documented. Time that a service mechanic may have to spend working out who has done what, and with what effect, would have to paid for!

P.R. raises other matters in his letter which we may follow up later but I do want to make one other point. The foregoing discussion is not directed, even obliquely, at those who specialise in modifying commercial equipment on a professional basis. One assumes that they would have the experience, information and facilities necessary and be able to provide adequate back-up service.

Whether the end result justifies the cost is for their clients to say.

4-channel DADs and DATs

To change the subject, I would like to round off the article with yet another mention of 4-channel sound on compact disc and digital tape cassettes.

In a letter which also refers to a number of other matters, A.J. of City Beach, WA, comes up with further evidence that I was not suffering from a too-active imagination when I recollected early references to 4-channel discrete sound on compact disc.

He encloses a photostat of a page from an unspecified Philips publication which poses the following query and comment, without any qualification as to track speed:

Usefulness for future developments?

Decoding circuit can also be used for four-channel version (quadraphonic reproduction).

In a recent reference to the DAT (Digital Audio Tape) cassette format, I drew attention to the fact that the literature to hand from Sony and Matsushita had made no mention of provision for other than 2-channel stereo recording and replay. This prompted the remark that, if we were ever to get 4-channel sound from either CD and DAT, it would be of the encoded compatible variety.

However, further information to hand indicates that DAT planning provides for no less than six operating modes, of which three are mandatory in hardware:

- Record and playback, 16-bit linear, 48kHz sampling, normal speed.
- Playback only, 16-bit linear, 44.1kHz sampling, normal speed.
- Playback only, 16-bit linear, 44.1kHz sampling, 1.5 times normal speed, two/thirds playing time.

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- 16-bit linear, normal speed, normal playing time;
- 12-bit non-linear, half speed, double playing time;
- 12-bit non-linear, normal speed and playing time, 4-channel discrete stereo.

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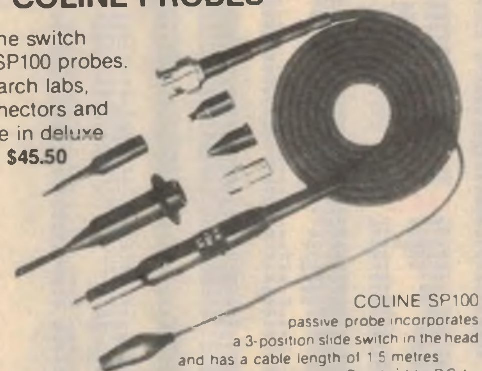

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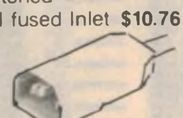

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All prices INCLUDE sales tax.

Tax exemption certificates accepted if line value exceeds $10.00.

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GEOFF WOOD ELECTRONICS P/L
INC IN NSW

(02) 427 1676

229 BURNS BAY RD.
(CORNER BEATRICE ST.)
LANE COVE WEST N.S.W.

TWX 71996
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No.1 for semiconductors

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MAILORDER HOTLINE: (03) 543 7877

SERIES 4000

4000	.50
4001	.50
4002	.50
4006	1.90
4007	.40
4008	1.20
4010	.90
4011	.40
4012	.40
4013	.60
4014	1.90
4015	1.90
4016	1.00
4017	1.50
4018	1.90
4019	.90
4020	1.50
4021	1.50
4022	1.50
4023	1.50
4024	1.50
4025	1.50
4026	1.50
4027	1.50
4028	1.50
4029	1.50
4030	1.50
4031	2.95
4032	2.75
4033	2.75
4034	3.50
4035	1.95
4038	3.25
4040	1.20
4041	1.50
4042	1.00
4043	1.60
4044	1.20
4045	4.90
4046	2.50
4047	1.20
4048	1.20
4049	1.00
4050	1.00
4051	1.50
4052	1.50
4053	1.50
4054	3.90
4055	3.90
4056	4.20
4060	2.50
4063	2.00
4066	2.50
4067	9.90
4068	1.00
4069	1.00
4070	.90
4071	.40
4072	.90
4073	.90
4075	.90
4076	1.50
4077	.80
4078	.80
4081	.40
4082	.80
4085	2.20
4086	2.30
4093	.75
4094	3.35
4095	2.40
4096	2.40
4097	6.50
4098	2.90
4099	3.90
4194	1.95
4510	1.50
4511	1.20
4512	1.10
4513	2.65
4514	2.90
4515	2.90
4516	1.45
4517	8.75
4518	2.50
4519	1.90
4520	1.20
4521	3.90
4522	1.90
4526	1.85
4527	2.65
4528	1.15
4558	2.25
4584	.85
4585	2.10

74 SERIES

7400	.80
7401	.80
7402	.80
7403	.80
7404	.80
7405	.80
7406	.80
7407	.80
7408	.60
7409	.60
7410	.60
7411	.70
7412	.70
7413	.70
7414	.80
7416	.80
7417	.80
7420	.60
7425	.90
7427	.80
7430	.70
7432	1.00
7437	1.00
7438	1.00
7440	1.00
7442	1.50
7445	1.95
7446	1.20
7447	1.50
7448	1.20
7450	1.00
7451	1.00
7473	1.00
7474	1.00
7475	1.20
7476	1.50
7485	1.80
7486	1.80
7489	3.90
7490	1.20
7493	1.20
7495	1.20
7497	2.75
74100	1.65
74107	1.20
74109	.90
74110	1.50
74121	.80
74122	.90
74123	1.50
74125	1.00
74128	1.80
74132	1.00
74139	1.50
74145	1.45
74150	1.50
74151	1.20
74154	2.75
74155	1.20
74161	1.20
74163	1.40
74164	1.20
74165	1.20
74166	1.70
74174	1.45
74175	1.20
74180	1.20
74190	1.00
74191	1.45
74192	1.65
74193	.80
74194	1.10
74195	1.00
74197	1.10
74221	1.90
74367	1.50
74368	1.50
75107	2.50
75110	2.50
75150	2.50
75154	2.50
75450	1.50
75451	.90
75452	.90
75453	.90
75461	1.50
75462	1.50
75471	3.00
75472	3.00
75491	2.00
75492	2.00
75493	3.00

74C

74C00	1.00
74C02	1.00
74C04	1.20
74C08	1.00
74C10	1.00
74C14	1.75
74C20	1.00
74C30	1.00
74C32	1.00
74C42	2.25
74C48	2.95
74C73	1.75
74C74	2.40
74C76	2.45
74C83	5.95
74C85	5.95
74C86	1.50
74C89	9.90
74C90	2.90
74C93	2.90
74C95	2.95
74C107	2.95
74C150	7.50
74C151	5.95
74C154	7.95
74C157	6.50
74C160	2.95
74C161	2.95
74C162	2.75
74C163	2.95
74C164	3.50
74C165	3.50
74C173	2.50
74C174	2.50
74C175	2.50
74C192	2.00
74C192	2.00
74C193	2.00
74C195	2.00
74C200	14.00
74C221	2.75
74C240	3.75
74C244	3.95
74C373	4.75
74C374	4.45
74C901	3.00
74C902	2.50
74C903	2.50
74C904	2.50
74C905	15.00
74C906	2.90
74C907	2.90
74C908	2.75
74C910	14.00
74C911	12.50
74C912	12.50
74C914	4.50
74C915	4.00
74C917	15.50
74C918	2.90
74C920	12.50
74C921	12.50
74C922	7.50
74C923	7.90
74C925	14.95
74C926	14.95
74C927	9.90
74C928	9.00
74C929	9.50
74C930	2.75
74C932	2.50
74C941	2.50
74C989	8.90

74F SERIES

74F00	.79
74F02	.79
74F04	.92
74F08	.79
74F10	.79
74F11	.79
74F20	.79
74F32	.79
74F64	.79
74F74	.89
74F86	1.19
74F109	.99
74F138	1.79
74F139	1.79
74F151	1.79
74F153	1.79
74F157	1.79
74F158	1.79
74F175	2.78
74F181	5.98
74F182	2.73
74F189	7.44
74F190	4.86
74F191	4.86
74F194	2.41
74F241	3.72
74F243	4.34
74F244	3.72
74F251	1.93
74F253	1.93
74F257	1.93
74F258	1.93
74F350	4.34
74F352	1.93
74F353	1.93
74F373	4.84
74F374	4.84
74F399	2.78
74F521	4.22
74F533	4.84
74F534	4.84

74HC SERIES

74HC00	.60
74HC02	.60
74HC04	.60
74HC08	.60
74HC11	.60
74HC14	1.40
74HC27	.60
74HC30	.60
74HC32	.60
74HC74	1.10
74HC76	1.10
74HC85	1.40
74HC86	1.10
74HC123	1.40
74HC138	1.40
74HC139	1.40
74HC157	1.40
74HC165	2.50
74HC174	1.40
74HC221	3.60
74HC240	2.50
74HC244	2.50
74HC245	3.90
74HC367	1.40
74HC373	2.90

74LS

74LS00	.60
74LS01	.60
74LS02	.60
74LS03	.60
74LS04	.60
74LS05	.60
74LS08	.60
74LS09	.60
74LS10	.60
74LS11	.80
74LS12	.80
74LS13	.90
74LS14	.80
74LS15	.80
74LS19	.90
74LS20	.60
74LS21	.90
74LS22	.90
74LS24	.90
74LS26	.90
74LS27	.90
74LS28	.90
74LS30	.60
74LS32	.70
74LS33	.70
74LS37	.70
74LS38	.80
74LS40	.80
74LS42	.60
74LS47	1.00
74LS48	1.00
74LS49	1.80
74LS51	.70
74LS54	.80
74LS55	.80
74LS63	2.80
74LS73	.60
74LS74	.60
74LS75	.60
74LS76	1.00
74LS77	1.00
74LS78	1.10
74LS83	.70
74LS85	.60
74LS86	.80
74LS90	.60
74LS91	.60
74LS92	.60
74LS93	.70
74LS95	1.20
74LS96	1.20
74LS107	.90
74LS109	.60
74LS112	.70
74LS113	.70
74LS114	.80
74LS122	1.30
74LS123	.90
74LS125	.80
74LS126	1.20
74LS132	1.50
74LS133	4.90
74LS136	1.50
74LS138	.80
74LS139	.80
74LS145	2.10
74LS147	2.50
74LS148	1.90
74LS151	1.20
74LS152	1.95
74LS153	1.00
74LS154	2.95
74LS155	1.00
74LS156	1.50
74LS157	1.10
74LS158	1.00
74LS160	1.00
74LS161	.80
74LS162	1.50
74LS163	1.10
74LS164	1.40
74LS165	1.50
74LS166	2.55
74LS169	2.45
74LS173	1.20
74LS174	1.20
74LS175	1.20
74LS181	4.00
74LS190	1.50
74LS191	1.20
74LS192	1.20
74LS193	1.20
74LS194	1.20
74LS195	.90
74LS196	.90
74LS197	1.75
74LS221	2.00
74LS240	1.90
74LS241	1.90
74LS242	1.90
74LS243	1.90
74LS244	1.50
74LS245	2.60
74LS247	1.30
74LS248	1.50
74LS249	1.60
74LS251	1.50
74LS253	1.20
74LS257	.70
74LS258	1.20
74LS259	1.50
74LS261	2.50
74LS266	1.20
74LS273	1.95
74LS275	6.80
74LS279	.60
74LS280	2.60
74LS283	1.50
74LS290	1.50
74LS293	1.30
74LS295	1.75
74LS297	6.50
74LS298	1.20
74LS299	3.90
74LS320	3.95
74LS321	3.95
74LS322	6.75
74LS323	6.50
74LS324	2.20
74LS326	2.20
74LS327	2.20
74LS352	2.20
74LS353	2.20
74LS354	3.95
74LS365	1.00
74LS366	1.00
74LS367	1.00
74LS368	1.00
74LS373	1.90
74LS374	1.90
74LS375	1.00
74LS377	2.15
74LS378	1.20
74LS379	1.90
74LS386	1.00
74LS390	1.80
74LS393	1.80
74LS395	2.00
74LS396	2.50
74LS398	3.00
74LS399	1.90
74LS424	5.50
74LS440	5.50
74LS441	5.50
74LS442	5.50
74LS443	5.50
74LS445	2.20
74LS446	5.50
74LS447	1.90
74LS448	5.50
74LS449	5.50
74LS490	3.20
74LS540	5.95
74LS541	3.95
74LS621	2.75
74LS622	2.75
74LS623	5.95
74LS629	5.95
74LS640	3.95
74LS642	2.75
74LS643	2.75
74LS644	2.75
74LS645	2.75
74LS668	1.75
74LS669	1.75
74LS670	2.75
74LS673	12.55
74LS674	12.55
74LS680	3.95
74LS681	3.95
74LS682	3.95
74LS683	3.95
74LS686	3.95
74LS699	3.95

74S SERIES

74S00	1.00
74S02	1.00
74S03	1.00
74S04	1.00
74S05	1.50
74S08	1.00
74S09	1.50
74S10	1.00
74S11	1.00
74S15	1.60
74S20	1.20
74S22	1.50
74S30	1.00
74S32	1.00
74S37	1.70
74S38	1.70
74S40	1.20
74S51	0.80
74S64	1.20
74S65	1.20
74S74	1.30
74S86	1.60
74S109	2.50
74S112	1.30
74S113	1.30
74S133	1.20
74S134	1.40
74S135	1.30
74S138	3.30
74S139	3.30
74S140	1.90
74S151	3.10
74S153	2.00
74S157	3.10
74S158	3.10
74S160	5.90
74S161	5.90
74S162	7.90
74S163	7.90
74S168	11.50
74S169	11.50
74S174	4.50
74S175	4.50
74S181	8.50
74S182	3.40
74S199AN	4.10
74S188	8.50
74S194	3.30
74S195	2.90
74S196/82S90	4.90
74S197/82S91	4.90
74S201	9.90
74S214AN	P.O.A.
74S225	10.90
74S226	7.90
74S240	6.90
74S241	6.90
74S244	9.90
74S251	3.90
74S253	4.90
74S257	3.30
74S258	3.30
74S260	2.90
74S274	P.O.A.
74S275	P.O.A.
74S280	5.90
74S281	P.O.A.
74S283	7.90
74S287	4.90
74S288	4.90
74S299	13.90
74S301	13.90
74S314	P.O.A.
74S330	P.O.A.
74S331	P.O.A.
74S373	9.90
74S374	9.90
74S381	9.90
74S387	3.30
74S412/8212	5.90
74S428/8212	7.90
74S470	9.90
74S471	9.90
74S472	9.90
74S473	9.90
74S474	9.90
74S475	9.90
74S482	11.90
74S489	7.90

8000 SERIES

8035	6.90
8039	7.90
8080	6.00
8085	9.50
8086	19.50
8088	19.50
8121	5.00
8123	4.00
8130	6.95
8131	5.95
8136	6.95
8155	6.50
8156	11.50
8185	37.50
81LS95	3.75
81LS96	3.75
81LS97	3.75
81LS98	3.75
8212	2.90
8214	4.90
8224	3.50
8226	4.90
8228	5.50
8237	19.50
8238	9.50
8243	8.50
8251	6.90
8253	7.50
8255	5.50
8257	16.50
8259	6.50
8272	33.00
8273	65.00
8274	42.50
8275	38.50
8276	28.50
8279	8.50
8282	6.90
8283	6.50
8284	8.50
8286	6.50
8287	6.50
8289	73.00
82S23	5.95
82S123	5.95
8303	5.50
8304	6.95
8311	5.95
8641	5.95
8741	57.50
8748	65.00
8749	58.50
8755	33.50
8820	6.95
8830	6.95
8832	6.95
8833	6.95
8834	6.95
8835	5.95
8T13	2.95
8T14	2.95
8T26	3.00
8T28	3.00
8T30	3.00
8T98	1.80
8T97	1.80

LINEAR

LH0002	9.50
LH0042CH	9.50
LH0070	9.50
LH0071	9.50
TL081	1.50
TL082	2.90
TL084	4.90
TL071	1.20
TL072	2.90
TL073	3.20
TL074	4.90
TL081	1.90
TL082	2.50
TL083	2.90
TL084	3.45
TL494	4.90
TCA220	9.50
TCA280	4.50
TDA1024	2.80
TA7205P	3.90
TEA1002	17.50
UAA170	5.95
UAA180	3.75
LM10CH	7.50
LM301	1.00
LM301H	1.50
LM302H	6.50
LM305H	1.50
LM307CN	1.00
LM308	1.00
LM308H	1.80
LM309K	2.90
LM310N	3.20
LM310H	3.20
LM311	1.00
LM311H	1.80
LM317T	2.50
LM317K	4.50
LM318	4.90
LM324	1.00
LM325	4.50
LM326	4.50
LM329DZ	.90
LM344Z	1.90
LM335Z	2.20
LM336 2.5V	2.95
LM338K	12.50
LM339	1.20
LM348	1.80
LM349	2.95
LM350K	10.50
LM351N	1.00
LM353	2.50
LM356N	2.40
LM357	2.40
LM358	1.40
LM361	3.50
LM377	4.90
LM378	6.95
LM380 8 pin	1.80
LM380 14 pin	1.90
LM381	3.50
LM382	3.50
LM383	5.95
LM384	3.50
LM386	1.95
LM387A	3.95
LM387	2.00
LM390	2.95
LM391	2.90
LM393	1.00
LM394CH	6.95
LM395T	9.95
LM396K	22.50
LF398	5.90
NE544	6.50
NE555	.60
NE556	1.20
NE558	5.00
NE560	4.60
NE567	2.00
NE570	5.90
NE571	5.90
NE592	6.90
NE594	9.50
LM709-14	1.50
UA710CN	1.00
LM711	1.20
LM723	.75
LM723CH	1.50
LM725	4.75
LM733	1.50
LM739	2.75
LM741	.60
UA747	1.30
UA748	1.00
MC1310	9.50
MC1312	7.95
MC1314	7.95
MC1315	8.95
MC1327	7.95
MC1350	1.95
MC1408L8	7.50
MC1437	4.95
MC1445	5.95
MC1456	1.95
MC1458	1.20
MC1466L	21.50
MC1469R	8.90
MC1488	1.20
MC1489	1.20
MC1494	8.40
MC1495	8.90
MC1496	2.50
LM1596	3.00
MC1648	8.90
LM1812	10.50
LM1830	3.90
LM2907	3.90
LM2917 8 PIN	4.90
LM2917 14 PIN	4.90
MN3001	17.50
CA3028	2.00
CA3046	1.90
CA3056	6.50
CA3059	5.95
CA3080	1.90
CA3086	1.90
CA3100E	7.95
CA3130E	2.90
CA3130T	3.50
CA3140E	2.20
CA3140T	2.95
CA3240E	11.95
CA3401	1.00
CA3900	1.20
CA3905	1.75
CA3909	2.95
LM3911	2.95
LM3914	5.90
LM3915	5.90
LM3916	5.90
LM3999Z	2.60
RL4136	1.95
RC4145	20.90
RC4194	3.90

CDP

CDP1802	16.50
CDP1864	17.50

CPU

6502	15.00
6502A	15.00
6522	15.00
6522A	15.00
6532	14.00
6551	12.90
6800	6.00
6802	7.00
6808	12.50
6809	10.00
6810	3.50
6821	5.50
6840	6.50
6845	12.50
6847	3.50
6850	7.90
6875	15.00
Z80CPU	5.00
Z80ACPU	5.00
Z80BCPU	12.00
Z80P10	4.50
Z80AP10	4.50
Z80CTC	5.50
Z80ACTC	5.50
Z80DMA	16.00
Z80ADMA	16.00
Z80AS10	13.00
Z80S10	13.00
AD570	69.50
AD590	9.50
AD7524	17.50
AY-3-8910	14.50
AY-3-2513	14.50
MSM5832	16.50
MM58174	19.50
MM5309	14.50
MM5369	4.95
FD1771	19.00
FD1791 (8876)	39.00
FD1793 (8877)	39.00
FD1795	39.00
FD1797	39.00
WD1691	29.50
WD2143	24.50
WD1931	22.50
WD1933	34.00
WD1983	14.75
WD1993	59.00
WD2123	26.50
WD8250	29.50
TR1602 (S1883)	8.50
TR1853	8.90
COM8116	24.00
BR1941	23.00
CRT8002A	59.90

MEMORY

2102	2.50
2114	4.95
2708	12.50
2716	9.90
2732	8.95
2764	7.95
27128	8.00
4116	3.95
4164	3.95
6116	5.00
6264	8.00
58725 (6116)	4.00
2101 (5101) (8101)	7.90
5101	7.90
8101	7.90
2532	12.50
27256	11.50
27512	29.50
41256	5.95

OPTO

4N25	1.50
4N26	1.50
4N27	1.50
4N28	1.50
4N29	1.50
4N30	2.00
4N32	2.80
4N33	2.50
4N35	2.50
4N37	2.50
MCT6	2.50
MCT66	6.90
MCT2	1.50
1LD74	5.90
1LQ74	6.50
FND507	2.00
TIL31A	2.95
TIL81A	2.95
TIL306	22.50
MAN72 (DL702)	3.50
MAN74 (DL704)	3.50
BPW50	2.25
CQY89A	1.95
HP5082-2811	4.95
HLMP6620	3.95
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3mm YELL	.30
3mm GRN	.30
5mm RED	.15
5mm YELL	.30
5mm GRN	.30
5mm ORA	.30
RED RECT	.30
GRN RECT	.30
YEL RECT	.30
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YELLOW CHME BEZEL	1.20
GRN CHRME BEZEL	1.20

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NE5534AN	4.95
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MC3341	2.90
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76488	8.95
76489	9.95
8038	6.50
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OM350	12.50
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XR8038	7.50
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LM7556	3.50
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LF13741	.80
LF13741H	1.50
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SAK140	9.50
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ADC0804LCN	6.50
ADC0808LCN	14.95
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DAC0800	4.95
DAC0808	4.95
DAC0832LCN	6.95
DAC1020LCN	19.95
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AC126	1.20
AC127	1.20
AC128	1.20
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AC188	1.50
AC149	3.40
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AD162	2.90
AF118	2.90
BC107	.50
BC108	.50
BC182L	.40
BC212	.30
BC318	.30
BC320	.40
BC327	.30
BC328	.30
BC337	.40
BC338	.40
BC546	.40
BC547	.20
BC548	.20
BC549	.20
BC550	.40
BC556	.40
BC557	.20
BC558	.20
BC559	.20
BC639	.50
BC640	.50
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BCY71	1.90
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MPSA12	1.00
MPSA13	1.00
MPSA14	1.00
MPSA20	1.00
MPSA42	1.00
MPSA43	1.20
MPSA55	1.00
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MPSA63	1.00
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2N3055	1.20
2N3096	1.20
2N3109	1.90
2N3251	1.90
2N3302	1.90
2N3440	1.80
2N3441	2.90
2N3442	3.50
2N3563	.30
2N3564	.30
2N3565	.30
2N3566	.30
2N3567	.30
2N3568	.30
2N3569	.30
2N3638	.30
2N3640	.30
2N3641	.30
2N3642	.30
2N3643	.30
2N3644	.30
2N3645	.30
2N3646	.30
2N3702	1.20
2N3704	1.40
2N3739	1.50
2N3771	5.50
2N3772	5.70
2N3773	5.90
2N3792	6.00
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2N3866	2.95
2N3904	1.00
2N3906	1.00
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2N4032	2.20
2N4033	2.20
2N4036	2.50
2N4121	1.50
2N4123	1.50
2N4236	1.90
2N4237	1.90
2N4248	.40
2N4249	.40
2N4250	.40
2N4258	.50
2N4355	.50
2N4356	.50
2N4360	1.00
2N4401	.30
2N4402	.30
2N4403	.30
2N4416	1.90
2N4427	3.90
2N4919	2.90
2N5088	1.00
2N5089	1.00
2N5139	1.20
2N5179	1.20
2N5190	2.50
2N5191	3.30
2N5192	3.10
2N5193	2.50
2N5194	2.95
2N5195	3.30
2N5210	1.50
2N5245	1.50
2N5303	8.50
2N5401	1.50
2N5457	1.00
2N5458	.90
2N5459	.90
2N5461	.90
2N5462	.90
2N5485	.90
2N5486	.90
2N5489	14.50
2N5590	26.50
2N5591	29.50
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2N5656	2.50
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2N5777	1.50
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2N5831	.30
2N5873	1.40
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7812KC	2.50
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7815KC	2.50
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7818KC	2.50
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7824KC	2.50
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7905KC	3.00
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7912KC	2.50
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7915KC	2.50
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78L05	.60
78L12	.60
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LM317T	2.50
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LM317HV	9.50
LM323K	7.50
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IC SPECIALS!

8087 CHIPS! from $279

8087-3 (4.77MHz)	$279
8087-2 (8MHz)....	$399
8087-1 (10MHz)..	$649
80287-6 (6MHz)..	$499
80287-7 (8MHz)..	$699
8087-3 (4.77MHz)	$279

SPO256A-AL2 SPEECH CHIP

Speech synthesiser chip, needs programming to work.

1-9	10+	100+
$15.00	$14.50	$14.00

CTS256-AL2 SPEECH CHIP

Contains the code recognition circuit to enable the project to plug directly on to the printer port, or into an IBM PC.

1-9	10+	100+
$27.00	$26.50	$26.00

41256-15

1-9	10+	100+
$7.95	$7.50	$6.95

4164

1-9	10+	100+
$3.95	$3.50	$2.95

27128

1-9	10+	100+
$9.95	$8.95	$7.95

27512

1-9	10+	100+
$19.50	$18.50	$17.50

CA3130E

1-9	10+	100+
$1.95	$1.75	$1.50

6116 LP-3

(150ns)

1-9	10+	100+
$3.95	$3.75	$3.50

NE5534AN

1-9	10+	100+
$1.95	$1.85	$1.75

INS8250

1-9	10+	100+
$29.95	$27.95	$26.95

AM 7910

(WORLD MODEM CHIP)

$24.95

Errors & Ommisions Excepted

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ROD IRVING ELECTRONICS
Nº1 FOR COMPONENT SPECIALS!

TAG TANTALUM CAPACITORS SPECIALS!

Cat.No.	Description	Price
R16124	16V 4.7uF	$0.48
R16125	16V 10uF	$0.52
R16126	16V 15uF	$0.75
R16128	16V 22uF	$0.85
R16216	25V 2.2uF	$0.40
R16220	25V 4.7uF	$0.70
R16222	25V 6.8uF	$0.70
R16224	25V 10uF	$0.60
R16228	25V 22uF	$2.40
R16300	35V 0.1uF	$0.30
R16302	35V 0.15uF	$0.30
R16304	35V 0.22uF	$0.30
R16306	35V 0.33uF	$0.30
R16308	35V 0.47uF	$0.30
R16310	35V 0.68uF	$0.35
R16311	35V 0.82uF	$0.35
R16312	35V 1.0uF	$0.30
R16314	35V 1.5uF	$0.50
R16316	35V 2.2uF	$0.50
R16318	35V 3.3uF	$0.45
R16320	35V 4.7uF	$0.70
R16322	35V 6.8uF	$0.80
R16324	35V 10uF	$0.80
R16326	35V 15uF	$1.40
R16328	35V 22uF	$3.50

NUMERIC KEYPAD

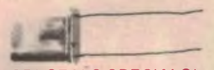
Unencoded keypad, 10 digit keys plus two utility keys. Light grey in colour.

OUTPUT ARRANGEMENT:

Output Pin Nº	Symbol
1	N.A.
2	Shield plate
3	Column 2
4	Row 4
5	Column 3
6	Row 1
7	Column 1
8	Row 2
9	Row 3
10	N.A.

Cat C19030

1-9	10+	100+
$2.95	$2.50	$1.95

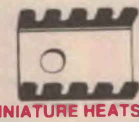


CRYSTALS SPECIALS!

Description	Cat.No.	1-9	10+
1MHz	Y11000	$7.50	$7.00
4.433618MHz	Y11023	$2.95	$2.75
8.867238MHz	Y11055	$2.95	$2.75
12MHz	Y11070	$2.95	$2.75
14.31818MHz	Y11072	$2.95	$2.75

CENTRONICS PLUG SPECIAL!
36 WAY MALE (P12200)

1-9	10+	100+
$3.95	$3.50	$3.00



MINIATURE HEATSINK!

A great little fellow if you are short of space. Great price too, because we import direct so you save!
Dimensions: 19(L) x 13(W) x 9(H)mm

Cat.No.	1-9	10+
H10606	$0.40	$0.35

UTILITY STORAGE CASE

A must for all electronic enthusiasts, technicians, hobbyists, fishermen and sewers! Features a clear plastic lid so you can tell at a glance the contents, and up to 48 adjustable compartments. A place for everything and everything in its place!
Cat. H10090 .... $19.95

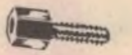
ECONOMY TRANSFORMERS

	1-9	10+
2155 240V 6-15V 1A Cat. M12155	$9.95	$8.95
2156 240V 6-15V 2A Cat. M12156	$14.95	$13.95
2840 240V 9V CT Cat. M12840	$5.95	$4.95
2851 240V 12-6V CT 150mA Cat. M12851	$5.95	$5.50
2860 240V 15V CT 250mA Cat. M12860	$5.95	$4.95
6672 240V 15-30V 1A tapped Cat. M16672	$14.95	$13.95

CHROME LED BEZELS

9mm hole, available 3 colours

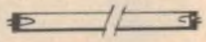
Cat.No.	Description	Price
S14030	Red	$1.20
S14032	Green	$1.45
S14034	Yellow	$1.45



DB STAND OFFS

At incredible prices! No need to pay absurd prices because we import them direct and pass on the savings to you!

2 Pack P10930	$1.00
10 Pack P10932	$3.95
100 Pack P10934	$20.00



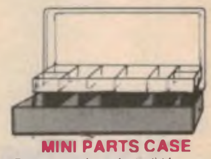
U.V. TUBES

Fits into standard 15W flouro holder. Suitable for Scotchcal, Eprom erasing etc. As used in ETI Eprom Erasing Kit.
WARNING: Do not look directly into UV Tubes.
Cat. H28600 .... $24.95
*If ordering by mail please include an extra $2 for "special" packing

MINI "U" HEATSINK

Used extensively on PCB's this heatsink suits most flat (plastic type) semiconductors, and has vertical flutes for maximum thermal efficiency.
Cat. H10602 .... Normally $1.25

1-9	10+	100+
$0.65	$0.55	$0.50



MINI PARTS CASE

Features a clear plastic lid for easy identification of contents. Up to five, adjustable lower compartments plus a self elevating upper tray for smaller items.
Dimensions: 110 x 210 x 43mm
Cat. H10087 .... $9.95

5 PIN DIN PLUG

UNBELIEVABLE PRICE!
Cat. P10157 .... Normally $1.00

1-9	10+	100+
$0.50	$0.45	$0.40

6.35mm STEREO PLUGS

UNBELIEVABLE PRICES!!
P10121 (plastic plug) Normally $1.00

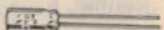
1-9	10+	100+
$0.50	$0.45	$0.40

ULTRASONIC TRANSDUCERS

Designed to transmit at 40kHz (L19990) and receive at 40kHz (L19991) with up to 20V I/P on the transmitter. These units can't be heard and so are ideal for TV remote controls, water level detectors, burglar alarms, motion detectors and information carriers as they can be either pulsed or used in the continuous wave mode.
Full specifications below for design purposes.

Maximum Input Voltage: 20V rms
Centre Frequency (kHz): 40 + - 1.0
Sound Pressure Level 10V RMS: 110dB min.
Sensitivity (dB/v/ubar) min: -65 min.
Bandwidth (kHz):
Transmit: 4.0 (at 100dB)
Receiver: 5.0 (at -73dB)
Impedance:
Transmit: 500
Receiver: 5000

Cat. L19990 (Transmitter)	$4.75
Cat. L19991 (Receiver)	$4.75



ELECTROLYTICS (PCB MOUNTING)

16 VOLT

Cat.No.	Description	1-9	10+
R15461	10uF	$0.25	$0.20
R15481	22uF	$0.25	$0.20
R15511	33uF	$0.25	$0.20
R15521	47uF	$0.25	$0.20
R15531	100uF	$0.30	$0.25
R15541	220uF	$0.60	$0.50
R15551	330uF	$0.75	$0.65
R15561	470uF	$0.75	$0.65
R15571	640uF	$0.90	$0.80
R15581	1000uF	$0.90	$0.80
R15601	2200/2500uF	$1.20	$1.10

25 VOLT

Cat.No.	Description	1-9	10+
R15422	2.2uF	$0.25	$0.20
R15432	3.3uF	$0.25	$0.20
R15442	4.7uF	$0.25	$0.20
R15462	10uF	$0.25	$0.20
R15502	25uF	$0.30	$0.25
R15512	33uF	$0.30	$0.25
R15522	47uF	$0.30	$0.25
R15532	100uF	$0.40	$0.35
R15542	220uF	$0.70	$0.65
R15552	330uF	$0.75	$0.65
R15562	470uF	$0.75	$0.65
R15582	1000uF	$1.00	$0.90
R15602	2200/2500uF	$1.40	$1.20

35 VOLT

Cat.No.	Description	1-9	10+
R15443	4.7uF	$0.30	$0.25
R15463	10uF	$0.30	$0.25
R15483	22uF	$0.30	$0.25
R15513	33uF	$0.40	$0.35
R15523	47uF	$0.40	$0.35
R15533	100uF	$0.60	$0.55
R15543	220uF	$0.60	$0.55
R15563	470uF	$0.70	$0.60
R15583	1000uF	$1.20	$1.10
R15593	2200/2500uF	$1.50	$1.30

50 VOLT

Cat.No.	Description	1-9	10+
R15404	0.47uF	$0.25	$0.22
R15414	1uF	$0.25	$0.22
R15424	2.2uF	$0.30	$0.25
R15434	3.3uF	$0.30	$0.25
R15444	4.7uF	$0.40	$0.35
R15464	10uF	$0.40	$0.35
R15484	22uF	$0.40	$0.35
R15514	33uF	$0.40	$0.35
R15524	47uF	$0.50	$0.45
R15534	100uF	$0.60	$0.55
R15544	220uF	$0.90	$0.80
R15564	470uF	$1.00	$0.90

63 VOLT

Cat.No.	Description	1-9	10+
R15405	0.47uF	$0.30	$0.25
R15415	1uF	$0.30	$0.25
R15425	2.2uF	$0.30	$0.25
R15435	3.3uF	$0.30	$0.25
R15445	4.7uF	$0.30	$0.25
R15465	10uF	$0.40	$0.35
R15505	25uF	$0.50	$0.45
R15525	47uF	$0.50	$0.45
R15535	100uF	$0.60	$0.55
R15545	220uF	$0.90	$0.80
R15555	330uF	$1.20	$1.10
R15565	470uF	$1.40	$1.20

SPECTROL MULTIDIALS
MODEL 15-1-11

Number of turns: 10
Minor Scale Division: 1/500 turn
Shaft Bore: 6.35mm (1/4")
Finish: Satin Chrome
Body Size: 25.4 x 44.45mm (1 x 1 3/4")
Depth: 25.4mm (1")
Weight: 45.4g (1.6oz.)
Cat. R14405 .... $45.95

MODEL 16-1-11

Number of turns: 15
Minor Scale Division: 1/50 turn
Shaft Bore: 6.35mm (1/4")
Finish: Clear Anodize
Body Size: 22.2mm diameter (.875")
Depth: 22.2mm (.875")
Weight: 19.8g (0.7oz.)
Cat. R14400 .... $26.95

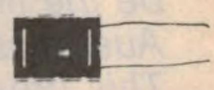
MODEL 21-1-11

Number of turns: 15
Minor Scale Division: 1/100 turn
Shaft Bore: 6.35mm (1/4")
Finish: Satin Chrome
Body Size: 46.04mm diameter (1.812")
Depth: 25.4mm (1")
Weight: 85g (3oz.)
Cat. R14410 .... $46.95

UNIVERSAL HEATSINK

Universal because of the hole pattern which allows it to be mounted to most "power" type semiconductors. Features vented sides and black anodised finish for maximum efficiency.
Dimensions: 60(L) x 35(W) x 30(H)mm
Cat. H10601 .... Normally $1.75

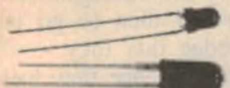
1-9	10+	100+
$0.75	$0.65	$0.60



VIDEO RF MODULATOR

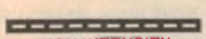
At an unbelievable prices! Our RF modulators are channel selectable either Channel 0 or Channel 1.
Cat. S16040

1-9	10+
$3.95	$2.95



QUALITY LEDS

Cat. No.	Description	Price
Z10140	3mm Red	$0.15
Z10141	3mm Green	$0.20
Z10143	3mm Yellow	$0.20
Z10145	3mm Orange	$0.20
Z10150	5mm Red	$0.15
Z10151	5mm Green	$0.20
Z10152	5mm Yellow	$0.20



HIGH INTENSITY RED LED BAR GRAPH

Dimensions:
Overall: 63mm across, 5mm high
LEDs: 10 x 5mm x 1mm

Cat.No.	1-9	10+
Z10180	$2.95	$2.75

1/2" HIGH INTENSITY RED LED DISPLAYS

(Available in Common Cathode and Common Anode)

Dimensions:
Overall: 12.7mm across, 19mm high
Display: 12.7mm(H) x 7.3mm(W)
Segment Width: 1.2mm
Brightness: 3400 ucd I_F = 10mA

COMMON CATHODE:

Pin 1 Segment E — Pin 6 Segment B
Pin 2 Segment D — Pin 7 Segment A
Pin 3 CC — Pin 8 CC
Pin 4 Segment C — Pin 9 Segment F
Pin 5 Segment Dp — Pin 10 Segment G

Cat.No.	1-9	10+	100+
Z10190	$1.95	$1.75	$1.50

COMMON ANODE:

Pin 1 Segment E — Pin 6 Segment B
Pin 2 Segment D — Pin 7 Segment A
Pin 3 CA — Pin 8 CA
Pin 4 Segment C — Pin 9 Segment F
Pin 5 Segment Dp — Pin 10 Segment G

Cat.No.	1-9	10+	100+
Z10191	$1.95	$1.75	$1.50

MINI JUMPERS

- Contact terminal: Phospor bronze
- Material: P.B.T. 94V-0
- Gold plated

Qty	Cat. No.	Price
10	P12053	$2.95
25	P12055	$4.95
100	P12057	$21.95

TRIGGER TRANSFORMERS

Cat. M10104 .... $1.45

10 AMP RELAY

S.P.D.T. 12V Coil 240V (S14114)

1-9	10+	100+
$4.95	$3.95	$3.75

DB25 CONNECTOR SPECIALS!

We have just imported 50,000. So you get to save a small fortune!

DB25 MALE (P10900)

1-9	10+	100+
$1.50	$1.20	$1.00

DB25 FEMALE (P10901)

1-9	10+	100+
$1.70	$1.40	$1.20

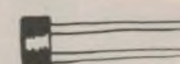
S.P.D.T TOGGLES

We have 15,000 to clear!
Cat. S11010 .... Normally $1.75

1-9	10+	100+
$0.80	$0.75	$0.65

CANNON TYPE CONNECTORS SPECIALS

Cat. No.	Description	Price
P10960	3 pin line male, Was $3.90	NOW $2.90
P10962	3 pin chasis male, Was $3.00	NOW $2.40
P10964	3 pin line female, Was $4.50	NOW $3.25
P10966	3 pin chasis female, Was $4.95	NOW $3.45



BRIDGE SPECIALS

	1-9	10+	100+
WO2 1A 200V Cat. Z11030	$0.30	$0.28	$0.26
WO4 1A 400V Cat. Z11032	$0.35	$0.30	$0.28
SB604 6A 400V Cat. Z11034	$0.90	$0.80	$0.75

RCA GOLD PLATED PLUGS AND SOCKETS

For those who need the ultimate in connection. Essential for laser disc players to get that fantastic sound quality.

Plug Cat. P10151	$3.75
Socket Cat. P10150	$2.95

RCA GOLD PLATED CHASIS SOCKET

For the ultimate connection!
Cat. P10229 .... Normally $1.95

1-9	10+	100+
$1.00	$0.90	$0.85

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$200 - $499	$10.00
$500 plus	$12.50

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***65TH BIRTHDAY FEATURE:**

A dream that lasted 65 years

– and is still going strong!

Sixty-five years ago this month, on August 4, 1922, Messrs W.J. Maclardy, of Castlereagh Street, Sydney launched what they claimed to be the first-ever publication to be produced in Australasia, wholly devoted to wireless . . . This present copy of Electronics Australia is a direct descendent of that first issue of Wireless Weekly.

by NEVILLE WILLIAMS

We don't have a copy of the very first issue (August 1922) good enough to reproduce, but here is the cover of the issue for September 2, 1927 — plus a typical advert of the time.

At the time, regular officially endorsed public broadcasting was something about which would-be listeners were still dreaming and agitating.

An article on page 3, headed: "OUT-BACK — As It Should Be" pictured "Dad Wayback" coming inside for the evening, hanging up his hat, and switching on the wireless in time to catch the weather forecast and daily market reports. A few minutes later the whole family would gather round to enjoy a concert "sent out by the Amalgamated Wireless". They would then to go to bed, in the knowledge that they were no longer as isolated as once they had been.

At the time, AWA was in fact broadcasting demonstration "wireless concerts" each week in Sydney and Melbourne, while other transmissions could be heard from enterprising amateur stations. But a whole year was to elapse before the Federal Government would implement formal broadcasting provision (August 1, 1923) with the first official broadcast station 2SB Sydney (later 2BL) later, 3AR Melbourne in January 1924, and 6WF Perth in June.

A clear objective

But, with all that still in the future, the writer of the introductory editorial in 1922 identified the objective of the new publication with rare insight — even if rather awkward punctuation. I quote the key paragraph, exactly as published:

"It will be the wholehearted endeavour of this journal to give its readers reliable news of the latest developments in the science from all parts of the world; keep the experimenter informed on all matters

concerning his hobby, and help him to put his case for the relaxation of restrictions under proper control; and generally deal with the science in an understandable way, from the elementary stages to the super-technical".

Sixty-five years on, that statement of intent is still relevant even though, in the meantime, the science of "wireless" has expanded at a speed, and to an extent, that is nothing short of mind-boggling.

The practical items in that first issue of 1922 were elementary in the extreme:

- A circuit for a one-valve regenerative radio receiver.
- A plug-in mounting system for honeycomb tuning coils;
- Constructional details for a fool-proof molybdenite signal detector.

This plus technical tips, news items, wireless club notes, advertisements and intriguing little snippets like the following:

"A well known Adelaide jeweller, who is interested in wireless, puts his hobby to an interesting use. At noon each day, he checks his chronometers by radio time signals received on a set at his shop. He finds this method more reliable than the telephone system".

By March 1923, with public broadcasting still eight months away, *Wireless Weekly* was sporting a colour cover, a new business address in Regent Street, Sydney and, more importantly, an array of titillating advertisements for an emerging of wireless hobbyists. Here's a sampling:

GRACE BROS, Sydney: "Send for our free booklet: 'All About Wireless'. Broadcasting will soon be in full swing."

ANTHONY HORDERNS, Sydney: "Murdock's double head sets. Myers' valves" . . . &c.

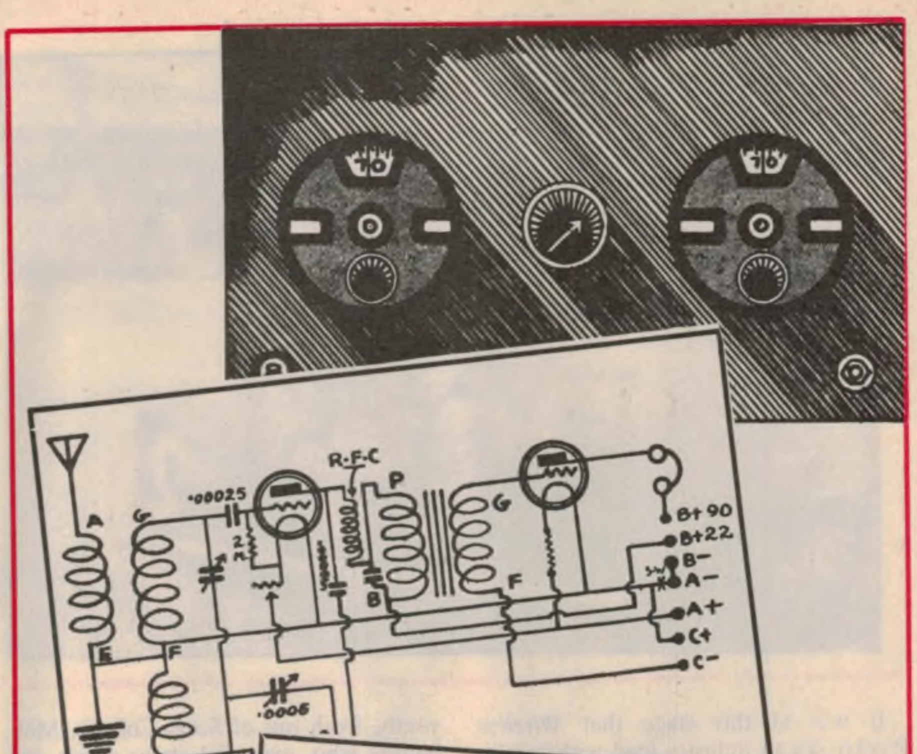
HOMECRAFTS, Melbourne: "Closed core intervalve transformers 45/-, postage 6d".

COLVILLE-MOORE, Sydney: "Receiving sets, AC 'Homecharger'. Charge your own A or B battery."

O.H.O'BRIEN & NICHOLL, Sydney: "The Trimm Professional head set. A quality phone at a quantity price".

With the commencement of public broadcasting, interest in wireless — or radio — grew rapidly, with receivers being variously bought and sold, built and rebuilt, in a seemingly tireless quest for any signals, more signals and louder signals.

In those days, broadcast stations using horizontal transmitting antennas tended to spray signals randomly far and wide, especially at night, and half the fun of owning a wireless set was to have listened to and logged more stations — especially distant ones — than anyone else in the street. A card with callsigns and dial settings was routine.



The KLOTZ 2-Valve RECEIVER

Described in This Issue.

	£	s.	d.
1 Radion Panel, 14 x 8 x 3-16	0	11	8
2 Eco Centreline Condensers, .0005, 10/-	1	0	0
2 Emmco Bakelite Vernier Dials, 7/6	0	15	0
2 Certified 30 ohm. (One-hole fixing) Rheostats	0	4	0
3 Radiokes R.F. Chokes, at 8/6	1	5	6
1 Wetless Reinartz Coil	0	12	6
2 Kelford Anti-vibration Sockets, U.X., at 3/-	0	6	0
1 Single Circuit Jack (Pilot)	0	2	0
1 Wetless Mica Condenser, .0003	0	1	6
1 Wetless Mica Condenser, .001	0	1	6
2 Wetless Mica Condensers, .0001, 1/6	0	3	0
1 Crescent Audio Transformer	0	13	6
1 Doz. Square Buswire	0	0	10
2 Lengths Spaghetti, 3d.	0	0	6
1 Standard Terminal Board	0	2	9

This Set of Quality Parts costs £6/0/3

A very popular build-it-yourself project described in 1927 was the "Klotz" two-valve regenerative receiver. Built on a wooden "breadboard" and with a bakelite panel, its kit of parts could be yours for only six pounds and thrippence (about $12).

Wireless Weekly catered for all this with a comprehensive menu of programs, articles on stations, sessions and personalities, products and trade information, technical assistance and — last but certainly not least — how-to-build articles dealing with domestic receivers and accessories.

Prominent, too, was "The Safety Valve", the fore-runner of today's "Letters to the Editor".

A couple of years back, EA reprinted examples of this now historic material in a publication entitled "The Best of Australia's Wireless Weekly in 1927" — a vintage year that saw something of a peak in the initial growth phase, involving mainly battery-powered receivers.

The dozen-odd projects which were reproduced covered receivers ranging from 1 to 8 valves, including a reflex circuit, a neutrodyne and a superhet. These, plus a crystal set, a B-battery eliminator and a selection of audio amplifier stages.

Interest in radio broadcasting reached even greater heights in the early and mid '30s, with more stations coming on-air and more imaginative programming. The same period saw the emergence of practical and reliable mains powered receivers, and a growing consciousness of sound quality as properly driven moving coil loudspeakers took over from the old "horn" and "cone" models.

When editor Ross Hull left the magazine to go the USA in the early 1930s, his brother 'Braith Hull (above) took his place. One of 'Braith Hull's other interests was motor racing, as shown in the shot at left. (Courtesy Ron Bell)

It was at this stage that *Wireless Weekly* set an industry lead with receivers for home construction like the "1933 Standard" and the "1934 Champion" superhet, which clearly outclassed most contemporary commercial designs. In a very real way, those receivers set the scene for the journal's later committment to high fidelity sound reproduction.

Technical writers

For some obscure reason, few of the articles in *Wireless Weekly* carried bylines. But one name that did become legendary in those early days was that of Ross Hull — an avid experimenter and "Ham", and a capable technical writer. I never met him personally, mainly because he was a decade ahead of me but his reputation remained for years as a standard against which his successors were measured.

In the early '30s, Ross Hull resigned from *Wireless Weekly* to take up a position with "QST", an amateur radio magazine published by the ARRL (American Radio Relay League). Tragically, his career was cut short when he was electrocuted while working on his latest interest — a developmental TV receiver.

Ross was succeeded in the editorial chair of *Wireless Weekly* by his brother A.G. Hull, whose immediate skills were administrative and mechanical rather than electronic. But according to his lifelong friend Ron Bell, founder of RCS Radio, 'Braith (Galbraith) Hull adapted quickly to his new role.

He engaged as technical assistant a youth, fresh out of Scots College, Melbourne who, over and above music and literature, had one dominating passion: radio. His name was John Murray (Johnny) Moyle.

Like Ross Hull before him, John already held an amateur licence and, as early as 1936, was to be found tearing around the countryside with mobile 5-metre (60MHz) equipment, talking back to fellow amateurs from remote mountain outcrops around Sydney. This interest was to be taken up again ten years later.

But, for the magazine itself, the winds of change were freshening. With radio receivers being accepted as a routine consumer appliance, the traditional nexus between programs, personalities and technical matters was eroding, placing a large question mark over the basic format of *Wireless Weekly*.

Between them, 'Braith Hull and John Moyle managed to talk their parent company into a completely new concept: *Wireless Weekly* would continue as a purely program and personality publication, produced by non-technical journalists. The technical team would concentrate on a new national monthly magazine, devoted mainly to radio and allied technology, but with a generous helping of science and hobbies.

It sounded like a good idea and, in April 1939, the first issue of *Radio and Hobbies* appeared on the streets. It sold quickly and, over the next few issues, gave all the indications of being a runaway success!

But then the scene changed when Australia joined Britain in declaring war on Germany. Braith Hull left to take up other activities, and I myself became involved with "R&H" — first as a contributor, then as a full-time technical editor. John Moyle accepted a commission with the RAAF as a radio/radar instructor, and I suddenly found myself with the job of running the magazine with the help of a junior assistant and a shared typist.

John Moyle (right) was editor of the magazine, then Radio & Hobbies, from 1939 until his untimely death in 1960. Here he is shown with Ron Bell, founder of RCS Radio.

With paper, facilities and radio components virtually frozen, it was essentially a holding operation, although the magazine was eagerly sought by service personnel, who were being introduced to radio technology for the first time in the armed forces.

A whole new team

Following the war, John Moyle and I set about assembling a technical team and organising new facilities to tackle the job ahead. Our aim was to find people with a range of skills, likely to complement the diverse interests of a whole new generation of readers.

And what unlimited scope for initiative there seemed to be, especially in view of the thousands of enthusiasts re-entering civilian life:

A huge backlog of ordinary receivers to be built; an urge to come to grips with better quality sound reproduction; a reopening of the amateur bands, and the promise of a mountain of surplus components through military disposals; the possibility of acquiring or building some real test equipment; and, further down the track, tape recording, a vastly improved disc format and television!

Far from being a daunting prospect, it was like a bunch of "carrots" out front, exasperating only because one couldn't tackle everything at once. I'm not exaggerating to say that John and I, along with newly recruited staff members, were like overgrown kids in a toyshop — incredulous that somebody was willing to pay us wages to pursue our collective hobby!

We would pore over disposals adverts and jostle with other enthusiasts every lunchtime at Price's Radio in Angel Place. "Two-bob for this ... a quid for that!"

We worked during the day in the office and, for the most part, went off home and kept right at it. John set up a ham shack and workshop in a spare (?) bedroom where, amongst other things, he spent countless hours grinding and etching crystals; I had a desperately overcrowded "shack" in the backyard; hifi gear dominated our respective living rooms. That was around 1947.

First radio newsgathering

As a measure of this immediate post-war enthusiasm, one of the projects tackled by the *R&H* technical team was only remotely connected to the magazine itself. Remembering his mobile radio activities in 1936, John saw the opportunity to set up what would be Australia's first mobile radio news gathering service, in association with our parent company's "Sun" newspaper.

Former assistant editor Philip Watson (left) with Neville Williams, author of this article, in mid-1948 on the roof of the Sun newspaper building in Sydney. They were trying out a VHF newsgathering system.

The PMG Radio Branch obliged with a licence for 70.46MHz, and the race was on to rework what was essentially 50MHz amateur equipment for the higher frequency. The base transmitter and receiver were installed on the roof of the old Sun building in Elizabeth Street (Sydney), with a control and copy reception centre in a disused studio on the 12th floor. It had been installed for 2UE in the early '30s, for simulated test cricket broadcasts.

With the vibrator-powered transmitter/receiver mounted in a (fortunately) capacious Chevrolet, and with yours-truly aboard to make sure it all worked, we made the first radio-controlled news sortie on July 2, 1948. Backing up was Ray Howe (ex RAAF) and Maurice Findlay, who, in later years, was to found his own company specialising in 2-way radio. (The exercise was described in the August, 1948 issue of EA).

Perhaps I should add that, at a later stage, Philip Watson — ultimately EA's assistant editor — was involved in the on-going mobile news-gathering project, as also was Ian Pogson, a long-term staff member, probably best remembered for the "Deltahet" series of high-tech, communication receivers.

On the amateur bands

Getting back to the magazine, most of the once well-known "2JU" amateur transmitter and receivers were built in John Moyle's bedroom/shack and checked out on air, in the late evenings. We would compare notes on the then 6-metre band, with occasional interruptions from as far afield as Arch Cox in Canberra (240km) and Alan Thackeray in Young (320km). This was long before the days of VHF repeaters.

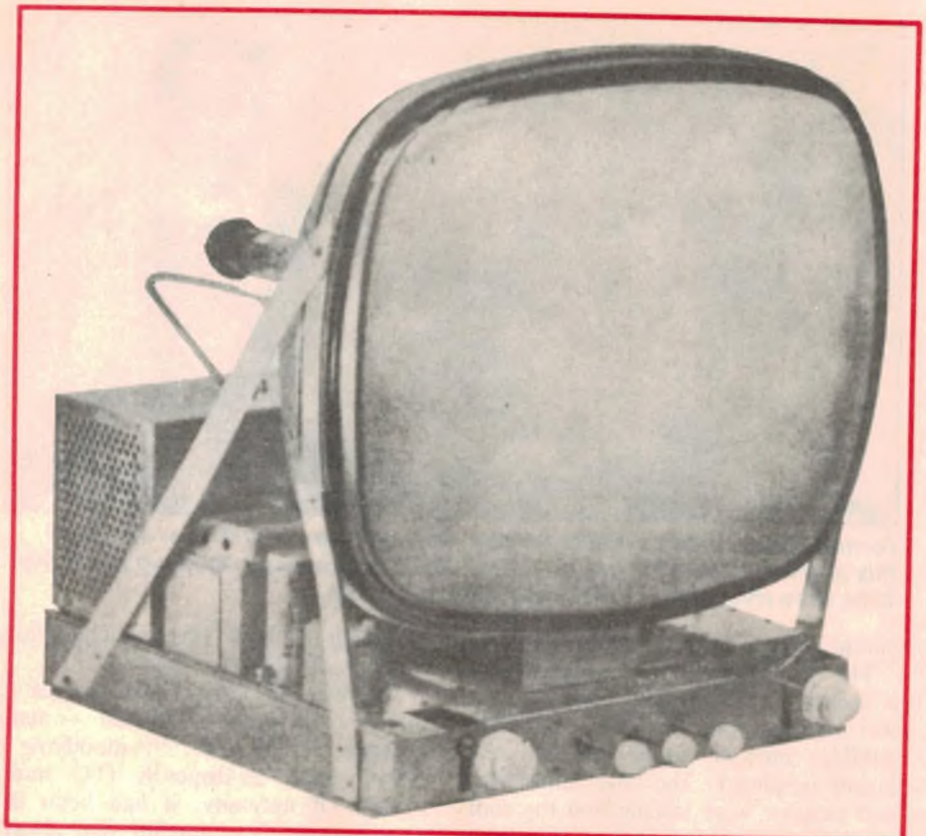
Around 1950, we began to use 2 metres or 2/5metre crossband — made possible, in my case, by modifying a British made ex-disposals 1143 transceiver. Of necessity, it had been designed around components that always were ill-suited to VHF service but, as I remember, it had been coaxed up to around 120MHz. To get it up to 144MHz was quite an assignment.

