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SPECIAL FEATURE

DISPLAY TECHNOLOGY

Electronics Australia

Volume 51, No.8

August 1989

AUSTRALIA'S LARGEST SELLING ELECTRONICS MAGAZINE – ESTABLISHED IN 1922

RGBI to PAL encoder/modulator

Can't justify the cost of a fancy colour video monitor for your PC, just for the kids' games? Here's the design for a low cost 'black box' which lets you use your colour TV instead. Easy to build and get going, too. (See page 80)

Hazard light flasher

Enhance your car alarm with this simple and low cost design which flashes your hazard lights and even sounds your horn if desired, to attract more attention. (See page 96)

'Frame Grabber' for your PC

Experiment with image processing, using this design for PC-based frame grabber. Built on a single card, it accepts normal composite video. (See page 84

On the cover

We wanted a picture to illustrate hifi listening on headphones (see page 108), and EA's busy production supervisor Kylie Prats graciously agreed to model for us. She's a natural, don't you think? (Photo: Greg McBean)

Features

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Projects and Technical

News and Comment

Departments

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Letters to the editor

Anniversary issue

Thank you for sending a copy of the 50th anniversary edition of *Electronics Australia*. It's an impressive effort.

Incidentally, regarding your comments about Amateur Radio experimentation, we've had such a mushrooming of digital and UHF/microwave experimentation here that we've had to create special means of documenting and disseminating all the work that's being done. We've found that most experimenters don't want to take the time to write polished articles for magazine publication, in part because by the time the article appears they've moved several steps farther ahead or in a different direction.

Our monthly QEX caters to this group, as well as various proceedings of specialised conferences that we publish at a rate of several per year.

David Sumner, K1ZZ,
Executive Vice President, ARRL,
Newington, Connecticut, USA

Bullet timing

The December 1988 issue of your magazine has an article by Ian Page on a Super Timer. A couple of years ago I built one almost identical, except that I used an RS flipflop for switching, and a 100KHz crystal, so the six measurement ranges are all one decimal point to the right of those shown.

The purpose was primarily to measure the speed of rifle and revolver bullets, with various bullet types and powder loads. The timer works perfectly, but the start and stop screens are the problem. I eventually made grids of narrow adhesive copper strip on cardboard, which the bullets short as they go through. I can get about five shots on a pair before they have to be repaired.

However, the smart way is to use the shadow of the bullet passing over a light sensitive device to switch the timer on and off.

Although widely used here, as far as I know none of these chronographs are made in Australia, or even imported these days. If you want one you have to send to America for it. And if you miscue and damage one of these "Skyscreens" it has to be sent to America for repair or replacement, so those who own one are a bit fussy about who uses it.

Perhaps your author could devise suitable units on these lines to go with the timer.

R H Beinke,
Quorn, SA

Wage rates

I wish to make some comments that may provide your readers (and the Industry) with an awareness of wage rates in the Industry. The basis for this correspondence arises from a comment contained in the March 1989 edition of *EA* under the article entitled 'The Serviceman'. On page 49 of that edition certain comments are raised in connection with wages, charges and interest in the industry. Accordingly I make the following comments:

(a) After a lengthy effort initiated by the Electrical Trades Union of Australia, the Australian Industrial Relations Commission (formerly the Conciliation and Arbitration Commission) established a Federal Award that set out wages and conditions for servicemen (technicians), installers and TV antennae erectors. That award, which is operative from March 1988, is entitled the *Television, Radio and Electronics Service Industry Award, 1988.*

(b) In terms of industrial coverage, there had not been a full and proper award coverage in the industry of electronics equipment servicing until this 1988 Award was put into place. Previously, the Metal Industry Award (which effectively is utilised for light and heavy engineering, fabrication type activities) had been the generally referred to means for setting wages and conditions. The ETU recognised the need for a specific award to apply in this ever expanding industry – not the Metal Industry Award.

(c) The intention in setting up such an industry specific award was to create a means of establishing uniformity of wages and conditions across the Industry. In so doing the skills, knowledge and technologies in the Industry would would be more properly recognised.

(d) As your article notes, " ..... I am

entirely on my own as to what I will charge my customers ..... I wish I knew what next week's wages are going to be; " there is an element of uncertainty still in the Industry. This award, over time, hopefully will resolve many of the problems. We too found that prior to the award coming into effect, that there was a disparity between wages and a disparity between charges.

(e) The ETU is an organisation that does have a deep interest in technology and is attempting to uplift the image of the Industry. This is a major task but with the co-operation of industry, hopefully the problem associated with the Industry will be alleviated.

(f) There is a major concern for the Industry in the area of employment and labour turnover. The ETU recognises this problem and is willing to discuss this problem with the industry.

R Krajewski,
Industrial Officer,
Electrical Trades Union of Aust.,
Sydney

Comment: Thanks for the advice, Mr Krajewski. Presumably if our Serviceman isn't paying himself enough money, he should go on strike!

Insights

Firstly, I would like to express my sincere thanks and appreciation to all those who have been involved with *EA* throughout its remarkable 50 years of publication. The Anniversary issue was excellently presented and I gained a valuable insight on many topics.

I have been a reader and collector of *EA* for over 20 years and have obtained numerous issues going back twice that period via secondhand book shops. I probably won't be around in 50 years time for the next celebration – which is just as well – because I'd be storing them in an underground shelter long before that.

Thank you once again and I trust that *EA* – under that title or another – will survive for the centennial issue.

Derek Hobbis,
Winmalee, NSW

12V test screwdrivers

The Energy Authority of New South Wales expressed concern to NSW Business and Consumer Affairs that some 6-12 volt test screwdrivers available were similar in appearance to 240 volt testers and did not bear labelling which clearly identified their voltage limits. In view of the similarities between the test

(Continued on page 143)

Editorial Viewpoint

New moves to help our components industry

I know I've been rather critical, in the past, of government initiatives to help build up Australia's electronics industry. Somehow many of them seem to have achieved little more than creating new jobs for bureaucrats, however well meaning may have been the intention of the industry committee or politician responsible for creating the initiative concerned.

Mind you, I'm happy to admit that some of the reasons why these earlier initiatives didn't achieve much might well be the rather insular and offhand attitudes of many people within the industry itself. It isn't easy to find ways to help people who aren't too keen to learn how the rest of the world does things, and what is expected and needed if products are to succeed in overseas markets.

Anyway, despite my criticisms of the past I have to admit that our current Minister for Industry, Technology & Commerce, Senator John Button *does* seem to have a realistic grasp of the problems involved in this area, and *has* prompted DITAC to come up with some practical, down-to-earth initiatives which look as if they might finally get things moving.

I've just seen some of the basic details of the new DITAC/NIES 'Vendor Qualification Scheme' and 'Vendor Development Program', for example. These are designed to provide practical, down to earth assistance to manufacturers in the telecommunications, computer hardware and components sectors of the industry. The idea is to help firms lift their manufacturing expertise and product quality to meet current international standards, and show them how to both exploit direct export opportunities and mesh in with the corporations already involved in Senator Button's existing 'Partnerships for Development' offsets program.

I've also been able to talk to Mr Wes Smith, National Co-ordinator of the Vendor Qualification Scheme, who strikes me as a very practical and forthright bloke – and one with many years of experience in the industry itself. He's determined to make the new scheme work, because like Senator Button he believes passionately that our manufacturing industry not only *can* become fully competitive in the world arena, but that it *must* do so.

Frankly, my impression is that if anything is going to get industry areas like components manufacturing going, the VQS/VDP schemes should do it – particularly in combination with the Partnerships for Development program, and with people like Wes Smith committed to making it work.

I certainly hope so, and I hope that everyone in the industry will give these new schemes their full support.

Jim Rowe

What's New In Entertainment Electronics

New 8mm camcorder from Sony

Sony Australia has announced the release of the CCD-AU220 Handycam, said to offer a range of features and benefits that make it the ideal unit for the first time video camera user or someone who is looking to update from the cumbersome 1/2" format.

It has a 6x power zoom lens with macro and a variable speed digital shutter with four settings up to 1/1000 of a second. There is also a linear time counter for easy location of particular scenes on a tape. The model also weighs less than 1.5kg, including battery and tape.

Those requiring low light recording capabilities have not been forgotten either. The unit will operate in light conditions as low as 7 lux, which makes it ideal for shooting indoors, like the family birthday cake cutting ceremony as well as perfect pictures outdoors.

As with all Sony 8mm camcorders the AU220 has 3 hours recording capability on one tape and AFM hifi sound recording for crystal transistions with no noise or colour smears. Instant playback is possible on any TV set, along with simple connection to any home VCR for easy editing.

The CCD-AU220 is available now throughout the Sony Dealer network at the suggested retail price of $1899.

Valve class-A amplifiers – made in UK

Believe it or not, there are now said to be more valve amplifier manufacturers in Great Britain then there are makers of solid state amplifiers. One such company is Audio Innovations of Brighton, UK which manufactures a range of distinctive looking class-A valve audio equipment, now being distributed in Australia by Audio Investments of Sydney.

Instead of hiding the valve compliment under a mesh exterior, the valves of the series 500 amplifiers are displayed in a semi-circle shape above a reflective perspex top plate.

The amplifiers use simple class-A circuit topology with low negative and local feedback (14dB). The designers have used the well-known EL34 pentode in matched pairs, to deliver 25 watts of pure class-A power per channel. The remainder of the valve compliment is two premium PCC88 and three ECC83. The circuit is also self-centreing and therefore requires no adjustment.

The input facilities accommodate CD, auxiliary, tuner, tape in/tape out and monitor. All inputs are 100k impedance and have a sensitivity of 400mV with a maximum overload better than 3V. The phono input is designed with ample sensitivity for most moving coil cartridges, however, the input impedance is 47k so an impedance matching transformer is recommended with most moving coil cartridges.

The series 500 is only one of several amplifiers in the Audio Innovations line up. Some very high end products are in line to be released shortly, including directly heated 100 watt/channel triode amplifiers using the famous 845 triode valve. Further details are available from Audio Investments on (02) 488 8184. Enquiries are welcomed from dealers.

CD, cassette head cleaners

Philips has introduced a new range of audio cleaning products, including cleaners for LPs, LP stylus, cassette heads and compact discs.

Philips claims that the new audio cleaners are extremely effective, safe and easy to use. They use special cleaning fluids, and are thus non-abrasive in action.

The Philips Cassette Head Cleaner kit contains a cassette with a special head cleaning tape and cleaning fluid. The moist cleaning tape removes oxide deposits and other residue from the audio tape head and capstan roller. Included in this kit, which retails for $4.95, is a set of replacement pads for the capstan.

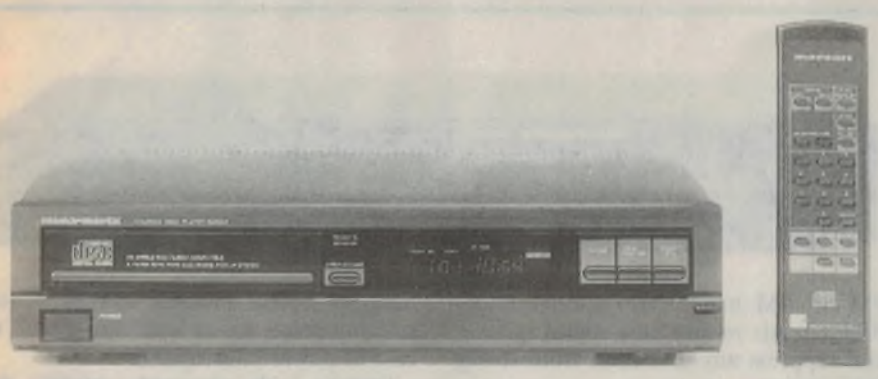
The Philips Auto Cassette Cleaner, which retails for $7.95, contains a mechanical cassette, cleaning fluid and replacement pads. This mechanical cassette operates with a gentle non-abrasive buffing action to ensure a thorough clean, and that no harm is done to the heads, capstan and pinch roller. Cleaning swabs, made of a newly developed material, are part of the kit. Also included is head cleaning fluid, pinch roller cleaning fluid, and a mirror for checking those hard to see areas.

The Philips Antistatic Spray, retailing at $5.95, is a specially formulated cleaning solution whose active ingredient is isopropyl alcohol, which inhibits the build-up of static electricity and dirt on LP discs. It is also harmless to the Ozone Layer!

The Philips Antistatic Cloth, retailing at $2.95, cleans records and inhibits further dust build-up, preserving the purity of tone, and prolonging stylus life.

The Philips Deluxe Record Cleaning Kit, which retails for $9.95, contains all the vital items needed to care for your stylus and records.

The Philips CD Autocleaner is motor driven, with a gear train and internal electronic controls. It cleans CDs in just 20 seconds, employing a radial cleaning action moving from the centre of the disc to the outside edge. It uses a high quality chamois cleaner supported by three balancing springs. Powered by battery, or an optional AC adaptor, it retails at $49.95.



Budget CD players with 'frills'

Two budget-priced compact disc players from Marantz offer sophisticated features usually found only in much more expensive CD decks.

The Marantz CD583 and CD883 sell for recommended retail prices of $399 and $499 respectively, but despite their low prices, they bristle with the same kind of advanced features found on audiophile models.

Both models have twin 16-bit digital-to-analog converters, with four times oversampling. Similarly, Marantz's fully floating laser transport with its swinging-arm pick-up can track the compact disc's incredibly small information track with much more precision than the linear-tracking arms used on most CD players.

Both the CD583 and CD883 models have shuffle play, repeat functions, direct access to 99 tracks, and a 20-track memory as standard. Automatic Music Search (AMS), which plays the first few seconds of each track, is also featured on the CD883.

Germans slam DAT performance

Although digital audio tape (DAT) recorders have so far not been allowed to reach the domestic hifi markets, outside Japan, they have at least produced an interested response from professional audio people. However even this may soon wane, as a result of a research finding published recently by the Institute for Broadcasting Technology in Munich, West Germany.

Institute researchers have carried out exhaustive tests on both DAT tape cassettes, from eight different makers, and a total of 19 different DAT recorders comprising eight 'professional' models, six 'domestic' models and five portables.

According to the Institute's report, none of the tape cassettes met professional standards of performance after repeated playing. Not only this, but inter-machine compatibility was limited, with recordings made on one machine not necessarily playing back reliably on another.

The report suggests that only drastic changes to the existing DAT format would allow it to meet professional requirements. It suggests either increasing the track width, giving shorter playing time, or a complete re-design with tape 6.3mm wide instead of 3.81mm, and a larger cassette.

Could this be another nail in the coffin of DAT as we know it?

Entertainment Electronics

New Tannoy 'near field' monitor speaker

Just released by UK loudspeaker specialist Tannoy is the NFM-8 a totally new Near Field Monitor.

Incorporating Tannoy's revolutionary new 8" dual concentric drive unit the monitor is cross braced from the rear of the drive unit to the rear of the cabinet and is finished in a stylish anthracite grey.

The innovative new drive unit incorporates an improved roll surround design, which ensures both linearity and robustness while allowing maximum acoustic radiation from the accurate piston action of the cone, but with minimum acoustic interference from the roll surround.

The new high frequency unit makes use of Tannoy's considerable research into Differential Material Technology (DMT), a technique in which a deep drawn aluminium diaphragm seated in a polyamide–based suspension gives the piston-like rigidity associated with titanium, but with little variability due to temperature variations. It also gives excellent self-damping. The addition of ferro-fluid damping and cooling liquid helps ensure that the first break up node is well above the audible and excitable range.

The NFM-8 is intended for use with amplifier power from 10 to 120 watts. It has a +/−3dB frequency response from 48Hz to 25kHz and distortion less than 0.5% between 100Hz and 10kHz.

Further information from Hi-Phon Distributors, Unit 1, 358 Eastern Valley Way, Chatswood 2067 or phone (02) 417 7088.

High quality outdoor speaker

Audio Telex Communications is the exclusive distributor of a unique outdoor speaker system it calls Omnispeaker.

This 'hi-tech' moulded speaker enclosure contains a waterproof bass speaker and Motorola peizo tweeter and will produce 100 watts peak power. The Omni can be planted in the ground and is dynamically stabilised to give a clear, vibrant sound.

Suitable for any outdoor situation, Omni is already used in such prestigeous installations as Disneyland, San Diego Seaworld, Opryland, Universal Studios and some of the finest homes in the world.

Attractively priced at $199.00 retail plus tax, the Omni is within the reach of most outdoor entertainment lovers.

Audio Telex Communications can provide the name of your nearest dealer (Dealer enquiries welcome), by ringing (02) 647 1411.

Improved FM tuner from Marantz

As the FM dial becomes more crowded, better quality receivers with improved tuning resolution and the ability to store large numbers of station frequencies in memory will be needed. A new model announced by Marantz Australia, the ST35, offers outstanding audiophile features for this growing FM scene – at a budget price. It can store sixteen FM stations and eight AM station frequencies in memory.

Quartz-synthesis tuning provides precise, drift-free reception on either the FM or AM band. Also special MOSFET circuits ensure best sound quality, and suppress any distortion from strong local stations.

'Last station' memory automatically brings in the last tuned station when the ST35 is switched on, and a memory back-up system protects the 24 stored station presets for at least one month in case of power interruption.

Despite such advanced features, the Marantz ST35 sells for only $349, recommended retail price. It carries a full two-year warranty.

Other meters show half the picture

The new Fluke 45 has dual display versatility.

With 2 multifunction displays and 16 different measurement capabilities, the new Fluke 45 does virtually everything you want a meter to do.
And all for a suprisingly affordable price of around $1260 (ex tax) plus options.

FLUKE

The 5-digit, 100,000 count dual displays give you more information in less time - and with less effort. For example, measure the Vdc output of a power supply while measuring the Vac ripple. Or check the amplitude and frequency of an ac signal. From a single test connection!

And the Fluke 45 is designed to make complex measurements easier, with standard features like a 1MHz frequency counter, Min Max, Limits testing (Hi/Lo/Pass), Touch Hold™ and Relative modes. There are 21 different reference impedances for dB measurements; in the 2Ω to 16Ω ranges, audio power can be automatically displayed in watts.

Accuracy to get the job done right.
The Fluke 45 is a true rms meter, with 0.02% basic dc voltage accuracy and 100,000 count resolution on both displays. Basic dc current accuracy is 0.05%, making the 45 ideal for servicing 4-20mA current loops. Closed-case calibration simplifies the calibration process and increases uptime.

Even an RS-232 interface is standard
Connect the Fluke 45 to PC's, RS-232 printers and modems is as easy as attaching the cable. An IEEE-488.2 interface and rechargeable batteries are available as options.

FLUKE 45 DUAL DISPLAY MULTIMETER

Dual Display	Compare and Relative functions
True-rms voltage and current, including ac+dc	Min Max and Touch Hold® functions
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0.05% basic dc current accuracy	Optional IEEE-488.2 interface, battery pack
1 MHz frequency counter	One year warranty
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RDS: adding data to normal FM radio

European FM broadcasters are pioneering the use of normal FM broadcast signals to carry digital data, via an ACS/SCA subcarrier. The resulting Radio Data System or RDS is used for distributing traffic and route information to motorists, continuous news messages, station identification, time and date codes and the like. Here's how it works.

by GEOFF BAINS

Radio broadcasting hasn't really changed much since it was first started. It's true that at first plain FM and then stereo has added a degree of better reception and higher fidelity to the medium, but basically things have stayed much as pioneers like Marconi and Armstrong left them.

The same cannot be said of television. What with cable, satellite TV, interactive TV, teletext and the like, television has expanded far beyond the simple entertainment concept it started with. But now at last radio is set to spread its wings a little, with the introduction of the 'Radio Data System' or RDS.

In essence, RDS is a simple idea. Digital data is added to an existing FM radio signal, to carry data about the station and the programme material. It's a little like TV teletext. However radio involves a much smaller bandwidth and has no blanking period in which to transmit the large amount of data possible with teletext – so the data rate is much smaller.

What's more, a radio receiver is often not stationary or even connected to a large effective aerial. The chances for useful but 'hidden' data transmission seem slim.

However, since the early 1970's the European Broadcasting Union has been working towards a system that not only overcomes the technical difficulties, but obviates any need to change existing receivers or make major changes to current transmitters.

Useful and far reaching applications to this transparent data transmission are already being operated in Northern European countries and some impressive proposals are in the pipeline.

Data transmission

The RDS data signal is transmitted as a double sideband suppressed subcarrier signal with a 57kHz separation from the main FM radio signal, in much the same way as the 38kHz L-R signal which is used with the main signal (L+R) to create the stereo pair.

This subcarrier frequency of 57kHz was chosen as it is three times the existing 19kHz stereo pilot tone and so can be simply locked into the third harmonic of this. The Swedish radio authorities had been trying out a paging system transmitted in this way for a while and found it most successful – with a minimum disturbance to the main signal.

The data subcarrier is simply amplitude modulated and bi-phase coded with the data, to provide a data rate of 1187.5 bits per second. The data itself is encoded in 'groups' of 104 bits, and these are divided into 'blocks' of 26 bits. In each block there are 16 useful bits of data and a massive ten bits of error checking, parity bits and block synchronisation.

Because RDS is a one-way traffic of data (there is no handshaking or back channel) it is essential that the inevitable errors in the data are detected. The RDS error protection system will detect all 1 and 2-bit errors, all single error bursts of 10 bits or less, and over 99% of longer bursts. Any errors of less than six bits can also be corrected without waiting for the next transmission.

There is a range of different types of data groups already established to provide various services. Further groups can (and will) be simply added to the list. Which groups are transmitted, in what order and at what regularity is entirely up to the service provider. However, those group types already defined are standardised, so that any RDS radio will receive and understand data transmitted from any service provider.

So far, nine group types have been internationally defined. These give a basic service and further group types are planned for the future.

All nine groups make use of a 'programme identification code' in the first block (block A). This is a 16-bit number giving information about the station, for use inside the receiver. The numbers specify the country of origin of the transmission, the intended coverage (local, regional, national or international) and a unique identification number

The Volvo SR-701, first RDS radio to become available in the UK. It is built in Japan by Mitsubishi.

for the station.

Six bits of block B are also used in every group type. A 5-bit 'programme type code' specifies the programme content according to type and a single bit 'travel programme' flag is used to indicate that the station carries traffic news broadcasts. The nine group types use the rest of block B and blocks C and D differently depending on their application.

Group 0

Group type 0 is transmitted over four times a second and it gives alternative frequencies for reception of the station. In a moving vehicle, when one frequency ceases to be received adequately, the receiver can automatically retune to a different transmitter for improved reception.

Block C in this group contains two 8-bit frequency alternatives, allowing for 200 possible frequencies at 100kHz spacing on FM band II to be detailed.

Block D in this group carries an eight letter 'programme service name' or station name, transmitted in ASCII (two 8-bit characters at a time) which can be displayed on the receiver.

Group 1

Block D of this group contains the 'programme item number' – a unique code for the transmitted programme consisting of the scheduled start time for transmission of the programme (month, day and time). This group is transmitted at the actual start time of the programme transmission, to start recorders and the like at the right moment.

Group 2

This group is used to transmit text to the receiver for display. Blocks C and D are used to send characters four at a time, up to a maximum of 64.

The transmitted 'Radio Text' can be used for anything the broadcaster may want, such as adverts, phone-in telephone numbers, information on the artist whose record is being transmitted, and so on. In Sweden the system has been used to give English subtitles to a Mozart opera, in real time.

Group 3

This group transmits 'Other Networks' information used by broadcasters with a number of stations (such as the BBC in the UK, which developed the idea), or by groups of independent broadcasters.

Again the idea is of particular benefit to travelling listeners. Whereas normally your push-button tuner would be tuned with a number of frequencies corresponding to a number of transmitters in the region of your home, an RDS receiver would be effectively preset to a number of stations, only initially tuned to their transmitter frequencies in your home area.

When travelling to another area, the Other Networks information gives the Programme identification code and Alternative Frequencies of other stations in the network in that area, so you can switch to another station in the network without retuning for the different transmitter.

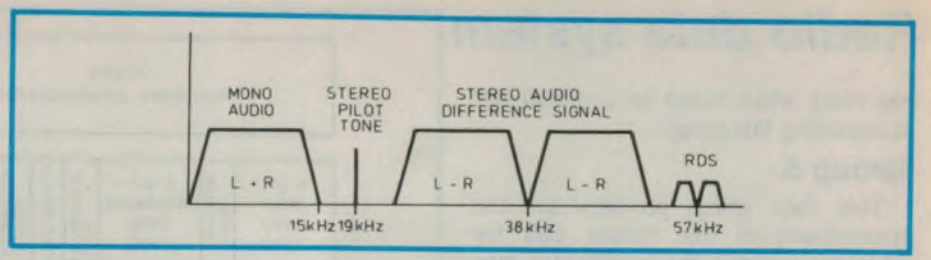


Fig.1: The RDS signal is transmitted on sidebands centred on a suppressed subcarrier 57kHz away from the main FM carrier, above the stereo difference signal.

Group 4

This group provides a timecode service, with two bits of block B and all of blocks C and D used to provide a running clock and date. The date is transmitted as number of days (0-99999) in the Julian calendar, which the receiver converts to date, month and year. The time is transmitted as five bits for the hour and six bits for the minute, with a further five bits for local variation.

The receiver is expected to provide a running seconds count between transmissions of the group, and to maintain

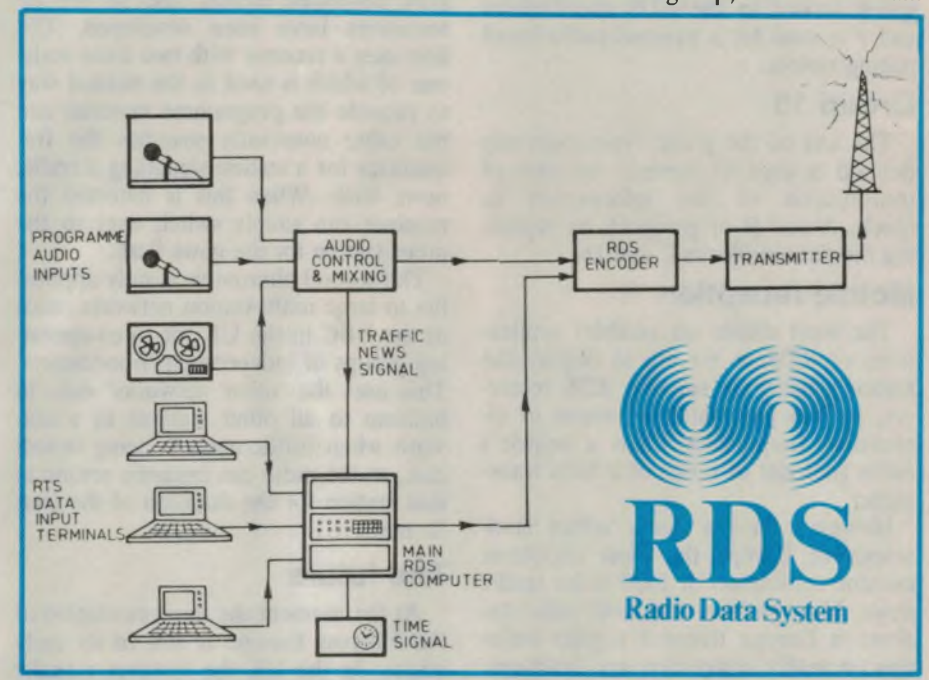


Fig.2: The basic setup used at an FM broadcaster to implement the RDS system.

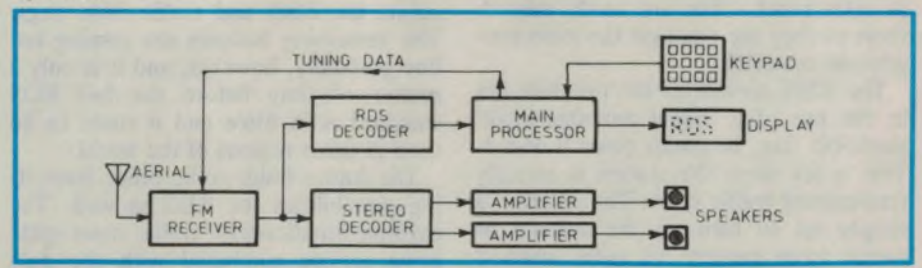


Fig.3: Inside the FM receiver, an added decoder and processor are used to separate and process the RDS signals for display and uses within the receiver itself – such as automatic retuning.

the clock when tuned to a station not transmitting this group.

Group 5

This data group provides for the transmission of free format data for whatever purpose the broadcaster may wish. The data is contained in blocks C and D with five bits of block B used to select one of 32 destinations at the receiver end.

As yet no broadcaster using RDS has made use of this group.

Group 6

This group is used for 'in-house' applications and is ignored by domestic receivers. The data is intended for use by the broadcaster for transmitter switching and other similar 'behind the scenes' operations.

Group 7

This is the most recently adopted group format in the RDS specification and it is used for a national radio-based paging system.

Group 15

The last of the group types currently defined is used to increase the rate of transmission of the information in blocks A and B of group O, by repeating the data in blocks C and D.

Mobile reception

The most visible (or audible) applications of RDS so far are to display the station's name on suitable RDS receivers, and to automatically retune to alternative frequencies when a vehicle's radio goes out of range of a local transmitter.

However, in the dense urban landscapes of Europe the most important current application of RDS is for traffic news. Most national and local radio stations in Europe transmit regular bulletins on traffic congestion and hold-ups. These are extremely useful to motorists regularly travelling large distances (such as sales reps) – but are easily missed, short as they are amongst the main programme material.

The RDS answer to the problem lies in the use of a 'travel announcement' single-bit flag, in group types 0 and 1. This is set when the station is actually transmitting traffic news. The receiver is simply set to turn up the volume or switch from cassette to radio when it detects that this flag has been set.

This in itself is an improvement, but it requires the radio to be tuned to a possibly unwanted station, and so two alternatives have been developed. The first uses a receiver with two front ends, one of which is used in the normal way to provide the programme material and the other constantly searches the frequencies for a station signalling a traffic news flash. When this is detected the receiver can simply switch over to the other station for the news flash.

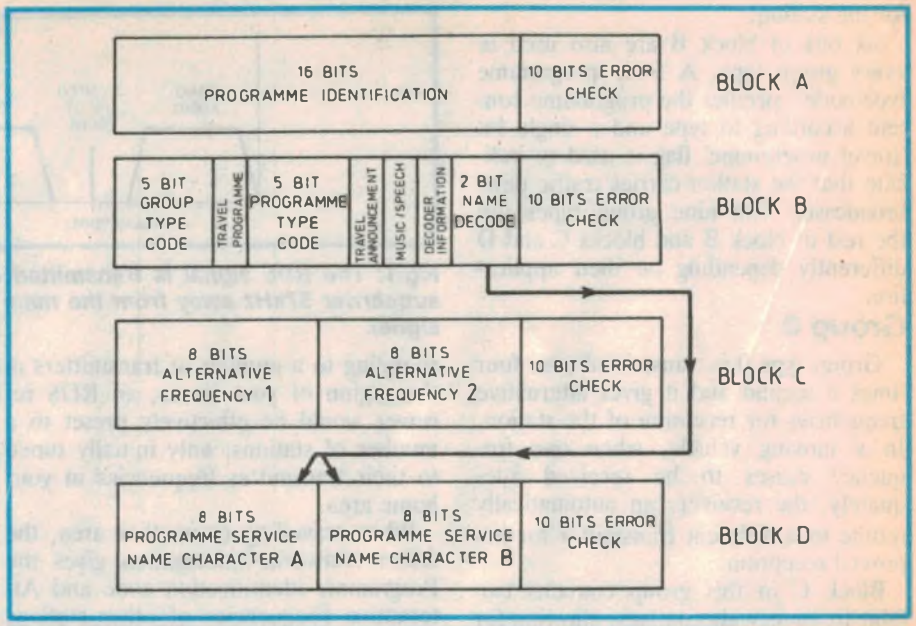


Fig.4: Each RDS data group is split into four sequential 26-bit blocks, each having 10 bits for error checking and correction. Here is the format used for 'Group 0' data.

The second alternative is only applicable to large multi-station networks, such as the BBC in the UK, or to co-operating groups of independent broadcasters. This uses the 'other networks' data to indicate to all other stations in a network when traffic news is being broadcast, so the radio can instantly retune to that station for the duration of the traffic news.

The future

At the moment the implementation of RDS across Europe is still in its early stages. In the UK the features actually transmitted are currently the alternative frequencies, station identification and name, the clock and traffic news flags. The remaining features are coming online gradually, however, and it is only a matter of time before the full RDS standard is in force and it starts to be used in other regions of the world.

The future holds some other interesting possibilities for RDS as well. The existing broadcasters' traffic news gathering service combined with the data transmission capabilities of the system (the type 5 group data) will allow in-car navigation systems currently being developed to be automatically updated with local and temporary traffic flow problems, and to take account of these when plotting routes.

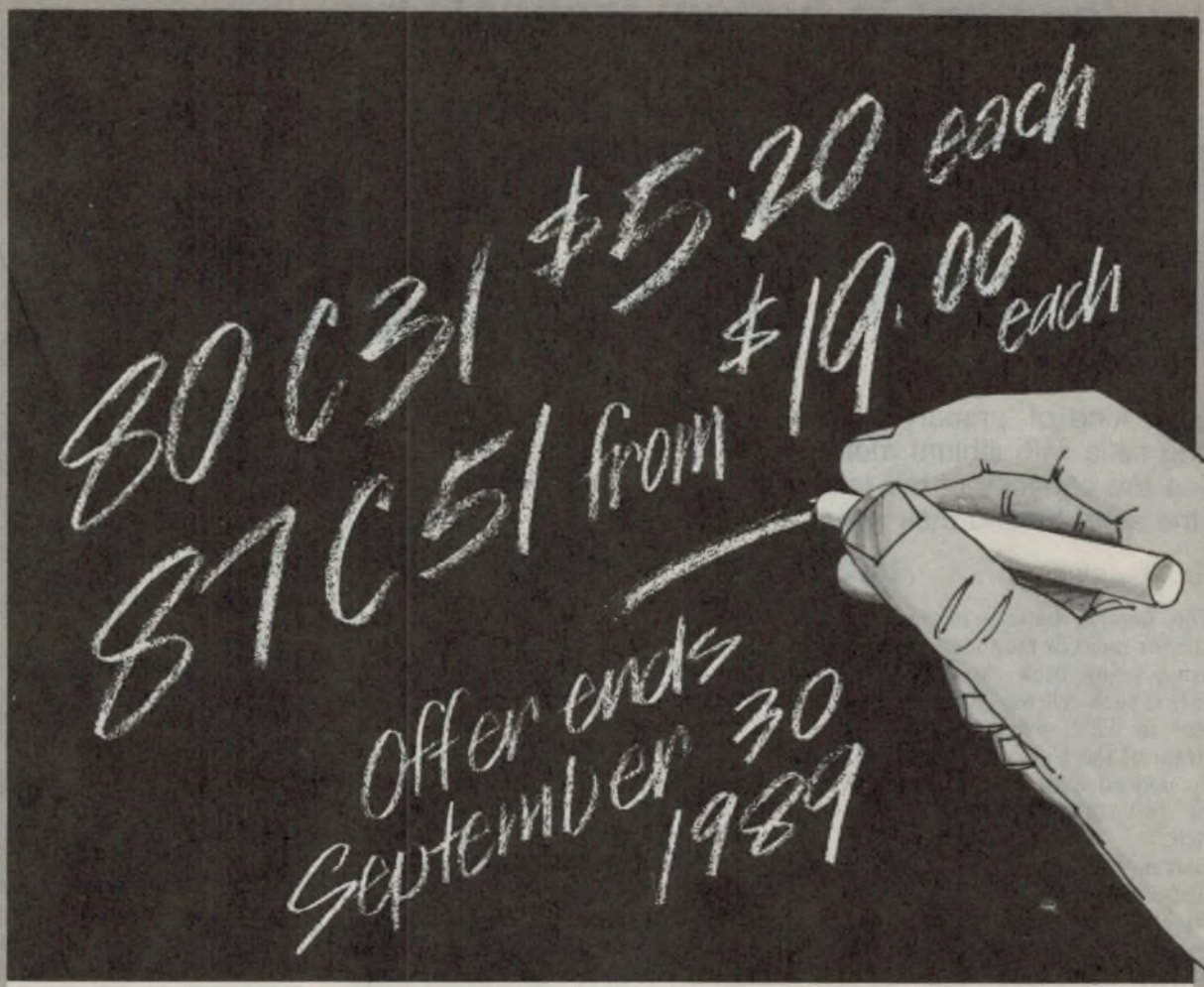
The BBC in the UK is also considering using the 'free format' data to transmit teachers' notes to be printed out to accompany educational programmes, and maybe to download computer programs for school or home use.

The programme type code (in block B in all groups) could be used for the receiver to select the programme material you want to hear. Your radio could then be set to play, say, exclusively jazz – selecting it automatically from any station in range.

A simple enhancement makes use of a single-bit flag in group types 0 and 1, to indicate if speech or music is being broadcast. a suitable receiver could use separate volume controls for speech and music, each independently set by the listener to avoid the now common tendency of broadcasters to set the DJ's chatter between records at a rather louder level than the music.

There is a lot of development work ahead for RDS before it will reach anywhere near its potential in the UK and Europe, and it has yet to make any impact in Australia. However, the die is now cast. RDS data is being transmitted and European receiver manufacturers are starting to offer RDS models.

It is only a matter of time before the huge Japanese electronics industry takes note of the developments, and then the whole world will be buzzing to the sound of RDS data on the airwaves.



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Development in battery technology:

Kodak's new lithium 'power cell'

A new kind of 'primary' battery is now available in Australia, using cells with lithium metal as the anode and offering up to twice the capacity of the familiar 'alkaline' cells. Here's a look at the story behind their development.

by JIM ROWE

The humble battery in your torch, transistor radio or multimeter has a long history, going back almost 200 years. The first such cell was discovered by accident in 1792, when Professor Luigi Galvani of the University of Bologna in Italy noticed that touching a frog's leg with two different metals made it twitch.

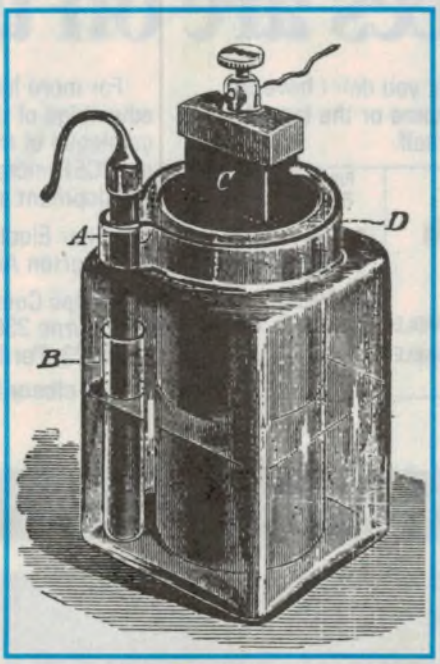
Galvani thought this was due to 'animal electricity', but a few years later in 1800 another Italian professor by the name of Alessandro Volta showed that the effect was caused not by the presence of animal tissue, but by the interaction of two different metals in the presence of a conducting liquid. Working at the University of Pavia, Volta found that considerably more 'electricity' could be produced by stacking alternate strips of zinc and copper with moistened paper between them.

Volta's 'pile' became the first true electrical *primary* battery, and of course ultimately earned him the honour of having a shortened version of his name used internationally for the unit of electromotive force: the *Volt*.

It wasn't until the 1830's that the technology of generating electricity was advanced significantly further, by that towering British scientist Michael Faraday. Only two years after discovering the principle of *electromagnetic induction* in 1831, and therefore setting the scene for the development of electromagnetic generators, Faraday was also first to discover in 1833 the basic principles of *electrolysis*, or the behaviour of electricity in liquids – setting the scene as well for the development of both primary and secondary cells.

After that, many different kinds of primary cell were developed, all generating energy rather more efficiently than Volta's original 'pile' but still based on the same principle: converting energy directly and irreversibly from chemical form into electricity.

But the first practical breakthrough came in the 1860's, when Georges Leclanche in France developed the improved zinc-carbon 'wet cell' battery, which soon became the main source of power for the newly-discovered electric telegraph – and later the telephone. The Leclanche cell used electrodes of zinc and carbon in a glass jar containing 'sal-ammoniac' (ammonium chloride) solution, and with the carbon electrode surrounded by a porous ceramic pot containing a mixture of carbon and manganese dioxide (the last-named as a 'depolariser').



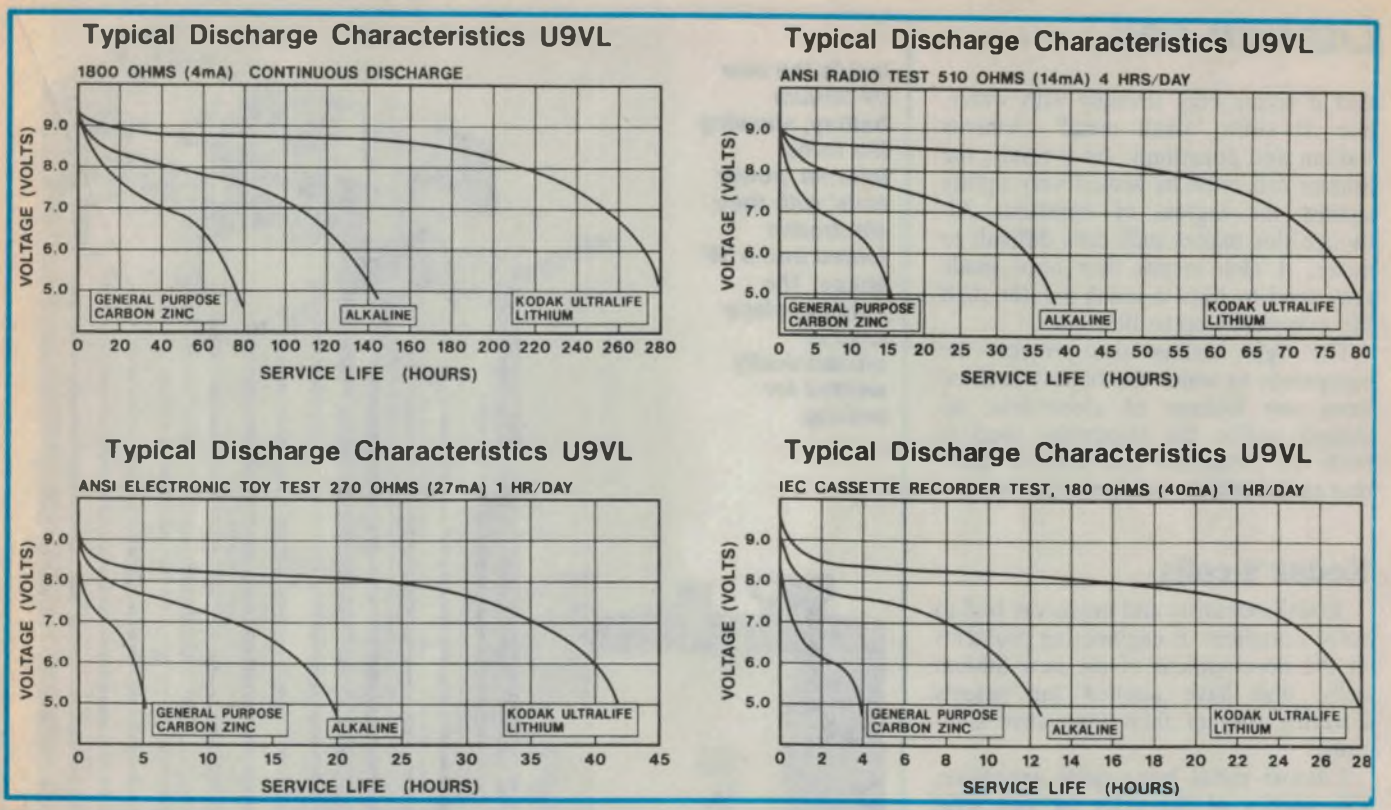
A Leclanche 'wet cell', circa 1870, and the ancestor of today's common zinc-carbon dry cell. C is the carbon rod, A the zinc rod.

Then in 1893 came the development of the 'dry' Leclanche cell, using virtually the same construction as today's common zinc-carbon cell. Here the zinc electrode itself became the outer container, with the carbon electrode in the centre surrounded as before by a compressed mixture of carbon and manganese dioxide, but with the sal-ammoniac electrolyte now combined with a 'binder' in the form of a jelly-like paste.

The 'dry' cell was much more compact and portable than Leclanche's original wet version, and made possible the development of all kinds of portable electrical equipment – including radio receivers and the humble electrical torch or 'flashlight', invented in America around 1900.

Up until the 1930's virtually the only 'dry' cells in common use throughout the world were of this Leclanche type, but in 1939 American Samuel Ruben developed the first real challenger: the 'alkaline' cell. This used manganese dioxide as the positive electrode, zinc as the negative electrode and an alkaline electrolyte of potassium hydroxide, and was able to offer a far greater electrical output than the existing Leclanche cells.

With its much greater capacity, improved energy storage to weight ratio and lower internal resistance compared with Leclanche cells, the alkaline-manganese cell has until very recently been the preferred cell for all applications where long life, reliability and the ability to deliver relatively heavy currents are important. However the Leclanche type cell has still remained extremely popular for less demanding applications, because of its lower cost; hence the current availability of both of these main kinds of primary cell, along with other more esoteric and specialised varieties such as the 'mercury' and 'silver oxide' cells.



The discharge characteristics of Kodak's new 9V lithium battery compared with normal alkaline and zinc-carbon types.

But the search has gone on, for primary cells with even better energy/-weight ratios, more consistent output voltage and longer effective life than the alkaline-manganese type. And in the mid 1970's this work resulted in the development of various kinds of *lithium cell*, offering up to twice the energy/-weight ratio of a manganese-alkaline cell, coupled with considerably better output voltage consistency and a very much longer shelf life.

Initially these lithium cells were used only in fairly esoteric applications, because of the difficulty in making them – and their resulting high cost. There were also a few cases reported where certain kinds of lithium cell were found to explode, when subjected to electrical overload. As a result, lithium cell technology tended to languish and little was heard of them during the latter 1970's and early 1980's.

However about two years ago the Eastman Kodak company in New York made a number of breakthroughs in battery manufacturing technology, opening the way for the company's lithium-manganese cells to be made more efficiently and at lower cost. As a result, they are now re-emerging as the 'dry cell of the future', perhaps destined to replace at least the alkaline-manganese type and conceivably even the Leclanche type as well.

Understandably Eastman Kodak is a leading player in this development. About a year ago the company released in the USA a high-performance 9V lithium 'Ultralife power cell' battery, and this has now also been released in Australia along with three small 6V lithium batteries for use in cameras. And a new 'Ultralife power cell' lithium battery has just been released in the USA, similar to the 9V type in size and shape but producing 3V at higher current, and designed for use in electronic flash units and similar equipment.

So after something of a false start in the 1970's, lithium cells and batteries have now finally become a practical reality, and seem likely to establish themselves as the new 'premium' member of the primary battery family.

The lithium cell

The essential components of a lithium-manganese cell are lithium metal, which forms the anode, and manganese dioxide which forms the cathode. These are immersed in an electrolyte, which consists of a lithium salt in a solution of organic solvents. A porous separator separates the two electrodes to prevent them physically touching, while permitting the flow of ions in the electrolyte.

The combination of lithium and manganese dioxide is a good one from an electrochemical point of view, as lithium is not only the lightest of all metals but the most readily oxidised – making it very *electropositive*, or eager to part with an electron in order to combine with oxygen.

Manganese dioxide is on the other hand very easily reduced, and hence *electronegative* – the manganese is eager to accept an electron, and sever its chemical bond with the oxygen.

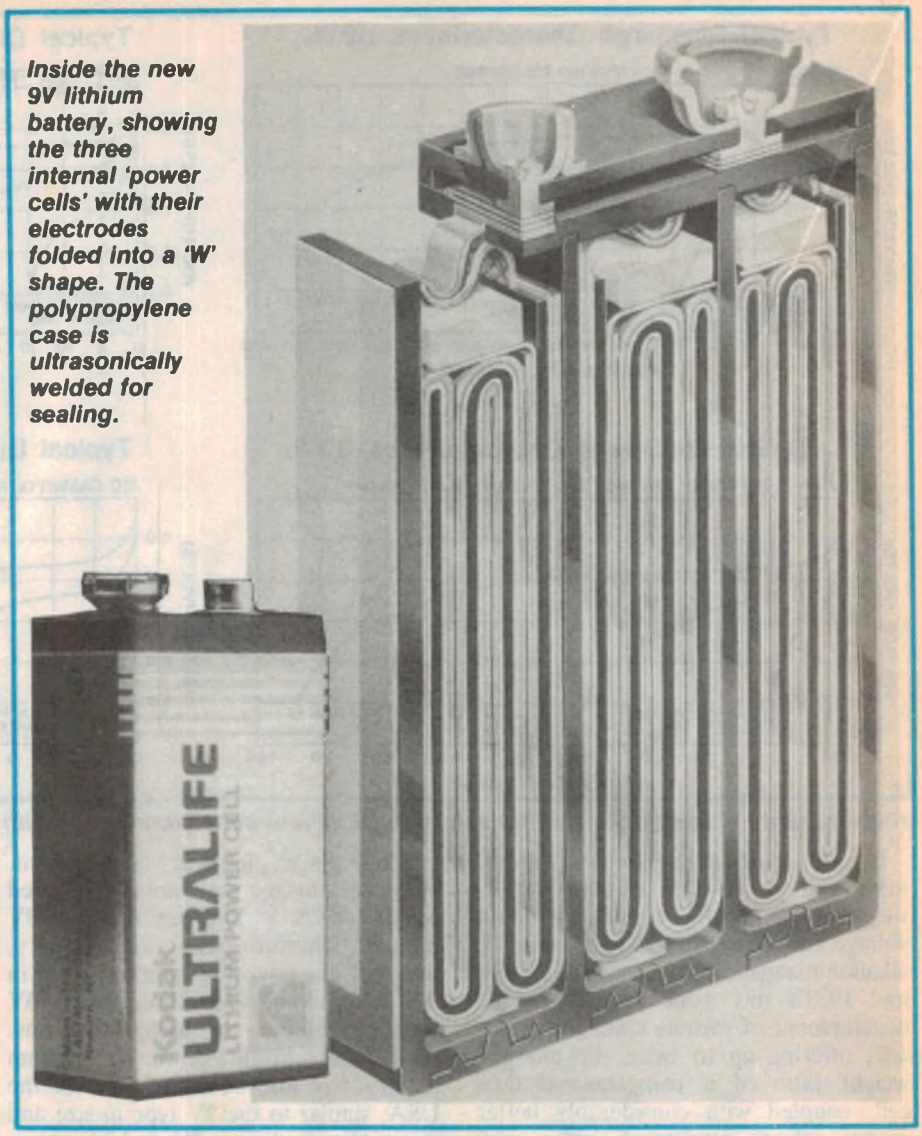
The combination of the two produces a basic cell with an output of 3 volts, in contrast with the 1.5V produced by both the Leclanche zinc-carbon cell and the Rubin alkaline-manganese cell. And the actual energy capacity/weight ratio is around double that of a normal manganese-alkaline – for example Kodak's new 9V lithium battery is rated at 1200mA.h, compared with 560mA.h for the equivalent alkaline type, yet weighs only 34.4 grams compared with the alkaline's 47g.