It was a multi-channel unit, with a fierce ratchet type stepping motor to change crystals and re-tune a bank of variable capacitors. In a plane, with a couple of Rolls Royce Merlins going full bore, the noise of the stepping mechanism would have been of no great consequence but, to change channels in an amateur shack in the dead of night, it was something else!

Audio-hifi activities

Interesting though these activities were, I doubt that they held the fascination of our on-going quest for even higher audio quality; this against a background of argument, during meal breaks in the cafeteria, between John Moyle the recorded music exponent and Julian Russell, more recently an EA record reviewer but, in those days, resident concert critic for our parent company. I can assure you that Julian upheld very capably the views of the "golden ear" fraternity!

I can recall our valiant efforts to win better sound from 78rpm records, the exercises in frequency compensation, the many lightweight — but often frail — pickups and the sad shake of the head by Fritz Langford-Smith, a guest at some of our listening sessions. As au-



The famous 1957 17-inch TV receiver, which Neville Williams himself designed. The first large-screen set described for home construction, it was extremely popular.

thor of the famous Radiotron Designer's Handbook, and a hifi fan with a keen ear for distortion, he had been my immediate superior in former days with the Amalgamated Wireless Valve Company.

Then along came microgroove LP records, marked by king-size commercial gaffes that left more than a few industry executives with egg on their corporate faces. For us, LP records marked a new era, but one that involved us in still more test runs in the search for a reliable microgroove magnetic pickups or, alternatively, for a suitably hifi ceramic cartridge. But it provided welcome copy for a technical magazine.

Meantime, domestic tape recorders had also made their appearance, backed up by a cloak-and-dagger tale of how they had been surreptitiously developed by the Germans, used secretly to further the Nazi War effort and discovered by chance by the rapidly advancing occupation troops.

In truth, German recording engineers had proudly demonstrated an early model tape deck to Sir Thomas Beecham in Ludwigshafen in 1936, and had used his orchestra to make the first-ever tape recording of a major concert. Far from being kept a secret, all relevant patents had been systematically filed in Switzerland, a neutral country. They were there for anybody to study.

Tape, and then stereo

The first tape recorder to reach us for inspection and comment was the "Magictape", a basic half-track model marketed by AWA. We had more fun with it in our lab than with any other "new toy" that I can remember, duly offering to prepare a lecture on the subject for the WIA (Wireless Institute of Australia).

The formal words and diagrams were prepared in good time but, on the morning of the lecture, we decided to make a send-up tape of an amateur transmission, with all the editing tricks that one could pull with such gear. For good measure, we added a home-grown, inlab version of the old comedy classic "The Crazy Pantomine".

For most of that day, our not-very-soundproof lab re-echoed to outlandish sound effects, grunts and guffaws that must have seemed slightly peculiar to other occupants of the floor. It must have appeared even more so to the spirits of the long-departed scientific fathers whose solemn portraits, on the night, gazed down from the walls of a packed Science House in Gloucester Street, Sydney.

As a tape recorder, the "Magictape" was no great shakes but one thing I know: From every point of view, it was far more affordable and practical as a recording device than the plastic coated aluminium recording discs and the Byer decks that some of us had been using previously to record interesting QSO's.

As for stereo LP discs, one could write a very long article about the philosophical arguments that they prompted. Many established hifi enthusiasts didn't want to pension off their prized mono pickup and amplifier, and they certainly couldn't afford or accommodate a duplicate of the massive mono loudspeaker enclosure they had fought to justify in the living room.

So any plausible anti-stereo argument was worth a run if it served to postpone the evil day: stereo was unnatural, artificial; it traded genuine quality for an illusion of spread; it could only work for someone sitting in one critical position; it was a gimmick, which wouldn't last, etc.

One man who didn't see it that way was a longstanding friend, Ernest (now Dr) Benson. At the time, he was a leading development engineer with AWA, who showed unusual interest when I mentioned that John and I would be auditioning a couple of advance-sample stereo records with a prototype ACOS cartridge. It had just arrived from the UK, and Max Cutts of Amplion had invited us to check it out.

Ernie B. duly joined us in John's lounge room and listened intently, saying scarcely a word. Finally, to our question "what do you think?" he drew breath and came up with what must be the most unbiased, matter-of-fact reply that I have ever heard:

"Gentlemen, you have just written off twelve months work!"

He went on to explain that he had been quietly researching simulated stereo sound, culminating in a prototype radiogram that would hopefully have stolen a march on AWA's competitors. In the light of what he had just heard, it would have been released just in time to be rendered obsolete!

Electronic organs

That same Ernest Benson was the man who, years before, had got me all steamed up about electronic organs. Together with EA science writer, Calvin Walters, I had visited his home and heard an organ in his lounge room that, in those days, sounded nothing short of magnificent. Then he took us downstairs to where a Hammond-like mechanism was purring away, generating waveforms for the console above.

I even went as far as having the blanks punched for a set of tone wheels, but that's as far as it went. Anyone who addresses himself to an organ on that scale may as well forget everything else for an indeterminate period!

Further involvement in the subject had to wait until around 1960, when Stromberg-Carlson Australia collapsed, following the failure of their unbranded receiver production. On the side, they had just previously begun to manufacture and market their version of a single-manual Thomas electronic organ and this, too, was doomed.

However, through the good offices of Neville Oates and Bob Swan — respectively Stromberg's organ engineer and sales executive — an arrangement was reached whereby the entire organ parts inventory would be cleared as kits and we would devise and publish a matching series of constructional articles.

In fact, we went well beyond the original Thomas/Stromberg design, adding optional 16' and 2'voices and reverberation. In so doing, we established something of a record in publishing about nine separate instalments, to the best of our knowledge without a single presentation error!

Admittedly, it was an essentially basic instrument but it allowed quite a few enthusiasts and small churches to acquire an electronic organ that they would not otherwise have been able to afford.

It also whet the appetites of quite a few others for something more pretentious but, apart from a few "ideas" articles, the Stromberg/Playmaster organ featured in and after December '61, remained a one-off exercise. The economics of designing, publishing, kitting-up for and supporting a complex organ for home construction simply don't stand up.

Another EA "milestone" project was the Stromberg-Playmaster organ of December 1961 and following issues, which was a very popular project. Here it was shown being played by Stromberg sales executive Bob Swan.

Home built hifi

But that's fortunately not the case with home-built hifi equipment, notably amplifiers, tuners and loudspeaker systems, Readers in Australia and New Zealand have built them in their tens of thousands, in many cases in numbers which would have delighted companies marketing name-brand products.

Quite early in the piece, John Moyle came up with the idea of adopting the name "Playmaster" for all audio-related projects which we might otherwise describe — at the time — as high fidelity. It was a brilliant idea, almost too good because, in short order, it was adopted for a whole range of audio related products. The Stromberg/Playmaster organ was an an obvious example.

It would require a whole article even to scan the Playmaster projects over the years, but my mind turns automatically to the memorable last generation of all-valve amplifiers, using tetrode output valves in ultralinear configuration, with overall negative feedback.

The ultralinear connection, with the screens returned to tappings on the output transformer, was an ingenious way to combine the efficiency of a beam tetrode with the low output impedance of a power triode. You were halfway there even before the application of negative feedback!

Mathematicians had long since known that overall negative feedback could turn nasty at high frequencies and cause instability — but they didn't build amplifiers. Manufacturers knew that their output transformers were the main source of phase rotation — but they didn't have to solve circuit problems!

It fell to people like Williamson in "Wireless World", Mullard in their "Outlook" and us with our "Playmasters" to bring together the maths, the transformer winding options, and circuit practicalities, in devising amplifiers that would work well and behave themselves in terms of high frequency stability.

There were many occasions when we could have done with "hotlines" from our lab to the valve manufacturers, along with Ferguson in Chatswood, Bramco in Newcastle, and A&R and RedLine in Melbourne. Those were days when Australians produced their own indigenous components, and we could consult directly with the engineers responsible. You'll have to pardon my nostalgia.

The television boom

Fortunately, and fairly obviously, that situation applied in the late '50s and early '60s when we had to meet reader clamour for home-built TV receivers. So much so that we changed our name from the original *Radio and Hobbies* to *Radio, TV and Hobbies* — a

**Neville Williams joined the magazine, then "Radio and Hobbies" in December 1941 — as Technical Editor. He held that position until April 1960, also serving as Acting Editor during the illness of the then Editor, John Moyle. After Mr Moyle's death he was appointed editor and served in this position until April 1971. He then became Editor-in-Chief and continued to guide the destiny of the magazine until his retirement in July 1983. His total length of service with the magazine is thus almost 42 years — more than any other individual. Since his retirement, Neville has remained very active and is still a regular contributor, with columns and articles coming from him each month in a steady stream. We're delighted he was able to write this article to celebrate our 65th birthday.*

mouthful if there ever was one!

Our attention turned initially to junk boxes and disposals stores, crammed alike with surplus cathode ray tubes and other radar remnants, hoarded against just this eventuality. After all, they were descendents of pre-war British television and who cared if the images were small and green, or blue? They would move and talk, wouldn't they?

John Moyle and I became involved in a two-horse race to devise a workable receiver, using one of the available 5-inch tubes — a 5BP1 or its somewhat more bulky English equivalent. The EHT supply was a problem, but someone had worked out that the need could be met with a voltage multiplier using 1000V paper capacitors and, of all things, a handful of 6H6 metal shell twin-diode valves.

Some would inevitably develop internal shorts, but who cared? There were thousands of otherwise useless 6H6s in the disposals stores, at "two bob" a time!

I managed to get hold of a prototype IF strip from Bob Steane of Q-plus, but I then had to devise my own tuner using a conventional Oak switch, incremental tuning and a box folded from sheet brass. It wasn't all that efficient but, given a reasonable location and antenna, it worked.

John chose to devise his own IF strip, as I remember, in collaboration with Ron Bell of RCS Radio. Phil Watson, meanwhile, was doing his best to devise suitable test gear, including a 36MHz FM generator or "wobbulator".

In due course, we were both rewarded with little green pictures that moved and talked — and it's debateable whether any single project ever gave us greater satisfaction. You could even reduce the walking/talking picture to postage stamp size, much to the intrigue of visitors.

Attempts to blow up the picture weren't always quite so successful, particularly when the circuitry was reworked for one or other of the larger tubes that could be picked up in those days.

Apart from their awkwardness and the sheer hazard of handling them, few of those early tubes were designed to have their total screen area brightly illuminated. Unable to drain away, the electrostatic charges inside and outside the glass would tear and distort the picture into grotesque shapes.

But then, just when we had had our fill of green pictures, the Manufacturers' Special Products (MSP) branch of AWA came up with a full kit of deflection components for their companion 17-inch (43cm) tube and my overcrowded shack in the backyard saw the birthpangs of what was the first modern TV receiver to be described in this country for home construction: The 1957 TV Receiver. It was finished and working before it even saw the inside of our lab.

Larger-screen models followed in successive years, but the urge to "roll your own" was gradually overtaken by the attraction of the factory-built product, off the shelf, at a cut price, on time payment.

Moreover, a new challenge had appeared on the horizon — the transistor — which was clearly going to change the whole scene, but that is another story.

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100 μV max resolution, 1.5%
A DC 2 mA-10 A, 5 ranges
1 μA max resolution 1.25%
A AC 2 mA-10 A 5 ranges
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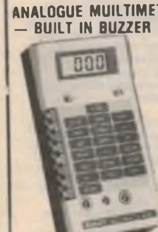

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CRT: 6" (150mm) Flat-faced high brightness CRT with Internal Graticule
Effective display area: 8 x 10 div (1 div = 10 mm)
Acceleration potential: 2KV

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Dual modes: Alter: 0.2ufs - 0.5ms/div. Chop: 1ms - 0.5s/div
CHOP frequency 200KHz approximately
Deflection factor: 5mV/div 20V/div +/−3%, 12 ranges in 1-2-5 step with fine control
Bandwidth: DC; DC - 20MHz (−3dB). AC: 10Hz - 20MHz -3dB)
Rise Time: Less than 17ns
Overshoot: Less than 3%
Input Impedance: 1M ohm +/−5%, 20pF +/−3pF
Maximum Input Voltage: 600Vp-p or 300V (DC+AC Peak)
Channel Isolation: Better than 60 dB at 1KHz

HORIZONTAL
Sweep Modes: NORMAL, and AUTO
Time Base: 0.2ufs - 0.5s/div +/−3%. 20 ranges in 1-2-5 step with fine control
Sweep Magnifier: 5 times (5X MAG).
Linearity: 3%

TRIGGERING
Sensitivity: INTERNAL: 1 div or better for 20Hz - 20MHz (Triggerable to more than 30MHz). EXTERNAL: 1Vp-p or better for DC - 20MHz (Triggerable to more than 30MHz).
Source: INT, CH-A, CH-B, LINE and EXT
Slope: Positive and Negative, continuosly variable with level control PULL AUTO for free-run.
Coupling: AC, HF-REJ and TV. TV SYNC Vertical and Horizontal Sync Separator Circuitry allows any portion of complex TV video waveform to be synchronized and expanded for viewing TV-H (Line) and TV-V (Frame) are switched automatically by SWEEP TIME/DIV switch.
TV-V:0.5s/div to 0.1ms/div. TV-H:50ufs/div to 0.2ufs/div.

X-Y OPERATIONS
X-Y Operations: **CH-A**: Y axis. CH-B: X axis Highest Sensitivity: 5mV/div

COMPONENT TESTER
Component Tester: Max AC 9V at the terminal with no load. Max current 2mA when the terminal is shorted. (Internal resistance is 4.7K ohm)

OTHER SPECIFICATIONS
Intensity Modulation: TTL LEVEL (3Vp-p), Positive ...... brighter
BANDWIDTH: DC - 1MHz MAXIMUM INPUT VOLTAGE: 50V (DC+AC Peak)
Calibration Voltage: 0.5Vp-p +/−5%, 1KHz +/−5% Square wave.
Trace Rotation: Electrically adjustable on the front panel.
Power Requirements: AC: 100, 120, 220, 240V 20W
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Size: 162(H) x 294(W) x 352(D)mm

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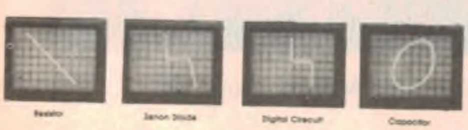

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This spectacular, rugged and compact DMM has a bright yellow high impact plastic case. It features a frequency counter (to 200kHz), diode and transistor test, continuity (with buzzer), capacitance meter, up to 20 amp current measurement and comprehensive AC/DC voltage, current and resistance ranges.

CHECK THESE FEATURES....
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- Transistor test
- Diode test
- Quality probes
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- Full overload protection
- 20 Amp
- Built in tilting bail
- Capacitance meter
- Instruction manual

SPECIFICATIONS:
DC VOLTAGE:
Range: 200mV, 2V, 20V, 1000V
Resolution: 100uV, 1mV, 10mV, 100mV, 1V
Accuracy: 200mV - 1000V +−0.3% +1 digit
AC VOLTAGE:
Range: 200mV, 2V, 20V, 200V, 750V
Resolution: 100uV, 1mV, 10mV, 100mV, 1V
Accuracy: 200mV - 200V +−0.8% rdg +3 digits
750V +−1.2% rdg +3 digits
Input Impedance: 10M ohm
DC CURRENT:
Range: 200uA, 2mA, 20mA, 200mA, 20A
Resolution: 100nA, 1nA, 10uA, 100uA, 10mA
Accuracy: 200uA - 20mA +−0.5% rdg +1 digit
200mA +−1.2% rdg +gt
10A +−2% rdg +5 digits (10A range unfused)
Max. I/P Amps: 10A (20A up to 60 seconds)
AC CURRENT:
Range: 2mA, 20mA, 200mA, 10A
Resolution: 1uA, 10uA, 100uA, 10mA
Accuracy: 2mA - 20mA +−1% rdg +3 digits
200mA +−1.8% rdg +3 digits
10A +−3% rdg +7 digits (10A range unfused)
RESISTANCE:
Range: 200, 2k, 20k, 200k, 2M, 20M ohms
Resolution: 0.1, 1, 10, 100, 1k, 10k ohms
Accuracy: 200 ohm +−0.5% rdg +3 digits
2k ohm - 2M ohm +−0.5% rdg +1 digit
20M ohm +−0.5% rdg +2 digits
Overload Protection: 200 ohm 250V DC/AC rms, 2k-20M ohm 500V DC/AC rms
CAPACITANCE:
Range: 200nF, 2uF, 20uF
Resolution: 100pF, 1nF, 10nF
Accuracy: 200nF-uF +−3% +5 digits
FREQUENCY RANGE: 0-20kHz, 0-200kHz

Cat. Q91550 .... **only $165**

METEX 4500H MULTIMETER

10A, 4½ digit multimeter with digital hold, transistor tester and audible continuity tester.

The Metex 4500H is perfect for the technician, engineer or enthusiast who requires the higher accuracy of a 4½ digit multimeter. This meter is exceptionally accurate, (just look at the specifications), and yet, still retains an exceptionally low price!

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CHECK THESE FEATURES...
- Readout hold
- Transistor Tester
- 4½ digit x ½"(H) LCD
- Audible continuity tester
- Push-button ON/OFF switch
- Quality set of probes
- Single function, 30 position easy to use rotary switch for FUNCTION and RANGE selection
- Built in tilting bail
- Instruction manual
- Full overload protection
- hFE test
- Battery and Spare fuse
- Diode Tester
- Vinyl case

SPECIFICATIONS:
DC VOLTAGE:
Range: 200mV, 2V, 20V, 1000V
Resolution: 10uV, 100uV, 1mV, 10mV, 100mV
Accuracy: 200mV - 1000V +−0.05% rdg +3 digits
Input Impedance: 10M ohms
AC VOLTAGE:
Range: 200mV, 2V, 20V, 200V, 750V
Resolution: 10uV, 100uV, 1mV, 10mV, 100mV
Accuracy: 200mV - 200V +−0.5% rdg +10 digits
750V +−0.8% rdg +15 digits
Input Impedance: 10M ohm
DC CURRENT:
Range: 200uA, 2mA, 20mA, 200mA, 2A, 10A
Resolution: 10nA, 100nA, 1uA, 10uA, 100uA, 1mA
Accuracy: 200uA - 20mA +−0.3% rdg +3 digits
200mA - 2A +−0.5% rdg +3 digits
10A +−1% rdg +5 digits (10A range unfused)
Max. I/P Amps: 10A (20A up to 60 seconds)
AC CURRENT:
Range: 200uA, 2mA, 20mA, 200mA, 2A, 10A
Resolution: 1nA, 10nA, 1uA, 10uA, 100uA, 1mA
Accuracy: 200uA - 20mA +−0.8% rdg +10 digits
200mA - 2A +−1% rdg +10 digits
10A +−1.5% +5 digits (10A range unfused)
Max I/P Amp: 10A (20A up to 60 seconds)
RESISTANCE:
Range: 200, 2k, 20k, 2M, 20M ohms
Resolution: 10m ohm, 100m ohm, 1, 10, 100, 1k ohms
Accuracy: 200 ohm +−0.2% rdg +5 digits
2k ohm - 2M ohm +−0.1% rdg +3 digits
20M ohm +−0.5% rdg +5 digits
OVERLOAD PROTECTION: 200 ohm 250V DC/AC rms, 2k-20M ohm 500V DC/AC rms

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This instrument is a compact, rugged, battery operated, hand held 3½ digit multimeter for measuring DC and AC voltage. DC and AC current. Resistance and Diode, for testing Audible continuity and transistor hFE. The Dual-slope A-D Converter uses C-MOS technology for auto-zeroing, polarity selection and over-range indication. Full overload is provided. It is an ideal instrument for use in the field, laboratory, workshop, hobby and home applications.

Features...
- Push-button ON/OFF power switch
- Single 30 position easy to use rotary switch for FUNCTION and RANGE selection
- ½" high contrast LCD
- Automatic over-range indication with the "1" displayed
- Automatic polarity indication on DC ranges
- All ranges fully protected plus Automatic "ZERO" of all ranges without short circuit except 200 ohm Range which shows "000 or 001".
- High Surge Voltage protection 1.5 KV-3 KV
- Diode testing with 1 mA fixed current
- Audible Continuity Test
- Transistor hFE Test

SPECIFICATIONS
Maximum Display: 1999 counts 3½ digit type with automatic polarity indication
Indication Method: LCD display
Measuring Method: Dual-slope in A-D converter system
Over-range Indication: "1" Figure only in the display
Temperature Ranges: Operating 0-C to +40-C
Power Supply: one 9 volt battery (006P or FC-1 type of equivalent)

Cat. Q91530 **Normally $109**
SPECIAL $79

METEX 3530 MULTIMETER

This instrument is a compact, rugged, battery operated, hand held 3½ digit multimeter for measuring DC and AC voltage, DC and AC current. Resistance and Diode Capacitance, Transistor hFE and Continuity Test. The Dual-slope A-D Converter uses C-MOS technology for auto-zeroing, polarity selection and over-range indication. Full overload is provided. It is an ideal instrument for use in the field, laboratory, workshop, hobby and home applications.

Features...
- Push-button ON/OFF power switch
- Single 30 position easy to use rotary switch for FUNCTION and RANGE selection
- ½" high contrast LCD
- Automatic over-range indication with the "1" displayed
- Automatic polarity indication on DC ranges
- All ranges fully protected plus Automatic "ZERO" of all ranges without short circuit except 200 ohm Range which shows "000 or 001"
- High Surge Voltage protection 1.5 KV-3 KV
- Capacitance measurements to 1pF
- Diode testing with 1 mA fixed current
- Audible Continuity Test
- Transistor hFE Test

SPECIFICATIONS
Maximum Display: 1999 counts 3½ digit type with automatic polarity indication
Indication Method: LCD display
Measuring Method: Dual-slope in A-D converter system
Over-range Indication: "1" Figure only in the display
Temperature Ranges: Operating 0-C to +40-C
Power Supply: one 9 volt battery (006P or FC-1 type of equivalent)

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- Instruction manual
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VIFA/AEM 3 WAY SPEAKER KIT!

This superb 3 way speaker kit competes with systems that cost 2 - 3 times the cost of these units! (which may even be using VIFA drivers etc.) Never before has it been possible to get such exceptional value in kit speakers! Call in personally and compare for yourself!

The system comprises...
- 2 x D19 dome tweeters
- 2 x D75 dome midrange
- 2 x P25 wooters
- 2 x pre-built quality crossovers

The cabinet kit consists of 2 knock-down boxes in beautiful black grain look with silver baffles, speaker cloth, innerbond, grill clips, speaker terminals, screws and ports.

D19 DOME TWEETER SPEAKER SPECIFICATIONS
Nominal Impedance: 8 ohms
Frequency Range: 2.5 - 20kHz
Free Air Resonance: 1,700Hz
Sensitivity 1W at 1m: 89dB
Nominal Power: 80 Watts (fo: 5,000Hz, 12dB/oct)
Voice Coil Diameter: 19mm
Voice Coil Resistance: 6.2ohms
Moving Mass: 0.2 grams
Weight: 0.28kg

D75 DOME MIDRANGE SPECIFICATIONS
Nominal Impedance: 8 ohms
Frequency Range: 350 - 5,000Hz
Free Air Resonance: 300Hz
Sensitivity (1W at 1m): 91dB
Nominal Power: 80 Watts (fo: 500Hz, 12dB/oct)
Voice Coil Diameter: 75mm
Voice Coil Resistance: 7.2ohms
Moving Mass (incl. air): 3.6 grams
Weight: 0.65kg

P25 WOOFER SPECIFICATIONS
Nominal Impedance: 8 ohms
Frequency Range: 25 - 3,000Hz
Free Air Resonance: 25Hz
Operating Power: 5 watts
Sensitivity (1W at 1m): 89dB
Nominal Power: 60 Watts
Music Power: 100 Watts
Voice Coil Diameter: 40mm
Voice Coil Resistance: 5.7ohms
Moving Mass (incl. air): 44 grams
Thiele/Small Parameters:
Qm: 3.15
Qe: 0.46
Qt: 0.40
Vas: 180.1
Weight: 1.95kg

Complete Kit Cat K16030 **$1,199**
Speaker Kit Cat K16031 **$949**
Cabinet Kit Cat K16032 **$349**

VIFA/AEM 2 WAY SPEAKER KIT!

This exciting new speaker kit, designed by David Tillbrook (a name synonymous with brilliant design and performance) uses VIFA's high performance drivers from Denmark. You will save around $800 when you hear what you get from this system when compared to something you buy off the shelf with similar characteristics. Call in personally and compare for yourself!

The system comprises...
- 2 x P21 Polycone 8" woofers
- 2 x D25T Ferrofluid cooled dome tweeters with Polymer diaphragms
- 2 pre-built quality crossovers

The cabinet kit consists of 2 knock-down boxes in beautiful black grain look with silver baffles, speaker cloth, innerbond, grill clips, speaker terminals, screws and ports.

D25T SPEAKER SPECIFICATIONS
Nominal Impedance: 6 ohms
Frequency Range: 2 - 24kHz
Free Air Resonance: 1500Hz
Operating Power: 3.2 watts
Sensitivity (1W at 1m): 90dB
Nominal Power: 90 Watts
Voice Coil Diameter: 25mm
Air Gap Height: 2mm
Voice Coil Resistance: 4.7ohms
Moving Mass: 0.3 grams
Weight: 0.53kg

P21 WOOFER SPECIFICATIONS:
Nominal Impedance: 8 ohms
Frequency Range: 26 - 4,000Hz
Free Air Resonance: 33Hz
Operating Power: 2.5 watts
Sensitivity (1W at 1m): 92dB
Nominal Power: 60 Watts
Voice Coil Diameter: 40mm
Voice Coil Resistance: 5.8ohms
Moving Mass: 20 grams
Thiele/Small Parameters: Qm: 2.4, Qe: 0.41, Qt: 0.35, Vas: 80.1
Weight: 1.65kg

Complete Kit Cat K16020 **$799**
Speaker Kit Cat K16021 **$649**
Cabinet Kit Cat K16022 **$209**

SUPERB NEW VIFA/EA 60 + 60 SPEAKER KIT!

The new Vifa/EA 60 + 60 loudspeaker kit has been designed to completely out perform any similarly priced speakers. This is a 2-way design incorporating drivers which give a deeper, more natural bass response and 19mm soft-dome ferro fluid cooled tweeters which provide clear, uncoloured sound reproduction.

These Vifa drivers are identical to the ones used in such fine speakers as Mission, Rogers, Bang & Olufsen, Monitor Audio and Haybrook just to name a few. Some of which cost well over $1,000 a pair!

The dividing network is of the highest quality and produce no inherent sound characteristics of their own; they simply act as passive devices which accurately distribute the frequency range between both drivers in each speaker.

The fully enclosed acoustic suspension cabinets are easily assembled. All you need are normal household tools and a couple of hours and you've built yourself the finest pair of speakers in their class!

D19 TWEETER SPECIFICATIONS:
Nominal Impedance: 8 ohms
Frequency Range: 2.5 - 20KHz
Free Air Resonance: 1,700Hz
Sensitivity 1W at 1m: 89dB
Nominal Power: 80 Watts (fo: 5,000Hz, 12dB/oct)
Voice Coil Diameter: 19mm
Voice Coil Resistance: 6.2 ohms
Moving Mass: 0.2 grams
Weight: 0.28kg
Cat C10301 **$38**

C20 WOOFER SPECIFICATIONS:
Nominal Impedance: 8 ohms
Frequency Range: 35 - 6,000Hz
Resonance Frequency: 39Hz
Sensitivity 1W at 1m: 90dB
Nominal Power: 50 Watts (12dB/oct)
Voice Coil Diameter: 25mm
Voice Coil Resistance: 5.5 ohms
Moving Mass: 15 grams
Cat C10322 **$89**

Cat K86092 (speakers only) **$379**
Cat K86091 (complete kit) **$449**

SENNHEISER HEADPHONES!!

The worlds best headphones are now available from Rod Irving Electronics!! 3 models to choose from, other models are available on request! (Phone Tony DiPaolo on (03) 543 2186)

SENNHEISER HD 40

The HD40 is feather light, at just 60g! This HiFi stereo headphone is uncommonly convenient to use. Its systems can be rotated so it can fit into any drawer. It is also available as a TV headphone.
SPECIFICATIONS:
Frequency Range: 22 - 18,000Hz
Impedance: 600ohm
Distortion Factor: Approx. 1.5%; pressure on ear: approx. 1.3 N
Weight: Approx. 60g
Length of lead: 3 metres
Cat A10515 **$49.95**

SENNHEISER HD 410 SL

The HD 410 SL embodies all the advantages of the new "Slim-line" concept: brilliant sound characteristics with an optimum of sound volume combined with high wearer comfort.
SPECIFICATIONS:
Frequency Range: 20 - 18,000Hz
Impedance: 600ohm
Distortion Factor: Less than 1%; pressure on ear: approx. 2.5 N
Weight: Approx. 82g
Length of lead: 3 metres
Cat A10518 **$74.95**

SENNHEISER HD 540 REFERENCE

The HD 540 reference headphones are open dynamic stereo headphones. They are among the best ever made. Designed according to latest findings in acoustics, their reproduction is of extraordinary transparency and the highest transients fidelity. The test with a CD player shows: their acoustic properties are outstanding. The ear cushions play a major role. They provide a completely resonance-free treble reproduction up to 25 KHz and assure an impressively clear bass reproduction down to 16 Hz.
SPECIFICATIONS:
Frequency Range: 16 - 25,000Hz
Impedance: 600ohm per capsule
Harmonic Distortion Factor: Less than 0.4%
Contact Pressure: Approx. 3 N
Weight: Approx. 250g
Length of lead: 3 metres
Cat A10519 **$199**

1" DOME TWEETER SPEAKER

Mylar diaphragm
SPECIFICATIONS:
Sensitivity: 96dB
Frequency Response: 2-20 kHz
Impedance: 8 ohms
Power RMS: 15 watts RMS
Magnet Weight: 5.4oz
Size: 96mm diameter
Cat C10234 **$10.95**

2" HORN TWEETER SPEAKER

Mylar diaphragm, aluminium voice coil
SPECIFICATIONS:
Sensitivity: 95dB
Frequency Response: 1.5-20 kHz
Impedance: 8 ohms
Power RMS: 10 watts RMS
Magnet Weight: 2.5oz
Cat C10232 **$8.95**

5" MIDRANGE SPEAKER

Sealed back, foam edge, black cone, silver dust cap
SPECIFICATIONS:
Sensitivity: 98dB
Frequency Response: 500-8 kHz
Impedance: 8 ohms
Power RMS: 10 watts RMS
Magnet Weight: 5.4oz
Cat C10230 **$12.95**

6½" TWIN CONE FULL RANGE SPEAKER

Foam edge, black cone, black whizzer cone
SPECIFICATIONS:
Sensitivity: 89dB
Frequency Response: 60-15 kHz
Impedance: 8 ohms
Power RMS: 10 watts RMS
Magnet Weight: 5.3oz
Cat C10222 **$14.95**

8" TWIN CONE FULL RANGE SPEAKER

Foam edge, black cone, black whizzer cone
SPECIFICATIONS:
Sensitivity: 98dB
Frequency Response: 45-16 kHz
Impedance: 8 ohms
Power RMS: 30 watts RMS
Magnet Weight: 13oz
Cat C10224 **$23.95**

8" WOOFER HIGH POWER SPEAKER

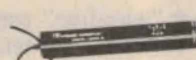
Cloth edge, dark grey cone, rubber mounting seal, cloth dust cap
SPECIFICATIONS:
Sensitivity: 90dB
Frequency Response: 60-4 kHz
Impedance: 8 ohms
Power RMS: 50 watts RMS
Magnet Weight: 20oz
Cat C10226 **$34.95**

10" WOOFER HIGH POWER SPEAKER

Cloth edge, dark grey cone, rubber mounting seal, cloth dust cap
SPECIFICATIONS:
Sensitivity: 93dB
Frequency Response: 50-2.5 kHz
Impedance: 8 ohms
Power RMS: 100 watts RMS
Magnet Weight: 30oz
Cat C10228 **$59.95**

12" WOOFER HIGH POWER SPEAKER

Cloth edge, dark grey cone, rubber mounting seal, cloth dust cap
SPECIFICATIONS:
Sensitivity: 97dB
Frequency Response: 28-4 kHz
Impedance: 8 ohms
Power RMS: 50 watts RMS
Magnet Weight: 30oz
Cat C10229 **$69.95**



OMNI-DIRECTIONAL WIRELESS MICROPHONE

Tuneable: 92 - 104MHz
Freq. Response: 50 - 15kHz
Range: Over 300 feet in open field
Modulation: FM
Power Source: 9V Battery
Type: Electret Condenser
Dimensions: 185 x 27 x 38mm
Weight: 160 grams
Cat A10450 **$19.95**

PHILIPS SPEAKERS

This month we are offering 20% off these prices! But, you'd better be quick as this offer is limited.

Description	Cat No.	Price
AD01610T8	(C12030)	$24.95
AD02160SQ8	(C12040)	$69.95
AD80652W8	(C12042)	$69.95
AD070620M8	(C12045)	$69.95
AD12250W8	(C12050)	$129.00

WIRELESS MICROPHONE RECEIVER WA100

Made by Piezo (Azden) of Japan this device will turn any microphone fitted with a Cannon Type male socket into a wireless microphone. The receiver will plug into any 6.35mm microphone input. Both transmitter and receiver can be tuned from 76 - 81MHz.
Freq. Response: 50 - 16kHz
Tunable: 76 - 81MHz
Field Strength: Transmitter 10uV/100 metres, Receiver 15mV (100%)
Battery: Transmitter LR44 (1.5V), Receiver 3 x UM4 (4.5V)
Instructions: Japanese (English not available!)
Cat A10520 R.R.P. $199
Our price, only $189

CRYSTAL LOCKED WIRELESS MICROPHONE AND RECIEVER

MICROPHONE SPECIFICATIONS:
Transmitting Frequency: 37.1MHz
Transmitting System: crystal oscillation
Microphone: Electret condenser
Power Supply: 9V battery
Range: 300 feet in open field
Dimensions: 185 x 27 x 38mm
Weight: 160 grams

RECIEVER SPECIFICATIONS:
Recieving Freq: 37.1MHz
Output Level: 30mV (maximum)
Recieving System: Super heterodyne crystal oscillation
Power Supply: 9V Battery or 9V DC power adapter
Volume control
Tuning LED
Dimensions: 115 x 32 x 44mm
Weight: 220 grams
Cat A10452 R.R.P. $113
Our price, $99

PORTABLE MINI P.A. AMPLIFIER

A completely portable system, sets up anywhere in seconds. Inputs for microphone, electronic organ and cassette players. Variable echo makes this an ideal unit for buskers and budding singers.
SPECIFICATIONS:
Output power: 1W RMS, 2W max
Frequency Response: 100-15kHz
Speaker: 5" full range, 4 ohms
Echo Time: Variable 5-52m/sec
Power Source: 6 x "D" size batteries (position for power adaptor also)
Size: 280(H) x 120(W) x 180(D)mm
Weight: 1.3kg
Cat A12022 **$89.95**

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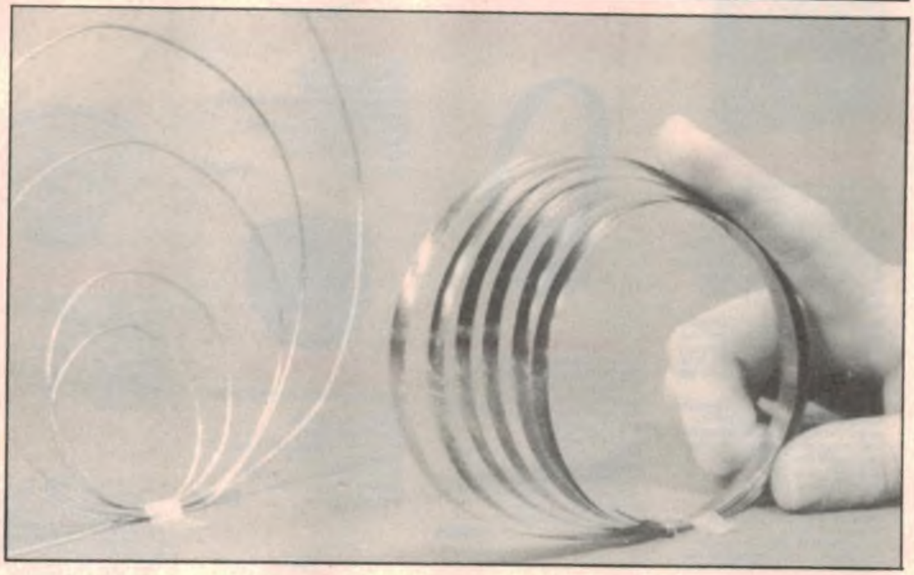
News Highlights



Toshiba produces wires and tapes of superconductor

Scientists working at Toshiba Corporation in Japan have developed superconducting wires and tapes, using the yttrium-barium-copper oxide superconductive ceramic material recently developed in various laboratories throughout the world (see EA July 1987, page 10).

Toshiba not only has helped to develop the new material, but also marked another important step forward in the practical application. The company molded this material into thin wire rods with ceramic cores 0.6mm in diameter, and tape formulation 5mm wide, 0.1mm thick.

Moreover, the company's researchers processed these thin wires into silver-covered coils of 2 centimetres in diameter and attained the critical current density of 510 ampere per square centimeter (A/cm^2) — a world record in these forms. Critical current density represents the maximum electricity which can be conducted in a given area without losing superconductivity.

"We have a lot of hurdles to overcome before putting these materials into practical use," says Fumio Miyashiro, manager of Toshiba's Metals and Ceramics Laboratory, "Ceramic superconductors are currently too brittle for practical applications. Also, critical current density is too small. We need to achieve at least 10,000 A/cm^2".

Mr Miyashiro says, however, that the exciting discoveries in the past few months regarding superconductors now make it possible to think about the previously unthinkable dream. "Who would have imagined a man could land on the moon forty years ago? We may, ultimately, be able to find superconductors that can operate at room temperature."

Toshiba has been pursuing research and development work on superconductivity for over 25 years.

The fruits of this research and development have already been applied in the company's magnetic resonance imaging (MRI) system — advanced medical equipment for image diagnosis. Toshiba is also a key participant in national projects in Japan for developing magnetically levitated trains and fusion power generators.

New software for Jindalee OTH radar

Computer Sciences of Australia has begun work on a $6 million project to convert experimental software developed for the Federal Government's Jindalee Over-The-Horizon Facility into an operational system.

Up to 30 CSA software engineers will be employed on the contract over the next three years at the Defence Research Centre in Adelaide.

Jindalee is a revolutionary radar technique that enables surveillance over immense areas far beyond the limits of conventional radar. It detects targets by bouncing high frequency radio waves off the ionosphere.

The reflected radio energy is gathered by very large antenna arrays and analysed by a computer system that takes into account the frequently changing characteristics of the ionosphere.

The Department of Defence intends to build three operational Jindalee systems which will become an integral part in Australia's defence program.

CSA has worked on Jindalee for the past four years. The company has carried out software studies and made recommendations of future software and computer systems needs to the Defence Research Centre which is part of the Defence Science and Technology Organisation.

Wireless video transmitter standard

A draft standard that aims to protect television reception against interference from wireless video transmitters has been released by the Department of Communications.

The new standard is designed to cover video transmitters which provide a "wire-free" connection between video recorders and television receivers.

According to DoC, any video transmitter connected to a power supply can cause interference to television receivers and to other types of radio communications equipment. In the case of a video transmitter with an excessive output power level, the "wire-free" link between the recorder and a receiver could be up to 100 metres. This could interfere with a neighbour's television reception, particularly where video transmitters are operated in a block of flats.

The new draft standard specifies the performance and effective range for video transmitters and, once it comes into force, all video transmitters sold in Australia would have to comply with the requirements.

Copies of the draft standard may be obtained by writing to the Assistant Secretary, Operations Branch, Department of Communications, Canberra.

Perth Electronics Show heading for a "sellout"

At the time of going to press with this issue, the 1987 Perth International Electronics Show was heading for a complete sellout in terms of exhibitors. According to Show manager Chris Gulland, this year looks like being as least as good as last year's show, if not better. There seems to be no doubt that the Perth Show has become the premier annual showcase for the Australian electronics industry.

Last year some 218 companies were represented at the show, in one capacity or another, and 93,600 trade and consumer visitors passed through the turnstiles. Of the latter, some 9,700 visitors were from overseas.

This year's show is being held from July 29 to August 2, at the Claremont showgrounds.

Philips CD players to be made in China

Philips of the Netherlands has established a 50%-50% joint venture with the Shenzhen Advanced Science and Technology Company (S.A.S.T. Ltd) of the People's Republic of China to manufacture and market laser optical systems including Laservision players and CD players and discs.

The signing of the joint venture contract and other main contract documents took place in Shenzhen on 16th May, 1987. The signing ceremony was attended by Mr Zhou Qie Wu, First Executive Vice Mayor of Shenzhen, Mr Zhu Yueh Ning, vice Mayor of Shenzhen and Mr Ye Hua Ming, Director of S.A.S.T., as well as Mr R.H. van Meurs, Managing Director of the product division Consumer Electronics of Philips and Mr C.J. Seelen, Senior Managing Director of Philips International, responsible for Philips activities in China.

Total investment for equipment will amount to 80 million dutch guilders. The factory and the offices of the joint venture, named Shenzhen Shen Fei Laser Optical Systems Co. Ltd, are presently under construction and will be completed by the end of this year. Production facilities are being built to meet international requirements for high technology process industry. Personnel employed will eventually reach 500 persons. The products of the company will be mainly destined for the domestic market and will be sold under the Philips brandname. The remaining part of the production will be exported.

Australian data logger monitors body temperature of Antarctic researchers

An Australian-made electronic data logger will record the body temperature of survey staff during field work on the ice plateau beyond Casey station during 1987.

The temperature recordings will be used to probe a possible link between low body temperature and gastro-intestinal disorders in traverse personnel. The project is directed by Dr Peter Gormly, Senior Medical Officer, and Dr Des Lugg, Assistant Director, or the Polar Medicine Branch, in the Antarctic Division of the Department of Science, which is based near Hobart. At Casey Station the program is supervised by Dr Vernon Moo.

Dr Gormly said that for some years there had been reports of gastro-intestinal disease in polar survey teams. He said it was known that moderate hypothermia (34-35 degrees C) disturbs the function of the stomach, reducing the quantity of gastro-intestinal secretions. Below normal body temperature was a possible cause of the gastro-intestinal problems, Dr Gormly said. Normal body temperature is 38.4 degrees C.

During the project, members of a glaciological survey team will "wear" a DT100 **Datataker** for 24 hour periods in turn. The Datataker will record temperatures sensed by two YSI number 401 probes. One probe will emerge from the outer clothing near the neck, and will measure air temperature. The other probe will be inserted rectally, and will measure deep body temperature.

Readings from both probes will be recorded automatically every five minutes by the Datataker, which has an inbuilt power supply and 24K of memory for storing information.

At the end of each 24-hour period, the team will answer a questionnaire about gastro-intestinal symptoms. The questions will be asked impersonally by a portable computer previously programmed with the questionnaire, and the answers entered directly by the team member. At the same time, the temperature records from the Datataker will be downloaded into the computer and, together with the data from the completed questionnaire, transferred to cassette tape for storage. The Datataker will then pass to the next team member for another 24-hour periods.

Dr Gormly expects that after two major traverses scheduled for 1987, there will be enough information to establish whether low body temperature is a factor in the gastro-intestinal problems.

One of the Datataker's designers, Mr Graham Henstridge, spent two years at Casey and Mawson working as an electronics engineer. Mr Henstridge is now a partner in Data Electronics, the Melbourne-based manufacturer of the Datataker.

News Highlights

Plessey to make Army's communications system

A $350 million contract has been signed between the defence manufacturer Plessey Australia and the Australian Government. Plessey will now begin Australian production of some 2000 HF and 3900 VHF radios, plus associated ancillary and frequency management systems.

All equipment, including computerised battlefield service and repair facilities, is currently being field trialled by the Australian Defence Force.

Code named RAVEN, the system incorporates the latest advances in tactical communications systems including highly sophisticated state of the art technology to prevent eavesdropping or jamming during field operations.

RAVEN is designed to perform in a wide variety of harsh climatic and electronic warfare situations, and provides simple "user friendly" operations for soldiers whether on foot, in four wheel drive, armoured vehicles or in command posts. It has been developed in Australia by Plessey in co-operation with its UK parent.

Welcoming the contract — the largest Australian defence contract ever received by the company, the Managing Director of Plessey (Australia), Mr Edwin Matiuk said RAVEN would provide a substantial impetus to Australia's electronics industry.

"Jobs, export opportunities and the further development of technology at the highest levels will all result from the Government's decision to proceed with RAVEN," he said. "We have already established advanced production facilities at our Sydney manufacturing plant.

"With this as a base, Plessey will now be able to manufacture state of the art defence communications systems to friendly nations throughout the Pacific Region."

Mr Matiuk said that to enhance RAVEN's development, Plessey had encouraged the manufacture of locally produced high technology components, many of which were now being evaluated for suitability in like projects overseas.

In total it is expected that more than 600 jobs will result at Plessey's Meadowbank plant and through the provision of components and assemblies by external manufacturers.

Shown here signing the Army contract are (left to right) Duncan Spencer and Edwin Matiuk of Plessey, Fred Bennett and Bill Drysdale of the Department of Defence, and Major General Duncan Francis, Chief of Army Materiel.

Freezeframe video camera

A new device which freezes video images and delivers a choice of high quality instant colour prints or 35mm slides from a range of video sources, is now available in Australia. The Polaroid FreezeFrame Video Recorder, a joint Polaroid and Toshiba design and development project, captures and digitises an image field at the touch of a single button. Pushing a second button produces the instant prints and slides.

Currently availabe only in an NTSC configuration, Freezeframe is the first relatively low cost device which simply and quickly delivers photographic still images from video.

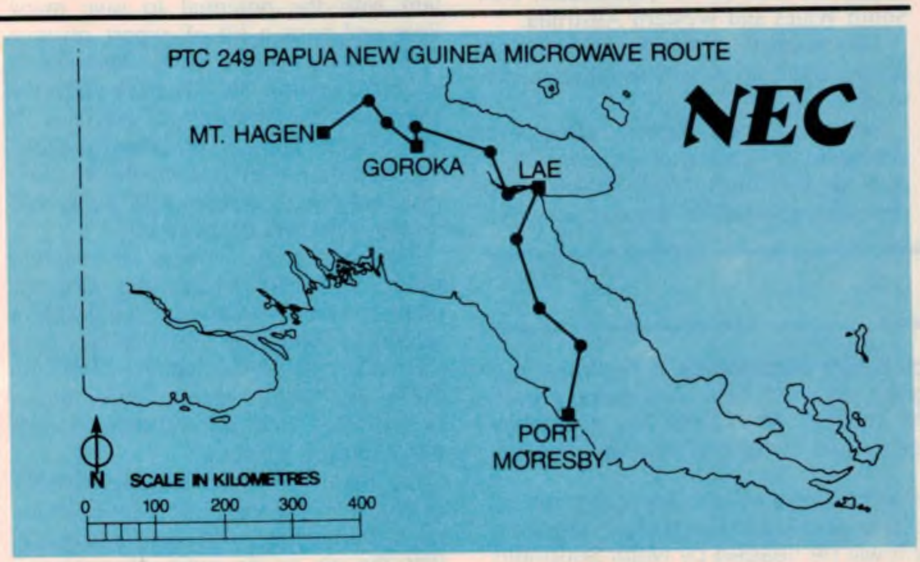
Polaroid believes that when the PAL version of FreezeFrame is in production, the new recorder will satisfy a broad range of previously unfulfilled video imaging needs in Australia.

The NTSC FreezeFrame has so far been proven to work with video sources which operate at 15.75kHz in the RGB analog or TTL mode, or can be converted to do so, such as computers and high technology medical video imaging devices.

The current model FreezeFrame Video Recorder digital freeze field device captures NTSC television signals off air, or from such standard video sources as cameras, VCRs or disc players and computers. It comprises an imaging unit with interchangeable instant print and 35mm film backs, and a keyboard type control unit.

The recorder produces instant 4x3 inch self-developing colour prints on Type 339 AutoFilm, at the push of a button, from its Polaroid CB-33 AutoFilm camera back. AutoFilm prints match the 4:3 aspect ratio of standard video displays and once ejected from the BC-33 back, develop themselves in ordinary light.

With its alternate 35mm motorised camera back, the system produces Polaroid instant 35mm slides or conventional 35mm images. Polaroid instant slide films are developed in a minute, in the Polaroid AutoProcessor and ready immediately after for cutting, mounting and projection.



NEC to supply microwave system for PNG telephones

NEC Australia has been awarded an export contract worth several million dollars to supply a turnkey microwave system across the rugged mountains of Papua New Guinea.

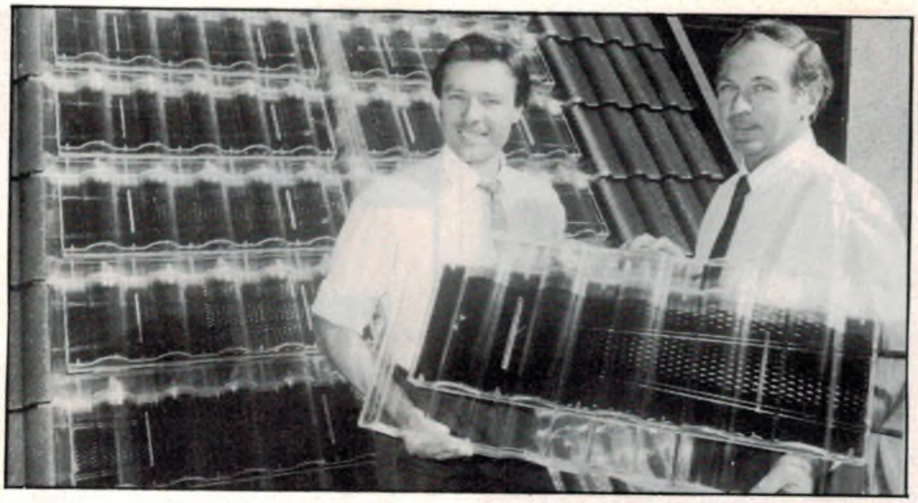
Average altitude of the microwave repeater stations along the 677 kilometre route will be 2800 metres (9,000 ft). Access to all but two of the repeater sites is by helicopter.

The system, ordered by the Post and Telecommunication Corporation of Papua New Guinea, will upgrade and expand telephone communications between Port Moresby, Lae, Goroka and Mount Hagen.

It will use NEC's 550 Series low power consumption equipment, with 960 channel capacity on each bearer. This equipment is specially designed for remote solar powered sites such as occur in the Papua New Guinea highlands.

The project also involves the establishment of a network control centre which will eventually gather data from all major microwave bearers in Papua New Guinea.

The Export Manager of NEC Australia, Mr John Norton, said this week: "Our success in this project shows that NEC Australia can be competitive in export markets. It is also a demonstration of the high level of cooperation and support between NEC Australia and NEC Corporation, Japan, in developing into new areas".



Australian solar invention goes on sale

An award winning Australian inventor has begun selling his highly acclaimed Solartile solar roofing system. Ken Lock won the Esso Energy Award for his unique design, which places solar panels within the normal roof line of a house or commercial building.

The panels are claimed to be more energy efficient than conventional solar collection units, as well as being more attractive.

Mr Lock floated a public company, Solartile, last year to bring the invention to market. The first roof units began leaving his factory last month, bound for markets in Queensland, New South Wales and Western Australia.

The Solartile system is backed by a strong distribution and installation network.

Solartile panels replace sections of conventional ceramic or cement tiles or steel decked roofs. They fit flush with the roof material to present a normal weather proof surface.

The Solartile is made of UV stabilised toughened clear acrylic with a black chrome solar collection panel mounted beneath it. Each Solartile takes the place of three conventional concrete tiles. Twelve Solartiles are sufficient to service a 300 litre (60 gallon) storage tank.

"The idea came to me because of the number of people who like the idea of solar-heating, but wanted less obvious collection units", said Mr Lock, a Sydney builder. "It's taken several years to perfect the technique of flush-mounting solar panels to make them virtually invisible on the roof".

Business Briefs

- Mike Wilson, managing director of ***Dick Smith Electronics*** in Australia and New Zealand since March 1984, resigned on 25th May. He gave parent company Woolworths Ltd three months' notice. Mr Wilson is apparently considering the various ways to capitalise on his considerable experience in the computer and electronics industries.
- ***Atari Corporation*** is to set up its own subsidiary in Australia, to handle all Australian and Asia Pacific business. Existing distributor Mobex is to become a shareholder in the new subsidiary, which will be headed by Nigel Shepherd — recently president of Commodore in the USA.
- ***Austral Standard Cables,*** a division of Metal Manufacturers, has won the $6.2 million Telecom contract for stage 2 of the east-west optical fibre cable link between Perth and Port Augusta. ASC will be supplying 75% of the 1500km long 14-fibre single mode non metallic fibre optic cable. Two of the fibres will be carrying information for the Australian National Railways, the remaining 12 an estimated 50,000 simultaneous telephone connections and data for Telecom.
- ***E.S. Rubin Marine*** is now the Australian agent for Marconi's Oceanray satellite communication system, and also for "Francis" searchlights.
- ***Scalar Industries***, manufacture of a wide range of antennas for UHF, VHF, HF, marine and CB, has changed its name to Scalar Antennas.
- ***Anitech*** is now the exclusive Australian distributor for Keyence, Japanese maker of photoelectric sensors.
- ***Oliver J. Nilsen (Aust)*** has acquired the New Zealand test and measuring equipment company GTS Engineering, continuing the expansion begun earlier in the year with the acquisition of Datac Digital Systems.
- ***Solar '87,*** a conference to examine the use of renewable energy resources, will be held in Canberra at the Australian National University, from November 26-28 1987. Further information is available from John Balinger, School of Architecture, the University of NSW, PO Box 1, Kensington 2033.

Life-saving aviation device to be developed in SA

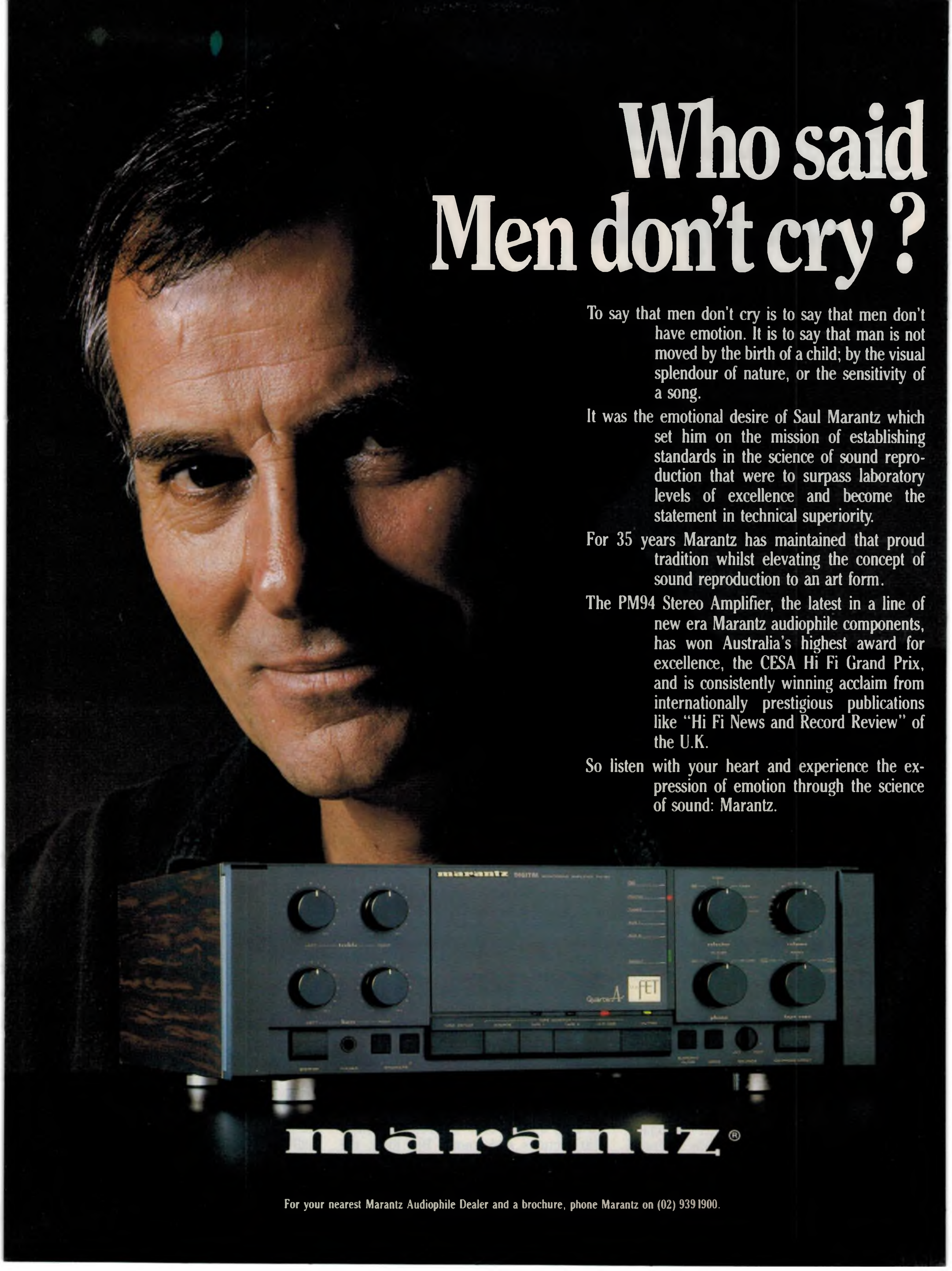
An aviation collision avoidance system with the potential to save many lives and earn a lot of export revenue will be developed in South Australia in a joint venture by Duntech International and the University of Adelaide. It will prevent mid-air collisions by allowing aircraft to detect each other, identify each other's courses and speeds and establish the risk of collision.

The increasing volume of aviation traffic worldwide makes the development of the system vital for aviation safety. In September 1986 a survey conducted by the 39,000 member Air Line Pilots' Association in the United States showed that "mid air collisions are the pilots' biggest concern."

Mr John Dunlavy, Managing Director of Duntech International and the inventor of the system, said it was anticipated that the air to air collision avoidance system would be flight tested within two years. "If successful, it will represent the only known system in the world affordable for both commercial and private aircraft."

The South Australian system is expected to cost between $5,000 and $10,000 compared to an expected $80,000 for a system being proposed by the US Federal Aviation Agency. "Furthermore, we believe our system is technologically superior to the American system," Mr Dunlavy said.

The development of the system by Duntech International and the University of Adelaide's Electrical and Electronic Engineering Department will take place under the National Teaching Company Scheme sponsored by the Department of Industy, Technology and Commerce.


Who said
Men don't cry ?
To say that men don't cry is to say that men don't have emotion. It is to say that man is not moved by the birth of a child; by the visual splendour of nature, or the sensitivity of a song.
It was the emotional desire of Saul Marantz which set him on the mission of establishing standards in the science of sound reproduction that were to surpass laboratory levels of excellence and become the statement in technical superiority.
For 35 years Marantz has maintained that proud tradition whilst elevating the concept of sound reproduction to an art form.
The PM94 Stereo Amplifier, the latest in a line of new era Marantz audiophile components, has won Australia's highest award for excellence, the CESA Hi Fi Grand Prix, and is consistently winning acclaim from internationally prestigious publications like "Hi Fi News and Record Review" of the U.K.
So listen with your heart and experience the expression of emotion through the science of sound: Marantz.
marantz®
For your nearest Marantz Audiophile Dealer and a brochure, phone Marantz on (02) 939 1900.

The Serviceman

A journey into unfamiliar territory

Like many doctors, the majority of electronics service technicians find themselves dealing with fairly familiar problems most of the time. But every so often, there are jobs that take you into areas where you really don't have much experience at all.

I'm sure that to the average consumer nowadays, one home appliance is much like another. They all tend to have knobs and switches on the front, and generally there's at least some electronics inside. So when they become faulty, where else would you seek help but from the local serviceman?

Of course this is not at all unreasonable, because often there isn't anywhere else to go apart from the service department run by the manufacturer or importer. And in the case of fairly exotic equipment, there may be only one such place in the country — so sending back a costly or bulky piece of equipment may well be impractical.

From the customer's point of view, taking it to the local serviceman is entirely logical. But for those of us on the other side of the counter, it can provide some real challenges.

In a lot of cases, you may never have seen one of these gadgets before, and quite possibly may never see one again. So before you can tackle the actual job of finding the fault, there's often a need to familiarise yourself with the equipment and how it works. This can make the job very time consuming, and consequently run up a sizeable bill for labour alone.

There's also the possibility that the equipment will contain some unusual components (perhaps not even electronic, but mechanical), which will not be part of your normal replacement stock. So you may have to order them in, even to try making a few substitutions. Not an entirely happy prospect, especially when Murphy's Law generally operates to ensure that the fault turns out to be somewhere else!

All in all then, for the serviceman this kind of job can turn out to be anything but straightforward. Yet when a customer fronts up with one, there's a natural desire to try and help out — despite the likely hassles.

Faulty projector

But enough preamble. The actual story which illustrates what I've been talking about concerns a home movie projector, and a fairly fancy one at that. It was a French make, a Beaulieu model 708EL super-8 sound machine. One of my old colleagues who was fairly keen on home movies before the coming of video tells me that at one stage (not all that long ago), it was regarded as pretty close to the "Rolls Royce" of such machines. It apparently sold for a lot of money — two or three times that of the more popular makes.

The story began when a chap rang up to ask if I did repairs on movie equipment. I was a bit light on for work at the time, and although I had the vague feeling that I might be letting myself in for something I might regret, I volunteered that I did so occasionally. In an effort to be helpful, I enquired as to the nature of the problem.

It turned out that he was a professional man, and had bought the projector overseas on a business trip. As a movie enthusiast he'd always wanted to own "the best", and it had been a good opportunity to pick one up at a good price.

Apparently it had operated perfectly up until a few weeks before, with excellent pictures and sound. But then, the customer explained, it started to play up and "mince the film" — losing its loops and ripping sprocket holes. But only when you were projecting sound films, he stressed; for silent projection it was still fine.

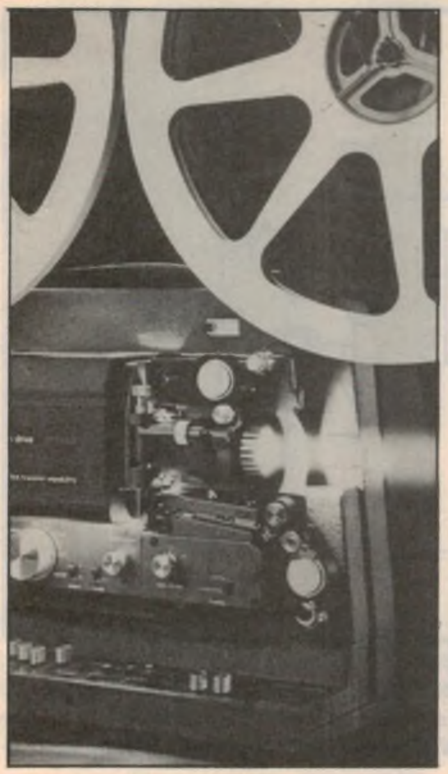
It sounded as if it could well be a mechanical problem rather than electronic, so I offered this as a possibility. Perhaps it would be better, I added, if he contacted the Australian distributor for Beaulieu. Presumably they would have a suitably equipped service department, with technicians more familiar with this equipment than I — plus a suitable stock of whatever special parts might be required.

But he was one jump ahead. He'd already found out that the distributor, Interdyn, was based in Melbourne. In order to have them look at it, he would need to pack it all up in a suitable box, well padded, and send it for hundreds of miles. As it had cost a lot of money and was a fairly delicate piece of equipment, he wasn't too keen on the prospect. Couldn't I have a look at it, and at least advise whether or not the problem was one that justified sending to Melbourne?

That didn't seem too unreasonable, so I agreed. Consequently a couple of days later, the said item was gingerly placed on my counter together with the driving manual and a reel of not-too-valuable film. I had explained to the customer that the last named of these would be necessary, because not tackling this kind of job very often, I had no test films on hand.

Needless to say the first thing I did was attempt to thread up the film and try it out. This should have been simple, because the machine was one of those fitted with automatic threading. You poke the end of the film in a slot, whereupon the projector grabs it and takes it around the various sprockets, through the picture gate, around the sound drum and out the other end ready to clip onto the takeup reel.

But here I struck the first snag, because when I tried it, the front of the film seemed to hit some obstacle just below the gate, and begin buckling out. After checking carefully that there was no obvious mechanical problem, I finally discovered that the leading end of the film had to be cut square but with chamfered corners, and even kinked



A close-up of the Beaulieu 708EL projector. The capstan, pinch wheel, sensing roller and lower sprocket described in this month's story are visible at lower right, below the lens.

over slightly. Then it would at least thread up correctly.

Next I tried turning the machine on for silent projection. As the customer had noted, everything seemed to operate normally. The picture was bright and steady, and the film loops seemed perfectly stable. No problems at all . . .

Graunching noises

Then I turned the main control knob to the last running position, for sound projection. Everything seemed OK for about 30 seconds, but then the film loop between the picture gate and the sound heads started shrinking and finally disappeared. In the few seconds before I could turn everything off the picture started jumping madly, the sound became badly distorted and there was the awful sound of film being graunched and its sprocket holes torn.

Obviously the customer was right — something was definitely wrong when the projector was set for sound projection. It was time to take off the back cover and look for some clues as to the cause.

The first thing I noticed when the cover came off was that instead of a single drive motor, as in most of the projectors I had seen before, there were two. The larger of the two was obviously driving the main picture projecting mechanism: the sprockets, shutter and intermittent "claw", plus the cooling fan for the lamp. This was of the modern quartz-halide type, complete with its own built-in mirror.

The other, much smaller motor appeared to be a DC type, which was arranged to drive the sound smoothing flywheel via a small rubber belt. The flywheel was on the end of a spindle, which on the other end formed what was effectively a capstan, just as in a tape recorder. There was even a very familiar looking pinch roller, to press the film against the capstan.

So far so good. By careful inspection with the power off, I discovered that when the projector was set for silent projection, the pinch roller did not press the film against the capstan. Aha — that must mean that in this mode of operation, the film was driven through the machine purely by the sprockets, from the main motor.

But when you switched the main control to the sound position, the pitch roller moved over to force the film against the capstan. So obviously this was where the second motor and sound flywheel came into the picture (sorry for the pun!).

Somehow the sound motor must normally be synchronised with the main motor, or vice-versa. Otherwise, the film would be trying to run at two different speeds, with all sorts of horrible effects rather like those we were actually getting. The question was, how were the two motors supposed to be locked to the same speed?

A bit of further investigation revealed that a film guide roller that was rigidly locked in position between the sound capstan and the final drive sprocket, for silent projection, became moveable in sound mode. It could swing in a small arc, against a tension spring, and was able to sense the length of film between the capstan and the sprocket.

By peering behind the sound flywheel inside the bowels of the machine, I could see a small strip of metal passing through a block. When I moved the film sensing roller back and forth through its arc, the strip slid to and fro inside the block. Since the block had a small terminal strip with six wires attached, leading back to the most visible PC board, it was evident that the metal strip and the block it passed through formed a sensor that was used to feed back the film loop size and control the speed of one of the motors.

This discovery prompted me to turn on the projector without any film, and switch the main control to the sound position. I then moved the sensing roller back and forth gently by hand, listening to see if I could hear or see any change in speed by either of the motors. There wasn't a skerrick.

Fairly obviously this was the real cause of the trouble. Without any ability to vary motor speed, there was no possibility of locking the two motors to run at the same speed. But what had gone wrong to stop this simple "servo mechanism" from working?

By this time I realised that it must be the main picture motor whose speed must be controlled, not the sound motor. Simple really, because if the sound motor were to be controlled the sound speed would be varying up and down either way to match the average picture motor speed, and you'd hear a most awful "wow" in the sound. So it must be the sound motor that stayed fixed as the reference, and the picture motor that was brought into lock with it. Normally, that is . . .

Circuit wanted

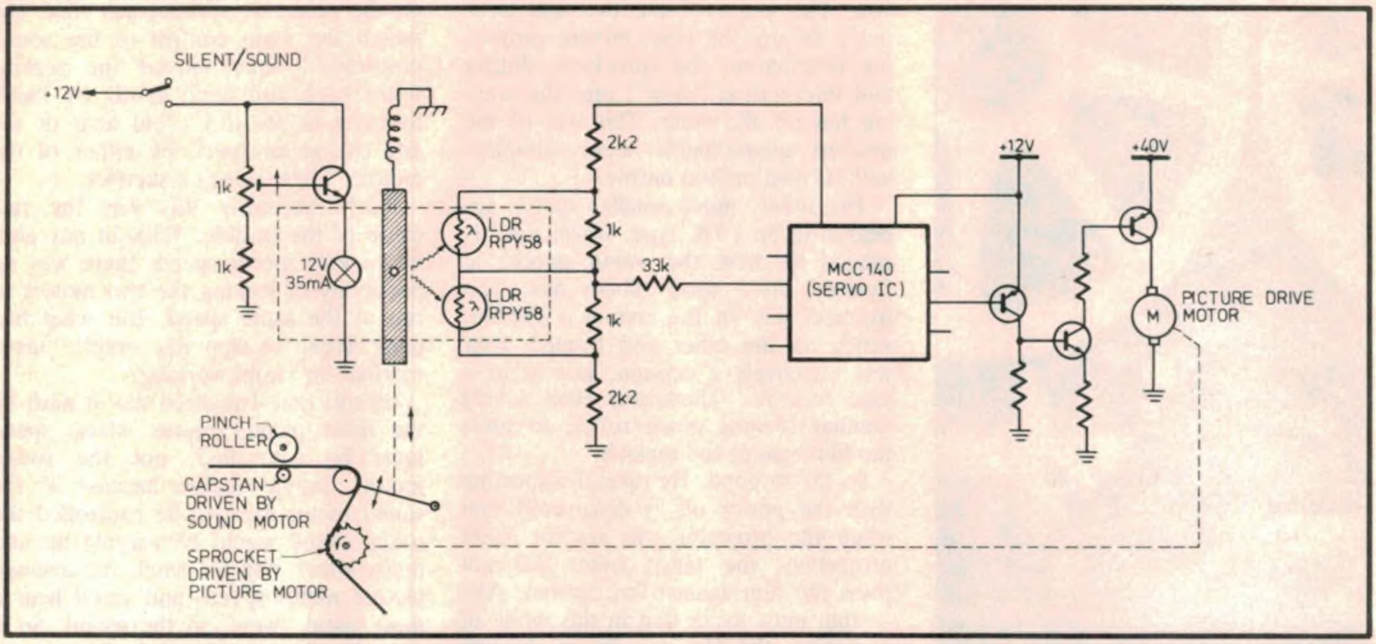
Unfortunately it was now also becoming clear that I was going to need a circuit schematic, and preferably at least a basic rundown on circuit operation, if I were to track down the fault without spending a huge amount of time. And by now I was pretty well "hooked" on the challenge of finding it — the idea of packing it all up and telling the customer to send it to Melbourne just wasn't on.

So the next thing was to ring up the Interdyn people in Melbourne, to see if they could provide any circuits or other service information. They could, it turned out, and would send them by priority mail. I left the projector with a dust cover over it on the end of the bench, and went on with a few other jobs that had turned up.

When the envelope turned up a couple of days later, it had some photocopies of circuits plus a description of the operation of the motor locking system and how it was normally adjusted. There were also a few suggestions as to the likely cause of the trouble, from the friendly Interdyn service guy.

It didn't take long to see that my initial deductions were on the right track (whew — haven't entirely lost the knack!). It was indeed the main picture motor whose speed was controlled in the sound projection mode, and the mysterious little block and sliding strip turned out to be a photo sensor.

The sliding metal strip had a central



Here is the basic idea of the motor locking system used in the Beaulieu 708EL projector. For sound projection, a capstan and pinch wheel driven by one motor pulls the film past the magnetic heads at a constant speed. To lock the picture motor to the same speed, a sensing roller is used to monitor the size of a film loop between the capstan and the final sprocket. A simple position sensor using two LDRs and a lamp, is used to drive a servo IC and control the speed of the picture drive motor — normally that is!

hole about 3mm diameter, and slid between a small filament lamp and a pair of light dependant resistors. These were arranged so that when the metal strip was in the mid position, they each received a small amount of light from the lamp. This corresponded to the correct "locked" position of the film sensing roller, with the film loop neither too big nor too small.

But when the film loop size varied up or down, the metal strip was pushed one way or the other, and one LDR received more light while the other got less. The circuit was obviously arranged to correct this by bringing about an opposing change in the speed of the picture drive motor. The service information even showed how to achieve the correct swing in motor speed, in response to swinging the sensor roller through its arc, by setting a pot which adjusted the brightness of the sensing lamp.

The screed also explained how to measure picture motor speed with a CRO, by taking advantage of a reed switch and magnet setup which was attached to the main drive shaft. This was apparently used for synchronising the projector with a tape recorder, when required.

Of course when I tried it all out again, following the approved procedure, I got the same results as before. You could swing the sensing roller back and forth through its full arc, and the speed of the picture motor didn't vary one iota.

Checking with the circuit showed that the two LDRs were connected into a resistive divider, and the divider point voltage was fed into one input of a rather unfamiliar looking IC with the designation "MCC140". This looked to be fairly complex, controlling not only the picture motor but the sound motor as well. It had inputs for signals from not only the LDRs and a set of pots for adjusting the various speeds, but from what appeared to be alternators built into each motor as well. Presumably these were for feedback and maintaining the correct speeds.

There's no point in worrying about the full circuit, as most of it didn't turn out to be relevant. The essential part from the point of this story is shown in the diagram.

The whole setup around the MCC140 was a bit daunting, and I didn't like to think about the possibility that the IC itself could be faulty. It looked a special purpose device, and there could well be a problem tracking down a replacement.

Still, there was no point in crossing bridges before I came to them. The first thing was to check if the optical sensing scheme was working. Who knows, it might be something simple, like a blown lamp. This would certainly be capable of causing the trouble.

But when I identified the leads to the lamp and gingerly disconnected them, a quick check with the multimeter showed that the lamp filament was intact. The emitter follower circuit feeding the lamp also checked out normally. So there was nothing amiss on the lamp side of the circuit.

The next thing was to look at the midpoint of the voltage divider, between the two LDRs, with the power on. There should be a variation in voltage when the film sensing roller was moved back and forth. Aha — nothing at all!

In fact the voltage stayed as steady as a rock, even on the LDR side of the 33kΩ resistor. This suggested that the problem was right at the LDRs themselves, not inside the input circuit of the IC. I started to breath a sigh of relief — but rather prematurely, as it happened.

Turning off the power again, I delved into the back again and lifted the leads from the LDR connections on the sensor block. A quick check with the meter showed that the resistors of the divider itself were OK. That left the LDRs themselves, but these were not easy to check buried as they were inside the block.

Strange LDRs

Still, by connecting some temporary leads and turning on the power again, I was able to determine that there was definitely something very strange about those LDRs. Moving the film sensing roller back and forth produced a modest change in resistance for one of them, but none whatever in the other. It was completely open circuit.

Even the one that did respond only came down to an "illuminated" resistance of about 15kΩ, which would hardly be capable of producing much voltage change with a parallel resistor of 1kΩ. Obviously they were both faulty.

So I had at last found the cause of the trouble, but I was not out of the woods yet, by a long chalk.

From the circuit I learned that the LDRs were type RPY58, apparently a miniature cadmium sulphide type made originally by Philips. But a quick check with Philips Elcoma revealed that this type had not been made for years. Nor was there any current replacement type available — apparently no-one uses LDRs much anymore.

What to do now? For a few minutes I gave thought to the prospect of re-designing the circuit, so it would accept some alternative components to the LDRs. One possibility was a pair of silicon photodiodes, driving junction FETs.

Then I suddenly remembered an old colleague, who had worked at Philips Elcoma for quite a few years earlier in his career. Perhaps he might be able to suggest where to try looking for a pair of the long-lost LDRs.

When I rang him, he did better than that. In fact, by sheer good luck he happened to have a small number of RPY58s, which he had bought some years ago for a project that fell flat. They were brand new and unused, and I could have them if they would help!

But before I could relax, he warned me they might not be much better than the two already in the projector. Apparently he had had quite a bit of experience with cadmium sulphide cells like the RPY58, and recalled that some of them seemed to suffer from a long-term "poisoning" or breakdown effect. It seemed quite likely that the two in the projector were in fact victims of this effect, and also entirely possible that the "brand new" units in his own junk box might have quietly succumbed to the same malady during the years since they were made.

Still, if I cared to pop over at a convenient time, he would be happy to dig them out and we could run the meter over them. Perhaps I might be lucky.

So it was that I called in at his place a couple of days later, multimeter in hand but without a great deal of optimism. After the inevitable greetings we sat down over a welcome cup of coffee and had a pleasant chat to catch up on what we'd both been doing since last we crossed paths. Then he produced the little stock of surviving RPY58s, and we began to check them out.

My spirits sank with the first we tried, which had an illuminated resistance even higher than 15kΩ. Obviously, it too had fallen prey to the same disease as the two in the projector.

But all was not lost. Among the others we found no less than three which seemed to have survived intact, with an illuminated resistance of well below 1kΩ. We were in luck! After offering my eternal thanks, I bid my old friend adieu and drove back to the workshop, the precious LDRs in an envelope.

Getting the faulty ones out and replacing them with two of the "new" ones turned out to be quite a job. To get at the sensor block in which they were mounted, I found I had to remove the sound drive motor carefully, along with the smoothing flywheel. Then when I did get access to the block and could remove it, I found that the old RPY58s were cemented into a shallow recess with some kind of epoxy. Removing them and cleaning out the recess ready to cement in the new parts took quite a while.

In fact the whole job took a surprising amount of time, but when it was all back together again it all paid off in terms of satisfaction. With the power on, moving the sensing roller back and forth now produced the expected healthy variation in the speed of the picture motor. Everything looked a lot better.

Just to make sure, I went through the speed adjustments as described in the Beaulieu service information. As expected, it all fell into place. Before long I was able to thread up the customer's film again, and project it together with excellent sound — with the motors obviously locking together nicely.

A happy owner

Needless to say, the owner was delighted that I had fixed his pride and joy. I decided not to charge him for all the time it had taken, because I felt that to a certain extent this had been the result of my own lack of experience with this kind of equipment.

As far as the LDRs were concerned, I simply charged him what I had offered my friend for them. Since it was unlikely that I would ever need the third one, I gave it to the customer with the suggestion that he put it in a safe place, just in case it might ever be needed. You never know, and if there was a next time they would probably be even harder to obtain than now.

As I said at the start, this kind of job can be quite a challenge for a "GP" serviceman like myself, because you're never likely to get enough experience with unusual equipment to be able to service them really efficiently.

Still, when a customer's in strife, you have to help out — even if you lose on the deal in terms of time and money. At least you end up with a grateful customer, who will hopefully call you next time their TV set plays up.

TETIA Fault of the Month

G.E. TC20T1 (Hitachi Pal3-A chassis)

Symptom: Low height, north/south pincushion distorton, no colour, 12 and 20V rails both low.

Cure: C753 (100μF 25 volt electro) open circuit. This is the main 20 volt rail filter cap, and its loss is seen in all parts of the set.

Educational video

Funway: first the books and kits, now a movie!

The Dick Smith Electronics "Funway" series of introductory kits has already helped large numbers of young people discover the fun and excitement of electronics, as both a hobby interest and a career. Now the company has produced a Funway Into Electronics video, to take the concept one stage further.

You've got to hand it to the people at Dick Smith Electronics. Most companies would have been fairly happy with something as successful as the Funway series, which has sold by the tens of thousands and helped beginners of all ages discover the excitement and satisfaction of electronics. But not DSE.

Explaining the story behind the new video, DSE's marketing manager Howard Needleman says that despite the success of the kits, his company still believed that they were not reaching their full potential.

"We realised that this wasn't likely to happen unless we used modern video communications technology, to attract the attention of young people and actually show them how interesting and enjoyable electronics can be", he added. "Nowadays, kids are very sophisticated, and they're bombarded daily with a lot of dynamic audio-visual material. You can't just show them a book and a kit, and expect them to suddenly get all excited and jump into electronics."

So the Funway Video concept was born. It's not meant to replace the existing Funway books or kits, but to precede and supplement them. It's basically a "sampler", designed to give you a quick overview of what the Funway books and kits cover, and how easy it is to use them as an enjoyable introduction to electronics.

Howard Needleman loaned me a copy of the video, and I was able to take it home and watch it a couple of times. I was most impressed.

A friendly young male presenter is used, and he begins the 19-minute show with a quick introduction to the various basic electronic components and their functions. He then leads the viewer gently and easily through the assembly and checkout of one of the simpler Funway kits, a soil moisture checker.

From here, he passes to a more elaborate kit, the beer-powered small radio receiver. As with the first kit, we see the circuit being put together, and the "big moment" when it begins working.

Finally, the presenter explains how various kits may be combined to produce more impressive circuits, and illustrates this by adding a two-transistor amplifier and speaker to the beer powered radio, to produce a more practical and satisfying radio.

All of this is done with good humour, and in a relaxed and informal fashion. There's no suggestion of a formal classroom approach, which would no doubt be an instant turnoff for many of today's kids.

The camerawork in the video leaves a little to be desired in odd places, with not quite as many closeups as one might wish and a few spots where the focussing might have been better. But on the whole, the subject matter and presentation more than make up for these slight rough edges.

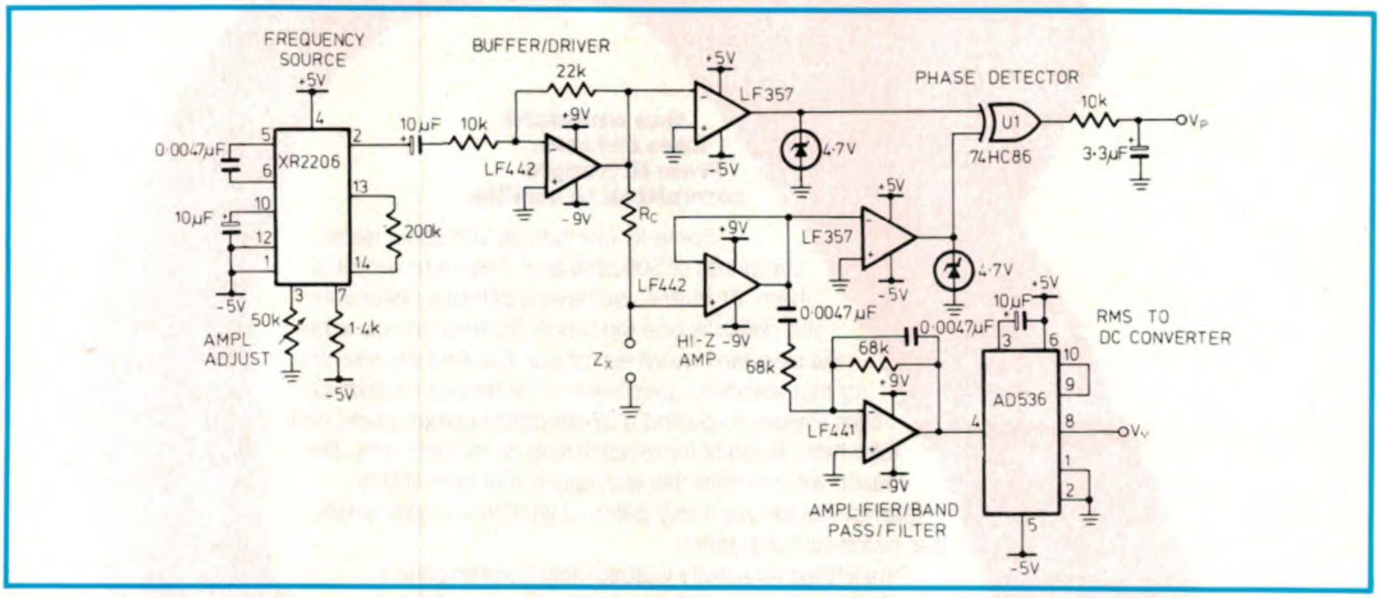
It's a very worthwhile production, and one that extends and enhances the original Funway concept. I feel sure it is likely to attract many more people — particularly young people — into the exciting world of electronics.

You'll be able to see the Funway Video in action at any Dick Smith Electronics store, by the time you read this story. Copies are also available for sale, at a very reasonable $19.95 each. I gather DSE is also offering a special pack of the Funway Video, the Funway Into Electronics No.1 Pack (book plus kits) for $39.95, but this is available through DSE's mail order department, not through the stores.

A good one DSE -- congratulations! (J.R.)

Circuit & Design Ideas

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



Complex impedance meter

No, not an impedance meter that's complex, but a meter to measure complex impedances.

Impedance meters are extremely useful test instruments. Despite this they are rarely seen, most likely due to their exuberant price tags. Likewise the need for measuring impedance is often seen as an unnecessary complication, and so is waived in favour of more familiar measurements.

By measuring impedance, both the resistance and reactance of a circuit can be determined. Similarly taking capacitance and inductance measurements is a breeze with an impedance meter.

This circuit calculates the impedance magnitude and argument (phase) of a circuit placed across the terminals Zx. The frequency of operation is 25kHz.

Impedance magnitude is calculated using a voltage divider network formed by the calibration resistor Rc and the unknown circuit element. Rc has not been assigned a value because its value depends on the range of impedances measured. A basic guideline is that Rc should be about 10 ohms. Values up to about 1M work well.

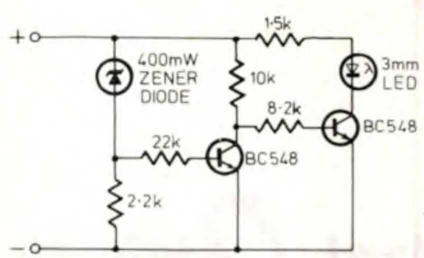
The phase circuit simply compares the phases of the signals before and after they have been passed across the circuit element. A basic rule here is

Phase Angle (degrees)
= (36 x Vp (volts)).

Calibration of the meter is performed simply using a few impedance elements (e.g., resistors and capacitors joined in series), to produce calibration graphs of impedance magnitude and impedance argument versus Vm and Vp respectively.

Andrew J. Stewart,
Pialba, Qld.

$20



Low battery indicator

This circuit will let the users of electronic equipment powered by zinc-carbon and similar cells know when the batteries are nearing the end of their useful life.

When the supply falls to within 0.8 volts of the voltage across the zener diode, the LED will light.

Using a 10 volt zener diode the LED will light when the supply voltage falls to 10.8 volts, which is suitable for use with a 12 volt battery supply. The current drawn rises from 2mA to 7mA when the LED lights.

For a 9 volt battery supply the zener diode could be 7.5 volts and the resistor in series with the LED could be reduced from 1.5k to 1.0k ohms.

Because zener diodes are not made to strict tolerances, it may be necessary to try several before the desired operating point is obtained.

Note also that because zeners do not have a sharp "knee" below 6 volts, this circuit is not very suitable for lower voltages.

This circuit can also be used to warn the user that Ni-Cad batteries require re-charging, but because they have a fairly flat discharge characteristic the working voltage of the zener diode becomes much more critical. A suitable re-charge point for Ni-Cad batteries would probably be 1.2 volts per cell or a little less.

If used with Ni-Cad batteries, the circuit may help reduce the risk of "reverse-charging" one or more of the cells, which can occur if the voltage is allowed to fall too low.

J. Emery,
Bullcreek, WA.

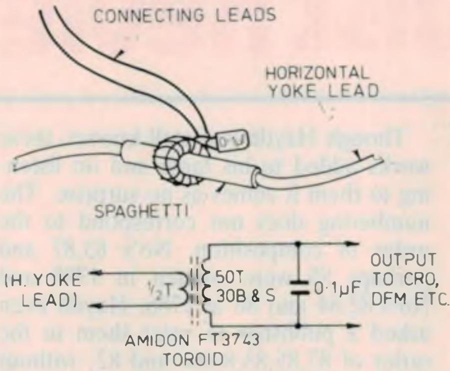
$10

El cheapo frequency reference

A cheap way of calibrating DMFs, with sufficient accuracy for most purposes is to use the 15625Hz line frequency of a TV set locked to say the local ABC channel.

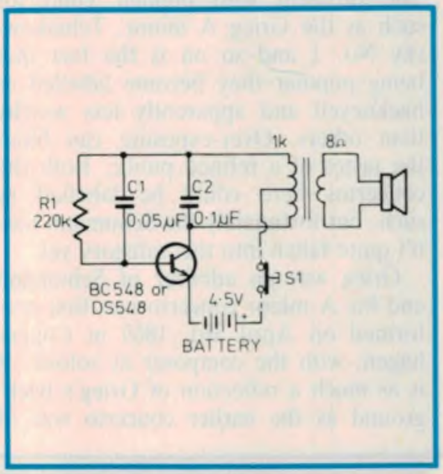
Construction is 50 turns of B&S of enamelled wire on an AFT3743 toroidal core, slipped over a 25mm piece of spaghetti. The 0.1μF capacitor and coil are fastened with silicone 780 sealant to the spaghetti. The capacitor pigtails are used to terminate the winding and the two connecting leads are also silasticed for support.

The assembly is slipped over one of the horizontal yoke leads, and the connecting leads passed through ventilation holes in the back of the TV set. This will give a known 15625Hz reference signal whenever the set is locked to a program.



Tim Wellstead,
Borden, WA. **$10**

Simple doorbell



Rather than paying the inflated prices for a commercial doorbell circuit, I decided to make up a simple one myself using this oscillator circuit.

The capacitor and resistor values can be changed to alter the sound it produces. I used a small pushbutton from Dick Smith Electronics, Cat. No.S-1102, but you could easily use an existing doorbell button, or even a reed switch if desired.

Total cost of the complete circuit was less than $10.

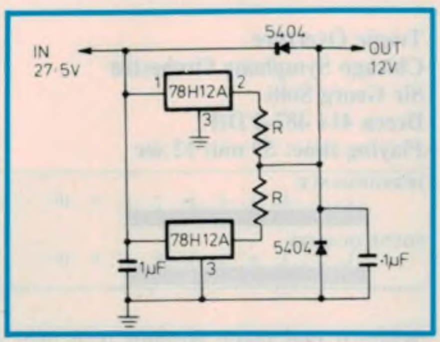
Ben Buxton,
Edgecliff, NSW. **$10**

24V/12V regulator

If efficiency is not too important, this simple arrangement can be used to operate 12V car equipment from a 24V truck electrical system. It will deliver up to 10 amps.

Basically two 78H12A three-terminal TO-3 power regulators are used, with resistors R to ensure that they share the load equally. The resistors were each made from a piece of toaster element 0.5 inches long. To the ends of these I crimped lengths of thick copper wire, to form pigtails for connecting into circuit.

Needless to say, the regulators need to be provided with good heatsinking — particularly if the circuit is to be used to deliver higher currents.



G.B. Wolfe,
Bombala, NSW. **$10**

Compact Disc Reviews

by RON COOPER

HAYDN SYMPHONIES 86 & 87

Academy of St. Martin-In-The-Fields
Neville Marriner
Philips 412 888-2
Playing time: 47 min 52 sec

PERFORMANCE
1 2 3 4 5 6 7 8 9 10

SOUND QUALITY
1 2 3 4 5 6 7 8 9 10

These two lesser-known works belong to a group known as the "Paris Symphonies" (No's 82-87) which were commissioned from Haydn by Claude-Francois-Marie Rigoley, Comte d'Orgny (1757-1790).

Though Haydn was well known, these works added to his fame and on listening to them it comes as no surprise. The numbering does not correspond to the order of composition. No's 83,87 and perhaps 85 were written in 1785 and No's 82,84 and 86 in 1786. Haydn even asked a publisher to print them in the order of 87,85,83,84,86 and 82, without success.

The two works on this disc have quite profound slow movements, the No. 86 being probably the greatest of the group, with excellent use of trumpet and tympani.

Here again, the Academy under Marriner is merely magnificent — very spirited playing which I feel makes these works just that little bit more exciting. This is the music the Academy are really renowned for and their brisk tempos capture your interest right from the first hearing, coupled as they are with an almost perfect mike balance from the un-named Philips recording team.

As with other recordings of the Academy, my usual comment is that they are not large-scale works and should therefore not be played too loud — the strings may sound a trifle edgy. This is front-row seat sound but only from a chamber orchestra, and a superb one at that. (R.L.C.)

GRIEG/SCHUMANN PIANO CONCERTOS

Piano Concerto in A minor (Grieg)
Piano Concerto in A minor (Schumann)
Stephen Bishop Kovacevich
BBC Symphony Orchestra
Sir Colin Davis
Philips 412 923-2
Playing time: 60 min 30 sec

PERFORMANCE
1 2 3 4 5 6 7 8 9 10

SOUND QUALITY
1 2 3 4 5 6 7 8 9 10

The problem with popular concertos such as the Grieg A minor, Tchaikowsky No. 1 and so on is the fact that being popular they become labelled as hackneyed and apparently less worthy than others. Over-exposure can blunt the tastes of a refined public. Both the concertos here could be labelled as such, but fortunately the Schumann hasn't quite fallen into this category yet.

Grieg was an admirer of Schumann and his A minor concerto was first performed on April 3rd, 1869 in Copenhagen, with the composer as soloist. It is as much a reflection of Grieg's background as the earlier concerto was of

BRAHMS SYMPHONY NO.2

Tragic Overture
Chicago Symphony Orchestra
Sir Georg Solti
Decca 414 487-2 DH
Playing time: 59 min 12 sec

PERFORMANCE
1 2 3 4 5 6 7 8 9 10

SOUND QUALITY
1 2 3 4 5 6 7 8 9 10

While it had taken Brahms well over a decade to compose his first symphony, possibly due to the thought of the mighty Beethoven looming over him, the second symphony was composed within the following year.

It was an immediate success and has gained wider appeal than the first. An influential critic of the period, Hanslick, wrote: "Seldom has there been such a cordial public expression of pleasure in a new composition. Brahms Symphony No.1 was a work for earnest connoisseurs capable of constant and micro-

Schumann's.

There are similarities between these works, mainly in the first movement. They both start with a short cadenza-like section for the soloist, after which the first subject appears, played initially by the winds and then by the soloist.

The performances here by Stephen Bishop-Kovacevich are excellent indeed and leave little room for comment, other than to say they are "traditional" versions (read that how you like!).

The analogue recording is slightly dated, but still very good, even though it has a rather wide left-right effect and a slightly higher background hiss. However, with CD's such as this, it is easy to play the music louder than it would normally be heard in a concert hall, so increasing the awareness of background hiss. Overall, this is first rate music with almost first rate sound. (R.L.C.)

scopic pursuit of its minutely ramified excursions; the Symphony No.2 extends its warm sunshine to connoisseurs and laymen alike".

Like the first symphony, this work is one of great feeling, particularly the 3rd and 4th movements, which appear to have a paradoxical air of complicated simplicity about them.

The Tragic Overture was first performed some four years after the second symphony and, I feel, shows Brahms in a somewhat different vein but still retaining his great orchestral skill.

Solti's handling of these works leaves little to be desired and almost defies comment. The overall balance is very good, with a very slight edginess to the strings and some minor background hiss, but on first-rate playback equipment the overall effect is verging on excellent — maybe just a little too much reverb. (R.L.C.)

MOZART PIANO SONATAS

Andras Schiff
Piano Sonata in A major, K331/300i
Piano Sonata in A minor, K310/300d
Piano Sonata in D major, K576
Decca 417 571-2 DH
Playing time: 54 min 26 sec

PERFORMANCE
1 2 3 4 5 6 7 8 9 10

SOUND QUALITY
1 2 3 4 5 6 7 8 9 10

Of the three sonatas on this disc the earliest is the A minor K310/300d, composed in 1778 in Paris. Apart from that, little is known about it. Mozart was in Paris for six months and the early good intentions of this stay culminated in grief at the death of his mother. The "Paris" symphony and this sonata, his first keyboard work in a minor key, were the most substantial compositions of this stay.

The beginning of the disc shows Mozart's genius, in the quiet, masterly K331 composition. The third movement, often performed as a separate piece, is familiar to all — the rondo "Alla Turca". Played here by Andras Schiff, it is excellent.

The first movement of the D major K576 shows influences of Haydn by being somewhat dominated by the opening theme. Elsewhere there are influences of the great Bach.

The performance on this disc is exhilarating. It shows a strong sense of purpose without any hesitancy, yet a sensitivity also seems to prevail. Soundwise, the recording is quite live and there is a constant faint background hiss, due, I gather to the original analogue recording, but as this is a quietly even noise, it does not really intrude. A very worthwhile disc. (R.L.C.)

Books & Literature

Home Video Guide

VIDEO ACTIVE: An Easy Guide to Home Video Making, by Geoff Elliott. Published by BBC Books, London 1987. Soft covers, 199 x 124mm, 168 pages. Illustrated with diagrams and sketches. ISBN 0 563 21314 0. Recommended retail price $14.95.

A very down to earth and friendly little book, this one. it was apparently written to accompany a series of TV programs with the same title, produced by BBC-TV and broadcast in the UK earlier this year.

Essentially it's a primer on making home video movies, using either a camera and VCR combination or one of the newer "camcorder" combined units. And although it is fairly clearly meant to be augmented by demos and other supplementary information provided in the TV programs, it's so well done that it can easily stand on its own feet.

It's divided into two main sections. The first covers choosing a camcorder or camera/VCR combination, how to set them up and basic operating techniques. It also provides a chapter on ideas for video movie projects, for those who need a few pointers to head them in the right direction.

Part 2 then deals with topics of interest once you've mastered the basics: things like adding accessories and other equipment (such as lights, titlers, editing gear etc.), creative production techniques, and ideas for more advanced video movie projects.

The emphasis throughout is on practical operation, rather than a lot of technical theory, and it's written in a concise, easy to read style.

If you're looking for a good no-nonsense guide to getting into video movie-making, either from scratch or as a transition from traditional home movies on film, it would make a good choice — particularly in view of the attractive price.

The review copy came from Heinemann Publishers Australia, the local distributors for BBC Books, but copies should be available from most bookstores by the time you read this. (J.R.)

An entrepreneur examined

SINCLAIR AND THE 'SUNRISE' TECHNOLOGY, or The Deconstruction of a Myth, by Ian Adamson and Richard Kennedy. Penguin Books, 1986. Soft covers, 199 x 130mm, 263 pages. ISBN 0 14 008774 5. Recommended retail price $12.95.

I first heard about this book from Dick Smith, who was apparently sent an advance copy by one of his friends in England. Dick found it fascinating, because apart from anything else he met Sir Clive Sinclair a number of times and did business with him (or tried) for years. As soon as Dick read it he rang up, saying "You'll have to get hold of a copy of this new book as soon as it's released here — it's incredible!".

Thanks to the Penguin people, I now know why Dick was so enthusiastic. It certainly makes intriguing reading, for anyone who has ever heard of Sir Clive and his career as entrepreneur, visionary boffin and self-styled saviour of the British electronics industry. If you've ever bought any of the Sinclair products, or checked them out (as I have), you'll find it irresistible.

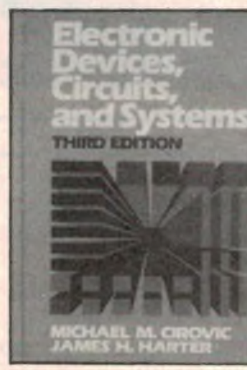
It really is a splendid study of a complex man, undoubtedly gifted and with enormous energy — but with almost equally serious shortcomings. A man of vision who can grasp new technology and use it to build new enterprises, but who also tends to destroy both vision and enterprise through mistrust, self deception and amazing mismanagement.

The book indeed makes fascinating reading, tracing through the ups and downs of 'Uncle Clive' and his companies right from the very early days of amplifier and watch kits, through the ZX80 and ZX81 computers to the C5 electric trike and beyond. For me there's also a few parallels there, with would-be Australian entrepreneurs I've come across recently (no, not Dick!).

The review copy came direct from Penguin Books Australia, but it's now available at major bookstores. (J.R.)

Semiconductor circuits

ELECTRONIC DEVICES, CIRCUITS AND SYSTEMS, by Michael M. Cirovic and James H. Harter. Third Edition, published by Prentice-Hall Inc., New Jersey 1987. Hard covers, 243 x 184mm, 444 pages, with many diagrams and circuits. ISBN 0 13 250655 6. Recommended retail price $83.50.



This is the third edition of a textbook that is now something of a classic, first published in 1974 and then in 1979 under the title Basic Electronics. For the third edition it has been extensively revised and updated, to include material on new linear ICs, power MOSFETs, fibre optic devices, IC thyristor devices and other recently developed devices.

As the title itself suggests, it is divided into three main sections dealing in turn with the various semiconductor devices themselves, the main kinds of basic electronic circuit employing them.

Continued on page 125

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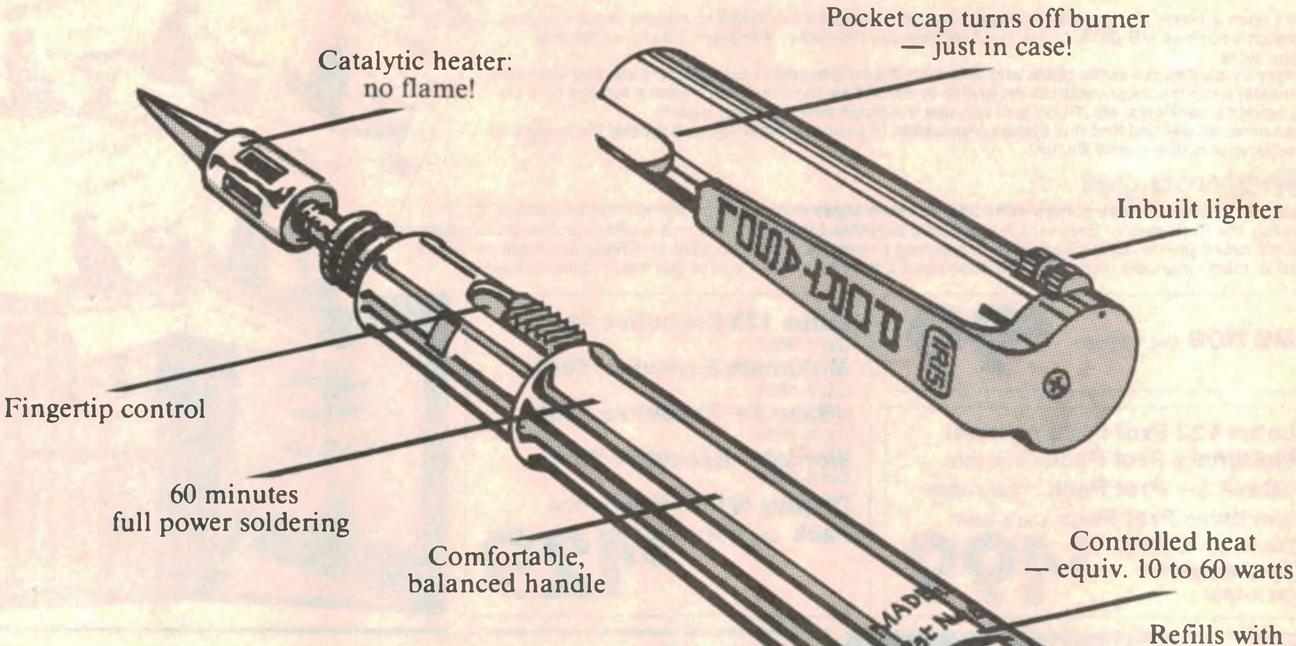

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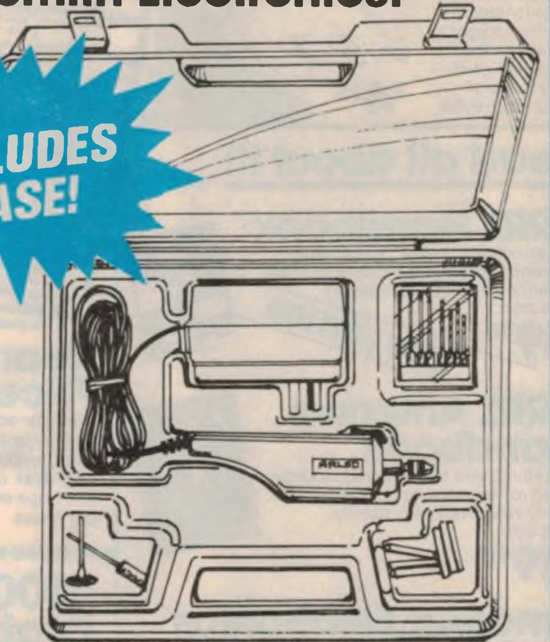

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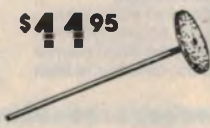

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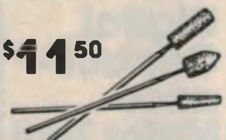

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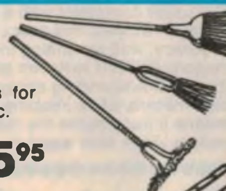

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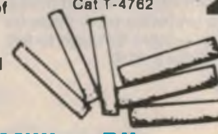

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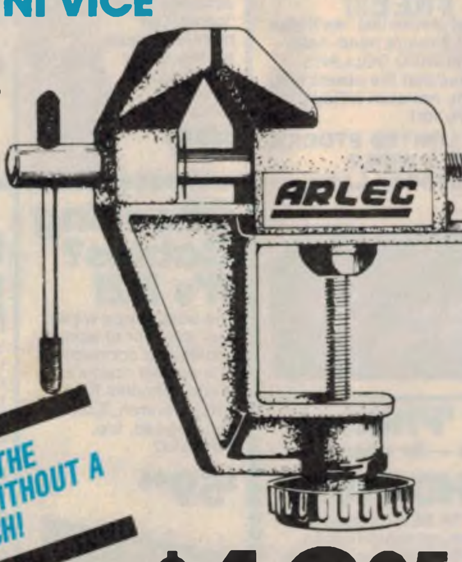

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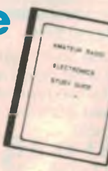

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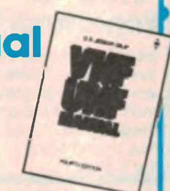

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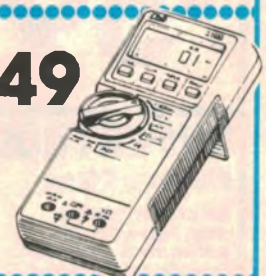

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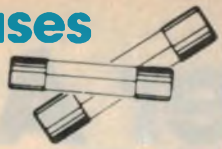

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3A	S-4469
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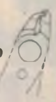

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No matter what your project, there's a DSE box just right for it. Professional finish, made to last. Here are just two styles from our large range:

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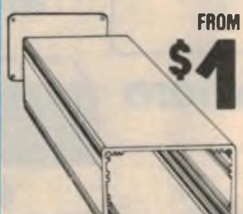

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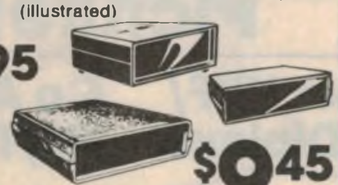

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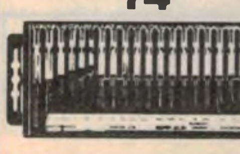

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DSE2155. Primary: 240V, 50Hz. Secondary voltage: 6.3, 7.5, 8.5, 9.5, 12 & 15V. Secondary current: 1 amp. Terminations: Flying leads. Cat M-2155
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DSE6672. Primary: 240V AC. Tapped: 15, 17.5, 20, 24. Secondary voltages: 27.5 & 30V. Secondary current: 1amp. Terminations: Solder lugs. Cat M-6672
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DSE2000. Primary: 240V AC. Secondary: 18 volts @ 6A. Terminations: Flying leads. Cat M-2000
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DSE0144. Primary: 240V AC. Secondary: 28-0-28V. Secondary current: 2A. Cat M-0144 **$29.50**

DSE0153. Primary: 240V AC. Secondary voltage: 35-0-35V. Secondary current: 2.5A. Cat M-0153 **$29.50**

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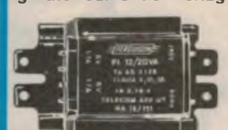

2 x 6V@1.7A	M-3596
2 x 7.5V@1.3A	M-3597
2 x 9V@1.1A	M-3598
2 x 12V@.85A	M-3599
2 x 15V@.69A	M-3600
2 x 20V@.51A	M-3601

ALL ONE PRICE! **$24.75** EACH

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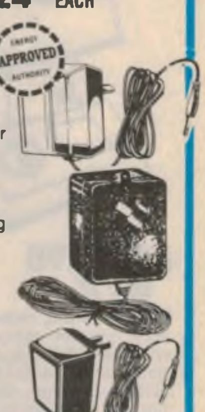

Plug packs make great sense. The bulky transformer is left on the power point while the whole of the case can be devoted to the circuitry! And your choice of AC or DC output - depending on application.

12V AC at 500mA Cat M-9555 **$19.95**

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Telecom Authorised

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It's a full function push-button phone AND answering machine. Takes up less space, doesn't need two phone sockets or double adaptors, yet gives all the features of both. Single tape unit uses standard audio cassettes, and you only need record your outgoing message once. Retrieve messages left from any phone — anywhere. Cat F-6140

Call Forwarding 2 Tape Answering Machine

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You won't believe that an answering machine could offer so much — at such a low price. But then it's much, much more than an answering machine. Look at the incredible features this state-of-the-art machine has to offer:

- Call forwarding
- Emergency message sending
- Security coded
- "Memo" function
- Answer delay
- Total remote control

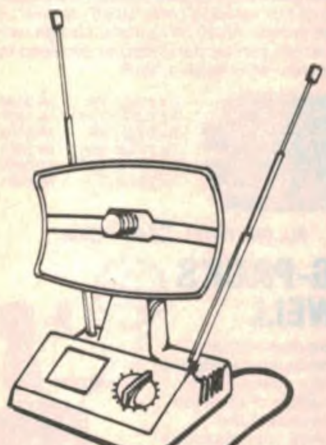
Plus all the "usual" answering machine features. Cat F-6145

16 Memory Hands-free Loudspeaking Phone

$179

The ideal office companion — even at home! It's the perfect telephone for busy people. Features 16 single touch memories so those important calls are always at your finger tips. Loudspeaking mode allows you to make or answer calls without interrupting your work. Features include adjustable speaker volume, mute switch, 16 single touch memories, handsfree operation, Hookflash for PABX use, adjustable ringer level, Tone/Pulse switchable, battery backup facility, desk or wall mountable and more! Cat F-5136

Deluxe 3 Band Indoor



$29.95

Ideal for strong reception areas, you'll save heaps on complex outside systems with this quality UHF, FM, VHF indoor antenna. Colour, black and white and stereo, nothing's a worry for this one. Installed in seconds for the perfect picture. Cat L-4005

Get A Clear Picture!!