Part of this energy/weight ratio advantage arises from the fact that the 9V lithium battery needs only three 3V cells in series to achieve the required terminal voltage, compared with the six separate 'AAAA' cells needed inside an alkaline or Leclanche 9V battery. Another contributing factor is that Kodak houses its lithium battery in a new lightweight polypropylene case, replacing the pressed steel case of the conventional types.

Another characteristic of lithium is

that it reacts very strongly with water, like its sister 'alkali metal' elements sodium and potassium. As a result, the lithium cell must be sealed very tightly against the ingress of moisture. Although this makes such cells difficult to make, it also means that once made they tend to have a much greater shelf life – typically up to 10 years.

The tight sealing also protects the equipment to which the battery is fitted from any leakage of electrolyte, although unlike the electrolyte used in both the Leclanche and alkaline cells, that in the lithium cell is not corrosive.



Inside the new 9V lithium battery, showing the three internal 'power cells' with their electrodes folded into a 'W' shape. The polypropylene case is ultrasonically welded for sealing.

Kodak's cells

Kodak scientists and engineers had to solve a number of engineering problems in the development of the new lithium cells, and have applied for patents covering four of their innovative solutions.

Lithium metal being quite expensive, the anodes of the cells are not solid lithium, but a thin layer of the metal coated on a ribbon of stainless steel foil. This reduces the amount of lithium required for a cell to only slightly more than a gram.

Similarly although the active material of the cell cathodes is manganese dioxide, they cannot be made exclusively of this material as it is essentially a poorly conducting powder. Instead the MnO_2 is mixed with powdered carbon, to improved its electrical conductivity, and a dispersion agent/adhesive, and applied by rollers to both sides of an expanded stainless steel mesh. This forms the main cathode support, as well as the current collector. The entire cathode assembly is only a few tens of thousandths of an inch thick.

For correct operation of the cells, the anode and cathode must be spaced as closely as possible to allow the free flow of ions – yet not allowed to short circuit. This is achieved by using a thin membrane-like polypropylene separator, together with a non-woven mesh of polypropylene fibres coated with wax.

The purpose of the wax coating is to provide the cells with an inbuilt 'shut-down' safety mechanism, in the event of internal temperature rise due to overload or an external short-circuit. If the temperature inside the cells rises to 90°C, the wax melts, filling the holes in the mesh, and preventing the flow of ions in the electrolyte. So the cell automatically shuts itself down, preventing the battery from melting its case and possibly causing a fire.

This automatic shut-down feature is one of the innovations for which Kodak has applied for a patent.

Inside the cells, the anode/separator/-safety layer/cathode 'sandwich' is folded into a 'W' shape in order to maximise the electrode area for a given volume. This construction leaves the ends of the electrodes accessible at the top for the electrical interconnections, and is the subject of Kodak's second patent application.

After the electrode assemblies are inserted into the chambers of the moulded polypropylene case, another polypropylene 'interconnect cover' is ultrasonically welded to the top, providing a hermetic and leak-proof seal for the tops of the cells. The cover also has metal inserts which provide the actual cell interconnections. The special ultrasonic welding technique used to seal the polypropylene cases is the subject of Kodak's third patent application.

Once the top is sealed, the battery is inverted and a vacuum applied through small holes in the bottom of each cell. They are then 'backfilled' with the lithium salt/organic solvent electrolyte solution, after which small polypropylene sealing stoppers are applied to the holes and ultrasonically welded in place.

The cells are then given a full electrical check, to ensure that they are fully functional. Following this the snap connector assembly is fitted, with gold-plated snap contacts to ensure long life and freedom from oxidation.

The completed batteries are tested a second time, during which a small percentage of its stored energy is 'burnt off' to remove any small residue of moisture or oxygen which remains inside. Following this they are labelled and given a final test, before being packaged and despatched.

Hi-tech factory

Along with developing new construction techniques for the new lithium cells, Eastman Kodak engineers also had to build a new factory and master new automated manufacturing processes, in order to ensure that the new batteries were priced at an attractive level.

The new 'Ultra Technologies' facility in Newark, New Jersey includes what is believed to be the largest 'dry room' in the USA. It occupies an area 100′ x 140′ – roughly the size of five tennis courts – and is fitted with airlocks and air-handling equipment to stabilise the production environment at a relative humidity of only 2%.

One of the challenges in building the factory and its fully automated production lines was to develop safe methods of handling the very reactive lithium metal. Another was to come up with a highly reliable method of welding polypropylene using ultrasonics. Although having many characteristics that make it ideal for enclosing a lithium cell, polypropylene was formerly regarded as 'impossible' to weld ultrasonically.

As part of the new facility the engineers also had to build a 'state of the art' testing laboratory, with instruments capable of testing both the finished cells and the materials to use in making them. This includes checking the purity of both the raw lithium metal and the chemicals for the electrolyte, in addition to the plastics used for the cases.

"The scientific apparatus had to be capable of a high degree of precision", says Peter Clark, the facility's V-P and general manager of operations. "For example, the changes that take place in extremely stable lithium cells – with a shelf life of up to 10 years – are almost too minute to measure. The lab equipment includes atomic absorption and infra-red spectrophotometers, gas chromatographs, thermogrammametric analysers, X-ray diffraction gear, and a microcalorimeter capable of measuring a millionth of a watt." The latter is used to predict the very long shelf life of the cells.

Highly automated machinery is used to coat the lithium, manganese dioxide and other materials used for the electrodes, onto the thin stainless steel support foils. Other equipment folds the 'sandwich' of electrodes and separation layers into the polypropylene cases, welds the electrical connections and ultrasonically welds the insert-moulded top, injects the electrolyte, welds the sealing stoppers and applies the snap connector assembly.

"We have also developed a very precise label-applying machine, that applies both sides of the labels to the finished batteries in perfect register", Clark noted.

"Because Ultra Technologies has instituted total process control methods, there is no separate quality control department", Clark added. "Everyone in the factory is responsible for quality. More than 150 process control points are automatically monitored. Sensors plot control charts and feed data to a central computer system that can provide statistical information by shift, day, or week as desired."

The implication is that this major investment in new manufacturing technology and process controls has played a major part in delivering the outstanding performance of the new lithium 'power cell' batteries, as much as the use of the lithium-manganese electrochemistry. But the combination of the two certainly seems to have produced an outstanding primary power source for small portable appliances – and for applications demanding long-term reliability, such as smoke detectors and emergency beacons. EA

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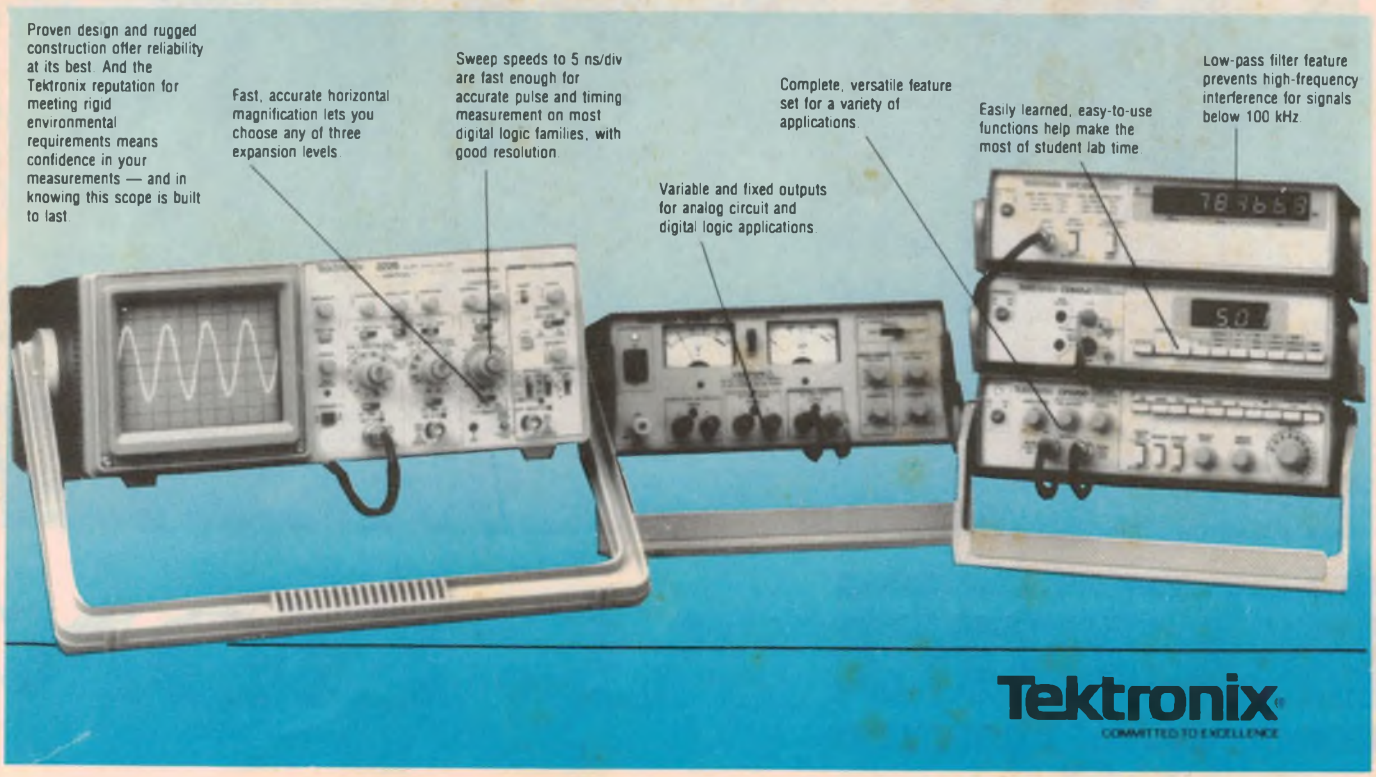

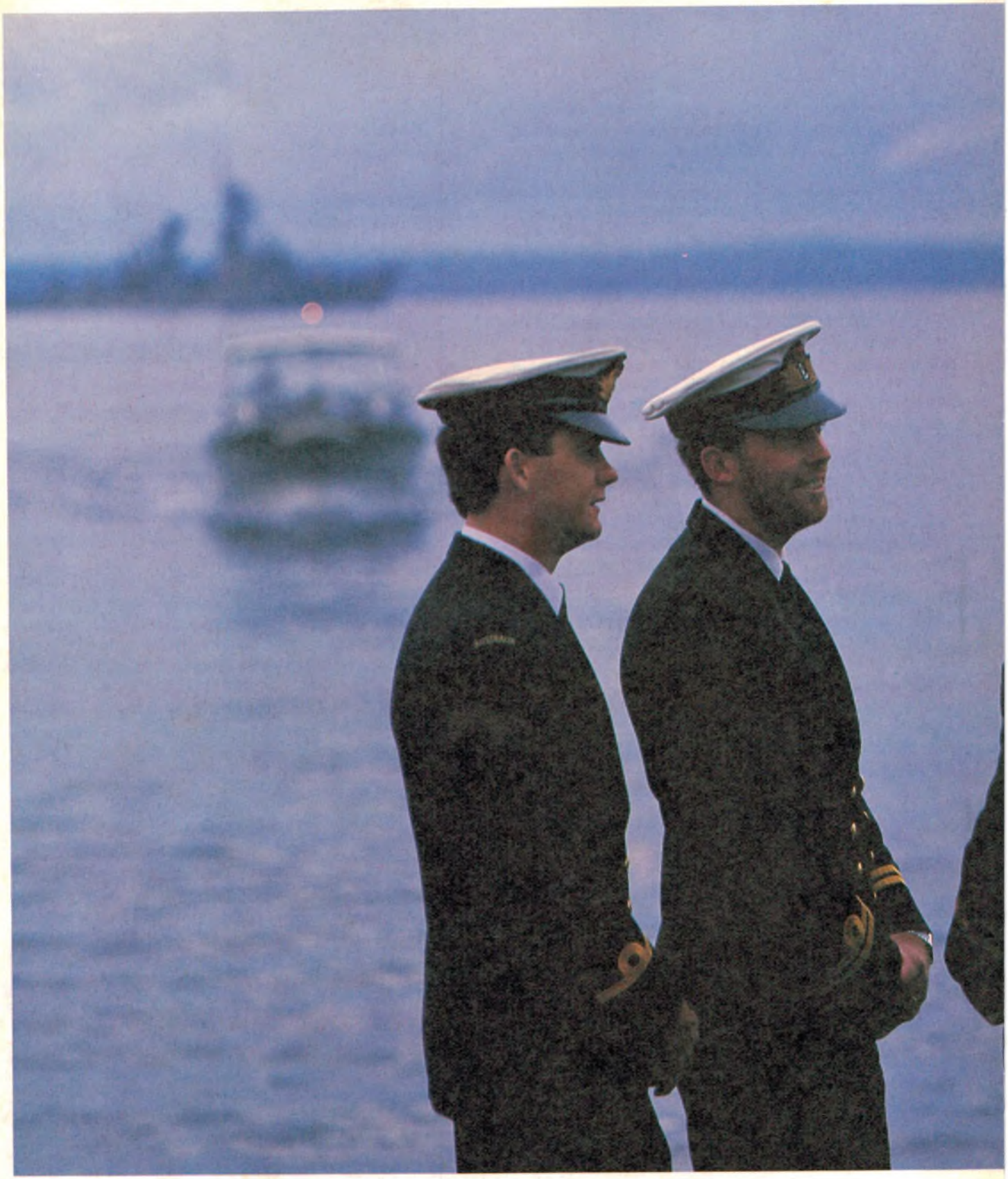

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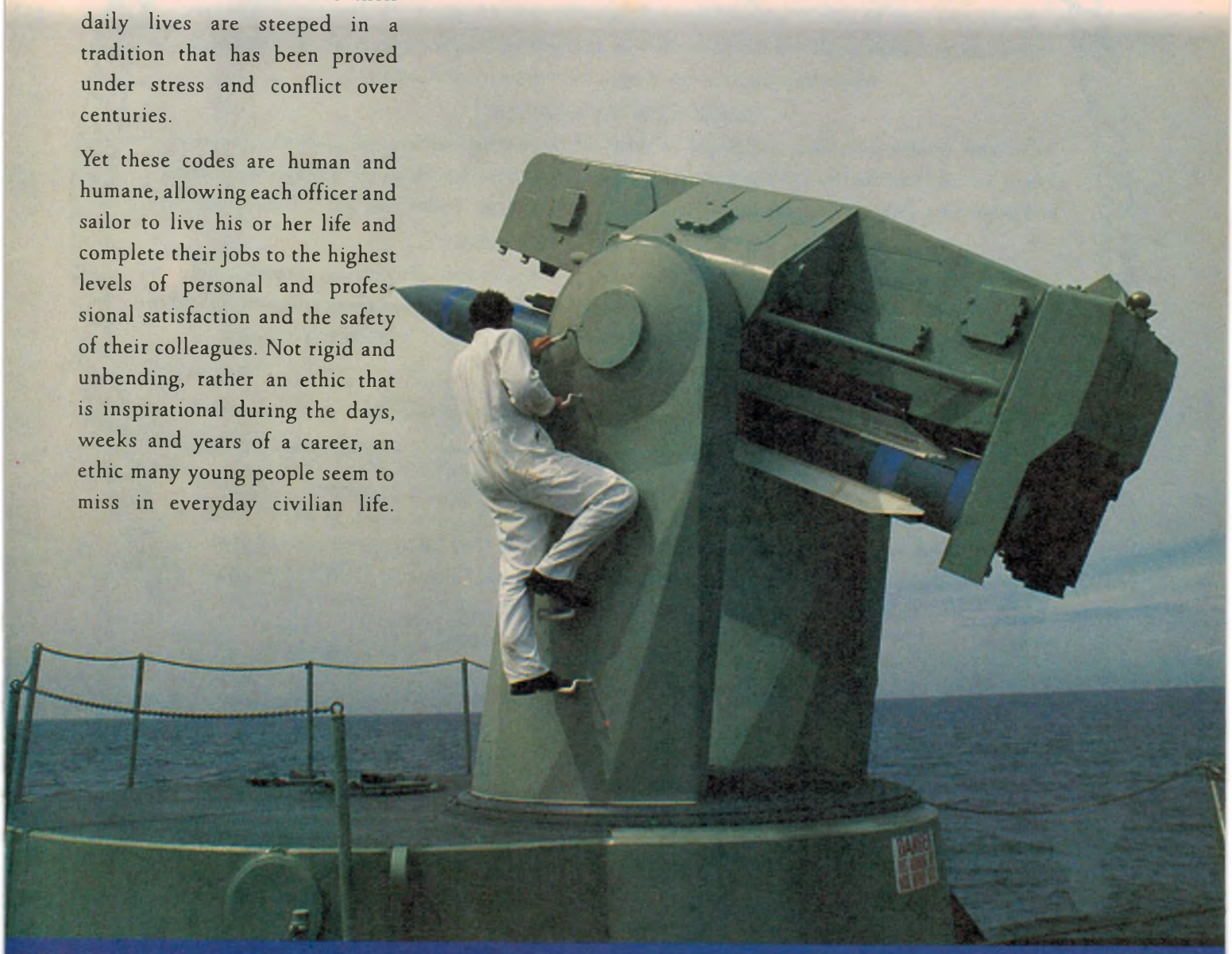

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Compact Disc Reviews

by RON COOPER

HAYDN

Joseph Haydn
'Surprise' Symphony No.94
Emperor String Quartett
Symphony No. 10
London Festival Orchestra
Alexander von Pitamic
VMK-Globe 18027 DDD
Playing time: 60 min

PERFORMANCE
1 2 3 4 5 6 7 8 9 10

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

Although called the 'Surprise' Symphony, there is no historically accurate record that the sudden fortissimo in the second movement was to wake up people who had fallen asleep. Certainly, compared to other sudden musical outbursts such as the explosion in Tchaikovsky's Pathetique, this 'surprise' is fairly tame. Nonetheless, this Haydn work is very enjoyable.

Following on this all-Haydn disc is the rather famous Emperor Quartet, a masterly chamber work revealing the composer's expertise in polyphoney, harmony and musical development.

The last work, Symphony No. 10 in D major was one of a group of works which were not discovered until after World War 2. It is an early quasi-symphony and while it contains the essentials of his later works, it is typical of the age of when it was written.

Muscially this disc is excellent, with very sensitive and skillful playing by the Melos quartet. Sound-wise it is very well balanced, but shows just a touch of top end hardness which is due most likely to the acoustic environment. Otherwise an excellent all-digital disc for $9.90.

OFFENBACH

Offenbach
Can Can
Overtures & Ballets
Philharmonia Orchestra
Antonio de Almeida
Philips 422 057-2 DDD
Playing time: 58 min 54 sec

PERFORMANCE
1 2 3 4 5 6 7 8 9 10

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

Can-Can (or Chahut) – a boisterous and latterly indecorous dance, of the quadrille order and including much high kicking, dating from about 1840 and then exploited in Paris for the benefit of such British and American visitors as were willing to pay well to be well shocked. (Oxford Companion)

By the nature of the title, you would expect to be very familar with this music but whilst it is very pleasant ballet music of Offenbach, most of the music is little known. Most people will be expecting to hear the famous 'Can-Can' from Offenbach's Gaite Parisienne or Orpheus in the Underworld, but it is not here; only a hint near the end of track 2.

Hence, my reference to the real meaning of the Can-Can, so to be fair this disc is not mis-labelled, but obviously titled to sell! However, there are interesting cover notes on all the works.

The spirited playing is first class, very typically Offenbach and most enjoyable. On that score you won't be disappointed – you can almost see the ballerinas scurrying and kicking.

Sound quality is in the 'very good' class, with very well balanced overall sound typical of Philips and Decca and excellent string sound.

GISELLE

Adolphe Adam
Giselle
Orchestra of the Royal Opera House
Covent Garden
Richard Bonynge
CD 417 505-2 DDD
Playing Time: 125 min 49 sec

PERFORMANCE
1 2 3 4 5 6 7 8 9 10

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

Here is over two hours of some of the most tuneful music ever written – and you don't have to be a ballet fan to enjoy it. This is the only way to hear this music, in its complete and original form.

Giselle is undoubtedly one of the masterpieces of French Romantic Theatre, being devised by Theophil Gautier, poet, theatre critic and novelist. Much of the music was sketched out by Jules Perrot before the composer Adolphe Adam was brought in, to complete the score for the opening which was in June 1841. Adam was quick at compositon and the work was an immediate success.

This new all-digital recording under the baton of the very experienced Richard Bonynge is simply superb in most respects – balance, reverberation, acoustics, tempos all sound 'just right'. However, there are just some occasional tempos which I would have preferred slower.

If you enjoy tuneful music, this set will bring much enjoyment whether just for background music or serious listening.

When I Think Back...

by Neville Williams

Fritz Langford-Smith: Engineer, author, music lover

Fritz Langford-Smith was widely known and respected for many years as Chief Applications Engineer for the Amalgamated Wireless Valve Company and as Editor of its *Radiotronics* technical bulletins, plus all four editions of the world famous *Radiotron Designer's Handbook*. Yet he was a very private man, whom few got to know at a personal level. This is probably the most intimate glimpse of 'FLS' published to date.

To better understand Fritz Langford Smith, it is helpful to know something of his family background. Fritz was the eldest of four sons born to Sydney Edgar and Charlotte Langford Smith, the former well known in Church of England circles as a long-serving Rector of St. Andrews C of E at Summer Hill, and Dean of St Andrews Cathedral and other charges in the Sydney Diocese.

If you noticed the missing hyphen in the above paragraph, it isn't a printer's error. That was the way that the family name was originally spelt, and how it still appears on Fritz Langford Smith's notable presentation to the IRE World Radio Convention in 1938. It was subsequently changed by deed poll to include the hyphen; so to avoid confusion, that's the spelling we'll use from this point on.

All four of the Langford-Smith brothers attended Trinity Grammar School at Summer Hill, in Sydney's inner west, each pursuing a different career:

FRITZ: Born 1904. Destined to be a prominent electronics engineer, editor and author. By way of private interests, a keen hifi enthusiast, yachtsman, hobby gardener and honorary office bearer for the Sydney Diocese of the Church of England. Now deceased.

KEITH: Born 1907 and affectionately regarded as the family 'maverick'. Keith's dominating ambition in life was to gain a pilot's licence and to minister to people in the remote areas of the Northern Territory, using the only planes he could afford: (very) second-hand biplanes. A born extrovert, he will be remembered by many for his 'Sky Pilot's Log' broadcasts over Sydney's radio 2CH – an entertaining mix of fiction and fact. Now also deceased.

Kindly made available to me by Mr Neil Bonney of Bundaberg, Qld, this picture of Fritz Langford-Smith is copied from the January 1951 issue of 'Radiotronics'. While still occupied with the production of the 4th edition of RDH, he had just handed responsibility for 'Radiotronics' to the new editor Ian Hansen.

NEVILLE: Born 1910. 'Went bush' as a jackeroo for two years before returning to the University of Sydney in 1929, where he gained a BA and later an MA in Education. He subsequently joined the C of E ministry and spent just on 45 years in overseas mission service, before retiring as the Anglican Bishop of Nakuru in Kenya. Having a lot in common with Fritz, he was my immediate family contact for this present article.

TREVOR: Born 1916. Formerly Professor of Geography at the University of Sydney. A very active man, he was keen on field work and, most years, led student groups on treks through central Australia. He is now retired but recently, at age 72, went trekking in the high Himalayas!

Fritz the schoolboy

But why 'Fritz' – a given name that, at the time, could not have been easy to live with? The answer, according to Neville, is simple enough.

Fred (short for Frederick) had been a traditional family name for generations and, in the normal way, would have been selected by his parents for their eldest son. But there seemed to be so many Freds in the family already that, to avoid further confusion, they chose the short Germanic form, little realising that, ten years on, World War I would breed an intense dislike of all things German.

At college, young Fritz was subject to considerable ridicule but, according to his brother, he displayed the 'uncompromising determination' that characterised him in later life. He chose to put up with the jibes, rather than change the family name that had been given him at birth.

Whether it was a helpful decision is another matter. His reserved disposition, the prevailing conservatism ('stuffiness') of the AWA Head Office and a given name that was still 'awkward' in the 1930s, were all barriers to familiarity. In the work situation, Fritz was rarely addressed by his christian name. To his face he was 'Mr'; in his absence by his initials 'FLS', or whatever else seemed appropriate at the time.

Like so many of his contemporaries,

Photographed at Summer Hill, the Rev. Canon Langford Smith, his wife Charlotte and their four sons (L to R): Fritz, Keith, Neville and Trevor.

young Fritz developed an interest in 'wireless' while still at school. To the intrigue of other occupants of the Summer Hill C of E rectory, he experimented with crystal – and later valve – sets on which he could listen to code transmissions from Pennant Hills, or voice and music broadcasts from Charles MacLurcan's amateur station at nearby Strathfield. This, before the commencement of official broadcasting in Australia.

Interested also in manual activities, he set up a workbench in the family garage, complete with lathe. By way of sport, his favourite pastime was canoeing and similar activities at Cabarita, on the nearby Parramatta River – an interest that, years later, led him to invest in a yacht on Sydney harbour.

Early career

From Trinity Grammar, Fritz matriculated to the University of Sydney where he later gained first class honours in Mechanical and Electrical Engineering, at the same time topping the Honours list in Electrical Engineering. In addition to his formal qualifications – BSc and BE with first class Honours, he subsequently became a Senior Member of the IRE (USA) and Chartered Engineer, a member of the IRE (Aust), and an associate member of the IE (Aust) and IEE (Aust).

The post-graduate years 1928-32 were spent gaining work experience in the UK, initially with the Metropolitan-Vickers Electrical Co, later as valve factory engineer with an associated company – the Cosmos Lamp Works at Brimsdown. On the side, he was at hand for the birth of Baird-style mechanical television.

According to John W. Stokes (ref. *70 Years of Radio Tubes and Valves*) it was a particularly interesting and innovative period for a young engineer to be associated with Cosmos around 1930 – both commercially and technically.

Originally a valve maker in its own right, Cosmos had been part of a merger in 1927/28 between Met-Vick, BTH and Ediswan, which saw the formation of Associated Electrical Industries Ltd (AEI). In the following years, the various valve types produced by BTH, Ediswan and Cosmos were gradually rationalised via Cosmos, with the individual brands gradually giving way to 'Mazda', a brandname to which the new AEI group held regional rights.

In 1927, just prior to the merger, E.Yoeman Robinson of Met-Vick had lodged a revolutionary patent covering 'slip-coated' heater elements in indirectly heated valves. Applied very successfully by Cosmos, it involved coating the heater element with an insulating layer by dipping it into a porcelain slurry ('slip') – later a paste – made from powdered alumina.

By obviating the need for other, more bulky insulation, the process permitted the use of a smaller diameter cathode sleeve, and offered more rapid heat transfer, greatly reducing the tedious warm-up period that characterised early mains-type valves.

About the same time, Cosmos also pioneered the 'short-path' concept, involving closely-spaced valve electrodes and producing, for the period, unusually high figures of transconductance – typically up to 4mA/V (or 4 milliSiemens, in modern parlance).

In 1928/29 Cosmos produced a general-purpose screen-grid mains-type pentode, and two notable high-gain indirectly heated output triodes. These were followed in 1930 by the world's first indirectly heated output pentode, the AC/Pen, sold under the Mazda label.

Back to Australia

Having been exposed to the then-innovative British valve manufacturing scene, with its many connotations in mechanical, electrical and electronic engineering, it was fitting that Fritz Langford-Smith should seek – and gain – a key position with what was to be Australia's first full-scale valve manufacturing company.

AWA had been involved in valve manufacture in a small way since about 1920. In 1924, they reached agreement with RCA to produce selected RCA types in Australia, distinguished by an AWA prefix. In practice, however, they represented a very small proportion of Australian market requirements.

In 1932 AWA decided to set up a full-scale valve manufacturing operation which, became a reality in the following year: the Amalgamated Wireless Valve Co, commonly referred to thereafter as AWV. The factory was set up in the AWA complex in Ashfield (Sydney) with the marketing and sales-technical activities operating, in due course, from the then-new AWA building in York St, City.

If dates mean anything, Fritz Langford-Smith must have been one of the foundation employees, joining AWV in 1932. As engineer in charge of the com-

pany laboratory, he visited Canada and the USA in 1935 to investigate the possible production of transmitting valves but, whereas in Britain his main American link would probably have been with Westinghouse, the Australian AWA connection was firmly with RCA.

As AWV expanded, FLS became progressively more involved in the sales-technical area, which led to his ultimate appointment as the company's chief applications engineer. It was in this role that I first met him personally and, at his subsequent invitation, joined the staff of the Ashfield Applications Laboratory in 1936.

Applications engineer

But what is the role of an applications engineer and, for that matter, what AWV later described as its 'Unified Sales-Engineering Service'?

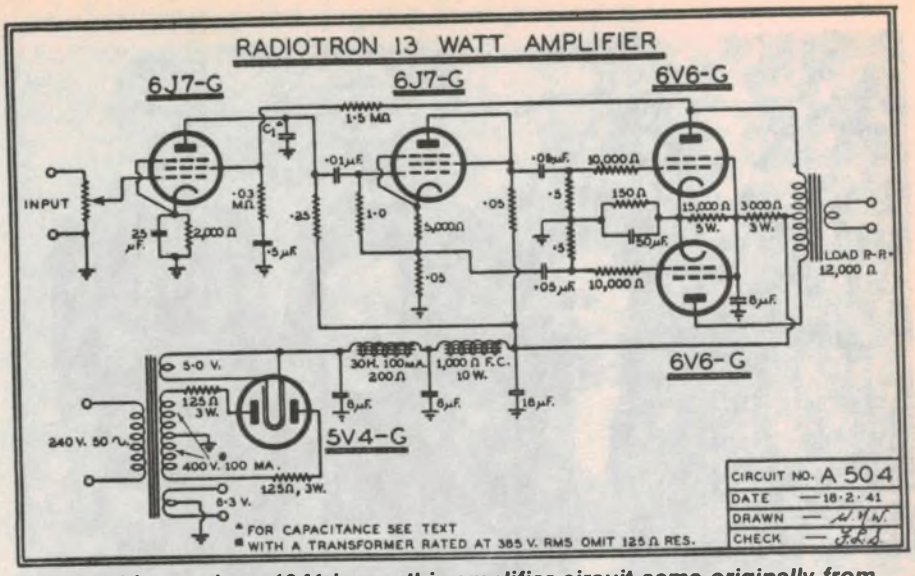
Even in those early days, AWV had men on the road full or part-time, some keeping in contact with equipment manufacturers, others with dealers and servicemen. Their job was to assure clients that Australian Radiotrons were the best valves, that AWV was the most reliable supplier, and that the company was well equipped to offer advice and assistance with any valve-related technical problems that they might encounter.

Problems brought to their notice were referred automatically to Fritz Langford-Smith, as Chief Applications Engineer. Matters to do with circuit design were handled by him personally, or by the Applications Laboratory staff; anything to do with valve quality or structure was referred to the appropriate factory personnel.

Perhaps I should add that other major suppliers like Philips and Mullard had also had their own sales-technical sections although, perhaps, somewhat less structured than the AWV team. And with good reason: in those days, equipment design, performance and reliability tended to centre around the valve complement.

By way of example – and I'm relying heavily on memory – my first contact with FLS had to do with early production samples of the all-metal 6L6 'beam' power tetrode, manufactured by RCA but distributed in this country by AWV; this, while I was still at Reliance Radio.

Attracted by the generous output ratings of the new valve, we had built up a couple of new-model prototypes featuring push-pull 6L6's, only to encounter a distinctly off-putting problem. Every now and again, when the volume was advanced, one or other of the 6L6's would arc from anode to shell across the tiny glass insulating bead used in the original construction. Even if the receiver was switched off before the arc severed the anode lead, the track etched across the bead by the arc would still render the valve unuseable.



Reprinted in our June 1941 issue, this amplifier circuit came originally from Radiotronics Bulletin No.112. Developed by AWV Applications Lab engineers in collaboration with Fritz Langford-Smith, it relies heavily for its performance on negative feedback. It was drawn by the writer (WNW) and checked by FLS.

Personal service

FLS visited Reliance, then in nearby Barrack St, City, to hear our tale of woe at first hand. There seemed little doubt that the problem was due to the peak anode voltages being developed, at high output levels, across the highly reactive (loudspeaker) load. In theory, this would be true of any high impedance output tetrode or pentode; in the case of the new 6L6, the voltages were clearly reaching destructive proportions.

RCA's initial literature on the new valve concentrated on its unique configuration and characteristics, and on typical operating conditions ranging from single-ended class-A to push-pull class AB2. Load values were recommended for each mode but, as I recall, without any reference whatever to the vagaries of practical loudspeaker loads.

Faced with the problem, Fritz Langford-Smith suggested that there appeared to be three options open to us, if we wanted to use the new 6L6's:

1. Operate them at a lower voltage and power level; or
2. Place a selected – and adequate – R/C network across the output transformer primary winding; or
3. Apply negative feedback around the output stage – at the time a relatively unfamiliar technique.

We offered a supplementary suggestion, which FLS acknowledged without official endorsement: namely that the metal shell of the valve be tied to chassis by a parallel capacitor and resistor, such that it could not support an arc, anyway.

Unless I miss my guess, it was the 6L6 and its problems that inspired a definitive paper which Fritz Langford-Smith subsequently presented to the 1938 IRE World Radio Convention entitled: 'The Relationship Between the Power Output Stage and the Loudspeaker'.

But old-timers could no doubt recall any number of other valve-related problems that he would have had to help sort out in the early and mid '30s:

- Type 47 output valves suffering from chronic grid current;
- Type 59 output valves with internal open and short-circuits;
- Loose grid caps, loose bases and unreadable type numbers;
- Gassy or low emission rectifiers;
- Microphonic or hum-prone audio voltage amplifiers;
- Autodyne frequency changers that dropped out of oscillation;
- Subtle differences in the behaviour of supposedly identical valves from different makers.

And so on – interminably!

Radiotron publications

By way of product promotion, AWV had sought, almost from the outset, to publicise its customer support activities by issuing stencilled information sheets entitled *Radiotronics*.

In 1935, the modest format was replaced by a regular monthly journal, professionally printed by Cloister Press. As the Company's Application Engineer, Fritz Langford-Smith was named officially as the Editor – a responsibility that effectively extended to other Company technical publications – until his resignation from that role in late 1950.

I can't recall ever having seen any of the early stencilled editions of *Radiotronics* but I do have a file of the printed issues from October 1935 to July 1941. They contain release announcements and details of new valves, some imported, others manufactured by AWV under licence from RCA and still others designed and produced in Australia to meet local requirements.

The very successful all-Australian 2-volt battery series announced in late 1935 were a prime example of AWV initiative in the lastnamed area.

Identified by Fritz Langford-Smith and the sales-engineering group, the urgent need for modern, reliable battery valves was met by the design/production team at Ashfield. Other engineers in the lab derived the data from which the official characteristic sheets and curves were prepared, while the applications team came up with typical circuits, coil winding data, and so on.

Apart from Radiotronics, FLS and his group were responsible for issuing valve data sheets and books for design engineers, quick reference wall charts and booklets for dealers and servicemen, valve interchangeability charts, bulletins for radio amateurs and sundry other publications.

I became deeply involved in all this, when I joined the AWV lab staff in 1936. Ironically, one of my early tasks was to prepare the drawings for Langford-Smith's paper mentioned above and inspired, at least in part, by the inquest at Reliance over the mortal remains of several metal 6L6's.

Landmark lecture

For Langford-Smith, preparation of the lecture involved sifting and rationalising literature on the broad subject dating back to around 1924, and re-defining the problem as it applied to current loudspeakers and valve types. The role of negative feedback had to be investigated and explained, together with the feasibility of obtaining triode-like performance figures from output tetrodes and pentodes – without sacrificing their innate power conversion efficiency.

Considerable practical work to authenticate the lecture was undertaken by staff in the Ashfield lab using signal sources, metering and distortion measuring equipment much more tedious to operate than their modern counterparts. Although delivered 50 years ago, the lecture re-defined the overall problem in terms that are still broadly relevant in the present solid-state era.

The RD Handbook

Hard on the heels of the lecture came the third edition of the *Radiotron Designer's Handbook*, released in 1940.

The first and second editions of this had been relatively modest publications of around 100-odd pages. But AWV Sales Manager Aub Hosking was not content with a merely 'modest' handbook, and encouraged his Chief Applications Engineer to come up with a more ambitious publication to carry the 'Radiotron' banner. I should perhaps add that FLS scarcely needed such encouragement!

The third edition comprised just over 350 pages, and was issued in both paperback and hardback form. It was subdivided into sections covering audio and radio frequencies, power supply,components, tests and measurements, valve characteristics, general theory and sundry data.

Once again it fell to my lot to prepare most of the drawings, many of them having to be created from raw data. With FLS as my immediate mentor, preparation of the drawings and involvement with the text turned out to be a revision course in the entire spectrum covered by the book.

In due course, Aub Hosking and Fritz Langford-Smith had the satisfaction of seeing their third edition sell over 280,000 copies, as well as being translated into Polish.

There had to be a fourth edition, of course, but it was in no more than the concept stage when I left AWV to join *Radio & Hobbies* at the end of 1941. About this same time, FLS had become a member of the Ministry of Munitions' Valve Production Advisory Panel and, in the absence of Aub Hosking on war service, acting Sales Manager of AWV, as well.

When ultimately released in Australia in mid 1952, the fourth edition of the RDH – *Radiotron Designer's Handbook* – resembled the third edition only in title and the identity of the editor.

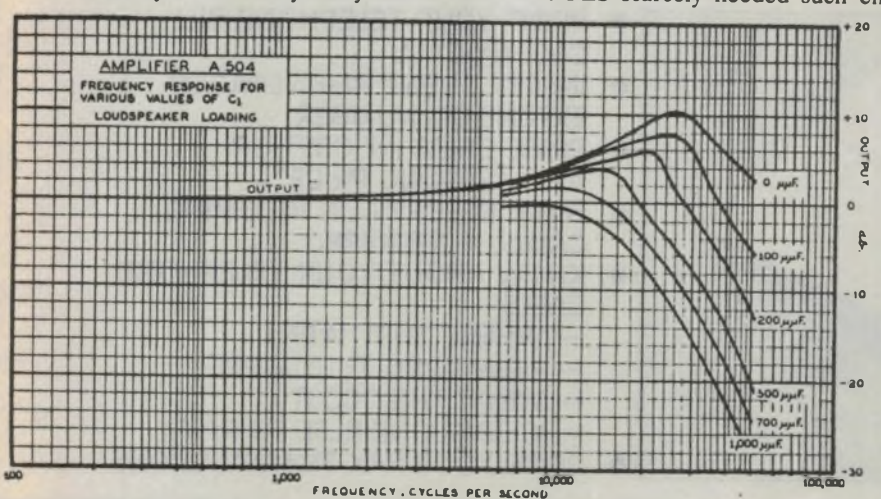
Completely re-written by FLS and nine other authors in the immediate post-war period, the text had been checked for accuracy by 23 engineers, mostly from AWA. Even when set in 8pt type, it ran to 1500 pages and could lay claim to being the most thorough and comprehensive reference book on receiver and audio amplifier design published anywhere in the world. It was reprinted for the UK and overseas markets minus the word 'Radiotron', which was no longer relevant outside Australia.

In an era before computers and word processors, its preparation had been a herculean task and it was to be the astundertaken by FLS in this country.

FLS – personal

In 1937, Fritz Langford-Smith had married Dulcie Mottram, who shared his involvement in Church of England activities. They set up home in Chatswood, at a time when it was still a quiet north-side suburb. But sadly their first and only child died shortly after birth.

At Chatswood, Fritz pursued his interest in hifi sound and, while still



One of several performance curves for the A-504 amplifier, showing its behaviour with a loudspeaker load and the need to consider response and stability in the supersonic region. It follows naturally on important research by Langford-Smith in the 1930s.

working with him at AWV, I was invited home to hear what he assumed might be his ultimate pride and joy – a unique loudspeaker that he had just imported from the UK.

As I recall, it was a new release from Hartley-Turner featuring a hard, polished bakelised cone, with a highly flexible support spider and chamois surround. Unfortunately, it proved a disappointment. Tested later in the AWV Applications Lab, it was magnificent on sinewave input, very pleasant on solo instrumental and voice, but a mess on complex program material – presumably due to intermodulation effects.

Immediately after the war, there was renewed interest in winning better sound from 78rpm discs, with the aid of new lightweight pickups, more precise compensation and improved amplifier systems.

This time FLS, who was exploring the subject for the fourth edition of the *RDH*, visited John Moyle and I at the *R&H* office in Elizabeth St, City, where we had set up a system which, if nothing else, offered extended frequency response.

FLS was interested in our efforts but, at the same time, disappointed. In the nicest possible way he expressed the firm conviction that there wasn't much point in achieving an extended top-end response if the most obvious aural effect was to expose a high level of distortion in the source signal. He was absolutely right, of course, but at the time we were loath to admit it.

Out-of-doors, FLS's pride and joy, as mentioned earlier, was his yacht, which was large enough to provide live-in accommodation when he and his wife felt so inclined. I never heard it discussed in the office but, according to his brothers, if he was ever likely to tempt fate, it was while at the wheel on Sydney Harbour!

But a great deal of his private life was taken up with C of E denominational affairs. A committed Christian, Fritz Langford-Smith was Honorary Secretary of the Moore Theological College (University of Sydney), a member of the Sydney Diocesan Synod, of the Provincial Synod of NSW, and the General Synod of Australia.

If you've wondered what he did in his spare time, you have your answer!

The final chapter

Especially after the death of their child, Dulcie Langford-Smith had suffered ill-health and, as his work on the *Designer's Handbook* neared completion, Fritz decided to move to England. It came as a complete surprise but, as he explained at the time, he was hopeful that the milder climate and the reduced glare would be less stressful for his wife.

Having been offered a position with the English Electric Company in charge of technical publications, he set up home nearby and, according to his brother Neville, took to riding a bicycle to the office (shades of Sir Ernest Fisk!).

Unfortunately, his own health failed when he developed a wasting disease that defied precise diagnosis. Unable to continue working, Fritz and his wife returned to Sydney in 1962, living at Ryde until he died in 1966 at the age of 62, mentally alert but physically immobilised.

The address at his funeral service in St. Anne's Anglican Church, Ryde, was given by the Most Rev. Sir Marcus Loane, Archbishop of Sydney.

To Fritz Langford-Smith, the highly qualified and respected engineer and widely read author/editor, Marcus Loane's touching, personal tribute in a subsequent letter to the family, concluded:

"He was always so gentle, modest and self-effacing... a servant of the Lord Jesus and a good and faithful one."

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Product Review:

The Account-a-Call telephone logger

Back in August last year, we reviewed an imported low cost telephone call logging device. Since then we have been made aware of a locally designed and manufactured unit which performs rather more functions, for a price which is still well within the budget of even small firms.

by JIM ROWE

Shortly after the August 1988 issue was published, with its review of a small imported 'Computerised Phone Accountant', I received a letter from David Gibson, a design engineer in Melbourne. In his letter Mr Gibson advised me that he had designed an Australian-made production called the 'Account-a-Call', which had been on sale for over two years. Would I be interested in trying one out of these sometime in the future, and writing a review?

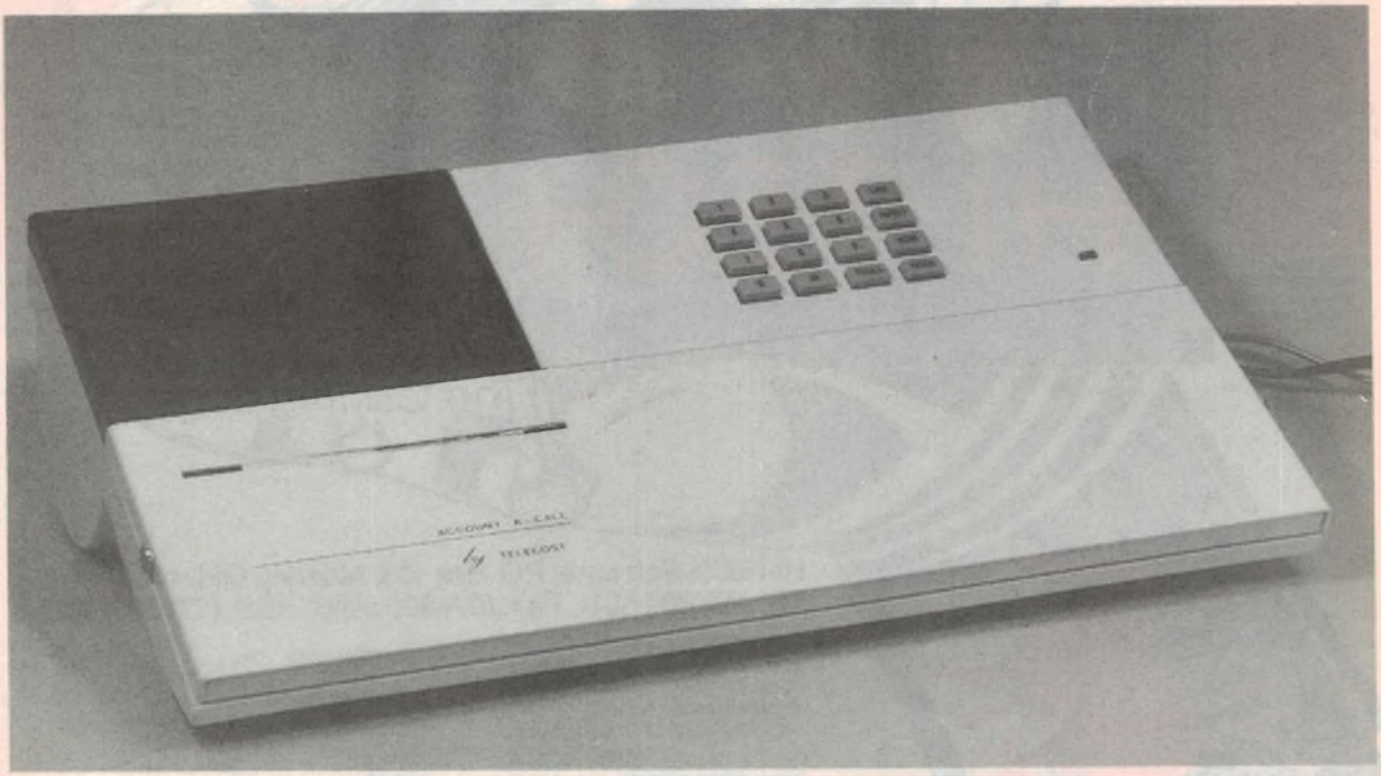
The answer was yes, of course, although one way and another it has taken a good few months for this to happen. But finally it has all happened, and here at last is the review.

The Account-a-Call is physically rather larger than the unit reviewed last year – in fact it's about double the size, measuring 330 x 194 x 80mm. However apart from this it looks rather similar, with the main feature visible being a small printer unit, in this case using 80mm-wide paper rolls. There's also a small keypad, with 16 control keys, and a separate 'plug-pack' power supply. And like the earlier unit, it has a cable and adaptor plug to allow it to be connected in parallel with your phone.

It's only when you hook up the unit and start putting it through its paces, that its impressive range of features and functions become apparent.

For a start, the printer in this unit has full alphanumeric character capability, over 40 columns. This allows it to print its call logs and other reports with 'plain English' headings and explanations, for much easier interpretation. All of the information for each call of a report is also printed on a single line, making for a tidier and more concise format.