Indoor UHF/ VHF Diplexer

$9.95

Many TV sets and videos have only one antenna input: tough luck if you're running VHF and UHF antennas! Now there's a solutions — the Diplexer. Accepts lead-ins (75 ohm) from both antennas and combines them without the normal losses associated with couplers used at UHF. Then you can run one lead-in to the TV/Video. Cat L-4470

Go Anywhere FM/TV

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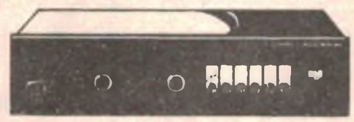
Here's a go anywhere TV/FM antenna that's small enough to be packed up and put in the camper or van. It even comes with a special 'gutter gripper' bracket for caravan use, plus a mini mast and 7 metres of 300 ohm ribbon. Single folded dipole for maximum performance over wide frequency range, suits horizontal or vertical mounting. Cat L-4026

Even from your old set you can now get... Stereo TV!



$199

Your old telly can have the best qualities of the modern ones — without spending a thousand dollars or more on a new model! You can have full stereo sound from your existing set. Just plug in the DSE Stereo Sound Receiver and quality stereo is at your fingertips (and buzzing around the room as well). You can put it through your existing stereo amplifier and speakers for true hi-fi and the 6 preset stations make tuning a breeze. Its handsome design and compact size mean it'll be at home anywhere. 6 preset stations, video and audio output with termianls, mono/stereo mode selection, LED stereo indicator and more! Yes, it's fully compatible with Australian "two carrier" TV system. Comes complete with adaptor plug and connecting leads. Cat L-4905

Metal Line Plug

Cat L-4508

$1.20 10 up 85¢

Metal Line Socket

Cat L-4509

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Because you're technical...

Install your own alarm system or second phone, etc, and save a fortune. Put your technical knowledge to work for you instead of someone else!

Control 444444444...!

The Affordable Professional System

The latest in electronic technology and concept, versatile enough for commercial use yet affordable for home use. The Control 4 is a complete 4 sector alarm panel with panic or emergency sector, with provision for a wide range of options which can turn it into a formidable and secure alarm package. Advanced features include adjustable entry, exit and alarm times, 4 inputs PLUS 2 end of line, allows connection to remote keyswitch or codepads for added security, monitors both mains power and standby battery against failure, emergency/panic button, allows silent access for authorised people, allows 24 hour circuits to be monitored (fire, medical, hold-up, freezers, etc), provision for 'At Home' Entry Guard feature, provision for dialler and just about every feature you're likely to ever want! Comes complete with DC adaptor. With Control 4 — you won't need any more! Cat L-5106

$299

Alarm Phone Dialler

Your home alarm can 'phone' you at work, phone a relative or friend to alert them. Telecom authorised, dial two numbers. Suitable for most alarm types. Cat L-5130

$249

Passive infrared detector

Wide angle protection of rooms, hallways, etc. Adjustable swivel head for precise line of detection. Convenient wall or ceiling mounting. Cat L-5009

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Help eliminate accidentally setting off the alarm! The CP1 remote keyswitch can be mounted out of the surveillance field of your alarm sensors (eg. in the garage, garden, verandah) so you can arm and disarm your system remotely. With tamper switch and three LED status report. Cat L-5104

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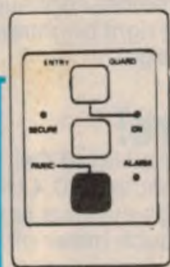
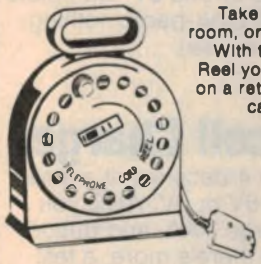


Entry Guard

Designed for use in conjunction with the Control 4 security system Entry Guard allows you to use your alarm while you're at home. It allows you to monitor one or more sectors of the house (say the perimeter sensors) while others are ignored. Incorporates 24 hour panic button for emergency use. You can even activate an optional plug-in dialler! Cat L-5107

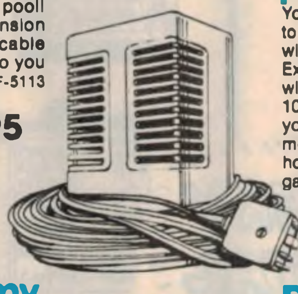
$79.95

15 metre Phone Extension!



Take the phone from room to room, or out to the patio or pool! With the Telephone Extension Reel you get 15 metres of cable on a retractable spool — so you can keep it tidy! Cat F-5113

$18.95



Is that the phone??

You won't have to strain to hear the phone ring with the Telephone Extension Bell. Comes with socket adaptor and 10 metres of lead. All you do is plug it in and move it anywhere in the house, workshop or garden, etc. Cat F-5119

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Hands-Free Telephone with Clock Radio!

Perfect for the bedside table! Alarm Clock Radio with all the features PLUS push-button Telephone with hands-free capability. Sure makes those early morning (or late night) calls easy! Cat F-5109

$65

Economy Phone!

The economical way to a second phone or replace that clumsy old thing with a modern push button model. Features automatic last number redial, mute switch and ringer On/Off! Cat F-5185

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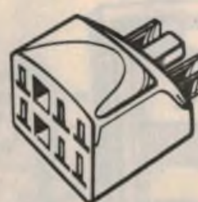

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Get away with it! Connect two phones or a phone and an answering machine without disconnecting and reconnecting. Cat F-5112

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DSE's phone plugs — identical to Telecom type 605 — as used in all phones, etc. Cat L-5117

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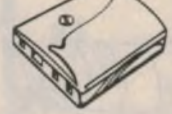

Our 610 phone sockets are designed to Telecom standard... and DSE's versatility. Cat F-5118

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Extra Heavy Duty NiCads

Type	Cat No.	Price
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D 4.0Ah	S-3310	$14.50
Sub C Fast Charge	S-3324	$6.50

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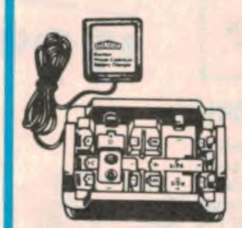

Eveready NiCad Charger

Multi-size (AA, C, D or 9V) NiCad battery charger. Takes two 1.2V cells at a time or one 9V. Complete unit including plug-pack: nothing extra to buy. Cat M-9515

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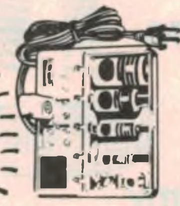
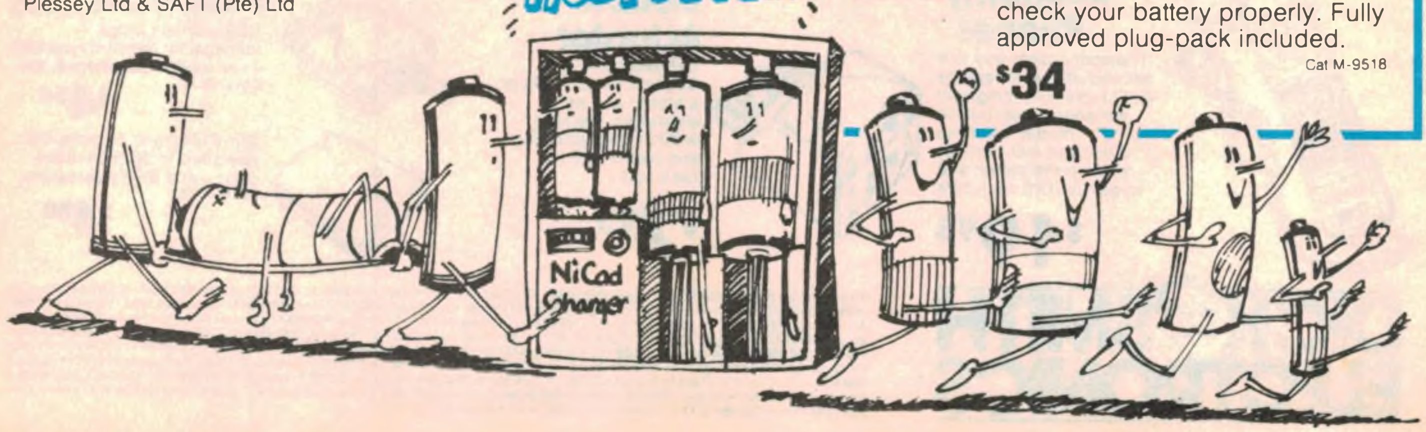


Multi-cell Charger

Charge up to 4 batteries at a time — AA, C, D, 6V or 9V. AND you can also charge AAA, and button cells too! But there's more: a test meter to check NiCad voltage under load — the only way to check your battery properly. Fully approved plug-pack included. Cat M-9518

$34



Build this low-cost wireless guitar link

You don't have to run long leads between your guitar and the amplifier or mixer unit. This professional quality FM wireless transmitter plugs into your instrument and transmits the signal to the amplifier via an FM receiver.

by BRANCO JUSTIC

The FM wireless transmitter published in the September 1986 issue was described simply as a printed circuit board with optional microphone preamplifier. We left it to the readers to house it in a box to suit their particular application.

Since then, many readers have asked us to publish the full details on this circuit, showing how the module could be housed in a suitable case complete with battery, on/off switch and input socket.

As described, the original transmitter has sufficient sensitivity for line level inputs such as from a guitar and various other electronic musical instruments. The sensitivity level is set by means of a trimpot (VR1) at the input. The optional microphone preamplifier is unnecessary in this application and can be deleted from the circuit.

A plastic case measuring 120 x 65 x 40mm houses the transmitter and 9V battery for the power supply. At one end of the case is a 6.5mm panel socket for the signal input and an on/off power switch. The 600mm antenna wire for the module is fed through a hole drilled in the opposite end of the case.

A clip can be attached to the case lid to allow the unit to be attached to a trouser belt.

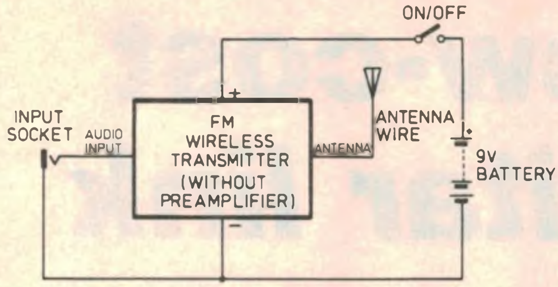
The circuit diagram (Fig.1) is very simple, and involves just a few external connections to the FM wireless transmitter PCB. These are for the audio input socket, the antenna and the power supply connections. The 9V battery supply is switched using a SPDT toggle switch (S1).

Construction

The transmitter uses the FM wireless transmitter module described in September 1986. This should be constructed as described in the article but, as noted above, the optional microphone preamplifier stage (Q6, Q7) is deleted.

In fact, the preamplifier section of the PCB should be separated from the rest of the PCB so that the completed module will fit in the recommended case.

Once the module has been completed, drill the necessary holes in the case to accommodate the on/off switch, audio socket and antenna lead. Fig.2 shows the details. The belt clip is secured to the lid of the case using a screw and nut. Follow the wiring diagram when wiring up the connections to the transmitter module. It is not necessary to use screened cable between the socket and PCB because of the short distance involved. The antenna lead should be about 600mm long and can be made by trimming one end of



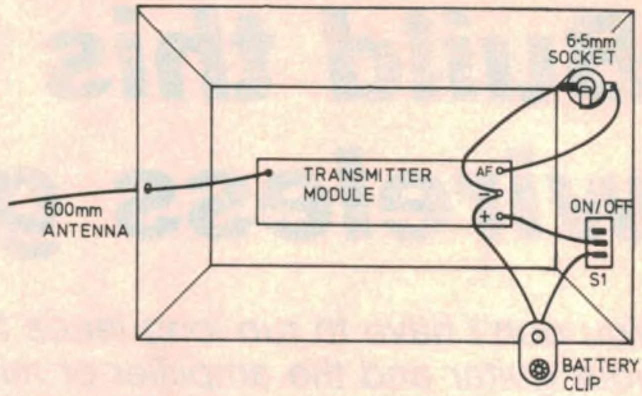
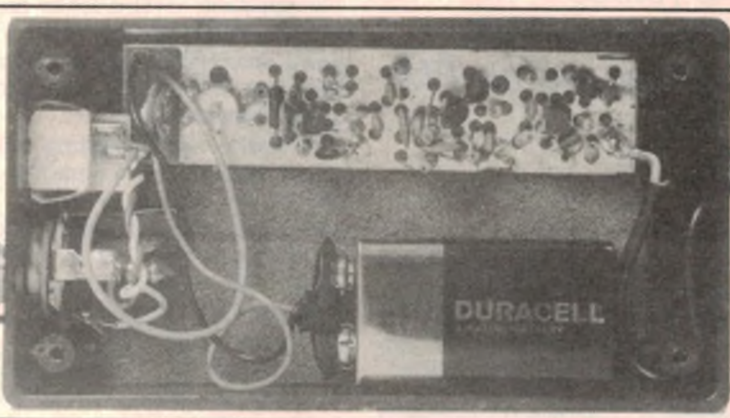


Fig.1 (above): the schematic, and Fig.2: the wiring diagram of the wireless guitar link, which is based on the FM wireless transmitter of September 1986.



Inside the box. There's not a great deal involved, apart from the transmitter module.

the 2-metre coax cable supplied with the kit. It can be hooked around one of the support pillars in the case to provide strain relief.

Note that the inside and outside conductors of the antenna lead should be soldered together at the transmitter module.

The PCB and battery are secured in the case using several pieces of foam rubber. Make sure that the battery cannot move and short out any of the connections before screwing the lid down.

Finally, an FM Walkman-style receiver makes an ideal companion unit to the Musolink. We showed you how to connect such a receiver to your amplifier in the October 1986 edition.

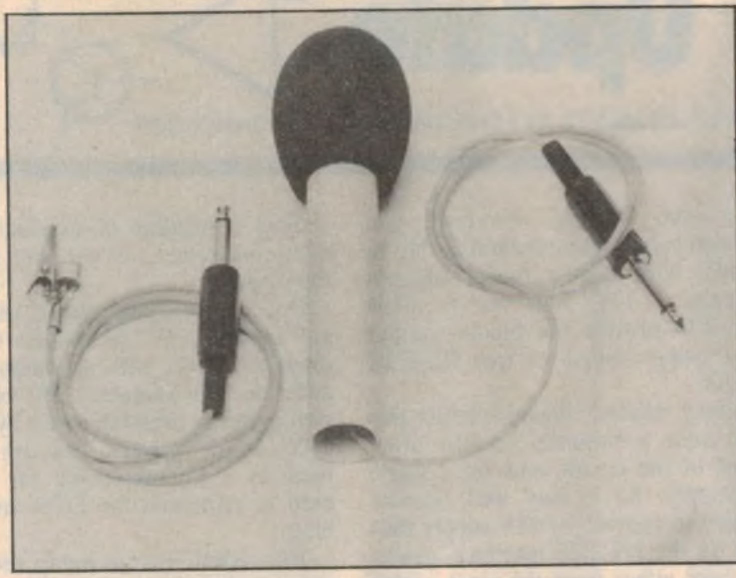
PARTS LIST

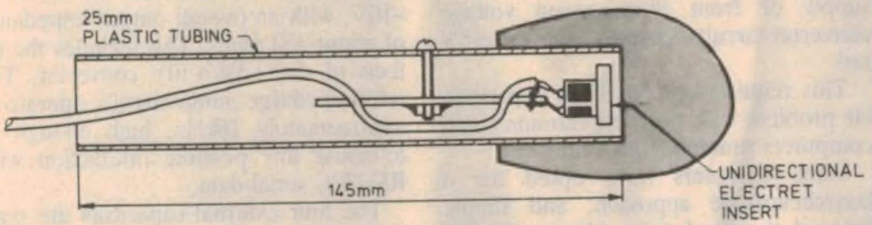
- 1 FM wireless transmitter (September 1986)
- 1 plastic case, 120 x 65 x 40mm
- 1 SPST rocker switch
- 1 6.5mm panel mounting mono socket
- 1 moulded plug with 2-metre coax lead
- 1 6.35mm jack plug
- 1 belt clip

Miscellaneous

Screw, nut, foam plastic, hookup wire, solder etc.

Note: a complete kit of parts for the Musolink is available for $23.90 (incl. p&p) from Oatley Electronics, 5 Lansdowne Parade, Oatley, NSW 2223. Phone (02) 579 4985. Send mail orders to PO Box 89, Oatley, NSW 2223.





Adding a microphone to your musolink

Many readers who have made the FM transmitter module (EA Sept. 1986) have asked how to connect an electret microphone to the unit. Here we describe how this can be done easily. We also show two different microphone assemblies which can be added to the original transmitter or the musolink transmitter.

The two units shown here are:

1. A clip-on omnidirectional microphone.
2. A hand-held unidirectional microphone.

As one reader pointed out (EA May 1987), the microphone is especially useful as an aid for people with hearing difficulties. The transmitted signal can be picked up by an inexpensive "walkman" type of receiver. The required microphone can be assembled on an alligator clip so that the unit can be easily attached near the sound source.

The alternative hand held microphone was assembled into a short length of 25mm plastic tubing. The microphone was supported by soldering its negative terminal to a small piece of unetched single sided printed circuit board. Two holes drilled on the PCB were used as a means of clamping the cable whilst a nut which was soldered to the PCB attaches it to the plastic tube by means of a single screw.

Depending on your application you may choose from the omnidirectional insert or the unidirectional insert. For a description of the two inserts refer to a project called "The Microphone" which was featured in the November 1986 issue of EA.

The construction of the microphones should be self explanatory from the accompanying photographs. They are mainly intended to give some ideas on inexpensive materials which can be effectively used. However to accommodate for the necessary combination of an AC signal and a DC supply on the one lead ("phantom power supply") a resistor and a capacitor have to be added to the transmitter circuit.

We have used the unidirectional insert in the hand held microphone shown.

The various bits and pieces used in the microphone are available from Oatley Electronics. ⒺⒶ

Solid State Update

KEEPING YOU INFORMED ON THE LATEST DEVELOPMENTS IN SEMICONDUCTOR TECHNOLOGY

Introduction

Hi! This is the first appearance of a new regular column, designed to keep you up to date on the latest developments in semiconductor technology. Each month we're going to discuss interesting new ICs or discrete components, new ways to use semiconductor devices, or new developments in the manufacture of these devices. Anything timely and to do with semiconductors and solid state electronics, in other words.

New chip simplifies RS-232 interfacing

In the spotlight this month we have a chip designed to take a lot of the hassle out of providing interface circuits for RS-232C serial communications ports in computers, modems, terminals, instruments or whatever. It's the MAX232 from Maxim Integrated Products, a dual RS-232C receiver/transmitter.

What's so new about an RS-232 receiver/transmitter? After all, RS-232 receiver and transmitter chips have been around for quite a while — chips like the trusty MS1488 and MC1488, and their clones.

The catch is that up until now, in order to use these existing chips to provide a true RS-232C interface, you needed to supply the transmitter chip in particular with bipolar power supplies — usually +/-12V. This was to allow the chip to provide the bipolar output voltage swing needed for true RS-232C operation.

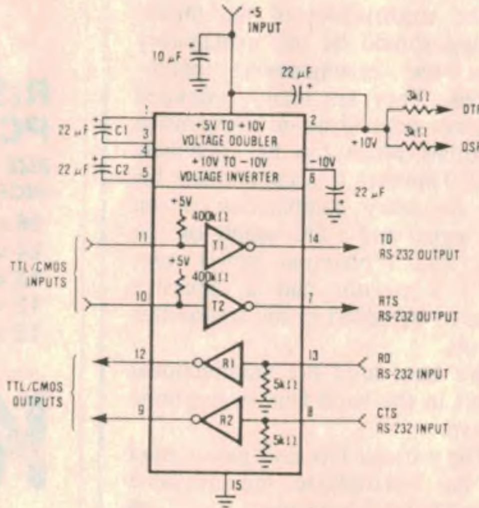
In many modern digital circuits this can be quite a nuisance, because often the rest of the circuit runs on a single +5V supply. So it may well become necessary to provide +/-12V supply rails purely for the RS-232C interface, generating them either from the main power supply or from charge-pump voltage converter circuits running from the +5V rail.

This requirement has been a particular problem with portable terminals and computers running from batteries.

Some designers have opted for a lazy/cheapskate approach, and simply ignored the need for a bipolar RS-232 output. But this produces a circuit that is non-standard, and often won't work reliably with other nominally standard RS-232C equipment.

The new MAX232 chip solves all of these hassles, providing true bipolar output signals which meet all of the RS-232C specs. Yet the chip runs from a single +5V supply, generating the necessary bipolar voltages (+/-10V) itself via a pair of on-chip charge pump converters.

How the MAX232 chip is used in a typical communications interface. It provides two RS-232C receivers and two transmitters with true bipolar outputs — but works from a single +5V supply.



Only a handful of external components is needed, as you can see from the diagram.

One charge pump circuit uses external capacitor C1 to double the +5V input to +10V, with an output impedance of approximately 200 ohms. As well as being used internally by the RS-232C output drivers, this can also be used as a pullup supply for resistors used to terminate the DTR and DSRS lines.

The second charge pump uses external capacitor C2 to invert the +10V to –10V, with an overall output impedance of about 450 ohms. This includes the effects of the +5V/+10V converter. The internal charge pump circuits operate at approximately 16kHz, high enough to minimise any possible interaction with RS-232C serial data.

The four external capacitors are typically 22uF as shown, but their values are not critical. They can be low cost aluminium electrolytics, or tantalums if size is critical. Increasing the value of C1 and C2 to 47uF will lower the output impedance of the +10V output by about 5 ohms, and that of the –10V output by about 10 ohms. Increasing the value of C3 and C4 lowers the 16kHz ripple on the RS-232C outputs.

In systems where size is critical, all four capacitors can be reduced in value to 1uF, at the expense of an additional 20 ohms impedance in the +10V output and 40 ohms in the –10V output. The 16kHz ripple on the –10V output also rises to 250mV.

Each of the two RS-232C transmitter drivers on the MAX232 is a CMOS inverter powered by the +/-10V internally generated supplies. The inputs are TTL and CMOS compatible, with a logic threshold of about 26% of Vcc (1.3V for a 5V rail). The input of an unused transmitter section can be left unconnected: an internal 400k pullup resistor connected between the transmitter input and Vcc will pull the input high, forcing the unused transmitter output low.

The open circuit output voltage swing is from +9.4V (V+ — 0.6V) to –10V. The outputs are guaranteed to meet the RS-232C specification of +/-5V minimum output swing, under the worst case conditions of both transmitters driving a 3k minimum load impedance, the Vcc input at +4.5V and maximum allowable ambient temperature. The outputs are limited to the RS-232C maximum slew rate of 30V/us, and are short-circuit protected.

The two receivers on the MAX232 fully conform to RS-232C specs. They have a 5k input impedance and can withstand up to +/-30V inputs, either with or without 5V power applied to the chip. The receivers are inverters; i.e., their TTL/CMOS outputs are low whenever the incoming RS-232C line concerned is more positive than +2.4V. Conversely they swing high whenever the input is floating or driven more negative than +0.8V.

As shown in the circuit, a single MAX232 chip can handle most signal requirements for a normal RS-232C interface. However if additional signal lines must be implemented, a second MAX232 can be coupled to the first. In this case the +10V and -10V outputs of both chips are tied together, to ensure correct operation.

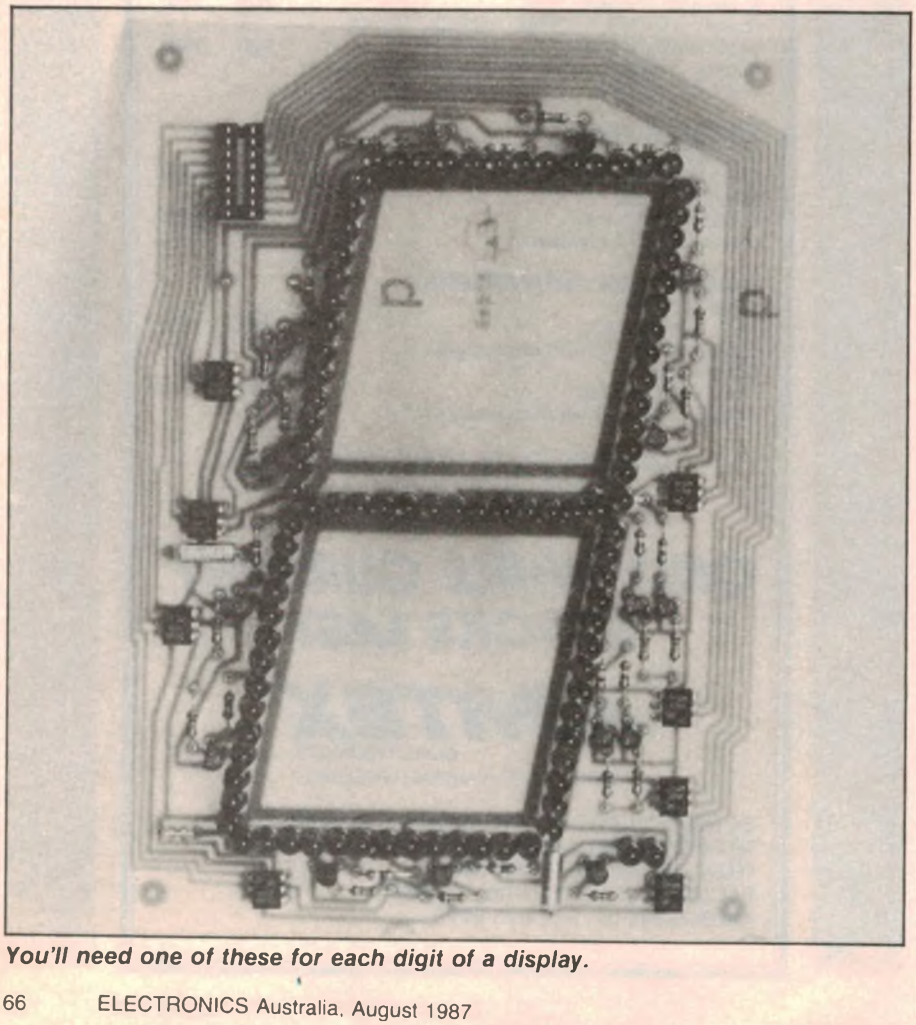
All this from a little CMOS chip which runs on little more than the smell of an oily rag — well, only about 5mA quiescent current! It's also available in a 16-pin outline package for surface mounting, as well as a normal plastic or ceramic 16-pin DIP.

MAX232 chips are available locally for $12.96 each from Geoff Wood Electronics, of 229 Burns Bay Road, Lane Cove West 2066. (J.R.)

A really BIG LED display module!

Need to produce an LED display that can be seen from a long way off? This single digit 153mm high seven segment LED display module is just what you need. It can be used as a replacement for both common anode and common cathode LED displays, can be either multiplexed or DC driven, and can be provided with a decimal point on either the right or left.

by JOHN CLARKE



You'll need one of these for each digit of a display.

The large LED display module to be described should find use in classrooms and lecture theatres, so that a demonstration can be seen by everyone. A set of the modules can display voltage, temperature or any other parameter simply by using them to replace the LED display in the piece of measuring equipment concerned.

The module should also have application in industry, to indicate process parameters which are important enough to be prominently displayed so that they will be visible over a large area (say a control room). No doubt there will also be novelty applications, such as a large digital clock and an event or elapsed timer for sports grounds and functions.

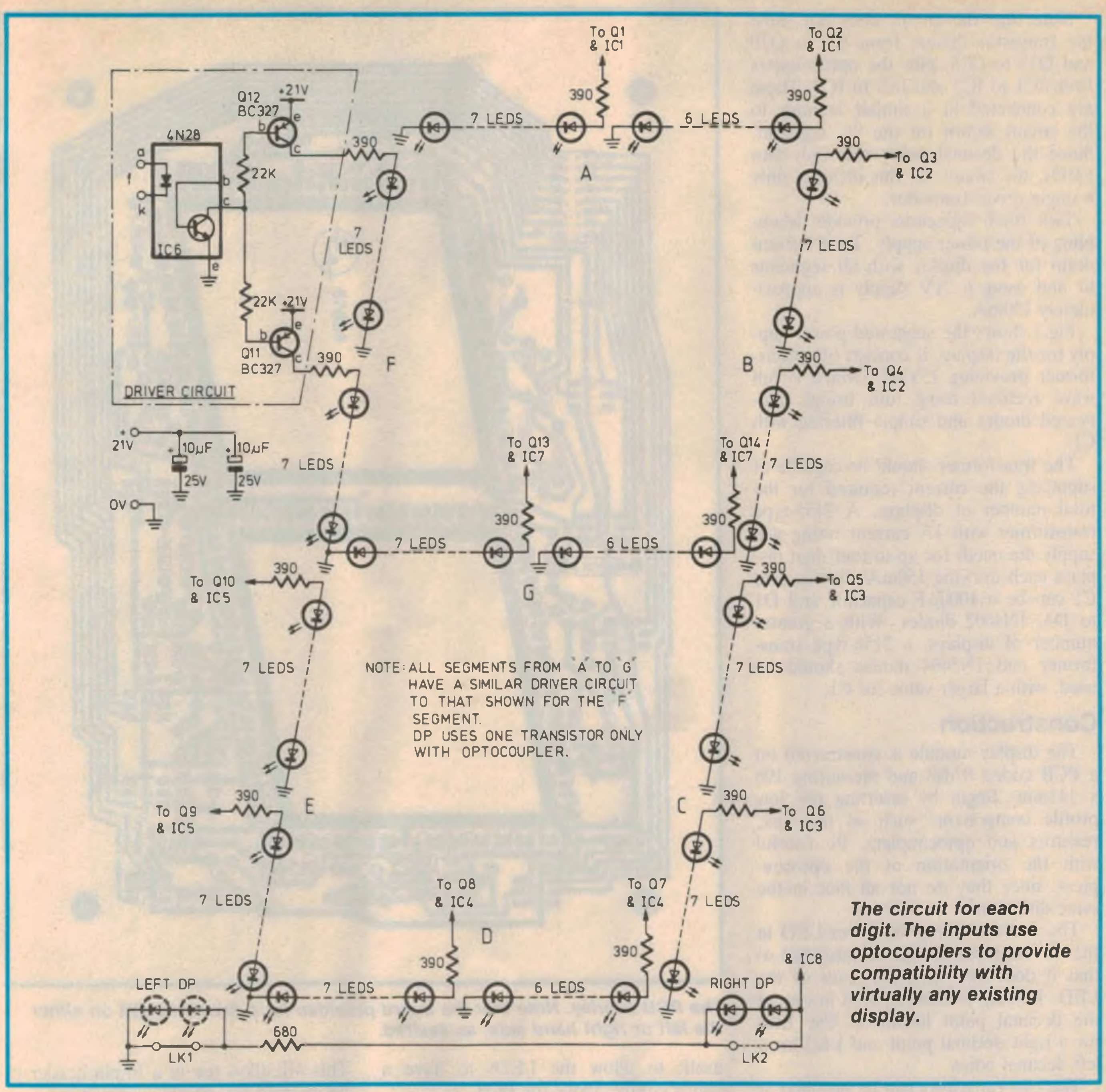
The display module has been designed to be fully compatible with standard smaller seven segment LED displays, of either the common cathode or common anode type. However the display is separately powered, so that its considerably higher power requirements do not cause additional drain on the original LED display circuit.

No modifications are necessary to the original LED display circuit to enable incorporation of the large display. The original display is removed and the inputs of the large display module connected in its place. The secret of this direct compatibility is the use of optocouplers, to isolate the segment and decimal point drivers of the large display.

An optocoupler consists internally of an LED which optically drives a phototransistor. Since it is the optocoupler LED which is driven, instead of the original small LED display, there is direct compatibility between the displays.

The LED terminals to the optocoupler are left free, so that all the optocoupler anodes can be connected to simulate a common anode display or all the cathodes connected for simulation of a common cathode display.

The module's display can be configured for left or right hand decimal points, to match displays with either a



The circuit for each digit. The inputs use optocouplers to provide compatibility with virtually any existing display.

left or right channel decimal point.

The large LED display module has a digit which consists of 95 LEDs, arranged in a standard seven segment format. Two further LEDs are used for the left or right decimal point. The LEDs are arranged on a printed circuit board, with the associated LED driving circuitry located around these LEDs. It is quite easy to mount several of the modules side by side to produce a multi-digit display.

Circuitry

The circuit for the module comprises eight optocouplers which provide the interface between a conventional LED display and the circuit. These optocouplers drive transistors which in turn drive the LEDs forming each large display segment.

As shown in the circuit schematic, the "f" segment comprises two sets of seven series connected LEDs. Each set is driven by a BC327 transistor with current limiting using a 390Ω resistor. The base of each transistor is driven via a 22kΩ resistor at the collector of the optocoupler transistor. When the optocoupler LED is powered, the optocoupler transistor turns on to allow base current flow to the BC327 transistors. These transistors switch on and drive the series connected LEDs.

PARTS LIST

- 1 PCB coded 87ds8, 196 x 141mm
- 97 5mm red LEDs
- 15 BC327 PNP transistors
- 8 4N28 optocouplers
- 2 10uF 25VW axial electrolytic capacitors
- 15 22k ohm 0.25W resistors
- 1 680 ohm 0.25W resistor
- 14 390 ohm 0.25W resistors
- 15mm of insulated link wire
- 1 16 pin socket (optional)
- 1 16 pin header plug (optional)

Note that the circuit does not show the transistor drivers from Q1 to Q10 and Q13 to Q15, plus the optocouplers from IC1 to IC3 and IC5 to IC8. These are connected in a similar manner to the circuit shown for the "f" segment. Since the decimal point uses only two LEDs, the circuit for this includes only a single driver transistor.

Two 10μF capacitors provide decoupling of the power supply. Total current drain for the display with all segments lit and using a 21V supply is approximately 150mA.

Fig.1 shows the suggested power supply for the display. It consists of a transformer providing 15VAC, which is full wave rectified using four bridge connected diodes and simple filtering with C1.

The transformer should be capable of supplying the current required for the total number of displays. A 2155-type transformer with 1A current rating will supply the needs for up to four digit displays each drawing 150mA. In this case C1 can be a 1000μF capacitor and D1 to D4, 1N4002 diodes. With a greater number of displays, a 2156-type transformer and 1N5404 diodes should be used, with a larger value for C1.

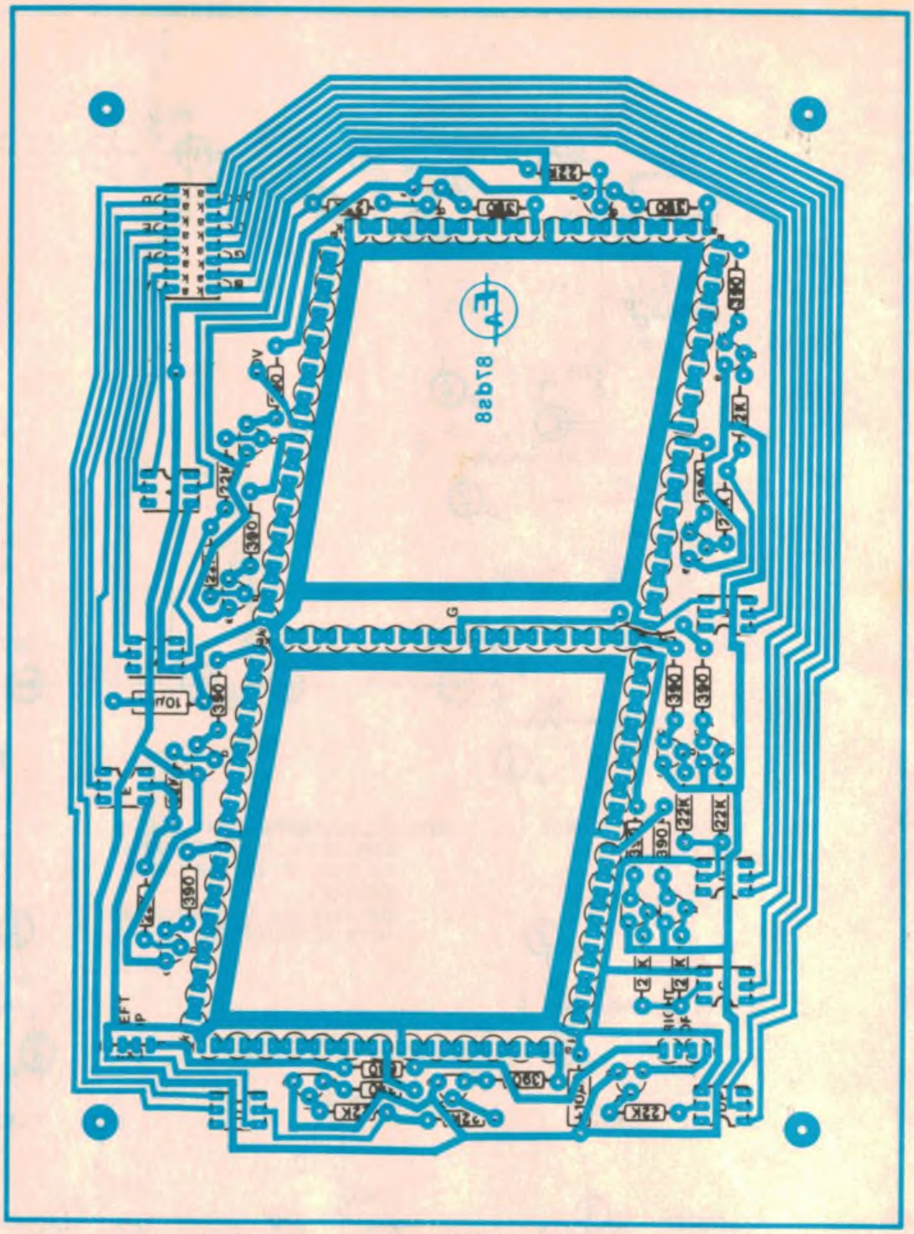
Construction

The display module is constructed on a PCB coded 87ds8 and measuring 196 x 141mm. Begin by inserting the low profile components such as the link, resistors and optocouplers. Be careful with the orientation of the optocouplers, since they do not all face in the same direction.

The link straddling the lower LED in the "b" segment should be insulated so that it does not short the leads of the LED. Linking is also required in one of the decimal point locations. Use LK1 for a right decimal point and LK2 for a left decimal point.

The two capacitors can be installed at this stage, taking note of the correct polarity. The transistors should be installed as closely as possible to the PCB itself, to allow the LEDs to have a higher profile above the PCB.

A 16-pin IC socket can be used for the seven segment and decimal point inputs at the top left side of the PCB. This will allow use of a 16 pin header to be inserted for external connections.



The PCB overlay. Note that the board provides for a decimal point on either the left or right hand side, as desired.

Finally, the LEDs can be installed. Begin by inserting every second LED fully down onto the PCB, taking care that they are orientated correctly. The longer lead is the anode while the flat side on the LED body is the cathode. Solder only one lead for the present, to allow adjustment of the LEDs in a straight line.

Now the in-between LEDs can be inserted. Full insertion onto the PCB for these LEDs is prevented by the plastic rim around the LED base. This is a reasonably attractive arrangement, however some readers may prefer to snip off the rim with side cutters to allow full

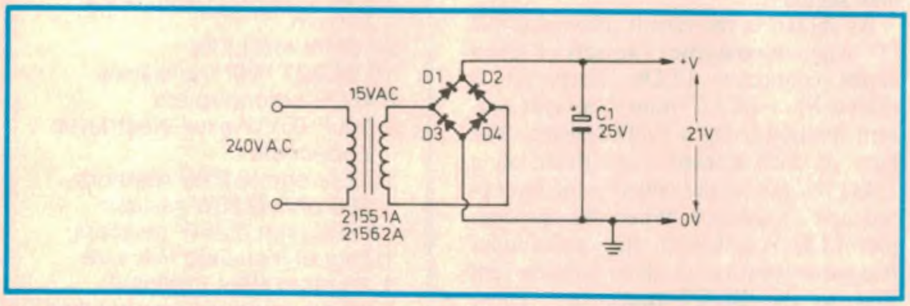
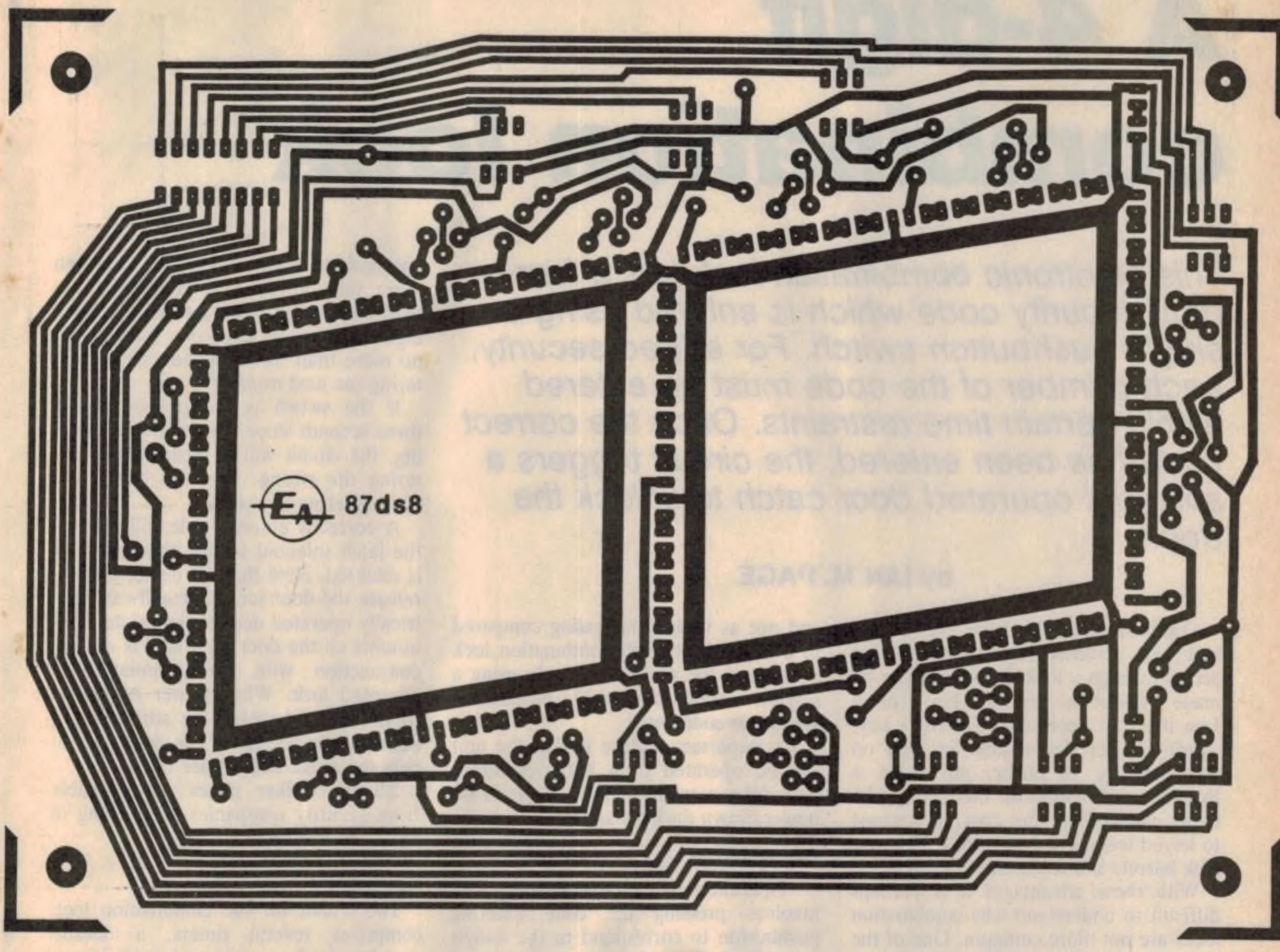


Fig.1: A suggested power supply, capable of running up to 4 digit modules with a 1A transformer or 8 modules with a 2A type.



The PCB pattern itself, reproduced actual size (we just made it!).

insertion on the PCB.

Solder these in position for one lead only and align the LEDs so that each segment is in a straight line. The remaining leads on all the LEDs can now be soldered.

That completes work on the display module PCB.

Testing requires a power supply of about 21V with current capability of at least 150mA. Connect the positive (+) and ground power terminals for the large display module to the power supply and the cathodes of the optocoupler LEDs to ground. To light a segment, connect a 3.9kΩ resistor between the anode of an optocoupler and the positive supply. This should light the large segment associated with that optocoupler.

Should the segment not light, check for incorrectly orientated or faulty LEDs. Similarly check that all the remaining segments operate.

When the display is used in a multiplexed situation, the resistor values specified will be suitable to give sufficient brightness for up to four digits. To give greater LED brightness, the resistor values for limiting the LED current and base drive to the transistors can be reduced. LED current is calculated assuming that there is a 2V drop across each LED, leaving about 7V across the resistor. The current through the transistor base should be 20 times less than the LED current, to ensure saturation of the transistor.

Note that we are assuming that the current through the optocoupler LED is sufficient to ensure saturation of the phototransistor. This should normally be the case.

Installation

There are four holes located in the corners of the PCB suitable for mounting the display. When more than one digit is used, each PCB can be secured at regular spacing onto a backing plate. To give protection for the diodes and ensure greater visibility, a red Perspex screen can be secured over the front of the display.

Connection of the large LED display to a seven segment LED driver circuit requires knowledge of the pinouts and polarity for the particular LED display involved. The Dick Smith catalog shows pinouts for several of the LED displays, but for greater detail and information on other displays, refer to the manufacturers' optoelectronic data books.

A 4-digit combination lock

This electronic combination lock has a four digit security code which is entered using a single pushbutton switch. For added security, each number of the code must be entered within certain time restraints. Once the correct code has been entered, the circuit triggers a solenoid operated door catch to unlock the door.

by IAN M. PAGE

Combination locks have the advantage over standard keyed locks in that access through a locked doorway can be made without the use of a key. Therefore it is not necessary to carry a key, which reduces the number of keys on your keyring. A further advantage is that the combination for the lock can be easily changed without cost, in contrast to keyed locks which require fitting new lock barrels and replacement of keys.

With these advantages it is perhaps difficult to understand why combination locks are not more common. One of the reasons could be that the keypad used to enter the code is usually obtrusive, and not as visually appealing compared to a keyed lock. This combination lock overcomes the problem by only using a single, easily concealed pushbutton switch for code entry.

An important feature is that the unit can be operated from batteries rather than from a mains supply. There is no power drawn during standby.

Operation

Operation of the combination lock involves pressing the code entering pushbutton to correspond to the 4-digit code. Each digit of the code is entered separately by pressing the button the appropriate number of times, with no more than a one second interval between pressings. The interval between digits must be at least one second, but no more than three seconds, before entering the next number.

If the switch is not pressed within three seconds since the last switch pressing, the circuit will be deactivated. Entering the wrong code will cancel the code entering operation.

A correctly entered code will activate the latch solenoid so that the door lock is released. Note that the device used to release the door lock is actually an electrically operated door striker plate. This mounts on the door jamb and is used in conjunction with the original door mounted lock. When power is applied to the electric strike, the strike opens, allowing the tongue of the door lock to pass the strike and release the door.

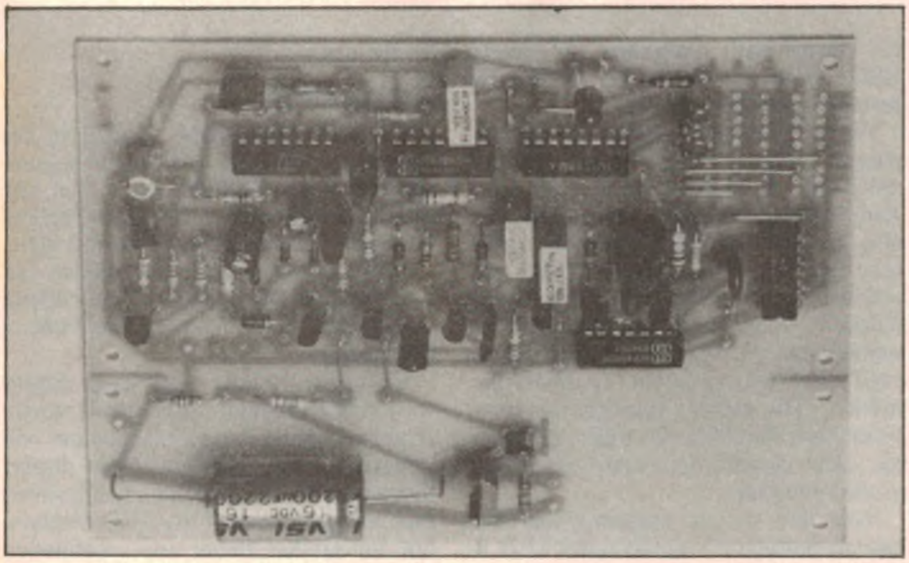
Electric striker plates are available from security companies specialising in locks.

Circuitry

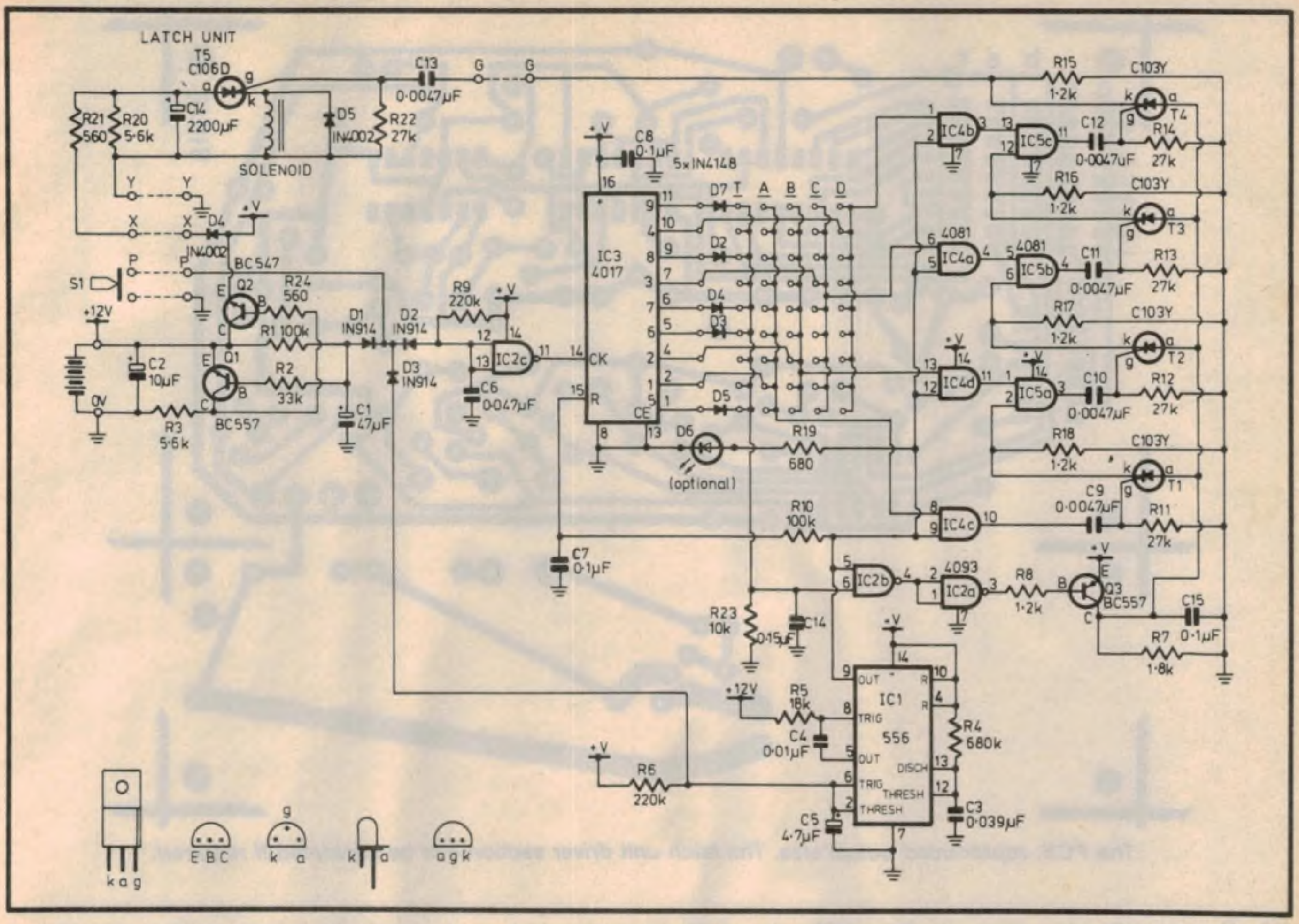
The circuit for the combination lock comprises several timers, a decade counter, latches and a solenoid driver. The decade counter is used to count the input pulses from the switch and produce an output at one of its ten pins corresponding to the number of pulses received. When a correct code number is entered, an SCR switches on preparing the circuit for the next number in the code. As each number is correctly entered, the corresponding SCR triggers on. Finally, on the last entered code the solenoid SCR fires to power the door lock solenoid.

An incorrect number or wrong timing will cause all the SCRs to drop out of the circuit, cancelling the counting operation.

Let's take a look at the circuit in more detail. Initially, capacitor C1 is charged to the supply voltage via R1. When S1 is first closed, C1 is discharged via D1 and turns on Q1 due to the base current through R2. Q1 switches on Q2, which supplies power to the remainder of the circuit.



The PC board for the combination lock. Programming for the code digits is carried out using the diodes and links in the top right hand corner.

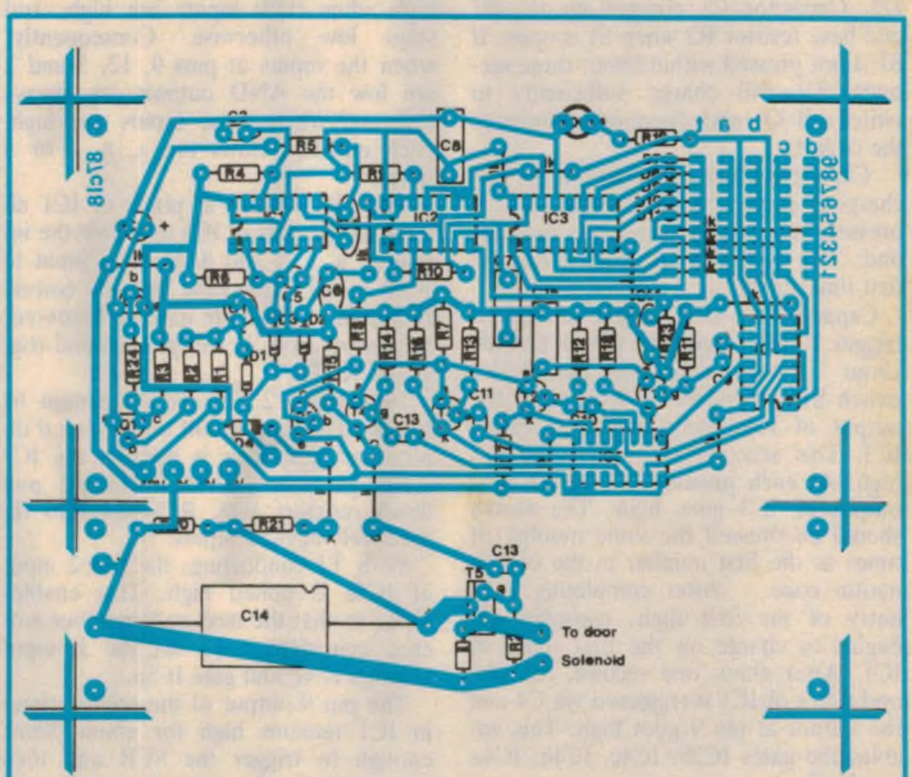


IC1 is a dual 555 timer (556). When power is first applied via Q2, the output of the first timer at pin 5 is high. The timing capacitor C5 and R6 at pins 2 and 6 respectively set the time constant to about 1 second. After this time the output at pin 5 goes low to trigger the second timer at pin 8 via capacitor, C4. The time period for which the output at pin 9 is high is set by C3 and R4 to about 30ms.

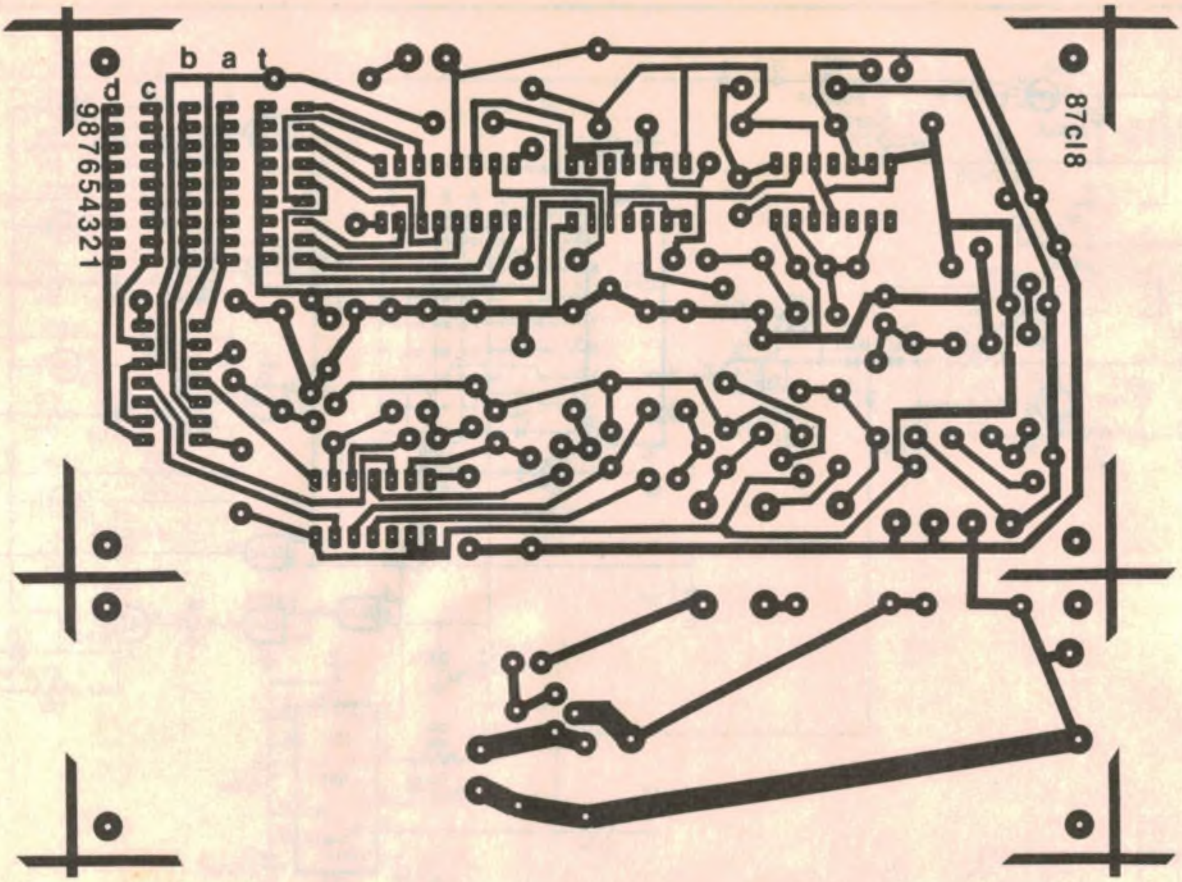
While the output at pin 9 is high, resistor R10 charges C7 at the reset pin (15), of IC3. This resets IC3 after about 10ms, setting low all the outputs of IC3 from 1 to 9.

Programming the code for the 4-digit combination lock is done by connecting the "a", "b", "c" and "d" inputs to outputs between 1 and 9 on IC3. For example, if "a" is connected to 1, "b" to 2, "c" to 3 and "d" to 4, the code becomes 1234. The remaining outputs of IC3 from 5 to 9 should be connected using diodes to the "t" input at pin 6 of IC2b.

Whenever switch S1 is pressed, three capacitors are independently discharged. Capacitor C1 is discharged via D1, capacitor C5 by D3 and capacitor C6 by



Here is the parts overlay for the combination lock PCB. Note that the latch unit driver section can be cut off and mounted separately.



The PCB, reproduced actual size. The latch unit driver section can be separated if required.

D2. Capacitor C1 charges up via R1 and base resistor R2 when S1 is open. If S1 is not pressed within about three seconds, C1 will charge sufficiently to switch off Q1 and disconnect power to the circuit.

Capacitor C5 remains held in the discharged state, provided that S1 is pressed more often than once per second. This is the timing period for the first timer of IC1.

Capacitor C6 at the input to Schmitt trigger IC2c charges via R9 to provide about a 10ms debounce period for switch S1. Whenever S1 is pressed, the output of IC2c goes high and clocks IC3. This sets the "1" output of IC3 high. At each pressing of S1, the next output of IC3 goes high. The switch should be pressed the same number of times as the first number in the combination code. After completing code entry of the first digit, capacitor C5 begins to charge on the first timer of IC1. After about one second, the second timer of IC1 is triggered via C4 and the output at pin 9 goes high. This enables the gates IC2b, IC4c, IC4d, IC4a and IC4b.

IC2 and IC4 are quad AND gates. These operate so that the output goes high when both inputs are high, and stays low otherwise. Consequently, when the inputs at pins 9, 12, 5 and 2 are low the AND outputs are always low and when these inputs are high, each output follows the a, b, c or d input.

The high output at pin 9 of IC1 allows the outputs of IC4 to follow the inputs at a, b, c and d. If the a input to IC4c is high, indicating that the correct first digit of the code has been entered, the output of IC4c will go high and trigger SCR T1.

Note that T2, T3 and T4 cannot be triggered even if one of the b, c or d inputs are high. This is because the IC5 AND gates are disabled via the pull down resistors R18, R17 and R16 respectively at their inputs.

With T1 conducting, the pin 2 input of IC5a is pulled high. This enables IC5a, so that the next code number entered can trigger T2 via the b input through IC4d and gate IC5a.

The pin 9 output of the second timer in IC1 remains high for about 30ms, enough to trigger the SCR and then reset IC3 via the delay formed by C7 and R10 at pin 15.

After the second digit is correctly entered, the b input to IC4d goes high at pin 13. SCR T2 is then triggered via IC5a and enables IC5b at pin 6. When the third digit is selected at c, SCR T3 is triggered enabling IC5c at pin 12. Similarly, entering the fourth digit brings the d input of IC4b high and triggers T4 via IC5c.

When T4 switches on, it supplies a positive pulse to the gate of T5 to switch it on. T5 powers the solenoid door latch mechanism. Note that the relatively heavy transient current required for the solenoid is drawn from a 2200μF capacitor, which is supplied via R21 and D4. Diode D5 removes the reverse voltage spike when the solenoid current is switched off.

To assist in data entry, LED D6 is lit briefly during resetting. This indicates that the next code can be entered.

If a digit that is not in the code is fed in, one of the diodes at D7 to D11 will go high and pull the pin 6 input of IC2b high. This sets the outputs of IC2b low and IC2a high respectively, to remove base bias to Q3. Q3 removes the positive power supply from the anodes of the SCRs and thus resets them. Note that C14 is used to remove glitches that can cause all the SCRs to latch on when

S1 is pressed. If code entry for each digit is entered before IC3 resets, any entered number will be added to the previous count, causing an incorrect code.

Construction

The circuitry for the 4-Digit Combination Lock is constructed on a PCB coded 87cl8 and measuring 137 x 110mm. Note that the PCB can be cut in two, so that the latch unit circuit on the PCB can be mounted close to the electric strike.

This has the advantage that the high transient current required for the solenoid can be supplied directly from the large storage capacitor C14, using short connecting leads. Alternatively, heavy duty wiring will be needed between the solenoid and latch unit PCB if this section of the PCB is located far from the solenoid.

Begin construction by deciding on the code required for the combination. Linking is required between the a, b, c and d inputs of IC4 and the outputs from IC3, while diodes (D7 — D11) are inserted between the unused outputs of IC3 and the "t" input to pin 6 of IC2b.

A special area at the top right side of the PCB has been reserved for combination coding and the overlay shows encoding for the example combination code of 1234. For this combination, the "1" output from IC3 is linked to the "a" bus, the "2" output to the "b" bus, the "3" output to the "c" bus and the "4" output to the "d" bus. The D7 to D11 diodes connect between the "t" bus and the "5, 6, 7, 8 and 9" outputs of IC3. These diodes will need to be mounted upright.

Note that it is also possible to duplicate a number in the code simply by linking between one output of IC3 and two of the a, b, c or d inputs. In this case an extra diode will be necessary for the free output from IC3.

Continue with construction by installing the low profile components such as the links, resistors, diodes and ICs. Take care with the orientation of the diodes and ICs. Now the transistors, SCRs and capacitors can be installed. Note that these with the exception of the non-electrolytic capacitors, must be orientated correctly as shown on the overlay diagram.

After installation of the components, check your work for the correct placement of components, for dry solder joints and shorts. The circuit is now ready for testing.

Connect S1 between the "P" terminal and "0V" on the PCB and interconnect the latch unit PCB to the main PCB if the two have been separated. A 12V power supply or battery can be connected to the +12V and 0V terminals.

Use a multimeter to check that Q2 switches power to pins 14 of IC1, IC2, IC4 and IC5 and pin 16 of IC3 when switch S1 is pressed. After S1 is released, the power should remain on the ICs for about 3 seconds.

Press S1 again and check that LED D6 flashes for a very short time one second after S1 is released. After this time, S1 can be pressed again and the "1" output of IC3 should go high. Pressing S1 again should bring the "2" output high. The pressing of S1 can be continued to check that each output

Continued on page 129

PARTS LIST

1 PCB coded 87cl8 measuring 137 x 110mm
8 AA size cells
1 8 x AA battery holder
1 momentary contact pushbutton switch
1 12V electrically operated striker plate

Semiconductors
1 556 dual timer
1 4093 quad NAND Schmitt
1 4017 decade counter
2 4081 quad AND gate
1 5mm LED
2 BC557 PNP transistors
1 BC547 NPN transistor
4 C103Y SCRs
1 C106D SCR
8 1N914 small signal diodes
2 1N4002 1A diodes

Capacitors
1 2200uF 16VW PC electrolytic
1 47uF 16VW PC electrolytic
1 10uF 16VW PC electrolytic
1 4.7uF 16VW PC electrolytic
1 0.15uF metallised polyester
3 0.1uF metallised polyester
1 0.047uF metallised polyester
1 0.039uF metallised polyester
1 0.01uF metallised polyester
5 0.0047uF metallised polyester

Resistors (0.25W, 5%)
1 x 680kΩ, 2 x 220kΩ, 2 x 100kΩ, 5 x 27kΩ, 1 x 18kΩ, 1 x 10kΩ, 1 x 5.6kΩ, 1 x 1.8kΩ, 5 x 1.2kΩ, 2 x 560Ω

Miscellaneous
Solder, tinned copper wire, hookup wire.

Putting old video gear to good use:

Home movies on the (very) cheap

It's exciting to open a box containing the very latest technology and to wonder what new tricks you'll be able to make it do. It can be equally exciting to open up some old technology and to learn about how it was done in days gone by. When the learning also results in a useful end product, the whole exercise can be very worthwhile . . .

by JIM LAWLER

Although the AV3420-CE is quite heavy at 8.5kg, it is not so heavy that it can't be used on a roof, to record closeup features of a television antenna.

When my younger son mentioned that he wanted to do "Film and TV" at college, I had a fleeting thought about getting a video camera and portable recorder so that he could practice at home. But we need a new car before spending two or three thousand dollars on new video gear, so the idea lasted about ten seconds before it disappeared in a tiny "pooff".

A few days later a colleague mentioned that the local University was selling off a lot of old audio/visual gear, and that there was a monochrome portapak and other video gear (all reel-to-reel) amongst it. Without realising just what I was getting myself into, I made an offer for a selection of the equipment and the offer was accepted.

Now before I go on, I should make it clear that I'm a qualified technician. I knew what I was getting into and was prepared to write off my expenses at any time. I learned early on that I could expect no help from the manufacturers or distributors of this equipment and that anything I learned would have to be from my own experience or from my fellow technicians.

So read on for entertainment, but don't expect to emulate my achievement unless you have the technical expertise or clever friends who can fix whatever might break!

The principal item of the gear concerned was a Sony model AV3420-CD portapak, with camera and AC power adapter. The second video item was a Sony model AV3670-CE recorder, a large desk type machine with what turned out to be a surprisingly effective editing function. Both of these items were supposed to be in working order, an opinion which proved quite accurate.

An item which *wasn't* working but was bought, anyway, for its curiosity value was an Akai quarter-inch video recorder. This funny little machine used ordinary quarter-inch audio tape for helical scan recording of monochrome video signals. The recorder had one unique feature that would not be amiss on modern VCR's, a built-in three inch monitor screen.

My purchase worked out to be something like $40 each for the two half inch Sony recorders and $20 for the Akai curiosity. (This last was not really a waste, because the kit included a black and white video camera which must be worth at least $20, when I can find out how to use it!)

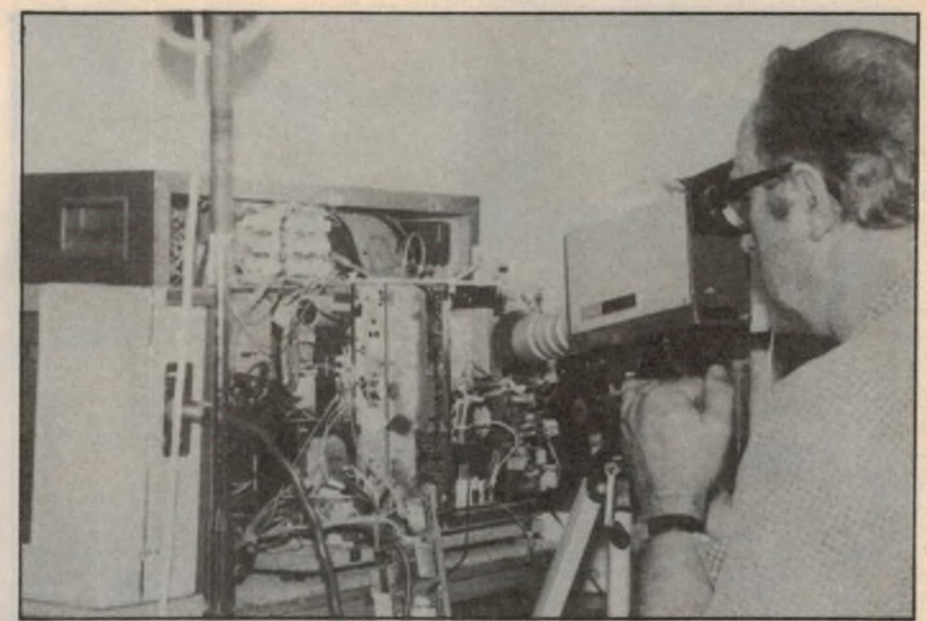
Before the machines could be properly tested, I needed a monitor (or monitors). Initially, I borrowed a couple of colour sets from the workshop but this seemed a wasteful way to go. Then among my junk I found an old Kriesler monochrome portable, a model PT2 that had been discarded because its power transformer had failed.

It was easy enough to find and fit a suitable replacement transformer. Then I removed the tuner and IF stage, devised a suitable video input configuration and fitted two BNC sockets on the back panel. I retained the audio stage and gave that a suitable input using 3.5mm phono jacks. I finished up with a monitor that matched the recorders for both appearance and vintage.

Later, I inherited two more of these little Krieslers, junked because simple faults had been considered uneconomical to repair at the time. I found the repairs easy enough, if a trifle time consuming. They were modified the same way as the first set, so now I have three ideal monitors, for a total cost of something like thirty dollars. They look quite impressive, sitting on the shelf above the recorders.

The portable recorder contained a Sony BP2 12 volt lead-acid battery pack. It was no surprise to find that the battery was flat, and it was so old that it would not hold any useful charge. The

The Akai VT110 quarter inch portable video-recorder. It includes most of the functions of larger machines, as well as a built in monitor seen here on the left of the deck.



The author at work recording a fault inside a television set. The portapak unit is sitting upright on the left of the bench and one of the 150W floods can be seen on its microphone stand, over the TV.

pack contained two six volt batteries which are still available as standard items. I ordered two replacements from the Yuasa distributors and got quite a surprise when I got a bill for $41. That's as much as the recorder they were to be used in!

Still, it was worth it because the old Sony started up and recorded near perfect pictures. The machine had come with a 5-inch reel of tape, enough for half an hour's recording. This was soon used up, and the search began for a supply of tape to fuel the machines.

Both of these recorders used half-inch video tape, of a grade described in their time as "High Density". I eventually found a source of tape which turned out to be "low density" and quite unsuitable. I spoke with a lot of people in an attempt to learn about the difference in these tapes but nobody seemed to know anything. It seems that when these machines were current models, they required no service and thus nobody learned anything about them (well that's the story anyway . . .).

I did hear dire warnings about a tape characteristic called "striction" which makes the tape stick to any polished surface. It was supposed to be particularly vicious on these machines but turned out to be a minor problem, and then only with tape made by or for Sony. Other brands gave no trouble at all.

Anyway, fate must have had its eye on me because the local college learned about my search and offered a quantity of old tape which proved to be ideal for both machines. Later experiments showed that tape from Philips N1500 cassettes suited these Sony machines perfectly, as does modern VHS or Beta tape. So there is unlikely to be any shortage of tape in the future.

So now I had one camera, two recorders, three monitors, a supply of tape, and no immediate subject to use them on. My son had lost interest now that we were working in thrilling black and white! Like most people he had decided that it was to be colour or nothing.

It came to pass that at this time I had a television set in my workshop with a most unusual fault. A full replacement of the faulty parts would have been very expensive for the customer. But I was able to devise a repair that has proved most reliable and cheap for the customer. So I decided to film the exercise and to distribute copies to my colleagues in the trade, in the hope that they could save their customers the cost and delays of getting scarce and expensive parts.

Then another odd fault showed up, and another, and soon I had enough material to make a 20 minute News tape for distribution among my friends in TETIA. The *Electronics Australia* "Fault of the Month" might soon be circulated on video!!

A very useful accessory (that also cost more than the portable recorder) was a set of closeup lenses. These allow me to film right down to an inch or so from the subject. I can fill the screen with a single dry joint, or display the type number on a transistor.

Showing the equipment set up in the "Editing" mode. The Portapak is on the left of the bench, then the 3670 editing machine and the VHS unit on the right. The three modified Kriesler monitors are on the shelf, and the AVC3420 camera on a tripod on the extreme left of the picture.

I spent $12 on a movie titling set and made up some quite smart titles for my creation, then added a personal introduction and a visit to the workshop of a couple of our members. All in all, the programme turned out to be surprisingly effective.

The final edited tape was copied onto VHS cassettes for distribution. (My colleagues are not yet lucky enough to have their own mono recorders). Even the VHS machine was bought on the cheap — $250 ex-rental. The entire studio has not yet cost $500 . . .

One advantage of working in monochrome is that any light source is suitable for black and white. Colour video needs proper colour corrected movie lights and lots of them. Mono video can use any kind of light (tungsten, fluoro, daylight or even sodium street lights) and even a mixture of different light sources.

Although the monochrome camera can work in extremely low light levels, I found I needed more light when working close up inside a TV set. To solve this probem I bought two 150 watt "Portafloods" and mounted them on ordinary microphone stands. This gave me effective studio lighting for less than $20.

Closeup views of the monochrome decks.

Two of the monitors displaying pictures during an editing session.

Another advantage of working with this old equipment is the remarkable quality of multi-generation copies. The VHS print of my Newstape is three and four generations from the original, and still has almost all the sharpness and gradation of the original camera material.

So there it is. A quality amateur production, assembled on the kind of equipment that is now being sold off for a "song". At which point I should remind readers that the song could go very flat. While the old gear is in good order it runs well, but any breakdown could be the end. Considering that the Sony recorders are only 13 years old (1973), it clearly demonstrates the rapid advance of modern technology.

The sad thing about this is that the thousands of dollars worth of taxpayer-funded equipment was very little used, before the advent of colour made it all redundant and therefore worthless. I hope that my exercise in the production of training and information films can squeeze a little more value out of the gear before it is finally put away.

FOOTNOTE: Since writing the bulk of this article, TETIA has been successful in tendering for more of this video equipment from the Tasmanian Education Department. The lots include seven cameras and portable recorders, four table model recorders, together with various power supplies and battery chargers.

It has been distributed among Tasmanian members of TETIA and hopefully will result in a flood of video service tips for our TETIA Newstape. In all, the gear has cost the Division $300, a tiny fraction of its original value, but invaluable in the possibilities it opens for us to develop our technical information service.

We have managed to secure a selection of spare parts to suit the old machines. With a few heads and a range of belts, we should be able to keep the old equipment running for many years into the future.

Special Publications from Electronics Australia

FUNDAMENTALS OF SOLID STATE. Now in its second reprinting — which shows how popular it has been! It provides a wealth of information on semiconductor theory and operation, delving much deeper than very elementary works but without the maths and abstract theory which make many of the more specialised texts heavy going. Starting with a background chapter on atomic theory, the book moves easily through discussions on crystals and conduction, diode types, unijunction, field effect and bipolar transistors, thyristor devices, device fabrication and microcircuits. A revised glossary of terms and index complete the book. *Fundamentals of Solid State* has also been widely adopted in colleges as recommended reading — but it's not just for the student. It's for anyone who wants to know just a bit more about the operation of semiconductor devices. **$4.50**

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SOLD OUT

BASIC ELECTRONICS. This popular text has now been re-issued. *Basic Electronics* is almost certainly the mosty widely used reference manual on electronics fundamentals in Australia. Written as a basic text for the electronics enthusiast, it is also being used by radio clubs, secondary schools and colleges, and WIA youth radio clubs. It begins with the electron, introduces and explains components and circuit concepts and progresses through radio, audio techniques, servicing instruments, television, etc. If you've always wanted to know more about electronics, but have been scared off by the mysteries involved, let *Basic Electronics* explain them to you. Easily understood diagrams and text make this the perfect introduction to the growing and exciting world of electronics. We've even included five electronic projects for the beginner. **$4.50**

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ROVER NEGATIVE ION GENERATOR

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If you've ever wondered about negative ion generators, this MUST be the time to buy one. These were selling for about $80. Jaycar has a limited quantity available for:
Cat. YX-2905

$29.95
SAVE $50.00

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NEW WELLER WTCPS SOLDERING STATION

At last, the old WTCPN has been upgraded and replaced by the new WTCPS. This station incorporates the famous Weller "closed loop" temperature control system.
New features include a detachable iron stand that clips on either side of the station, which incorporates a "water well" which keeps the sponge constantly damp. Uses the well known PT range of tips.
Cat. TS-1002

$149.50

NEW

SQUEAKY CLEAN MAINS FILTERS

TWO BRAND NEW MODELS, BOTH FULLY APPROVED BY THE ELECTRICITY AUTHORITY.

4 OUTLET

The MS-4020 will supply up to 4 appliances. Each 240V socket is independently filtered from the other, i.e. interference from disk drives is de-coupled from the CPU power supply, etc. The filter will suppress interference from RF sources, spikes, transients and lighting, and supply up to 4 outlets with a total load of 10 amps.

Cat. MS-4020 **$269.00** NEW

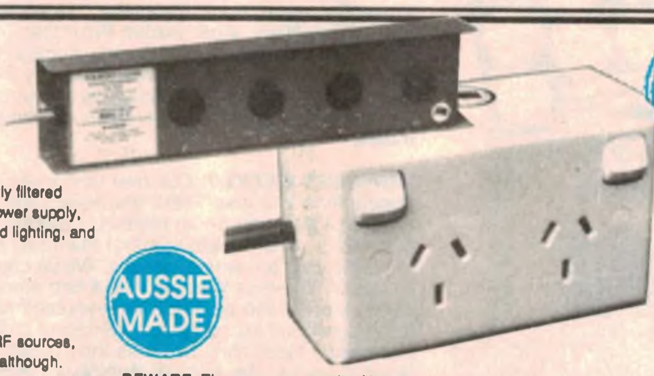
2 OUTLET

The two outlet will handle up to 7.5 amps and will suppress interference from RF sources, spikes, transients and lighting. The two sockets are not independently filtered, although.

Cat. MS-4025 **$99.00**

MASSIVE 10 AMP RATING

AUSSIE MADE



BEWARE: There are many mains filters on the market. One sample we evaluated had only one capacitor in it!

INSTRUMENT CASE

A proud addition to our range. This very attractive case is instrument blue in colour, made in ABS plastic, has removeable front and rear panels, vented and looks extremely smart. Its along the same lines as our HB-5912 box, but not as high.
Measures: 180(W) x 230(D) x 40(H)mm. Accepts PCB vertically 170 x 34mm and horizontally 220mm x 145mm.
Cat. HB-5915

NEW

ONLY $16.95
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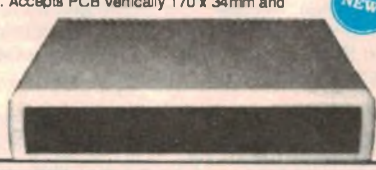

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Now all hobbyists can afford to have a roll of each colour hook-up wire by their work bench. Quality 13/0.12 tinned hook-up wire on plastic spools.

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Brown	Cat. WH-3002	Blue	Cat. WH-3006
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$2.95 per reel

ILLUMINATED ROCKER SWITCH

- Great for amps
- SPDT, 8A, 240V
- Illuminated actuator
- As used in P/Master 60/60
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- Panel cutout 13 x 19.5mm

Cat. SK-0985

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$3.95 ea 10 up $3.25 ea

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Cat. LA-5255

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NEW

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$19.95 - SAVE $3.65

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MIXED COMPONENT PACKS - SAVE HEAPS!!

We reserve the right to make changes to these packs if stock shortages occur

NEW ELECTROLYTIC PACK

- Contains over 80 assorted electrolytics
- Most are normal stock lines
- Types supplied: 1, 2.2, 10, 22, 25, 47, 100, 150, 220, 470, 680, 4700, 10,000uF
- Voltages 6.3, 10, 16, 25, 35, 40, 50, 63, 250V
- At our current prices these caps are worth $85.00
- That's only 12¢ per capacitor

Cat. RE-6260

80 PRIME SPEC ELECTROS FOR $10.00
SAVE 88%

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Don't miss this bargain!
This pack contains approx. 150 assorted capacitors. Not junk values, most are normal stock lines. Here's what you get:

RT Electro	1, 4.7, 25, 100, 220, 470uF most 63V
RB Electro	1, 2.2, 25, 47uF
Greencap	100V - 0.0022, 0.01, 0.22, 1uF
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Ceramic	4.7, 47, 220, 470pF, 0.022uF
Polystyrene	220, 820, 2200pF
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PLUS LOTS MORE

150 PRIME SPEC CAPACITORS
Cat. RE-6260 **FOR $10.00**

POT PACK

After the huge success of our Plessey pot pack, we present our new one.
This pack includes trimpots of various styles, switchpots and expensive slider pots. There is a minimum of 10 sliders, dual sliders sell for $5.50 each. If you only use two sliders, you will be in front, not to mention the trimpots. Typical values included are: 500, 2k, 5k, 20k, 100k, 250k, and 500k ohm. The pack includes at least 35 items.
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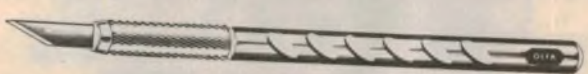

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When the blade becomes blunt, snap it off! Housed in a metal holder (not plastic). Fully retractable blade, one hand operation.
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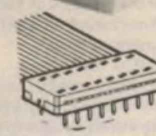

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Jaycar is proud to announce that we stock a Pyroelectric Infra-Red Sensor Element. This is the 'eye' of a passive infra-red detector.
The Murata IRA.F001-P is tiny! It measures 10mm high, 9mm wide and only 6.2mm deep. The element is a ceramic-ferroelectric (modified Lead Zirconate Titonate) which is very stable with VERY high sensitivity and wide spectral response - (1-20um)!
The IRA.F001-P comes complete with full technical data including performance graphs, information on the operating principle and two typical application circuits!
Typical Applications:

- Burglar Alarms
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- Toys, robotics
- Accident prevention/machine guard
- Electronic appliances
- Automatic lighting (in toilet?)

Jaycar (once again!) has purchased this item at a stunning low price so (once again!) we pass the savings on to you!
Cat. ZR-9500
The IRA.F001.P comes complete with all data mentioned above for:

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- Genuine scoop purchase
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See the Jaycar 1987 Catalogue for full details.
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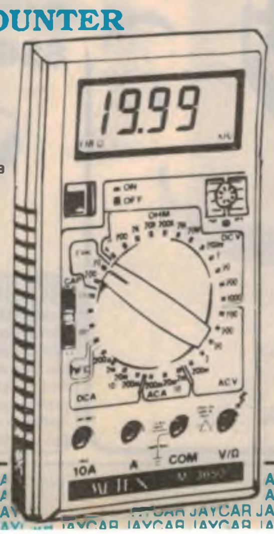

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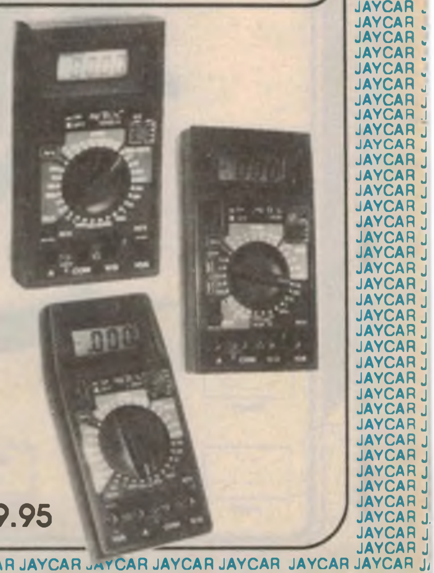

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- 4k RAM for operations
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Once again (boring!) we only have a limited number of Elami Jr's - ACT NOW!
Cat. XR-1030
(Requires 4 x "AA" & 4 x "C" batts - not included). SIZE 300(H) x 175(D) x 235(W)mm

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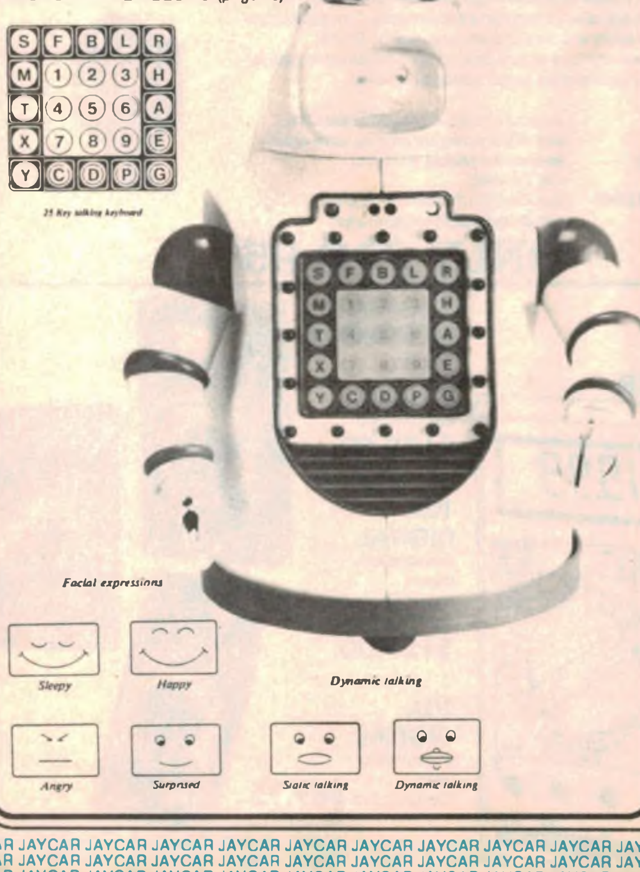
SEE REIVIEW AEM DEC '85! (page 33)



SENSATIONAL BUY OF 1987!!!

Jaycar is proud to announce that we have made a SCOOP PURCHASE of genuine VIATEL terminals WITH 14" COLOUR MONITOR at an unbelievable price!!
We can pass ENORMOUS SAVINGS on to you as a result. RGB MONITOR. Such is the quality of this system the monitor has RGB input. RGB signals from a suitable computer can be connected to the monitor so that it can double as a high res COLOUR computer monitor! With a composite RGB adaptor you can use virtually any computer!
VIATEL ADAPTOR. The adaptor is professionally made by Phillips and INCLUDES an inbuilt modem to Viatel standard (1200/75). It features:

- Detachable remote keypad
- Keylock on/offswitch
- Centronics type printer port
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ONLY $399
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We must emphasise that these units are from 3-5 years old but are in a very clean and good condition.

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FEATURES:

- Simple to use and easy to install - just plug in
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TRANSISTOR BARGAIN 2N5415

PNP, 200V, 1A, metal TO-5 case
Cat. ZT-2365

NORMALLY 50¢ ea
AUGUST SPECIAL
10 for $1.00
50 for $3.50
100 for $6.00

SCOOP BUY - VEHICLE BACK-UP BEEPER

Genuine Mallory 'Sonalert'.
This device mounts near the rear of any 12V vehicle. When +12V is connected (i.e. from reverse gear switch) it will give the familiar 'beep-beep' noise. Simple panel mount fixing. (Operates 4-28V) 69dB min - 80dBA max.
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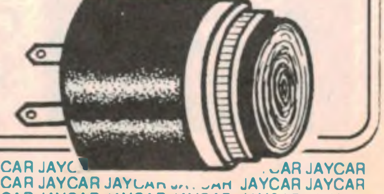
ONLY $9.95



JAYCAR No1 for *New Kits*

100 WATT MOSFET MODULE

REF AEM April 1987
Upgrade your ETI 5000 power amp. Kit supplied with all parts less the 4 MOSFETs. (Use the ones you already have).
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REF EA August 1986
Precisely time your photographic processing from one second up to 9 minutes 59 seconds in increments of one second.
Complete kit.
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VALUE AT $89.95

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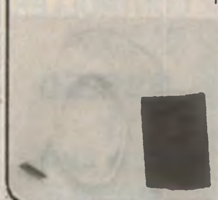

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This project allows a low cost electronic flash to be used as an electronic stroboscope.
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BALANCED LINE DRIVER

REF AEM August 1987
Accepts unbalanced inputs and converts them to balanced outputs! This device enables you to convert unbalanced line level signals to balanced line level signals. It is stereo (2 channel) and has a noise floor of -100dB and 0.005% distortion. Great for PA applications when long signal lines in noisy environments are commonly encountered. Can also be used to bridge amps for greater power!
The Jaycar kit includes all board components, case, etc. Requires 30V AC power, i.e. 6672 type transformer.
Cat. KM-3060

$99.50

AUDIO CLIPPING FAULT INDICATOR

Ref: AEM June 1987
* Indicates overload condition * PCB and all components * Use with amps 5 - 250W * Mono
Cat. KM-3054

$19.95

CUSTOM TELEPHONE RINGER

Ref: ETI June 1987
Connect this to your phone (with double adaptor $7.50) and generate your own variable space age ring tone.
Cat. KE-4728

$39.95

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COMMODORE 64 PACKET RADIO TERMINAL NODE CONTROLLER (TNC)

refer AEM July 1987

- at last! A modem for the airwaves!

This handy project connects between your C-64 and your amateur transceiver. It enables you to send data from your C-64 to another Ham (who has the same equipment at the other end) by radio!
The Jaycar kit includes all board components, die cast box etc. A 12V plug pack is required to power the device. Cat. MP-3012 $18.95
Cat. KM-3058

$59.95

8 CHANNEL I.R. REMOTE CONTROL

Ref: EA June 1987
This project enbables you to control up to 8 separate circuits or functions - DC or 240V AC. With the optional add on kit the full receiver will perform such functions as up-down, volume, muting, etc. The transmitter kit is enclosed in an all ABS case with neat Scotchcal label. The standard receiver kit is supplied with 4 relays. Extra 12V relays (up to 8 total can be fitted) are available at $4.25 ea (Cat. SY-4061).

TRANSMITTER KIT
Cat. KA-1684 **$45.00**

STANDARD RECEIVER KIT (4 relays)
Cat. KA-1685 **$127.95**

ADD ON KIT FOR UP/DOWN, VOL ETC
Cat. KA-1686 **$82.95**

RTTY ENCODER

Companion for "Listening Post"
Ref: AEM May/June 1987
This encoder teams up with the ever popular AEM 3500 Listening Post Kit (Cat. KM-3015 - $39.95) to make a complete transmit/receive tone decoder-/encoder. Complete kit.
Cat. KM-3016

$29.95

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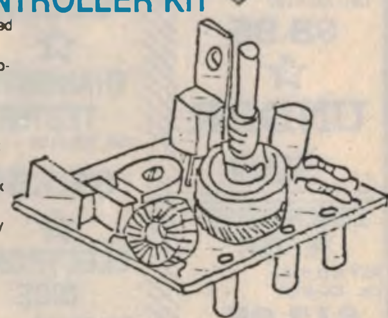
CALL GARY JOHNSTON OR BRUCE ROUTLEY NOW ON (02) 747 2022

UNIVERSAL SPEED/LIGHT/HEAT CONTROLLER KIT

We have once again made a scoop purchase of a partially assembled fan speed controller that was part of a well known Australian made product.
The controller consists of a PCB measuring 45 x 60mm with most of the components professionally soldered in. Two other components, a set of 3 brass connection terminals and the control switch/potentiometer must be soldered in place by the user. That's the only assembly work required.
You can connect the controller to many 240V mains powered devices such as: incandescent lighting, electric motors (both series wound and shaded pole) or heating elements, etc. It will control up to 3 amps (i.e. 750VA). A small heatsink may be required on the TRIAC over 2 amps.
The kit is complete and includes all assembly/connection instructions. You only need a suitable knob for the nylon insulated pot shaft.
Cat. KJ-6522



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PLAYMASTER 60/60 AMPLIFIER KIT NOW YOU HAVE A CHOICE!

We believe the 'Blueprint' represents a significant improvement in the development of this project.
* Dual diagonally wound C-Core power transformer. Endorsed in writing (with each kit) by EA. Slightly higher power rating than toroid power transformer (which is in the standard kit).
* For lower noise, metal film 1% 50ppm resistors are now supplied
* Power supply filter capacitors - doubled! This significantly improves power supply performance.
* Special extruded heatsink.
* Special high quality pre-tinned PCB * Special front panel treatment - graphics emphasise Blueprint treatment.

STANDARD VERSION $299 Cat. KA-1650 **BLUEPRINT VERSION $349** Cat. KA-1652

Computer controlled electronic strobe

for the Apple and Microbee

The cheapest electronic stroboscope still costs over $300 and even a project version adds up to $100. By converting an old electronic flash from a camera and triggering it by computer, an accurate strobe can be built for a fraction of the price.

by RICHARD WALDING and PAUL PAVLUK

The authors' prototype strobe interface, with a typical low-cost electronic flash. How to modify the flash is explained.

The original purpose of developing this strobe was to produce an accurate and cheap electronic strobe for use in high school physics classes, to analyse standing waves on strings and wave motion in ripple tanks. Mechanical shutter strobes, common to many schools, were uncalibrated and electronic units were far too expensive. The unit described here is cheap, accurate and simple to build. It has far wider applications than originally planned.

The three parts of this project are: converting the flash; building the trigger interface and installing the software driver.

Overview

Non-automatic electronic flashguns can be bought new for as little as $20, and secondhand even as cheap as a few dollars. The flash needs to be modified, so that the recycling time can be kept low enough for stroboscopic purposes, and also to reduce intensity so as to not drain the batteries excessively.

This is done by replacing the main storage capacitor, which could have a capacitance in the order of 500 microfarad, with one of about 0.5μF — depending on the frequency range required. The charging resistor in the trigger circuit has also to be replaced with one of smaller value.

The typical flash firing circuit works on the capacitor discharge principle — a capacitor is charged via a resistor from the main high tension supply (Fig.1). This capacitor is in series with the primary of the ignition or trigger transformer, and when the flash lead contacts are shorted, the discharge current passes through the transformer. This produces a high voltage spike (typically 5-10kV) across the secondary of the transformer, which is connected to the

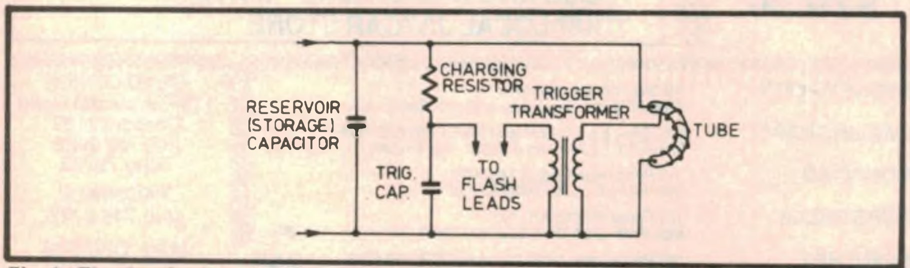


Fig.1: The basic circuit of a typical electronic flash. The main storage capacitor and trigger charging resistor must be reduced in value.

flashtube.

If the camera (or computer) contacts are used to short the capacitor directly, quite an appreciable peak current flows even if the capacitor is made quite small. And so, the camera contacts suffer due to arcing and in turn burn out. The usual output port of a computer would be devastated.

In our interface circuit (Fig.2), a thyristor device (actually a triac) and an opto-coupler are used to provide current amplification and isolation, to protect the computer from damage.

How it works

When the computer makes the terminal "IN" go from 0 to 5 volts, a pulse passes through the 10kΩ resistor and the 0.01μF capacitor into the base of the transistor, causing it to be biased on. A 5mA current then passes through the 1kΩ resistor and the light emitting diode within the optocoupler. The purpose of the optocoupler is to isolate the high voltage in the flash from the low voltage circuits of the computer.

The triac in the opto-coupler is then triggered by the light from the LED, thereby discharging the 0.001μF capacitor C2 through the main triac. This triggers and causes the strobe to flash once.

The use of a triac, rather than an SCR, for triggering the flash makes it possible to connect the interface to flash units with camera contacts in either side of the circuit (positive or negative). This is also the reason for using the MOC3021 opto-coupler, with a triac output element rather than the usual transistor.

The software

Whenever an output pulse is sent by the computer to the interface, the flash fires. The frequency of these pulses is under software control, and with the software we have developed it can be altered in realtime by the user pressing the arrow keys.

The time between pulses and hence the frequency of the pulses is determined by a machine code counter routine — the longer the program is in the counter loop, the longer the duration between flashes. This machine code routine is loaded by poke statements in the BASIC control program. It has an eight bit and a sixteen bit counter, whose count values are set and transferred across from the control program during use.

The sixteen-bit counter is made up of two nested eight-bit counters. One pass through the inside loop (255 counts) decrements the outer counter by one count. Thus a maximum of 255 x 255 = 65025 counts is possible for this counter. Finer control is achieved by using the eight-bit counter, where up to another 255 counts can be added. The initial values of both counters are set in the BASIC control program and are altered by pressing the up or down-arrow keys.

After finishing counting, the annunciator (output) memory location is accessed ($CO40 for the Apple) to trigger the flash and then the speaker is "clicked" (Apple $CO30) to produce an audible signal with each flash. The machine code routine then checks for a keypress, and if none is detected an-

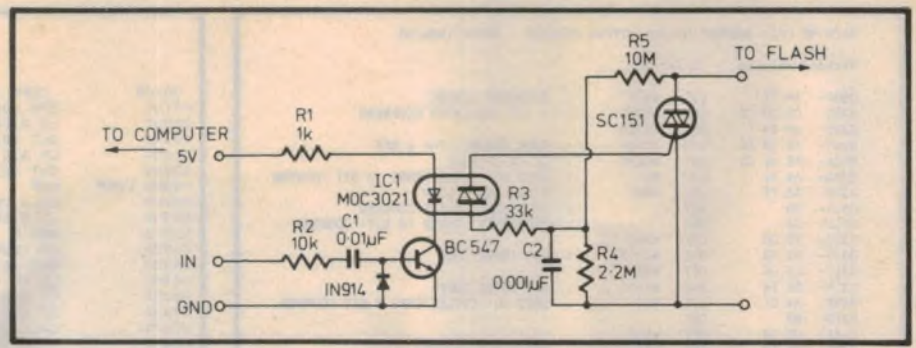
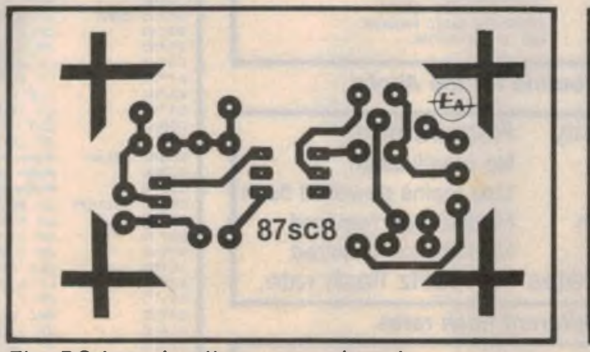
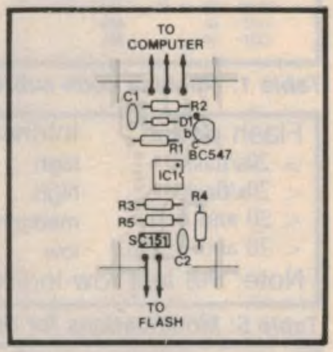


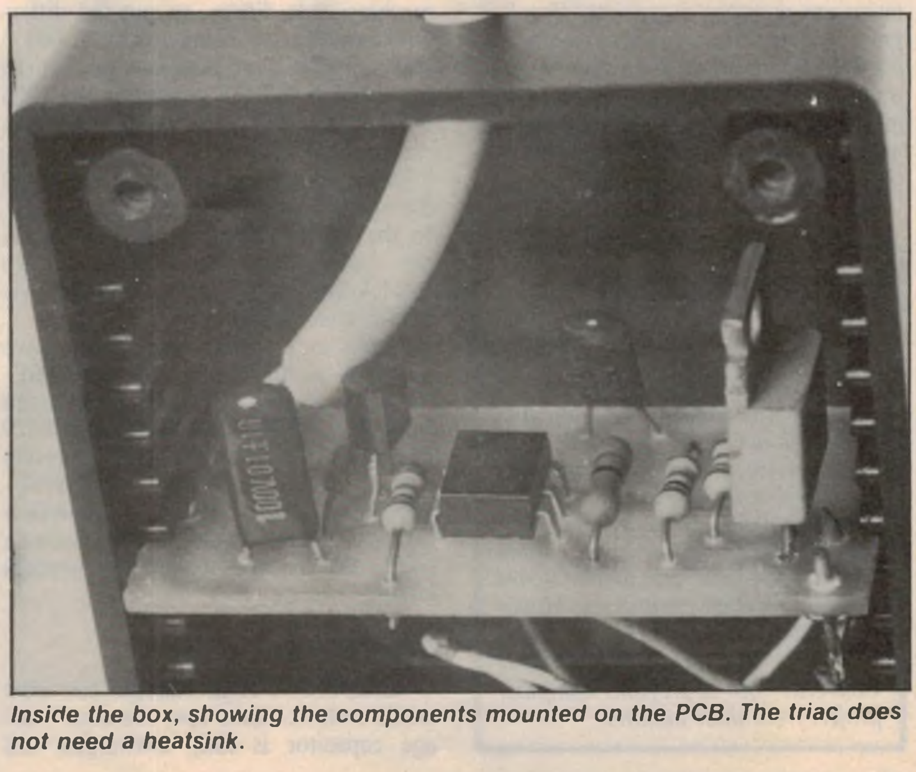
Fig.2: The circuit diagram for the triggering interface. An opto-coupler isolates the computer from dangerous voltages.



The PC board pattern, reproduced actual size (49 x 25mm).



The component overlay. Be careful with orientation of the diode!



Inside the box, showing the components mounted on the PCB. The triac does not need a heatsink.

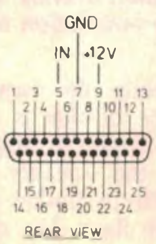
```
MACHINE CODE SUBROUTINE FOR STROBE PROGRAM - APPLE VERSION

Richard Walding  -  3 Jan 87

0300-  A9 7F      LDA  #$7F    :  KEYBOARD STROBE
0302-  CD 00 C0   CMP  $C000   :  > 127 INDICATES KEYPRESS
0305-  30 24      BMI  $032B
0307-  AE 58 C0   LDX  $C058   :  TURN ANNUNCIATOR 0 OFF
030A-  AE 30 C0   LDX  $C030   :  CLICK SPEAKER
030D-  A4 00      LDY  $00     :  SETS NO. CYCLES THRU 16 BIT COUNTER
030F-  A2 FF      LDX  #$FF    :  START INNER LOOP
0311-  88         DEY          :  DECREMENT 16 BIT COUNTER
0312-  CA         DEX          :  DECREMENT  INNER (8 BIT) COUNTER
0313-  E0 00      CPX  #$00
0315-  D0 FB      BNE  $0312   :  END INNER LOOP
0317-  C0 00      CPY  #$00
0319-  D0 F4      BNE  $030F   :  END OUTER LOOP
031B-  A4 01      LDY  $01     :  SETS NO. CYCLES THRU 8 BIT COUNTER
031D-  88         DEY
031E-  C0 00      CPY  #$00
0320-  D0 FB      BNE  $031D   :  END 8 BIT COUNTER
0322-  AE 59 C0   LDX  $C059   :  ANNUNCIATOR 0 ON
0325-  AE 30 C0   LDX  $C030   :  SPEAKER CLICK
0328-  4C 02 03   JMP  $0302   :  RETURN TO START
032B-  AD 10 C0   LDA  $C010   :  CLEAR KEYBOARD STROBE
032E-  60         RTS          :  RETURN TO BASIC PROGRAM
032F-  00         BRK          :  END OF SUBROUTINE
```

Table 1: Machine code subroutine for the Apple.

Flash period	Intensity	Requirement
$>$ 20s/flash	high	No modification
$<$ 20s/flash	high	Use mains powered flash
$<$ 20 and $>$ 1	medium	Modification required
$<$ 20 and $>$ 0.02	low	Modification required

Note: the last row indicates the 50Hz flash rate.

Table 5: Modifications for different flash rates.



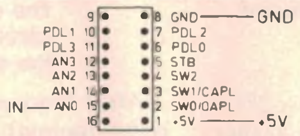


Fig.3 (above): Plug connections for the Apple II+, IIe or IIGS I/O port (the IIC cannot be used). Fig.4 (left): Connections for the Microbee DB25 socket.

```
                DEFR 16
                ORG 6000H
                LD A,0FFH           ;INITIALIZE PORT
                OUT (03),A
                LD A,0
                OUT (03),A
        LOOP    NOP
                LD A,(BUFF)
                LD B,0B3H
                AND B
                LD (BUFF),A
                OUT (02),A
                LD HL,(HOWLON)           ; DELAY SOME
                LD D,H
                LD E,L
                CALL DELAY
                CALL KEYWAT
                JR Z,CONT           ; IF NO KEY THEN PROCEED
                LD B,0
                LD C,A              ; LOAD A INTO C TO RETURN IT TO BASIC
                RET
        CONT    LD A,(PAUSE)
                CP 1
                JR Z,LOOP
                LD A,(BUFF)         ; CLICK THE SPEAKER
                LD B,04CH
                XOR B
                LD (BUFF),A
                OUT (02),A
                JP LOOP
        DELAY   PUSH AF
                PUSH BC
                PUSH DE
        DELNUM  LD BC,5H
                LD A,E
                OR D
                JR Z,EXIT
                DEC DE
        DELOOP  LD A,B
                OR C
                DEC BC
                JR Z,DELNUM
                JR DELOOP
        EXIT    POP DE
                POP BC
                POP AF
                RET
        BUFF    EQU 514D
        PAUSE   EQU 516D
        HOWLON  EQU 512D            ;NUMBER OF DELAYS
        KEYWAT  EQU 8009            ;SEE IF THERE IS A KEY
                END
```

Table 2: Assembly language subroutine for the Microbee.

other counting sequence is begun which maintains constant frequency. If a keypress is detected, control is returned to the BASIC program where the keypress is decoded into one of several options including: coarse, fine or extra-fine adjustment, sound on/off, increase/decrease frequency, stop or quit.

The Microbee BASIC control program is similar but the operation of the machine code differs, to suit the different hardware environment. Here bits 3 and 6 of port 2 are pulses — bit 3 clicks the speaker and bit 6 strobes the CTS line on the RS232 port, used to drive the strobe interface.

In Tables 1 (Apple) and 2 (Microbee) the annotated assembly codes are listed. In the BASIC listings (Table 3 and 4) the codes have been converted to DATA that is placed in memory via POKE statements.

Apple users could alternatively save the code as the binary file STROBE-.OBJ, at memory location $0300 with BSAVE STROBE.OBJ,A$300,L$29 and load it from the BASIC program with a line 10 PRINT CHR$(4)"-BLOAD STROBE.OBJ". If modifications are being made to the machine code, this change makes the process easier.

About the Authors

Richard Walding, B.App.Sc, Grad, Dip.Tch, M.SC., M.Phil. is the physics and chemistry teacher at Moreton Bay College, Brisbane and has developed a number of teaching packages for simple Apple interfacing experiments in science.

Paul Pavluk, B.Sc., is a computer programmer with the South East Queensland Electricity Board and has developed numerous Microbee utilities.

See EA, July '86 "Low Cost A-D Converter" for a previous computer project from these authors.