The next thing you notice, as soon as you connect up the Account-a-Call and turn it on, is that the unit itself helps



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Account-a-Call     ROM=19255c
Firmware V1.80 (Australia)

*OLD SETTINGS PRESERVED WHILE POWER OFF*
 ** PLEASE SET JUST THE TIME AND DATE **
PRESS [MENU] KEY TO START REPROGRAMMING

USER PROGRAMMABLE FUNCTIONS:

0  Print this menu list
1  Set the time and/or date
2  Printing of cost totals
3  Print / not print in-calls
4  Direct line / PABX connection
5  Call metering, timed or meter pulse
6  Call costing, normal or hotel method
7  Hide/show last 2 digits dialed
9  Print summary of settings
Just ENTER key without a number to quit

Enter program number then ENTER key.
>1
Key time as HHMM e.g. 1904[ENTER]
Just ENTER for no change
>1923
Key date as DDMMYY then ENTER, e.g.
011287 for 1st of December 1987
Just ENTER for no change
```

Fig.1: The menu of programmable functions and options printed out by the Account-a-Call.

you to set itself up. Firstly it prints out a menu of programmable functions (Fig.1), as soon as you press the 'MENU' key. Pressing each number key causes it to print out the various options available, and how to set them to suit your needs.

It's all very clear and straightforward, and as a result there is really no need for a separate operating manual – which would inevitably be impossible to find, when you needed it!

As you can see from Fig.1 some of the options include the ability to set the unit up for either a direct line or a PABX; to print or not print incoming calls; to meter outgoing calls by timer or metering pulses; to print or not print cost totals; to cost calls either normally or via the Telecom recommended method for hotels and motels; and to either show or hide the last two digits of the dialled numbers.

This last option allows the Account-a-Call to comply with privacy requirements in force in various countries, including Australia. When the 'hide last digits' option is operating, the final two digits of each number dialled are shown in the listing as 'XX'.

The Account-a-Call normally prints call lists and costing totals once a day, at midnight. However it can be programmed to print the summaries at up to eight times a day, making it suitable for use in hotels with staff operating in various shifts.

The two call costing methods used by the unit are quite interesting. The more accurate method relies on the so-called 'metering pulses' available from Telecom exchanges – 100ms pulses of 50Hz tone and about 45V RMS, applied longitudinally to the subscriber line, and generally inaudible to the user. For a fee, Telecom will arrange for one of these pulses to be fed down the line each time a 'call unit' has been registered by Telecom's own costing equipment.

Generally a call unit is equivalent to the cost of a local call (currently 21c). On STD or ISD calls one call unit is registered every so many seconds, depending on the distance and time of day. When the metering pulses are available the Account-a-Call can therefore calculate the exact Telecom charges for all calls.

The only complications with this method are that (a) Telecom charges a fee for providing the metering pulses, currently some $50 to set things up and then $3.00 per month; and (b) the pulses are not normally available on PABX extensions.

It is to allow costing of calls where metering pulses are *not* available that Account-a-Call provides its second costing option. Here the unit uses call timing, reference to the time of day and comparison of the originating and destination STD codes, together with some fairly fancy number-crunching by the internal microcomputer.

To allow it to do this, the internal software includes quite an extensive database of STD codes and charging rate information.

This ability to perform call costing, plus the option of working out the costing using either the metering pulses or its own estimating algorithm, really sets the Account-a-Call in a class of its own. The unit reviewed last year provided no costings at all, for example, only timing information. Normally units which provide true call metering and costing data cost many times more than the Account-a-Call.

The kind of call summary printed out by the unit is shown in Fig.2. As you can see it's both clear and concise, with a full listing of date, time of day for each call, the number dialled for outgoing calls plus timing (duration) and estimated costs – including the total cost since the previous summary.

Incidentally the only outgoing calls which the unit does not cost are 'special' Telecom services such as 015 (telegrams) or 0173 (reminder calls). As these cannot be costed the Account-a-Call prints a message describing the type of call, plus '???' in the costing column.

Account-a-Call — Thu 16 Mar 89

Time	Nº Dialed	Dur.	Cost	Ref.
0801	1100	:30	0.20	
1216	116611	:52	0.20	
1628	In-call	:40	---	
1636	In-call	17:55	---	
2004	2	59:49	???	
2111	In-call	7:35	---	
Total since last total:			0.40	

Account-a-Call — Fri 17 Mar 89

Time	Nº Dialed	Dur.	Cost	Ref.
0855	3992106	1:58	0.20	
0859	2173400	:59	0.20	
0901	2173400	2:02	0.20	
1121	5991176	16:51	0.20	
1240	5682880	:33	0.20	
1241	5604588	:32	0.20	
1449	In-call	:29	---	
1503	In-call	10:36	---	
1650	5971875	1:28	0.20	
1807	In-call	10:43	---	
Total since last total:			1.40	

Account-a-Call — Sat 18 Mar 89

Time	Nº Dialed	Dur.	Cost	Ref.
1147	2331944	1:05	0.20	
1152	5883380	1:40	0.20	
1159	6996802	1:32	0.20	
1449	In-call	:18	---	
1608	9731124	26:54	0.20	
Total since last total:			0.80	

Fig.2: Samples of the kind of call and costing summaries which are produced by the Account-a-Call.

All in all, the Account-a-Call seems to do an excellent job of monitoring a 'phone line, and logging calls and costs. As a result, it should be very suitable indeed for hotels, motels and businesses which need to monitor and manage office phone usage, and professionals such as solicitors and accountants who need to be able to cost and charge for calls made on behalf of clients.

I gather that David Gibson's firm Microconsultants has received strong interest from overseas countries, and the Account-a-Call is now in use in The Netherlands as well as Australia. It's apparently also likely that it may make inroads into few other European countries, in the near future.

If you're interested in learning more about the Account-a-Call, or purchasing one, I suggest you contact Microconsultants at 72 Derinya Drive, Frankston 3199 or phone (03) 787 7700. Cost of the unit is $699 including sales tax, which seems very good value for money considering its features and capabilities.

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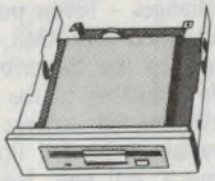

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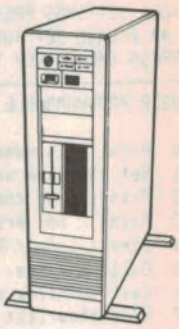

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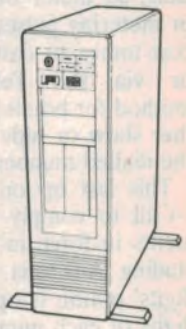

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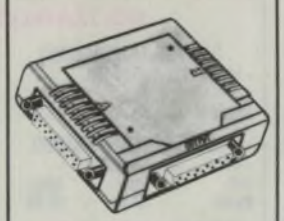

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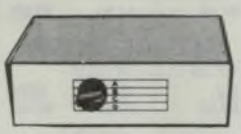

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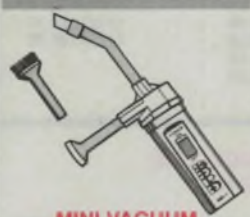

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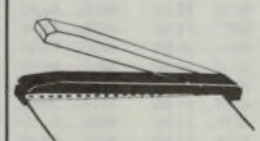

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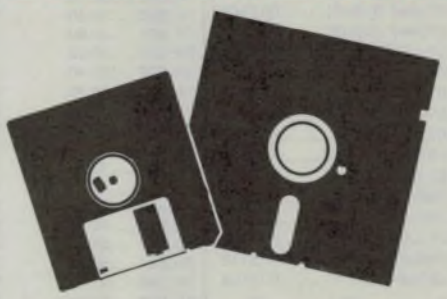

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0.33uF (330nF) R15166			
0.39uF (390nF) R15167			
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2.2uF (2,200nF) R15176			
	1-9	10+	100+
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SEMICONDUCTORS 74LS SERIES

74LS00 $0.75	74LS112 $0.70	74LS244 $2.50
74LS01 $0.60	74LS113 $0.70	74LS245 $2.95
74LS02 $0.60	74LS114 $0.80	74LS247 $1.30
74LS03 $0.60	74LS122 $1.30	74LS248 $1.40
74LS04 $0.75	74LS123 $1.30	74LS249 $1.50
74LS05 $0.75	74LS125 $1.00	74LS251 $1.50
74LS08 $0.60	74LS126 $1.00	74LS253 $1.35
74LS09 $0.80	74LS132 $1.00	74LS257 $1.20
74LS10 $0.60	74LS133 $0.90	74LS258 $1.20
74LS11 $0.75	74LS136 $1.20	74LS259 $2.25
74LS12 $0.80	74LS138 $1.20	74LS261 $2.50
74LS13 $0.90	74LS139 $1.00	74LS266 $0.70
74LS14 $0.80	74LS145 $1.50	74LS273 $1.95
74LS15 $0.80	74LS147 $2.50	74LS275 $6.80
74LS20 $0.60	74LS148 $1.90	74LS279 $0.80
74LS21 $0.90	74LS151 $1.20	74LS280 $2.60
74LS22 $0.90	74LS152 $1.95	74LS283 $1.20
74LS26 $0.90	74LS153 $1.00	74LS290 $1.20
74LS27 $0.90	74LS154 $3.80	74LS293 $1.10
74LS28 $0.90	74LS155 $1.50	74LS295 $1.50
74LS30 $0.60	74LS156 $1.50	74LS299 $3.90
74LS32 $0.60	74LS157 $1.20	74LS323 $6.50
74LS33 $0.60	74LS158 $1.00	74LS324 $2.20
74LS37 $0.70	74LS160 $1.50	74LS352 $2.20
74LS38 $0.80	74LS161 $1.00	74LS365 $1.00
74LS40 $0.80	74LS162 $1.50	74LS366 $1.00
74LS42 $1.20	74LS163 $1.10	74LS367 $1.00
74LS47 $1.80	74LS164 $1.40	74LS368 $1.00
74LS48 $1.80	74LS165 $1.20	74LS373 $2.00
74LS49 $1.80	74LS166 $2.55	74LS374 $2.00
74LS51 $0.70	74LS169 $2.95	74LS375 $1.00
74LS54 $0.80	74LS173 $1.20	74LS377 $2.15
74LS55 $0.80	74LS174 $1.20	74LS378 $1.20
74LS73 $0.60	74LS175 $1.00	74LS379 $1.90
74LS74 $1.00	74LS181 $4.00	74LS386 $1.00
74LS75 $1.00	74LS190 $1.50	74LS390 $1.80
74LS76 $1.00	74LS191 $1.20	74LS393 $1.80
74LS83 $1.20	74LS192 $1.20	74LS395 $2.00
74LS85 $0.85	74LS193 $1.20	74LS424 $5.50
74LS86 $0.60	74LS194 $1.20	74LS490 $3.20
74LS90 $1.20	74LS195 $1.00	74LS540 $2.95
74LS91 $1.20	74LS196 $1.20	74LS541 $3.50
74LS92 $1.20	74LS197 $1.35	74LS574 $4.90
74LS93 $1.50	74LS221 $2.00	74LS601 $5.90
74LS95 $1.20	74LS240 $2.40	74LS629 $5.95
74LS96 $1.20	74LS241 $2.40	74LS640 $3.95
74LS107 $0.90	74LS242 $2.40	74LS642 $2.75
74LS109 $0.90	74LS243 $2.10	74LS645 $2.75

GREAT SAVINGS AT R.I.E

Ring Now Toll Free 008 33 5757

SEMICONDUCTORS 74 SERIES

7400 $0.50	7416 $0.50	74123 $0.70
7404 $0.50	7437 $0.50	74154 $2.00
7406 $0.50	7445 $0.80	
7407 $0.50	7474 $0.60	

SEMICONDUCTORS SERIES 4000

4000 $0.75	4027 $0.85	4054 $3.90	4096 $2.40
4001 $0.45	4028 $1.15	4055 $3.90	4097 $6.50
4002 $0.45	4029 $1.50	4056 $4.20	4098 $2.90
4006 $1.55	4030 $1.50	4060 $2.50	4099 $3.90
4007 $0.45	4031 $2.95	4063 $2.00	40194 $2.50
4008 $1.70	4032 $2.30	4066 $0.80	4510 $1.40
4009 $0.90	4033 $2.75	4067 $9.90	4511 $1.45
4010 $0.90	4034 $3.10	4068 $0.50	4512 $1.40
4011 $0.45	4035 $1.80	4069 $0.50	4513 $2.65
4012 $0.45	4038 $2.25	4070 $0.50	4514 $2.60
4013 $0.70	4040 $1.20	4071 $0.50	4515 $2.90
4014 $1.45	4041 $1.50	4072 $0.50	4516 $1.60
4015 $1.45	4042 $1.50	4073 $0.50	4517 $4.80
4016 $0.70	4043 $1.20	4075 $0.50	4518 $1.50
4017 $1.35	4044 $1.25	4076 $1.90	4519 $0.90
4018 $1.50	4045 $4.90	4077 $0.50	4520 $1.50
4019 $0.80	4046 $1.90	4078 $0.50	4521 $3.40
4020 $1.40	4047 $1.90	4081 $0.50	4522 $1.90
4021 $1.50	4048 $1.20	4082 $0.75	4526 $1.90
4022 $1.45	4049 $0.60	4085 $2.20	4527 $1.90
4023 $1.45	4050 $0.60	4086 $2.30	4528 $1.95
4024 $1.30	4051 $1.20	4093 $0.80	4558 $2.25
4025 $0.45	4052 $1.20	4094 $3.35	4584 $0.90
4026 $2.40	4053 $1.20	4095 $2.40	4585 $2.10

TAG TANTALUM CAPACITORS

3V TAG TANTALUMS

	1-9	10+	100+
• 100uF R16020	$1.00	$0.80	$0.70

6.3V TAG TANTALUMS

	1-9	10+	100+
• 47uF R16032	$1.00	$0.80	$0.70
• 100uF R16036	$2.00	$1.90	$1.80

16V TAG TANTALUMS

	1-9	10+	100+
• 10uF R16124	$0.60	$0.50	$0.40
• 15uF R16026	$0.80	$0.70	$0.60
• 22uF R16128	$0.90	$0.80	$0.70
• 33uF R16030	$1.20	$1.10	$1.00
• 47uF R16132	$2.80	$2.70	$2.60
• 68uF R16034	$4.95	$4.30	$3.90

25V TAG TANTALUMS

	1-9	10+	100+
• 2.2uF R16216	$0.60	$0.50	$0.40
• 3.3uF R16218	$0.80	$0.70	$0.60
• 4.7uF R16220	$1.20	$1.00	$0.70
• 10uF R16224	$1.50	$1.30	$1.10
• 22uF R16228	$2.00	$1.80	$1.50

35V TAG TANTALUMS

	1-9	10+	100+
• 0.1uF R16300	$0.60	$0.50	$0.40
• 0.15uF R16302	$0.80	$0.70	$0.60
• 22uF R16304	$1.20	$1.00	$0.70
• 33uF R16306	$2.00	$1.70	$1.50
• 0.47uF R16308	$0.50	$0.40	$0.35
• 0.68uF R16310	$0.60	$0.50	$0.40
• 0.82uF R16311	$0.80	$0.70	$0.60
• 1.0uF R16312			
• 1.5uF R16314			
• 2.2uF R16316	1-9	10+	100+
	$0.60	$0.50	$0.40
• 3.3uF R16318			
• 4.7uF R16320	$0.80	$0.70	$0.60
• 6.8uF R16322	$0.90	$0.80	$0.70
• 10uF R16324	$1.00	$0.90	$0.80
• 15uF R16326	$1.90	$1.70	$1.50
• 22uF R16328	$2.80	$2.70	$2.50
• 33uF R16330	$3.80	$3.70	$3.60
• 47uF R16332	$4.50	$4.00	$3.70

GENERAL COMPONENTS

WIRE WRAP WIRE

- Pack of 100
- Precut wire

W19002	Blue	3.0"	$4.75
W19022	Red	3.0"	$4.75
W19042	Yellow	3.0"	$4.75
W19062	Black	3.0"	$4.75
W12784	Green	3.0"	$4.75
W19026	Red	5.0"	$5.95
W19046	Yellow	5.0"	$5.95
W19066	Black	5.0"	$5.95
W12790	Green	5.0"	$5.95
W19006	Blue	5.0"	$5.95
W19016	Blue	10.0"	$10.50
W19036	Red	10.0"	$10.50
W19056	Yellow	10.0"	$10.50
W19076	Black	10.0"	$10.50
W12796	Green	10.0"	$10.50

- Spool wire

W19390	Green	50ft	$8.00
W19400	Blue	50ft	$8.00
W19406	Purple	50ft	$8.00
W19407	White	50ft	$8.00
W19408	Orange	50ft	$8.00
W19410	Yellow	50ft	$8.00
W19415	Black	50ft	$8.00
W19416	Green	100ft	$10.75
W19417	Brown	100ft	$10.75
W19420	Blue	100ft	$10.75
W19425	Red	100ft	$10.75
W19426	Purple	100ft	$10.75
W19427	White	100ft	$10.75
W19428	Orange	100ft	$10.75
W19430	Yellow	100ft	$10.75
W19435	Black	100ft	$10.75
W19460	Blue	500ft	$33.75
W19461	Green	500ft	$33.75
W19465	Red	500ft	$33.75
W19475	Black	500ft	$33.75

JUMP WIRE KIT (KS-350)

Contains:
14 kinds of length from 0.1" to 5" with different colors

Q11278.....$19.95

FLASHING LEADS

- Red, 5mm

	1-10	10+
Z10159	$1.10	$1.00

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	$0.10
Z10151	5mm Green	$0.15
Z10152	5mm Orange	$0.15
Z10155	10mm Red	$1.00
Z10156	10mm Green	$1.00
Z10157	10mm Yellow	$1.00

PLUGS AND SOCKETS

CENTRONICS CONNECTORS

- 14 Way P12205
- 24 Way P12207
- 36 Way P12210

1-9	10+
$5.95	$5.50

SOLDER CENTRONICS IN-LINE SOCKET

- 36 Way P12211

1-9	10+
$9.95	$9.50

IDC SOCKETS

1" SPACING

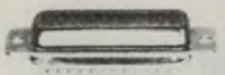
	1-9	10+
• 10 Pin P12100	$1.95	$1.75
• 16 Pin P12101	$2.25	$2.00
• 20 Pin P12102	$2.50	$2.25
• 26 Pin P12103	$2.75	$2.50
• 34 Pin P12104	$2.95	$2.75
• 36 Pin P12106	$4.50	$3.50
• 40 Pin P12108	$4.95	$4.50

IDC CENTRONICS 36 WAY PLUG & SOCKET

• Plug	P12200	
1-9	10+	
$7.95	$6.95	
• Socket	P12201	
1-9	10+	
$9.95	$8.95	

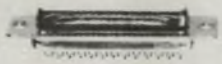
D TYPE IDC PLUGS

	1-9	10+
• DE9P P12166	$7.50	$7.25
• DA15P P12168	$7.75	$7.50
• DB25P P12170	$7.50	$6.95



D TYPE SOLDER PLUGS

• DE9P	P10880		
1-9	10+	100+	
$1.55	$1.50	$0.80	
• DA15P	P10890		
$1.85	$1.55	$0.90	
• DB25P	P10900		
$1.95	$1.60	$0.90	
• DC37P	P10910		
$3.95	$3.75	$3.50	
• DF50P	P10920		
$5.95	$5.75	$4.95	

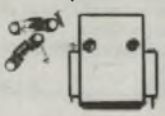


D TYPE SOLDER SOCKETS

• DE9S	P10881		
1-9	10+	100+	
$1.95	$1.75	$0.80	
• DA15S	P10891		
$1.95	$1.75	$0.90	
• DB25S	P10901		
$1.95	$1.75	$1.00	
• DC37S	P10911		
$3.90	$2.90	$2.70	
• DF50S	P10921		
$6.90	$5.90	$4.90	

D TYPE IDC SOCKETS

	1-9	10+
• DE9S P12167	$7.50	$7.00
• DA15S P12169	$7.75	$7.25
• DB25S P12171	$7.95	$7.50



D TYPE SOLDER COVERS

	1-9	10+
• DE9C P10882	$1.20	$1.00
• DA15C P1089	$1.25	$1.10
• DB25C P10902	$1.25	$1.10
• DC37C P10912	$5.50	$4.95
• DF50C P10922	$6.50	$5.95
•DE9C P10882	$1.20	$1.00

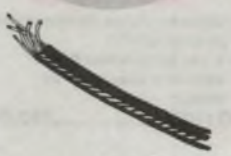
CABLES

FLAT GREY RIBBON CABLE

- Flat cable for IDC connectors
- m = metre

• 14 way	W12614		
1-9 m	10+ m	100+ m	
$1.90m	$1.80m	$1.20m	
• 16 way	W12616		
1-9 m	10+ m	100+ m	
$1.90m	$1.80m	$1.20m	
• 20 way	W12620		
1-9 m	10+ m	100+ m	
$2.50m	$2.20m	$1.50m	
• 24 way	W12624		
1-9 m	10+ m	100+ m	
$2.90m	$2.70m	$1.70m	
• 26 way	W12626		
1-9 m	10+ m	100+ m	
$3.60m	$3.30m	$2.20m	
• 34 way	W12634		
1-9 m	10+ m	100+ m	
$3.90m	$3.60m	$2.30m	
• 36 way	W12636		
1-9 m	10+ m	100+ m	
$4.50m	$3.80m	$2.50m	
• 40 way	W12640		
1-9 m	10+ m	100+ m	
$4.90m	$4.00m	$2.80m	
• 50 way	W12650		
1-9 m	10+ m	100+ m	
$5.50m	$4.90m	$2.90m	

ORDER HOTLINE 008 33 5757 TOLL FREE



COMPUTER CABLE

- Six conductor shielded computer interface cable
- m = metre

• CIC6	W12670		
1-9 m	10+ m	100+ m	
$1.30m	$1.10m	$1.00m	
• CIC9	W12672		
1-9 m	10+ m	100+ m	
$1.60m	$1.50m	$1.20m	
• CIC12	W12674		
1-9 m	10+ m	100+ m	
$2.50m	$2.20m	$1.90m	
• CIC16	W12676		
1-9 m	10+ m	100+ m	
$3.50m	$3.20m	$2.50m	
• CIC25	W12678		
1-9 m	10+ m	100+ m	
$3.90m	$3.40m	$3.00m	

GENERAL ACCESSORIES

AAA SIZE NICAD (2 PACK)

Nominal Voltage: 1.2V 180mAH

S15026

1-9	10+
$11.95/Pk	$10.95/Pk

AA SIZE NICAD

Nominal Voltage: 1.2V 450mAH

S15020

1-9	10+	100+
$2.95	$2.75	$2.50

C SIZE NICAD

Nominal Voltage: 1.2V 1,200mAH

S15021

1-9	10+
$9.95	$8.95

D SIZE NICAD

Nominal Voltage: 1.2V 1,200mAH

S15022

1-9	10+
$10.95	$9.95

NR-N SIZE NICAD (2 PACK)

Nominal Voltage: 1.2V 150mAH

S15027

1-9	10+
$11.95/Pk	$10.95/Pk

9V SQUARE TYPE NICAD

Nominal Voltage: 9V 100mAH

S15023

1-9	10+
$11.95	$10.95

NBC1 UNIVERSAL BATTERY CHARGER/ TESTER

NiCad battery charger complete with tester

- Will standard charge UM3, UM4, UM5, 006P NiCad batteries
- Slow charge UM1 and UM2 NiCad batteries
- Automatic current ranging from 20 to 70mA
- LED indicators and voltage level meter
- Supplied with 240V AC adaptor
- Approval No. N/1499

M23519.....$39.95

NBC5 RACING PACK BATTERY QUICK CHARGER

Fast charger for 7.2V Nickel Cadmium batteries

- Input: 12V DC cigarette lighter - fuse protected
- Output: standard racing pack lead and terminal to suit "NCRP72" and Tamiya 7.2V batteries
- 0 to30 minute timer - standard fast charge is 15 minutes for "NCRP72" and other 7.2V batteries

M23528.....$39.95

NRP72 7.2V NICAD RACING PACK BATTERY

Suits most Tamiya and other brand remote control cars, toys and models

Voltage: 7.3 volts

Charging Current: 130mA

Nominal Capacity: 1300mAH

Charging Time: 15 hours

S15025.....$39.95

NBC3 SUPER DELUXE BATTERY CHARGER

- Standard charges up to ten- UM3, UM4 and UM5 NiCad with "NM4/5" charging modules
- Slow charges up to ten- UM1 and UM2 NiCad batteries
- Also charges up to three- 006P 8.4 volt NiCads
- 240V AC operated
- Approval No. N/10637
- Automatic current ranging
- Dual colour LED indicators

M23525.....$54.95

GREAT SAVINGS AT

ROD IRVING ELECTRONICS

All sales tax exempt orders and wholesale inquiries to:

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Fax: (03) 543 2648

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Stanmore 2048
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Fax: (02) 519 3868

MELBOURNE: 48 A'Beckett St
Phone: (03) 663 6151

NORTHCOTE: 425 High St.
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ADELAIDE:
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$25 - $49.99	$4.00
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$100 +	$7.50

The above postage rates are for basic postage only. Road Freight, bulky and fragile items will be charged at different rates.

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MasterCard VISA

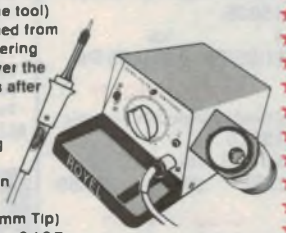
ROD IRVING ELECTRONICS

RODIRVING ELECTRONICS

GENERAL TOOLS

ROYEL SOLDERING STATION

The all solid-state heat sensor and control unit allows the selection of the appropriate soldering tip idling temperature. The very high-powered element (relative to the size of the tool) will replenish heat drained from the tip during each soldering operation and will recover the tip tempreture moments after the tip is lifted.



- Zero voltage switching
- Zero tip potential
- Aux ground connection
- For soldering irons- CT6 (3mm Tip), CT7 (5mm Tip)

T12570.....$195

SOLDER (HOBBY PACKS)

- 60/40 Resin cored

- 0.71mm, 1 metre

T31030.....$1.50

- 0.91mm, 1 metre

T31032.....$1.25

- 1.6mm, 1 metre

T31034.....$1.00

PORTASOL PROFESSIONAL

- Four tools in one: Blow torch, Hot Blow or Hot Knife
- No Cords or batteries
- Heavy duty, tip temperature adjustable up to 400°C
- Equivalent to 10-60 watts
- Hard working. Average continuous use 90 minuters
- Refills in seconds
- Powered by standard butane gas lighter fuel
- Range of easily replaceable screw tips included
- Includes metal stand for the soldering iron when working
- Cap features bully-in flint for igniting Portasol tip
- Includes snap case for storage

T12639.....$89.95

PORTASOL PROFESSIONAL TIPS

4.8mm (T12610).....$12.50
3.2mm (T12612).....$12.50
2.4mm (T12614).....$12.50
1.0mm (T12616).....$12.50

ECONOMY ANTISTATIC SOLDER SUCKER

- Light Weight
- Sturdy construction
- Easy to remove tip
- Excellent value for money

T11281.....$13.95

UV EPROM ERASER

Erase your EPROMs quickly and safely. This unit is the cost effective solution to your problems. It will erase up to 9 x 24 pin devices in complete safety, in about 40 minutes (less time for less chips)

- Chip drawer has conductive foam pad
- Mains powered
- High UV intensity at chip surface ensures EPROMs are thoroughly erased
- Engineereed to prevent UV exposure
- Dimensions 217 x 80 x 68mm

Without timer

X14950.....$79

With built-in timer

X14955.....$99

ACCESSORIES

SOLDER PENCIL

- Approximately 5 metres of 1.2mm resin cored solder in handy dispenser

T31024.....$1.95

SOLDER ROLLS

- 60/40 Resin cored

- 0.71mm, 250gm

T31000.....$8.95

- 0.71mm, 500gm

T31002.....$15.95

- 0.91mm, 250gm

T31010.....$7.95

- 0.91mm, 500gm

T31012.....$14.95

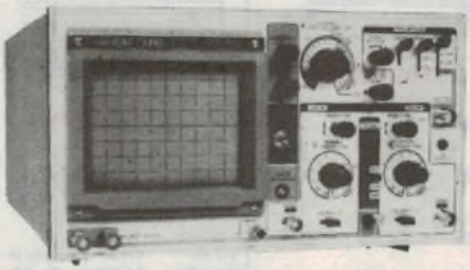
- 1.6mm, 250gm

T31020.....$7.50

- 1.6mm, 500gm

T31022.....$13.95

TEST EQUIPMENT



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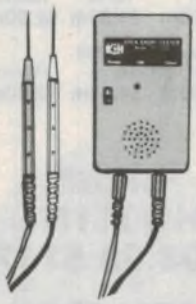
Q12105.....$695



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- Instantly shows the open/short position of PCB
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Q11276.....$22.95

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- Can be used directly to inject a signal into logic circuits without removing IC
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Q11274.....$49.95

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CONTAINS: Compensated probe lead with...

- Detachable 6 inch earth lead
- Retractable hook
- IC test tip
- Tip insulator
- BNC adaptor
- Trimming tool

SPECIFICATIONS:

Bandwidth: 10:1 position :250MHz at -3dB into 20pF

Rise Time: 10:1 position less than 1.4ns nominal

Switch Function:

(a) 10:1 attenuation +/-1%, with oscilloscope of 1Mohm input resistance

(b) 1:1 attenuation with bandwidth of 10 MHz approx.

(c) Reference position, tip grounded via 9 Mohm, oscilloscope input grounded

Input Capacitance: 16pF typical depending upon oscilloscope input capacitance

Compensation Range: Oscilloscopes of 15 to 60 pF input capacitance

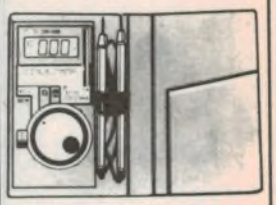
Working Voltage: 600V DC or peak AC

Q12200.....$49.95

DIGITAL METER

- Autoranging operation
- Data-hold for easy readout
- Full range protection
- 0-500 volts AC-DC
- 0-20 MΩ
- Dimension & weight =133 x 29 x 17mm and 60g approx

Q11270.....$98.95



MULTIMETER (YF-100)

- Autoranging for DCV, ACV, OHM & continuity measurement
- 10mm thickness & 80g light weight for easy operation
- Drop proof of any incidental fall-off
- Dimension & weight = 108 x 54 x 8mm and 60g approx

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- Large display 4 1/2 dgt 0.5" height LCD with maximum reading of 19999
- Automatic polarity."-" display for negative input
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- Over load display, the highest digit "1" or "-1" alone glows
- Power consumption 20mW approx.
- Dimension & weight = 162 x 86 x28mm and 200g approx

Q11266.....$199

MULTIMETER (YF-3000)

- Large display 3 1/2 digit 0.5" height LCD for easy readout
- Auto/manual range select easy to operate
- Automatic low battery": - + " display for battery indication
- Memory-comparative function available for allowance within ±5% f.s
- Warning sound for overload and conductance
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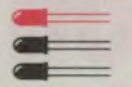


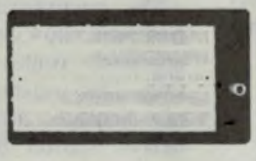
SUPER BRIGHT LEDS

- Red.....Z10146
- Green.....Z10147
- Yellow.....Z10148

1-9	10+
$1.00	$0.90

IBM* PC/XT WIRE WRAPPING BOARD

H19117.....$59.95



BREAD BOARDS

This inexpensive rang of modular interlocking units enables a quick, easy way of experimenting with new circuits and ideas. There are two main units consisting of a terminal strip or distribution and a Central plug-in unit.

- 100 holes

P11000.....$2.75

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- 1280 + 100 holes

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- 2560 + 700 holes

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"CLEARANCE" SALE ON NOW

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PC DRIVEN FUNCTION GENERATOR

Here's a simple and low cost little unit which lets you use your personal computer to generate signals with almost any conceivable waveform. It hooks up to the computer via a standard Centronics-type parallel printer port, making it compatible with almost any kind of computer. Building and using it will also give you valuable insight into the growing trend towards computer-driven test instruments, too! Software included. (EA JAN 89)

K88111.....$49.95

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Here's a hands-free telephone that anyone can afford. With the speakerphone you can have relaxing conversations without the need to hold the phone to your ear. And if you are put on "hold" you can continue with you work while you wait. (SC SEP 88)

K88130.....$89

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K88125.....$159

LOW COST TESTER FOR TRANSISTORS, FETS & ZENERS

This tester checks zener diodes as well as transistors and FETs, and also lets you check transistor breakdown voltages. Great for the work bench, and also for showing how semi-conductor devices operate.
(EA FEB 88)

K88013.....$54.95

PCB SHORTS LOCATOR

Here is a simple circuit to help you locate shorted tracks on printed circuit boards, by means of a varying audio tone. It is easily built and will cost you a lot less than equivalent commercial units.(EA FEB 89)

K88015.....$22.95

AUTOMOTIVE BRAKE LAMP MONITOR

Here's the project that won first prize in the Newcomer section of the recent Grand Aussie Hobby Electronics Contest. Low in cost and easy to build, it warns you if your vehicle's brake lamps aren't working as they should- hopefully before another motorist rams into your rear end! (EA MAR. 89)

K89030.....$24.95

HEAD PHONE AMP FOR CD PLAYERS

Does your compact disc player have a headphone socket? Now you can correct that situation and listen to the music direct, without degrading the sound quality (SC APRIL 88)

K88120.....$24.95

CAPACITANCE ADAPTOR FOR YOUR DMM

This clever adaptor circuit plugs into your digital multimeter and can measure capacitance up to 2.2 microfarads. (SC NOV 87)

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This walk around throttle offers a host of features including pulse power, inertia (momentum), braking and full overload protection.
(SC APRIL 88)

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PRINTER BUFFER

This external printer buffer will allow two computers to share one printer without the bother of swapping cables. Without dynamic ram (ETI 1620 FEB 89)

K56012.....$139.95

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With negligible circuit loading
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(EA OCT 87)

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NOISE GATE

Eliminate annoying audio noises (ETI 1429 FEB 89)

K54215.....$49.95

HIGH ENERGY IGNITION SYSTEM

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(SC SEP. 88)

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ROD IRVING ELECTRONICS

Cockpit automation: good news & bad news

As aircraft become more and more sophisticated, pilots are having to depend more and more on computers to help manage the operational systems. But increasing computerisation brings with it problems of another kind, both for the pilots and their passengers.

by STEPHEN ROBITAILLE

Engineers at NASA/Ames Research Center in Mountain View, California are perfecting computer guidance systems so sophisticated that airline pilots could almost fly jumbo jets in their sleep. Unfortunately, some pilots already do – and it's because computer-controlled aircraft and jet lag leaves pilots exhausted, bored or ill-prepared to handle disaster, say prominent National Aeronatics and Space Administration researchers at Ames.

These conflicting research projects, conducted in labs and offices just moments apart, reflect the quandary of air safety as it enters the computer age.

In the rush to replace human error with technology, computers exert increasing control over the cockpits and control towers of commercial aviation. Pilots and flight officials say the machines can help unclog the crowed sky around major airports and lessen the danger of crashes or other accidents.

But pilots also say the computers have turned them into spectators in their own cockpits, inundating them with more data than they can use and leaving them hesitant or unprepared to grab the controls when emergencies do arise.

As aviation officials try to pinpoint why pilot error rates have doubled in the last two years, experts say the flight industry will be slow to adapt to what has been dubbed the 'glass cockpit'.

"Our basic concern is the eroding margin of safety. Pilots fall asleep, they take off without clearance, there are incorrect altitude problems, they're landing on the wrong runway", says Curtis Graeber, a NASA scientist who studies jet lag and sleep disruption among commercial pilots.

"As we've stripped away the skills of flying, it could affect the pilot's ability to program and integrate information", Graeber adds. "Humans do the creative thinking, and as the role of the pilot is beginning to shift toward more of a systems manager, we've got to change how we look at work schedules – and at how we look at flight operations."

With the advent of automated flight controls in the 1980s, computers now can program a majority of flight tasks: engine thrust, navigation, takeoffs, landings, cabin pressure and fuel distribution in the aircraft's tanks.

Pilots and air safety officials praise the controls, saying they provide concise flight information never before available and handle boring, routine tasks.

"Computer operations provide a situational awareness. Before, you had to kind of judge where you were, with a needle and mileage", said Richard Stone, a pilot with Delta Air lines and an official of the US Air Line Pilots Association. "Pilots like the precision in navigation and approach."

Microwave-based landing

In the flight guidance projects at Ames, engineers with the US Federal Aviation Administration have tested a microwave landing system for pilots and air traffic controllers and a cockpit-mounted collision avoidance system.

The microwave system (originally developed in Australia) was approved for installation in 1978 by the International Civil Aviation Organization, a worldwide air safety group with 160 member nations.

By 1998, the microwave landing system is scheduled to be installed in every major airport in the world. While current landing systems give incoming pilots only a standard descent angle, the microwave system will present them with a 'highway in the sky' that will contain information on what aircraft are nearby, according to FAA engineer Barry Scott.

The microwave system will for the first time allow controllers to use curved approach routes to runwaves, Scott said. This will mean more efficient use of airspace around airports, fewer delays, shorter flights and airline fuel savings.

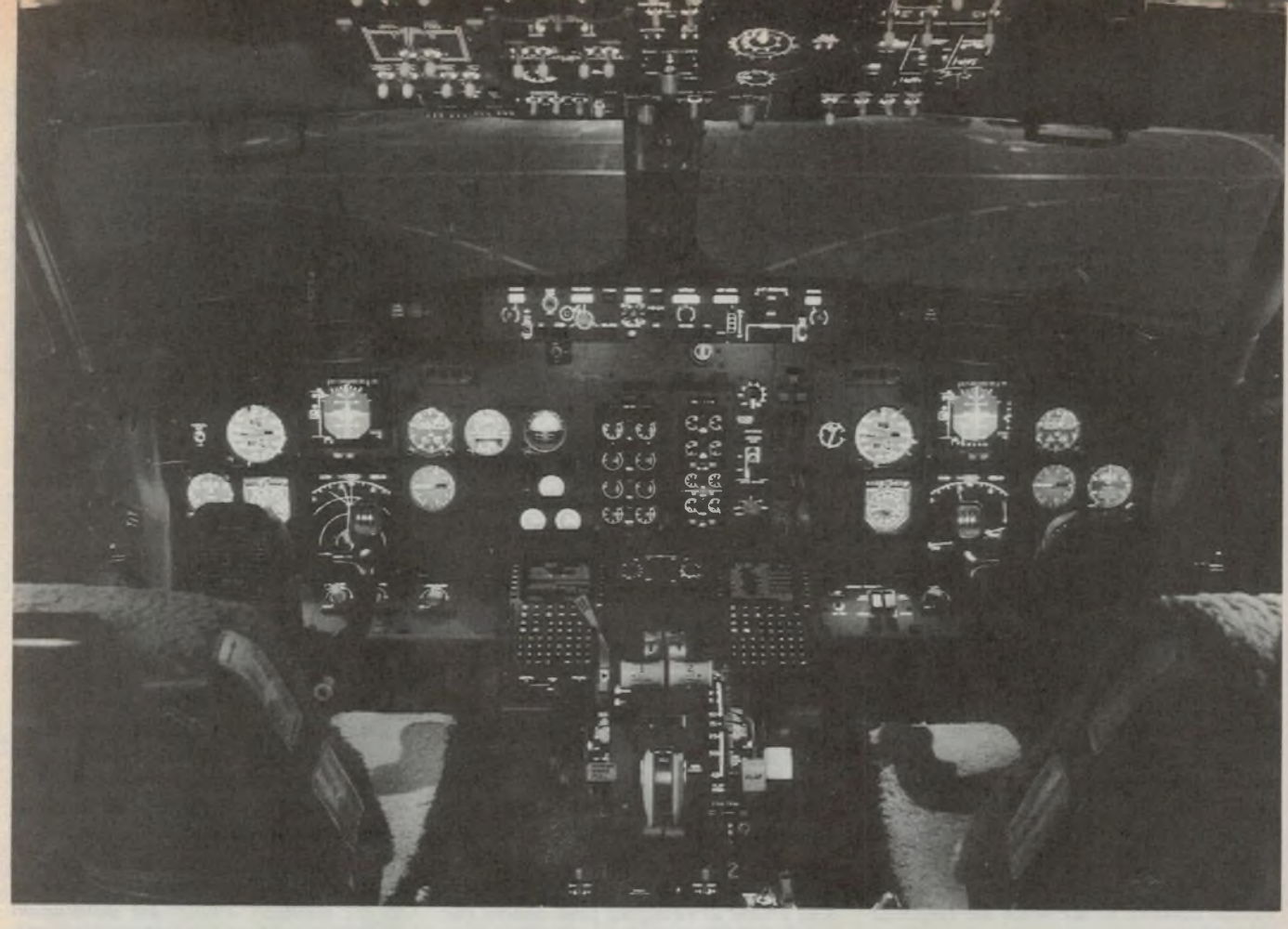
The anti-crash system, undergoing test trials at United, Piedmont and Northwest airlines, alerts pilots when they are on a collision course with another aircraft and suggests vertical escape routes – while plotting the location of all other nearby aircraft.

In mid-November 1988, American Airlines ordered anti-crash units for its fleet from Bendix/King, an operating unit of Allied Signal Aerospace Co. The contract could be worth up to US$60 million, American spokesman James Brown said.

By 1991, the system will be standard equipment on US jetliners, Scott said. But the cockpit display screens, which have replaced the old-time dial-and-gauge manual control systems, also bring in a whole new set of problems.

"When things start to go wrong, it gets very confusing. The pilot is hesitant to make changes with the computer because we've been told that the computer is so much smarter than we are", said pilot Stone, a 31-year veteran. "Less-experienced pilots will sit and watch an automated system and be amazed at how it screws up. When a pilot is in the chair, running the engines, hands on, he's right inside the loop because he's controlling the craft", Stone said. "With automation, pilots feel displaced, alienated."

In a 1985 mishap, a jetliner en route from Taipei to Los Angeles plunged 30,000 feet and sustained major structural damage because the flight crew left the craft on automatic pilot, while attempting to fix a sputtering engine. Air safety investigators said the automatic control allowed the plane to fall into a nose-dive but the preoccupied crew failed to notice the problem until it was too late.



Cockpits in today's commercial jets, such as this Boeing 737, feature numerous CRT displays presenting data from various on-board computers.

Missed LA by 100 miles

Another complicated factor in computerised cockpits is jet lag among international flight crews, who cross numerous time zones during week-long flight schedules.

Exhausted pilots spend hours with nearly nothing to do, which can put them to sleep or leave them so groggy that they have difficulty reacting to trouble, said pilots and sleep researcher Graeber.

In one incident, an entire flight crew fell asleep on a transcontinental flight to Los Angeles, overshooting the city by 100 miles before air traffic controllers managed to rouse them.

Overall pilot error among civilian pilots, both commercial and private, more than doubled recently in two years, from 1,812 in 1985 to 3,650 in 1987, according to FAA figures. Those numbers include all errors on domestic US flights and international flights with US carriers.

Aviation officials blame the problems on increased air traffic, a shortage of air traffic controllers and lower experience levels among those in the cockpit and the control tower – but these problems can be offset by computer flight aids, they said.

Airline representatives said nothing can be proved about the effects of pilot fatigue or increased automation on air travel, and they, like pilots, praise computerised flight controls.

"I think the jury is still out on whether we overshot the target with automating the cockpit", said Walter Coleman, assistant vice president of the Air Transport Association, a group that represents 23 major airlines in the United States and Canada.

"It may be arguable that you are merely a monitor, but as to whether pilots are lulled into a sense of complacency, I'm not sure we've done enough studies to know if it's true", Coleman said.

Despite the transport association's stated reluctance to speculate, it organised a major industry task force that only a couple of months ago called for wide-ranging studies on the needs of pilots, controllers and maintenance workers. Other efforts are under way as well.

Graeber is working on a prototype transcontinental work schedule for United Airlines that will attempt to incorporate layovers for flight crews, to lessen jet lag. Current FAA flight regulations on pilot work limits date back to the 1940's, when planes flew so slowly that jet lag was almost physically impossible, he said.

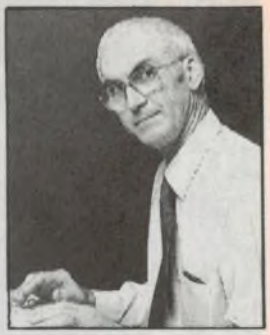
Cockpits should be outfitted with some sort of safety mechanism to ensure flight crews stay alert, say both pilots and researchers, and the FAA should give its official blessing to brief naps by individual crew members in the cockpit.

And Stone, looking to the future, suggested that adjustment to the 'glass cockpit' would finally be complete when the people who have grown up with computers move to the forefront of the aviation industry.

"I think in the future, rather than more trust in the computers, they'll know better the limitations of computers", Stone said. "It's like the 12-year-old with his Macintosh knowing what the computer is doing wrong, even when it doesn't look like it. I think the system is self-correcting that way."

FORUM

Conducted by Jim Rowe



Golden connectors, directional cables and other hifi exotica...

Along with my references to the decline of experimental amateur radio, the only other topic which has evoked much response over the last few weeks is the esoteric claims of some hifi equipment marketers. Here's a look at a selection from the letters this one has produced.

Since we gave a reasonable amount of space last month to the amateur radio topic, I'm proposing to give it a rest this month, and meantime deal with the thorny area of 'interesting' claims made by some of those marketing and selling hifi equipment – and especially the fancy cables and gadgets claimed to produce dramatic improvements in sound quality. You may recall that I reproduced a number of these interesting claims without much comment in the March column, to see what the response might be.

Interestingly enough, there has only been one letter specifically responding to these particular claims. I confess to finding this a bit surprising, because some of the claims seemed to me pretty dubious.

However the letter concerned was a very thoughtful and methodical one, from a reader by the name of Kerry Williams – who apparently works in the School of Applied Science at Phillip Institute of Technology, in Bundoora Victoria. And because it makes interesting reading, I'm reproducing it here in full:

Referring to the item 'Interesting Claims by Hifi Dealers' in the March issue 'Forum', I am concerned that you are opening a subject for debate that could very easily get out of hand. The provocative nature of the content and of your own comments begs for a response similar to the free-for-all observed in recent overseas magazine articles (particularly from Britain) which, entertaining as it may be, does little to uncloud a very murky area of pseudo-research and investigation!

Before throwing your pages open to the flat-earth brigade, and the hard-nosed objectivists who don't even believe their own ears, could we please agree to limit the discussion within a framework of what is scientifically reasonable. Readers of some of the recent British magazine articles will have some idea of how 'unreasonable' both sides can become on matters relating to subjective audio, and will realise how readily black magic and superstition enter the debate.

Bypassing (pun intended) capacitor sound, silver or gold wire, lead bricks, valve vs. transistor sound and similar fruitful topics for debate, let us look at the six points of contention contained in your article as examples (and believe me, I've heard 60 more that make these seem quite tame and reasonable by comparison). This is with a view to debunking the field a little and establishing a framework of investigation within which we can view these and similar claims.

Taking the points in turn:

Statement: New speakers need a few hours' use to 'run-in'.

Comment: Not an unreasonable claim. As with most manufactured mechanical items, the various component parts take time to 'free up' and come to work smoothly as a whole. After all no one expects a car to perform at its peak straight out of the showroom.

With speakers, even before Briggs thoroughly investigated the phenomenon, it was known that after an initial period of use the resonant frequency of dynamic drivers dropped. Now since most drivers are mounted in enclosures which have a characteristic (Helmholtz) resonance, the complex interaction of the two will change (quite drastically in some cases) to produce a CHANGE in sound quality. It should be noted that this change is not always for the better, and depends on how well the designer has done his/her sums.

This general philosophy holds for all drivers, although cabinet interactions are less specific with HF drivers.

Statement: Correct AC polarity at the mains plug improves clarity, dynamics and stereo imaging.

Comment: There is huge scope for speculation here, but some of the more obvious factors are as follows.

Due to the MEN distribution system used in this country one side of the mains can be considered more 'hot' in regard to noise, etc., while the other is relatively 'cold' due to being grounded. This disposition of the hot and cold sides can, particularly where large transformers are involved, change the distribution of leakage and eddy currents in chassis and wiring, and these can add noticeably to background hum and noise. This in turn can swamp low level signal information.

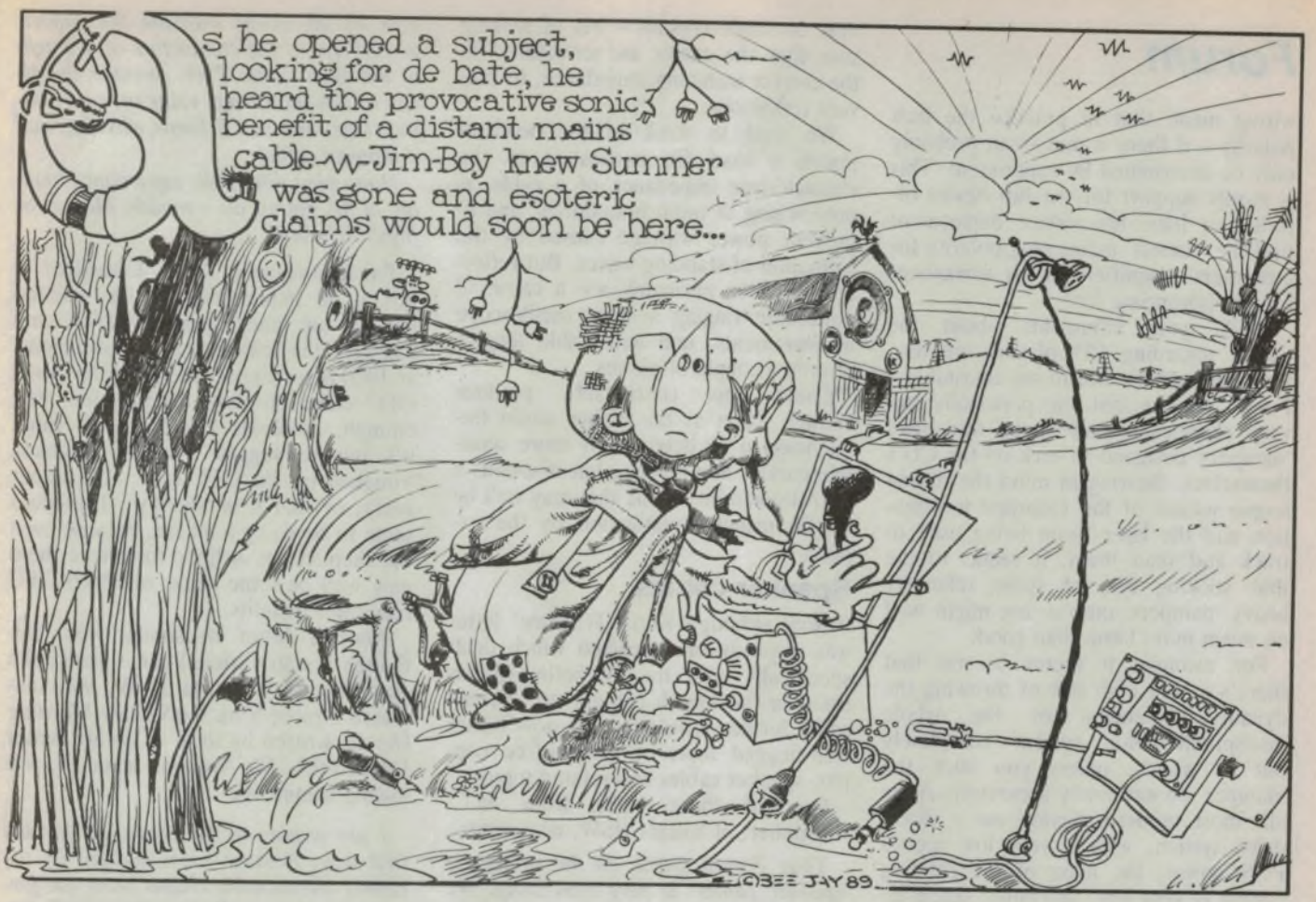
As there appears to be no universally correct 'polarity', each case must be established by experiment to find the optimum polarity (if any). The apparently random nature of these phenomena undoubtedly accounts for the wildly varying claims made by the protagonists.

Statement: All contacts must be clean.

Comment: This should be self evident, as there is no argument that electron flow in a circuit can be interrupted by layers of various oxides, skin oils, raspberry jam, etc. However I do not wish to buy into claims that various proprietary 'contact improving' substances should be used. I'll leave comment on that to the chemists among your readers.

Statement: Use high quality power cable where applicable.

Comment: Shades of the oxygen free copper debate. Enough people whose ears and credentials I respect claim to have 'heard' mains cables; however I remain skeptical. Logically if the cable is capable of delivering the required current without voltage drops, how can the equipment connected to the end of it tell



the difference? Perhaps others can shed some light on this point.

One aspect of mains cable I have shown, at least to my own satisfaction, to be a relevant factor is that if one uses standard three-core twisted flex to connect the various components of the system, especially if more than one item is actually grounded to mains (i.e., to form an earth loop), 'noise' from the active can be inductively or capacitively coupled into the ground wire and hence to the 'signal ground', where it can obscure low level detail.

Now for the points about compact disc players.

Statement: Quality interconnect lead must be used.

Comment: What is a quality interconnect? I am quite convinced that this can under no circumstances be defined on the basis of cost. Perhaps the oxygen-free-copper advocates should buy into this one.

In my experience there seems to be no universally accepted 'superior' type of cable. Superstition and unproven opinion run rife, with seemingly no definable SCIENTIFIC test being available. Due to the wide assortment of levels and load impedances exhibited by available equipment, it is conceivable that no universally optimum interconnect is possible, so again one is forced into a trial and error situation.

Statement: External vibrations should be isolated for CD's.

Comment: If one considers the compact microscopic nature of the recorded data on a compact disc, and the incredible accuracy of alignment needed for the laser beam to read it, reason dictates that in less than perfect players more data will be read accurately if everything is kept stable.

It is to be hoped that manufacturers would take care of this at the design stage. However due to processes of mass production and economy, lightweight construction and normal tolerance plus wear and tear of the mechanisms, it is not unreasonable to expect that help in suppressing external vibration could provide a sonic benefit.

The same line of reasoning is equally applicable to such accessories as disc dampers, under some conditions. I think one must bear in mind that 'stereo focus' is primarily achieved through time and phase accuracy of high frequency information – the very area most affected by mechanical instabilities in the transducer.

In closing, it seems to me that too many people want 'cut and dried' answers to what in essence are highly technical and quite often extremely subtle problems. The real answers to these questions will undoubtedly emerge, given time and an appropriately scientific line of investigation. Without this the debate will continue ad nauseam in a way more suited to hifi gurus and commercial advertisers, than a respected technical journal.

Thanks for those thoughtful and considered comments, Kerry. And broadly speaking I can't really argue with any of the points you make, because they are so reasonable.

But then your comments don't exactly give a great deal of support to the marketers of some of the disputed goods and services claimed to give 'improvements' to hifi system performance, do they? I note your comment about changes in the resonant frequency of loudspeaker drivers, for example, and that this can potentially produce changes for the worse just as easily as changes for the better.

Similarly you note that while hum and noise may well be injected into a hifi system by 'unfavourable' mains connections, the vagaries of household mains

wiring mean that in practice the best polarity – if there is one – can probably only be determined by experiment. This is hardly support for the hifi dealer offering to have his service department find the 'correct' mains plug polarity for customers' amplifiers in his workshop, for an appropriate fee!

While your comments about the claims regarding CD players are also very reasonable – not to say charitable – I must confess that I'm personally still very skeptical about those thin lead 'dampers' designed to stick on the CD's themselves. Bearing in mind the microscopic nature of the recorded information and the laser beam being used to track and read them, it seems to me that sticking one of these relatively heavy 'dampers' onto a disc might well do much more harm than good.

For example it seems to me that there's a very high risk of throwing the dynamic balancing of the whole disc/spindle/motor system completely out of whack, unless you stick the 'damper' on extremely accurately. After all, most modern players use a direct drive system, with a very low inertia PCB motor; the mass of the rotating system is very low, and could surely be disturbed quite drastically by an added disc of lead foil – if it were even slightly eccentric and/or not stuck down completely smoothly.

Also with this additional mass added to the CD, it must surely become much more critical that both disc and damper are gripped by the player mechanism's locating boss so that they are aligned exactly with the plane of rotation, orthogonal to the spindle axis.

Frankly I wouldn't be at all surprised if the vibration capable of being produced by an unbalanced 'damper' were much *greater* than that produced by any slight 'flapping' of an untreated disc as it rotated, due to surface bumps or dust or whatever. But like Kerry Williams, I hope that someone with the appropriate equipment will be able to check this out in a truly objective manner, and let us all know their findings.

The same applies to things like interconnection cable characteristics. In fact while reading Kerry Williams' letter for the first time, I found myself wondering whether 'golden eared' audio people may not have been barking up the wrong tree here altogether: perhaps it's not so much a matter of using the right conductor material – ordinary copper, OFC, silver, gold or whatever, and multiple or single crystals – but of making sure that the cables are *terminated* in the correct matching impedance, to prevent reflections.

We tend to think of the need to match a load (in particular) to the characteristic impedance of a cable as only arising at radio frequencies, and to prevent power wastage caused by the formation of standing waves. But reflections due to mismatch are a cause of noticeable 'ringing' in many oscilloscope measurements, and with cable lengths of only a couple of metres.

Could this conceivably produce enough effect at the higher audio frequencies to be detected by more sensitive ears? I don't know, but it sounds a (faint) possibility – one that may well be worth further investigation by the experts.

Speaker cables

Now although Kerry Williams' letter was the only one received which dealt specifically with the marketing claims listed in the March column, there *were* some further letters on our now rather well-flogged topic of oxygen-free copper, speaker cables and related topics.

One of these came from M.C. Chevallier, of Killara NSW, who wrote:

Your Forum article on the subject of 'speaker cables' is very interesting. We measure and probe and generate papers of hypothesy – but if I wish to transmit 10GHz, then I'll do it on the cheap and call Alcan Guttering, ask them to erect X metres vertical to a windmill-frame, and if they wouldn't mind closing one end off.

I will NOT spend $XXX on doubtful, cable that someone has roughed up (between saki and sushi), a glowing tribute for a product that has only to conduct an AC current in the range 70Hz to 9kHz, not gigahertz!

Why 70Hz – 9kHz? Well, anybody who is able to afford the type of cable that enables a salesman to lease his BMW and/or Porsche, is of the age where his/her wallet may be wide, but their hearing range is definitely narrow. More than 9kHz is effectively beyond those over the 50's hurdle.

If you really are paranoidly fanatical about Beethoven's 'Requiem for the Dead' or even for a little of Ward Swingle's trapeze work, then may I suggest that you (not I) apply practical considerations to increase the damping factor of your speaker setup, by emptying the treasury of silver for the making of speaker wire.

Meanwhile, if you have any compassion toward your precious 'hifi' gear, then by all means measure the capacitance between the conductors of a length of this twin cable. Then consider the effect of this monstrous value on your output stage, and you'll know why they call it monster cable!

Hint: what does bulk capacitance loading at the output do – muddy Mozart or finish Schubert?

Fairly obviously, M.C. Chevallier is not at all impressed with the claimed benefits of fancy speaker cables, and can't see the relevance of measurements at 10GHz to support the claim for using OFC cable at audio frequencies. Fair enough, although I really don't think it's fair to suggest that Mr Kamada 'roughed up' his OFC cable at a dinner party, or that it is 'shonky'. That does seem to be going a bit far, because even the skeptics are inclined to believe there may well be *some* areas in which OFC may offer benefits.

Another letter in similar vein (although not so vitriolic) came from John Andrews of Vaucluse NSW, who enclosed a piece from the *Sydney Morning Herald* written by local video-hifi writer David Frith. Mr Andrews made the following comments:

I am writing to the magazine for the first time, because I am amazed by the clearly questionable claims being put forward by the so-called 'golden eared' fraternity in relation to the interesting debate over oxygen-free conductors for audio signals.

I have enclosed a copy of a recent article in the Herald's guide supplement, although I would not be surprised if you have already been buried in copies of it!

I was interested to read the analysis provided by Mr Fowler, and agree that it is the first time anyone has examined the matter in an objective way. There do seem to be some theoretical advantages in using oxygen-free copper wire, and a need to look into the matter further.

However I have yet to be presented with evidence, as opposed to pure puffery and supposition, that there is indeed measurable and objectively discernable improvement in the sound coming out of the speakers. When one considers the other possible sources of distortion and signal degradation inherent in the whole process from microphone to speaker cone, I conclude that oxygen-free copper is largely 'flavour of the month' for the mug buyers of 'hifi'.

To use as but one example, we are told that gold plated connectors are the fashion. A cursory perusal of the audio connectors at the local Tandy store showed plugs completely plated in gold –

not only the parts 'doing the job', so to speak.

I feel that we will only get to the bottom of this matter when the pseudo-technical golden eared afficionados move on to some newer innovations, such as virus-free electricity or idealogically compatible transistors!

It is gratifying to see that Electronics Australia is able to get stuck into the hocus pocus and mumbo jumbo that is still with us in these so-called enlightened times, and my congratulations on maintaining the standard of the publication.

Thanks for those kind words, John, and for your thoughts on the OFC topic. As it happens I hadn't been buried in copies of David Frith's piece on the benefits of using so-called 'specialist' cables; you were the only reader to bring it to my attention. But like yourself, I certainly found some of the claims David seemed to be making for these cables rather difficult to swallow.

By sheer coincidence, at almost exactly the same time as I received John Andrews' letter another turned up from Andrew Goldfinch – whose firm Leisure Imports brings in and distributes the very same cables about which David Frith was writing in the *SMH* piece concerned. So before I make any further comment on these cables, perhaps it would be a good idea to let Andrew have the rostrum:

It really surprises me that you would waste five pages of EA trying to obtain a better understanding about speaker cables, when you say at the end of your article that you don't think cables make any real difference anyway.

After over twenty years in the audio industry I don't have a technical bone in my body, and by default I am forced to use my ears to assess things like speaker cable. You might be thinking of the story about the king and his clothes when it comes to cable; if that is so I can assure you there are a hell of a lot of people out there walking around without any clothes on.

As you know I am the Australian representative for QED Audio Products Ltd., and we have worked hard to improve the public awareness of the benefit that QED cables can make to their hifi systems. QED cables do not make big improvements, they prevent big losses, and as such they allow the major, and much more costly components, to perform to their full potential. Therefore the cost of QED cables are small compared to the improvement they can make to the whole system.

We are very proud of the quality of our cables, but it does concern us that the majority of so-called audio cables provide very little sonic benefit. And while some say a single strand cable is best, others say 2000-strand is better. How do you cut the confusion?

In England, where QED claim to have 90% of the market, audio magazines have been discussing cable quality for many years. However little has been done here.

My concern with your article is the fact that you are discussing oxygen-free copper (OFC), what is it and is there a specification for it?

There are some very attractive looking clear cables claiming to be OFC in hifi stores around Australia, which are turning black or oxidising before they can be sold. I am concerned that you will be prompting your readers to go out looking for OFC cables, and not consider the quality of the product in the shops.

It's a bit like linear crystal cables, which appear to have come and gone; you rarely see them on the market now. There must be a good reason why? It's great to write about this technology, but if no one is buying it you should be asking why.

QED cables do not trade on their good looks or claim any great technical achievement, they simply ask that you listen to their products. A good test for your readers, if there is any doubt about the importance of cables, are our QED INCON interconnecting cables. They are a directional cable, only improving the sonic performance in one direction. When used with a quality source like a CD player, they can make a considerable improvement for as little as $40.

Most QED dealers are happy to sell INCON leads on a sale or return basis, because for some reason they just don't come back.

Hmmm... Thanks for your comments too, Andrew, although in places your letter does seem a thinly-veiled advertisement for QED cables – not surprising, I suppose.

There's certainly quite a difference between the positions of M.C. Chevallier and John Andrews on the one hand, and Andrew Goldfinch on the other. In fact they seem to be almost diametrically opposed, don't they?

Actually I don't quite know where to start, in trying to comment on Andrew Goldfinch's letter, because he makes so many claims and in some cases I can't really follow what he's driving at.

One point I would like to correct is that despite Andrew's claim to the contrary, I *didn't* say at the end of the May column that I didn't think cables "make any real difference anyway."

What I wrote was this:

I don't know about you, but the more I learn about the subject of oxygen-free copper, the more confused I'm getting. One thing's certain, though – at present, I still see no good reason for throwing away my low-cost speaker leads (using figure-8 power cable), and investing hundreds of hard-earned dollars in fancy OFC and/or single crystal super cables.

I think you'll agree it's twisting my meaning to say from this that I don't think cables make any real difference.

In fact I'm well aware that good old-fashioned cable resistance makes a big difference – that's why I use the relatively sturdy 'power' type plastic figure-8 flex for my speaker leads, instead of thinner 'speaker' flex or even thinner bell wire.

Actually I use one length of the figure-8 flex for *each side* of the leads to each speaker, with the two conductors connected in parallel. This gives me some 46 conductors of 0.2mm in diameter, or a total cross-sectional area of just on 1.5mm^2.

My lounge-room is probably fairly typical, I imagine, with speaker leads about 3.5 metres long. And although these leads are only made from 'ordinary' ETP copper, it turns out that the resistance of two 3.5m-long lengths of this 'doubled up' figure-8 flex adds up to only around 75 milliohms – .075 ohms.

So each of my speakers sees a driving impedance only 75 milliohms higher than the output impedance of the amplifier output stages, which as far as I can see (or hear) has negligible effect on performance. For example if the amplifier had zero output impedance (which it doesn't), the speaker damping factor would still be over 100. And these cables cost me the princely sum of $7.70, for a total of 14 metres at 55 cents per metre!

Even if I went berserk and used TWO doubled-up lengths of the same flex for each lead to each speaker – thereby halving the series resistance to less than 40 milliohms – the whole setup would still only cost me about $15, very much cheaper than any of Andrew's cables. In fact from David Frith's article, the top 'Flat 200' grade of QED speaker cable costs $15 *per metre*.

So it's not that I don't think cables make any difference, Andrew – just that I doubt whether spending 27 times more money ($210 compared with my present $7.70) to buy *your* cables would achieve a similar improvement in sound quality. Or even a sufficiently noticeable improvement to justify the exer-

cise, to be honest.

One of the points where Andrew leaves me puzzled is his claim that although 'QED cables do not make big improvements, they prevent big losses', and that their cost is 'small compared to the improvement they make to the whole system'.

Frankly I find this a bit mystifying. If the cables prevent 'big losses', I would have thought that this *should* result in big and noticeable improvements. Yet Andrew says himself that they *don't* make big improvements – all very confusing.

Another point where he leaves me rather bewildered is the claim that somehow all of our discussions about OFC cable will result in our readers going out lemming-like to their nearest supplier, and blindly buying whatever OFC cable they can find there.

I would have thought that our discussions would have produced exactly the *opposite* effect: a good deal more skepticism about OFC cable, and the claims made for it, than before. And I suspect that's really what is worrying Andrew, if the truth's known.

Yes, I have heard of some OFC cables with clear plastic insulation, where you can see that the conductors appear to gradually 'turn black'. I hadn't heard of this happening before they were even sold, although I guess that's possible.

But is the blackening actually caused by oxidation? It occurs to me that it might be due to some other kind of chemical reaction, perhaps with one of the ingredients of the plastic insulation. Or it might even be the plastic insulation itself going black right at the metal surface, rather than the copper, and again due to some other chemical reaction.

Perhaps I'm also an incorrigible skeptic, but it also occurs to me that even if this blackening *is* due to oxidisation, for all you or I know the same thing might well happen with cables which use opaque plastic insulation – for example like those made by QED, according to David Frith's article.

The thing about opaque insulation, of course, is that since it doesn't let you see the conductors, you have no way of knowing what colour they have become. They *might* have remained nice and shiny, with no nasty oxide forming on the surface, or they might not. Probably the only way to find out would be to strip off the plastic insulation – thereby exposing them to the air, and making sure that if they weren't going black already, they soon would!

But the statement where Andrew really left me gasping was the one about the QED 'INCON' interconnecting cables being 'directional', and only improving the sonic performance in one direction. Wow! What do you say to that?

I must be dense as well as skeptical, because frankly I find the idea of a low-level audio interconnection cable being *directional* in its characteristics quite mind boggling. In what way could it be directional, when it is carrying quite low frequency AC signals where the currents are already flowing in opposite directions on alternate half-cycles?

It sounds to me as if the cable must somehow be *non-linear*, being able to sense which way the energy is flowing along it, and change its characteristics to suit. Yet non-linearity is not a characteristic which one normally regards as desirable in audio systems. In fact we generally go to great lengths to avoid it, so I find it hard to understand how it could possibly make 'a considerable improvement'.

You really lost me with that one, Andrew. But what do other readers think – am I being too reactionary?

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Silicon Valley NEWSLETTER . . .

Report praises Sematech

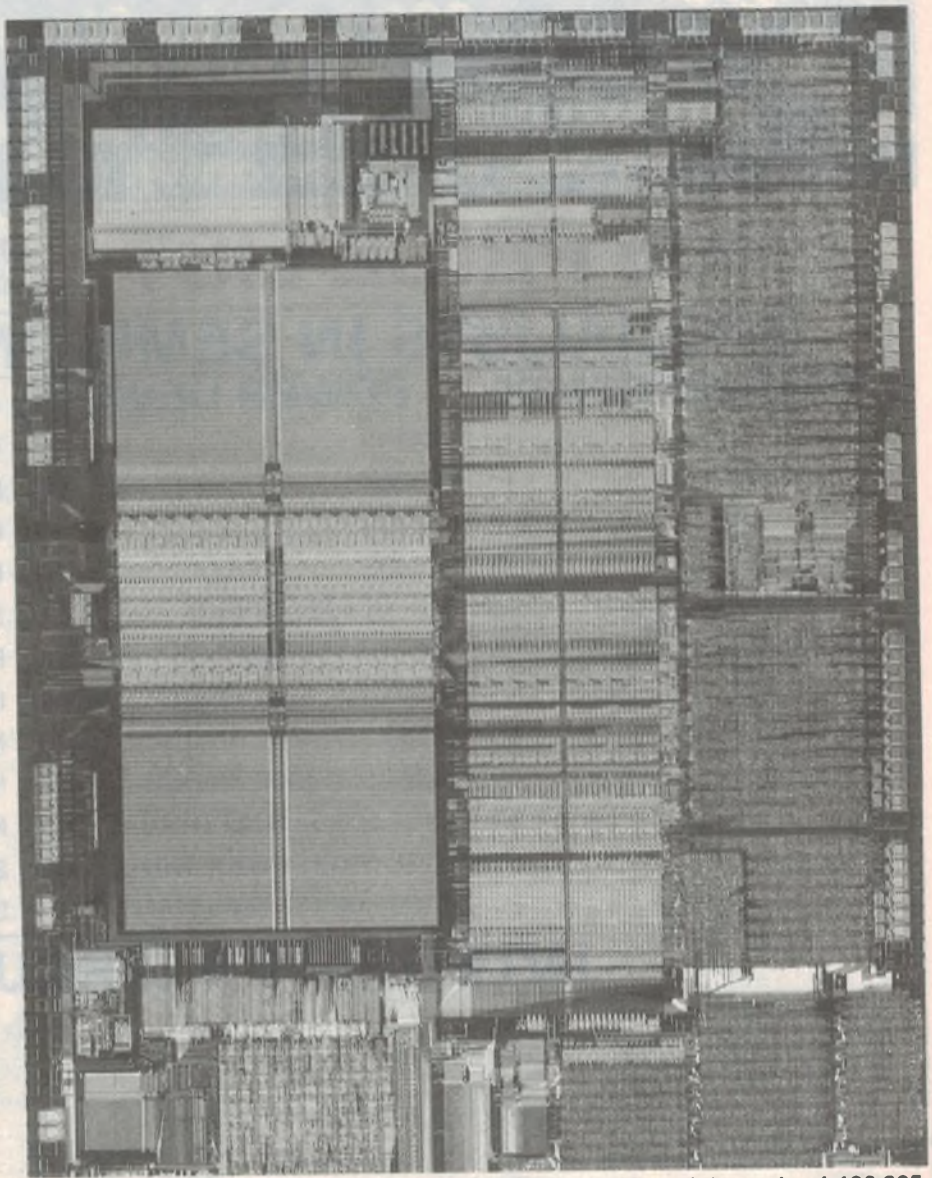
The Bush Administration has released a report praising the US chip industry's Sematech research consortium.

The US Commerce Department released its first 'report card' on Sematech, which is receiving annual federal subsidies of US $100 million to help develop the necessary manufacturing equipment and technology to keep American chipmakers competitive in world markets.

In the 49-page report, the Commerce Department applauds the Texas-based organisation for quickly having settled complex and thorny debates regarding its goals an structure. The report concludes by recommending that Sematech receive the second of five US $100 million annual subsidies from the Defense Department.

"I think congress should be reassured by Sematech's efforts at self-definition" said Jeffrey Mayer, author of the report and director of the Commerce Department's Office of Economic Policy.

Recently, Sematech delivered its first batch of 64K SRAM memory chips. Sematech's ultimate goal is to develop the technology and equipment to produce reliable 64 megabit SRAM chips (equivalent to 4 gigabit DRAMs) by 1993. Those chips would feature linewidths of just 0.35 micron. By the end of this year, Sematech hopes to be making chips with 0.8 micron dimensions, and 0.5 micron by the end of 1990.



A blowup of Intel's new i486 microprocessor chip, which packs 1,180,235 transistors into a die measuring only 10.5 x 15.7mm (0.414" x 0.619").

Cray splits itself in two

Less than a month after Control Data's dramatic retreat from the supercomputer market, America's lone surviving supercomputer maker announced it is splitting itself into two companies, one focusing on Cray's current line of silicon-based supercomputers, while the other will develop a new generation of gallium-arsenide-based systems. Cray also announced a major marketing agreement with Control Data.

Saying that the US needs a second major supercomputer vendor in the face of mounting Japanese competition, Cray founder Seymour Cray will leave Cray Research to start up a second company, to be known as Cray Computer.

Cray Research will fund the new venture with some US$100 million in operating funds over a two-year period. Cray will also transfer some US$50 million worth of equipment (5% of Cray's assets) to the new company. In return Cray Research will maintain a 50% equity position in Cray Computer.

Cray Computer will be located in Colorado Springs in Colorado, where a special research group headed by Seymour Cray has been working on Cray's next-generation machine for the past couple of years.

The new computer will be based on gallium arsenide components and will be at least 10 times as fast as the company's current top-of-the-line machine. However, the Ga-As technology has yet to prove itself reliable in heavy-duty types of applications like supercomputers.

Proposal for US-German HDTV pact

Both the United States and Western Europe face the same challenge of trying to overcome Japan's lead in the development of next-generation high-definition television technology. To succeed, the US should pool its resources with those of Western Europe, according to a plan presented to President Bush by West Germany's Minister of Telecommunications, Christian Schwarz-Shilling.

Schwarz-Shilling said discussing the merging of US and European HDTV development was a top priority in his talks with US Secretary of Commerce Robert Mosbacher. The latter has been the driving force within the Bush Administration to establish a government policy on HDTV development.

"If we have separate development in the United States and Europe, I don't think Japan will ever be beaten because Japan is so far ahead," said Schwarz-Shilling to a group of reporters.

He added that in discussing his proposal with Mosbacher, he was speaking with the full authority of the West German government. In addition, he said he has received positive reactions to his plan from his colleagues from the other 12 Common Market nations.

For the US the development of an HDTV industry is regarded as critical to the economic health of the country's electronics industry, paricularly the semiconductor and computer industries. This is because the technologies necessary to develop HDTVs will be the same as will be required in future generation computers. Tehcnological leadership in the HDTV components technology will virtually guarantee leadership in a number of other related technology markets.

Perkin-Elmer throws in the chip

Bad news continues to pile up for the American semiconductor equipment industry. Following a recent report that their Japanese competitors have taken away America's leadership, the industry has been rocked by the announcement that one of America's premier equipment makers is leaving the business.

Blaming Japanese competition, Perkin Elmer said it is quitting the semiconductor equipment business altogether and is in the process of closing or selling off its various product groups and technology.

The Norwalk, Connecticut-based company said it is restructuring its entire organisation in order to focus on materials technology and scientific instruments. In the process, Perkin Elmer will sell off its semiconductor operations, its West German-based aerospace group, and its government contracts operations. Proceeds from the sales will be distributed among shareholders.

Immediately following the announcement, Santa Clara-based LAM Research said it has already paid an undisclosed amount to Perkin Elmer for key patents related to P-E's advanced new 'Omni-Etch' technology.

US industry analysts and executives said the decision by Perkin Elmer comes as a severe blow to the US equipment and overall semiconductor industry.

"It is the continuing saga that there is investment money available in Japan and not in America," commented Robert Noyce, Intel founder and currently chairman of the Sematech chip consortium.

National closes the book on its original plant

For National Semiconductor, life began in 1959 in the town of Danbury in Connecticut, and for the next 30 years the company's facilities there played a key role in National's manufacturing operation. But National announced recently that it is closing the Danbury facility, as part of its belt-tightening program aimed at stemming the flow of red ink that has engulfed the Santa Clara-based chip maker.

Currently, the Danbury facility produces a number of products, including logic and memory, as well as individual transistors. The latter line is an extension of the original product National made at the Danbury plant.

National said it will move production of the products made at Danbury to the company's facilities in South Portland, in the state of Maine, and Greenock in Scotland. All 400 employees of the Danbury plant will lose their jobs as a result of the action.

"While this is our first plant, we really have to look closely at everything," commented a spokeswoman for the company.

It was at the Danbury plant where National got its early start making transistors. By 1968, when sales had grown to US$11 million, company founder Peter Sprague moved the company to Silicon Valley, where Sprague had acquired chip maker Molectro. At the time of the move, Sprague hired Charlie Sporck, the general manager of Fairchild Camera & Instruments, to run his fledgling chip company. Sporck is now National's president.

NEC reclaims supercomputer lead with 20-BIPS machine

NEC has reclaimed the top position in the market for the world's fastest computers, with the introduction of the latest model in its SX-X line of supercomputers.

The SX-3 machine will be able to process up to 20 BIPS (billion instructions per second) in certain applications. At that speed, the NEC machine is 25% faster than its future rival, the forthcoming Cray-3 from Cray Research. Both systems are expected to become available for shipment by the middle of next year.

Despite the considerable speed advantage of the NEC system, industry analysts say NEC is not likely to make major inroads into Cray's dominance of the supercomputer market. This is because of the considerably larger base of application software that has been made available fo the Cray machines over the years.

Still, in the long run, the apparently increasing lead the Japanese are achieving in system performance may help them overcome the superiority of the Amercian firm's software.

New flat screen from IBM & Toshiba

IBM and Toshiba have announced the joint development of a new flat-screen computer display. The two firms said they have developed a prototype of the display, which they intend to use for their lines of lap-top personal computers.

The new display is considerably larger than any of today's flat-panel displays, and apparently much clearer as well. The technology involved is an improved version of the LCD-based display technology used by Toshiba in its portable televisions. The display has more than 400,000 picture elements, arranged in a 720 x 550 array. Each of the picture elements consists of four dots – red, green, blue and white.

The elements can be switched on-and-off 60 times a second, allowing it to display full-motion pictures. As many as 16 colours can be displayed on the screen, which is just 1.5" thick.

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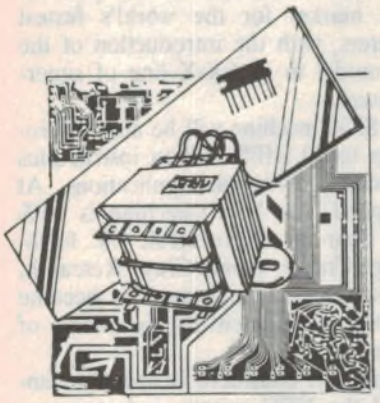

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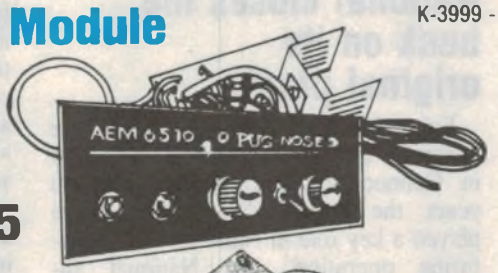

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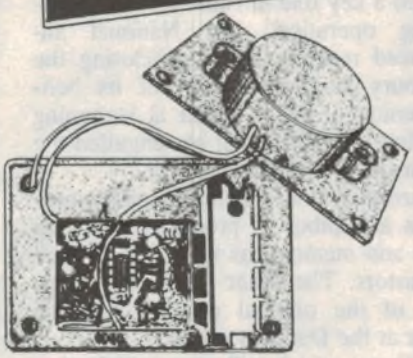

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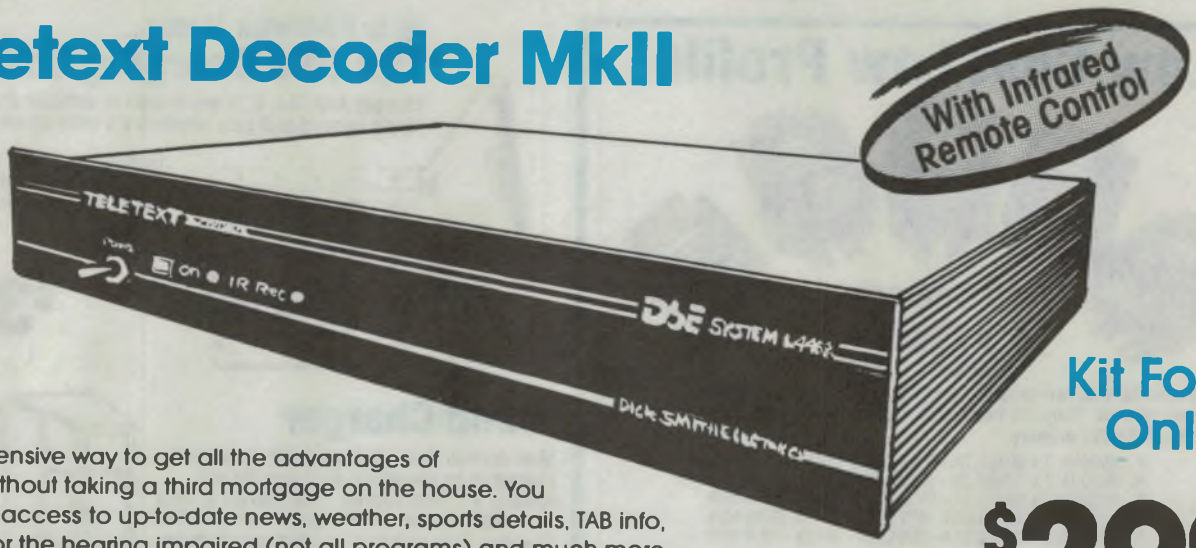

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All one price!

$29.95 each

Each transformer has two separate secondary windings which can be wired in series or in parallel. They are fitted with round pin terminations and include connectors. 240V AC primary.

PL 12/20VA 2 x 6V@1.7A - 6V@3.4A - 12V@1.7A M-3596
PL 15/20VA 2 x 7.5@1.3A - 7.5V@2.6A 15@1.3AM-3597
PL 18/20VA 2 x 9V@1.1A - 9V@2.2A - 18V@1.1A M-3598
PL 24/20VA 2 x 12V@.85A - 12V@1.7A 24V@.85AM-3599
PL 40/20VA 2 x 20V@.51A - 20V@1A - 40V@.51A M-3601

DSE 0144

Primary: 240V AC
Secondary: 28-0-28V
Secondary current: 2A
Cat M-0144

$34.95

DSE 0150

300VA Primary: 240V
Secondary: 47-0-47V @ 3 Amps
15-0-15V @ 5 Amps
Terminations: Flying Leads
Size: 115 x 95 x 97mm
Weight: 4.85kg
Cat M-0150

$69.95

DSE 2851

Primary: 240V, 50Hz
Secondary voltage: 6.3-0-6.3V
Secondary current: 150mA
Terminations: Flying leads
Cat M-2851

$5.95

DSE 2000

Primary: 240, AC
Seconday: 18 volts @ 6A
Terminations: Flying leads
Cat M-2000

$36.95

DSE 1990

Primary: 240V
Secondary voltage: 18V
Secondary current: 2.2A
Terminations: Flying lead
Cat M-1990

$16.95

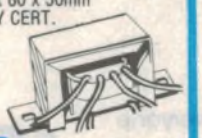
DSE 2010

Massive 18 volts at 14 amps continuous..ideal for high power rating power supplies, linear amplifiers, etc, etc. Compare our price with what you've had to pay in the past...What a bargain!
Cat M-2010
Suits 13.8V 25A pk supplies As used in our VK powermaster kit

$69.95

DSE 2155

Primary: 240V, 50Hz
Secondary voltage: 6.3, 7.5, 8.5, 9.5, 12 & 15V
Secondary current: 1 amp
Terminations: Flying leads
Shipping weight: 491g
Shipping size: 100 x 60 x 50mm
ENERGY AUTHORITY CERT. NO. CS2078N
Cat M-2155



$7.95

DSE 2840

Primary: 240V, 50Hz
Secondary voltage: 4.5-0-4.5V
Secondary current: 150mA
Terminations: Flying lead
Cat M-2840

$3.95

DSE 1602

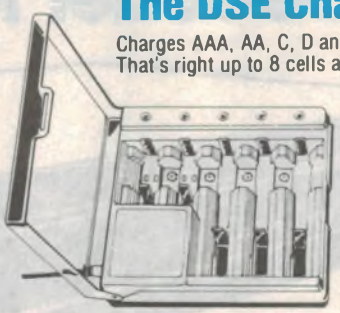
Standard toroidal transformer suited to audio work. Terminations are soldered flying leads and it's supplied with neoprene rubber insulating disks and centering washer.
Primary: 240V AC
Secondary: 2 x 35V @ 2.5A
2 x 15V @ 0.25A
Size: 113mm OD x 48mm
Cat M-1602

$59.95

Up to 8 batteries at once...

The DSE Charging Cabinet

Charges AAA, AA, C, D and 9 Volts in virtually any combination. That's right up to 8 cells and/or 3 x 9 Volts at one time.

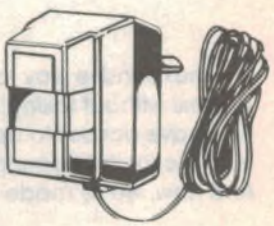


Features indicator lights for each cell, reverse polarity protection, mains operation, test meter and more!