Modifying the flash

CAUTION! High voltages can exist inside a flash. Make sure the main storage capacitor is fully discharged and

PARTS LIST

1 PCB, 87sc8, 49 x 23mm
1 plastic utility case, 2.5 x 8cm
1 1 metre length of 4 core phone cable or similar
1 plug — J15 (16 pin dip-header) for Apple or DB25 plug for Microbee
1 DC power plug (5mm) and socket
1 non-automatic electronic flashgun

Resistors(0.25W, 5%)
1 x 33Ω, 1 x 1kΩ, 1 x 10kΩ, 1 x 2.2MΩ, 1 x 10MΩ

Capacitors
1 x 0.01μF, 1 x 0.001μF

Semiconductors
1 x 1N914 diode
1 x BC547 or DS547 transistor
1 x MOC3021 opto coupled triac driver
1 x SC151D triac

An additonal capacitor and resistor will be required (see text for values).
Total estimated cost (excluding flashgun): $12 — $14

```
]
]LIST

 2  REM  :PROGRAM "STROBE": APPLE //E, //GS
 3  REM  : R.WALDING 17/4/87
 4  HTAB 7: PRINT "
 20  POKE  - 16368,0: REM  CLEAR
 30  POKE 34,0
 40  HOME
 50  POKE 34,13: REM  SET WINDOW
 60 X = 0
 70 Y = 10
 80  VTAB 2: HTAB 10: PRINT "<C> = COARSE"
 90  HTAB 10: PRINT "<F> = FINE"
 100  HTAB 10: PRINT "<X> = EXTRA FINE"
 110  HTAB 5: PRINT "UP ARROW = INCREASE FREQUENCY"
 120  HTAB 3: PRINT "DOWN ARROW = DECREASE FREQUENCY"
 130  HTAB 10: PRINT "<S> = STOP/START  FLASH"
 135  HTAB 10: PRINT "<Q> = QUIT"
 140  POKE 1160,106
 150 HB = 200: REM  16 BIT COUNTER
 160 LB = 100: REM   8 BIT COUNTER
 170  REM :TEST FOR OUT OF RANGE
 180  IF HB < 1 THEN HB = 1: GOSUB 12000
 185  IF HB > 255 THEN HB = 255: GOSUB 12000
 190  IF LB < 1 THEN LB = 255:HB = HB - 1
 195  IF LB > 255 THEN LB = 1:HB = HB + 1
 198  VTAB 13: PRINT "
 200  POKE 0,HB: POKE 1,LB
 205  VTAB 11
 206  PRINT "COUNTER 0: ";: PRINT  PEEK (0)"
 208  VTAB 12
 209  PRINT "COUNTER 1: ";: PRINT  PEEK (1)"
 210  VTAB 14: PRINT "KEEP COUNTER 0 BETWEEN 1 AND 255"
 218 P =  PEEK (1) + 256 *  PEEK (0)
 220  VTAB 16: HTAB 7: PRINT "
 230  VTAB 16: PRINT "COUNT = "P
 240 A = .000052:B = .00000956
 250 FR = 1 / (A + B * P)
 262  VTAB 18: HTAB 12: PRINT "
 263  VTAB 18: PRINT "FREQUENCY = " INT (FR * 1392) / 1000" Hz "
 330  CALL 768
 340 K =  PEEK ( - 16384): REM  VALUE OF KEY PRESSED
 360  IF K = 11 THEN LB = LB - X:HB = HB - Y: GOTO 180
 380  IF K = 10 THEN LB = LB + X:HB = HB + Y: GOTO 180
 384  REM : QUIT
 385  IF K = 81 THEN  POKE 34,0: HOME : END
 390  REM :COARSE
 400  IF K = 67 THEN  GOSUB 520: POKE 1160,106:X = 0:Y = 10
 410  REM :FINE
 420  IF K = 70 THEN  GOSUB 520: POKE 1288,106:X = 0:Y = 1
 430  REM :EXTRA FINE
 440  IF K = 88 THEN  GOSUB 520: POKE 1416,106:X = 10:Y = 0
 450  REM :STOP/START
 460  IF K <  > 83 THEN  GOTO 490
 470  IF  PEEK (777) = 192 THEN  POKE 777,0: VTAB 7: HTAB 16: FLASH : PRINT
 "STOP";: NORMAL : PRINT "/START": GOTO 490
 480  POKE 777,192: VTAB 7: HTAB 16: PRINT "STOP/";: FLASH : PRINT "START
 ": NORMAL : GOTO 490
 490  VTAB 17: GOTO 180
 510  RETURN
 520  POKE 1160,160: POKE 1288,160: POKE 1416,160: RETURN
 800  REM :BASIC LOADER PROGRAM
 820  FOR Z = 0 TO 48: READ C: POKE 768 + Z,C: NEXT
 830  DATA   169,127,205,0,192,48,36
 840  DATA   174,88,192,174,48,192,164,0
 850  DATA 162,255,136,202,224,0,208,251
 860  DATA 192,0,208,244,164,1,136,192,0
 870  DATA   208,251,174,89,192,174,48,192,76,2
 880  DATA  3,173,16,192,96,0,0
 900  RETURN
 12000  REM :OUT OF RANGE ROUTINE
 12010  PRINT  CHR$ (7): PRINT  CHR$ (7)
 12020  VTAB 13: FLASH : PRINT "OUT OF RANGE ERROR"
 12030  NORMAL
 12035  FOR T = 1 TO 3000: NEXT
 12040  RETURN
```

Table 3: BASIC listing for the Apple.

```
00100 REM program Strobe
00110 REM date     17/8/86
00120 REM monitor program for flashing routine
00121 DIM M(4) : GOSUB 12000 : REM load machine code
00122 F=2 : C=40 : N1=15202 : N2=2.596
00124 POKE 516,0 : REM RESET PAUSE
00130 GOSUB 5000 : REM init the screen
00135 A=C :CURS 40,8  : PRINT "COARSE"; : REM SET COARSE
00136 GOSUB [32,2] 6000
00138 K=USR(6*16*256)
00140 IF K>96 THEN LET K=(K AND 95)
00142 A1$=CHR$(K)
00150 IF A1$="F" THEN LET A=F: CURS 40,8 : PRINT "FINE  "; : GOTO 1000
00160 IF A1$="C" THEN LET A=C : CURS 40,8 : PRINT "COARSE";: GOTO 1000
00165 IF A1$="D" THEN LET K=USR(7*256+16+3)
00170 IF A1$=">" OR A1$="." THEN GOSUB 9500 : GOTO 1000
00180 IF A1$="<" OR A1$="," THEN GOSUB 9000 : GOTO 1000
00185 IF A1$<"5" AND A1$>"0" THEN  LET Z=INT(VAL(A1$)+3 : M(Z-3)=B: GOSUB [32,
2] 6000 : GOTO 1000
00190 IF A1$="S" THEN STOP
00200 IF A1$="P" THEN GOSUB 7000 : GOTO 1000
00210 IF A1$>" " AND A1$<"%" THEN GOSUB 10000 : GOTO 1000
01000 GOTO 138
05000 REM clear screen and set up help
05005 Z=INT(50/N1-N2) : GOSUB 9030
05010 CLS : LORES : OUTL#1
05020 FOR I=1 TO 5
05030    CURS 12,3+I : PRINT "Memory # ";[I2 I];" ------";
05040 NEXT I
05050 CURS 12,2 : PRINT "Current Frequency";
05060 PLOT 0,0 TO 0,24 TO 127,24 TO 127,0 TO 0,0
05065 PLOT 18,46 TO 18,40 TO 90,40 TO 90,46 TO 18,46
05070 CURS 10,10 : PRINT "S - Stop                      P - Pause   "
05080 CURS 10,11 : PRINT "F - Fine Adjustment           C - Coarse Adjustment"
05090 CURS 10,12 : PRINT "< - Decrease Frequency        > - Increase Frequency"
05100 CURS 10,15 : PRINT "    1, 2, 3, 4    -    Store in  Memories"
05102 CURS 10,14 : PRINT "Shift  1, 2, 3, 4  -    Recall  Memories"
05110 RETURN
06000 VAR (X,Y)
06020 CURS X,Y
06030 F1 = N1/(N2 + FLT(PEEK(513)*256 + PEEK(512)))
06040 PRINT [F8.1 F1];" Hz"
06100 RETURN
07000 REM PAUSE
07010 Z = PEEK(516)
07020 IF Z=0 THEN POKE 516,1 : CURS 7,8 : PRINT "PAUSE"
07030 IF Z<>0 THEN POKE 516,0 : CURS 7,8 : PRINT "     "
07040 RETURN
08000 REM DISPLAY NUMBER
08010 Z = VAL(A1$)
08040 GOSUB [32,3+Z] 6000
08050 RETURN
09000 REM ADJUST deCREMENT
09010 Z=PEEK(512) + PEEK(513)*256
09020 Z=Z+A
09030 IF Z>32000 THEN LET Z=32000
09031 IF A=C THEN LET A=1 ELSE LET A=0
09035 B=Z : C = B/10 : IF C=0 THEN LET C=1
09036 F=C/30 : IF F=0 THEN LET F=1
09037 IF A=1 THEN LET A=C ELSE LET A=F
09040 Y=Z/256
09050 X=Z-Y*256
09060 POKE 512,X : POKE 513,Y
09065 GOSUB [32,2] 6000
09070 RETURN
09500 REM ADJUST INCREMENT
09510 Z=PEEK(512) + PEEK(513)*256
09520 Z=Z-A
09530 IF Z<0 THEN LET Z=0
09531 IF A=C THEN LET A=1 ELSE LET A=0
09535 B=Z : C = B/10 : IF C=0 THEN LET C=1
09536 F=C/30 : IF F=0 THEN LET F=1
09537 IF A=1 THEN LET A=C ELSE LET A=F
09540 Y=Z/256
09550 X=Z-Y*256
09560 POKE 512,X : POKE 513,Y
09565 GOSUB [32,2] 6000
09570 RETURN
10000 REM RECALL MEMORY
10025 B=M(ASC(A1$)-32)
10030 X=B/256
10040 Y=B-X*256
10050 POKE 512,Y : POKE 513,X
10060 GOSUB [32,2] 6000
10070 RETURN
12000 REM a basic loader program
12010 RESTORE  12000
12030 READ A,B
12040 FOR Z=1 TO 8 : READ C : POKE A+Z-1,C : NEXT Z
12050 DATA      24576  ,         80
12060 DATA 62, 255, 211, 3, 62, 0, 211, 3, 0, 58
12070 DATA 2, 2, 6, 179, 160, 50, 2, 2, 211, 2
12080 DATA 42, 0, 2, 84, 93, 205, 58, 96, 205, 9
12090 DATA 128, 40, 4, 6, 0, 79, 201, 58, 4, 2
12100 DATA 254, 1, 40, 220, 58, 2, 2, 6, 76, 168
12110 DATA 50, 2, 2, 211, 2, 195, 8, 96, 245, 197
12120 DATA 213, 1, 5, 0, 123, 178, 40, 8, 27, 120
12130 DATA 177, 11, 40, 243, 24, 249, 209, 193, 241, 201
12140 RESTORE : RETURN
32767 END
```

Table 4: BASIC listing for the Microbee.

batteries removed before modifications are attempted.

The higher the frequency required from the flash as a strobe, the lower the intensity that can be accommodated. If used unmodified, the flash can only be triggered every 20 seconds or so, but at full intensity. If full intensity is required at a higher frequency, a mains powered unit is needed. At low intensity, but still suitable for stroboscopic use, frequencies up to 50Hz can be maintained for long periods with the modified flash. Table 5 sets out these details.

There are two components which will generally need replacing inside a flash in order to achieve high flash rates. The following only applies to the inexpensive non-automatic type of flash.

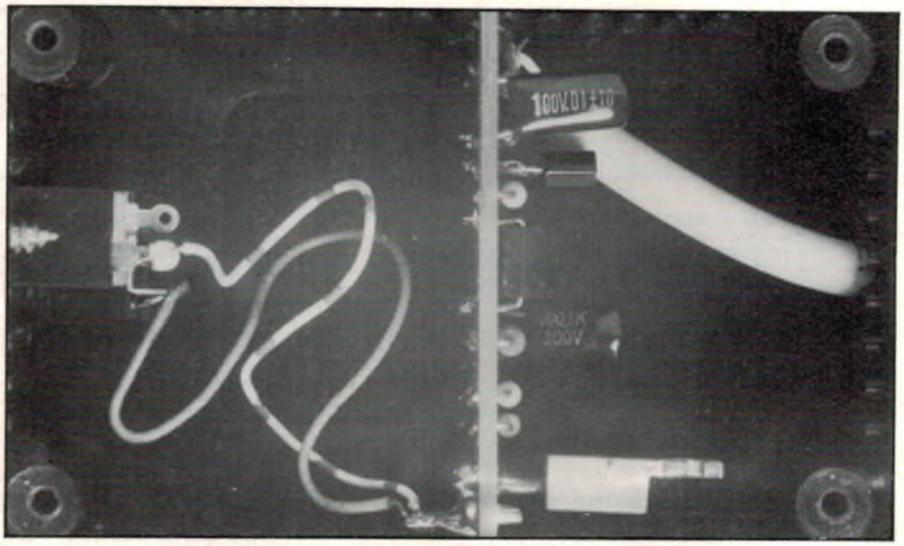
Firstly the main storage capacitor (the large one with a capacitance around 300-500 microfarad at 300 or so volts) will need to be replaced with one of smaller capacitance, and the charging resistor in the trigger circuit will also need to be reduced in value.

The new values required for these are given by:

New trigger resistance
= 300,000/(Rate x Cap) ohms

New storage capacitance
= (10/Rate) microfarad

where "Rate" equals the maximum



A general look inside the trigger interface box, showing the lead connections and the socket connecting to the modified flash.

number of flashes per second required, and "Cap" equals the value of the trigger (not storage) capacitor in microfarads (usually about 0.01 to 1μF).

The main storage capacitor's new value should be around 0.5μF. The new resistor should be about 0.5MΩ, rated at 400V DC.

Construction

The authors' interface was built on a very small PCB, measuring 49 x 23mm. The PCB pattern and component overlay are shown in the illustration. Note that the layout of their PCB should be followed fairly closely to ensure that the circuits of your computer are protected from damage. Veroboard should not be used for this project.

In mounting the components on the PCB, fit the resistors and capacitors first. Then fit the 1N914 diode and the BC547 transistor, watching the lead orientation carefully.

Finally, add the opto-coupler and the triac, again making sure of their orientation. All that is necessary now is to add the external connections.

We mounted the PCB assembly in one of the very small plastic utility boxes, Dick Smith Electronics type H-2855 or similar. This has internal slots, to allow the PCB to be mounted vertically across the centre as shown in the pictures.

The cable from the computer is brought in through a hole at one end of the case, and connected directly to the PCB. The lead from the flash unit is terminated in a small concentric-type DC power plug (5mm OD), and a matching socket mounted on the "other end" of the interface box.

This system allows the flash unit to be disconnected from the interface for storage. The interface itself can be left permanently connected to the computer.

Conclusion

Without any modification to the software, the computer interface can be used as an external trigger for a commercially manufactured electronic stroboscope.

For externally triggered stroboscopes which require a 5V pulse, the strobe could be connected directly to pins 1 and 15 on the Apple, thus bypassing the interface.

By connecting appropriate light sensors or other transducers to the computer plug, the strobe can be started when a pre-programmed set of conditions are met. Experiments could include the stroboscopic photography of collisions in two dimensions, such as the trajectory of projectiles, or droplet formation in water streams.

As stated in the introduction, the unit described in this article can be used to examine waves in elastic media such as strings, springs and water. Like all stroboscopes, it can be used to measure the speeds of rotating shafts and even to calibrate mechanical shutter-type stroboscopes.

With modification to the software, the unit can be programmed to alter frequency at some preselected time or condition, such as in a stage presentation. To do this, time delay loops can be written into the BASIC control program before transferring counter settings and control to the machine code routine for some specified time. The program then returns to BASIC for further instructions. The possibilities seem endless.

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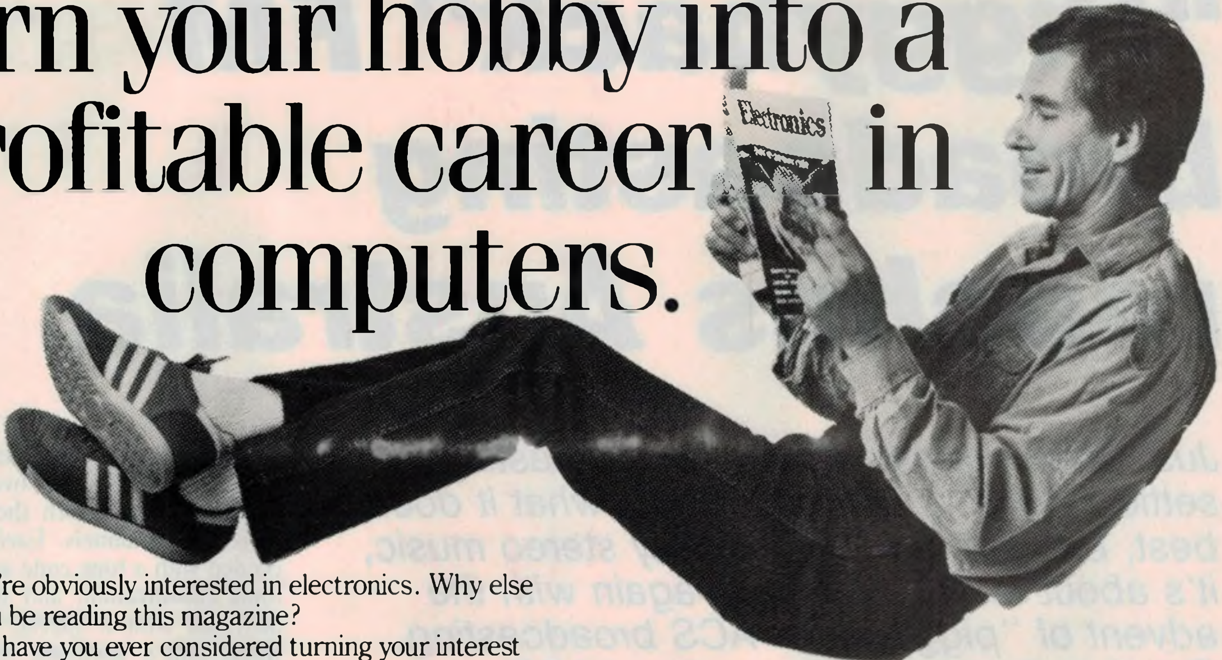

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"Piggyback" FM broadcasting reaches Australia

Just when you thought FM broadcasting had settled down to concentrate on what it does best, bringing you high quality stereo music, it's about to be shaken up again with the advent of "piggyback" ACS broadcasting. But there's no need to panic — ACS shouldn't upset your listening.

A few weeks ago, after extensive testing, the Federal Department of Communications announced that it was ready to authorise the use of Ancillary Communication Services (ACS) by FM broadcasters. This means that Australia will now be able to catch up to countries like the USA, which have been making use of this technique for many years.

In America, it's called SCA — short for Subsidiary Communications Authorization. The US Federal Communications Commission has allowed FM broadcasters to provide SCA services for over 15 years, and they are now very well established. In fact the use of SCA over there has boomed since 1983, when the FCC authorised broadcasters to run multiple SCA channels.

Don't be too worried if you've never even heard of ACS/SCA, though, because even in the USA most people probably aren't aware of its existence. That's because it isn't an enhancement for the basic FM program material being broadcast, like stereo or one of the newer noise reduction systems like FMX.

Even in the States you can't walk into a department store or electronic supplier and pick up an FM receiver or tuner with an SCA switch or output socket. They're certainly available, but not in the usual consumer outlets.

The reason for this is that ACS/SCA is a second and completely separate broadcast signal, transmitted "piggyback" on the main FM stereo signal of a station using a second subcarrier. This second signal cannot be demodulated by normal FM receivers tuned to the station's signal, and doesn't interfere in any way with normal reception (at least with modern FM receivers).

What is this second "hidden" channel used for? For a multitude of things, actually.

In the US, its main use for many years has been to distribute background music services for use in restaurants, lifts, shopping centres and offices. For this purpose it is much more efficient and cost effective than using leased telephone lines, which were the previous medium of distribution. It also frees up a lot of telephone lines for their original purpose.

Another major use of ACS/SCA is for distributing specialised news and information services, to meet the needs of business, industry and the professions.

A Physicians' Radio Network has been operating in many states of the US for nearly 15 years, using SCA channels on more than 37 different FM stations. Medicos are provided with a free SCA receiver, so they can use the PRN news and information service to keep abreast of the latest developments.

The Dow Jones financial organisation also provides a national SCA business news service, based on the resources of its Wall Street Journal. Beamed from New Jersey to a communications satellite, it is distributed all over the country to FM stations which then relay it on their SCA channels. Each item is preceeded with a tone code according to its topic classification, and subscribers are provided with a special SCA receiver fitted with a keyboard and audio cassette recorder.

The receiver can identify and record on cassette just those items of interest, by punching in the appropriate codes. This lets the conscientious US executive take the cassette and catch up on the day's financial news, on the way home in the car.

SCA has also been used to provide news and other programs for visually impaired people.

All of these services are essentially using the ACS/SCA channel to carry normal audio, either music or speech. But more recently, it has been used for carrying digital data services like conventional teleprinter/terminal news services, and Videotex.

One such service has been operating for about five years, providing commodity future prices for farmers and wholesalers in rural areas.

Now that ACS has been given the DoC go-ahead, we could see many of these services start to spring up here.

On the technical side, ACS uses a 67kHz subcarrier added to the existing FM stereo multiplex signal. So the complete composite signal used to modulate the station's carrier is as shown in Figure 1. The "piggyback" ACS signals frequency modulate the 67kHz subcarrier, well above the stereo difference signal components centred on 38kHz.

So there will now be four different components: the basic mono sum signal from 0 to 15kHz, the stereo pilot tone at 19kHz, the stereo difference signals from 23 to 53kHz and the new ACS signals from 59 to 75kHz.

The ACS signals are held at an injection level of 10%, to prevent any cross-modulation or other interference with the main stereo signal. This means that the ACS subcarrier and its modulation signal cannot deviate the main station carrier by more than plus or minus 7.5kHz. The frequency response of the ACS channel is kept to around 5kHz for audio signals, or 3600 baud for data.

To allow for the additional modulation produced by the ACS signal, and ensure that the resulting composite FM signal does not exceed the overall bandwidth of 150kHz (+/-75kHz) allocated to FM channels, the FM station is required to reduce its main channel modulation by 1.0dB. In theory this gives a corresponding reduction in received signal level and degraded signal to noise ratio, but in practice the effect is negligible.

Modern FM stereo broadcast receivers with phase-lock loop demodulators and stereo decoders completely ignore the ACS subcarrier signal, providing this is kept at the correct levels. Apparently some early FM tuners and receivers with discrete component ratio detectors may produce minor background noise effects, but very few of these receivers are still in use.

Before making the decision to authorise ACS in Australia, the Department of Communications carried out very thorough tests in conjunction with FM stations 3EON in Melbourne, 6UVS in Perth and 2DAY in Sydney. The results showed that with well adjusted transmitters and antennas, ACS services caused virtually no deterioration of normal FM stereo reception.

Needless to say, many of our FM broadcasters are looking very seriously at getting the necessary equipment to add ACS capabilities to their transmitters. Typically this costs around $15-20,000, not a huge sum compared with the cost of a complete new FM station plant.

On the licensing side, the Department of Communications is regarding ACS channels as entirely separate from the main station channels. They will require separate licences, regardless of whether the extra channel is operated by the main station licensee or a different organisation. And because ACS is regarded as a specialised communications service, rather than broadcasting to the public at large, its licences will be issued under the Radio Communications Act, rather than the Broadcasting Act.

That's the story of ACS, our latest development in FM broadcasting. For public broadcasters in particular, it looks like providing a welcome way to boost their modest incomes, by leasing out their ACS channel to a background music provider or news service.

It's also likely to provide all sorts of people in our community with many more sources of helpful information, at relatively low cost. About the only people who hopefully won't even notice its arrival are normal FM stereo listeners!

Rumour has it that one large organisation is planning an Australia-wide ACS system which would call for at least 100,000 special receivers. If this goes ahead, it would almost certainly involve local manufacturing of the receivers — another boost for the local electronics industry. Hopefully we'll be able to say more about this soon.

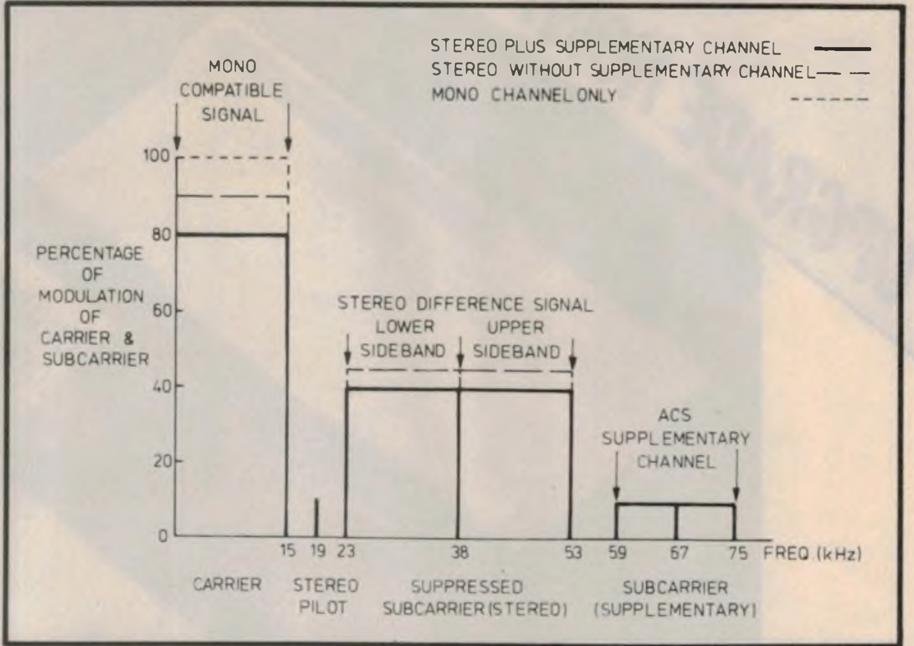


Fig.1: The complete signal spectrum for an FM stereo transmitter, showing where the ACS "piggyback" signal slots in at 67kHz.

ACS solution for FM stations

This is the Sidekick, an integrated ACS generator and processor unit made by Modulation Sciences Inc. in New York. It is very widely used by FM broadcasters in the US, to provide their transmitters with ACS/SCA music or speech capability. A matching unit, the Data Sidekick, is used to provide for ACS/SCA data capability.

Both units are crystal controlled and provide an inbuilt transmitter tuning aid and deviation monitor. As the Australian ACS standards are essentially the same as those used in the US, they are both very suitable for use here.

The local agent for Modulation Sciences is Radio Manufacturing Engineers, of Unit A, 30-32 Skarratt Street, Auburn 2144. This company can also provide ACS receivers from Johnson Electronics, also of the USA.

Our thanks to RME for this picture, and for their help in providing information used in this article.

Compact new 10MHz scope runs from batteries

Part of a new family of compact test instruments from OK Industries, the Model 1010 oscilloscope provides all of the features found in larger laboratory models but in a highly portable battery-powered package.

OK Industries has been around for a long time. Based in the Bronx area of New York, the company has become well known throughout the world for its wire-wrapping tools and other production equipment. More recently it formed an electronics division, which has been producing a growing range of practical and sensibly priced test instruments.

The latest addition to the company's instrument range is a family of compact models, which appear to be designed primarily for the service workshop or college/university laboratory. They are also likely to be of interest to the serious hobbyist.

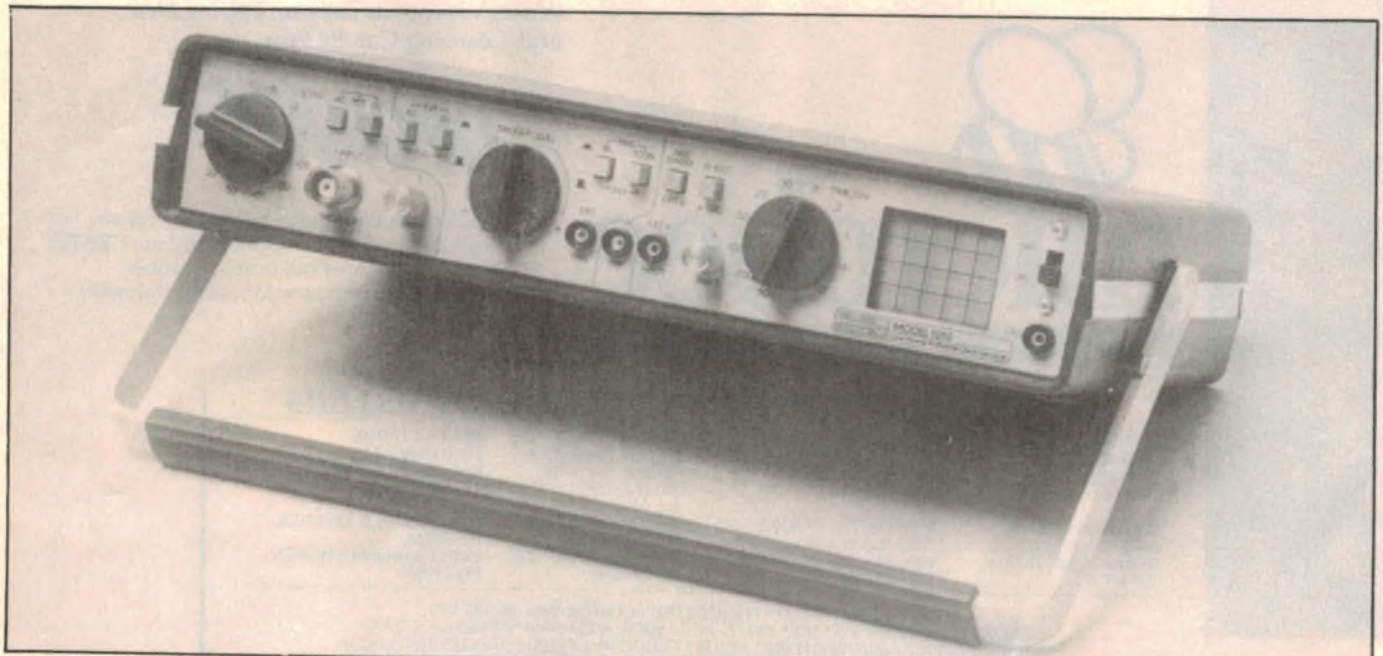
Apart from the 10MHz scope, there's a 2MHz function generator, a 5MHz pulse generator, a 200MHz universal counter, a 500MHz frequency counter and three different digital multimeters. All instruments in the family are housed in matching compact low profile cases, moulded from high-impact ABS plastic. The scope, counters and multimeters are all capable of running from either internal batteries or an external AC adaptors.

To go with the new instruments there's also an attractive mini bench rack, to hold up to four of them in a convenient assembly. OK also provides a comprehensive range of test probes and other accessories, including thermocouple probe for temperature measurement.

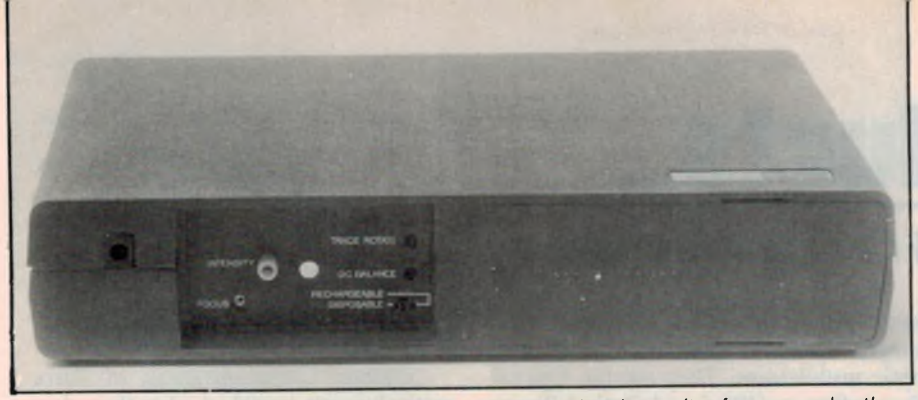
Perhaps the most interesting model in the new family is the model 1010 scope. There aren't too many battery operated scopes available, let alone any this compact and packed with features.

Naturally enough the screen isn't large, measuring only 32 x 26mm. But the trace itself is surprisingly bright and well focussed, providing a surprisingly good display even at high sweep speeds. As a result it actually seems bigger than its true size.

For such a compact instrument it sports an impressive range of features, not the least of which is a full range of triggering modes and controls. Internal or external, AC or DC coupling, TV frame or field filtering, positive or negative slope and fully adjustable — you name it. There's even a special "econ-



Although it's compact and very portable, the model 1010 provides all of the controls and facilities found on a full-size laboratory instrument. Although small, the display is crisp and bright.



Rear view of the OK portable scope, showing the intensity focus and other presets. The batteries (four C-type cells) are housed behind the cover on the right.

omy" triggering mode, to conserve the batteries by blanking the CRT until a signal is applied and the timebase triggers. Typical average power consumption in this mode is only 350mW, roughly a third of that in normal modes.

The timebase itself provides 21 sweep speeds, from 0.5s/div to 0.1us/div in the usual 1:2:5 ratios. The timebase can also be disabled, and the X amplifier used with an external input. For this purpose it has a bandwidth of DC to 2MHz (-6dB), with a sensitivity of approximately 0.5V/div and an input impedance of 1M in parallel with 10pF.

The single vertical channel provides a bandwidth of DC to 10MHz (-3dB), for one division of deflection. Sensitivity is 10mV/div, with 12 attenuator ranges down to 50V/div again in 1:2:5 ratios. The input impedance is 1M in parallel with 47pF, compatible with most standard probes. A switchable input coupling capacitor blocks any DC component and provides AC response down to 2Hz (-3dB).

Other features of the 1010 include rear controls for trace intensity, focus and rotation (to allow alignment with the measuring graticule), and a built-in calibration source of 1kHz square waves of 1V p-p.

The power supply for the 1010 is of the switch-mode type, which can operate from any DC input between 4V and 10V. The internal battery compartment accepts four C-type cells, and these may be either standard or alkaline dry batteries, or rechargeable ni-cad cells. Alternatively it can operate from an external plug-pack AC adaptor. In short it's a very flexible little unit.

Inside the 1010 there isn't a great deal of space to spare, as you might expect. Pretty well everything apart from the CRT is packed onto a set of compact PC boards. The CRT itself is wrapped with a magnetic shield, which appears to be of mu-metal or similar. It all looks quite snug, and should be able to take a fair degree of shock.

In use, I found the 1010 very convenient and easy to drive. It triggered reliably on a variety of signals, and gave every indication of being a dependable measuring tool. I'd say that OK Industries have produced a very nice little scope here — and it's cute, too!

If you're in the market for a compact scope, particularly one that is battery operated, it would have to be a strong contender. At the quoted retail price of $655.00 plus tax it also seems quite good value for money.

The review sample came from OK's Australian distributors Electronic Development Sales, of 92 Chandos Street, St Leonards NSW 2065. (J.R.)

New Products...

Signal generator covers to 2.1GHz

Elmeasco Instruments has introduced the Fluke 6062A Synthesized Frequency Generator, with signal generation capabilities from 0.1MHz to 2.1GHz. The instrument also incorporates a high-performance pulse modulator, which uses gallium arsenide switch technology for rise/fall times of 15ns and on/off ratios of 80dB. The 6062A is designed for L-band applications in avionics, communication and navigation.

The 6062A's output level is adjustable over the range of +16 to –137dBm (to 1050MHz), and +13 to –137dBm to 2100MHz. Absolute accuracy is +/- 1.5dB. Amplitude can be displayed in volts, dBm, dB, uV or dB mV.

Residual FM is guaranteed to be less than 6Hz (0.3 to 3kHz) in the frequency range of 245 to 512MHz, with –123dBc typical SSB phase noise 20kHz offset from a 500MHz carrier frequency.

For more information contact Elmeasco Instruments offices in Sydney, Melbourne, Adelaide, Brisbane and Perth.

Fibre optics test gear

Philips has developed two small, hand-held instruments for quick and simple testing of glass fibres and fibre optic installations. They are the Optical Power Source OPS-5 and Optical Power Meter OPM-6.

The OPS-5 is available in different versions: for single- and multi-mode operation, for the wavelengths of 850nm, 1300nm and 1550nm and with LED or laser diode. All power sources are power-controlled and provide high level stability.

The OPM-6 is used in the field to measure the absolute light level coming from a fibre. The instrument is the size of a pocket calculator and only weighs about 400g. It can be used for wavelengths of 800 to 1800nm. The calibration of the three most used wavelengths (850, 1300, 1550nm) are switched selectable, dispensing with the need for conversion with calibration factors. The measuring range of +5 dBm to –60 is well-suited for the power range of today's and future transmission systems.

For more information contact Philips Scientific and Industrial, 25-27 Paul Street North, North Ryde, 2113.

UHF mobile antenna

Captain Communications of Parramatta has just launched what they claim is Australia's (and the world's) most rugged gain antenna for UHF CB use. Named "The Safari Stick", it is a ground independent gain antenna for use on bull-bars, roof-bars, gutter mounts and on fibreglass vehicles.

The Safari Stick has a gain of 6dB over a normal 1/4-wave antenna mounted in the same position. It is mounted on a heavy duty barrel spring made from high grade stainless steel, with chrome plated brass end plates, making corrosion problems non-existent. The spring is designed to prevent the antenna from tilting more than 15 degrees from the vertical at a vehicle speed of 160km/hr, so the radiation pattern and gain remain virtually constant at high speed. At the same time, the spring acts as an effective shock absorber for off-road conditions.

The chrome plated brass round skirt is both attractive and rugged and is the key to the antenna's ability to operate independently of a ground plane such as the metal body of a vehicle. The mounting position on the vehicle is therefore less critical than with conventional antennas (in emergencies the antenna could even be held in the hand and still work efficiently).

Further information from Captain Communications, 28 Parkes Street, Parramatta 2150.

Low cost logic analyser

The new Thurlby LA160-PC Series Logic Analyser provides sophisticated instrument performance at low cost.

The LA160-PC has 16 data channels (expandable to 32), with a 2,000 word acquisition memory and may be used in conjunction with an IBM PC using a driver program supplied with the unit. Microprocessor disassembly is also available via the simple connection of "personality" modules for most popular microprocessors.

The built-in state domain display shows the data in any of five formats: binary, octal, decimal, hex or mixed. A full sixteen channel timing domain display is also available by connecting to any conventional oscilloscope. The maximum clock rate is 10MHz for the LA160A-PC or 20MHz for the LA160B-PC.

The LA160-PI is microprocessor controlled via an interactive keyboard, with all the set-up information being stored in permanent memory. A non-volatile reference memory is also included. This can be loaded from the acquisition memory or the keyboard and allows reference data to be stored for comparison purposes.

The inputs of the LA160 are fixed TTL level with optional high impedance variable threshold data pods being available. Other options include a 32 channel expander unit, an IEEE-488 bus analysis connector, and a printer interface for hard copy.

The LA160 weighs less than 1.8 kilograms and is compact enough to fit into a tool kit or briefcase. As such, it has an advantage over other logic analysers in portable applications.

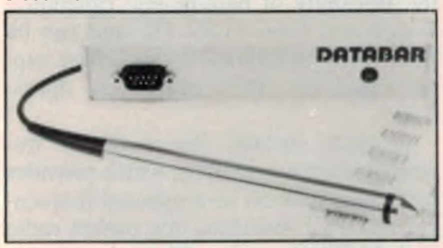
Further details from Parameters, 106 Howe Street, Osborne Park 6017.

High quality electrolytics

High quality electrolytic capacitors manufactured by Lelon in Taiwan are now available from Altronic Distributors. Lelon products are manufactured under stringent conditions in a modern factory, and are used by many of the world's largest equipment manufacturers.

Types available include PCB mount (radial), axial, PCB mount low leakage, radial bipolar and chassis-mounting can types. Values range from 1uF to 100uF for bipolar types. Normal types are available in 16VW, 25VW, 50VW and 63VW sizes, low leakage types in 16VW, 25VW and 35VW, and bipolar types in 50VW.

Full technical specs for Lelon electrolytics are available on request, from Altronic Distributors, 174 Roe Street, Perth 6000.



Bar code reader

With the release of the Model 440, Nortronic Instruments has increased performance, reduced size and lowered the price of hand held bar code readers wands. In a package smaller than a paperback book, the new reader is available for RS-232 systems and keyboard emulation on many popular PC's and terminals.

The reader is capable of reading all common codes, including Code 39, Interleaved 2 of 5, APN, Code 128 and Codabar. The reader detects which code is being scanned and decodes it automatically. A Return, Return/Line Feed, ETX or no terminator is appended and transmitted to the computer.

Other user switch selections are parity options, baud rate and inter-character delay. A series of internal jumper pins allows initial set up of a wide variety of serial handshaking configurations.

The Databar Model 440 Reader is made in Australia and is priced at up to several hundred dollars below some imported readers. Dealer and OEM enquiries are particularly welcome.

Additional information is available from Nortronic Instruments, P.O. Box 300, Brookvale 2100.

Desolder braid options

There is now a choice of desoldering braids from Scope, offering either ease of use or economy.

Scope Solder Blotter is standard desolder braid which can be wound or unwound from a plastic dispenser that helps position the braid even in awkward places.

The dispenser also lets the user keep fingers well away from the hot zone and eliminates the threat of human sweat or body oil to solder joint integrity.

Scope Tech Wick has the same high absorbancy fluxed braid, but offers the economy of a basic — no frills container.

Both products are available through electronic supply houses including Dick Smith Electronics in all states.

For further information contact Scope Laboratories, 3 Walton Street, Airport West, Melbourne 3042.

(E)Eprom programmer

The Bytek Writer-I is a low cost fully standalone (E)Eprom multiprogrammer. (E)Eprom programming is achieved internally within the main unit. All voltages and waveforms required are generated under software control. No personality modules or adapters are required.

The Writer-I provides serial data input and output through its RS232 port. Both down-loading and uploading to a host computer are supported.

Features include a single 28-pin ZIF socket,30-key full travel keyboard and 6 character 0.6" 7 segment LED display.

Further information from Scientific Devices Australia, 2 Jacks Road, South Oakleigh 3167.

Knobs for instruments, appliances

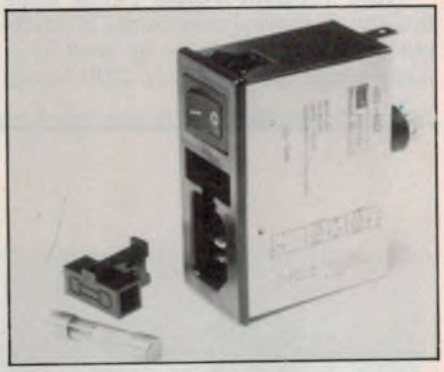
A complete range of control knobs with four shaft fixing systems is available from Crusader Electronics.

The knobs are suitable for shaft diameters of 3mm, 4mm, 6mm metric and 1/2", 1/4" imperial. They can be supplied with collet, grub screw, push on with tension spring for knurled shafts, or push on with rubber friction ring for use with smooth shafts.

Supplied in a comprehensive range of colours and designs, including diamond aluminium finish, the knobs are manufactured to the highest standards. Designs to customers specifications can be supplied, subject to minimum order levels.

Included in the range is a complete assortment for gas cookers, electric cookers, washing machines, dishwashers, electric heaters, thermostats, timers and small household appliances.

For further details contact Crusader Electronic Components, 81 Princes Highway, St Peters 2044.



EMI filters

Most EMI (electro-magnetic interference) filters fitted to electronic equipment are normally an integral part of the socket, the power switch being located elsewhere. A new product recently introduced by J.A. Severn is a composite power line socket module that includes both filter and switch.

The socket is a standard 3-pin IEC connector, suitable for 250V AC and the switch is capable of switching 6 amps. Common mode insertion loss at 10MHz is claimed to be greater than 40dB and, in normal mode (line-to-line) greater than 60dB.

The module is designed for panel mounting and standard connection is by 6.3mm quick-connect terminals.

Further details of the EMI 7103 series power line socket module is available from J.A. Severn, P.O. Box 129, St Leonards 2065.

New Products...

Multistandard TV test pattern generators

Testing of VPS-equipped VCRs has been simplified by introduction of special versions of the PM 5515 and PM 5518 multistandard TV colour pattern generators, from Philips Test & Measurement. All instruments in the PM5515 family now cover Hyperband cable channels H21 to H40 (300 to 470MHz) as standard. US cable TV companies have used the Hyperband for some years and it is being adopted rapidly elsewhere in the world as cable demands grow.

Video Program System (VPS) facilities are of growing importance in northern Europe, particularly in West Germany where the ARD and ZDF broadcast companies already supply special signals on line 16 in the vertical blanking interval to set up, start and stop suitably equipped video recorders automatically.

The VPS versions (PM 5515-TXS and PM 5518-TXS) provide a choice of up to nine coded signals. Unique facilities include on-screen display of the codes and the possibility for the user to program the generator to set codes locally if required. Both instruments also allow verification of Teletext and PAL stereo televisions; the PM 5518-TXS offers Antiope checking as well.

Over 70 test pattern combinations are provided by the already existing versatile units, with accurate digital electronic RF frequency selection over the full 32 to 900MHz range. Coverage includes S1 to S10 and S11 to S20 and now Hyperband cable channels H21 to H40.

The microprocessor-controlled generators are particularly easy to use with pattern selection and RF setting on a multifunction front panel keyboard. Up to ten RF frequencies or television channels can be stored and recalled together with any desired pattern and sound modulation.

The PM 5515 meets both PAL and NTSC standards, the PM 5516 works to SECAM while the PM 5518 handles all three. Instruments can operate on CCIR and RTMS TV standards to both PAL and NTSC chroma standards or to SECAM standards.

Further information from Philips Scientific and Industrial, 25-27 Paul Street, North Ryde 2113.

Two-metre mobile transceiver

The Icom IC-275A two metre transceiver offers all-mode operation, plus the flexibility of base/mobile capability. It operates from 13.8V DC and can be fitted with an internal mains power supply rated for 100% duty cycle operation.

Features include direct digital frequency synthesis (DDS), which provides fast (5ms) lock-on to a selected frequency; fast PTT switching for packet radio and AMTOR modes; 99 user programmable memory channels storing frequency, mode, duplex direction and offset; and advanced remote control functions.

Four separate scanning functions provide easy automatic monitoring of selected band segments or the entire 2m amateur band: memory scan, mode-selective memory scan, programmed scan or skip scan.

The use of a 3SK121 disk-type GaAs-FET front end provides low noise, high gain RF amplification. The receiver section also features a balanced mixer using 2SK125 junction FETs for increased sensitivity and wide dynamic range.

Transmitter power output is continuously adjustable from 2.5 to 25 watts under front panel control. For higher power applications, the IC-275H version provides continuously adjustable output up to a beefy 100 watts. Spurious output rejection is better than 60dB below peak power output, while carrier suppression and unwanted sideband suppression are better than 40dB below peak output.

The Icom IC-275A/H is on display now at authorised Icom dealers. For more information contact Icom (Australia), 7 Duke Street, Windsor 3121.

Power conditioners

The latest addition to the Topaz range of power conditioning equipment is the 3kVA Line 2 high peak current power conditioner. This model, as with the smaller 12kVA and 1kVA models, is specifically designed for personal

computers, minicomputers and other power sensitive equipment, with the added bonus of being able to offer a greater load handling capacity.

The conditioner provides voltage regulation via a high speed microcomputer controlled electronic transformer tap changer, featuring zero current switching. Very high electrical noise suppression (130dB) is achieved by an ultra isolation transformer and filter.

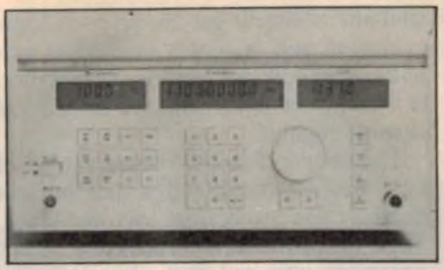
The one-cycle peak current rating is 14 times rated current. This allows the full steady state rating of the conditioner to be utilised with switching and series regulated DC power supplies, which typically draw a high current pulse at the peak of the voltage waveform.

The attractively styled, compact unit has the over-current circuit breaker and input-output terminals conveniently placed at the rear of the unit.

Further information is available from Online Control, Unit 2/7 Waltham Street, Artarmon 2064.

2200MHz signal generator

The Wavetek Model 2520 is claimed to be the first 2GHz signal generator to use modern single-loop phase-lock technology and a low frequency direct digital synthesizer to provide outstanding

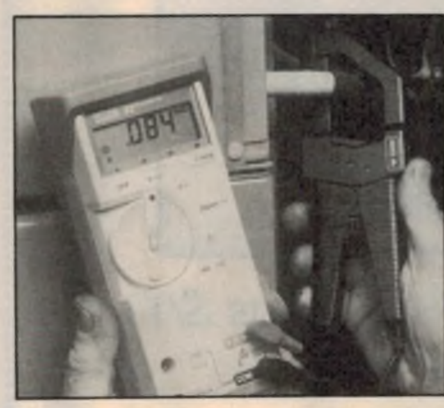


performance at a modest cost.

Internal and external AM and FM modulation capability are standard. Internal rates of 400Hz or 100Hz may be combined with an external source for AM on FM or FM on AM complex modulation. FM deviation of 1MHz or greater is available over most of the frequency range of the 2520. Several standard modulation options provide for phase, pulse and FSK modulation.

A broad range of output power from 137dBm to +13dBm makes the 2520 suitable for driving high level mixers, or making low level receiver sensitivity tests with a resolution of 0.1dB throughout the full range of output level.

For further information contact Scientific Devices Australia, 2 Jacks Road, South Oakleigh 3167.



Clamp on current probe

Elmeasco Instruments has announced the release of the Fluke model 80i-1010 clamp-on current probe. This accessory is designed for use with a digital multimeter and can accurately measure AC current to 700A and DC current to 1000A.

In use, the probe clamps around the conductor and senses the magnetic field produced by the current flow. A feature of the 80i-1010 is a thumbwheel zero control which allows the user to compensate for residual core magnetism in the clamp.

For further information contact Elmeasco Instruments Pty Ltd, 15 McDonald St, Mortlake, NSW 2137. Telephone: (02) 736 2888.

Sony's new CDP-C10 CD

Following the success of their disc jockey compact disc player for the car, Sony has now released a new unit for the home — the CDP-C10.

The CDP-C10 has a built-in changer for the 10-disc magazine. The magazines are interchangeable with the CDX-J10 disk jockey unit, allowing the user to take a compilation of discs from car to house without removing the discs from the magazine.

Features of the new player include 20 track RMS (Random Music Select) and direct assess of playing selections via the 21-key pad wireless infrared remote control.

The suggested retail price of the CDP-C10 is $1,599.

For further information contact Sony (Australia) Pty Ltd, 33-39 Talavera Road, North Ryde, NSW 2113. Telephone: (02) 887 6666.

Optical inspection system

A new optical inspection system for printed circuit boards, artwork, surface mounted devices and soldering has been devised by Westinghouse Systems.

The Vista VX optical inspection systems consists of variable magnification in the range of 5 to 10 times and a low glare projection screen that can be viewed by more than one operator at a time. The usual eye strain experienced when using microscopes is eliminated.

The workpiece being inspected is quickly fitted into the special carrier which is moved manually for instant inspection along its free lateral axis. This, together with the Y axis indexing system, makes for quick and accurate inspection. Any fault can be repaired or marked for rework. The 10 times magnification enables a detailed investigation where faults are found.

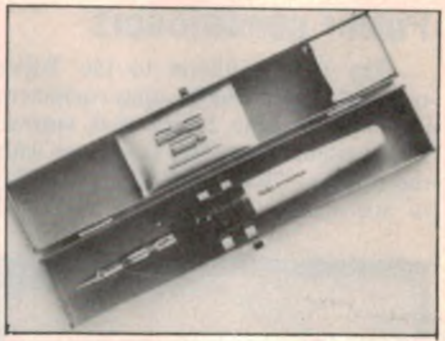
For further information contact Westinghouse Systems, 80-86 Douglas Parade, Williamstown, Vic 3016. Telephone: (03) 397 1033.

New Products...

Gas powered service tool

Weller's new Pyropen is a liquid butane gas powered "cordless" service tool with adjustable temperature facility, which can be used effectively for a wide range of soldering, brazing or shrinking jobs. Comparable in size to conventional soldering irons, the tool contains sufficient gas for up to 3 hours operation and is simply refilled in seconds using a liquid butane gas cylinder, in exactly the same manner as filling a cigarette lighter.

The Weller Pyropen has a choice of 17 different long-life tips and hot air nozzles for soldering or shrinking. These incorporate a catalyzer, which generates infra-red and ultra infra-red radiation to provide the necessary hot-air temperature, 200-450°C for soldering and up to 700°C for shrinking tubing or for fusing or melting acrylic and vinyl materials.



When used as a brazing tool, the ignition vents are simply opened by pushing forward a button on the handle and the gas is ignited with a lighter. This produces an adjustable flame temperature of up to 1300°C.

The Pyropen comes in a robust metal carry case with nozzles, sponge for cleaning tips and tool stand. The tool can be replaced in the box when still warm.

For further information contact your local George Brown or Protronics outlet or George Brown Group Marketing Division, 456 Spencer Street, West Melbourne. Telephone: (03) 329 7500.

Software education by cassettes

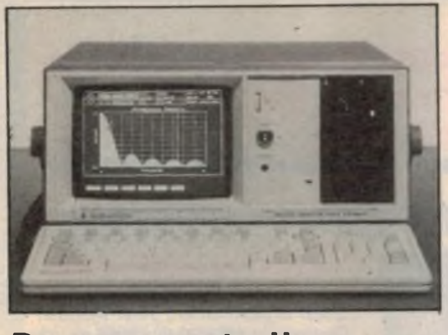
Until now, the only way to master software programs has been to take expensive training courses or spend perhaps weeks wading through volumes of manuals.

Two innovative and highly experienced Perth educators identified this problem and set about to design a system which would inexpensively lead to a solution. *Listen & Learn* is the fruit of their four years labour, the first audio self instruction cassette system.

The system consists of four cassette tapes plus an easy to follow, colour coded instruction manual which takes the user, step by step, through all the functions of the program. This enables one to master the most complex programs in as little as ten to twenty hours, in the user's own time and at their own pace.

The Listen & Learn library, at present, covers Lotus 1-2-3, Multimate, dBase III, Plus, MS—DOS, Wordstar and Displaywrite3 and many more titles will be available in the near future.

Listen & Learn is distributed in Australia exclusively through Dick Smith Electronics.



Process controllers

Two new members of the Rohde & Schwarz process controller family are the PCA12 and PCA15. These are extremely powerful 16-bit desktop computers and, when used as instrumentation controllers in highly demanding measurement and test systems, afford short computing times and comprehensive mass storage for flexible and efficient data processing.

The PCA's are accommodated in a rackable, sturdy 19" cabinet, in which particular attention has been paid to active and passive immunity to RF interference. RF shielding ensures that correct measurement results are obtained even with low RF and AF signals.

The PCA12 and PCA15 incorporate a 80286 CPU as the main processor with an 80-bit arithmetic processor 80287 supporting the CPU thus speeding up calculations many times over. A parallel 80186 processor is provided for all the I/O operations, releasing the main processor from time-consuming I/O operations. The 1-Mbyte RAM with parity error detection has more storage capacity than most personal computers.

The built-in floppy disk drive stores 1.2 Mbyte and is conveniently managed by the operating system MS-DOS 3.1. A second floppy disk drive and a 21.3 Mbyte Winchester drive are optionally available for integration to enhance the memory capacity. For use in measurement engineering, the PCA12 and PCA15 feature high-resolution monochrome graphics with 640 x 480 pixels.

Further information from Rohde & Schwarz Australia, 13-15 Wentworth Avenue, Darlinghurst 2010.

24-Track audio mixing console

British manufacturer of professional mixing consoles, Soundtracs has released its CP6800.

Designed for recording studios, video post production, broadcast theatre and on-air, the CP6800 is a fully modular split analog console with microprocessor based digital routing.

The benefits for multi-track recording include the automation of mutes and routing (FX sends) which enable 60% of mixing work to be carried out automatically.

The CP6800 is also well suited to stage and theatre production, as all routing can be programmed during rehearsals for recall at the performance. For television, the mix can be programmed "off-air" and synched to the house SMPTE clock for automatic control "on-air".

The main features of the CP6800 include SMPTE/EBU time code triggering of patches, events and muting, and automatic muting of groups and monitor. The console is controlled through an integral computer module consisting of a keyboard and monitor. "Fail Safe" and "Help" features add to ease of operation.

For further information contact Amber Technology, Unit 6, Forestview Park Estate, Frenchs Forest 2086.

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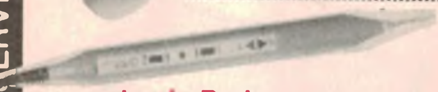
Altronics Will Deliver Any Of These Quality Products To Your Door Faster Than Any Other Australian Supplier Or Your Money Back

(Within 24 Hours To Every Capital City and Suburbs - Allow Additonal 24 - 48 Hours For Country Areas)



Logic Probe

20MHz Model

Max.Input Frequency 20MHz. Input Impedance 1M ohm. Operating supply Range 4 volt minimum. TTL Logic 1 Hi LED greater than 2.3 volts. Logic O Lo LED less than 0.8 volts. CMOS Logic 1 Hi LED greater than 70% Vcc. Logic O Lo LED less than 30% Vcc. Minimum Detectable pulse width 30 nano seconds. Maximum signal input 220V AC/DC (for 15 secs.) **Cat Q 1272**

Was $34.95 Now $29.95

Mini Bench Vice

Direct Import Price Quality Die Cast Allow **Cat. T 2365**

$8.95

The Simply Magic Third Hand

PCB Holders

We never ever used to like to hear of anything 3rd hand - until of course we tried out these fantasmagorical PCB board holders. Each unit grips the PCB by means of crocodile clips enabling you to build or service your projects with total convenience.

Two Models

(Both, we believe, a dollar or two cheaper than D . . . . . . .H)

T 1450 No Magnifier **$9.50**

T 1460 Inc.Magnifier **$14.95**

Heavy Duty Unit Suitable For Boards Up To 400mm Long

Solder

200g Reel

$7ea

10 or More **$6**

Alarm Stickers

WARNING

ALTRONICS SURVEILLANCE ALARM SYSTEM FITTED HERE

For Home or Office

S 5400 200mm x 75mm $2 **$1**

Rugged Ultra Quiet- Now With Metal Diecast Frame

240V High Specification Computer Fans

Durable Die Cast Aluminium Venturi PBT Plastic impeller of 94V—0 material. Shaded pole motor.