Cat M-9505

$39.95

NiCad Charger

Most devices these days allow for an external charger to be plugged in to charge NiCads (usually a 2.5mm socket). This charger is ideal for all NiCad packs from 6 to 10 cells (ie 7.2 to 12 volts). Fully approved by Electricity Authority.
Cat M-9517



$17.95

POWER SUPPLIES

9V DC @ 200mA

For all equipment requiring 9V DC at a 9V transistor type battery or many other static hobby models that require 9V. Eliminator modules simply plugs into a 240V AC power socket.
Cat M-9514

$11.95

3-4.5-6-7.5-9-12V @ 300mA

An extremely versatile supply ready for just about any application. Switchable output gives 6 different voltages ranging from 3V to 12V, at up to 300mA.
Cat M-9526

$17.95

AC Supply 16V 900mA

The biggest problem with most projects is fitting in the transformer! This one obviates the problem - keep the supply components inside, but the plug-pack hangs on the power point! With a very healthy 16V at 900mA. It's perfect for 12 volt DC supplies. Energy authority approved.
Cat M-9567

$14.95

3-6-9V DC @ 200mA

This battery eliminator is one of the most superb buys in this catalogue - many thousands have been purchased by people who know how to save money! It is a small plug-in unit that has three output voltages of 3,6 and 9 volts DC at 200 milliamps - possibly the three most used voltages on battery powered equipment. It is ideal for many battery driven items.
Cat M-9525

$16.95

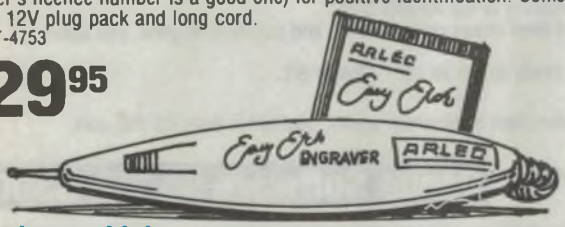
DICK SMITH ELECTRONICS

'THE EASY WAY TO WORK!'

Arlec - Easy Etch Engraver

You know how easily tools and valuables go for a walk - never to be seen again! Well, here's a great way to identify them. Steel bit lets you engrave metal, plastic, wood etc., with your name or a security number (your driver's licence number is a good one) for positive identification. Comes with 12V plug pack and long cord.
Cat T-4753

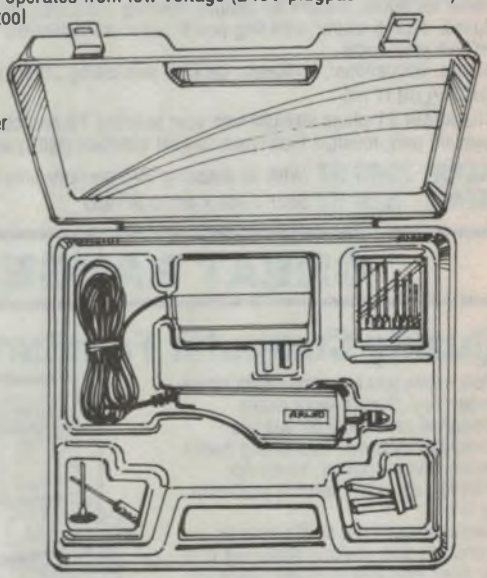
$29.95



Arlec Supertool

What versatility! It sands. It polishes. It engraves. It erases. It mills. It's one of the handiest tools you can have in your arsenal! This fantastic hobby machine is a 10,000 RPM power head which does all of the above with the attachments supplied. And because it operates from low voltage (240V plugpack included!) it's safe. Includes the Supertool and plugpack, 2 milling cutters, 1 wire brush, 1 grinding wheel, 4 high speed drills, 5 chuck collets (0 to 4mm), eraser sticks and instructions.
Cat T-4754

$59.95

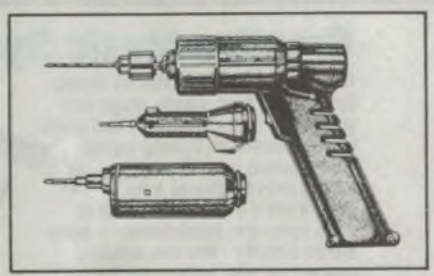


Rechargeable!

3-In-1 Modular Tool

It's a DRILL, a SOLDERING IRON and a SCREWDRIVER all in one! This has to be one of the smartest tools for hobbyist, handyman and tradesman alike.
Modular components fix to rechargeable battery pack (handle) in seconds. Comes with assorted drills, screwdrivers, solder accessories and charger. Cat T-5712

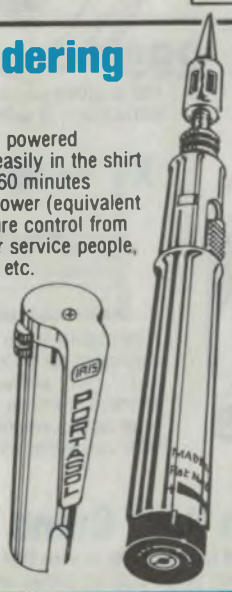
$99



Pocket Soldering Iron

Totally portable, butane powered soldering iron that fits easily in the shirt pocket. Provides up to 60 minutes continuous use at full power (equivalent of 60 watts). Temperature control from 10 to 60 watts. Ideal for service people, handymen, technicans, etc.
Cat T-1370

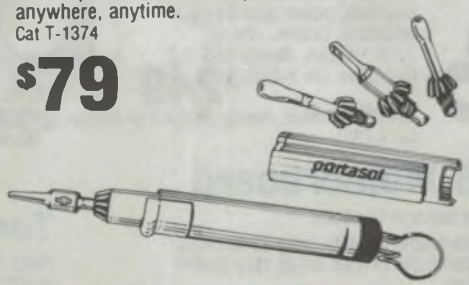
$29.95



The Professional 'Pocket Soldering System

The convenient soldering system from Portasol its a complete kit with the equivalent of 10-60 watts of power and temperature adjustment up to 400 degrees Celsius.
Ideal for the hobbyist, handyman or technican, this butane powered kit allows you to make repairs, etc. anywhere, anytime.
Cat T-1374

$79



Electronics/Electrical Formual Casio fx-61f

Without doubt one of the most useful tools anyone working with electronics could have. With 27 of the most used electronics formulas built-in - resonance frequency, impedance, voltage/current gain... everything! Includes 74 scientific functions, 10 digit display, programming functions ...it's unbelievable.
Cat V-3828

$79.95

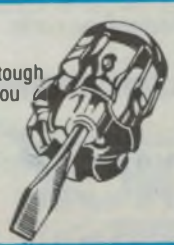
DICK SMITH ELECTRONICS

Stubby Drivers

Great for confined spaces - or that tough screw which needs extra muscle. You can really get a grip on these!

Flat Blade: Cat T-6020
Size: L 38mm
D 6mm H 45 x 30mm

$1.45

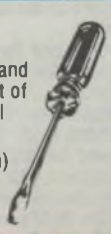


Medium Duty

Big enough to get a good strong grip and plenty of leverage. Add this to the rest of the range and you've got the right tool for just about any job. Cat T-6050

Blade Size: 150mm x 6.5mm (D: 5mm)
Handle: 95 x 25mm

$1.45



Heavy Duty

Everyone needs a big gun sometimes! Strong enough for the toughest work - ideal for the tradesman.

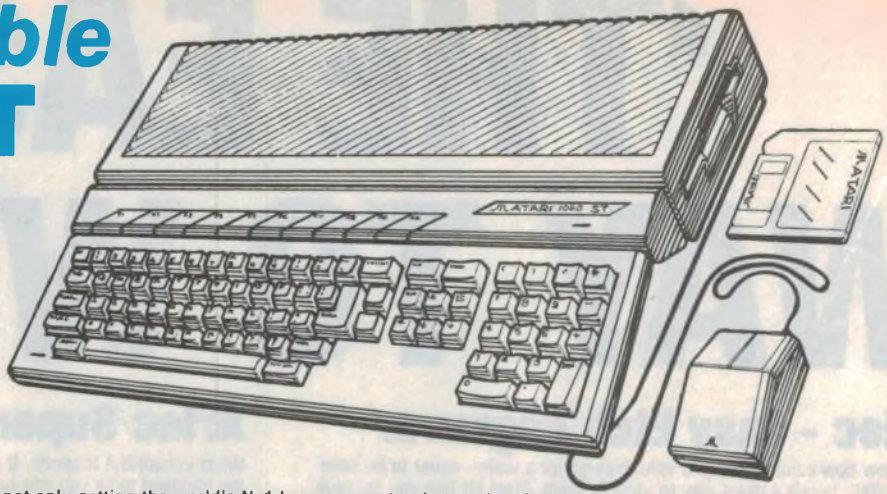
Flat Blade: Cat T-6060
Size L 200mm D7mm H 100 25mm

$2.95

The Incredible ATARI ST

For Work and Play!

ASTOUNDING GRAPHICS, INCREDIBLE POWER & BONUS SOFTWARE!



$1099

When you decide on the incredible **ATARI ST** you're not only getting the world's No1 home computer, but you're giving your family a complete video entertainment system, a superb educational tool PLUS a high powered computer for all your serious computing needs.
Dollar for dollar, feature for feature, nothing compares with the incredible performance and versatility of the **ATARI STI**
Speed, superb sound, amazing power (up to an incredible 1Mb memory), standard features that most others call options... and graphics so good, you won't believe your eyes!
Games, educational, business, desktop publishing...there's literally hundreds of software titles ready to run on your **ATARI ST.**
JUST PLUG IT IN!
The ATARI ST plugs straight into your existing TV and comes with mouse, 720K 3 1/2" disk drive, fast 8MHz clock speed, Centronics port, RS-232 port, joystick port, musical instrument digital interface (MIDI) and ....

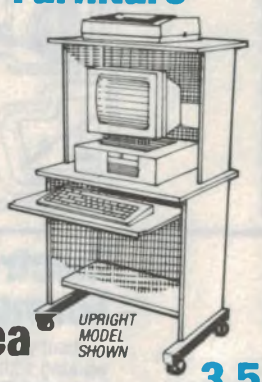
ATARI 1040 ST With an amazing 1Mb memory plus all the famous ATARI features! Cat X-6005
ATARI 520 ST 512K RAM X-6000 **$700**

Bonus Software valued at over **$300!**

GREAT RANGE OF COMPUTER ACCESSORIES

Quality Computer Furniture

Here's how you keep your work space organised! Superb work desks designed especially for today's computer systems. Everything packs neatly away - printer, computer, monitor, etc, etc - leaving you room to work.
Comes packed flat so it's easy to transport and you can assemble it in no time. Finished in quality laminate so it looks great and it's easy to clean. Choose between the standard DESK MODEL (Cat X-3815) or the space saving UPRIGHT MODEL (Cat X-3816). Both are fantastic value! **$299ea**



Creative Music System

It's astounding! The Creative Music Synthesizer card simply plugs into your IBM PC or compatible and gives you 12 channels (Voices) stereo music output and 32 preset instruments to choose from. Plus, there's a stereo amplifier to drive speakers, headphones or home stereo directly. You can actually define your own instruments, play background music while you work on your computer, create albums of your favourite tunes and play them in any sequence (great for non-stop party music) or compose your own music.

It's New!

$299

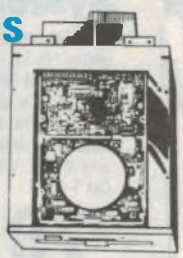
And it allows you to utilize the new Sierra range of software! Cat X-2020

Anti Static Wrist Strap

A must for when installing expansion cards or changing memory chips. Stray static charges can destroy chips in an instant. With adjustable velcro fastening, coiled ground lead and high value series resistor for added safety. Eliminates the risk! Cat X-2042 **$9.95**

3.5" Disk Drives

Now you can fit a 3.5" disk drive to your IBM compatible. These 720K and 1.44Mb disk drives come complete with mounting kit, hardware, manuals, power and 34 pin adaptors, bezels...the lot.
720K Version. Needs DOS 3.2 or higher. Cat X-2220 **$249**



1.44Mb Version. Needs DOS 3.3 or higher. Cat X-2221 **$299**

XT Prototype Card

A veroboard on an XT compatible expansion card. Complete with interrupt and memory addressing circuits already installed to enable easier construction of more advanced project ideas.
With comprehensive manual. Cat X-2034 **$149**

IBM AT Compatible 80286 Motherboard

Building your own computer or upgrading the old one? Our new 12MHz motherboard is the way to go for the ultimate computing power. DRAM not included. **$499**

Just take a look....

- Expandable to 1Mb using 256K chips
- Expandable to 4Mb using 1Mb DRAM chips
- Keyboard or hardware selectable 8/12MHz operation
- Six 16-Bit and Two 8-Bit expansion slots.
- Selectable for RAM speed - 80 or 100 nanosecond
- Selectable from 0 wait states on read operations (with 80 nanosecond RAM)
- Socketed for 80287 Co-processor
- Performance - 13.7 using Norton S.I.
- Battery backed real time clock on board
- AMI Bios ROM's included
- 0K RAM supplied Cat X-1002

Twin Port Game Card

Want to fit two joysticks to your IBM compatible for faster action when you're playing games with an opponent? Well, here's how you do it. Easy to fit, it gives you two joystick connections. Cat X-2040 **$39.95**

COMPUTER HOTLINE (02) 888 2002

DICK SMITH COMPUTERS

Professional Quality Security

You can install yourself!

Vibration Sensor Budget 4-Sector Alarm

The security system you can install yourself and save money as well as your valued possessions. It's actually based on a commerical module and comes with a heavy steel case, 4 individually controllable sectors, key-lock switch, inbuilt battery charger for your standby battery, mains power supply, siren oscillator, LED status report...the lot! Cat L-5140

$199

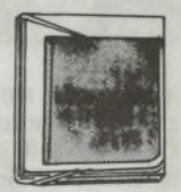
Economy Infrared Detector

The all round room protector at a bargain price! With just one or two of these on your alarm system and you can easily protect your entire house. Provides protection for a 6m x 6m area which is ample for most rooms. Features special mounting bracket and swivel head so it can be adjusted for maximum protection. Cat L-5009

$79.95

High Sensitivity Volumetric Sensor

Remarkably small, highly reliable volumetric sensor which gives 120 degree coverage for entrance, room, hallway, etc. Adjustable range up to 12 metres. Complete with tamper protection. Easy to install, it fits virtually any alarm system. (Small enough to protect the Barbie House). Cat L-5013



$139

Extra Value Security Accessories

Surface Mounting Magnetic Switch

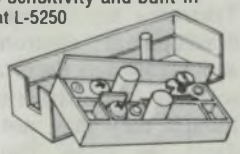
In plastic case that makes it much easier to install. Includes magnet, mounting holes and terminal connectors. Cat L-5210

$3.95

Vibration Sensor

Detects any vibration or shock caused by forced entry through windows, doors, cabinets, safes, glass surfaces, ceilings, etc. With a adjustable sensitivity and built-in tamper switch. Cat L-5250

$5.95



Panic Switch

Great for people who live alone, invalids, etc. Can be used in conjunction with virtually any alarm system. Hit the button and the alarm will sound. Cat L-5285

$3.95

Concealed Magnetic Switch

Just the thing for wood doors, windows etc. Can be installed so they're almost impossible to detect. Cat L-5212

$4.95

Alarm Horn Cover With Tamper Switch!

They'll find it hard to disable your alarm with this fitted over the horn speaker - and if they try, the alarm will sound. Made from heavy duty steel. Cat L-5300

$24.95

Window Sticker

Sticks to the inside of your window or glass doors to tell the crooks they'd better try some place else. Measures 130 x 60mm. Cat L-5311 **$2**

Large 245 x 270mm heavy gauge aluminium sign in fire-engine red. Cat L-5312

$10.95

SIRENS AND HORN SPEAKERS

Electronic Buzzer $2.25

It's ideal as a local alarm or warning buzzer! Works between 4 & 15V DC. It's diode protected with 70dB @ 1m output. Cat L-7009

Piezo Siren Alarm $14.95

With a sound output of 110dB at 1m this local siren alarm is loud enough to suit most applications. Working voltage 7.5 - 15 (200mA @ 12V). Frequency 2800Hz. Cat L-7025

Mini Two Tone Piezo $7.95

Only 38 x 22mm yet when activated it emits a high pitched, two tone warbling sound that's very attention getting. Operates on 9-16 volts. Cat L-7027

Micro Piezo Alarm $14.95

Great for cars, bikes, vans, etc, especially where space is a consideration. Amazingly compact yet very, very loud. It's easy to install and operates from 12V at 120-240mA. Output is 110dB at 1m. Cat L-7029

Large Piezo $19.95

This is the same type as used in many commercial car and home alarms. Quite small yet it gives 110dB output at 1m. Operates from 12V DC. Comes with adjustable mounting bracket. Cat L-7030

Siren Speaker $32.95

If your alarm hasn't got a siren output - here's what you'll need. This speaker horn has the siren driver built into the back of the horn. Just connect the 12V power supply (eg via the alarm's relay output). Cat L-7026

Normal Reed Switches $2.95

Small and easy to conceal. Ideal for doors, windows, etc. Cat L-5215

Reed Switch Magnets $2.95

To suit the normal Reed Switches L-5215. Cat L-5214

DICK SMITH ELECTRONICS

News Highlights

Soundtracs console for local studio

Rick Turk's recording and audio post production house in Sydney has installed a Soundtracs IL 3632 console as part of an overall upgrading of facilities.

The studio, whimsically called 'While You're Down There', has been undergoing refurbishment. Rick Turk writes music for a number of television programmes, including game shows for Grundy's and programmes and documentaries for the ABC.

The upgraded facilities will allow the studio to branch out into music production for more ambitious projects, like mini series and feature films.

The Soundtracs IL 3632 was installed by distributor Amber Technology.

GaAs ICs

A grant of $100,000 is to be provided by the Sir Ross and Sir Keith Smith Fund to the Centre for Gallium Arsenide VLSI Technology at The University of Adelaide for initial research into developing a very high speed imaging system for aerospace vehicles.

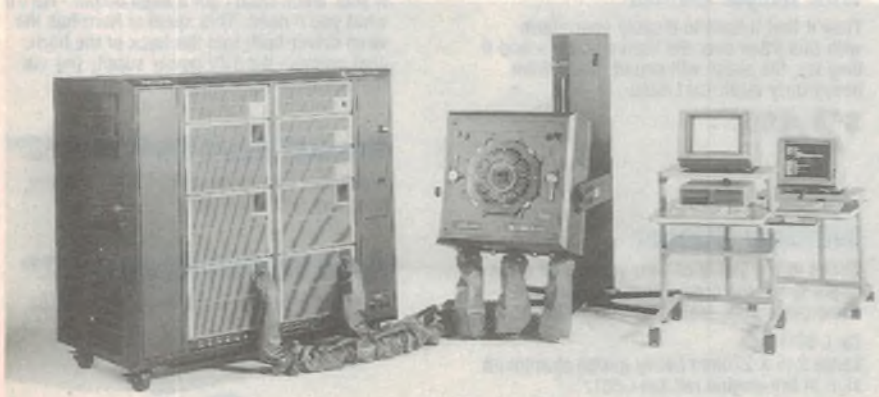
Nicknamed 'Magic Eye in the Sky' by the research team, headed by Dr Kamran Eshraghian, this multi-million dollar project could revolutionise the computer industry world-wide and will be of particular significance in the aerospace industry. The potential of this project is the ultimate development of a very powerful gallium arsenide real-time intelligent vision system that could have significant impact upon the information industry.

According to Dr Eshraghian, the new generation of computer chips made from gallium arsenide offers a major speed-power advantage over silicon and, together with increased radiation hardness and temperature tolerance, satisfies the demands imposed by the harsh aerospace environment.

The Centre for Gallium Arsenide VLSI Technology in South Australia is, the first of its kind in Australia and one of the few centres in the world with such a strength in system and circuit design, VLSI microwave engineering, communications and optics. Since its inception in 1987 the centre has attracted funding from the State Government, the University, and more recently from the Australian Research Council to pursue advanced research in a number of innovative programs which could very well associate Australia in the hi tech arena with the United States and Japan.

VLSI test system to West German university

Tektronix has sold an LT-1001 semiconductor test system valued at US$800,000 to the University of Erlangen (Northern Bavaria, West Germany) for use at its Institute of Computer-Aided Circuit Design (ICCD).



The tester will be used at the ICCD, in conjunction with the Fraunhofer Institute, for teaching test engineering as well as prototype characterisation and verification of high-speed Application Specific Integrated Circuit (ASIC) designs.

"The most attractive feature (of the Tektronix test system) is its program development environment. Beginners and occasional users are guided by the software to construct test programs even though they may not be familiar with the C language. The fexibility of the software allows the experienced engineer to change C-code programs", said Dr Werner Wolz of the University of Erlangen. "This software approach guarantees that teaching classes and introducing chip designers to the tester can be done in a short time."

US and Japan linked by fibre optic cable

The first undersea fibre-optic communications link between the United States, Japan and Guam has been put into service by AT&T and Kokusai Denshin Denwa (KDD) of Japan. Hong Kong and Korea will be connected into the Pacific fibre-optic network through Japan in 1990.

The first call on the cable – a video call – was placed by Donald J Soladar of the New York Stock Exchange, to Shiro Uramatsu of the Tokyo Stock Exhange. Speaking from the Board Room of the New York Stock Exchange, Solodar said, "The world continues to become smaller and all of us are beneficiaries."

The latest undersea fibre-optic cable, called the Pacific Link, can accommodate the equivalent of 40,000 simultaneous calls and will be used to transmit voice, data and video signals. The 8,271-mile cable is a critical part of a world wide fibre-optic network that connects three continents – Asia, North America and Europe. A call can now travel from Zurich to Tokyo entirely through fibre-optic cable.

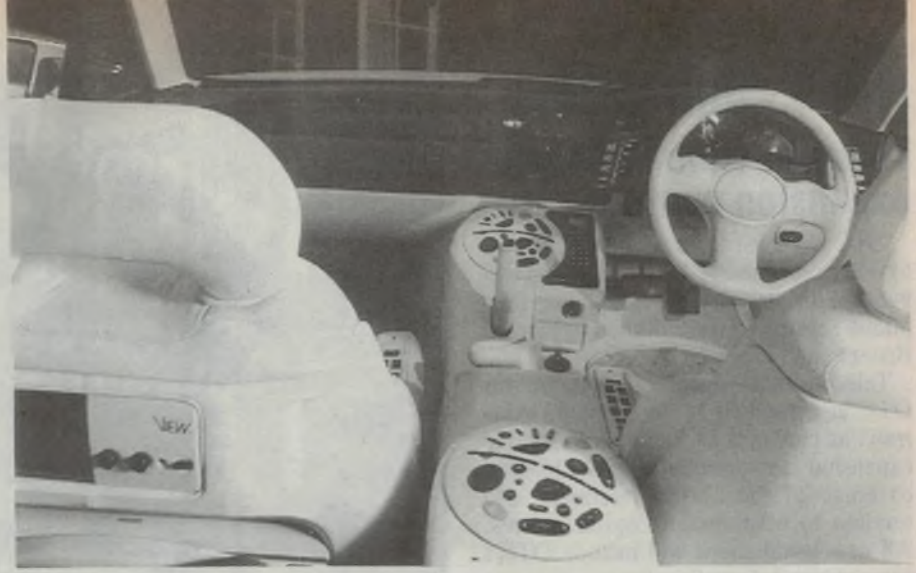
Leading edge technology played a role in developing the new fibre-optic cable route. The breakthrough mathematical formula known as the Cramarkar algorithm was used to verify the design and routing plan for the Pacific region for the next 15 years. The algorithm was invented in 1984 by AT&T Bell Laboratories mathematician Narendra Karmarkar.

Marconi Instruments sets up in Australia

UK-based Marconi Instruments has opened an Australian subsidiary, based in Sydney.

The Lane Cove head office of the new company was opened recently by Dr Colin Gaskell, Managing Director of the parent company in the UK. Also present at the opening was Dr Peter Bailey, parent company Director of International Business, and local General Manager Mr Daniel Restuccia.

Marconi Instruments products have been available in Australia since the last 1930s, the firm being represented for many years by AWA. Since 1983 representation has been by GEC Australia, but this arrangement ended in April. Many of the staff of the new Marconi Instruments were formerly with GEC Australia, and involved in marketing and support of Marconi products.



Philips displays 'Car of the Future'

Senior executives and designers from each of the Melbourne-based local car manufacturers were given a closed-door glimpse of the future recently, when Philips displayed the *Royale* – a concept car developed jointly by Philips Car Stereo and International Automotive Design (IAD) of the UK.

The *Royale* was first shown to the European auto industry at Turin. The car has spearheaded Philips' talks with the industry about what should go into new cars from 1992 – and how to put it all in.

Externally the *Royale* features items such as headlights only 50mm high, based on gas discharge lamps, and a LED message display at the rear. However most of the interest in the car centred around the interior, which integrated a host of electronic items – audio and video, navigation, information and communication systems.

Great care had been taken to combine aesthetics with ease of operation. Centrally mounted rotary keyboards replace numerous traditional controls, while 70mm LCD video screens (as used in the latest passenger aircraft) provide rear seat passengers with entertainment and/or information display.

News Briefs

- Telecommunications equipment maker ***Exicom***, which bought the telecomms businesses of AWA last year, is selling its Ashfield, Sydney location and early next year moving to a new $25 million manufacturing site in Villawood, further west.
- Judging by paper summaries already submitted by authors, this year's ***IREE Convention*** looks like being a wide-ranging reflection of scientific thinking in government, academic and commercial circles. IREECON '89 will be held in Melbourne's Royal Exhibition Building, from September 11 to 15.
- US semiconductor maker Analog Devices is now represented in Australia by ***Avisun***, of 11-15 Alexander Street, Crows Nest 2065 or phone (02) 438 3900.
- Local cable maker ***Olex Cables*** has won two major overseas contracts. One is to supply an optical fibre communication system to the Indian Petrochemical Corporation, as part of a $10 million contract; the other is to supply $2.5 million worth of XLPE high voltage cable to Malaysia's National Electricity Board.
- Jack Larsen, formerly V-P of distribution marketing for Motorola in the USA, has been appointed managing director of ***Motorola Communications Australia***.
- ***Tecnico Electronics*** has been appointed Australian distributor for Electrochem Industries of the USA, which specialises in manufacturing a range of lithium cells and batteries.
- Local data communications specialist ***Datacraft Australia*** has been granted type approval in Japan for its 'new generation' type 5099 data modem. Over 2000 of the Australian-made modems have already been installed in Hong Kong.
- Next year's ***Australian International Engineering Exhibition (AIEE)*** will be held in Sydney at the RAS Showgrounds, from May 21 – 25. The theme of AIEE '90 will be 'The Competitive Edge'.
- Gerald Allen has been appointed managing director of ***AT&T Australia***, replacing M.L. (Lonny) Rush – who has returned to the USA. Mr Allen formely headed the Australian Communications Services division.

News Highlights

Telecom wins Seaphone expansion contract

OTC has awarded a $350,000 contract to Telecom Australia for the initial expansion of its national Seaphone telephone service to Geraldton, Carnarvon, Broome and Darwin.

Telecom will install equipment for OTC at a total of 18 sites around Australia as part of a $4.8 million Seaphone expansion to provide almost blanket coverage of the eastern seaboard and services to other major coastal centres. All new installations will include OTC's computerised Auto-Seaphone system.

Auto-Seaphone is a VHF radio telephone service developed by OTC which allows users direct dial access to the domestic and international telephone networks from up to 100km out to sea. Calls to vessels equipped with the system can be made from any shore phone.

OTC's Chief Manager Maritime Business, Mr Phillip Hastings, said that Telecom had been chosen as the successful contractor from a group of 10 tenderers.

"By year's end we expect to have Auto-Seaphone available from base stations in Geraldton, Broome, Port Headland, Dampier and Carnarvon in Western Australia; Darwin in the Northern Territory; Thursday Island, Cairns, Whitsunday Island, Yeppoon, Gladstone and Fraser Island in Queensland; Kempsey and Eden in New South Wales, Lakes Entrance in Victoria; Burnie/Devonport and Hobart in Tasmania; and Port Lincoln in South Australia," Mr Hastings said.

Davor Smolej and Hugh Kelly of GPT with Tim Wortman of Philips T&M.

8 Orders for new calibrator

The first Fluke 5700A multipurpose calibrator to be delivered by Philips is already performing daily calibration tasks 'on the factory floor' at the GEC Plessey Telecommunications (Australia) plant at Silverwater NSW.

Cost efficient in-house calibration on a wide range of digital multimeters was behind the decision to buy the 5700A, according to Hugh Kelly, GPT's divisional chief executive, manufacturing. He explained that, to meet GPT's contractual arrangements prior to buying the 5700A, the calibration of all instruments had been performed outside the company. "Now, the 5700A will do up to 35% of this work."

"In-house calibration gives us full control over the process. The elimination of transport and the reduction of equipment downtime bring considerable cost benefits. If a measuring instrument is suspect, its performance can be quickly verified, and adjustments made if necessary. This brings greater confidence to measurements and tests throughout our factory", said Mr Kelly.

Eight local orders have already been taken for this multi-function Fluke calibrator, since it was first shown in Australia by Philips Test & Measurement last October. Tim Wortman, manager of Philips T & M, revealed that four units are to be incorporated into racks for the Royal New Zealand Airforce.

Cairns-based alarm maker expands

Instalarm International, the Cairns-based manufacturer of radio controlled electronic telemetry security alarm systems, has signed joint venture agreements with two US manufacturers of high technology equipment, and has also bought a Sydney-based electronics company.

The American connection will now give Instalarm some of the most advanced and sophisticated research and development facilities and skills in radio and communication electronics, while the Sydney acquisition will enable the company to relocate its sales and administration activities close to its major customer base.

Instalarm's joint venture is with two companies which are tied to the multi-million dollar Sanmina Corporation in San Jose, California. They are Code International, a 100% subsidiary of Instalarm International, and Senses International, an associate company of Sanmina Corporation, which has five plants throughout America. Sanmina is a major manufacturer of complex multilayer and double-sided printed circuit boards.

Speaking from California's Silicon Valley, managing director of Instalarm International Mr Doug Garton said that following weeks of extensive and in-depth negotiations the American joint venture was signed, giving the Australian company access to high technology research and development in the security systems field.

"A program of research and development is already under way in the USA", he said. "It will provide Instalarm with a range of new and exciting security products which can be marketed in Australia and other parts of the world at extremely competitive prices."

Mr Garton said the purchase of Cumbrae Electronics at Brookvale NSW, had resulted in Instalarm moving its sales and administration departments from Cairns to Sydney. He said Cumbrae Electronics, a specialist security equipment manufacturer, would enable Instalarm to improve the overall service offered to customers and also provide a broader range of products to satisfy all customer needs.

Jands A-V for new Congress Centre

Jands Contracting has been appointed the audio visual contractor for Melbourne's 'World Congress Centre'. The contract, worth an estimated $4 million, was finally signed after negotiations lasting many months.

Jands was on site within a week and with a 'fast track' project such as this every day will count. With the bulk of the work scheduled to be finished by the end of 1989, it was Jands' history of competent engineering and their proven ability to complete a job on time that finally swung the contract.

The World Congress Centre involves 13 separate audio systems including 2 central clusters, stereo imaging and portable systems. A mobile concert sound system complete with flown loudspeakers, delay stack, sub bass and processing equipment is to be provided for use within the banquet hall.

Within the Theatre and Plenary Hall high resolution video projection systems will be supplied together with 16mm film and 35mm slide projection equipment. Remote controlled motorised projection screens and masking are also to be provided.

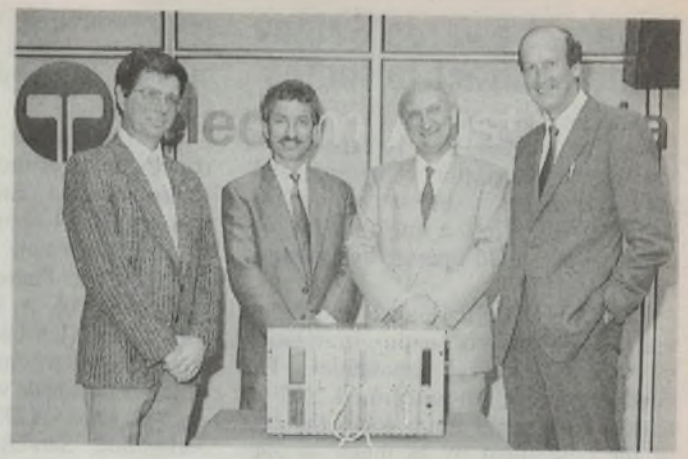
Philips selling monitors worth $100M to Apple

Computer monitors worth more than $100 million are to be supplied by Philips to Apple over the next three years. This is part of a contract between Philips Canada and Apple Canada Inc., which specifies a 53cm (21") screen size.

Called the 'Two-Page Monochrome Monitor', the display was designed by the Electronic Display division of Philips Canada. Setting new standards for large-screen technology, it will be used with the new Apple Macintosh IIcx personal computer.

The monitor is well suited for desktop publishing, engineering and 'multi-window' applications, because it can display two full 8.5" x 11", or A4 pages of text and graphics. It uses a flatter screen and higher 'refresh' rate than many other monitors and the 1152 x 870 pixel resolution of the display provides excellent focus for sharp, clear images and text. It also features a built-in tilt-and-swivel stand.

The order, the largest placed in Canada by Apple, was announced at a Press conference in Toronto, and others held simultaneously across North America, linked by satellite.



L to R: Bob Mills of Telecom, John Jorgenson and Ernst Hede (CEO) of G.N. Elmi, and Telecom MD Mel Ward.

Telecom installs call monitoring system

A new computerised call-monitoring system developed and configured by Australian software house Praxa Limited for communications company Ericsson has been installed by Telecom. It is being used for servicing customer meter account queries in selected country exchanges throughout Australia.

In addition to providing an improved customer service, the new system is anticipated to decrease Telecom's costs in handling customer account queries. This will be achieved by providing the accounts staff with more data regarding the customer's service, thus increasing the number of queries that can be resolved at the first interview with the customer.

Praxa, a co-operative marketing partner of Digital Equipment Corporation (DEC), was subcontracted to create the system by L.M.Ericsson, the successful tenderer for the $9 million contract. Ericsson required a system devised around 356 SMART 10 Subscriber Monitoring and Registration Terminals created by the Danish Company G.N. Elmi. Elmi, a long-time supplier to Telecom and Ericsson, has built an international reputation in telephone call tracking hardware and this latest product is considered a world leader for the recording and analysis of medium and large scale subscriber call data.

Telecom's latest order for 243 SMART 10's is part of the largest single order to be received by G.N.Elmi.

New instrument renter

Rental provides an ideal solution to many of industry's needs. A new specialist company with a fresh enthusiasm for service is now offering competitive rental solutions to those needs.

The company, Instrumentation and Computer Rentals, (ICR), was founded to service the needs of corporate, government and small business customers.

ICR employs a hand-picked team of rental specialists, each with a positive attitude to customer service. Although a new company, its team represents decades of experience and is backed by the resource of Imagineering Technology.

ICR's inventory includes equipment by Fluke, Hewlett Packard, Hioki, Marconi, Philips, Tektronix and Yokogawa. The range extends from simple electrical testers through to sophisticated analysers and covers every aspect of test and measurement equipment.

For further information, contact Instrumentation & Computer Rentals, Unit 10, 27 Thornton Crescent, Mitcham 3132 or phone (03) 872 3999.

Export Orders for Touchfone

Alcatel STC has scored what is believed to be the first export sales of the new Australian-designed and manufactured telephone, the Touchfone 200. Sales are to Papua New Guinea and to Western Samoa. The company has also scored sales of its pay-telephone Gold Phone to Fiji.

The total value of these three orders amounts to almost $600,000.

The Touchfone 200 was the result of a joint development which involved Alcatel STC and Telecom. It is now being distributed in Australia as Telecom's standard domestic telephone. The advanced unit has also been accepted for use in the telephone systems of North America.

"The research and development effort which went into the Touchfone 200 was planned with an eye on export sales", said Spencer Bell, Marketing Director of Alcatel STC. "The effort is beginning to pay off. We are sure this is the first of many export orders for the product."

Inmarsat awards Satnav study contract to Inmos

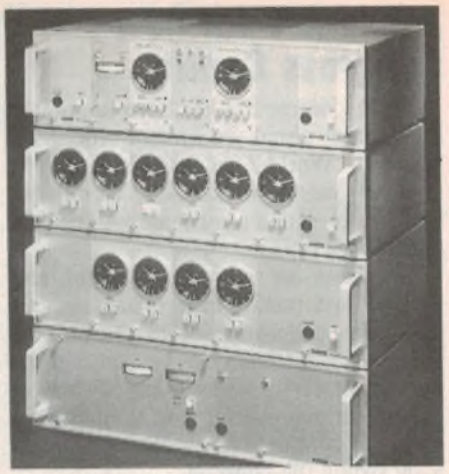
Inmarsat has awarded a contract to Inmos for a study that is expected to lead to the integration of mobile satellite communications and satellite navigation capabilities into a single mobile terminal which would operate anywhere in the world.

Mobile users often need both communications and positioning (navigation or vehicle tracking) capabilities. The development of an integrated unit to handle both could bring down the cost of the equipment by as much as one-half.

Inmarsat, a satellite operator with investors from 55 countries, provides mobile satellite communications worldwide. Inmos is a Bristol (UK) based VLSI semiconductor company which designs and manufactures the Transputer, the parallel-processing chip to be used in the project. Inmos is part of the SGS-Thomson Microelectronics Group of Companies.

The three-phase study will examine the feasibility of incorporating a satellite radionavigation unit into micro-terminals capable of operating with Standard-C, Inmarsat's new satellite communications system. Phase one will study the integration of a Standard-C terminal with a GPS (US Global Positioning System) reception module. Phase two, which is optional, will conduct the same analysis for a GLONASS (Soviet Global Navigation Satellite System) module. And phase three, also optional, but certain to be pursued if the results of phase one are satisfactory, will be to build an integrated Standard-C/GPS demonstration prototype.

The value of the contract, including the options, is approximately $250,000.



'World's biggest clock system'

An extensive master clock system installed throughout the new Parliament House building in Canberra is, according to suppliers, probably the biggest clock system in the world. The system includes approximately 2500 analog, slimline wall clocks connected by 50 kilometres of cable to a telesynchronised master clock with five satellites.

The massive system, costing several hundred thousand dollars, is similar to, yet larger than, systems normally used in long-distance railway networks. Both Upper House and Lower House are served by the master clock system.

NEC sells 10,000th Australian-made PABX

NEC Australia has reached an important milestone – it sold its 10,000th Australian-built PABX system, just nine years since the NEAX system came onto the Australia market.

The 10,000th customer was CSR Hebel Australia, a new subsidiary of CSR Ltd, one of Australia's largest companies and a major force in the building, construction and sugar industries.

The 10,000th sale was a NEAX 2400 SDS, the PABX system developed as a joint project between NEC Japan and Australia. The SDS system involved the Australian development team in 10 man-years of work before it was launched on the market 12 months ago.

Bull, Fujitsu to use Aussie power supplies

Melbourne-based power supply manufacturer SETEC has signed an agreement with Bull HN Information Systems Australia to provide power supply units to Bull SA of France. The power supplies will be used for the company's Questar 400 Series workstations.

The $A700,000 agreement, signed following 16 months of extensive negotiations, marks the first sales by SETEC to a European-based computer manufacturer. The SETEC power supply has undergone a full range of tests, and qualifications up to international quality standards have recently been completed. The product will be integrated into Bull SA's manufacturing operation for the Questar in France.

The agreement is an important milestone for both companies, according to Bull Australia's Export Development Manager, Mr Brian McDonnell. "Australian companies like SETEC are where the future of high-tech industry for Australia lies", he added.

"Our goal with the Federal Government's Partnership for Development Agreement is to see companies like SETEC, with great products to sell, get those products on the world market."

Fujitsu Australia has also signed SETEC to replace switch-mode power supplies currently imported from Japan for its VDU product line.

SETEC will supply all switch mode power to Fujitsu's VDU assemby plant as Mascot, Sydney, replacing currently imported supplies worth more than $500,000.

SETEC is Australia's largest switch-mode power supplier and the first to win Japanese qualified vendor status with a locally manufactured product.

NIES starts Vendor Qualification Scheme

Australia, never having access to volume domestic markets, lacks the expertise, know how and technologies to compete internationally. This is the view of Wes Smith, the National Co-ordinator of the National Industry Extension Service's (NIES) new Vendor Qualification Scheme.

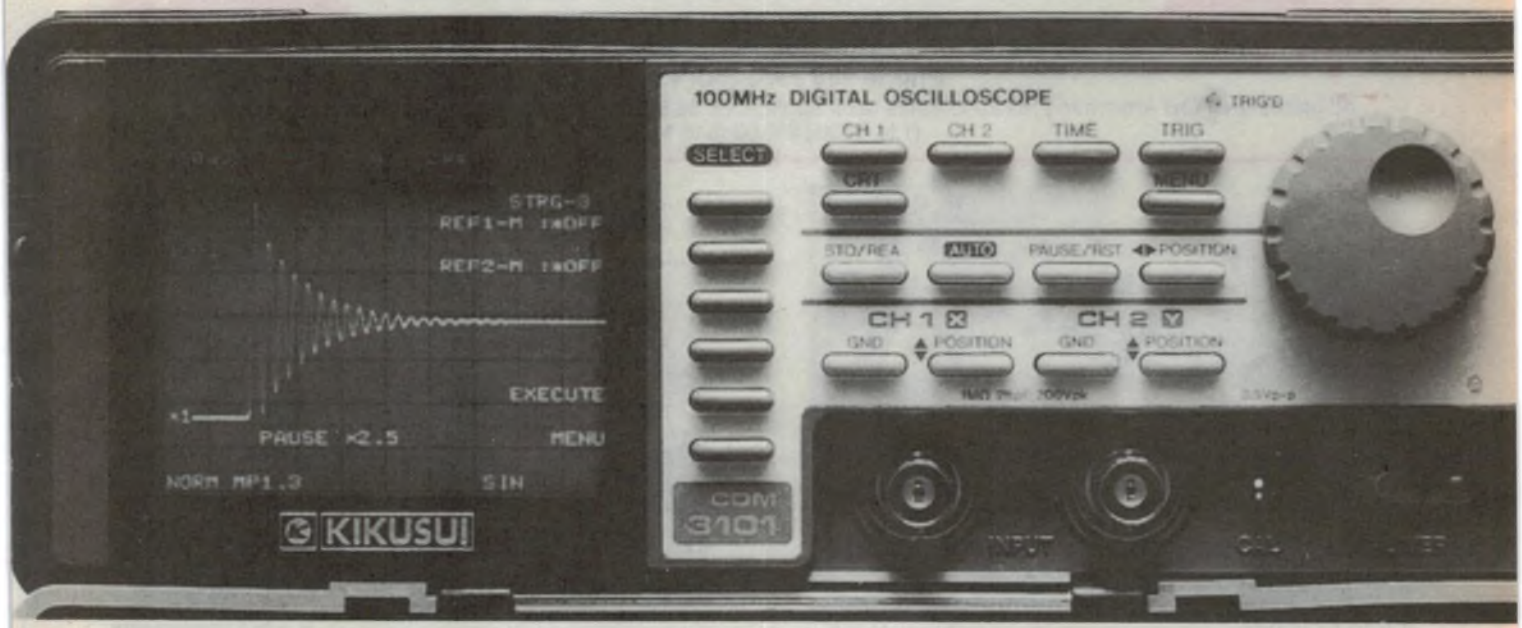
Mr Smith was in Adelaide recently, at Technology Park Adelaide's monthly luncheon meeting, addressing a seminar of people involved in technological and manufacturing enterprise about the new NIES scheme.

"The scheme will create awareness of a company's needs and requirements and then assist in gaining accreditation and meeting international standards", he said.

"Part of setting up the scheme involves establishing a local capability to undertake testing of products compatible with international standards."

The Vendor Qualification Scheme is an important component of the Commonwealth Government's strategy to assist the information industries (telecommunications, computer hardware products and components) to become internationally competitive. The scheme is administered by NIES through its State offices.

Auto-Ranging DSO with On-Screen Cursors, DVM, Counter, Battery Pack . . .



. . . and this is the Actual Size.

COM 3101

Real Time DC to 100MHz
Digital Storage DC to 100MHz

COM 3051

Real Time DC to 50MHz
Digital Storage DC to 50MHz

The COM-3000 Series from Kikusui is the first compact sized, fully featured Real Time and Digital Storage oscilloscope to offer true portability and the option of a battery pack.

Advanced oscilloscope features such as cursor control, inbuilt DVM and frequency counter, and optional GP-IB are combined with Auto Set Up of timebase and voltage ranges and a unique interactive menu system. The result is a package that allows even casual oscilloscope users to become immediately familiar with its powerful features.

Auto Set Up

The Auto Set function automatically selects the optimum range according to the input signal.

Interactive Menu System

One of the outstanding strengths of the COM-3000 Series is its ease of use. A wealth of functions can be accessed by a minimum of control operations. For example, to change any setting of CH1, simply press the CH1 key, then press a SELECT key for the required voltage range or coupling. The value e.g. Voltage is selected from the rotary Dial.

FEATURES	COM 3101	COM 3051
Real Time		
Bandwidth	100MHz	50MHz
Channels	2	2
Vertical Range	5mV-5V/DIV	5mV-5V/DIV
Max Sweep Speed	2ns/DIV	10ns/DIV
Delayed Sweep	YES	YES
Digital Storage		
Repetitive BW	100MHz	50MHz
Single shot BW	8MHz	8MHz
Functions Envelope, Averaging, Arithmetic etc		
Options		
Battery Pack	50 mins	50 mins
GP-IB	Available	Available

All the Data is On-Screen

The real mode and storage mode waveforms are displayed on the COM-3000's high intensity and high resolution CRT. The parameters and cursor measured value, as well as the values measured by the DVM and frequency counter in the real mode are all displayed on the screen.

Three Way Power

A choice of three power options (90-250V, external DC or rechargeable Ni-Cd battery pack), also ensures total flexibility.

For more information on the COM-3000 Series contact **Emona Instruments,** 86 Parramatta Rd, Camperdown, 2050 or call **(02) 519 3933.**

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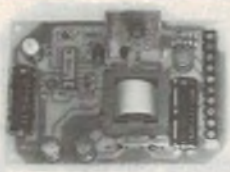
3 CAD STATIONS

R & D LABORITORY

WHO ARE AT&M?

AT&M was started about one year ago by CLIVE CHAMBERLAIN to develop a range of industrial grade self assembly kits useful for numerous control and instrumentation applications in workshops, factories, hospitals, mines and any situation where time and money can be saved rather than commit engineers and technicians to design and build these functional modules in house. We have installed over $100,000.00 worth of computers and electronic test equipment for PCB design, electronic publishing and product development to give the efficiency and sophistication needed for low cost end products. Only industrial grade components are used in our kits such as 50ppm metal film resistors, cermet pots and trimmers and conformal moulded capacitors for consistent assembly. We even pre-cut and bend the resistor leads to help present a neat appearance. These are small points, but they stand us apart from previously offered self assembly kits! AT&M is commited to a vigorous program of affordable and innovative project development in many areas of industrial control, measuring equipment and scientific research. *Keep watching the pages of EA!!*

ATM10 TRIPLE OUTPUT SWITCHING REGULATOR



Input voltage range +10 to +15VDC, outputs +5V @1A, −5V @100mA, −12V @ 100mA.
Short circuit shutdown, low ripple and high efficiency.

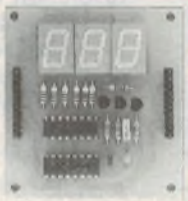
PRICE **$42.50**

ATM 12 6 DIGIT BATCH COUNTER

6 digit down counter, high brightness ½" orange 7 Seg. LED displays, with 2 push buttons presetable from 1 to 999999, counts to "O" & stops clock.
Max. count rate 10 KHz, SINGLE +5v @ 120Ma.

PRICE **$62.50**

ATM01 3 DIGIT LED COUNTER



A three digit 1.5MHz. up counter with high brightness ½" orange displays, count enable, reset and latch. Current drain 50mA typ. Single +5V supply, CMOS input.

Price **$26.50**

ATM15 AMP ATTENUATOR

Companion PCB to the ATM03 Precision Digital Voltmeter give sensitivities of 19.99mV, 199.9mV, 1.999V, 19.99V, 199.9V.

Power supply ±5V. 60 mA (+5V) 2mA. (−5V).

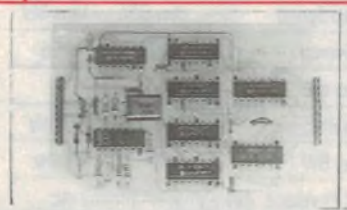
PRICE **$34.50**

ATM13 INFRA RED PROXIMITY DETECTOR

Transmitter/receiver for sensing objects, no special mirrors needed, range to 2M, Single +12V supply 20mA.

Price **$26.00**

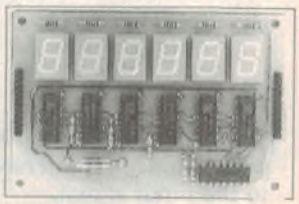
ATM07 10MHz TIMEBASE



Xtal controlled oscillator/divider outputs 10 MHz, 1 MHz, 100KHz, 10 KHz, 1 KHz, 100 Hz 10Hz, 1Hz. Aux. Wide band amp. (10Hz to 15MHz) for external clock to decade dividers. Synchroniser included (precision monostable) giving outputs of 100nSec, 1μSec, 10μSec, 100μSec, 1Msec, 10mSec, 100mSec, 1 Sec.

PRICE **$38.00**

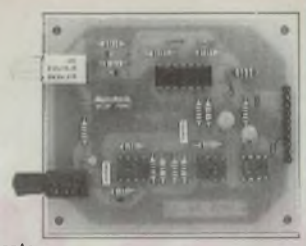
ATM19 6 DIGIT UP/DOWN COUNTER



A six digit 4MHz selectable up/down counter with high brightness ½" orange displays, reset, latch and U/D select. single +5V supply 100mA typ.

Price **$58.00**

ATM05 FIBRE-OPTIC MODEM



Full duplex DC to 500KBAUD transmission rate using easy connecting 1mm plastic fibre, 1M to 25M without adjustment. Single +5V power supply 15mA.

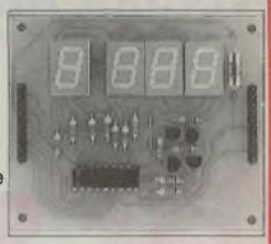
Price **$62.50**

ATM03 3½ DIGIT LED VOLTMETER

Precision Voltmeter +−199.9mV sensitivity (Adjustable) 0.05% accurate, 4 readings/Sec. high brightness ½" orange displays, +5V 150mA & −5V 4mA supply.

Price **$42.50**

ATM11 9 Min. 59.9 Sec. TIMER



4 Digit Counter/timer with bright orange ½" displays uses 10Hz clock. Single +5V supply 60mA.

Price **$38.00**

ATM16 10KV ANALOGUE ISOLATOR

Precision V/F/V converters with a 10kV UL & VDE approved opto isolator in between. 0 o 1V in, 0 to 5V out., accuracy ±0.1%

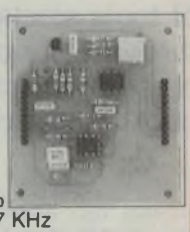
PRICE **$54.50**

ATM08 VOLTAGE TO FREQUENCY CONVERTER

Precision converter, 0.03% accurate input 0 to 1V, output 2 KHz to 7 KHz pulse frequency, open collector output, CMOS or TTL compatible, single +12V supply 4mA.

Price **$28.50**

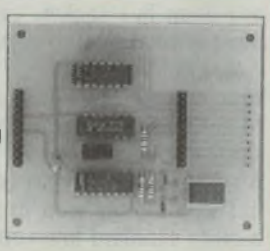
ATM09 FREQUENCY TO VOLTAGE CONVERTER



Precision converter, 0.03% accurate, input 2 KHz to 7 KHz output 0 to 5V, single +12V supply 5mA.

Price **$28.50**

ATM04 CRYSTAL TIMEBASE



Crystal controlled oscillator & divider with precision monostable. Outputs 32.768KHz, 4Hz, 2Hz, 1Hz, 0.5Hz. Triggered monostable 250mSec, 500mSec, 1,000mSec, 2,000mSec. Single +5V supply, 2mA.

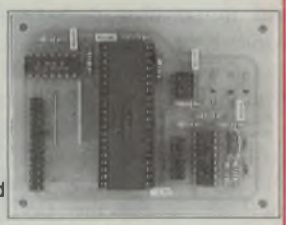
Price **$24.50**

AT&M produce high quality electronic construction kits using professional grade components and techniques for industrial applications, enthusiasts and educational establishments.

The kits are all developed in our research laboratory and have individual instruction and application booklets showing construction details and theory of operation.

Our products are for serious work and can form the basis of many types of electronic equipment and systems. Please phone, FAX or write for a fully descriptive brochure showing our full range and the name of your nearest stockist.

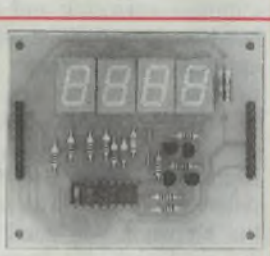
ATM18 UART



Parallel to Serial transmitter & Serial to Parallel receiver, RS232 &crystal standard controlled Baud rates of 9600, 4800, 2400, 1200, 600, 300 Single +5V supply 10mA.

Price **$42.00**

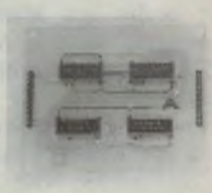
ATM02 4 DIGIT LED COUNTER



A four digit 4MHz up counter with high brightness ½" orange displays, reset and latch. Current drain 60mA typ. Single +5V supply, CMOS input.

Price **$38.00**

ATM06 RECIPROCAL CALCULATOR



16 Bit accumulator with ÷"N" for converting elapsed time to frequency or translating slow events such as heart beat rate to higher frequency for convenient counting. Single +5V, 1mA supply.

PRICE **$24.50**

ATM14 FM TRANSCODER

Companion PCB to the ATM05, converts speech etc. in 300Hz to 5KHz band to FM modulated 40KHz subcarrier to use with fibre optic link to carry speech for up to 100Metres. Transmitter and receiver 1/2 duplex, VOX and squelch, input sensitivity 100mV, output 1W into 8Ω spkr. Single + 12v. supply @ UP TO 100Ma (peak).

PRICE **$28.50**

FORTHCOMING AT&M KITS

ATM18 Analogue to digital recorder, 8Bit x 8K samples up to 200K per second, used as a Digital oscilloscope adaptor.

ATM21 Timebase for ATM18 in 1,2,5 steps from 1Hz to 200KHz with digital readout.

ATM22 8 channel Infra-red remote control transmitter.

ATM23 8 channel Infra-red receiver.

ATM24 8 channel UHF remote control transmitter.

ATM25 8 channel UHF remote control receiver.

ATM20 INFRA-RED BARRIER TRANSMITTER/RECEIVER

Uses coded IR signal and high gain noise immune detector & amplifier. Gives open collector 500mA output on signal loss. Range to 15 Metres.

PRICE **$33.00**

Product Review:

DSE's 3-in-1 cordless tool

The T-5712 is a particularly interesting addition to the range of tools stocked by Dick Smith Electronics, combining a set of three handy cordless tools: a 2-speed drill, a screwdriver and a soldering iron. All three share a common handle and battery pack, fitting together in modular fashion.

by JIM ROWE

I was very interested to try out DSE's new T-5712 '3-in-1 Rechargeable Modular Tool', because it looked as if it combined the three small power tools mainly used by electronics people: a soldering iron, a drill and a screwdriver – and in cordless rechargeable form, to boot. If it did all of this well, it was therefore likely to interest a lot of our readers.

There was a second reason, too. I had heard that my old colleague Marshall Gill had been instrumental in arranging for DSE to put the T-5712 into stock, and that he was particularly keen about it.

Now Marshall is a keen model engineer, and has many years of experience – and also high standards – when it comes to tools and machinery. There are not all that many tools or machines that really get Marshall too excited nowadays, so this told me that the T-5712 must indeed be something pretty special.

Having tried one out for myself now, for a few weeks, I can see why he was so enthusiastic. But I'm jumping the gun a little – let's look at the basic concept of the thing first, before I talk about the way it performs in practice.

Obviously cordless tools as such are not new. There have been cordless drills, electric screwdrivers and soldering irons around now for a few years, each based on rechargeable NiCad batteries. And each with an appropriate price tag, of course – generally between about $70 and $120.

What DSE have done with the T-5712 is combine these three handy tools in a modular fashion, so that a single 'power handle' (which contains the NiCad batteries) can be mated with any of the three interchangeable 'functional heads'. This saves the cost of two sets of NiCads, together with the separate charger units and control switches that would normally accompany them. As a result, you get what is effectively the set of three tools for only $99 – virtually the cost of any one normal cordless tool bought separately.

Perhaps surprisingly, the 'power handle' contains only the NiCad batteries, plus the on-off switch and the charging control circuit. The 'functional heads' are quite independent, with the drill and screwdriver having separate motors and gearboxes. Inside the handle itself there are three 1300mA/h 'C' sized cells fitted, made by Panasonic and obviously capable of delivering quite a respectable amount of 'punch'.

The functional heads mate with the handle via a locating spigot and a locking ring, which is turned clockwise to release one head and fit another, and then anticlockwise to lock on the new head. The same ring also functions as the reversing switch, when the electric screwdriver head is fitted.

The drill head is fitted with a two-speed gearbox, with the speeds changed by rotating an outer ribbed sleeve. Approximate spindle speed in the 'low' position is 1000rpm, and in the 'high' position 5000rpm – with the exact speeds depending on loading and the state of battery charge, of course.

The chuck is of the 'Jacobs' type, very nicely made and with a maximum capacity of 4mm – not quite as large as some other cordless drills, but in some ways more realistic. In any case this capacity is quite sufficient nowadays to cope with most electronics work – the days of heavy 'metal bashing' being long gone, after all.

Supplied with the T-5712 are four high speed twist drills, to get you going: 1.5mm, 2.5mm, 3.0mm and 3.5mm. Needless to say there's also a matching chuck key.

The electric screwdriver head is fitted with a single-speed gearbox, providing a speed of around 140rpm – quite practical for most general screwing and unscrewing operations. As noted earlier, reversal of rotation is performed by turning the locking ring on the power handle. The 'business end' has a standard 6mm hex socket, capable of taking most normal interchangeable driver bits.

As before, the T-5712 comes with four chrome vanadium screwdriver bits to get you going: two standard types for slotted heads (4mm and 6mm), and two for Phillips head types (sizes I and II).

The soldering iron head is fitted with a fairly standard low-voltage element, of the type used in soldering 'guns'. However like most quality modern irons it is provided with a nicely tin-plated bit, to minimise corrosion and extend life. The head is also provided with a small integral-lens lamp, which illuminates the working area quite well – just the shot for working in dark corners!

And not surprisingly the soldering head comes with its own little extras: an Allen key to undo the screws holding in the bit when you need to replace it, a 400mm length of 1.5mm resin cored solder, and a piece of sponge for wiping the bit clean. They've thought of almost everything.

The T-5712 also comes complete with a small 'plug-pack' transformer, for charging the NiCads. The cable from the plug pack plugs into the base of the power handle, and there is a small red LED nearby which lights up to indicate that charging is taking place correctly. Charging time is approximately 14-16 hours for fully exhausted NiCads.

Made in Hong Kong, the T-5712 is quite solidly made from high impact plastic, and nicely finished. The metal parts of the drill and screwdriver heads

appear to be surface ground, and suitably hardened. All in all, it gives every impression of being a well designed and carefully made tool.

In practice

Enough now of the basic details, and back to the way it actually performs.

As I said earlier, I've been using a sample T-5712 on my home workbench for a few weeks now, and this has been a good opportunity to try it out under typical working conditions.

To set the scene, although I have a number of soldering irons and a couple of drills, most of these are normal mains-powered tools. I'm not normally all that keen on cordless tools; to my mind they've been oversold to the public, with too much emphasis on their advantages and not enough advice about their shortcomings and limitations.

Not that I'm saying that cordless tools and appliances are useless, I hasten to add. Just that I believe you need to be properly aware of the characteristics and ideosyncracies of NiCad cells, in particular, in order to get really acceptable performance from them – especially in the long run.

I guess on the personal level I have always tended to forget to keep the NiCads charged, so that when I have wanted to use the tool or appliance concerned, the jolly things were as flat as a tack!

So overall, I guess I'm not one to get overly excited about any cordless tool or appliance. Yet despite this, I really have become quite enthusiastic about the T-5712 '3-in-1' Modular Tool.

On the whole I have found it a very handy little *machine a trois*. All of the modules are quite sturdy, they're convenient to use and they seem to have more than enough capacity for the majority of jobs on the electronics workbench.

I was a bit dubious at first about the locking ring system used to mate the functional heads to the power handle – particularly as this is also used as a reversing switch for the screwdriver head. It doesn't look all that strong, and there are also wires inside the handle that flex back and forth when it turns.

This is undoubtedly the weakest part of the system, and it's hard to say how reliable it is likely to be in the long term. However I've given it quite a flogging so far, and all I can say is that it has performed extremely well. So it may well be that my doubts may prove to be groundless.

The two speeds provided on the drill head make it suitable for most electronic work, with the high speed quite good for things like drilling small holes in PC boards, and the low speed for jobs requiring a bit more 'grunt'. Similarly the speed provided on the screwdriver head gives plenty of torque, without being unduly slow.

I guess I found the soldering iron head just a little slow to heat up, especially when the charge in the NiCads was getting low. But then I'm a bit impatient. On the average it takes only about 15 seconds to reach operating temperature, which is really not too bad.

And of course the big thing about the T-5712 is that you get the whole box and dice for only $99 – roughly what you'd expect to pay for an ordinary cordless drill or screwdriver. This is really very good value for money, by anyone's standards.

So on the whole, I think it's a great little package and one that would be a very useful asset to any electronics workbench. Good one, Marshall!

You can see the T-5712 for yourself at any Dick Smith Electronics store, and at many DSE stockists.

The Serviceman

Melted amplifiers and blown triplers

I have a hotch-potch collection of servicing stories for you this month. There's one about a very lucky customer, who really didn't deserve to be, and another about a stereo amplifier with less good fortune. There's also a tip about servicing high voltage triplers, and finally a story about mysterious electrolytic capacitors...

You'd never believe how foolhardy some people are! Nor would you believe just how undeservedly lucky some of these characters can be.

One customer that came in the other day really doesn't deserve to be alive, let alone so easily absolved from his stupidity. He wandered in with a small Sharp colour set and said rather sheepishly "You're going to kick me when I tell ya what I just done!" When pressed for details, he said that he had blown up his girlfriend's telly.

It seems that the antenna socket had suffered a total collapse, and he had cast around for some means to cure the trouble.

He realised that he would have to join the wires attached to the inside of the socket to the wires coming from the rabbit ears. He also knew enough to know that the wires had to be soldered, so he took the set down to his mate at the local garage, who had a soldering iron.

The repair worked OK for a couple of weeks, but one day he made the mistake of allowing the rabbit ears to contact a nearby light fitting. As he told me, "There was a flash and cloud of sparks from the antenna, and a bloody great explosion outside in the fuse box!"

He reckoned there must be something wrong with the set, because it had never done that before! Would I have a go at fixing it for him?

I tried to explain to him about live chassis sets, and what I was likely to find inside the cabinet after that kind of abuse. But it didn't really sink in.

Actually, he was luckier than he deserved to be, because the only internal damage was an open circuit 6.8 ohm 5 watt resistor in the power supply. Often this kind of accident takes out the bridge diodes, along with any fuses and series limiting resistors in the AC rails.

As I said, some people don't deserve such luck. It's just as well he didn't touch the light fitting while he was holding the antenna. That would really have curled his hair!

Needless to say, as well as fixing the damage caused by his dangerous and makeshift 'repair', I had to replace the original faulty antenna socket and refit the correct isolating capacitors, to ensure that the set was safe again.

The silent amp

Then there was the young chap who brought in a small stereo amplifier, of reputable make and better than average quality. He didn't know what was wrong with it, but they'd "had a party last night, and the amp got hot then stopped working!"

When I first looked inside I could see nothing unusual. A quick once-over the fuses showed them to be intact, a circumstance which seems odd in the light of what I found later.

A closer investigation showed that all four output transistors were very leaky. They were not short circuited as one might expect, but were exhibiting low gain and severe leakage between collector and emitter.

I didn't try to run the amplifier, but it would seem that the unit would have worked – after a fashion – if supplied with sufficient power. It was a funny one, and a type of failure that I haven't come across before. But that wasn't the whole story.

After replacing the four output transistors, and checking the emitter resistors and driver transistors, I switched the amp on for a listening test. There wasn't a whisper. So I set about finding fault number two.

Again, it wasn't too hard to find because there was no DC on the board, and no AC input to the power supply. The power lead was OK up to the on/-off switch, but there was no continuity on the amp side of the switch. Quite simply, the primary of the power transformer was open circuit.

When I lifted the tranny out of the chassis, I saw what I should have seen earlier. The low voltage leads from the transformer to the power input pins on the circuit board had been melted. Or at least the plastic insulation on the leads had been melted.

Obviously, what had happened was that the transistors had begun to break down, and the extra current had overheated the transformer. I imagine that the distortion under these circumstances would have been intolerable to most people.

But these weren't 'most people', they were teenagers at a party – and they probably just turned the wick up a bit more and raged on regardless. Of course, this caused further overheating until the transformer primary went open circuit, no doubt to the great relief of the neighbours.

It's a pointed comment on modern pop music that they could listen to an extremely distorted version for half an hour or more, without realising that there was anything wrong.

As for the fuses, it seems as if they must have been running at their limit for some considerable time. In fact it's a pity that the transistors didn't go short circuit. That would have blown the fuses and probably saved the power transformer.

As it is, the customer was up for not only a complete set of output transistors, but a power transformer as well. Quite an expensive party!

Tripler repairs

Now here's a tip that might save a lot of old TV sets from the junk heap. Some of the material is from my own experience, and some was circulated recently in a TETIA newsletter.

A breakdown in the high voltage unit is a not altogether uncommon fault in solid state television sets, both old fashioned and modern ones.

The earlier sets generally used a tripler to develop the EHT, and its failure rarely left any sign that something was

wrong. Replacing the tripler restored the set to normal, thus proving that the old unit was indeed faulty.

More recent sets use a diode split transformer, and failure of one of these units is no more obvious than the old triplers – but it is just as definite and a lot more expensive.

Most triplers and diode-split transformers cannot be repaired. The faulty parts are buried deep inside a solid mass of epoxy resin, and there is just no way they can be dismantled for repair. But there are one and a half exceptions to this general rule.

Early Rank Arena sets use a tripler with a common habit of bursting through the side of its case. Provided that the set is not used after the breakout – and you'd have to be a bit demented to continue watching through the smoke and flames! – the tripler can usually be salvaged and put back into service.

The casing has to be cleaned up and every trace of burned plastic removed. I use a small dental burr in an Arlec Supertool, to cut away the carbonised body of the tripler. I have sometimes had to cut right down to the body of the diodes within the tripler, but it is most important that every trace of carbon is removed. Then fill the hole with non-acid silicone sealant, allow a day to cure then refit the tripler. Nine times out of ten the tripler is fixed and will go on working for years.

These Rank triplers are the half exception to the rule. They can also break down internally, like any other tripler, and this kind of fault cannot be repaired.

The principal exception to the rule is in the case of those high voltage units fitted to the early AWA and Thorn sets, those models using the Mitsubishi G and K chassis. In fact, these HV units are not triplers at all, but are really voltage doublers. But even more interesting is the fact that they can be repaired equal to new.

When the doubler was assembled, it was filled not with epoxy resin but with a form of silicone rubber. This material sets fairly hard, but can be chipped out with quite gentle pressure. It seems to be the same material as those superbounce balls once popular with children. In fact the pieces of rubber chipped out of the doubler body will bounce clear out of the rubbish bin unless you place them in there gently!

As the filling is chipped away there will be revealed three high voltage diodes, two circular high voltage capacitors, and a resistor of some 10k in value. Almost certainly one of the diodes will be faulty – usually short circuited, but sometimes open.

If a diode has shorted, the 10k limiting resistor will also be cooked and this can be replaced with a good grade of 1 watt metal film resistor. Despite working at 26kV, there is only a milliamp or so of current in the circuit – so there is very little voltage across the resistor and special HV types are not called for. But finding a replacement diode is much less easy, because it has to work with about 12kV.

I junked one of these doublers before I realised they could be repaired, and from that I got two good diodes. They repaired two other doublers, but I don't know what I'll do next time.

Replacing the faulty parts must be done carefully. The solder joints must be smoothed off, so that no sharp points exist to promote arcing. The new parts are laid out in the same way as the old ones, and the whole doubler body filled with non-acid silicone sealer.

Once the silicone is in the doubler, it's in for keeps and won't come out again. When cured, it's much tougher than the original material. So be very careful to fit the diode the right way around, etc. – you won't have a second chance!

The doubler can be refitted to the set and tested almost straight away. But be warned: the silicone sealant is extremely sticky until it is cured and it will get everywhere while you are trying to replace the doubler. Better to wait until next day, when it can be handled with little or no risk.

Mystery capacitor

When selecting subjects for these stories, I always try to chose different kinds of faults and from different brands of set, to make things more interesting. But at times the uncertainty principle catches up with me and I find the shop filled with a particular brand – all with similar faults.

So it has been lately with Philips K9's and K11's, all with brightness and blanking faults. Most of these respond to replacement of a particular electrolytic capacitor.

In fact, over the past six months, electros of one kind or another have comprised threequarters of all the parts I've replaced, in all the domestic electronic equipment that I handle. Overall, the products might be more reliable but electros are still the weak link in the chain.

But to get back to the Philips sets. Another one came in recently, with

what seemed like the usual brightness problem. As it turned out, it was anything but the usual trouble, although the culprit was an all too familiar one.

The set itself was a little unusual, being a model KE028, fitted with a KT2A-3 chassis. I've not had many of these particular chassis in my workshop, but those that do arrive usually bring with them uncommonly difficult faults. They are probably no more troublesome than any other Philips sets, but my experience with them has never been happy.

The owner of this one said that the picture took a long time to come up – 10 minutes or more. I waited half an hour and still there was only a trace of picture highlights. With the colour turned flat out there was a bit more picture but it was all chroma – there was an almost total lack of luminance.

A check around the picture tube base showed all the voltages to be within range of their correct values. I used to worry about getting these voltages just right, but experience has taught me that wide variations can exist without causing any serious problems. I felt that waveform analysis was going to tell me a lot more about this fault than any voltage analysis.

I switched on my pattern generator and tried to tune the set to colour-bars. Here I struck trouble number one, because the picture was so dark that I couldn't see when the bars were properly tuned. Even with the colour turned right up, only the white, yellow and cyan bars could be seen and then not too clearly.

Eventually I tuned the set by ear – I switched on the generator's audio tone and tuned the set for best sound. In the absence of picture, what else could I do?

In fact, before this I had hooked the CRO to one of the tube cathodes and tried to fine-tune the set for the clearest video. But there was almost no recognisable video, and what there was had been crushed down to about 10 volts rather than the 50 odd volts that should have been present. So tuning by ear was the only trick left to me.

The next move was to track the video back into the earlier stages of the set, to see if I could find where it was being distorted. The inputs to the colour difference amplifiers were also crushed, although the video looked to be a bit cleaner.

The video delay line was the next place I looked, and here the video was as clean as a whistle – and exactly the amplitude given in the circuit diagram. This was a bit of a puzzle, because there were only two resistors between the clean video at TS173 emitter and the inputs to the output amplifiers at Pin 8.

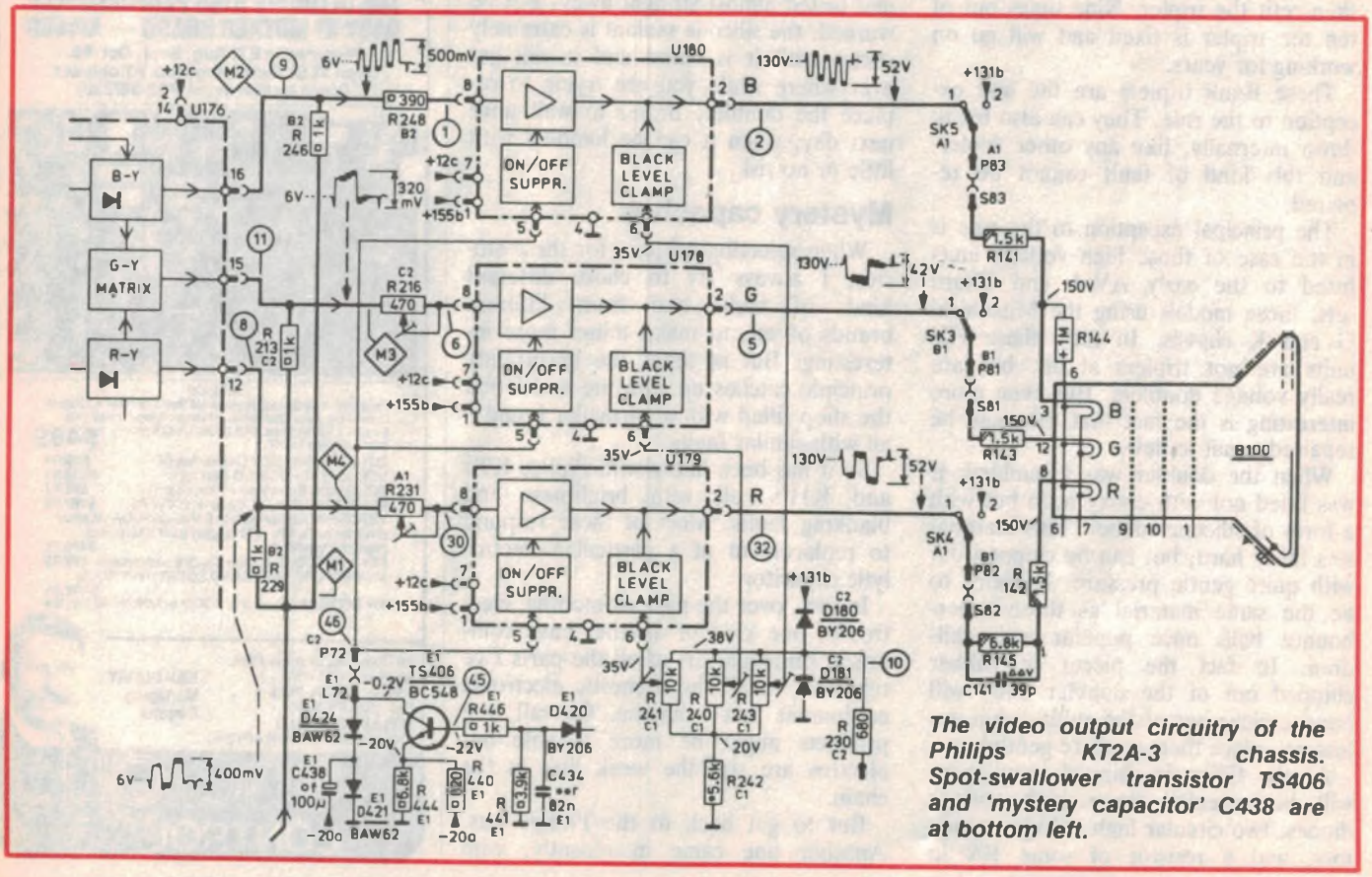
The video line to, say, the red channel, goes from the emitter of TS173 to R229, then through R231 to the input. The only other connection is the chroma input from pin 12 in U175, the chroma module. The other channels are identical in layout, although the resistor values are slightly different.

Given that all the voltages were reasonably close to the figures given in the diagram, just where could the video crushing come from?

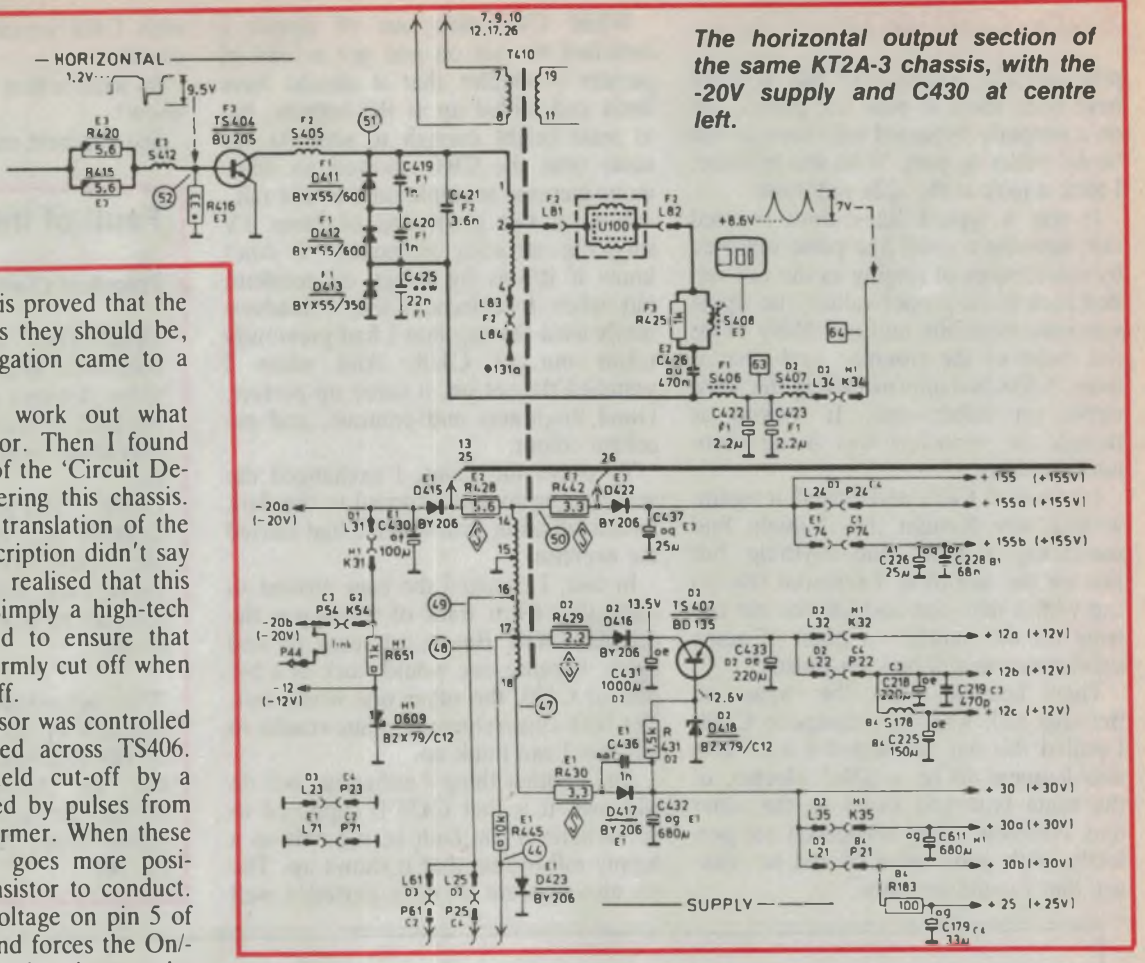
Within the block diagrams for the colour difference amp modules were two stages that offered promise of a solution to the problem. They were labelled 'On/Off Suppr.' and 'Black Level Clamp.'

At first, I thought I had found it, because the Black Level Clamp control voltage on pin 6 of each module was about 15 volts, instead of the 35 volts shown on the diagram in the manual. Then I realised that the manual I was using was for the initial KT2A chassis, while this set was the later KT2A-3 version.

Then I found a copy of the newer circuit diagram in an envelope in the bot-



The video output circuitry of the Philips KT2A-3 chassis. Spot-swallower transistor TS406 and 'mystery capacitor' C438 are at bottom left.



The horizontal output section of the same KT2A-3 chassis, with the -20V supply and C430 at centre left.

tom of the cabinet. This proved that the clamp voltages were as they should be, so that line of investigation came to a dead end.

At first I couldn't work out what 'On/Off Suppr.' was for. Then I found the answer in a copy of the 'Circuit Description' booklet covering this chassis. Although the English translation of the original European description didn't say so straight out, I soon realised that this On/Off business was simply a high-tech 'Spot Swallower', used to ensure that the picture tube was firmly cut off when the set was switched off.

The On/Off Suppressor was controlled by a voltage developed across TS406. This was normally held cut-off by a negative bias generated by pulses from the line output transformer. When these pulses stop, the base goes more positive, allowing the transistor to conduct. This pulls down the voltage on pin 5 of each output module and forces the On/-Off Suppressor to bias the picture tube hard off.

Well, that is what is supposed to happen. In this set it wasn't anything like that.

The control voltage is shown in the manual as -0.2V on pin 5. But in the set on my bench the voltage was 0.7V, even though the transistor was not turned on. In fact when I removed the transistor to test it, the set continued to produce this mysterious 0.7V.

As well as TS406 in this suppression network, there are four resistors, three diodes and a couple of capacitors. The resistors were spot-on for value and the diodes showed no sign of leakage.

The capacitors were not so easy to test in situ, so I pulled them out for a more exacting test. C434 is shown as 82nF, and my capacitance meter is not calibrated for that odd value. But after a few minutes of juggling decimal points, the capacitor checked out at .08uF or thereabouts – near enough for this exercise.

The other cap, C438, was a 100uF electro and this also offered difficulties in getting an accurate test value. My cap tester only reads up to 10uF so I've had to devise a way to check the bigger values. I do this with my multi-meter, switched to the ohms X1000 range and with a known good cap of the appropriate value for comparison.

The meter probes are dabbed across the good cap, and a note is made of the meter deflection and the time it takes the cap to charge up – that is, for the meter pointer to return to zero. Then the same thing is done to the doubtful cap and its deflection and time to charge is compared with the good one.

In this case I couldn't find any significant difference between the two capacitors, and had to concede that C438 was a good one.

Then I started wondering about this C438 and just what it was meant to do. The more you look at it, the less obvious its purpose appears. It is interposed between one of the -20V rails (-20a) and the junction of D421 and D424. I can't see the reason for having a cap in series with a DC source, particularly when the cap feeds into (or out of) two diodes – both of which appear to be biased off! Keener brains might see a reason but it's beyond me.

Using the scope, I looked at the conditions around TS406. The line pulses were clear enough at the cathode of D420, but at the anode there was just a little ripple on a firm -23V potential. This is the negative bias to hold off the transistor.

At the collector there was again only a millivolt or two of ripple, on the 0.7V that was causing trouble in the On/Off Suppressor.

Just to see what would happen, I removed this control voltage by shorting the collector to ground. The tube immediately flared up to maximum brightness, with an overexposed picture and retrace lines. Then the power supply shut down. So there was no trouble with the tube, and the job would be done if I could only regain control of this 'On/Off Suppr' business.

I removed the short and replaced it with a 100 ohm resistor. This pulled the 0.7V control voltage down to about 0.15V and presented me with a perfect picture, with good brightness and contrast, and excellent colour.

In fact, I could have left it at that and no-one would ever known that it was a patch rather than a repair. I could be a rich man if I could overcome my aversion to crude patches! Instead, I had to spend another hour hunting down and fixing the true cause of the trouble.

I was still intrigued to know the pur-

pose of C438 in the – 20V rail. It could have been there to pass line pulses, but on a properly bypassed rail there should be no pulses to pass. With this in mind, I took a look at the -20a rail itself.

It was a typical line-output sourced rail, showing a small line pulse followed by some traces of ringing as the rail settled back to its proper value. The ripple was only millivolts and not likely to be the cause of the trouble. And what is more, C438 had approximately the same ripple on either end. It looked as though the capacitor was doing absolutely nothing.

I removed C438 and tested it again, without any thought that I might find something. I didn't find anything, but just for the hell of it, I replaced the old cap with a new one and left the old cap lying on the bench – a point of some significance as will be seen shortly.

Then, because C430, the bypass on the -20a rail, was right alongside C438, I pulled this out and tested it too. This also happens to be a 100uF electro, of the same type and make as the other one. Needless to say it checked out perfectly, with good capacity and no leakage that I could measure.