80mm x 80mm x 32mm

Air Flow 45 C.F.M. **Input Power** 16W **Speed** 2300 RPM **Noise Level** 31 dba. **Cat. F 1020**

$24.50ea 4 or More **$22.50**

120mm x 120 x 38mm

Air Flow 80C.F.M. **Input Power** 25W **Speed 2600 RPM Noise Level** 43 dbA. **Cat. F 1030**

$24.50ea 4 or More **$22.50**

Fan Finger Guards

F 1022 (for 80mm Fan) **$1.50**

F 1032 (for 110mmFan) **$1.50**

Piezo Tweeter 150W

95.3mm Diam. Piezo Speaker Suitable for HiFi applications. **Frequency Response:** 3K to 40KHz **Sensitivity:** 104db @ 2.8V **Cat. C 6100**

$16.95 4 Up **$15**

150W HiFi-PA Piezo

144.8 x 54mm Rectangular Piezo Horn Speaker suitable for HiFi and Sound Reinforcement. Full 90 deg. horizontal dispersion angle • **Freq.Res.** 3 to 40KHz • **Sens:** 110db @ 2.8V **Cat. C 6120**

$18.95 4 Up **$17**

Horn Relay

12-16V coil 20 Amp Contacts . **S 4130**

1/2 Price $3.75

Solar Cell Module

.4V at 450mA

Great experimenters Solar Module. Connect in parallel or series as you wish. Terminal strap enables easy interconnection to other cells

A 0210 Value **$4.98**

10 cells or more **$4.75**

Solar Charger

Charges up to 4AA Nicads by simply placing in sun light. (we recommend placing on the inside window ledge in the extreme heat of summer). Will charge from dead flat to fully charged in 8-10 hours average sunlight.

Take Care if charging inside car e.g. on dash board etc. — ensure car inside is well ventilated — remember midsummer inside car temperatures can be extreme.

A 0230

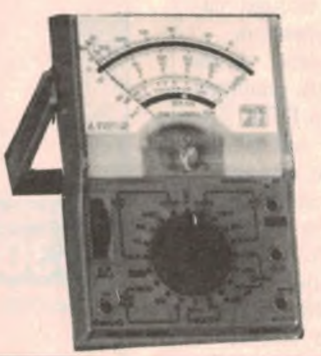
$14.95

Engineers Multimeter

$10 Off This Month

Includes Continuity Buzzer

20,000 Ohms/Volt DC • 8,000 Ohms/Volts AC. Mirror backed scale • Overload protected. 10 amp DC current range. Unique carry handle doubles as a bench stand.



RANGES

DC Voltage 2.5, 10, 50, 250, 1000V

AC Voltage 10, 50, 250, 1000V

Decibels —8db to +62db

DC Current 5, 50, 500mA

Ohm meter 0-6 meg. Ohms in 3 ranges,50 Ohms centre scale.

Size 135 x 91 x 39 mm

Includes Battery Tester

Q 1018

Normally $39.95

Now $29.95

Check Appliances And Electrical Wiring

Build This 1000V Megohm Meter

(1985 Successor to the "Megger")

It uses a transistor inverter to produce a regulated 1000V DC supply which is applied to the insulation under test. Insulation resistances between 2M Ohm and more than 2000 Ohm can be measured. **K 2550** (See EA July'85)

Just $55

Manufacturers, Contractors, Resellers Visit Our Wholesale Booth At The Sydney IREECON Exhibition September 15th — 18th at Sydney Show Grounds

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Get a System for Mum and the Kids
Full Security System

Fantastic system for this price. Frankly we were amazed at the performance of this very compact system.

Very simple to connect and operate - New Technology has enabled very compact overall dimensions (master unit only 180 x 100 x 65) hence ideal for concealing amoung book shelves etc.

S 5310 ~~$99~~ **$75**

Look At The Features

EXIT DELAY 30-35 secs. **ENTRY DELAY** 10 secs. **DC SOURCE** AC adaptor 240/9V DC Supplied **BATTERY BACKUP** 9V Nicad rechargeable- additonal cost S5024 $14.50. **AUTO RESET** 3 minute operate cycle and auto reset **RANGE** Reliable to 30ft (9M) **LOW BATTERY INDICATOR** included.

Accessories Included for the One Low Price

4 Sets Reed Switches for Window/Doors. 1 Roll fig. "8" cable. 1 External Type Horn Speaker. 1 AC/DC plug pack adaptor. Now there is now excuse for not Protecting yourself, your family and all your hard earned possessions!

Strobe Signal Lamp

Uses Xenon Strobe tube for High energy strobe flash output at a rate approx. 1 per second.Fantastic light energy output for the DC power used. DC input 12V 320mA Dimensions 97 dia.90H

S 5455 Blue **$19**
Were $24.50

Fantastic Multipurpose Nicad Battery Charger

Charges every concievable size nicad from AAA through to 9V

M 8010 **$27.50**

Sealed Lead Acid Batteries

These rugged high performance batteries are ideally suited for systems where uninterrupted DC power is required i.e. Security Systems, Computers, Solar Power Systems etc.

Three Models To Choose From

S 5065	12V/1.2AH	**$22.95**
S 5067	12V/2.7AH	**$34.50**
S 5069	12V/4.5AH	**$45.00**

Mains Transformer Bargains

Great For All Sorts of Projects

M 2851 240 — 12.6V at 150mA

Was $5.50 Now $4.99

M 2155 240V—6.3V,7.5V,8.5V, 12.6V, 15V at 1A

Was $7.95 Now $6.00

Quality Long Life Hand Tools

All stainless steel construction with insulated handles. Ideal for the hobbyist and tradesman alike.

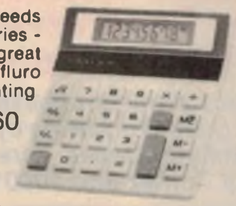
Diagonal Cutter	T 2700	**$9.95**
Flat Nose Plier	T 2710	**$9.95**
Needle Nose Plier	T 2720	**$9.95**
Curved Needle Nose Plier	T 2730	**$9.95**

Buy the set of 4 for Only $30 and Save

Solar Desk Calculators

Never needs batteries - works great under fluro lighting

X 1060



Brilliant Little Solar Credit Card Calculator With "Positive Feel" Rubber Keypads

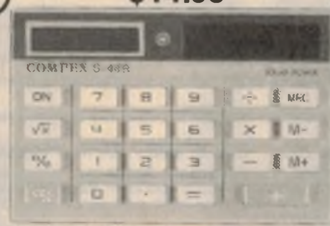
(Allows fast error free operation)

Runs Forever Without Batteries

Operates free from the sun or fluro light. Full 8 digit 4 function calculator. Positive push button keys. **Cat. X 1050**

All This in Credit Card Size ***Incredible***

$14.95



New Model IRD Has Fantastic Range

Infra Red Movement Detector

With Two Mode Lens

Features:

- Lens simply 'snaps' to either **wide angle** (range 40 feet) for normal use or **Normal angle** (range 80 feet plus) for corridor applications.
- Snazzy integral mounting bracket allows corner 90 deg. mounting as well as normal surface mount (This is a fantastic feature as these work best in corners and are visually unobtrusive)
- 12V DC Powered
- Built-in test lamp
- Alarm output SPDT 30V 1a

S 5301

Why Pay $150 or More

Our Price **$99ea**

10 or More **$90ea**

N.B. These professional detectors use state of the art circuitry to achieve ultra reliability in operation. They are currently specified by several "Name" commercial Security Companies.

Fantastic for Heatsink Cooling with Amplifiers, Power Supplies, Inverters etc.

New

DC Brushless Fan

Electronically commutated DC motor ensures low vibration and ultra long life

120mm x 120mm x 38mm

Voltage	24V DC
Current	330mA
Speed	3100 RPM
Air Flow	23 C.F.M.
Noise Level	32dbA

F 1040 .... **$29.98**

4 or More **$28.00ea**

Radar Sensation

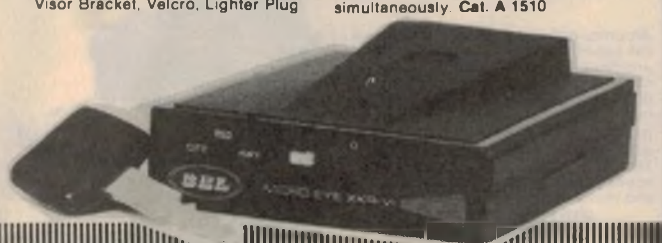
Incorporates exclusive superheterodyne Horn Microstrip hybrid circuitry.

Was $399
Now $349

Accessories Included
Visor Bracket, Velcro, Lighter Plug

Features:

- Separate audio alerts for X and K bands.
- RSD (Radar Signal Discriminator) switch eliminate extraneous signals with an LO and LR positions. The amber LED pulses to indicate LO and LR positions.
- Alarm: Red LEDs will light up in sequence as signal strength increases. When all Red LEDs are lit and signal strength continues to increase, all Red LEDs will flash simultaneously. **Cat. A 1510**



Magazine Binders for Your EA's and ETI's

Holds 12 magazines, each on a spring out wire rod. Just the shot for each years set of EA's ETI's or any of your favourite magazines. **Cat. B 9999**

$8.50

Phone Double Adaptor 1/2 Price

P 0995 **$4.50**

High Definition Computer Monitor New 2 DIN Series 4

The New 2 DIN Computer Monitor has a high performance Non Glare CRTdesigned to reduce eye strain and improve concentration. Coupled with the non-glare screen is a rock solid Video display and high resolution characters.

SPECIFICATIONS:

Screen	Green Phosphor - Non glare 14
Front Controls	Power On/Off, Contrast, Brightness
Rear Controls	Vertical size, vertical hold.
Bottom Controls	Horizontal hold, horizontal position.
Input Impedance	75 Ohm/10K switch selectable
Bandwidth	18MHz
Resolution	900 lines at centre screen
Input/Output Connector	RCA
Input	Composite Video 1V P-P

D 1115 **$229** This Month **$199**

Definitely Australias Best Value In a High Resolution Monitor

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Superb Eleco Wireless Microphone System uses Dual Diversity Receivers for Long Range, Noise Free Pure Fidelity Reproduction.

Now Available In Australia For Less Than $1,000

Altronics proudly release the Eleco System - Used Worldwide by Entertainers i.e. Rolling Stones, Dire Straites, Tina Turner and 1000's more!

Amazing Range of Over 200 Metres in typical applications

Superb Microphone Reproduction Compares with Shure, Beyer and AKG

Unique Microphone design completely Eliminates "Dangling" Antenna

Breathtaking performance without signal drop-out or noise interference. The Eleco Wireless Microphone System is virtually the ultimate in an Entertainers Microphone system (or for any roving microphone application for that matter!)
All the annoying wireless microphone characteristics such as "drop out", static and noise are completely eliminated by use of **auto switching dual diversity receivers.** The output of each receiver is continually monitored, with the strongest and clearest signal always selected. **Dynamic Range exceeding 100 db** is obtained by employment of a Patented special Parabola level compressor and Dynamic expander.

The operating range is a minimum of 50 metres (often this can be extended to 200 metres and more in normal circumstances)

Several Frequencies are available to aleviate cross interference when two or more systems are used in proximity.

Brief Specifications Frequency 202.1, 202.9, 203.7 MHz (Please specify if you have a preference)
Mic Carrier Power 50mW (Max) **Mic Antenna** built-in **Dynamic Range** over 100db **S/N Ratio** better than 90db **Frequency Response** 20Hz to 16KHz + or - 3db **Mic Battery** 4 x AA cells **Battery Life** over 24 hours continuous operation. **Receiver Sensitivity** 12db/micro volt for 60db S/N ratio **Pre emphasis/De emphasis** 50us. **Receiver output** unbalanced 6.3mm phone jack and balanced 3 pin cannon type. **Output Level** (adjustable) Unbalanced 0-2.5V Balanced O to + or - .3V into 600 ohms. **Receiver Power Supply** 200 - 260VAC.

Prices
(A) Dual Diversity Receiver **$729.00**
(B) Entertainment Microphone (hand held type) **$349.00**
(C) Lavalier Type Microphone **$349.00**

Bonus Offer SAVE $78 **Choose Receiver and Either Microphone For Just $999**

Please Note 3 different operating frequencies are available (you will need to specifically nominate desired frequency only if the equipment is being used in proximity with other Eleco Systems on the 200MHz band.

Frequencies

C 0111	Dual Diversity Receiver	202.1MHz	**$729**
C 0113	Dual Diversity Receiver	202.9MHz	**$729**
C 0115	Dual Diversity Receiver	203.7MHz	**$729**
C 0121	Entertainment Microphone	202.1MHz	**$349**
C 0123	Entertainment Microphone	202.9MHz	**$349**
C 0125	Entertainment Microphone	203.7MHz	**$349**
C 0131	Lavalier Microphone	202.1MHz	**$349**
C 0133	Lavalier Microphone	202.9MHz	**$349**
C 0135	Lavalier Microphone	203.7MHz	**$349**

AT LAST Design Quality Weather Proof Speakers And Sound Columns By *Redford*

• Rugged extruded aluminium construction • Superb powdercoat industrial paint finish • Engineered in Australia • Excellent reproduction • Superior to imports — Yet just a fraction of the price!

Altronics proudly announce the release of the superb ***Redford*** Weatherproof Speaker and Sound Column Range. Imagine a wide range speaker system which is highly directional and with efficiency approaching that of reflex horns!

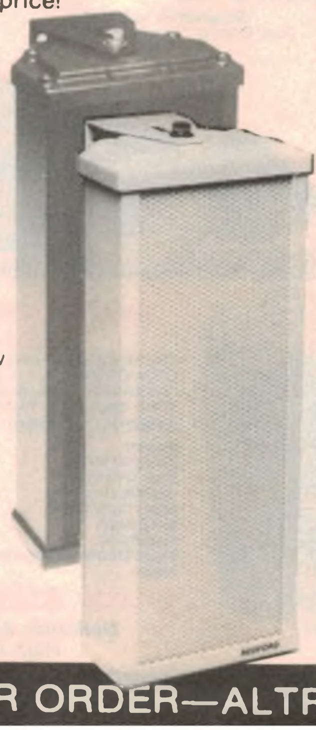
Redford is the solution for high quality sound reproduction outdoors. The Five Models to choose from "Fill the Bill" from applications on boats to high grade paging and music entertainment installations.

RUGGED EXTRUDED CONSTRUCTION

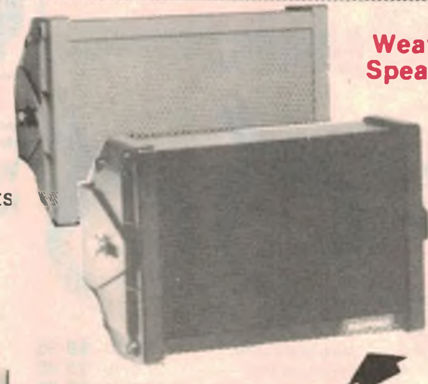
These vibration free enclosures are constructed from die extruded heavy gauge aluminium and finished with incredibly durable industrial powdercoat enamel. The speaker ends are sealed via gaskets and tough moulded "LURAN S" UV resistant end caps. The end result is "Good Looks" together with assured rugged durability for the Australian environment.

EXCELLENT REPORDUCTION

The drivers have been chosen for wide range, low distortion, mid range "presence" (essential for high grade vocal work) and high efficiency in general. **Power Capacity** for short term use, the drivers will safely handle 150% of rated power. Acoustic wadding is used to dampen Bass resonance. **Weather Proof Construction and use of "Doped Cones"** Foam plastic and cloth is sandwiched between Baffle and Front Grill to prevent water ingress. A first for ***Redford*** is the use of a patented cone moisture repellant process for all models.



Wide Range Weatherproof Extension Speakers For Your Stereo System



Great For The Back Patio, Swimming Pool, Games Room, Den, Pool Room Etc.

Dimensions 260mm wide x 170mm high x 150mm D. (Mounting brackets are included)

10 Watt 16 Ohm (Max 15 Watt)
Single dual doped cone driver 16 ohm impedance is employed to give a generally correct volume balance with main speakers - an added bonus is your amplifier load is kept to respectable limits!! Great for back patio, Den, Boat Deck etc.

C 0938	White	**$99ea**	**$190 per Pair**
C 0940	Black	**$99ea**	**$190 per Pair**

20 Watt 8 Ohm (Max 30 Watt)
Use 2 special dual doped cone drivers for those wanting a bit more umph!

C 0943	Black	**$139ea**	**$260 per pair**
C 0944	White	**$139ea**	**$260 per pair**

100 Volt Line Models For Use With Professional PA And Music Systems
Using a "Doped" wide range drivers and fitted with grain oriented steel line transformer Output cable allows connection to 10W/5W/2.5W with 10 watt models, 20W/10W/5W with 20 watt models and 40W/20W/10W with the 40 watt versions.

C 0941	**10W/100V line Black**	$119ea	$220 per pair
C 0942	**10W/100V line White**	$119ea	$220 per pair
C 0945	**20W/100V line Black**	$169ea	$299 per pair
C 0946	**20W/100V line White**	$169ea	$299 per pair
C 0950	**40W/100V line Black**	$225ea	$399 per pair
C 0955	**40W/100V line White**	$225ea	$399 per pair

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Save Up To 50% On Top Quality D Series Connectors!
Fantastic Value

D Series Computer Connectors. Gold Plated Professional Series

Items Marked • are 1/2 Price or Less

DB9

	Were	Now
P 3000 Male 9 Pin	2.95	1.95
P 3010 Female 9 Pin	3.25	1.60•
P 3020 Male PCB Rt/L	3.75	3.60
P 3030 Fmale PCB Rt/L	4.50	3.25
P 3040 Male PCB mnt.	2.95	2.85
P 3050 Fmale PCB mnt.	3.95	3.25
P 3090 Backshell cover	1.95	1.29

DB15

	Were	Now
P 3100 Male 15 Pin	3.25	2.50
P 3110 Fmale 15 Pin	3.85	1.90•
P 3120 Male PCB Rt/L	4.35	2.95
P 3130 Fmale PCB Rt/L	5.50	2.75•
P 3140 Male PCB mnt.	3.85	1.90•
P 3150 Fmale PCB	4.85	2.40•
P 3190 Backshell cover	2.20	1.10•

DB25

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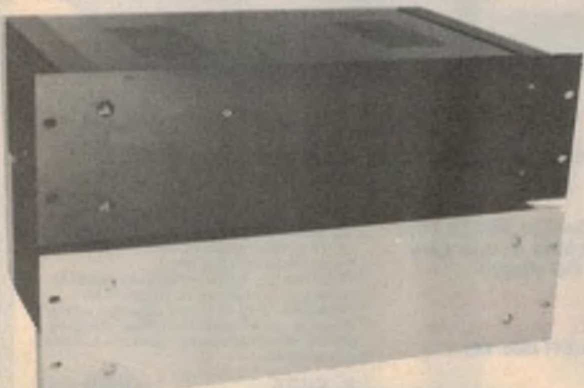

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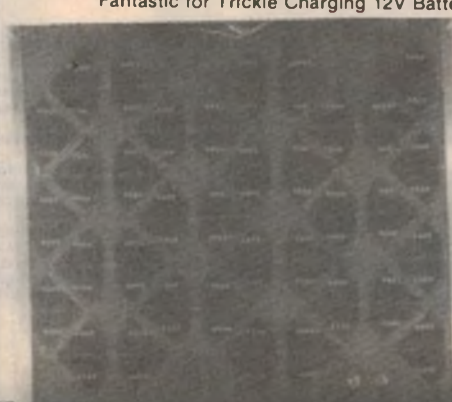

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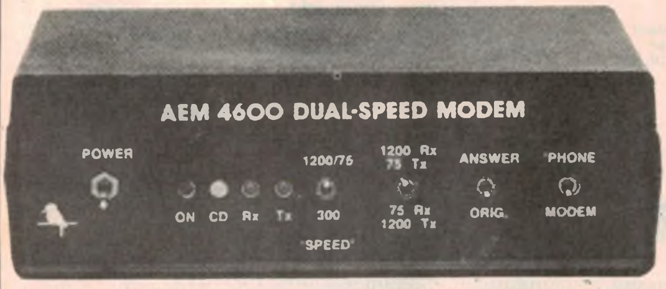

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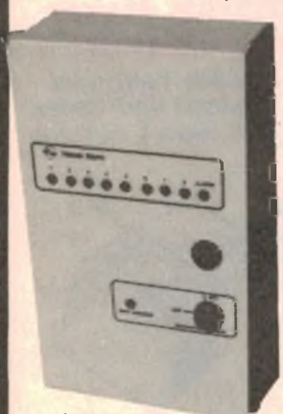

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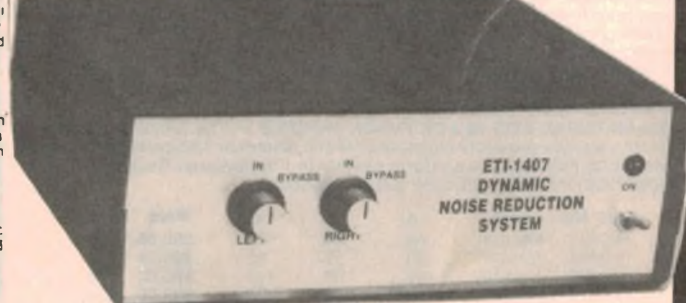

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The complete PAL colour TV receiver (1)

Now that we've looked at the basic concepts involved in PAL colour TV encoding, transmission, reception, decoding and display, we are in a position to analyse the operation of a typical PAL colour receiver in more detail.

by DAVID BOTTO

Before considering the complete circuitry contained in a PAL colour receiver, we'll first take a look at the basic schematic of a standard 625 line monochrome receiver. This will assist us as we discuss the additional circuitry needed by the PAL colour receiver.

In the block diagram shown in Fig.1 the basic arrangement of the monochrome TV is shown. The block diagram of Fig.2 shows the additional circuitry of a PAL colour receiver.

During the transmission of a television programme the energy radiated by the TV station is in the form of an electromagnetic field. When this energy reaches the TV receiving antenna via the transmission path, an electrical signal is extracted. This signal is then fed down through the antenna cable to the TV receiver.

In the receiver the signal is taken to an RF tuner. The tuner is used to select the desired television programme broadcast from among the other received signals present at the TV antenna socket.

Fig.3 shows the total station channel bandwidth used in Australia, together with the signal information arrangement.

The received signal is amplified by the signal frequency circuitry in the tuner. Since modern TV sets operate as superheterodyne receivers, the tuner contains a local oscillator which beats with the received amplified station frequency signal.

Two intermediate frequency signal IF are produced, one carrying the vision signal, the other the sound signal. For Australia the vision IF signal is 36MHz and the sound signal 30.5MHz. Notice that the two signals are separated by 5.5MHz. In Britain the vision IF frequency is 39.5MHz and the sound IF frequency 33.35MHz — a separation of 6MHz.

Both vision and sound IF signals pass through and are amplified in the vision IF stages.

The circuit of Fig.1 includes an automatic gain control (AGC) circuit. This is needed because when changing from one TV station to another the signal strength of the received programme

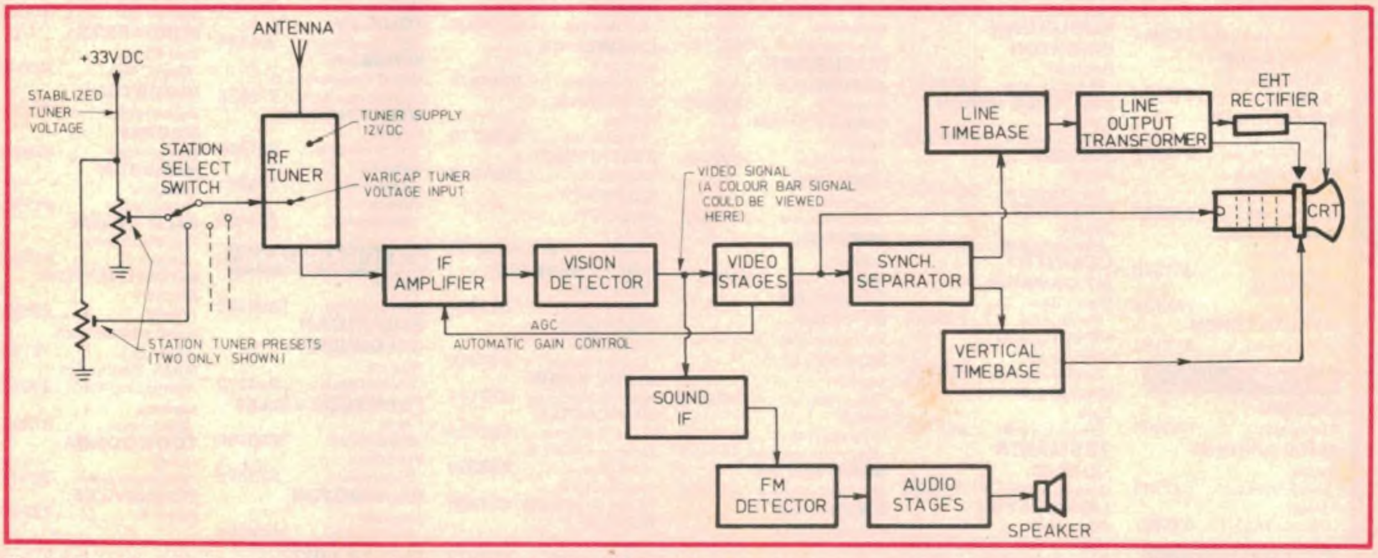

Fig.1: The block diagram of a modern monochrome TV receiver, in basic form. A colour set is virtually identical up to the output of the vision detector.

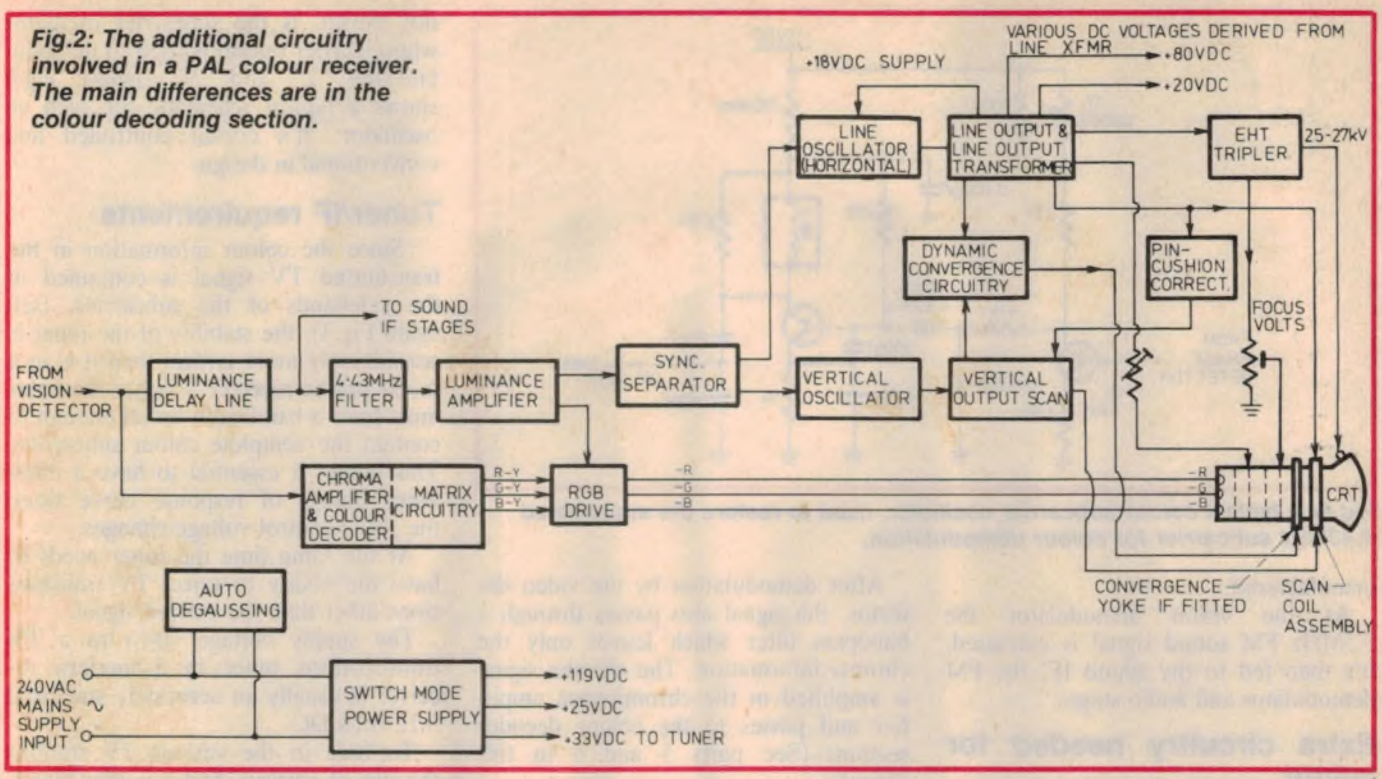

Fig.2: The additional circuitry involved in a PAL colour receiver. The main differences are in the colour decoding section.

may vary. Also in weak signal areas fading may be experienced. The AGC affects the gain of all the signals passing through the vision IF amplifier, to provide a substantially constant video output level.

You will see from the block diagrams of Figs.1 and 2 that many sections of the circuitry of the monochrome and PAL colour receivers seem to be identical. However there are certain additional requirements essential for colour reception.

After IF amplification the signals are then demodulated by the vision detector. The vision signal obtained consists of the entire vision carrier modulation and is known as the video signal.

If you supply a colour bar input signal to a good quality monochrome receiver, and connect an oscilloscope to the output of the vision detector, it will display the complete colour bar signal exactly as would be viewed on the colour TV.

In the monochrome TV the demodulated video signals are directly amplified by the video stages and drive the single cathode of the monochrome picture tube.

The brightness of the picture at each point of the raster varies, as the received vision signal causes the tube beam current to increase and decrease. Provided the raster is correctly synchronized a picture will be viewed, in black and white.

Both the line timebase and the vertical timebase will run in the absence of any signal, producing a raster on the picture tube. However it is necessary that both timebases be exactly synchronized with the horizontal and vertical scanning of the camera at the TV transmitter.

When correctly adjusted the free running speeds — with no signal input to the TV — of the receiver timebases are slightly lower than those of a synchronised picture. The sync pulses "trigger" both timebases, speeding them up so that both the scanning of the TV picture raster is exactly "in step" with the transmitted picture. These vertical scan and line scan synchronizing pulses are extracted and separated at the output of the video amplifier.

In the PAL colour receiver similar synchronization circuitry is used to "lock" the picture raster to the transmitted signal.

The extra high tension voltage (EHT) required for the final anode of the picture tube is obtained by rectifying a portion of the energy developed by the line output transformer (Fig.1). The low-current EHT voltage produced may be between 8 to 15 kilovolts, according to the size of the picture tube. Generally at the present time only small portable monochrome TV sets are being

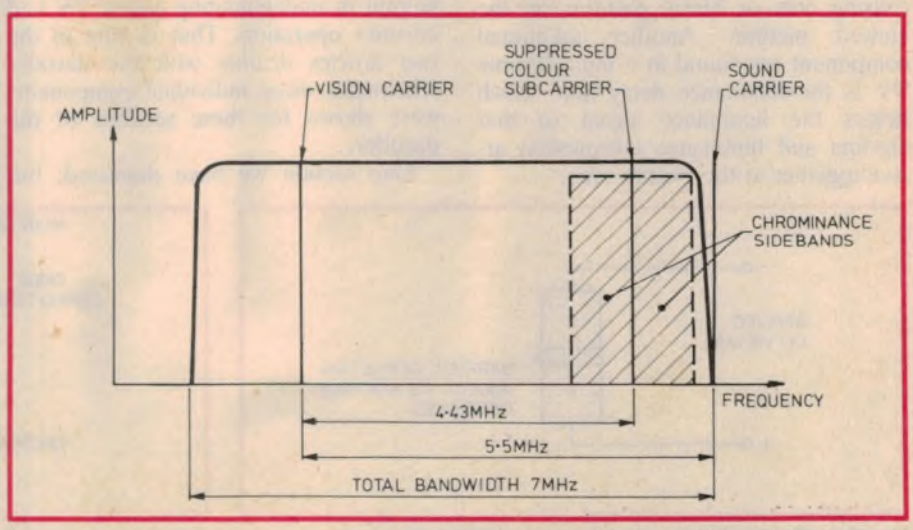

Fig.3: The total frequency bandwidth occupied by an Australian TV channel, showing the various signal components.

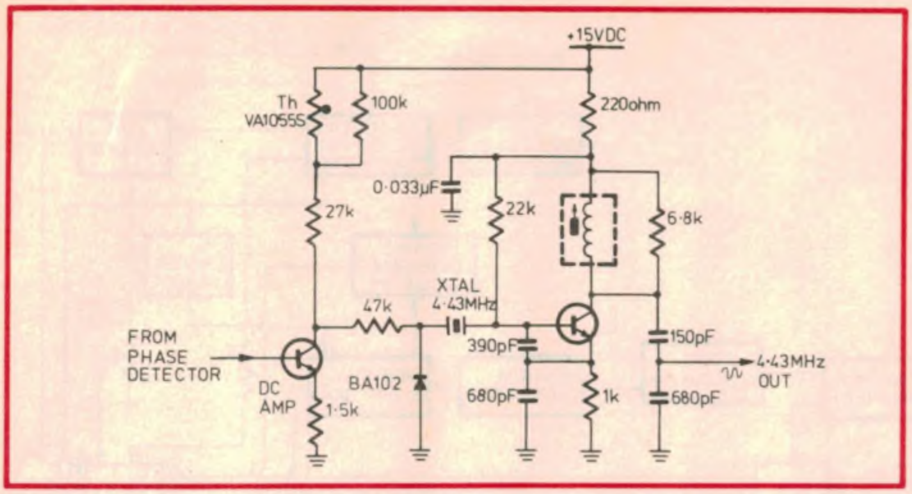

Fig.4: A typical colour subcarrier oscillator, used to restore the suppressed 4.43MHz subcarrier for colour demodulation.

manufactured.

At the vision demodulator the 5.5MHz FM sound signal is extracted. It's then fed to the sound IF, the FM demodulator and audio stages.

Extra circuitry needed for colour

In the block diagram of Fig.2 you'll notice some extra circuitry. The video output stage of the mono receiver is replaced by the luminance output stage of the PAL receiver. The luminance amplifier must drive the three cathodes of the colour picture tube, instead of the single cathode of a mono tube. For this reason the luminance stage has greater gain than does the monochrome TV video amplifier.

The notch filter shown at the input of the luminance amplifier is tuned to 4.43MHz. This filter is necessary to stop chrominance information passing through the luminance amplifier and causing dots or Moire patterns on the viewed picture. Another additional component not found in a monochrome TV is the luminance delay line, which delays the luminance signal so that chroma and luminance information arrive together at the picture tube.

After demodulation by the video detector, the signal also passes through a bandpass filter which leaves only the chroma information. The chroma signal is amplified in the chrominance amplifier and passes to the colour decoder section. (See parts 5 and 6 in this series).

You'll recall that the decoder output consists of the (R-Y) and the (B-Y) signals and supplies these to the matrix circuitry where the (G-Y) signal is recovered. The luminance and colour difference signals are then combined in the RGB drive strages and drive the three cathodes of the colour picture tube.

In older PAL colour TV's the decoder consisted of discrete circuitry using valves or transistors.

In the latest colour receivers, practically the entire decoder is contained in a single very large scale integrated circuit (see part 6 of this series). However the study of the discrete circuitry is helpful in understanding colour TV and decoder operation. That is why in the two articles dealing with the decoder schematics using individual components were shown for these sections of the decoder.

One section we have discussed, but not shown, is the subcarrier oscillator whose carrier output is used to demodulate the "U" and "V" signals. Fig.4 shows a typical schematic for such an oscillator. It's crystal controlled and conventional in design.

Tuner/IF requirements

Since the colour information in the transmitted TV signal is contained in the sidebands of the subcarrier, (see again Fig.3), the stability of the tuner is considerably more critical than it is in a monochrome receiver. Further the tuner must have a bandwidth broad enough to contain the complete colour subcarrier. This makes it essential to have a minimum change of response curve when the AGC control voltage changes.

At the same time the tuner needs to have the ability to reject TV transmissions other than the desired signal.

The supply voltage (B+) to a TV transistorized tuner in a modern receiver is usually an accurately stabilized +12 volts DC.

To tune in the various TV stations the use of varicap diodes is now standard practice. *Electronics Australia* readers will know that varicap (or varactor) diodes are diodes that are biased in reverse at a voltage lower than their reverse breakdown voltage value. If any diode has a reverse voltage applied then its barrier depletion area widens as the voltage increases (Fig.5a).

The N and P junctions of the diode act as the plates of a small capacitor, with the barrier area as the dielectric. This means that as the applied voltage changes so does the capacitance of the diode. The varicap diode is designed to have a much larger internal capacitance than an ordinary diode. Fig.5b shows that as the voltage increases, the diode capacitance decreases.

The variable tuning capacitors used in the old type TV tuners are replaced in modern TVs by varicap diodes. An accurately stabilized variable tuning voltage supplied to the tuner causes the ca-

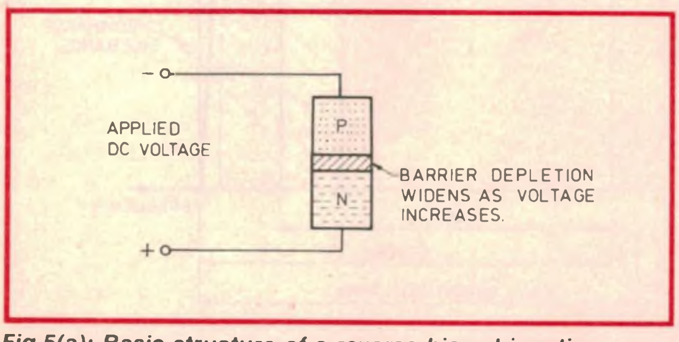

Fig.5(a): Basic structure of a reverse biased junction diode, as used for a varicap.

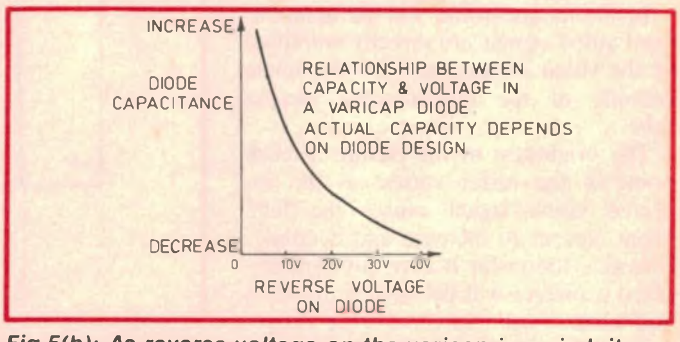

Fig.5(b): As reverse voltage on the varicap is varied, its capacitance varies inversely.

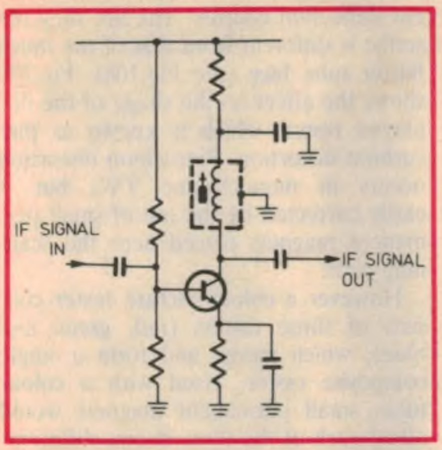

Fig.6: A typical LC-tuned IF amplifier stage, as used in older receivers.

pacity of the tuner varicap diodes to change, and the tuned circuits to resonate at the desired frequencies. In this way the required TV station is "tuned in" — see Fig.1. TV channel selection may be made by simple switch-type pushbuttons.

However it is now more usual to employ complex digital or infrared remote control methods. These different station selecting methods all operate in the same basic manner by changing the applied DC tuning voltage in order to select the desired programme. The result is an accurately stabilized TV tuner which does not drift away from the tuned channel frequency. Further when a different TV station broadcast is selected the tuner "locks in" to the signal at once.

Actually the tuning stability of modern colour TV receivers is made even better, by the use of automatic frequency control (AFC). This involves a voltage fed back to the RF tuner's local oscillator varicap from the FM sound detector, with such a polarity to automatically correct any drift.

The intermediate frequency amplifier (IF) section of a PAL colour receiver has basically the same requirements as that of a monochrome 625 line set.

However it is important that the chrominance signal remains undistorted, and is not attenuated by the IF amplifier. Older colour TV receivers used IF stages containing individual transistors (or valves) together with tuned IF transformers. Fig.6 shows a section of such an IF amplifier. In the modern colour receiver some individual transistors together with integrated circuits may be found, but the trend towards the exclusive use of integrated circuitry is increasing.

Another device found in the IF circuitry of the modern PAL TV is the surface acoustic wave filter (SAWF). The SAWF may be shown in the receiver schematic either as in Fig.7 (a) or (b). It is a piezoelectric device, about the size of a line output transistor such as a BU208.

Used in the PAL IF amplifier, the SAWF has the advantage of both better bandpass filter shape, stability of tuning and elimination of all the transformers when used with integrated circuits. Fig.7(a) is basically a simplified schematic of a complete IF amplifier using a SAWF.

Power supplies

The mains power supply section of a modern PAL colour receiver is quite complex in design. In early PAL receivers using a valve design with perhaps just a few transistors, the stability of the power supply was not so critical. However modern PAL receivers contain transistor and integrated circuits that require accurately stabilized DC supply voltages to ensure correct and safe operating conditions. these DC voltages must remain constant even if the load current taken by the receiver varies, or when reasonable variations in the AC mains supply voltage occur. A further requirement is that in the event of any heavy overload, due to component breakdown in the TV, the power supply must switch itself off.

Practically all PAL TV receivers now contain switch-mode power supplies. A switch-mode power supply is one where the regulator (sometimes called the "chopper") transistor is rapidly switched "on" and "off", usually in this case at about line timebase frequency (15.625kHz). The longer the "on" period lasts, the more current flows through the regulator transistor. If the "on" period shortens then less current flows.

If the current consumption of the set increases or decreases, the DC output voltage of the power supply will try to change. This is detected by the sensing circuitry, which alters the on/off ratio of the 15.625kHz pulse driving the base of the regulator transistor to compensate for this. Thus the DC output voltage is kept constant.

Fig.8 shows a simplified block diagram of a switched mode power supply of the self-oscillating type. You'll find this basic circuit in many late model PAL receivers.

A Siemens TDA4600 integrated circuit drives the BU208 regulator transistor. This power supply can operate on a wide range of mains input AC voltages ranging from 90 to 270 volts. However the basic design shown in Fig.8 is for an AC mains input of 240V. Tappings from transformer T1 supply various rectifier diodes and various DC voltages are produced across the electrolytic capacitors. Notice the 33 volts for the tuner varicap voltage supply. Should excessive current due to an overload be drawn from the secondary winding of transformer T1, the power supply shuts down.

Power supplies regulated by silicon controlled rectifiers (thyristors) were popular in the 1970's. Today you will encounter many different versions of switch mode supplies. Each type requires careful study in order to grasp its operating principles. In fact to properly describe all the different types of power supplies would take a series of articles on this subject alone!

Scanning circuitry

Scanning and synchronising the colour picture tube raster requires circuitry basically similar to that found in a monochrome TV. However there are again significant differences. Three electron beams must be deflected both vertically and horizontally in the colour picture tube. Also the EHT voltage is much higher on the colour CRT (24 to 27kV according to picture size). Thus increased power is necessary for the deflection circuitry.

In older receivers, discrete transistors or valves were used in the vertical oscil-

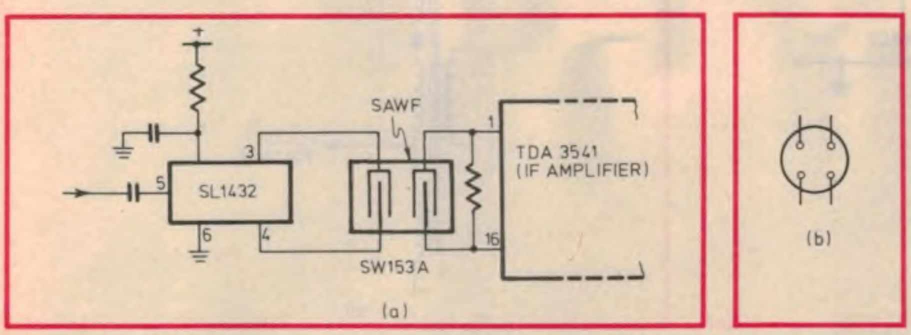

Fig.7: In modern receivers, all IF bandpass shaping is performed by a SAW filter. An alternative symbol is shown in (b).

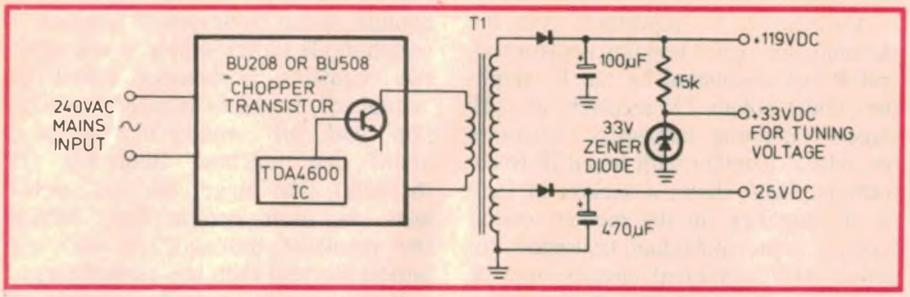

Fig.8: A simplified block diagram of the switch-mode power supply used in most modern receivers.

lator, horizontal oscillator and synchronizing stages (see again Fig.2). However nowadays a single integrated circuit, such as a type TDA 2578A contains the line oscillator and the vertical scan oscillator, together with all the necessary field and line synchronization circuitry.

In a colour TV the line output transformer (which is driven by the line output stage) fulfils several functions. Besides energising the horizontal scan coils, it also produces anything from 400 to 800 volts DC for the A1(s) grids of the picture tube.

In addition, from various windings on the line output transformer are derived AC voltages which are then rectified to produce DC voltages that supply various circuitry in the TV. Further the transformer has an EHT winding producing just over 8kV.

Since approximately 25kV is required for the final anode of the colour picture tube, the 8kV is supplied to a tripler (Fig.9a). When a line of picture is scanned at the end of the line, a positive going flyback pulse occurs as the beams return to the beginning of the scan. The capacitor C1 is then charged through diode D1 by a pulse from the EHT winding. As the input falls the charge on C1 passes via diode D2 to capacitor C2.

When the next positive going flyback pulse arrives, C1 is again charged through diode D1. Capacitor C2 now receives an additional charge from diode D2. The original 8kV on capacitor C2 now has a further 8kV added to it, so that the charge across C2 is now 16kV and capacitor C3 charges via D3. as the flyback pulse again dies away during the next line of picture, diode D4 transfers the charge on capacitor C3 to capacitor C4. There is now 8kV at point A, and 16kV at point B.

At the junction of diodes D1 and D2 the tube focus voltage is derived and taken via the focus circuitry to the focus electrode of the colour picture tube.

When the third flyback pulse arrives, the whole process is repeated, increasing all the potentials by a further 8kV. Capacitor C5 now charges up via diode D5 to a potential of 24kV, which is taken through a safety resistor R3 to the picture tube's final anode.

The diode split line output transformer is rapidly replacing the separate tripler block. The rectifying diodes are contained within the transformer itself with the transformer windings providing the necessary capacitance (Fig.9b).

Pincushion correction

As explained in part 4 of this series, the three electron beams of the colour picture tube are deflected at the apparent deflection centres. The arc they describe is different from that of the much flatter tube face (see Fig.10a). Fig.10b shows the effect on the shape of the displayed raster, which is known as pincushion distortion. Pincushion distortion occurs in monochrome TV's but is easily corrected by the use of small permanent magnets placed near the scanning coils.

However a colour picture raster consists of three rasters (red, green and blue), which merge and form a single composite raster. Used with a colour tube, small permanent magnets would affect each of the three beams differently, ruining the convergence and purity.

The solution is to use a transductor, which was developed by Mullard Ltd particularly for use with the shadow-mask picture tube (Fig.11). The pincushion correction takes place at the apparent deflection centres of the colour tube, by allowing the horizontal and vertical scanning signals to interact in a ferrite core.

The current flowing through the line deflection coils is modulated by a parabolic waveform at vertical scanning frequency. By means of this correction waveform, the sides of the composite raster are straightened. The transductor provides maximum correction at the centre of the raster, with gradually less correction falling to zero at the top and bottom of the picture.

The current flowing through the vertical deflection coils is corrected by a parabolic waveform at line frequency. At the beginning of each line of the raster this correction is zero; gradually increasing to maximum at the centre of each line and then slowly falling to zero again by the end of the line.

In later developments of colour tubes, other types of pincushion correction have been used. By careful design of

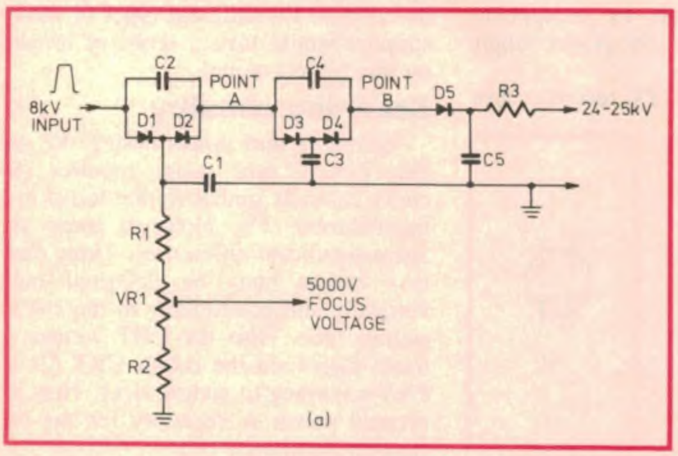

Fig.9(a): The basic voltage tripler frequently used to derive the 24-25kV EHT supply for the CRT.

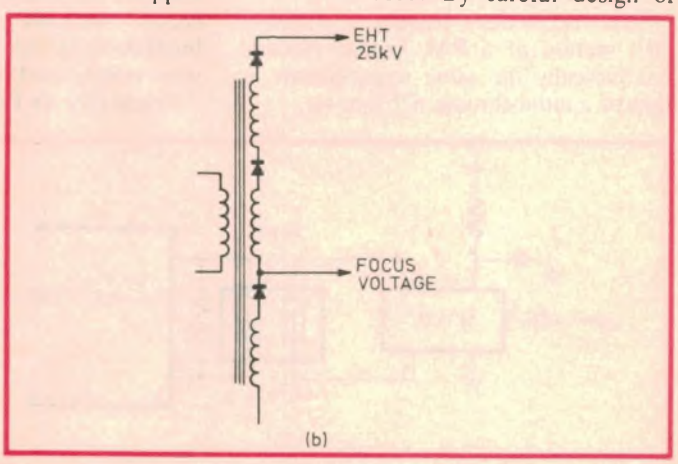

Fig.9(b): More recent designs use a split EHT winding with distributed rectifier diodes.

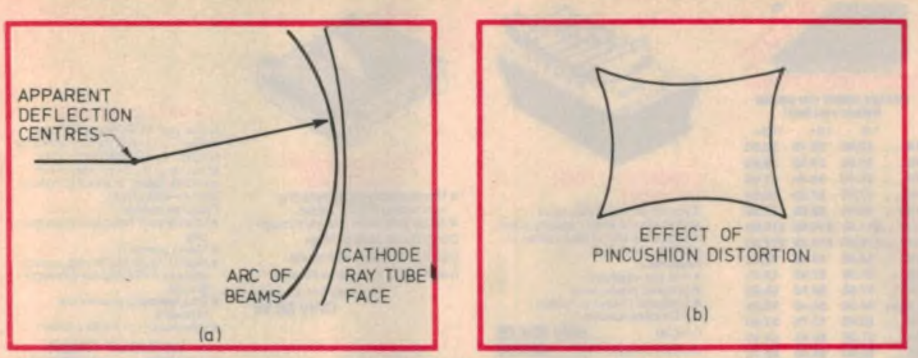

Fig.10: Because the electron beams are deflected with a radius much shorter than that of the CRT screen (a), this tends to produce a picture with "pincushion distortion" (b).

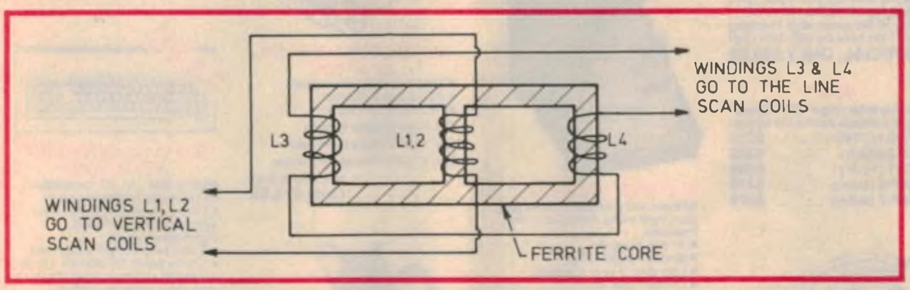

Fig.11: A transductor allows the line and field scanning circuits to interact, adding parabolic correction currents to each.

the scan coil assembly, and by using special methods of winding the coils, pincushion distortion has been largely overcome.

However, particularly with larger picture tubes, some method of pincushion correction is still necessary.

Convergence

Convergence circuitry is provided so that the three rasters properly merge to form one composite colour raster over the entire surface of the picture tube face. In part 4 of this series, the basic method of converging the three red, blue and green rasters at the centre of the screen was described. This is known as static convergence. However to obtain proper convergence at the edges and corners of the picture, *dynamic* convergence is necessary.

With the earlier shadow-mask type of picture tube coils were wound around the static convergence magnets contained in the convergence assembly. Controlled adjustable currents passed through these coils. Both line and vertical scan frequency parabolic currents were used.

The earlier colour TV receivers fitted with shadow-mask picture tubes thus contained a large number of preset convergence adjustments. A total of twenty or more (including both static and dynamic controls) were common. Each adjustment usually had to be repeated several times because of interaction in the circuitry.

A few of these receivers are still in use. Should you encounter one, remember that it is essential to first carefully study the TV manufacturer's service instructions before attempting any convergence adjustments. They're quite complex.

A warning

If you make any adjustment or measurement on or near a colour picture tube, remember that the 24-27kV EHT voltage can be lethal. Even when the colour TV is switched off and disconnected from the supply mains, it is possible for the picture tube to hold a considerable charge of high voltage due to the tube's internal capacitance.

Fortunately you'll find that colour receivers fitted with the very latest "in line" colour tubes are practically self converging and need only minor adjustments. If the tube is a Philips 30AX none at all will be required!

In the final part of this series we'll discuss some additional sections of the circuitry found in a PAL receiver. We'll also examine the schematic of a complete line oscillator and line output stage that uses the latest technology. Finally we'll consider the interesting effects produced when faults in the chroma sections affect the colour picture.

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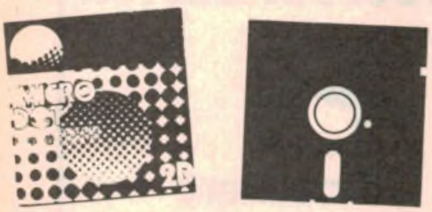

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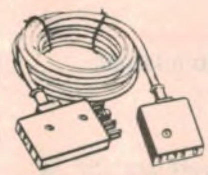

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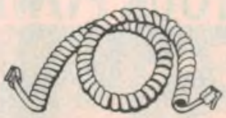

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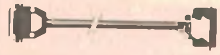

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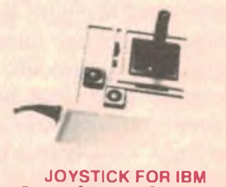

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Wireless Weekly 3d

August 1937

Calling the number: An innovation has been introduced at the Head Office of the Commonwealth Savings Bank to obviate the necessity of the paying tellers shouting the numbers of depositors. The teller now simply speaks in his ordinary tone into a small microphone. The "mike" is connected to an amplifier, which reproduces the call to the circle of clients. The new system has been found a great improvement.