While C430 was out of circuit I switched the set on and got a kind of picture – smaller that it should have been and folded up at the bottom, but at least bright enough to see. At the same time the CRO showed an enormous increase in ripple on the -20a rail.

Now at this point one of those TV servicing miracles happened. I don't know if it was by design or accident, but when I replaced C430, I inadvertantly used the cap that I had previously taken out of C438. And when I switched the set on, it came up perfect. Good brightness and contrast, and excellent colour.

To prove the point, I exchanged the two caps again and returned to the dark screen situation with which I had started the exercise.

In fact, I changed the caps around so often that I lost track of which was the original C430. But it was easy to find again, because one would work as a bypass at C430, the other one would not. Yet both caps return the same results to any test I can think up.

And another thing – either cap will do whatever it is that C438 is supposed to do. Whatever the fault is, it's only as a supply rail bypass that it shows up. The set also appears to work perfectly well with C438 entirely removed from the circuit!

So what is that cap there for – do *you* know?

See you next month.

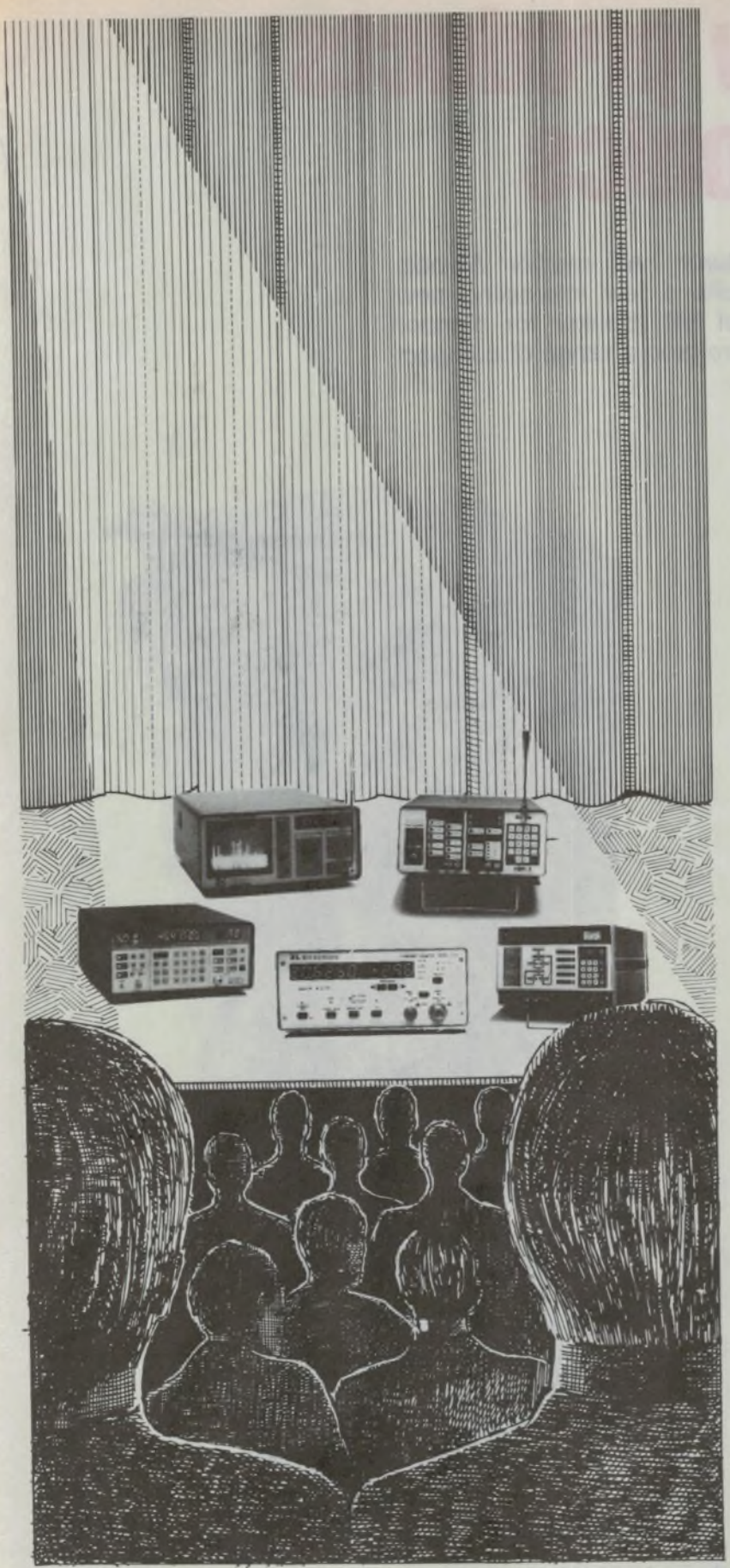
Fault of the Month

Precedent (Toshiba C810 chassis)

SYMPTOM: Intermittent loss of horizontal sync. The output of the video detector drops by 90% when the fault is present. The fine tuning also shifts each time the fault shows up.

CURE: Dry joints under the video detector chip, on the video IF module. These dry joints may not be visible even under magnification, so resolder all pins on the chip, just to be sure.

This information is supplied by courtesy of the Tasmanian branch of The Electronic Technicians' Institute of Australia. Contributions should be sent to J.Lawler, 16 Adina Street, Geilston Bay, Tasmania 7015.



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Many new products from Altronics

Perth-based distributor, manufacturer and retailer Altronic Distributors has come up with quite a few interesting new products, including a weatherproof hifi speaker for outdoor use, a stereo speaker volume control and a range of compact PCB-mounting power transformers.

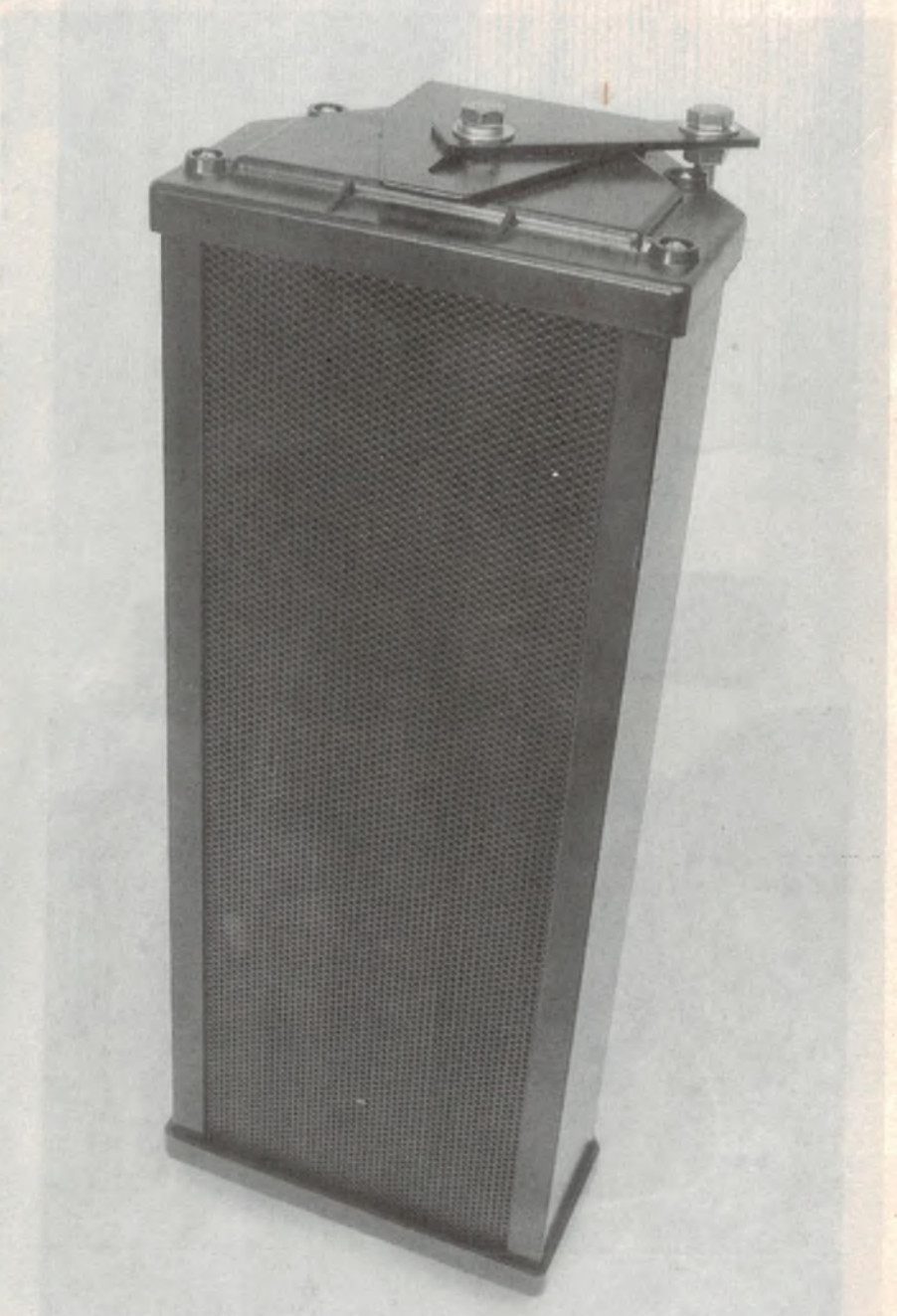
If Altronics is anything to go on, entrepreneural energy and enthusiasm are still very much alive and well in Western Australia. Certainly whenever the *EA* office is favoured with a visit by 'genial giant' Jack O'Donnell, the founder and MD of Altronics, he always seems to bring with him a bulging bag of samples to show us the latest additions to his range of products.

So it was on the latest visit, with Jack being particularly proud of his new 2-way weatherproof hifi speaker system. This is fully designed and made locally, apart from the drivers, and combines two of the excellent VIFA drivers in a computer-optimised 5-litre bass reflex cabinet built from the same rugged aluminium extrusion used in Jack's existing 'Redford' range of less pretentious outdoor systems.

The bass/midrange driver is a specially-developed 125mm (5") model, designed for use in a 5 litre reflex enclosure. This is combined with the D19 19mm dome tweeter, which features ferrofluid damping. In fact the drivers and crossover network are identical to those used in the VIFA SA-50 compact bookshelf system – only in this case, they're housed in a tidy weatherproof enclosure.

We tried out the sample unit Jack brought with him, and it certainly gave a very impressive account of itself. Full, well-rounded sound, with a surprising amount of 'guts' for such a small enclosure. It would make an excellent choice for the discerning music lover who wants to be able to extend their enjoyment outdoors to the patio, alongside the pool or on the boat – without sacrificing quality.

Incidentally the enclosures are fitted with overdrive protection, and will take up to 100 watts of input without damage. Available in either black (C-0970) or white (C-0972) finish, they sell singly for $199.50 each, or $399 per pair.



The Redford-VIFA hifi outdoor speaker, virtually a weatherproof SA-50 system.

Left: The Redford A-2300 stereo speaker control, rated to handle 30W per channel.

Right: One of the new 7VA PCB-mounting power transformers, a little larger than actual size.

Jack was also very proud of his new A-2300 stereo speaker volume control. Like his existing Redford audio controls for PA and similar applications, this is built very neatly into a standard electrical flush plate. It provides a six-position control switch, with five stepped volume settings together with an 'off' position. Although rated to handle 60W (30W/channel), it is able to cope with 100W peak 'music' power. All connections to the speakers and amplifier are via screw terminals, for reliability and convenience, and full connection details are supplied. Price of the A-2300 is $49.95, complete with mounting block.

The other new items included a new range of PCB-mounting power transformers, rated at 7VA for nominal voltage within 3%, or 9VA for +6%/-8%. Thanks to the use of grain orientated steel laminations, the transformers combine small size with high efficiency and low temperature rise. They measure only 36 x 43mm in terms of PCB area, with a height of only 35mm.

The primary and secondary windings are on separate bobbin channels, with fully rated insulation between the two and the leads terminated in solidly anchored PCB pins, which also serve to attach the transformer to the PCB.

There are five models in the range, each offering two identical secondaries which may be connected in series or parallel for flexibility. The M-7012 has two 6V windings, while the voltages for the other models are 7.5V (M-7015), 9V (M-7018), 12V (M-7024) and 15V (M-7030). Price of all models is $12.95 each.

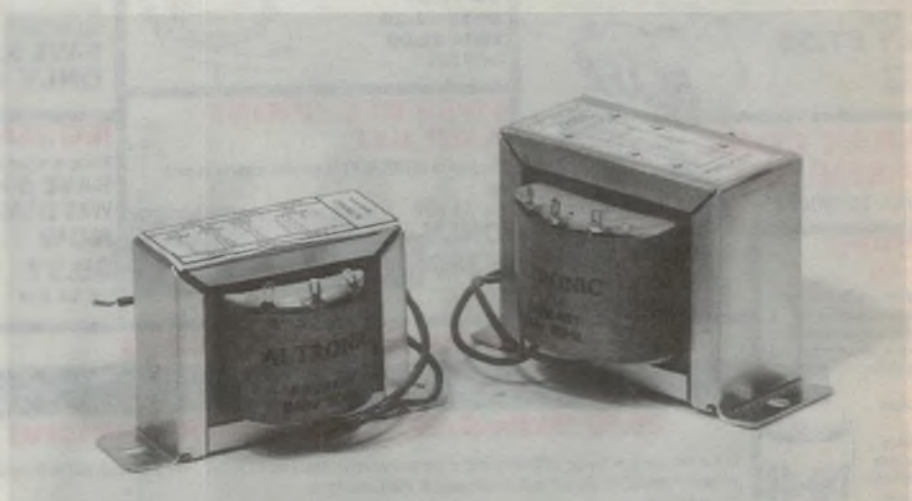
In addition to these small PCB transformers, Altronics is now also offering two new and improved multi-purpose transformers of the normal flange-mounting type, and rated at 120VA and 60VA respectively. Both use high-grade silicon steel for compact size and efficiency, and use two singly-tapped secondary windings which can be combined to produce a wide range of output voltages and currents.

The larger M-2175 model can deliver five different output voltages, for example – 12V, 15V, 24V, 27V and 30V, with current capacities ranging from 10A down to 4A for rising voltages. It measures a modest 110 x 65 x 65mm, and has a mass of 1.25kg.

Similarly the smaller M-2165 can deliver 9V, 12V, 15V, 18V, 21V or 24V, at currents from 6.6A down to 2.5A. It measures only 70 x 70 x 58mm.

Price of the M-2175 in single quantity is $39.95, while the corresponding price of the M-2165 is $26.50.

All of the above products are available from Altronics either direct or via mail order, and also via independent stockists in each state. Enquiries can be directed to the company's toll-free ordering hot line, on (008) 999 007, or to the technical enquiry line on (09) 328 2199. (J.R.)



Samples of the new Altronics 120VA (right) and 60VA (left) multi-purpose power transformers. Both provide a number of output voltage options.

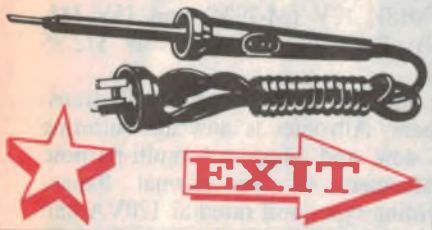
Mail Order Customers - Find your name and postcode on these pages and receive $25 off your next mail order.

BIGGER AND BETTER BARGAINS

ADCOLA 240 VOLT IRONS

20 watt **$32.95 SAVE $4** Cat. TS-1492

30 watt **$32.95 SAVE $7** Cat. TS-1494



OPEN AN ACCOUNT

Jaycar is quite happy to provide ACCOUNT FACILITIES for the following:

- All schools (Government and non-government)
- All CAE's, Colleges, Universities, etc
- All State and Commonwealth Depts. inc research institutions
- All mining companies • All TV and Radio stations
- All public i.e. "LTD" not Pty Ltd companies • All Pty Ltd companies may apply for an account, please ask for an account application form

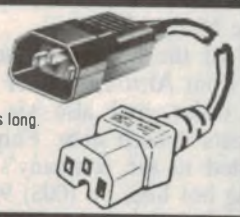
PCB MAINS FILTER

4amp 240V
Cat. MS-4008
SAVE $2
$7.95
10+ $6.95 ea

COMPUTER KEYBOARD SWITCHES

Ideal replacements. 3 wire connection, angled shaft for key.
Size 15mm x 15mm x 30mm high.
Cat. SP-0777
SPECIAL 20 for $5
WORTH OVER $2 EACH

IEC EXTENSION LEAD



What a great idea! 2 metres long.
Cat. PS-4108
$12.95

SWITCH BARGAIN BELOW 1/2 PRICE

12V illuminated as used in expensive car alarms (Momentary on/off) T. Pinocchiaro 0801. 12V lamp supplied. Rectangular NO/NC contacts.
Normally $15.95
ONLY $7.50
10+ $6.50 ea
Cat. SP-0750

TWINAX COAX CHASSIS SKT

Cat. PS-0672 *1/2 PRICE*

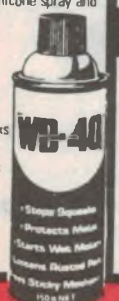
WAS $11.95
NOW $5.98

FAMOUS WD-40

Combines the functions of light lubricant, penetrating oil, rust preventative, moisture repellent, metal cleaner, silicone spray and even household cleaner.

- Starts moist engines
- Removes tar
- Loosens nuts
- Lubricates locks
- Cleans tools
- Stops squeaks

150g NA-1015
$3.95
300g NA-1016
$5.50



CORDLESS TELEPHONE BARGAIN

ONLY $159

SAVE $20

Cat. YT-7066

WIRELESS DOORBELL KIT

Ref: Cat page 17
Transmitter **$12.95**
SAVE $4
KC-5036
Receiver **$34.50**
SAVE $8
KC-5037

ULTRASONIC PEST REPELLER

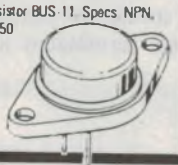
Dual Transducer

- Frequency Range 30kHz-65kHz variable
- Output level 130dB @ 0 Krumins 3875
- Includes 240V power adaptor

Cat. YS-5512
WAS $39.95
NOW $25

BUS-11 HIGH VOLTAGE TRANSISTOR BARGAIN

Another surplus buy. Phillips transistor BUS-11. Specs. NPN, TO-3, IcA - 5, Vceo - 400, Vcbo - 850
Normally about $8
1-9 $1.50
10-99 $1.20
100+ $1.00
Cat. ZT-2218



60/60 BLUEPRINT AMP KIT

Receive two FREE RDE115 polyswitches with each kit.
Cat. KA-1652
ONLY $369

AC/DC MILLIVOLTMETER KIT

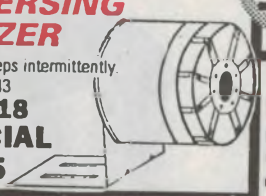
Ref: Cat page 11
Cat. KA-1695
SAVE $8
ONLY $38.50

Dear Customers

Sometimes the products we advertise are so popular they run out within a few days. At other times unforseen circumstances might hold up the shipment so that advertised lines are not in the stores by the time the advert appears. And, very occasionally, an error may slip through our checks and appear in the advert (we're human too!) Please don't blame the store managers or staff, they cannot control a dock strike or a lost PCB artwork from the magazine to the PCB manufacturer for a new kit, or for an error that appeared in print. If you are about to drive across town to pick up an advertised item, why not play it safe and call the store first - just in case.
Thankyou.

PIEZO REVERSING BUZZER

115dB - beeps intermittently.
Cat. AB-3443
NOT $18
SPECIAL $9.95

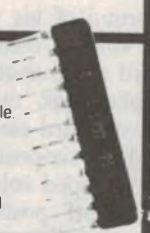


TRIMMER CAP BARGAIN

Another surplus stock purchase. Quality Japanese made with lead spacing standard 5mm. Capacitance 20-60pF. High quality.
Cat. RV-5710
SPECIAL 50¢ ea
10+ 40¢ ea

RESISTOR NETWORKS

Pack of 50pcs, 10 lead style. Values from 680n to 1M.
Cat. RR-3380
SAVE $3.50
ONLY $6.50



IEC MAINS FILTER

3 amp in metal box
SAVE 50%
WAS $19.95
NOW $9.97
Cat. MS-4004

DISK DRIVE BARGAIN

Brand new Chinon model F2-502 5 1/4" 360k - made in Japan - normally $279. Brand new - 3 month warranty.
Cat. XD-4600
$149

VIFA 3 WAY SA-130 SPEAKER KIT

Complete with cabinets and crossovers. 130W rms power handling.
Cat. CS-2465/CS-2467
SAVE $200
ONLY $999
a pair

PC PINS - BULK PACK

Pkt of 500 pcs
Cat. HP-1252
ONLY $15.95

TELEPHONE PLUG SAVE $1

Cat. PP-1400
$2.95

KNOB PACK

Another surplus deal. Japanese Sato brand knobs in different types all imperial. Also a quantity of Rean knobs with different coloured caps - these are metric. Pack includes minimum 50 knobs, generally more - majority Rean. We figure about $60 worth of knobs.
Cat. HK-7050
ONLY $10

END OF MODEL RUNOUT

SAVE $44

2010 MkIIa STEREO EQUALISER (1 octave)

This is the famous Jaycar 2010 one control per octave equaliser. This kit would look great with any Hi Fi system and performs beautifully. For full details see page 6 1989 catalogue.
Cat. KJ-6535
ONLY $125

PCB TERMINAL STRIP BARGAIN

These are high quality 10 way thermoplastic PCB terminal strip. As used extensively in the alarm industry. Units are supplied unassembled, i.e. you have to screw the screws in!
These are normally $4.95
Cat. HM-3205
This month 10 FOR $10

FOR YOU FROM JAYCAR ELECTRONICS

6264 STATIC RAM BARGAIN

SPEED 150ns NORMALLY $22
NOW $15
10+ $12.50 ea Cat. ZZ-8440

4.5 DIGIT DMM FOR $99 CRAZY!! WAS $179

Limited Quantity
Cat. QM-1550
- 10 amp
- Digital hold
- Trans tester

See page 38 1989 catalogue

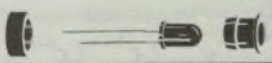
MIDRANGE & TWEETER LEVEL CONTROL BARGAIN

80 watts handling. See catalogue for full details. Horizontal mounting Cat. AC-1684
Vertical mounting Cat. AC-1685 SPECIAL CAT PRICE $9.95

NOW $4.95 10+ $4 ea

WHITE LED CLIPS!

For a short time only! Sound familiar?
5mm Pkt of 20
Cat. HP-1104
$1.90

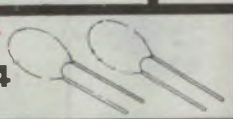


SALVAGE SOME CASH

Turn your surplus stock into cash Jaycar will purchase your surplus stocks of components and equipment.

CALL GARY JOHNSTON or BRUCE ROUTLEY TODAY
on (02) 747 2022

RF CHOKE PACK



Over 50 pcs supplied.
Normally $5
Cat. RC-5600
ONLY $4
Worth over $50

WIRE STRIPPER, CUTTER & PLIERS

See cat page 119
SAVE $2
$5.95 Cat. TH-1825

VERBATIM DISKS AT UNREAL PRICES

Compare our prices with your normal supplier.

Description	1-9 Boxes	10+ Boxes
3.5" 1S/2D Cat. XC-4720	$39.95	$37.95
3.5" 2S/2D Cat. XC-4721	$46.95	$43.95
3.5" 2S/HD Cat. XC-4722	$99.00	$89.00
5.25" 1S/2D Cat. XC-4725	$22.00	$21.00
5.25" 2S/2D Cat. XC-4726	$26.00	$24.00
5.25" 2S/HD Cat. XC-4727	$41.00	$39.95

MIXED SEMICONDUCTOR PACK

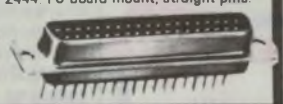
Brand new pack just finished. Guaranteed minimum 100 units supplied but packs generally exceed this amount. R Kirkham 7250 IC's, transistors, diodes, LED's, RAM, etc.
Cat. ZP-8990
ONLY
$10

6" TWINCONE WIDERANGE

Another direct import which saves you money. G Hill 4051
WAS $18.95
NOW $13.95
SAVE $5
Cat. CE-2320

37D PLUG BARGAIN

(37 way Cannon type D male)
Scoop purchase. AJ Harvey 2444. PC board mount, straight pins.
Cat. PP-0861
$5 for 10 or
$30 for 100

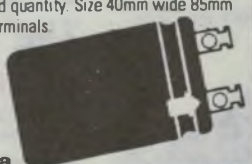


INNER EAR HEADPHONES

Store in a matchbox. With 6.5mm adaptor
SAVE $3
ONLY $5.95
Cat. AA-2014

ELNA COMPUTER CAPACITOR 27,000µF 35V CAN

Grab some while they last, which won't be long at this price. Limited quantity. Size 40mm wide 85mm high including terminals.
Cat. RU-6715
ONLY
$14.95
10+
$13.95 ea



DRILL MADNESS

Are you sick of paying high prices for mini PCB drill bits? We were. Now you don't have to pay outrageous prices anymore. R Brown 2443. Jaycar's direct imports save you money.

DRILL PACK

Includes all those common ones
- 1 x 3.5mm - for PC supports, relays
- 2 x 1.2mm - for PC pins, hookup wire
- 3 x 1mm - for resistors, capacitors etc
- 4 x 0.8mm - IC's etc.

TOTAL 10 DRILLS FOR ONLY $12.95
Cat. TD-2400 - WERE SELLING FOR $24

MINI DRILLS IN PKTS OF 10

- 0.8mm x 10 (Cat. TD-2420)
- 1mm x 10 (Cat. TD-2421)
- 1.2mm x 10 (Cat. TD-2420)

ANY PACK ONLY $9.95

LOWER PRICES ON SINGLE BUYS

- 0.8mm Cat. TD-2408 SAVE 70¢
- 1mm Cat. TD-2410 SAVE 90¢
- 1.2mm Cat. TD-2412 SAVE 90¢

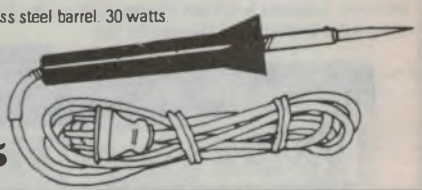
ANY ONE ONLY $1.50

WORK SKILL OLYMPICS

Each year the best of Australia's young skilled workers battle the best from the rest of the world. The first team of young Aussie's competed in Austria in 1983 at the 27th Skill Olympics. Our 12 'pioneer' competitors laid a solid foundation - no medals but 10th position in the overall placings. 2 years later in Japan the 18 strong team came home with 6 medals and an equal 5th placing with Austria. Last year at the 29th Skill Olympics held in Sydney the Australian team won 12 medals and came in third place behind Korea and Taiwan; causing quite a stir among the participating 19 nations. Australia is represented in the Consumer Electronics section by a young man named DAVID ZAMMIT from Sydney. Jaycar is proud to have helped David with his training and we wish him luck in Birmingham (England) in August.

JAYCAR SOLDERING IRON • BUY A SPARE •

240 volt. Stainless steel barrel. 30 watts.
Cat. TS-1450
SAVE $2
ONLY $14.95



AM/FM STEREO TUNER KIT SALE

Ref: EA Dec 85 - Feb 86
Full details page 5 1989 catalogue
Cat. KA-1636
SAVE $70
$529

Remote Control
Cat KA-1636
$70 - SAVE $29.95

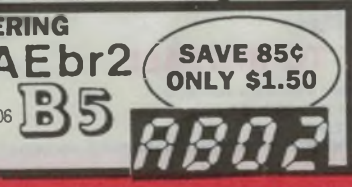
SMOKELESS ASHTRAY WHAT A FLOP!

See catalogue page 135
Cat. YX-2930
1/2 price - was $14.95
NOW
$7.50

DRY TRANSFER LETTERING

3 styles available
1. BLACK 4mm high Cat. NL-4100
2. SILVER 7mm high C NL-4104
3. FLOURESCENT YELLOW Cat. NL-4106

See page 85 of catalogue



SAVE 85¢
ONLY $1.50

240V ILLUMINATED ROCKER SWITCH

SPDT 8A
Cat. SK-0965
WERE $3.95
$1.95

III VOLTAGE CAPACITOR SPECIAL - 0.47µF 630V

CAT PRICE $2 ea
SPECIAL 20 FOR $10 Cat. RG-5247
That's 1/4 of normal price

EXIDE RECHARGEABLE BATTERY MADNESS.....

EXPENSIVE RECOMBINATION ELECTRODE TYPE

Another surplus buy which saves you a fortune. This time we have 12 volt Gel-type batteries. They are high-tech recombination electrolyte batteries (a spin off of the space program) which can be used in any orientation and which do not gas, spill, leak or need top up. We are able to offer these batteries at about 1/2 trade price. These are not "cheap" batteries, they are high quality and are made in Japan.

PLEASE NOTE - TRADE NOT SUPPLIED.

THREE SIZES AVAILABLE

SAVE HEAPS

1.9 amp/hour Exide No. RE 12-1.9

ONLY $14.95 10+ $13.95 ea Cat. SB-2482 (Trade price $30)

2.6 amp/hour Exide No. RE 12-2.6

ONLY $19.95 10+ $18.95 ea Cat. SB-2484 (Trade price $35)

15 amp/hour Exide No. RE 12-15

ONLY $79 10+ $75 ea Cat. SB-2490

SPECIFICATIONS

• (1.9) specs for 1.9 A/H batt • (2.6) specs for 2.6 A/H batt • (15) specs for 15 A/H batt

Nominated Capacity (A.h.)	
20hr rate to 1.75 V.P.C.	1.9, 2.6, 15
10hr rate to 1.75 V.P.C.	1.8 (1.9 A/H), 2.4 (2.6 A/H), 14 (15 A/H)
5hr rate to 1.7 V.P.C.	1.6 (1.9), 2.2 (2.6), 12.8 (15)
1hr rate to 1.6 V.P.C.	1.1 (1.9), 1.6 (2.6), 9 (15)
Maximum Discharge Amps	
Standard terminals	40 (1.9), 40 (2.6), 100 (15)
Short Period	75 (1.9), 100 (2.6), 400 (15)
Charge Rates	
3.75 (15) Standby & Cyclic Use - max amps	0.5 (1.9), 0.6 (2.6)
13.5-13.8 (15) Standby Use - volts	13.5-13.8 (1.9), 13.5-13.8 (2.6)
14.4-15 (15) Cyclic Use	14.4-15.0 (1.9), 14.4-15.0 (2.6)
Energy Density (Wh/l)	61 (1.9), 58 (2.6)
Specific Energy (Wh/Kg)	25 (1.9), 28 (2.6)
Internal Resistance	
Fully Charged (milliohms)	100 (1.9), 80 (2.6), 15 (15)
Weight (Kg)	0.9 (1.9), 1.1 (2.6), 5.9 (15)
Size	178mm x 34 x 67 LWH inc connector (1.9) 134mm x 67 x 67 LWH inc connector (2.6) 181mm x 76 x 167 LWH inc connector (15)

Mail order customers in WA and NT please add on extra $2 for 1.9 and 2.6 batteries for extra mail charges due to weight, and $10 extra for 15A.

MONITOR MADNESS

Another distress stock purchase!
This time a quantity of Samsung brand 12" composite computer monitors. Available in either green or amber.

Specifications	
Picture Tube	12ZBY31N (12" diagonal 90° deflection)
Mode	Composite
Composite Input Signal	
■ Polarity	Negative sync
■ Level	0.5-2.0V pp
■ Impedance	75Ω
Active Video Period	
■ Horizontal	39.11µs max.
■ Vertical	12.21ms max.
■ Video Band Width	25MHz (-3dB)
Scanning Frequency	
■ Horizontal	15.75kHz
■ Vertical	60Hz
Active Display Area	216(H) x 160(V)
Display Characters	40 characters x 24 lines (7 x 9 cell)
Input Connector	RCA Phono Jack
Controls	
■ Front	Power on/off, contrast
■ Rear	V-hold, V-size, Brightness
■ Internal	V linearity, H hold, H linearity, H width, Focus
Mechanical and Environmental	
■ Operating Ambient Temperature	+5° through +40°C
■ Power Supply	115V, 230V/60Hz, 50Hz
■ Power Consumption	50W max
■ External Dimensions	312(W) x 300(H) x 307(D)mm
■ Weight	Approx 7.5kg

ONLY $99.50

SAVE $50

LIMITED STOCK - BE QUICK GREEN Cat. XC-3000 AMBER Cat. XC-3001

WORLD TIME

This product is ideal for overseas travellers or those who ring overseas, and have trouble sorting out time differences. It is pre-programmed with 12 times* for different cities including Tokyo, Hong Kong, Bangkok, Sydney, London, Paris, Cairo, Moscow, Honolulu, Los Angeles, Chicago, New York and one spare zone for another city. The times are displayed immediately after touching the button.

Also incorporated is a calculator as well as the date and an alarm. All this fits into a credit card size unit 3mm thick. Another direct import that saves you money.

*Once one time zone is programmed in, the other zones are automatically calculated by the unit.

Cat. QM-7210

ONLY $19.95

DIGITAL HYGRO-THERMOMETER

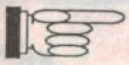
NEW FOR 89

Measures temperature AND humidity at the same time!
This compact battery operated unit has two bright LCD readouts. One for temperature (down to -25°C) and the other for humidity (20 - 95%).
Can be used in the car or home/office etc.

DUE MID JULY

Cat. QM-7230

$69.50



ELECTRONIC PEDOMETER

We've all seen those old mechanical pedometers in mail order catalogues that don't work terribly well. Electronics have caught up, and Jaycar proudly present the first electronic pedometer.

FEATURES

- Measures distance travelled in miles and kilometres.
- Counts steps taken
- Tally counter, to count numbers by hand
- Calculator function

Easy to read LCD display, clips on belt, battery lasts for years. Size 50x56x17mm

Direct import. Cat. QM-7220

$29.95

NEW FOR 89

UHF ANTENNAS

91 Element

Receives all band 4 and 5 channels through 21 to 69. Ideal for fringe areas. Includes balun for 75 Ω cable. Max gain 16dB.

Cat. LT-3182

$139

43 Element

Suits both bands 4 and 5. Ideal for medium signal reception areas. Includes balun. Max gain 13dB.

Cat. LT-3181

$75

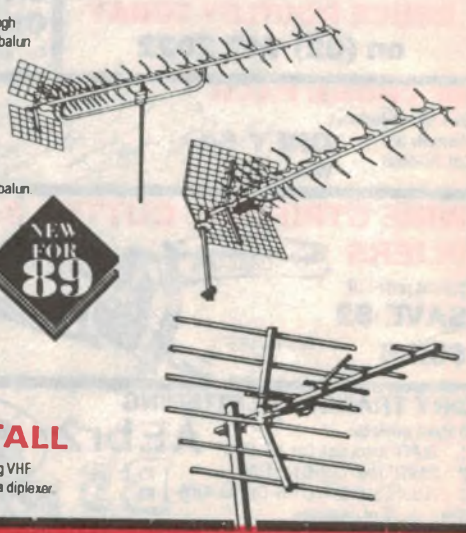
NEW FOR 89

11 Element

The baby. Again bands 4 and 5. Includes balun. 8dB gain.

Cat. LT-3178

$39.95



EASY TO INSTALL

Simply mount above or below your existing VHF aerial and connect to existing cable with a diplexer.

Cat. LT-3014 $12.95

NiCad DISCHARGER

Ref: EA August 1989
Combine this automatic discharger with our equally automatic charger kit (KA-1718 $42.50) and rejuvenate your NiCad batteries. It's amazing how they'll respond to the discharge/charge treatment - you could add years to the life of your re-chargeables. Kit includes PCB, box, front panel and all specified components. Power supplied by companion charger.
Cat. KA-1719
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NEW KITS

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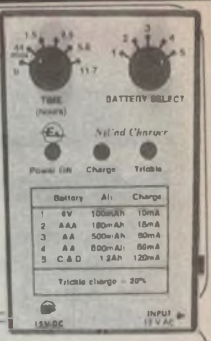
Ref: EA July 1989
This kit is a fully automatic NiCad charger that is simpe and cheap to build. Once the battery is charged, the unit automatically switches to trickle charge.
Kit includes PCB, box, panel and all specified components. Power supply extra - Cat. MP-3020 $14.95
Cat. KA-1718
$42.50



STEREO 1/2 OCTAVE GRAPHIC EQUALISER

Ref: Silicon Chip August 1989
This project enables you to equalise your room or disc or other source etc., with great precision. Until recently you had to buy TWO mono equalisers to do this task. The Silicon Chip people have come up with a state-of-the-art design featuring close tolerance capacitors and superior gyrator performance. Headroom is over 100dB. Distortion? Negligible <0.001%. With TWO controls per octave you have a precision Hi Fi instrument that covers 28Hz to 20kHz. 20 slider controls per channel with Fx. out for dubbing tape. ±12dB per control. 240V powered. 19" 2 unit rack configuration. The Jaycar kit is complete down to the last nut and screw.
Cat. KC-5055 **PRICE TO BE ADVISED**

TOUCH LAMP DIMMER

Ref: Silicon Chip June 1989
Amaze your friends. Replace your normal light switches with these. All you see is a plate. To dim simply hold your finger on the plate. To switch simply touch the plate. Works extremely well.
Cat. KC-5052 **$32.95**

REMOTE FOR TOUCH LAMP DIMMER

Ref: Silicon Chip July 1989
Add one or more extension units, so you can dim/switch your lights from several positions. These can be simply wired in place of 2-way switches.
Cat. KC-5053 **$14.95**

1/3 OCTAVE EQUALISER KIT - $239 Cat. KC-5050

RGBI TO PAL ENCODER/MODULATOR

Ref: EA August 1989
Here's a kit for a low cost RGBI to PAL video encoder and RF modulator, suitable for use with an IBM or compatible computer fitted with a colour graphics adaptor (CGA). By providing a modulated RF signal on a suitable TV channel, it allows a standard colour TV receiver to be used as a colour monitor for games etc. Kit includes PCB, box, and all specified components except those for optional power supply.
Cat. KA-1720 **$39.95**

NiCad BATTERY ADAPTORS

Why buy expensive C and D size NiCads when these adaptors allow you to use low cost AA NiCads instead.
These adaptors look like a normal battery exept that they are hollow, and on AA NiCad can be inserted inside. These can then be used in place of the C or D NiCads.
C Size Pkt of 4 **$4.95** Cat. SB-2462
D Size Pkt of 4 **$4.95** Cat. SB-2464
AA NiCads 500mA/hr $3.50 ea
4 for $12.50 Cat. SB-2452

NEW FOR 89

STEREO COMPRESSION FOR CD PLAYERS

Ref: Silicon Chip March 1989
Simple compressor circuit reduces the dynamic range of CDs so that you can make good recordings. Kit includes PCB, box, and all specified components.
(12V AC plugpack not included Cat. MP-3020 $14.95)
Cat. KC-5051 **$49.50**

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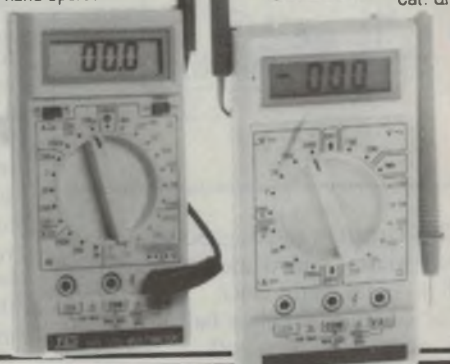
Cat. QM-1410



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Circuit & Design Ideas

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

Oscilloscope aid for microprocessors

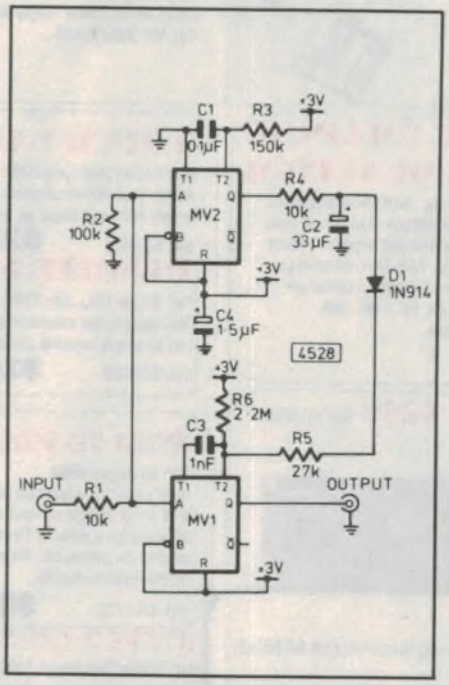
While setting software time constants in a microprocessor-based system, it became apparent that low to mid-priced oscilloscopes are useless for observing input-port-enable pulses of 1us or less at a repetition rate of 30Hz or 300 baud.

As an ocilloscope aid, the circuit shown was designed around a 4528 CMOS dual-monostable IC.

MV1 proudces 1ms pulses while MV2 produces 5ms pulses. As the 4528 is retriggerable, the Q output of MV2 stays high at an input pulse rate of 200Hz or above.

Below 200Hz, the Q output of MV2 produces a 5ms pulse waveform whose mark/space ratio varies with decreasing frequency. This pulse waveform is integrated by R4 and C2 to produce a varying DC which is applied via D1 to auxillary timing resistor R5.

Above 200Hz or 2000 baud, R5 is in parallel with R6 and the output pulse from MV1 is 20us.



Between 200Hz and 60Hz, the output of pulse width of MV1 varies from 20us to 1ms and below 60Hz, MV1 produces 1ms pulses.

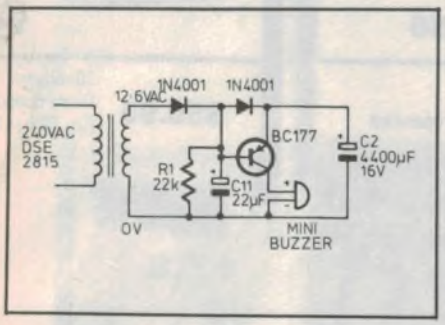
The unit was built in a small box designed to connect to a 'x 1' probe and the oscilloscope input. It may be powered by two miniature alkaline cells (3V) or three miniature button NiCads (3.6V).

R1 protects the input protection diodes in the 4528. If NiCads are used, they may be charged by applying 12V DC to the input connector. Current will flow through R1, via the protection diodes onto the HT-rail and into the NiCads.

The output pulse amplitude shows the condition of the batteries and as there is very little current drain, no on/off switch was fitted.

Darren Yates,
Frenchs Forest, NSW **$35**

Mains failure alarm



This circuit was designed as a mains failure alarm, and is used in conjuction with a digital alarm clock.

The circuit is simply a half wave rectified supply biassing off a transistor. When the mains supply dips for more than a few cycles, the base of the transistor drops low, turning it on and allowing the charge on the storage capacitor to flow to the buzzer.

The sensitivity can be adjusted by R1. A higher value will lessen the sensitivity. The value of C2 shown will give around 5 seconds of 'buzz' – enough to alert you to the mains failure.

Doug Nichols,
North Rocks, NSW **$25**

Powering solid state gear from valve equipment

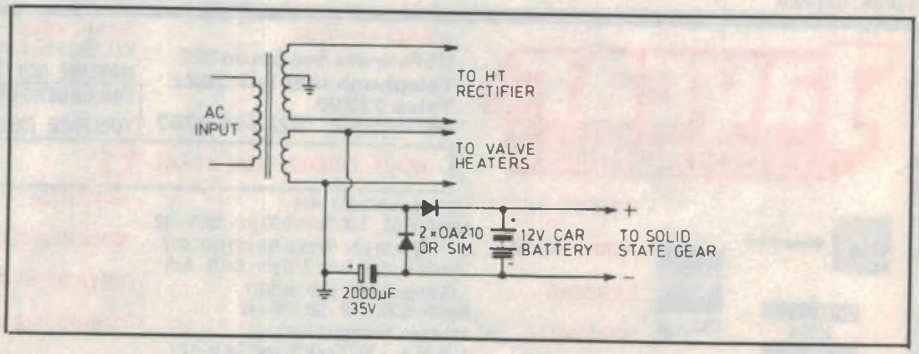
This idea can be used with most valve equipment, to allow powering of intermittently-used solid state gear intended to operate from 13.8V DC from the same supply.

The 6.3V AC from the power transformer heater winding is fed to a simple voltage doubler, which produces around 17-18V DC when unloaded. This is used to maintain the charge in a 12V car battery, which in turn powers the solid state equipment – such as a VHF amateur transceiver, etc. Providing that the valve equipment is left on for a rather longer time than the solid state gear, the battery will remain charged indefinitely.

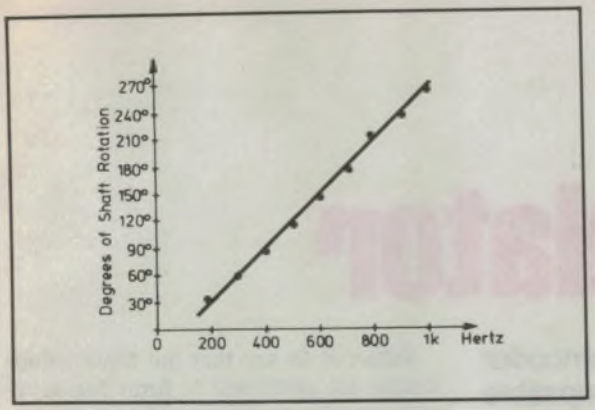
An advantage of this arrangement is that during a power cut, the solid state gear can still be used. But note that the car battery should not be disconnected while the solid state equipment is switched on, as this may cause damage due to over-voltage.

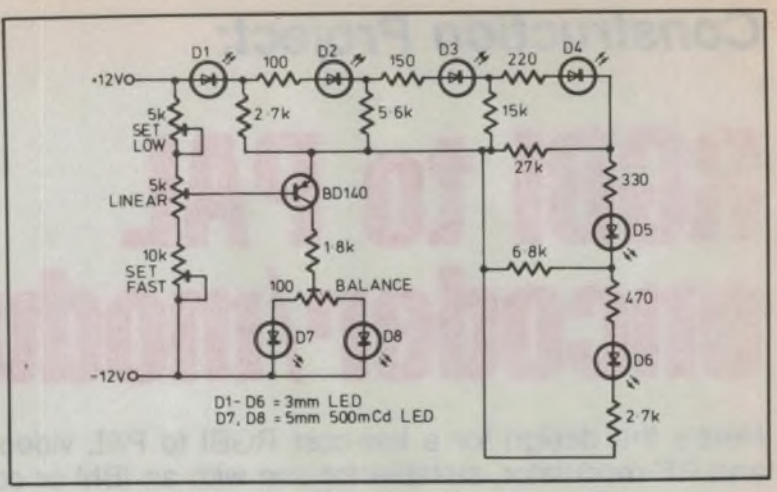
I have been using this supply for over three months, to power a low power mobile-type transceiver. It seems to me ideal for powering this sort of rig, when one doesn't want to go to the trouble and expense of building a separate 13.8V supply.

Peter Parker, VK6BWI
Witchcliffe, WA **$30**



Synthetic dual matched pot





Here is a modification to the circuit of the new *EA* Low Distortion Audio Oscillator of February-March 1989, to get around the problem of the mistracking of dual pots, and also the non linear frequency scale by substituting an LED/LDR pair for R3/RV1a and for R6/RV1b. Signal current may modulate the resistance of the LDR, but if so the effect is not visible on a CRO trace. It is not difficult to get two LDR's to track quite closely over the 16:1 resistance range required, and if they are driven by a high intensity LED the current requirements are quite modest.

The relationships between output frequency versus control resistance and LED current verses LDR resistance are both hyperbolic in form, but a reasonably linear scale can be realised by the use of a diode ladder as shown in the attached circuit. The ladder diodes are LEDs, because of the larger voltage drop available; the scale linearity can be judged from the enclosed graph.

The control LED/LDR pairs were made by inserting them into 15mm lengths of black plastic tube and covering the back of the LDR to exclude stray light. The circuit was then powered up and the individual LDR resisitances matched at 2k ohms by adjusting the 100 ohm balance pot, before connection to the oscillator circuit.

Bill Jolly,
Nambucca Heads, NSW **$40**

Passive frequency doubler

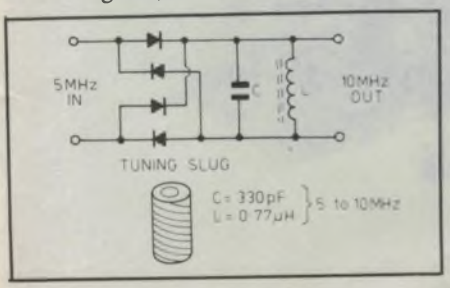
Here is a little circuit I have constructed that allows a frequency to be doubled passively – provided it is of the order of a volt or more, and is a sinusoid.

I used this circuit to multiply the 5MHz output of our frequency standard to 10MHz, to lock our frequency counters and signal generators as they only have 10MHz external standard inputs. The circuit could be adapted to other frequencies/uses however, simply by making tuned circuit LC resonate to the desired output frequency.

The inductance L for 5MHz is 0.77uH and was wound on an old tunig slug as shown (7 turns 32 SWG). For 5MHz the capacitor C is 330pF.

The diodes should be matched for best results.

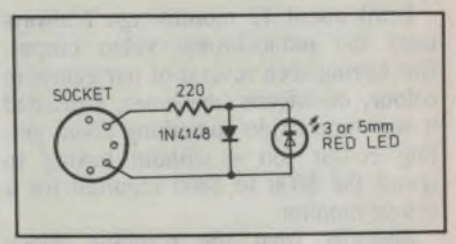
Paul Spresser,
Morningside, Qld **$30**



Midi tester, opto replacement

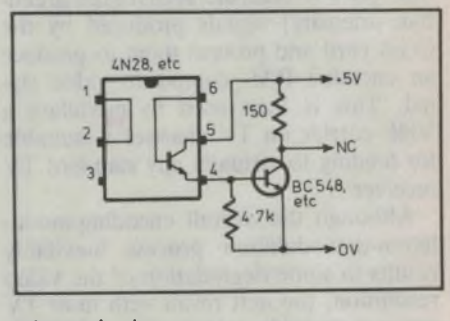
Oftentimes when working with synthesisers, sequencers etc., it is important to identify the difference between a MIDI 'in' and a MIDI 'out' flying lead, or to confirm that a particular synth or sequence is outputting MIDI information.

This simple MIDI detector works in exactly the same way as the input diode in an optocoupler. The circuit completes the MIDI current loop and the LED (visible) provides an indication that the particular lead or synthesiser is operating. Note also that the detector will check that any MIDI leads are correctly wired.



While on the subject of MIDI and optocouplers, here's a way to improve the speed and transfer efficiency of standard optocouplers.

Anyone using optocouplers for MIDI applications will be aware that standard optocouplers (4N25, 4N28, TIL111, etc.) are not satisfactory substitutes for the 6N138 generally recommended for MIDI applicatons, because of their slower response time or poor transfer efficiency. However by adding an additional transistor and biassing the phototransistor in the optocoupler in the photodiode mode, a standard device may replace the 6N138 which is much more expensive and generally very difficult to obtain.



The modifications shown here add a transistor and two resistors to a standard optocoupler. By reducing the current in the phototransistor, it operates as a photodiode and response time is much improved. Also the Darlington configuration increased the transfer efficiency from about 30 typically to as high as 600.

Grant Wills,
Clarence Park, SA **$30**

Construction Project:

RGBI to PAL encoder/modulator

Here's the design for a low-cost RGBI to PAL video encoder and RF modulator, suitable for use with an IBM or compatible computer fitted with a color graphics adaptor (CGA). By providing a modulated RF signal on a suitable television channel, it allows a standard colour TV receiver to be used as a colour monitor for games, etc.

by ALLAN ABBOTT, VK4ABP

My reason for developing this circuit was simple. Like many IBM clones, mine is equipped with a video board which provides three outputs: RGBI, monochrome composite video, and a composite colour video output which happens to be encoded for NTSC – and is therefore not compatible with a PAL monitor or TV set.

Until about 12 months ago I always used the monochrome video output. But having seen several of our games in colour, on friends' machines, I decided it was time to do something about getting colour too – without having to spend the $600 to $800 required for a colour monitor.

Basically what the resulting 'black box' does is take the RGBI (red-green-blue-intensity) signals produced by the CGA card and process them to produce an encoded PAL composite video signal. This is then used to modulate a VHF carrier on TV channel 1, suitable for feeding to virtually any standard TV receiver.

Although the overall encoding-modulation-demodulation process inevitably results in some degradation of the video resolution, the nett result with most TV sets is a passable colour picture which is quite suitable for games etc. In fact even 80-column text can be read on a well-converged old TV receiver, making it suitable for things like word processing and spread sheets.

While not really good enough for hi-res graphics, the setup does have the big advantage that you don't have to invest in an expensive colour monitor. And the kids will love it – even 'big kids'!

How it works

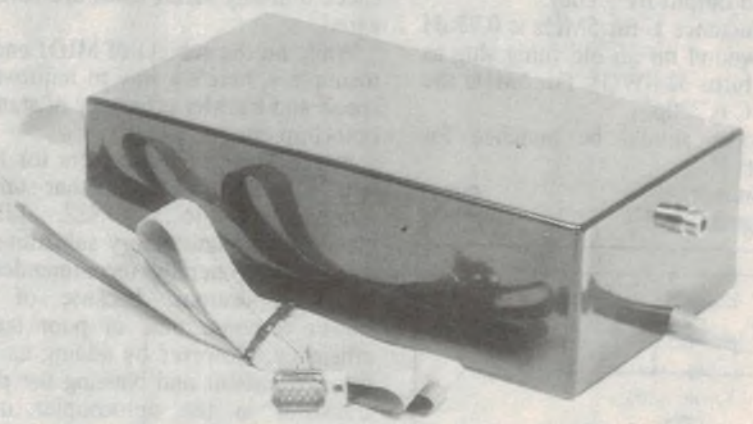
Without going deeply into the theory of colour television, the PAL signal required to drive a normal TV receiver consists of three main signals. These are the picture synchronizing information or *sync pulses*; the *luminance* information, or the detail on brightness levels within the picture; and finally the *chrominance* information, or the detail on colour variation throughout the picture.

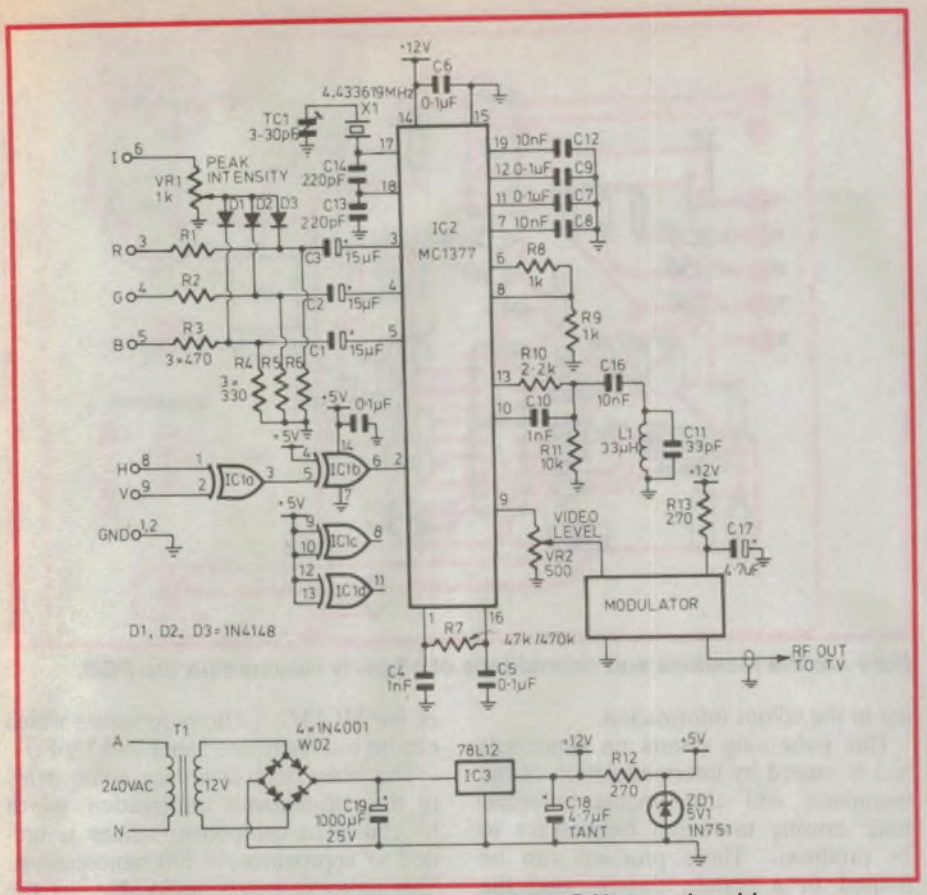
How the luminance and sync information are combined is simple: the sync information is sent prior to sending each line or frame of information, and so can be thought of as sequential. The colour information however is sent at the same time as the luminance, and the full detail of how this is arranged is beyond the scope of this article.

Suffice it to say that the three colour signals are combined to form two separate signals, containing information on all three colours. These signals are then modulated onto a subcarrier located at 4.433619MHz, which is within the normal bandwidth of a black and white picture.

Because the eye is more sensitive to brightness levels than variations of colour, the bandwidth required for the chrominance information is much less than that required for the luminance information. By interleaving the spectrum of the colour information produced by the colour modulators, no additional bandwidth required.

This brief introduction has skipped lightly over many details such as the 'colour burst' and the very detail of why the system is called PAL, but even so it shows some of the complexity involved in the generation of a composite colour TV signal from the basic red, green and blue information. And the reason why we can skip some of these details is that this problem has now been solved by those magicians who design and manufacture the IC's which we handle as easily as our predecessors handled a





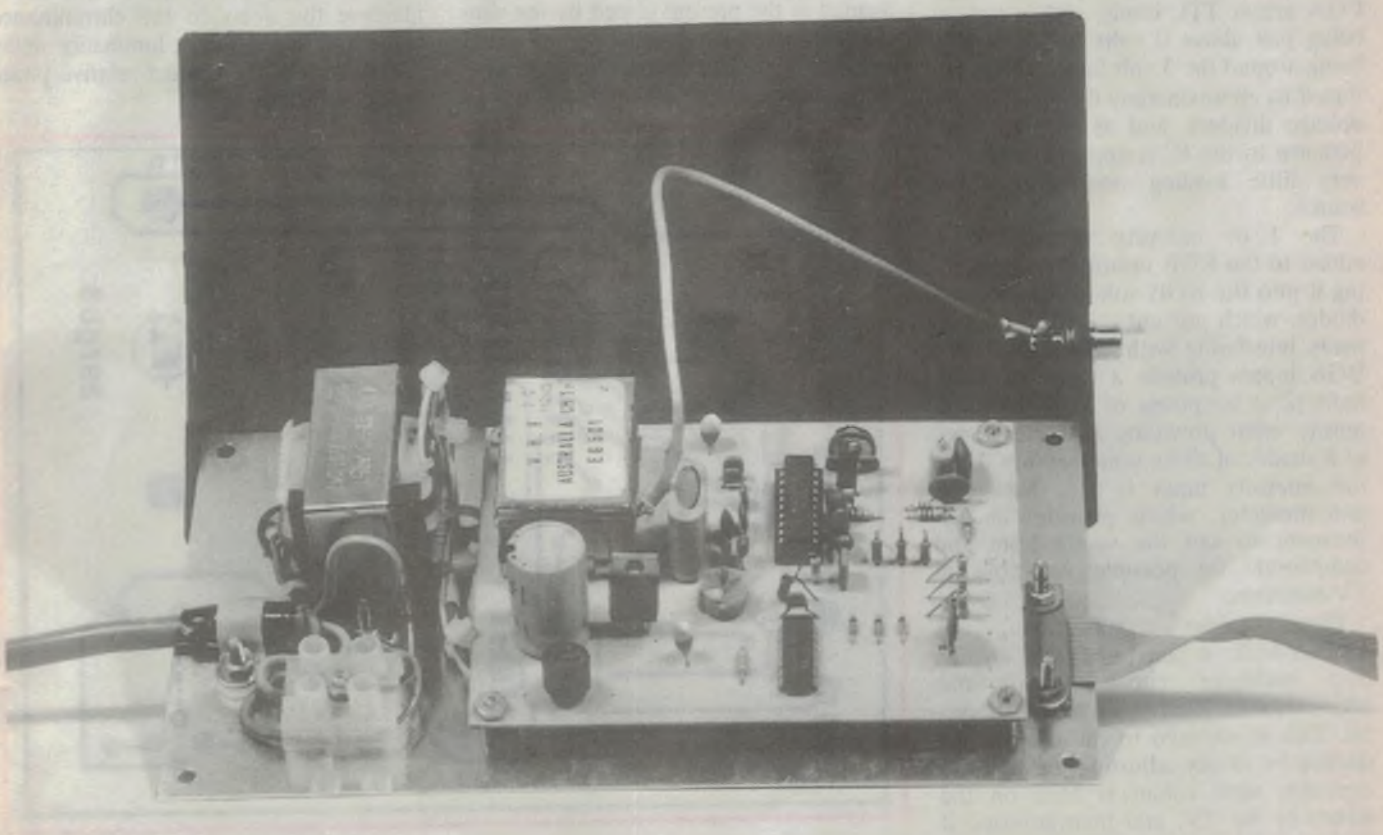
At the heart of the circuit is a Motorola MC1377 PAL encoder chip.

vacuum tube. In other words, the complete encoding process can be performed by a single chip.

Actually two different types of encoder chip were investigated and tried, during the development of this project. Each handled the problem a different way. The devices were the TEA2000 from Philips, which has six digital inputs, and the MC1377 from Motorola which has only three analog inputs. The MC1377 won out in subjective tests, with the analog inputs seeming to be better suited to combining the four outputs from a colour graphics adaptor.