Wireless telephone: A U.S.A. Government official says that even before television is properly developed "it may be possible for you, while riding in your automobile to pick up a wireless telephone and talk with your home or with any telephone connection anywhere", and he also mentions the possibility of "small radio-telephone and receiving sets of vest-pocket size".

Powerful new station: A modern broadcasting station is about to be established at Kingaroy, Queensland, for the South Burnett Broadcasting Proprietary. The station, which is being designed and constructed by Amalgamated Wireless, will operate on a power of 2000 watts in the aerial.

RADIO. TELEVISION and HOBBIES

August 1962

Satellites — for how long? (Editorial) Much publicity has been given to the successful launching of "Telstar", the world's first active satellite repeater. Mention has been made that other similar projects are well under way, so that "Telstar" is not likely to be alone in space for very long. To date, the emphasis has been on improved communications, and the exchange of television programs, which might allow us the better to understand our neighbours.

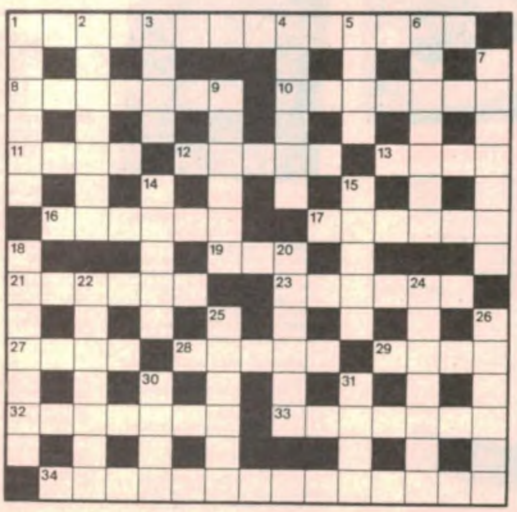
Driverless trucks: A driverless truck with a rotating flashing beacon adds a Wellsian touch to mechanical landing.

The Robotug is fitted with an electronic guidance system and follows an energised wire buried half an inch below the surface of the ground. A flashing beacon will warn staff of the Robotug's approach and it will stop immediately if it touches any obstruction.

AUGUST CROSSWORD

ACROSS

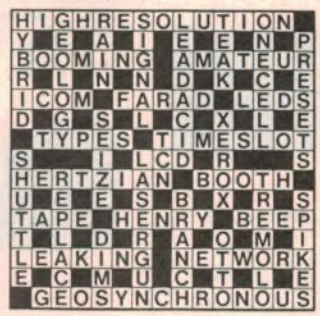
1. Loss of temperature stability. (7,7)
8. Evolutionary process in electrolysis. (7)
10. Type of cartridge. (7)
11. Base SI unit. (4)
12. Sometimes it's synthesised. (5)
13. Trade jargon for crystal.(4)
16. Encapsulate. (6)
17. Feature of meter scale to lessen parallax error.
19. Type of meter used in radio applications. (1,1,1)
21. Filter or attenuator with a step-like arrangement. (6)
23. Resistor code colour. (6)
27. ANSCAN cable messages can go to this place. (4)
28. Construct. (5)
29. The standard-setting American Society of Mechanical Engineers. (1,1,1,1)
32. Device in earlier cathode-ray tubes. (3,4)
33. Metal used with platinum in thermocouples. (7)
34. Pixel. (7,7)



DOWN

1.Video pastime. (1,1,4)
2. Letter used as symbol for electric permittivity. (7)
3. Special message service, electronic ——. (4)
4. Remove wire from winding (6)
5. American Radio Relay League. (1,1,1,1)
6. Measuring instrument. (7)
7. Devices used in radiation counters. (7)
9. Wire metal sizes. (6)
14. The first name of Joule, the discoverer of magnetostriction. (5)
15. Kind of secondary cell. (5)
18. Typical insulating substance. (7)
20. Part of tape-deck, the pinch ——. (6)
22. Inventive genius, engineer, and artist. (2,5)
24. Heater, possibly ignited by a piezoelectric spark. (3,4)
25. Kind of connecting lead. (6)
26. Modern material made from more than metal. (6)
30. This can be removed from air by electrostatic precipitation. (4)
31. Type of laser. (2-2)

SOLUTION FOR JULY



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Pt.3 The ins and outs of Local Area Networks

So far, in our articles on the Token-Ring LAN, we have looked at the general operation of the hardware and the means of accessing that hardware via software. This article will highlight the ring functions that are performed, as well as the hardware components that perform them.

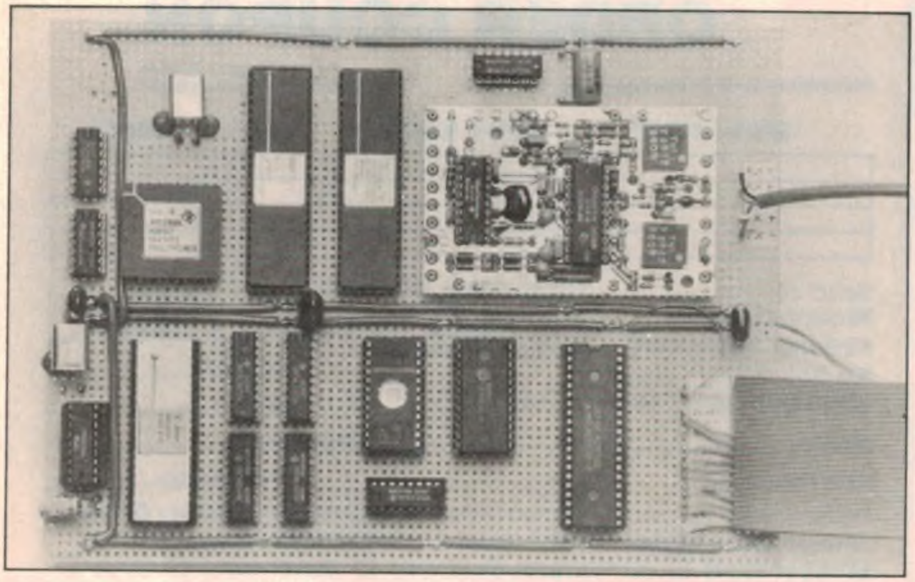
DAVID CARTWRIGHT & GREG PEAKE
Texas Instruments Australia

Major hardware components

These aspects of communicating on the Token-Ring are transparent to the user and the associated software, providing the user an "error-free pipeline" as mentioned in the previous article.

The adapter illustrated containing the Texas Instruments TMS380 chipset will be referenced throughout this article when considering the hardware blocks needed to implement the adapter function. This chipset consists of five main chips, the basic block interconnects of which are shown in Fig.1, and the individual functions highlighted in Table 1.

Other components needed for the operation of the adapter are discrete components which interface the adapter to the network, and some logic for interfacing to the host bus. Auxiliary equipment needed to complete the network are the Wiring Concentrator, the twisted pair cabling, and of course other nodes to communicate with. The auxiliary equipment is also noted in Table 1.



This intelligent printer server node using the Texas Instruments TMS380 chipset was developed in 12 weeks by a university student.

One of the more distinguishing features of the Token-Ring is the management and reliability control implemented on the ring. The adapter chipset performs these functions at the Medium Access Control (MAC) level, hence the implementation of network management is unknown to the users (Refer Article 1). Adapter based firmware is used by the TMS38010 (Communications Processor) to implement these functions. The firmware is stored in a 16K on-chip ROM contained in the TMS38020 (Protocol Handler), from which the TMS38010 operates and controls the rest of the adapter.

Ring management

When a DTE is to be connected to an operational ring and after diagnostics have been run, a special MAC control frame containing a proposed source address is sent on the ring. This frame is looked at by all DTE's on the ring, to make sure that the address is not duplicated. If not duplicated, the DTE is connected to the ring and an initialisation process is started. The accepted address becomes the DTE's network address at the MAC level, and is used when either sending or receiving LLC or MAC-control based frames. Fig.2 contains the descriptions of these frames.

For ring management at the MAC-control level, there is another type of address called "a function address", which is embedded into the MAC address field. These addresses are used to access Ring Management functions resident within particular nodes on the ring. A functional address will be recognised and the frame copied by a node, only if that node supports the function. MAC-control frames can only be sent when the originating node has the token, however they are generally classed as higher priority type frames and are sent before LLC-based MAC frames.

Network manager

MAC-control frames are used for recording ring status, error recovery, and controlling the insertion and de-insertion of DTE's. For these functions to be synchronised, there is a Network Manager assigned, the function of which could be contained in any node. When any node on the ring communicates with the Network Manager, it uses a MAC-control frame and the destination address has embedded within it a functional address which always denotes the Network Manager.

The latter is responsible for keeping a list of all nodes currently on the ring and has the ability to allow additional nodes to join in. It also can de-insert a node, for time-share applications, or change the initialisation parameters within a node as required. Optimisation of Network Manager control invariably increases the efficiency of the network.

Ring parameter server and ring error monitor

These functions work under the Network Manager and are accessed by their appropriate functional addresses. The Ring Parameter server facilitates the inserting of a DTE into the ring, by providing it with parameters such as authorised priority codes and accessible functional addresses. If there is no Ring Parameter Server, the node parameters are initialised with default values.

The Ring Error Monitor acts as a collection point for errors occurring on the network. If any node detects a soft error (CRC or token errors etc.), regardless of whether there is a Ring Error Monitor, a report will be sent to that functional address. Errors detected by and about the Active Monitor are also reported to this functional address.

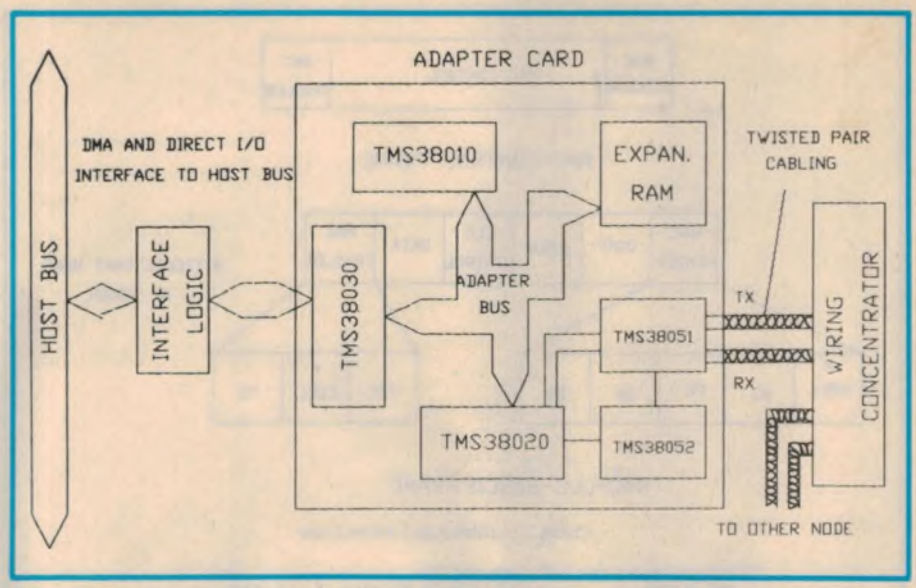


Fig.1: The block interconnect diagram for a Token-Ring node adapter using the TMS380 chipset.

Active monitor and standby monitor

There is only one Active Monitor on the ring at any one time, this entity being accessed by another functional address. The remaining nodes on the ring are classed as Standby Monitors, ready to take over the Active Monitor role should it fail.

When an Active Monitor fails, the ring moves into a monitor contention mode whereby all monitors contest for the Active Monitor role. This process involves the sending of a MAC-control frame indicating the desire to claim the Active Monitor role. The role is normally won by the node with the highest address.

So what does the Active Monitor do? Essentially it is a "labourer" to the Network Manager, that maintains the circulating token, while sending reports on token errors and new node insertion. It checks for a valid token every 10ms, which indirectly checks for any ring faults. Invalid tokens are usually caused by adapter or media faults.

On the discovery of an invalid token, the Active Monitor purges the ring.

COMPONENT	PURPOSE	FEATURES
TMS38010 COMMUNICATIONS PROCESSOR	- CONTROLS ADAPTER - BUFFERS DATA FROM HOST SYSTEM - CHECKS VALIDITY OF DATA AND ADDRESS BLOCKS FROM HOST	16 BIT CPU 2.75K ON-CHIP RAM 9 INTERRUPT LEVELS 256K ADDRESS SPACE GENERAL PURPOSE TIMER 333NS CYCLE TIME
TMS38020 PROTOCOL HANDLER 1	- CHECKS DESTINATION ADDRESS OF RING FRAME - DIFFERENTIAL MANCHESTER ENCODER - CHECKS + CREATES CRC - MANAGES PRIORITY - GENERATES FRAME DELIMITERS	4MBIT MANCHESTER ENCODER 2 PAIRS DMA CHANNELS ON-CHIP 16K ROM (CONTAINS ADAP.SOFT.) ROM BYTE PARITY PROT.
TMS38021 PROTOCOL HANDLER 2 (GENERIC VERSION OF TMS38020)	- ENABLES ROUTING INFORMATION DETECTION - ENABLES EXTERNAL ADDRESS DETECTION	EXTERNAL HARDWARE COPY INTERFACE
TMS38030 SYSTEM INTERFACE	- ADAPTER INTERFACE TO HOST BUS - USES DMA CONTROL TO EXTRACT DATA FROM HOST MEMORY - CONTROLLED BY DIRECT I/O FROM HOST - DMA -BURST TRANSFERS - CYCLE STEAL - PASSES DATA TO ADAP. BUFFER	CONNECTS ASSYNCH. BUSES DMA/HOST - 5MBITS/S DMA/ADAP. BUS - 6MBITS/S DIRECT I/O OPTION 8 OR 16 BIT SYSTEM BUSES 808X OR 680XX
TMS38051 RING INTERFACE TRANSCIEVER	- PROVIDES INTERFACE TO RING - SIGNAL RESHAPING - RETIMING OF RXED DATA	PHASE LOCK-LOOP 4MBPS ENCODED DATA RATE 2 CHANNEL - TX,RX
TMS38052 RING INTERFACE CONTROLLER	- ADAPTIVE EQUAL. - LOOPBACK FOR DIAGNOSTICS	
TWISTED PAIR CABLING (IBM SYSTEM TYPE 1/2)	- FOR CONNECTING ADAPTER TO WIRING CONCENTRATOR - SHIELDED	MAX DATA RATE - 16MBPS MAX LENGTH TO W.C - 300M MAX LENGTH BETWEEN CASCADED WIRING CONCEN. - 200M
WIRING CONCENTRATOR	- PROVIDES THE STAR WIRED HUB OF NETWORK - CONTAINS RELAYS FOR SWITCHING NODES IN AND OUT - RELAYS CONNECTED IN SERIES FOR TOKEN PASSING + RING INSERTION/DEINSERT.	UP TO 260 NODES/RING USING SYSTEM TYPE 1/2 CABLING. RELAY SWITCHING CONTROL BY ADAPTER INTERFACE MAX OF 2 WIRING CON. PER RING - BEING CASCADED TOGETHER
INTERFACE LOGIC	- PROVIDES INTERFACE GLUE BETWEEN 38030 AND SYSTEM BUS - INCLUDES LATCHES, BUFFERS, DECODE LOGIC	GLUE ENABLES DMA AND DIRECT I/O INTERFACE

Table 1: The various components used in the Token-Ring interface adaptor shown, with a summary of their functions and features.

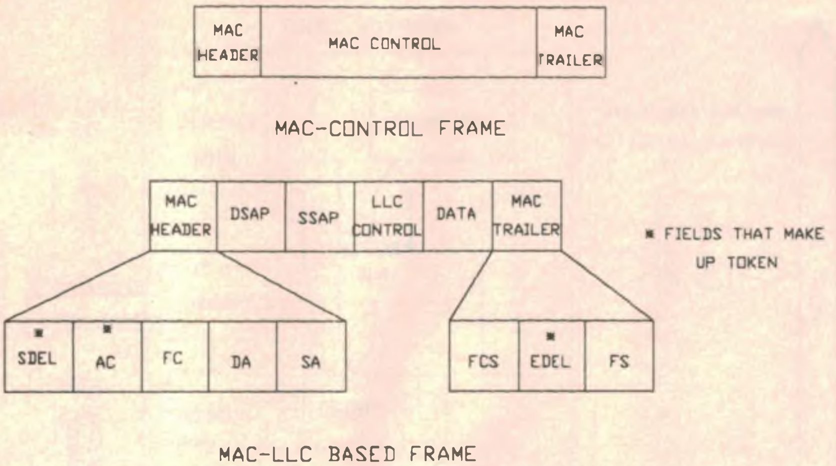


FIGURE 2 - FRAME FIELD DEFINITIONS

MAC CONTROL	SEE TABLE 2
MAC HEADER	APPENDED TO BEGINNING OF LLC FRAME
MAC TRAILER	APPENDED TO END OF LLC FRAME
DSAP	DESTINATION SERVICE ACCESS POINT (ADDRESS WITHIN DESTINATION HOST SOFTWARE)
SSAP	SOURCE SERVICE ACCESS POINT (ADDRESS WITHIN SOURCE HOST SOFTWARE)
LLC CONTROL	LOGICAL-LINK CONTROL WORDS
DATA	APPLICATION DATA
SDEL	STARTING DELIMITER
AC	ACCESS CONTROL FIELD (FRAME PRIORITY ...)
FC	FRAME CONTROL FIELD (FRAME TYPE,COMMANDS)
DA	DESTINATION RING ADDRESS
SA	SOURCE RING ADDRESS
FCS	FRAME CHECK SEQUENCE
EDEL	END OF FRAME DELIMITER
FS	FRAME STATUS FIELD(FRAME COPIED INDICATOR)

Fig.2: The two different kinds of MAC control frames.

This involves the transmitting of a MAC-control frame by the Active Monitor, which can be sent without possession of the token. The MAC-Control frame is passed around the ring and returned to the Active Monitor for error detection. If no error is detected in the frame, a new token is created and passed on for normal ring operation. If a CRC error is detected in the frame, the Active Monitor sends it again, this continuing until the faulty equipment is detected and de-inserted from the ring.

In maintaining the validity of frames on the ring, the Active Monitor also provides a master clock to compensate for frequency and phase errors (jitter) caused mainly by the filter characteristics of the ring cabling. It locks onto the incoming data via a phase-locked loop (PLL), and stores the data in an elastic buffer.

The elastic buffer allows for group delay stretching of the digital train by allowing room for the individual bits that are sampled by the PLL more than once. The buffer, which is organised as a FIFO, re-transmits the data at the adapter's crystal clock frequency. All adapters contain this function, however it is only exercised by the Active Monitor. The Standby Monitors use the PLL for the clocking of data into and out of their respective FIFO's.

The bridge

Although there can only be 260 nodes per ring when using IBM shielded twisted pair cabling for node connection to the wiring concentrator, this does not limit the size to which a Token-Ring *network* can expand.

Rings can be linked together via bridges, such that a node from one ring can communicate with a node on another. The bridge function is carried out by the TMS38020 Protocol Handler, working within a dedicated ring server. Eight rings can be linked together, using seven bridges, which gives a *network* total of approximately 2000 nodes maximum (this is assuming only one bridge per ring).

The bridge adapter can be accessed for configuration and error checking by the network manager via a functional address. When addressing the bridge for information transfer to another ring, routing information is included with the external destination address and local source address of the frame. This information defines the route that the frame must take to reach the desired node by using ring and bridge addressing.

When implementing the TMS38020 for the bridge function, all frames have to be copied and passed to the host — which contains the software to determine whether the frame is external or not. A generic version of the TMS38020, the TMS38021, allows more efficient bridging management. It facilitates the connection of external copy hardware, which checks the frames for routing information or dedicated external addresses, hence eliminating the need to copy all frames.

Bridges normally consist of two network adapters connected to a common host. They must remain transparent when forwarding frames across a network, and not change any frame parameters when copying. They can be used for bridging two networks of different MAC protocols (ie Token-Ring and Ethernet) with the same LLC. Hence the host must perform the function of MAC protocol conversion.

Due to the possibility of one bridge within a ring being a bottleneck, frames being transmitted to and from external rings are set at a higher priority than local frames. Two bridges working in parallel within one ring can also be used to solve bottleneck problems.

Adapter diagnostics

Prior to connection to the ring, a node undergoes hardware tests to ensure reliability of the chipset and the attached cabling. These tests are carried out under the scrutiny of the TMS38010, operating from the adapter firmware.

Fig.3(a) shows the internal loopback test, where communication between the Communications Processor and the Protocol Handler is thoroughly tested. This test checks the CRC circuitry, the RAM buffers, parity checkers, and transmission functions of the Protocol Handler which all need to be functioning for reliable adapter processing.

Fig.3(b) shows the cabling loopback test. When the node is not inserted into the ring, but the cable is physically connected, a short circuit exists between the TX and RX lines of the ring interface. This is caused by the relay in the wiring concentrator being closed, thus providing a test loop for cable fault diagnosis.

These tests ensure that a faulty adapter or cable is not inserted into the

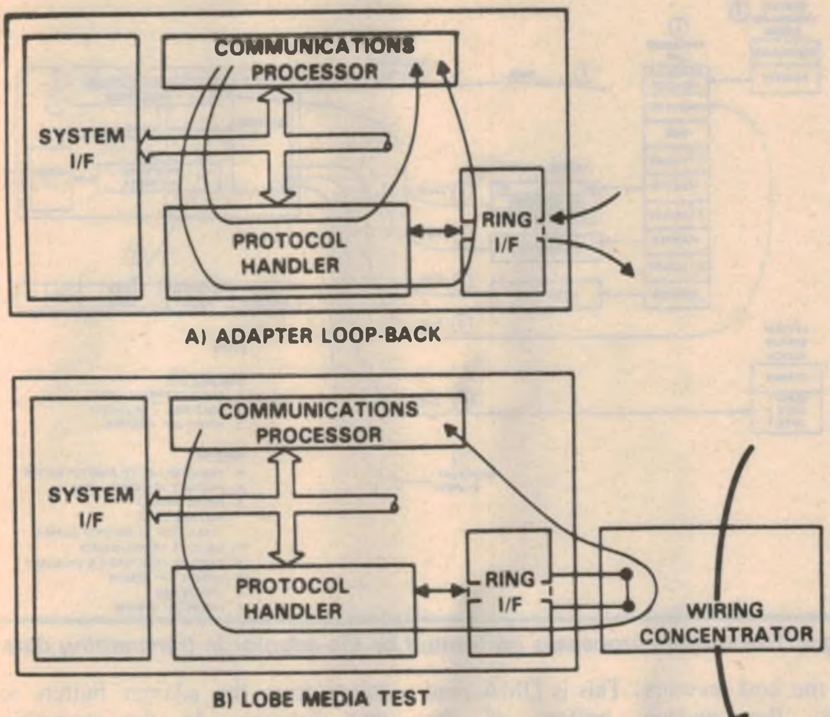


Fig.3: Before connecting a node into the ring, the adaptor controller performs both internal and cabling (b) loopback diagnostic tests.

TABLE 2 — THE MAJOR MAC-CONTROL COMMANDS

COMMAND	SENDER, DESTINATION
BEACON	NODE TO RING
LOBE MEDIA TEST	INSERTING NODE TO CABLING
CLAIM TOKEN	NODE IN MONITOR CONTENTION
REMOVE RING STATION	NETWORK MANAGER(NM) TO NODE
REPORT STATION STATE	NODE TO NM
REPORT MONITOR ERROR	NODE TO RING ERROR MONITOR
REPORT STORED UPSTREAM ADDRESS (SUA) CHANGE	NODE TO NM
REPORT NEW MONITOR	ACTIVE MONITOR (AM) TO NM
REPORT STATION ATTACHMENT	NODE TO NM
REPORT RING POLL FAILURE	AM TO RING ERROR MONITOR
REPORT ERROR	NODE TO RING ERROR MONITOR
REPORT STATION ADDRESS	NODE TO NM
REQUEST STATION STATE	NM TO NODE
REQUEST INITIALISATION	NODE TO RING PARAMETER SERV
REQUEST STATION ATTACHMENT	NM TO NODE
REQUEST STATION ADDRESS	NM TO NODE
REPORT TRANSMIT FORWARD	NODE TO NM
RESPONSE	GENERAL RESPONSE TO REQUEST
ACTIVE MONITOR PRESENT	NEW AM TO DOWNSTREAM NODE
STANDBY MONITOR PRESENT	STANDBY MONITOR TO AM
RING PURGE	AM TO RING
CHANGE PARAMETERS	NM TO NODE
INITIALISE RING STATION	RING PARAMETER SERV TO NODE
TRANSMIT FORWARD	NODE TO RING
DUPLICATE ADDRESS TEST	NODE TO RING

Table 2: The major MAC control commands used for controlling ring operation, and the active participants involved.

ring. If an adapter detects an error *after* insertion into the LAN, it immediately de-inserts and completes diagnostic testing to determine the fault. If the tests are successful the node re-inserts. If testing is unsuccessful, it stays de-inserted and reports the error to the host. All such errors are reported to the Ring Manager.

MAC-Control processes

Table 2 contains a list of the major MAC-control commands used for the underlying services of the ring and the active participants in implementing the function. These commands are used for communication between adapters for error reporting, initialisation, and Active Monitor functions. Certain commands are used in addressing network management functions, while other commands are directed at all nodes on the ring. Some of the major commands will be discussed briefly here.

BEACON — The beaconing process is created when a hardware fault is detected, for example a discontinuity in the ring. The node closest to the break will time out, due to not having received a token or frame in a specified time. It will send a beacon MAC frame onto the ring to the address of the node preceding it on the ring, in order to isolate the error location. This process continues until a return frame is detected. In this period, other nodes will also move into beacon transmit mode, while others will just repeat the beacon. After a succession of beacon frames have been sent to the faulty node, it will de-insert from the ring and perform self-tests. Meanwhile, the ring will reconfigure.

TRANSMIT FORWARD — The transmit forward process is used to test links between nodes in the ring. When a node receives a transmit forward MAC frame, it notifies the Network Manager and uses the data contained within the frame to re-transmit the frame. The data could include addressing, frame type, or a MAC command.

RING POLL — A ring poll is a process where each node transmits its address to its downstream neighbour. If a downstream node identifies its upstream node's address as being different from that which it has stored, then a request is made to the Network Manager to report a change in that address. Ring polls are useful for letting the Network Manager know of any un-recorded nodes on the network, as well as letting each node know the address of its neighbour for easy detection of ring discontinuities.

Adapter data flow process

Let us now examine the method of transmitting and receiving data on the LAN via a TSM380 based adapter. The TMS38030 (System interface chip) has the necessary control lines to support 8 or 16 bit host buses, with the choice of 808X or 680XX memory arrangements. Extra interface glue is required for the DMA and Direct I/O modes, since the address and data lines of the TMS 38030 are multiplexed. These lines need to be de-multiplexed and address-decoded to enable memory mapped I/O operations between the two buses.

Data transmission

When the host has data to send, the adapter is interrupted by a direct I/O write to its interrupt register. The host then transfers the System Command Block (see Fig.4) to the adapter, via a DMA. The command block contains the address of the Transmit List contained

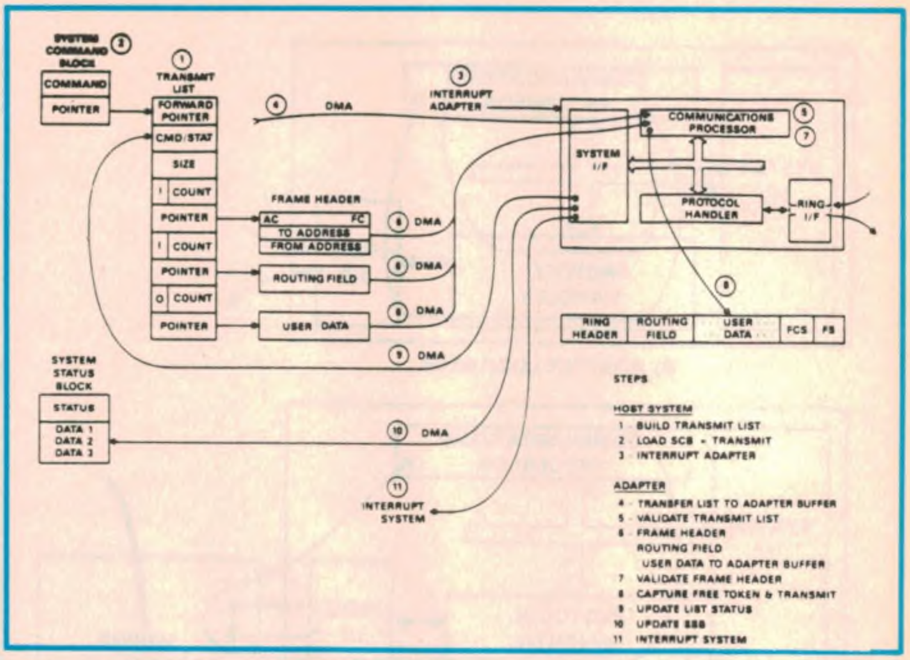


Fig.4: The various processes performed by the adaptor in transmitting data.

in the host memory. This is DMA read into the on-chip buffers of the TMS38010.

The size and number of buffers available is setup during the initialisation process with the host. The transmit list contains the "TRANSMIT" command from the host, as well as the address pointers to the host memory where the frame is being stored. The frame is broken up into segments, the total size of the frame being stored in "SIZE". The "COUNT" field contains the number of bytes contained in the following frame segment. The bits before the "COUNT" field indicate the position of the frame end, and a "O" marks that end. The adapter can now DMA read the frame into the adapter RAM for processing.

The TMS38010 firstly checks the frame headers for validity and then sets up the Protocol Handler (TMS38020) for data transmission onto the ring. The TMS38020 then starts transferring the frame from the adapter buffers to its own registers. In the meantime it catches a free token from the ring and starts to add the frame headers and eventually the data. The beginning of the frame is transmitted on the ring while the data is still being appended. When all data has been added, the Frame Check Sequence which is simultaneously generated with the frame creation, is appended to the end and sent as the completion to the frame.

While transmission of the frame is occurring, the TMS38020 is receiving data and checking for a match with its source address. This is facilitated by separate transmit and receive channels. Thus the node can actually detect the beginning of the return frame before the end has been fully transmitted. Once the node finishes transmitting the end of the frame, receives the return frame with its own source address, and detects whether the frame has been copied properly by the destination, a new

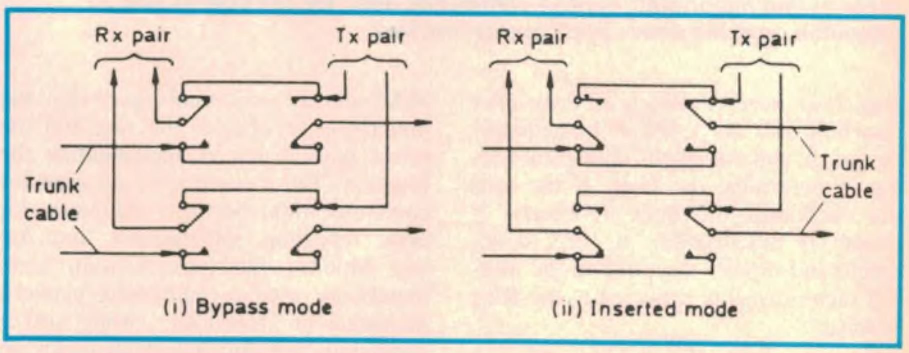


Fig.5: Inside the wiring concentrator, relays are used to either bypass (de-insert) or insert the adaptor and node concerned.

token is passed onto the ring.

Data reception

On receiving a frame, the Ring Interface (TMS38051, TMS38052) chips clock the data into the TMS38020, regardless of whether the frame is destined for that node or not. Clock recovery is performed by training a phase-locked loop (PLL) with the incoming Manchester-encoded data stream. Equalisation is also performed, so that the signal level is TTL compatible with that of the TMS38020.

A serial data stream is passed to the TMS38020, which in turn deserialises the data into 16 bit registers. Parity protection is then added for error detection in data transfer to the host, while the destination address is compared to see if the frame was destined for its node. If that test fails, the data is serialised and clocked back onto the ring using the PLL frequency (unless that node is the Active Monitor).

While the frame is being transferred to the adapter RAM, the TMS38020 calculates the CRC and compares it to that contained in the frame. If there is a match, it indicates to the TMS38010 that the message has been received error-free. However if an error is detected, the TMS38020 signals the TMS38010 to ignore that frame.

Once the data has been buffered in the adapter RAM, the TMS38010 begins to DMA transfer the data to the host memory. When that process is completed the adapter interrupts the host and sends a status signal via the System Status Block.

Concentrator & cabling

Both the wiring concentrator and cabling used in a Token-Ring have to conform to the IBM Token-Ring standard. These are various types of cabling that can be used, including telephone twisted pair (system 3) for 4Mbps transmission, shielded twisted pair (system 1/2) for up to 16Mbps transmission, and fibre optics cable. These cables have varying limits and must have the correct connections for compliance to the standard.

For twisted pair cable there are two sizes of wiring concentrators currently defined: 72 nodes maximum for system 3 cabling and 260 nodes maximum for system 1/2 cabling. The format of the relays for each node connection is shown in Fig.5.

In the by-pass node the relay acts as a short circuit and the node is de-inserted from the ring. The inserted mode allows the DTE to receive and transmit data.

Fibre Optics cable requires special adapters, such as those available from Dupont Optoelectronics, which interface between a wiring concentrator and fibre optic cable. In addition a number of US, European and Japanese manufacturers are working on fibre optic wiring concentrators that conform to the Token-Ring standards.

Conclusion

The efficiency and architecture of a LAN's hardware is crucial in the performance and speed of the network, hence benefitting the most important component of a network, the user.

The Token-Ring LAN can support the high speeds at low error rates, owing to its comprehensive ring management and the implementation of the standard in "state of the art" chipset design.

Recent industry surveys by companies such as the Yankee Group and the Gartner Group indicate that the Token-Ring LAN will be the dominant LAN architecture by the early 1990's. Users can therefore look forward to an abundance of software and hardware supporting the Token-Ring LAN, clearly making it the LAN of choice.

Books *Continued from page 52*

and finally complete functional systems.

The first section begins with atomic and crystal structure, leading to semiconductor physics. It then deals with diodes, bipolar transistors, JFETs and MOSFETs, UJTs and the various kinds of thyristors, ending up with photoelectric devices.

Section two then deals with the various basic circuits: rectifiers and filters, amplifiers, tuned amplifiers, power amplifiers, operational amplifiers, oscillators and waveshaping circuits. Finally section three deals with two typical kinds of system: regulated power supplies and thyristor power control systems.

The treatment throughout is systematic, thorough and concise, with all basic maths given to cover device operation and circuit analysis/design. At the back there is also a very useful appendix with manufacturers' data on a range of representative devices.

In short, a very well produced text on basic semiconductor devices and their application in circuits.

The review copy came from Prentice-Hall of Australia, but copies should be available from all larger and technical bookstores. (J.R.)

Letters Continued from page 7

and for TV. Also production information and service data.

The cost of this catalogue was 3 pounds sterling, including postage to Australia. They do advertise in "The Gramophone" on occasion. It is a Mail Order and Export company only, selling direct to their customers. My relation with them was for old TV books and instruction leaflets, sent very promptly (photostats).

I hope this information is of interest.

E.F. Watts,
Newcomb, Vic.

Comment: Thanks for sharing the good news, Mr Watts!

More on metal fume fever

I write in reply to M.W.'s letter in the June 1987 issue of *Electronics Australia* Forum.

As a medical practitioner myself, I read with some amusement, M.W.'s reference to my profession and your appropriate reply. However I would like to comment on your subsequent text.

"The Merck Index" is, as its name indicates, an index of chemicals, giving brief details of around 10,000 substances. My copy cost me $27.50 new. It is not a useful reference when considering medical or veterinary toxicology. Far more appropriate is:

E. Broioing, "Toxicity of Industrial Metals" (Appleton-Century-Crofts. New York, 2nd Ed., 1969); or

R. Baselt, "Disposition of Toxic Drugs and Chemicals in Man" (Biomedical Publications. Davis, California, 2nd Ed., 1982).

It would appear from the latter that copper is more likely to be the aetiological agent, if indeed the diagnosis is Metal Fume Fever, rather than cadmium or cerium.

Finally, I would advise M.W. to contact the Occupational Health or Industrial Health Medical Officer of his State Health Department, for more information.

Hoping this is of interest.

Dr. C.A. Appleton,
Chemical Pathologist,
Queensland Medical Laboratory,
West End, Qld.

Starter battery care

I write to help inform both your contributors and your readers in the matter of starter battery care, including charging and fault diagnosis.

Nearly 30% of all batteries are replaced because they are "just flat". This is the result of a combination of several factors, drive times and trip distances, for example short drives at night in cold winter conditions will cause the battery to be discharged because:

(a) Lighting, heating and ventilation loads will consume most of the alternator output and cause voltage drop in the wiring, reducing the volts applied to the battery terminals, so the battery is not charged. In fact, when idling at traffic lights, the battery is being discharged.

(b) With a cold vehicle, the alternator warms to engine temperature quite rapidly in 5 minutes or so but the battery takes up to an hour to heat. Cold batteries need higher voltages to charge them and the regulator in the alternator reduces the output voltage as its temperature rises, so there is a "no charge" situation.

All of these conditions prevail in vehicles where all of the manufacturers specifications are within tolerance. Voltage settings vary from 14.2 volts to 14.6 volts when the battery, alternator and regulator are all at 25°. In Australia, battery temperatures vary from 0°, to above 60°C and while the regulator may be cold before starting it quickly heats to 85°C or more.

Investigations of the battery/starter motor relationship have also been enlightening. The most difficult engine start was found to be when the engine is very hot but starts were certain if the battery was fully charged. This and other unexpected results were explained by reference to the battery internal resistance. Internal resistance increases rapidly as the battery is discharged, so that when it is connected to the small and nearly fixed load resistance, the current, torque and power delivered by the starter is required.

Overcharge is no longer a problem with automotive batteries due to better alloys in the grid metal, greater control of the purity of ingredients and the highly reliable solid state regulators.

Recent research has shown that some changes need to be made to both the regulation of charging and the installation of the battery in the vehicle. We must assume that batteries may be discharged by 5% during a 30-minute journey; this is about 125 ampminutes. For this to be recharged in next 30-minute trip, the charge must average 4.16 amps.

The charge acceptance diminishes with time, state of charge and temperature by around 5 times, so this calls for 21 amps initially, reducing to 1 amp at the journey end. This is only possible if the battery terminals are maintained at 14.6 volts with a temperature correction of –20 millivolts per °C away from 25°C.

This means that the EA voltmeter should indicate 14.6 volts shortly after starting during a day of 20 to 30°. On a 5°C morning, a satisfactory battery condition would be indicated by a reading of 20 x 20 = 400 millivolts more i.e., 15.0 volts. This is the maximum permissable and the regulator will not allow higher outputs.

The effects of high temperature encountered in summer in Australia also greatly influence battery life and performance. Batteries operated above 60°C tend to be unstable, to the extent that they enter a condition known as "thermal runaway" if overcharged at this temperature. So vehicle engineering must locate the battery where it will not reach this maximum.

Between 25 and 55°C the terminal voltage must follow the thermal coefficient above, so that at 45°C in the battery the EA instrument should read 400 millivolts less, i.e., 14.2 volts. You will see now that the addition of a temperature sensor and scaler correction would greatly add to the value of this project.

The open circuit voltage of a 12-volt lead acid battery happily coincides with the digits used to express specific gravity of the electrolyte. As a result, the so-called electric hydrometer is just another suppressed zero voltmeter, where 12.60 volts equates to an average specific gravity of 1.260. This relationship holds down to about 40% full charge.

Care must be taken that temperature is around 25°C and the surface charge has been allowed to dissipate; this takes one hour to occur. Voltages displayed during driving periods reflect several aspects of the vehicle electrical system, ranging from drive belt slip to load, regulator setting and even battery state of charge.

I write with the experience of more than 30 years in the technical, research and development of Dunlop Batteries and would be happy to assist your very good magazine, which I have received for 35 years.

J.C. Howlett,
Cheltenham, Vic.

Comment: Many thanks for your information. We'll see if it is possible to modify the voltmeter project along the lines you suggest.

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Information centre

Connecting a CD player

I have recently purchased a Compact Disc player, and have experienced difficulties matching it to my amplifier. I have only one spare input left in the amplifier, a 2.5mV/50k ohm phono input. I am wondering how I could design an attenuator to match it to my CD, which puts out 2.0V at 10k ohms. Thank you. (P.S., Mt. Riverview, NSW).

● *It sounds as if the input concerned is for a magnetic pickup, and will have the appropriate equalisation circuitry built in. As a result, you would have to use an attenuator with "reverse equalisation", to bring the response to "flat". The results are likely to be rather disappointing and would scarcely do justice to the signals delivered by the CD player.*

Frankly, we'd suggest you organise things another way, so the 'CD signal can be fed into a higher level "flat" input like "AUX" or "Tuner". This is likely to give far better results.

Electronic rain gauge

I have just completed an electronic rain gauge to the specifications published in your issue of March 1987.

I thought the following may be of interest to you or any of your readers who may have experienced the same effect on the operation by the use of a relatively long trigger cable as I did.

I made the unit up exactly as described by Mr Clarke. I had to make the funnel out of 26ga sheet galvanised iron as a plastic one was not obtainable in these parts. The board was obtained from RCS Radio and the parts from the local Dick Smith Electronics store.

No difficulty was experienced in getting the unit to work, its operation on the bench was faultless using about 2m of twin figure 8 light duty flex for the trigger lead.

But on increasing this lead to about 15m, a "double " trigger effect was experienced doubling the count x2. Increasing the time constant to about 2 secs by increasing the 1 Meg resistor to 2.2M only slowed the second pulse. I tried various types of cable, larger, with the same results.

Reasoning that this was no doubt a spurious pulse developed by an unterminated line, a damping resistor of 330 ohms was placed in series with one leg of the line. This effected a cure and the unit now works as intended with the 15m of light flex. Unfortunately, I do not have a CRO to check this out to my complete satisfaction.

I must compliment the author of the article for a well presented and very clean description of the unit. In conclusion I take this opportunity to thank you for your recent help with the Video Fader. You may recall Jaycar supplied the wrong IC in the kit supplied to me. Changing this to the correct type as suggested by you completely fixed the problem and the fader now works well. (T.D.K., Rosewood, Qld.)

● *Thanks for writing. We didn't strike any problems of the kind you describe, but your solution seems quite in order. It's good to know that your Video Fader is now working as it should, too.*

Turbo-timer

I have constructed the turbo-timer but I have struck several problems in its operation.

Firstly a 500 ohm trimpot had been supplied by Jaycar in the kit instead of the 200 ohm trimpot specified. This caused the adjustment to be too sensitive but was solved after the trimpot was replaced with the correct value.

Secondly, I found it better to set the trigger voltage at pin 6 of IC1a to about 5.5V, rather than by experiment. This was done with the engine cold.

The problem that I have is that the unit triggers prematurely, only after a short drive. When tested on the bench this problem does not occur. After replacing IC1, IC2 and the LM334, I suspect that it is being triggered by electrical noise when installed to the vehicle.

Can you explain the problem? At present I have to ensure that S1 is pressed when turning off the ignition after a short drive. (B.C, Gunnedah, NSW).

● *We suspect that your problem is due to incorrect adjustment of VR1. It is not recommended that the Turbo-timer be calibrated by measuring the voltage at pin 2 of IC1a. While the setting of VR1 does determine the number of mV per degree C from the LM334, it is the actual high going trigger voltage for pin 6 of IC1a that determines the final setting of VR1. Consequently, the setting of VR1 must be made on the vehicle as suggested in the article or unreliable results will be obtained.*

Tachometer on the TAI

I built the Hall Effect pointless electronic ignition from your February 1983 and September 1984 issues of *Electronics Australia*. It is fitted to a 1975 202 Holden Torana with a full GMH instrument panel.

The engine fires up and runs very well. The problem that I have is that when the ignition is switched off the tachometer jumps. Some of the time the tachometer drops to zero, but most of the time it jumps to between 2000 to 5000 RPM mark. The tachometer reads steadily and accurately when the car is being driven.

Connection of the tachometer is to the negative side of the coil. Could you please give a possible cause for tachometer movement as the ignition is switched off? (R.R., Ipswitch, QLD).

● *The reason your tachometer jumps at switch off is probably due to discharge current through the coil. When the ignition is switched off, the BUX80 transistor used to switch on the coil will go open circuit and the only path for the coil current to flow is through the tachometer.*

We suggest connecting a 1k ohm 1W resistor between the negative of the coil and chassis to divert the coil current.

Screecher alarm

I am an avid student interested in the field of electronics. I intend to install the Screecher Car Burglar Alarm from August 1986 into my mother's car, together with the UHF Remote Switch from January 1987.

This will mean that the exit and entry delay timers and also the three second soft alarm feature are not necessary. Could you please tell me what is necessary to leave out of the alarm circuit and how to hook it up to the remote switch.

When adding a piezo alarm transducer, the article states that a 1k ohm resistor should be placed in parallel. Where should this be fitted?

The adjustment of the UHF remote switch transmitter requires setting to 304MHz. Since I do not have a frequency meter how can this be adjusted correctly? Also can you please tell me which output for the UHF receiver (1 to 4) should be connected to the screecher alarm. I would also like to install the external relay for the blinkers. (I.T., Greenfield Park, NSW).

• *The appropriate modifications to enable use of this project with the remote switch are as follows: Leave out diode D3 to remove the exit delay, leave out diode D6, the 10uF capacitor on pin 2 of IC2c and replace the 1M ohm resistor in parallel with D6 with a wire link to remove the entry delay.*

Removal of the soft alarm feature is not recommended since if you forget to switch off the alarm before entering the car the soft alarm feature will give a quiet reminder rather than a deafening screech. However, to disable the soft alarm feature, leave out transistor Q2.

To connect the UHF remote switch to the screecher alarm, simply delete switch S1 from the alarm and connect the +12V switched supply from the remote receiver to the supply for the screecher car alarm.

To set the UHF transmitter to 304MHz does require a frequency meter. Perhaps your local TV serviceman may be able to help you.

Further information on using the remote switch with the car burglar alarm is in our June issue.

Voltage regulator for outboard motors

I am interested in obtaining a voltage regulator circuit to incorporate in an outboard motor electrical system. The alternator installed is a single phase 6A unit feeding a bridge rectifier, to a battery.

The main problem is that during extended running periods the battery voltage can rise to over 16V. This is too high for electrical equipment such as the radio and depth sounder. Could you recommend a suitable solution to cure this problem. (K.C., Northgate, QLD).

• *Although we have not tried it, the VK Powermate described in December 1983 may form the basis of a suitable regulator. The approach would be to leave out the transformer and bridge rectifier in the existing circuit and feed the output of the alternator bridge directly to the 10A fuse.*

Playmaster amplifier

I have purchased and constructed the 60/60 amplifier and the results are very impressive indeed.

One thing concerns me however, is the loud switch off thump in the loudspeakers.

Is it normal for such switch off thumps to occur and can you offer any suggestions to a cure? (M.L., Woodville, SA).

• *You can cure the switch off thump in two ways. Firstly try increasing the 1000uF capacitor connected to pin 7 of IC2 and IC3 (located near IC3). The value of 2200uF should be suitable. Alternatively, install an 8.2V zener in series with the resistor at the base of transistor Q21 and replacing the 2.2k ohm resistor with a 1k ohm resistor.*

Notes & Errata

VZ-300 MEMORY EXPANSION (May 1987, CDI). Pins 2 and 4 of IC4 should be tied low and pins 6 and 15 tied high; not 4 and 15 low, and 2 and 6 high, as indicated. Connecting the circuit as shown may cause damage to either the static RAMS or the VZ-300.

Combination Lock

Continued from page 73

from IC3 goes high from 1 to 9 consecutively.

Allow more than 3 seconds to elapse, so that the power supply is disconnected from the ICs, and press S1 again. Wait for D6 to flash, and then press S1 the number of times equal to the first digit in the combination code. Check that after 1 second D6 flashes and T1 closes to pull pin 2 of IC5 high.

Press S1 again for the number of times equal to the second code in the combination. This time T2 should close, to bring pin 6 of IC5b high. Press S1 again for the number of times equal to the third number in the combination code. This time T3 should close to bring pin 12 of IC5c high. Press S1 again for the number of times equal to the fourth number in the combination code, and T4 should close to trigger T5 and the solenoid.

The solenoid can be held energised for as long as S1 is held closed. R21 may need to be reduced in value to suit the particular latch solenoid used for the striker.

Release S1 and wait 3 seconds for the power supply to be removed, then press S1. Wait for a second, and then press S1 a number of times equal to the first digit of the combination code. Wait for T1 to close. Now press S1 a number of times which is not equal to the next digit in the combination code. After D6 flashes, transistor Q3 should turn off, removing power to the anodes of the SCRs. This will release SCR, T1.

If everything has happened according to the above description, your combination lock should be working properly.

Installation

The electric striker plate will require installation into the door jamb. This normally will replace the original striker plate of a key operated lock, allowing use of the original lock to gain entry to the door when the combination lock is not activated.

Cut away sufficient material in the door jamb to accommodate the striker plate and temporarily locate the plate to check that the door will close satisfactorily. Once it is installed correctly, wiring can begin.

Wiring to the striker plate should be concealed within the door frame and run to the combination lock circuit which can be located in the ceiling or under the floor. Ideally, the latch unit part of the PCB should be located as close as possible to the striker plate, as noted earlier.

Further wiring is necessary between the combination lock PCB and the switch S1 and LED D6. These can be unobtrusively located near the door, with the wiring again run within the door frame if possible.

EA marketplace EA marketplace

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Next month in Electronics Australia

All about thermocouples

Ever wonder how thermocouples are used to measure high temperatures? One of our features next month looks at the various kinds of thermocouples, how they work and how they're used. There's even news of a recent breakthrough in thermocouple technology — made right here in Australia!

Switch-tuned shirt pocket radio

Tuning a compact shirt-pocket type radio can be tricky — and if you bump it accidentally, the setting is usually lost. One of our projects next month is a low cost radio that solves this problem by using switch tuning. It's built in a novel case, too!

Experimenters' power supply

Looking for a good low cost power supply for experimenting with new circuits? Then don't miss next month's issue, when we'll be describing just the thing. It has adjustable current limiting, and runs off a standard low cost plug-pack.

**Note: although these articles have been prepared for publication, circumstances may change the final content.*

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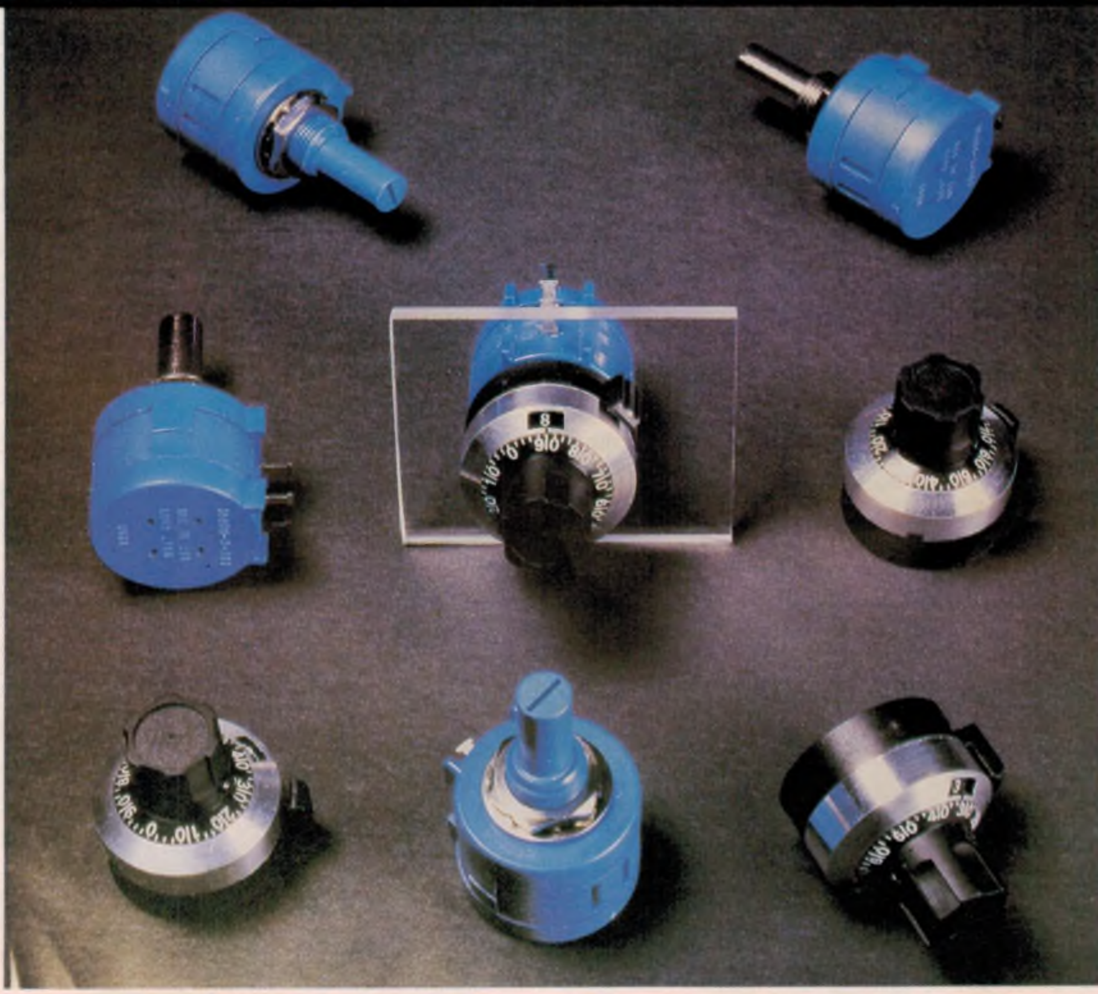

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1. The competition is open only to Australian Residents authorising a new/renewal subscription before last mail September 30, 1987. Entries received after closing date will not be included. Employees of The Federal Publishing Company, Thai Airways International Limited and their families are not eligible to enter. To be valid for drawing, subscription must be signed against a nominated valid credit card, or, if paid by cheque, cleared for payment.

2. Soбth Australian residents need not purchase a subscription to enter, but may enter once only by submitting their name, address and hand-drawn facsimile of the subscription coupon to The Federal Publishing Company, PO Box 227, Waterloo, NSW 2017.

3. Prizes are not transferable or exchangeable and may not be converted into cash.

4. The judges decision is final and no correspondence will be entered into.

5. Description of the competition and instructions on how to enter, form a part of the competition conditions.

6. The Competition commences on July 1, 1987, and closes on August 31, 1987. The draw will take place in Sydney on September 3, 1987 and the winner will be notified by telephone and letter. The winner will also be announced in The Australian on September 7, 1987, and a later issue of this magazine.

7. The prize is: A return trip for two people flying Thai Airlines economy class Bangkok with 8 days and 6 nights accommodation. Breakfast, one set of transfers to and from the International Airport in Bangkok and your hotel are included.

8. Passports, visas, insurance, departure taxes, transportation between any other destination, immmigration formalities, transfers to the nearest Thai Airlines International departure Airport, are the responsiblity of the winner. The promoter accepts no responsiblity for any delay, cancellation, accident, personal or property damage arising from and/or in connection with the travel prize.

9. Entrants under the age of 18 years will be required to nominate a guardian to accompany them on the journey should they win.

10. The winner and their companion agree to abide by the booking conditions as laid out in the Royal Orchid Holiday Brochure. All travel must be completed by September 3, 1988.

11. The promoter is The Federal Publishing Company, 180 Bourke Road, Alexandria, NSW, 2015. Permit No. TC 87/1119 issued under the Lotteries and Art Unions Act 1901. Raffles and Bingo Permits Board Permit No. 87/635 issued on 28/4/87. ACT Permit No. TP87/317 issued under the Lotteries Ordinance 1964.

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