A brief overview of the MC1377 shows the simplicity of interfacing to a well designed chip, with only a few external components required to make a high quality colour encoder – which only a few years ago would have required extremely complex circuits. The IC requires only composite synchronising pulses, together with red, green and blue colour information at a level of up to 1V peak to peak. Apart from these signals all it needs is a handful of external components, including a 4.433619MHz crystal to provide the required colour subcarrier signal.

To provide suitable inputs to the MC1377 the horizontal and vertical sychronizing pulses from the CGA have



Inside the case. Take special care with the wiring for the power transformer and mains cord terminations.

to be combined and inverted to provide the required composite sync signal (CSYNC). A check on the specifications for the H and V outputs from the CGA showed that the period of the pulses are close enough to the requirements for composite sync, so that simple mixing is all that is required.

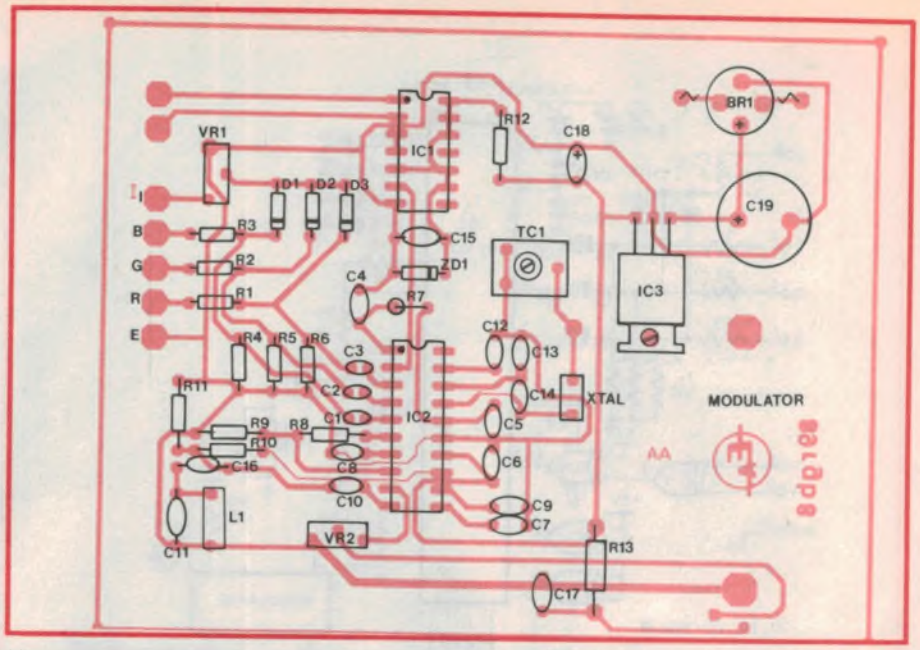
This function is performed by two sections of a 74LS86 quad exclusive-OR gate, the ex-OR function providing the correct horizontal sync serrations during the vertical sync period. These serrations ensure the correct operation of the PAL flipflop within the MC1377, which reverses the phase of the colour burst and chrominance information on alternate lines (hence PAL – phase alternate lines).

The sync input of the MC1377 is able to handle the TTL level as a direct input. Whilst on the topic of sync pulses, one problem we have is that the CGA uses 60Hz vertical sync, compared to the Australian standard of 50Hz. This will probably mean that you will have to adjust your colour TV's vertical hold control to lock the picture and stop it rolling. All TV sets I have tried so far have successfully locked on to the 60Hz signal.

The R, G, B, and I inputs from the CGA are at TTL levels, with a logic 0 being just above 0 volts and a logic 1 being around the 3 volt level. This is reduced to approximately 0.6V p-p by the voltage dividers, and as the input impedance to the IC is approximately 10k very little loading occurs from this source.

The I or intensity information is added to the RGB information by feeding it into the RGB voltage dividers via diodes, which prevent the RGB components interfering with each other. The RGB inputs provide a range of 8 colours (2 to the power of 3), with the intensity input providing a further range of 8 shades of those same colours. Here the intensity input is fed through a potentiometer, which provides an adjustment to suit the user's taste and compensate for possible variations in TV receivers.

The colour subcarrier of 4.433619MHz is generated with an on-chip oscillator circuit within the MC1377, controlled by an external crystal. This is adjusted to the correct frequency by simply adjusting the trimmer capacitor until colour is seen on the screen of the TV, and then adjusted if necessary for minimum 'Moire' patterning in the colour information.

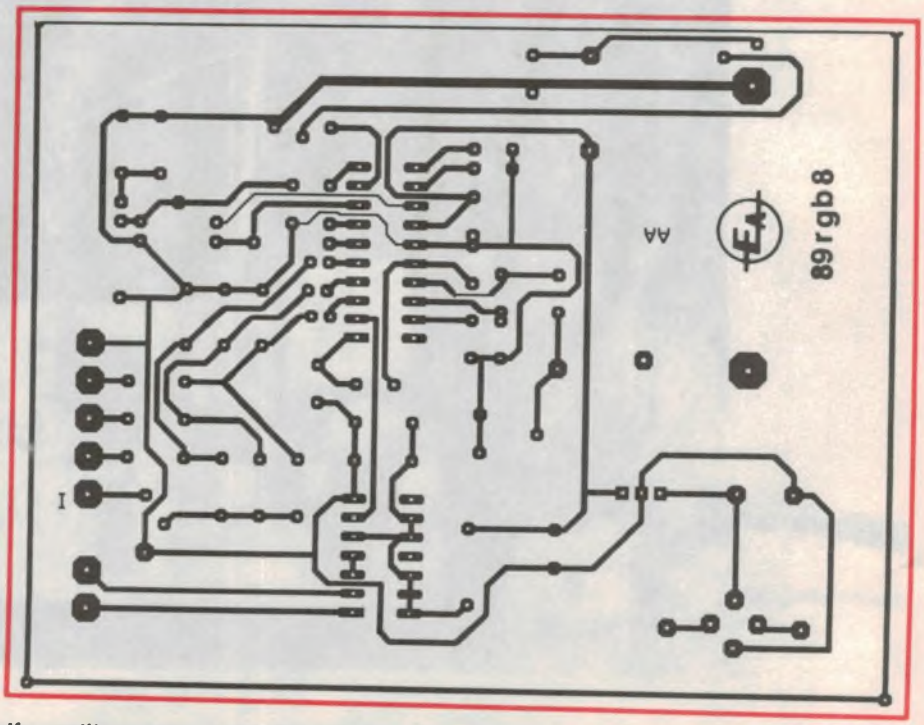


Here are the locations and orientations of all parts mounted on the PCB.

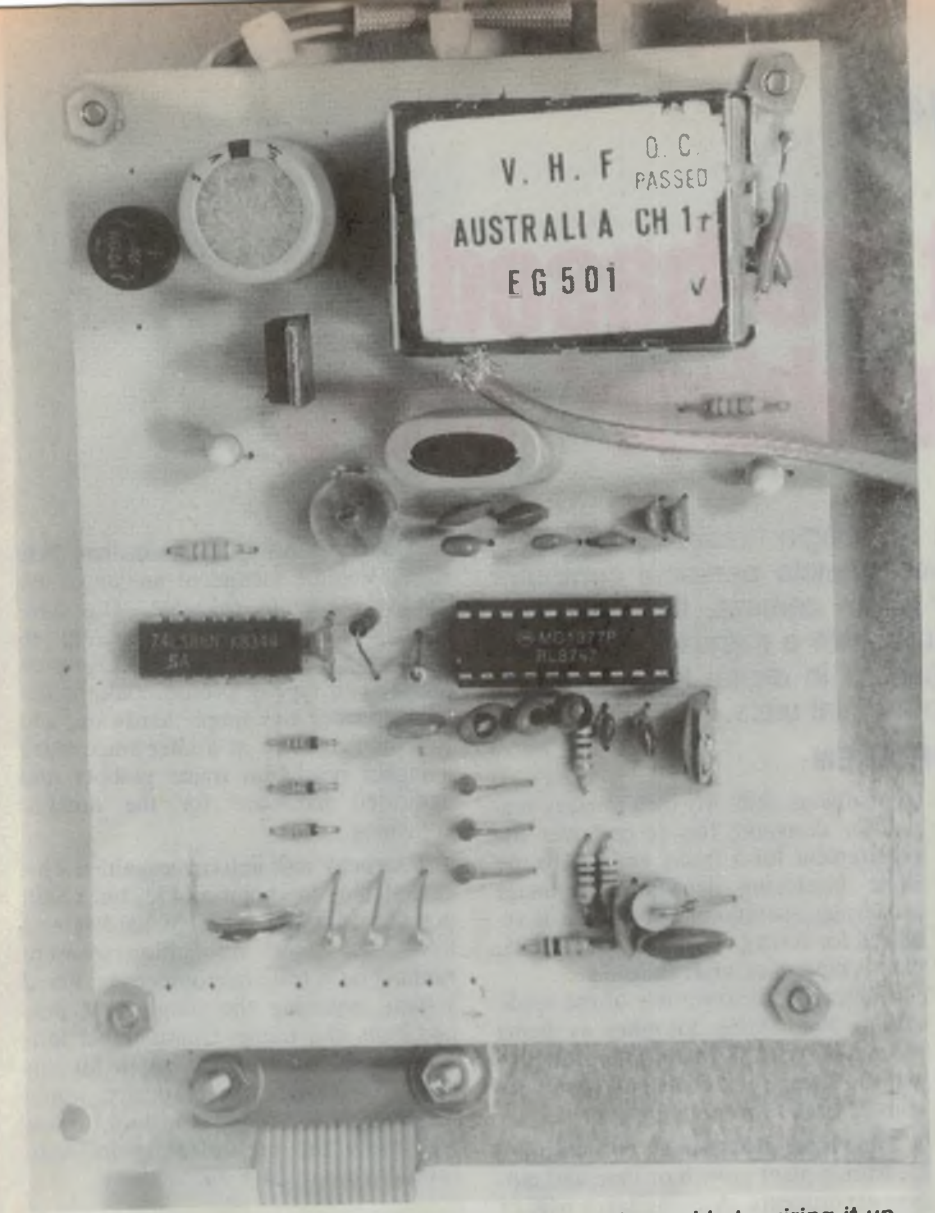
This patterning occurs on some sets and is caused by intermodulation of the luminance and chrominance information, causing unwanted frequencies to be produced. These products can be limited to a certain degree, and the amount of patterning therefore reduced, by limiting the bandwidth of the chrominance information. This is performed in the present circuit by the simple bandpass filter formed by the 33uH inductor and 33pF capacitor connected in the network between pins 13 and 10 of the MC1377. (Alternate values which can be used here are 56uH and 18pF.)

The filter does introduce some delay to the chrominance information, which by choice of component values is limited to approximately 100 nanoseconds. This delay is barely noticeable, as the active line period is approximately 50us.

A better filter would reduce the bandwidth and patterning more, but would increase the delay in the chrominance chain and necessitate a luminance delay line to restore the correct relative phase between the two.



If you like to etch your own PC boards, here is the pattern – actual size.



A closeup of the assembled PCB, to give you a further guide to wiring it up.

As an example, a chrominance filter using a value of approximately 15uH and 82pF would require a delay line of approximately 270ns between pins 8 and 6 of the MC1377. Such a delay line is available from Philips for between $8 and $10, designated type DL270. But the final result is only slightly better than with the present circuit.

Because of this no provision has been made on the PC board for such a delay line, as it was felt that the improvement provided by such additions is not worth the added complexity and cost.

The resulting composite PAL video signal from pin 9 of the MC1377 is fed to a commercial RF modulator, which provides adequate performance at reasonable cost. It requires no tuning and the only adjustment required is the video level. This adjustment is made by setting the trimpot to give good results whilst observing the result on a TV receiver, tuned to VHF channel 1.

Construction

Construction of the device is simple and although the MC1377 is not an expensive chip nor extremely static sensitive, I would still suggest a good quality socket or at least some of the latest break off socket strips which use the machined pin inserts. However anti-static procedures are simple and it is probably wise to follow these for most components these days anyway.

The 74LS86 does not require a socket.

For the bypass capacitors use good quality monolithic types, while the R, G, B input capacitors should be tantalum bead types (C1, C2 and C3). The remaining capacitors should be metallised polyester, ceramic or good quality electrolytics.

An AC power supply is shown on the circuit, but if you are confident and competent you may wish to take +12V

(Continued on page 143)

PARTS LIST

1 Plastic utility box, 196 x 113 x 60mm
1 PC board, 113 x 87mm, code 89rgb8
1 RF modulator, VHF channel 1
L1-33uH inductor
X1-4.433619MHz quartz crystal
Length of 14-way ribbon cable; DB-9 plug and backshell; short length of co-axial cable; panel-mount RCA socket; 4 x 6.5mm standoff pillars; 6 x 3mm x 12mm round head screws with nuts and locking washers; 4 x stick-on rubber feet.

Resistors

VR1 – 1k linear trimpot
VR2 – 500 ohm linear trimpot
All 1/4W, 5%:
R1,2,3,13 – 470 ohms
R4,5,6 – 390 ohms
R7 – 43k
R8,9 – 1k
R10 – 2.2k
R11 – 10k
R12 – 270 ohms

Capacitors

C1,2,3 – 15uF 16VW tag tantalum
C4 – 1nF metallised polyester
C5,6,7,9,15 – 0.1uF monolithic
C8,12 – 10nF monolithic
C10 – 1nF metallised polyester
C11 – 33pF NPO ceramic
C13,14 – 220pF NPO ceramic
C16 – 10nF ceramic
C17,18 – 4.7uF 16VW tag tantalum
TC1 – 3-30pF trimmer

Semiconductors

D1,2,3 – 1N4148 silicon diode
ZD1 – 5.1V 400mW zener diode
IC1 – 74LS86 quad ex-OR gate
IC2 – MC1377 PAL encoder

Optional, for power supply:

T1 – 12V/150mA transformer
WO2 – 1A rectifier bridge
IC3 – 78L12 three terminal regulator
C19 – 1000uF 25VW electrolytic
Mains cord and plug; nylon cable clamp; 2-way length of B-B connector strip; 5 x nylon cable ties; earthing lug; 4 x 3mm x 12mm round head screws with nuts, washers etc.

Construction Project:

Low-cost PC-based 'Frame Grabber' card

This project will enable you to begin image processing research using your own IBM-compatible personal computer and domestic video system or video camera. It allows your computer to 'grab' a single picture from a standard composite video signal, and store or process it in digital form – for far less than currently available commercial units.

by KEITH HEAVEN

A 'frame grabber' bridges the gap between a personal computer and a standard video system, by presenting the computer with a digital version of a video signal. The design presented here has a resolution of 256 x 256 pixels (picture elements), with each pixel having a gray scale of 256 discrete values. In layman's terms this is approximately the same picture quality as you would get from a normal video recorder reproducing a black and white picture.

The resolution is more than adequate for simple image processing functions such as edge detection, filtering, and object detection.

A video signal is produced by scanning an image in a raster pattern, and generating a signal that varies in amplitude with the intensity of the image. Synchronising information is included with the picture information to indicate the start of a new scan line or new frame. The frame grabber takes a video signal as it is scanned across the picture, digitises it, and then stores it into memory. Each scanned line is broken up into 256 intervals or pixels. A stored picture is made up of 256 such lines.

The unit accepts a standard composite video signal of 1 volt p-p, with negative-going sync, as provided by most video cameras and recorders. A video output signal is provided, to allow monitoring of the digitised image. A simple design has been used to keep the cost minimal, but still provide a good quality digitised image.

What can you use it for? A device like this can be used for many purposes. The real limiting factor is your ingenuity and software skill. My own primary reason for designing this project was the requirement for a frame grabber to use while developing algorithms for image processing operations. 'Real' data is required for testing filters, edge detectors, data compression algorithms etc.

I have listed below a few of the applications that spring to mind as being potentially rewarding and interesting, to get you going. Some of these don't require a large software effort:

1. Time lapse photography For example, measuring plant growth or time and motion experiments. A frame takes 64K of disk space in an uncompressed form, so about 300 frames could be stored on a 20 megabyte hard disk. A grid could be overlaid on the recorded digital image, to measure growth or movement.

2. Slow scan television With a simple hardware interface to the audio input of your tranceiver and a little software, this device would make a good slow scan TV system. The ability to store pictures in digital form on disk is an added bonus.

3. Quality control of production item sizing Volume factors of an image are relatively easy to calculate. The computer could be used to generate an accept/reject signal, after processing an image. This type of project could be developed using this simple hardware, and fully implemented at a later stage using a higher resolution frame grabber and dedicated hardware for the number crunching.

4. Character and object recognition This is stretching the point a little, but is still possible with this piece of hardware. I have seen object recognition software running on a 6502 microprocessor based system, counting the number of nuts and bolts in a frame. Considerable software would need to be written for this task. Again the present device would make an ideal development tool, to test algorithms for implementing in dedicated hardware later on.

Circuit details

Fig 1. shows the block diagram of the frame grabber. Video input is processed by the signal conditioning section and presented to the analog to digital converter (ADC). The signal conditioning also separates the sync pulses for the control logic. A 'flash' type ADC is used to digitise the video signal, to provide the necessary speed.

Digital output from the ADC is stored in the RAM buffer while a frame

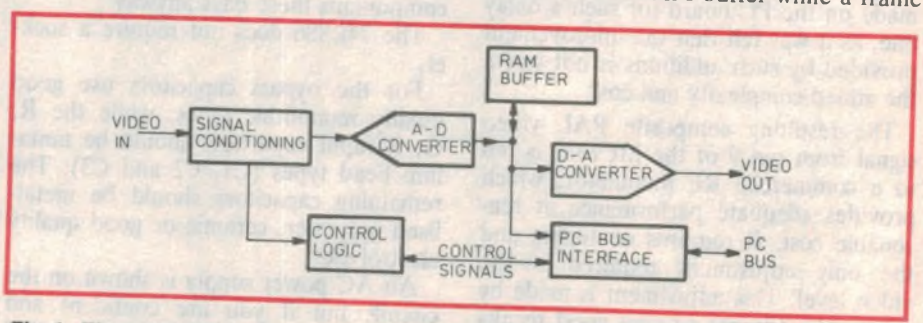
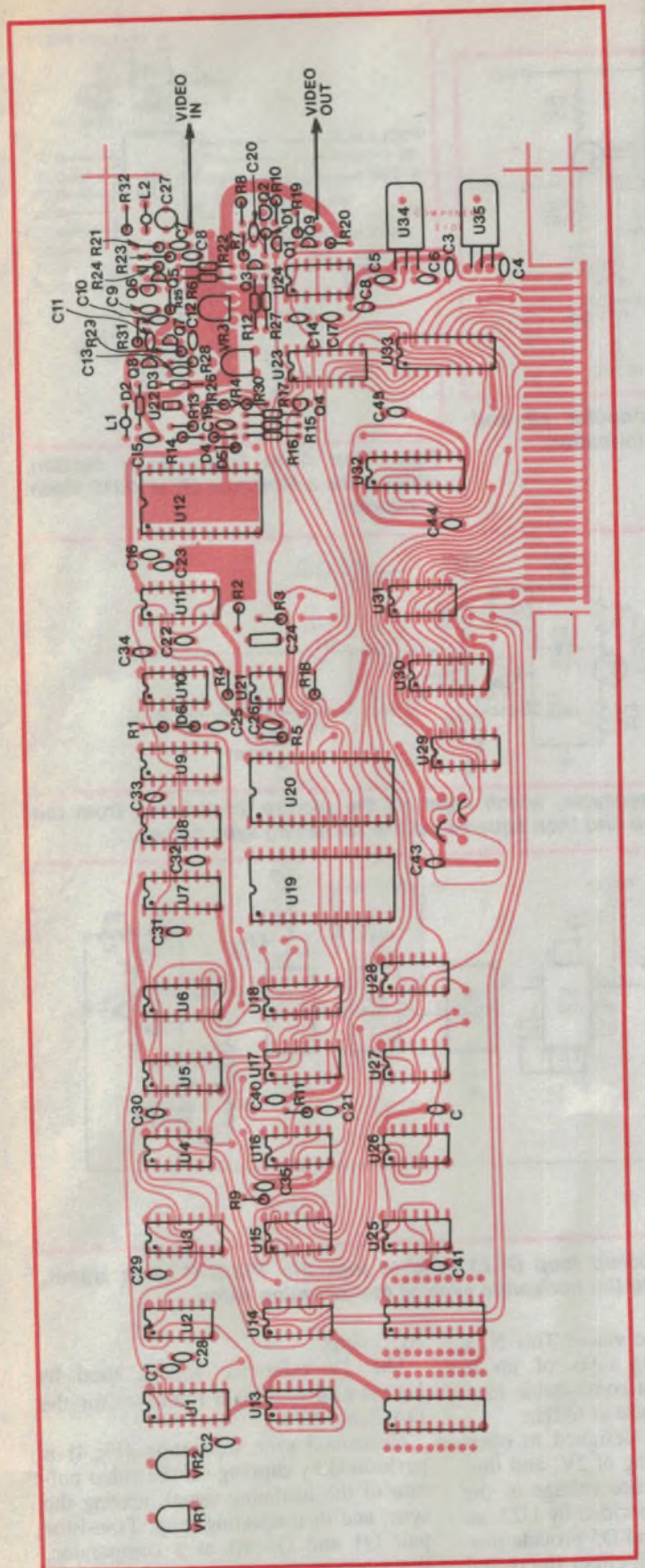
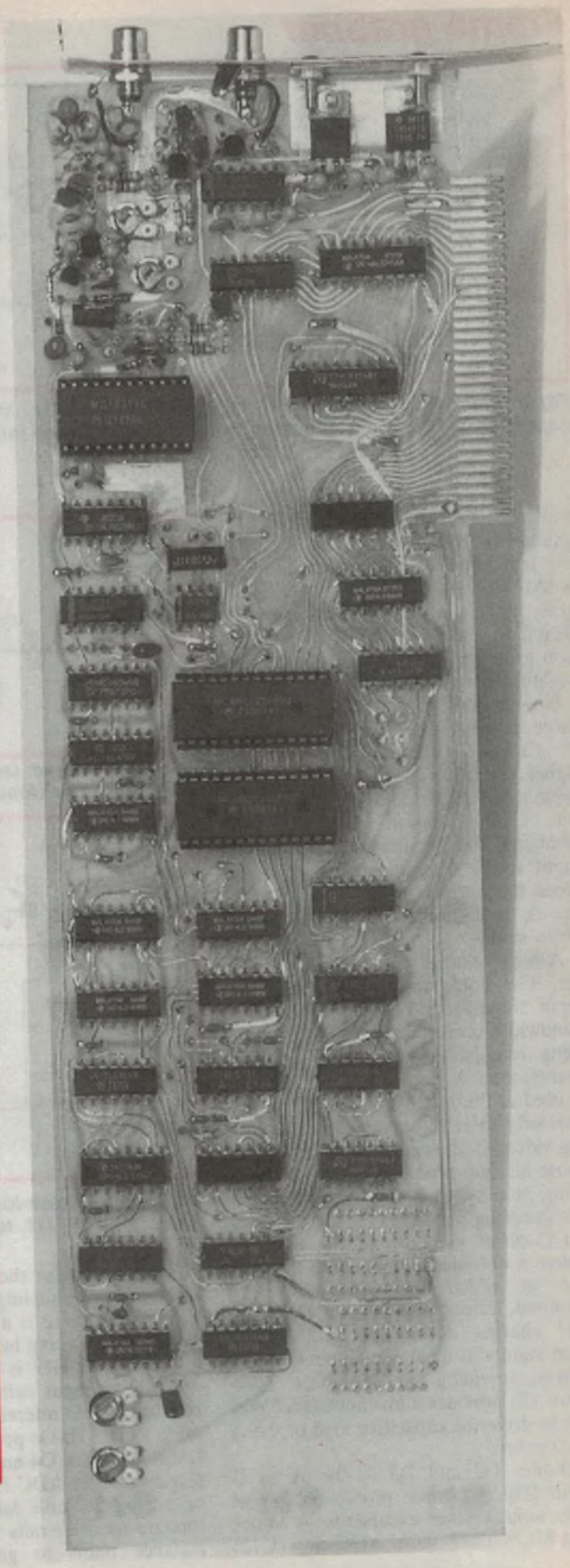


Fig.1: The overall block diagram for the the author's frame grabber, which fits on one double-sided PC-compatible 'long' card.





The wiring diagram for the card, along with a close-up photo. Actual-size PCB patterns are available via the Reader Information Service, for $10.

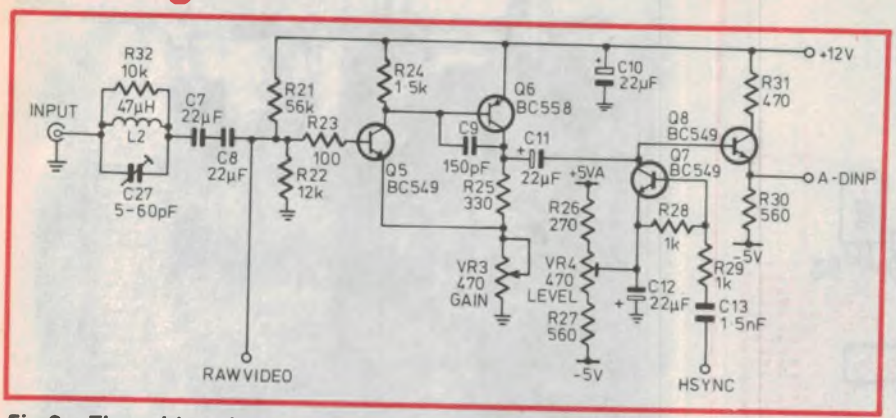


Fig.2: The video input signal conditioning circuitry. Inductor L2 and capacitor C27 form a trap circuit, to reject chrominance information.

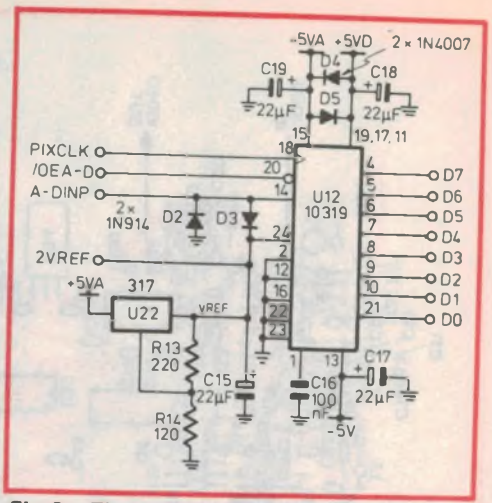


Fig.3: The A to D converter section, which uses a Motorola MCM10319 'flash' converter.

is being grabbed. A single frame requires 64K bytes of buffer storage. The PC bus interface allows access to the RAM buffer by the host PC. During grab mode and re-display mode, the digital to analog converter (DAC) section provides video output for monitoring purposes.

Now to look at the circuit sections in more detail. To allow for differences in the various sources of video signal, the signal conditioning section (Fig.2) has both variable gain and variable DC offset. Gain variation is obtained by changing the feedback factor of the input stage. A nominal gain of 3 provides the correct level at the input to the A to D from a 1 volt composite video source.

A high value of compensation capacitor, C9, holds the bandwidth of the input stage around 2.5 to 3MHz. This bandwidth corresponds to half the sampling rate, to satisfy the Nyquist requirements. A trap tuned to 4.438MHz is used at the input to eliminate any colour subcarrier component in the incoming video. If allowed to pass, this would cause aliasing problems during the sampling process, as it is greater than half the sampling frequency.

DC offset variation of the incoming video is obtained by changing the voltage at which the input signal is clamped, during sync periods. Capacitor C11 charges during the sync pulses, then maintains its charge in between the pulses, providing the DC offset. Transistor Q8 provides a low impedance output to drive the capacitive load of the A to D input.

Diodes D2 and D3 at the A to D input (Fig.3) provide protection against wide input voltage excursions. A Motorola MCM10319 'flash' ADC chip (U12) is used to digitise the video. This IC is effective at sampling rates of up to 25MHz, so there is a comfortable margin when operating here at 6MHz.

The MCM10319 is designed to operate with an input swing of 2V, and thus requires a DC reference voltage of the same value. This is provided by U22, an LM317. Diodes D4 and D5 provide protection for the ADC if either the digital or analog 5V rails fail. Bypass capacitors are used liberally to ensure low impedance paths to ground about the ADC chip.

The 2V reference voltage used by U12 is also used as a reference for the DAC chip U23.

Horizontal sync separation (Fig.4) is performed by clipping off the video portion of the incoming signal, leaving the sync, and then squaring it up. Transistor pair Q1 and Q2 act as a comparator, thresholding the clipped video signal. The effective threshold voltage of this section is approximately 0.1V above the negative sync tips. Vertical sync separa-

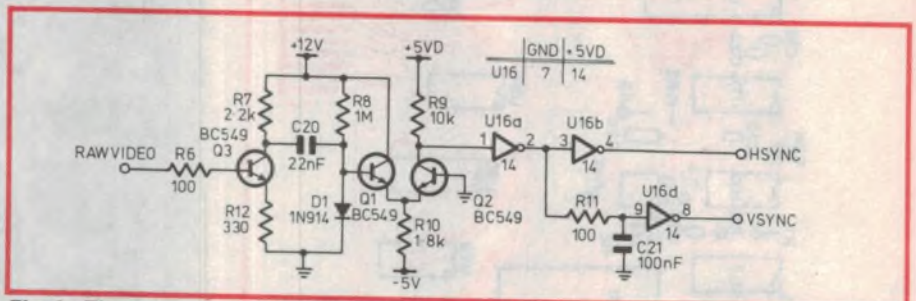


Fig.4: The sync separator, which clips off the picture information from the incoming raw video and then squares up the remaining sync pulses.

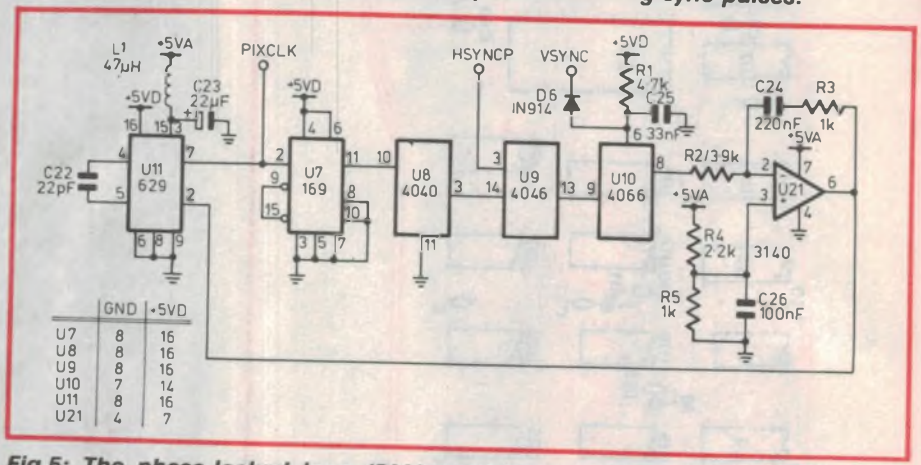


Fig.5: The phase-locked loop (PLL) used to lock the 'PIXCLK' clock signal, generated by U11, to the horizontal sync of the incoming video.

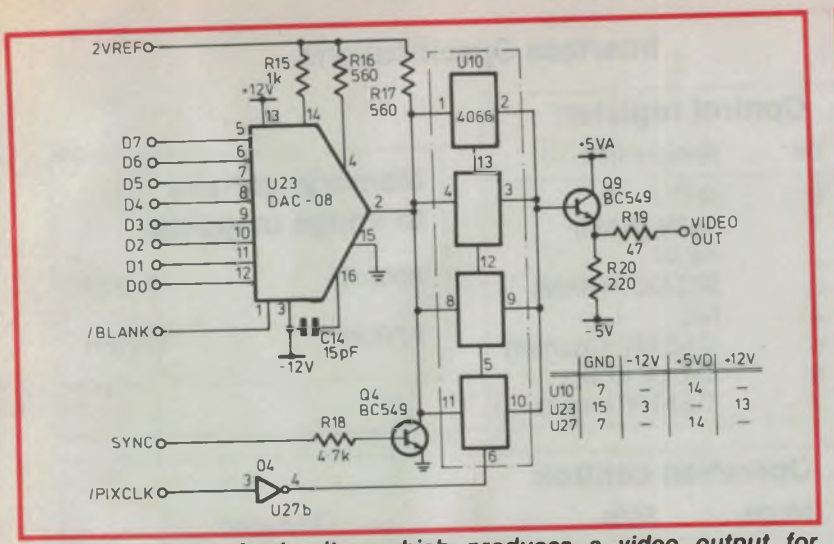


Fig.6: The D to A circuitry, which produces a video output for monitoring grabber operation. U10 performs sample and hold.

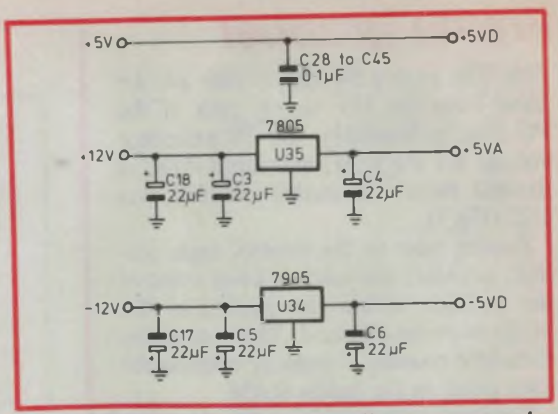


Fig.7: Separate +5V supply lines are used for the analog and digital circuitry.

tion is performed by integration of the separated horizontal sync signal. Schmitt trigger gates are used to ensure clean transitions of the digital sync pulses.

A phase locked loop (PLL) is used to keep the frame grabber clock signal 'PIXCLK', generated by VCO U11 (Fig.5), at a multiple of the horizontal sync frequency of the incoming video. The division ratio is fixed at 384, giving a pixel clock rate of approximately 6MHz or a period of 167us. As there are 256 pixels per line, the active digitising window is therefore approximately 43us wide, leaving 20us for sync and blanking pulses. Divider U7 provides a division of 12 and U8 provides a division of 32, giving the total ratio of 384.

During vertical sync periods, the phase locked loop is disabled by U10. This action reduces the effect of the change in horizontal sync frequency that occurs at this point. The PLL filter used is a charge pump type using U21, with C24 being the reservoir.

This circuit has a lock range from 10kHz up to around 22kHz, thus allowing for a wide range of video scan frequencies. Inductor L1 is used to filter out noise from the digital sections of the circuit on the VCO supply, improving the stability.

Video output for monitoring the digital image is provided by a DAC (D to A converter) operating off the frame grabber data bus (Fig.6). The DAC chip used is a DAC-08 (U23). Blanking is performed by disabling the D to A logic inputs, forcing the analog output to minimum value. A basic sample and hold circuit is used to clean up the output of the D to A. This is required, as the settling time of the D to A is approximately 100ns – i.e., half the clock period. The sample and hold samples in the second half of the clock cycle, after the D to A has settled.

The 'sampling' is done here by the four sections of a 4066 analog switch U10, wired in parallel. The self capacitance of U10 itself is sufficient for the hold capacitance. Quite a large level of pixel clock signal leaks through the 4066 from the control input, to the video output. However as this is synchronised to the video, it does not affect the picture quality.

The nominal output swing of the DAC is from 2V (full white) down to 0.64V (blanked). Transistor Q4 effectively clamps the DAC output to 0V when horizontal sync is active, to provide an output sync signal.

Note that the video output is delayed a pixel period, compared to the sync pulses, due to the latching process in the DAC. An emitter follower provides a defined low impedance output for driving a cable load. When terminated with 75 ohms, the output swing is 1V p-p.

Separate analog and digital 5 volt supplies are used, to minimise the effect of power supply noise on the analog sec-

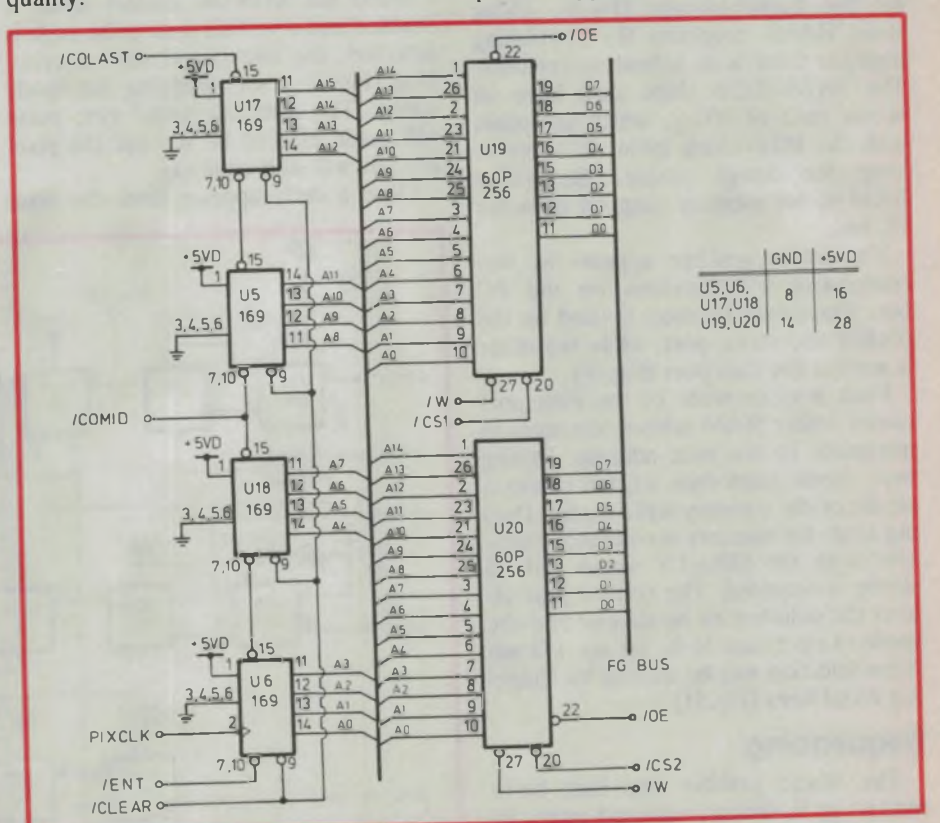


Fig.8: The video frame storage memory uses two MCM60P256 static RAM chips, obviating the need for any refresh circuitry.

tion. The analog 5V supply rails are derived from the 12V supply rails of the PC (Fig.7). Similarly, the 2V reference voltage for the DAC and input ADC is derived from the analog 5V rail, via U22 (Fig.3).

Passing now to the control logic section, counters are used to keep track of the position within the image, as the image is being digitised. These counters therefore provide a memory address for each pixel, in the buffer RAM.

Counter section U6/U18 (Fig.8) keeps track of the position within the line being digitised, while counter section U5/U17 keeps track of the line number. The counters are triggered from the sync pulses, after a time interval determined by their respective one-shot delays (Fig.9). Variation of the one-shot time intervals is used to move the digitising window about the picture for alignment.

Latches U13 and U25 form single pulsers, that are used to synchronise the horizontal sync and increment signals to the pixel clock. The single clock pulse wide signal from the single pulsers allows the respective counter to clock once for each input pulse, irrespective of the width of the input pulse.

Two 32K x 8 static RAMs are used for the frame storage (Fig.8). Using static RAMs simplifies the controlling logic, as there is no refresh to consider. The MCM60P256 chips used have an access time of 100ns, which compares with the 167ns clock cycle. In order to keep the design simple, the buffer RAM is not memory mapped onto the PC bus.

The frame grabber appears as two consecutive I/O locations on the PC bus. The lower location is used as the control and status port, while the other is used as the data port (Fig.10).

Each read or write of the data port causes buffer RAM address counters to increment to the next address. During write mode, each byte written causes a strobe of the memory write signal. During read, the memory is continually enabled with the SELECT signal and no strobe is required. The control port allows the counters to be cleared and the mode of operation to be set up. I/O address selection can be altered by changing wired links (Fig.11).

Sequencing

The frame grabber has four basic modes: grab, freeze, read and write. In both the grab and freeze mode, the circuit continually cycles, either storing the consecutive frames, or re-displaying the currently stored frame. In the buffer read and write modes, the circuit ignores the sync pulses and is clocked by the PC bus read or write activity.

When the RUN-bar control signal is enabled and a vertical sync pulse edge is detected, the circuit will start a cycle. U3a (Fig.9) is set, dropping the ready status. The next horizontal sync pulse will cause U3b to be set and the pixel counter will start counting.

Once a carry appears from the pixel counter, indicating the end of the line, U3b is reset. At this point the line counter increments once. This sequence repeats for each line of the picture. When a carry appears from the line counter, U3a is reset and the process stops. The process will repeat each time a vertical sync pulse is detected if RUN-bar is active.

Construction

As you can see from the photograph, the frame grabber is constructed on a

Interface Specifications

Control register:

Bit	Assignment
0	N/C
1	/R-W (RAM)
2	/RUN
3	SELECT (RAM)
4	N/C
5	/CLEAR (Counter)
6	/OE (A to D)
7	/READY (Input)

Memory address to image mapping:

0000H	0100H
FF00H	FFFFH

Operation control:

Mode	Byte	Operation
Free run	53H	Video input is echoed to output
Halt	04H	Halt and don't start next frame
Freeze	79H	Current frame stored is re-displayed
Clrread	EDH	Clear address register ready for read
Read	FDH	Read in data
Clrwrite	E7H	Clear address register ready for write
Write	F7H	Write out data

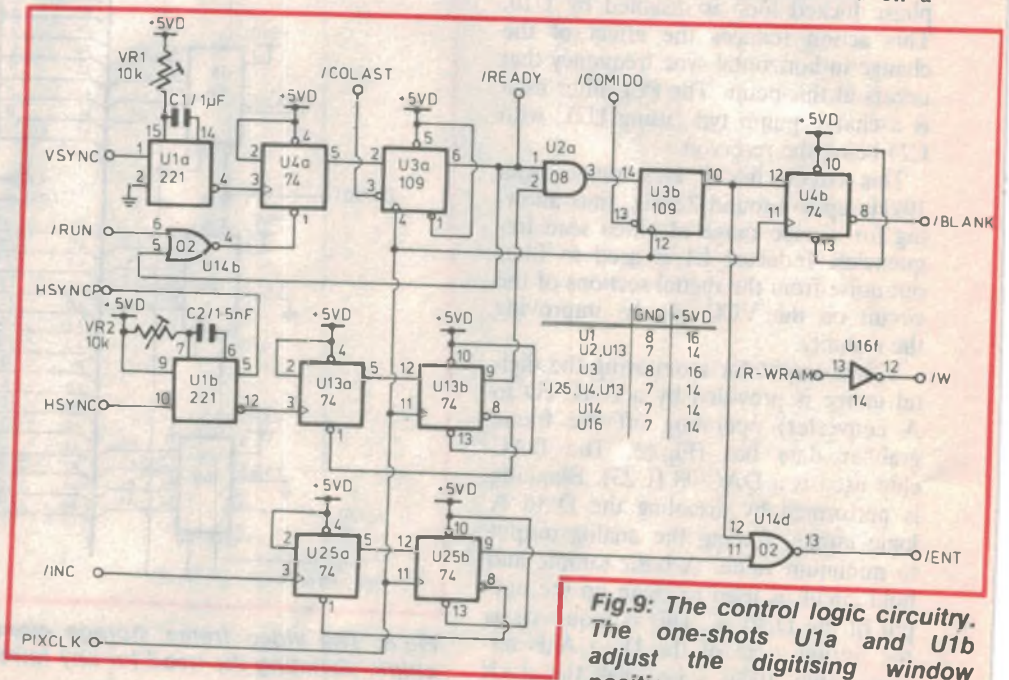


Fig.9: The control logic circuitry. The one-shots U1a and U1b adjust the digitising window position.

single full-length PC card which plugs directly into a card slot on an IBM PC or compatible. The PCB is double sided, with copper tracks on both sides, but need not be provided with plated-through holes as there are not a huge number of through connections and these can be made by carefully soldering component leads on both sides.

There are two pieces of metalwork to construct, the back panel/mounting bracket and the regulator chip heatsink. The dimensions for these are shown in Figs.14 and 15 respectively.

The easiest way to make the back panel/mounting bracket is to use a standard blank 'filler' panel and drill four holes as shown in the drawing – two 7mm in diameter for the video connectors, and two 3mm in diameter for the heatsink bracket.

A piece of 0.5mm aluminium is used for the heatsink. This gauge of material can be bent into shape with a large pair of pliers relatively easily if sheetmetal-working tools are not available. It is provided with four 3mm holes as shown.

Assembly of the PCB should be a straightforward process. First of all mount the two regulators, U34 and U35, placing the heatsink between the regulators and the PCB. Be sure to insulate the -5V regulator (U34 - 7905) from the heatsink. Then secure the back panel to the heatsink and fit the video connectors.

The discrete components should be inserted and soldered next, taking care with the polarity of electrolytic capacitors, transistors and diodes. Then mount the ICs.

Sockets should be used for the A to D (U12), D to A (U23) and memory chips (U19, U20) to facilitate easier testing. Be careful not to bridge between any of the IC pins during soldering. If the PCB does not have plated through holes, be sure to solder the connections on the component side well.

Leave the A to D and memory ICs out of circuit at this stage, until preliminary tests have been performed. Initially pre-align the preset pots near the positions visible in the photograph.

Address jumpers

The I/O address location options provided for the frame grabber are 2E2H/2E3H or 6E2H/6E3H. These are the addresses defined by IBM for a data acquisition adapter in the PC's I/O map. The jumper settings required to set up the card for these two addresses are shown in Table 1.

Address Jumper settings	
Address	Jumper links
2E2H/2E3H	E1 – E2, E5 – E6
6E2H/6E3H	E2 – E3, E4 – E5

TABLE 1: Addressing options for the card.

Checking it out

First of all inspect the PCB in the vicinity of the +12V and -12V supply rail tracks. A short between one of these and a logic line will be sure to cause damage, maybe even to your PC.

It is recommended that the unit should be powered up gradually with a bench supply initially, to avoid any serious damage that may occur if there are any shorts or misplaced components.

The first step is to apply 5V to the digital supply rail. Using the bench supply, bring up the voltage slowly, watching the current consumption, until 5V is reached. Check for a current consumption of around 270mA. If it is significantly different, turn off and look for the problem. Note that the analog supply will come up also, due to the diodes protecting the A to D converter chip.

Once the digital section appears OK, try the +12V rail. Current consumption this time should be around 300mA. Quickly check that the analog 5V rail is OK and the 2V reference voltage is pre-

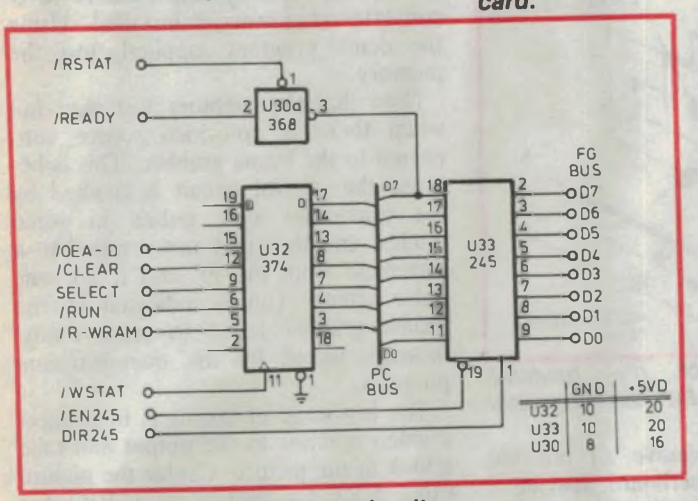


Fig.10: The PC bus interface circuit.

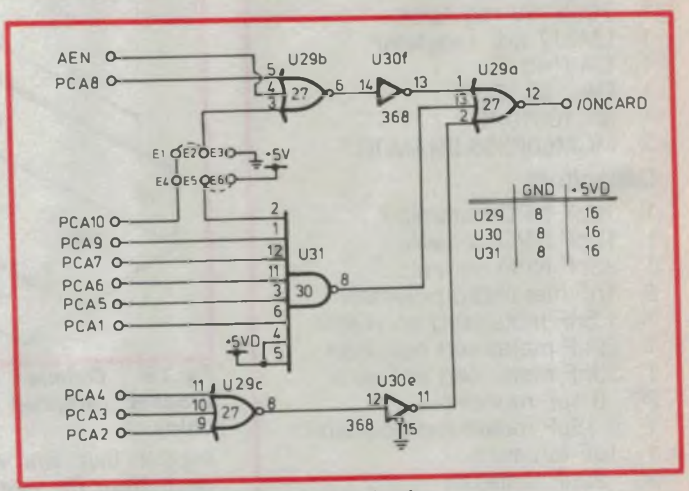


Fig.11: The address decoding logic.

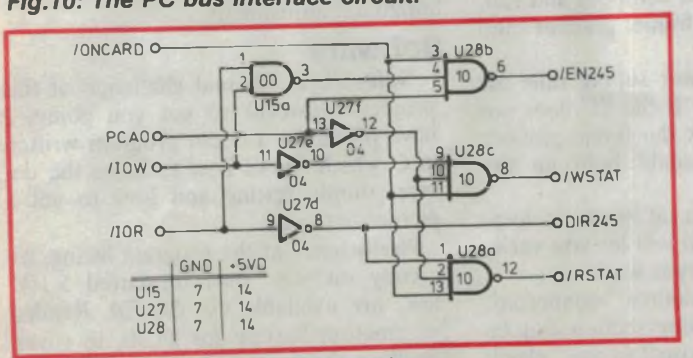


Fig.12: The control signal decoding.

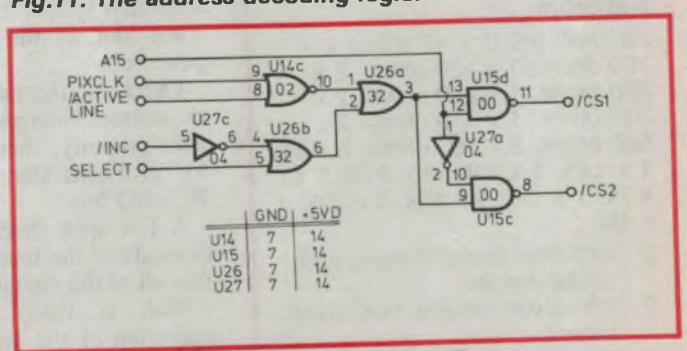


Fig.13: The memory chip select decoding.

PARTS LIST

1 PC board, double sided
1 Back panel bracket
1 Heatsink bracket
2 BNC or RCA connectors, panel mounting
2 RF inductor, 22uH

Semiconductors

2 1N4007 diodes
4 1N914 diodes
5 BC549 or similar transistor
1 BC558 or similar transistor
1 4016 IC
1 4040 IC
1 4046 IC
1 4066 IC
1 74LS00 IC
1 74LS02 IC
1 74LS04 IC
1 74LS08 IC
1 74LS10 IC
1 74LS14 IC
1 74LS27 IC
1 74LS30 IC
1 74LS32 IC
3 74LS74 IC
1 74LS109 IC
5 74LS169 IC
1 74LS221 IC
1 74LS240 IC
1 74LS245 IC
1 74LS374 IC
1 74LS629 IC
1 7805 5V regulator
1 7905 -5V regulator
1 LM317 adj. regulator
1 CA3140 IC
1 DAC-08 IC
1 MC10319 IC
2 MCM60P256 SRAM IC

Capacitors

1 10pF NPO ceramic
1 15pF NPO ceramic
1 33pF NPO ceramic
2 1nF metallised polyester
1 1.5nF metallised polyester
1 22nF metallised polyester
1 33nF metallised polyester
20 0.1uF monolithic
1 0.15uF metallised polyester
1 1uF tantalum
20 22uF tantalum

Resistors

All 1/4W 5%: 1 x 47 ohms; 2 x 100 ohms; 1 x 120 ohms; 2 x 220 ohms; 1 x 270 ohms; 2 x 330 ohms; 1 x 470 ohms; 2 x 560 ohms; 2 x 680 ohms; 5 x 1k; 1 x 1.5k; 1 x 1.8k; 2 x 2.2k; 2 x 4.7k; 1 x 10k; 1 x 12k; 1 x 22k; 1 x 1M

2 470 ohm linear trimpot, horizontal mount
2 10k linear trimpot, horizontal mount

sent. Then turn off as soon as possible, to avoid overheating of U35. Remember that the digital supply will again be up, because of the A to D protection diodes.

Now for the -12V rail. Current consumption should be around 35mA. You should also check the -5V rail for the correct voltage, as this is derived from the -12V rail.

If all seems to be well at this stage, you should now be ready for powering up the card in a PC. As a precaution, I

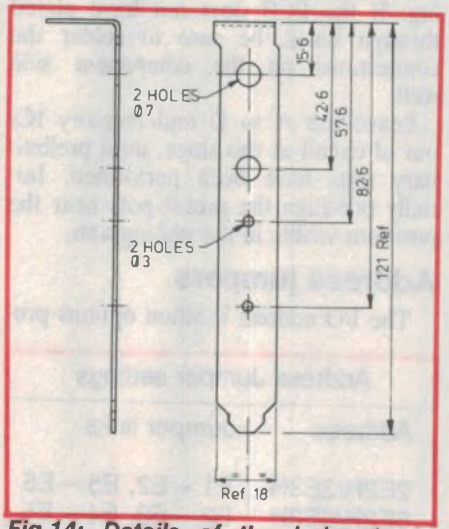


Fig.14: Details of the holes to be drilled in the rear mounting bracket.

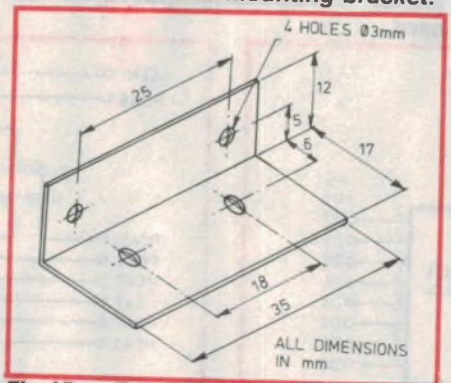


Fig.15: Details of the heatsink bracket required for the regulator chips.

suggest that you remove all possible cards from the motherboard, leaving a minimum system that will boot and run. Then slot in the frame grabber and power up.

Check all the power supply rails for the correct voltages. If the PC does not boot properly, check the frame grabber for problems that could hold up the PC's I/O bus.

A few spot checks at strategic locations about the board will let you verify that all of the circuitry is working.

With a video source connected, operation of the analog section can be checked. Using an oscilloscope, check that video is present on pin 14 of U12. If no video is present, the signal conditioning section needs to be checked.

Separated horizontal sync pulses should be present on pin 4 of U16, and similiarly separated vertical sync pulses should be present on pin 8 of U16.

To check for correct operation of the phase locked loop, inspect the signal on pin 2 of U11. This should be a steady voltage of about 2V, with a small 'bump' during vertical sync periods.

Analog alignment

An oscilloscope is required for good alignment of the analog section. With a video source connected to the input, connect the 'scope to the top end of R30 and adjust the level shift (VR4) and gain (VR3) to center the video signal in the 0 – 2V digitising window of the A to D. Note that the sync tips should be *below* this window.

To adjust the colour subcarrier trap, connect a colour video source to the input and monitor the video signal on the base of Q5 with the 'scope. Trigger the 'scope so that the colour subcarrier burst can be seen (on the 'back porch' of the horizontal sync pulse). Then adjust C27 to minimise the level of this subcarrier burst.

Testing

Now the memory chips and A to D converter chip can be installed. Using the demo program supplied, test the memory.

Note that the memory test may fail when there is no video source connected to the frame grabber. This is because the control circuit is clocked by the horizontal sync pulses in some modes, and thus may not respond to a command from the PC bus if no sync pulse occurs. This is indicated by the 'frame grabber failed to come ready' message issued by the demonstration program.

The last stage of testing is to connect a video monitor to the output and take a look at the picture. Center the picture using VR1 for vertical and VR2 for horizontal adjustment.

Software

Software is the real challenge of this project. However to get you going, I have produced a demo program written in *C* which shows how to drive the device, simple testing and how to get a picture onto disk.

Photocopies of the program listing, or a copy on your own formatted 5-1/4" disk, are available via the *EA* Reader Information Service for $4.50, to cover handling and postage.

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H 0403	GREY	132	89	126	$85.00	$80.00	$5.00
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H 0412	BLACK	88	57	82	$79.95	$75.00	$4.95
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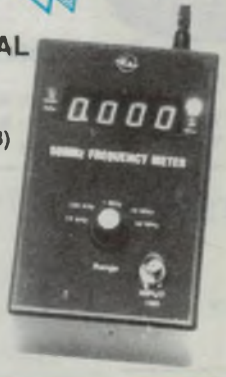

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(See EA March/April'89)

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Features:(See EA Jan/Feb'85 or our 1989 Catalogue for full features)

Kit (Less Battery Back Up) K 1900 **$149.50**

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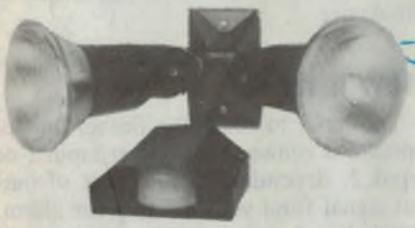

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Construction Project

Hazard light flasher for car alarms

Enhance your car alarm with this simple unit that will flash your car blinkers and pulse the horn whenever the alarm is activated. It is easily connected into any existing car alarm system and a complete kit costs a mere $19.50.

by BRANCO JUSTIC and PETER PHILLIPS

Car alarms have to attract as much attention as possible when they are triggered. After all, the idea is not only to scare the intruder, but to identify the car that is being broken into, in the hope someone will do something about it. In a car park, it is often very difficult to pinpoint the sound, and some form of visual indication is often the only way to identify precisely which car is making all the noise.

Most car alarms these days use a siren of some sort, which range from unpleasantly loud to deafening. Many commercial alarms also have inbuilt electronics that flashes the vehicle's hazard lights during the full alarm period. This feature is not difficult to add, and is the main function provided by the project described here.

While we were at it, we also decided to make provision for another relay that could be used to pulse the horn. Just having the horn blast away is often insufficient to attract attention, as it could be mistaken for a fault, or little Tommy playing with daddy's car. But if the horn is caused to pulse, it becomes obvious that an alarm situation is being sounded.

Many *EA* readers are likely to have built their own car alarm, or are planning to do so, and this unit will provide the interface needed to complete the job. Because sirens can be very expensive, this project will probably save you money into the bargain, by utilising the car's horn instead, but in intermittent mode rather than sounding continually.

The whole unit fits in a small plastic box, which can be mounted to give the best security as well as access to the wiring of your car. The entire circuit is mounted on the PCB, making construction extremely easy. To enable it to work with any alarm, the unit has two inputs to allow it to operate with either an active high or an active low output from the alarm module.

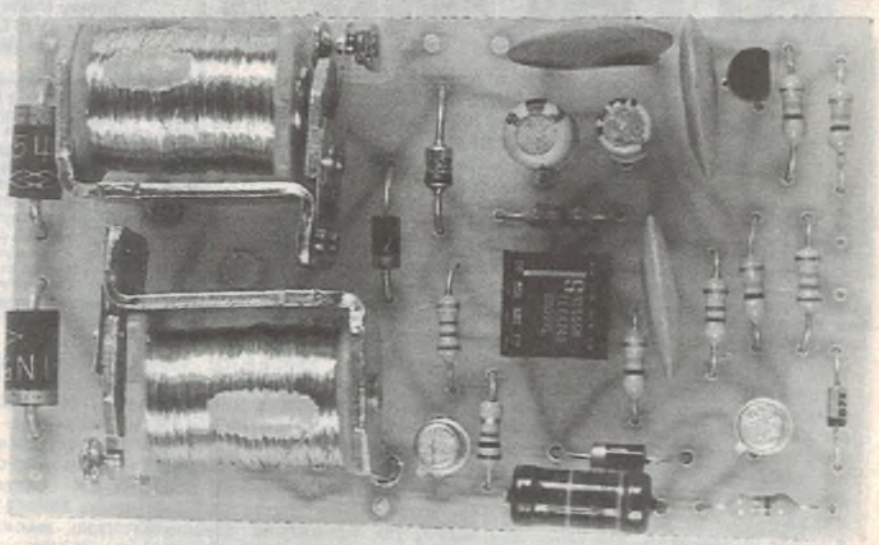
The on-board relays are both heavy current types, and can drive loads of around 10 amps, which should cater for the blinker systems of most cars. The second relay can drive the horn directly, although many cars are already fitted with a horn relay operated from the horn button, giving a relatively small load current for the interface.

Connection to the car's electrical system requires the usual 12V supply and ground connections, as well as two wires to the blinkers, one to the horn and a single wire connection to the alarm module. But first to the circuit of the device...

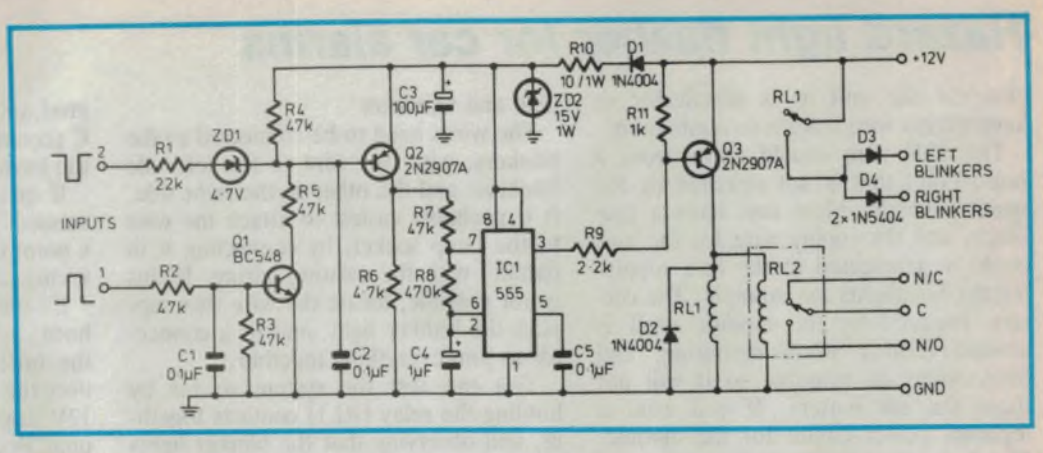
How it works

The input to cause the flasher unit to operate is connected to either input 1 or input 2, depending on the type of output signal from your existing car alarm. Input 1 accepts a positive signal, and this input would be used if your alarm produces a 'logic 1' as its output during an alarm state. Normally, the output of the alarm would be 12V in this case, although the flasher unit will recognise an input as low as 5V.

When a positive input signal is applied to input 1, Q1 receives base current via resistor R1, causing it to switch on. This causes transistor Q2 to operate, as it is now forward biased due to the collector voltage of Q1 having



This simple unit can enhance your existing car alarm by flashing the blinkers during an alarm state. It can also pulse the horn, if required.



The circuit diagram. IC1 is a 1Hz astable oscillator operating Q3, which in turn drives two heavy duty relays. RL1 switches the blinkers and RL2 can be used to pulse the horn.

dropped to virtually zero. When Q2 turns on, its collector voltage rises to around 12V, supplying the timing components for the astable multivibrator associated with IC1.

As a result, the astable starts operating, commencing its cycle by first sending the output of IC1 (pin 3) high, then, after a timing cycle, low. This will cause Q3 to conduct, energising both relays. When the astable switches the output of IC1 high, Q3 will turn off. The relays are therefore switched on and off by the astable, at a rate determined by R7, R8 and C4.

The circuit will continue oscillating as long as the input signal is present, which, according to the noise pollution laws should only be for a limited time. The pulse rate is set to around half a second on, followed by half a second off. Changing the value of either R8 or C4 will alter this frequency, without changing the duty cycle.

Input 2 is used if the alarm module gives a low output when activated, and operates Q2 directly via R1 and ZD1. The voltage level at this input needs only to fall below the value of the zener voltage plus 0.6V. There is also a certain voltage drop across R1, and on the prototype, the unit would operate for input voltages less than 7V. If you want a lower operating voltage, the zener diode can be changed to one of a different value, or deleted altogether. The present arrangement means the output of the alarm only has to drop by around 5V from its normal 12V level, giving a good margin for loading effects.

Capacitors C1 and C2 provide filtering for any noise that may be picked up by the wiring between the inputs (1 or 2) and the alarm unit. Diode D2 prevents the back EMF generated by the inductance of the relay winding from damaging the driver transistor Q3. Resistor R10 and zener diode ZD2 provide over-voltage protection and also prevent possible voltage spikes on the power supply from damaging IC1.

The two diodes D3 and D4 are used to isolate the left and right blinker lights, so that normal operation is not affected. With this arrangement, when the alarm causes the relay (RL1) to start operating, all blinkers will flash, as supply is now provided to both sides through the diodes. These diodes are heavy current types to handle the load current required by the lights.

Construction, testing

A complete kit of parts for this project is available from Oatley Electronics, which has been able to source the special relays required, and has produced a PCB to suit. If you decide to build the unit by sourcing your own parts, make sure the relays are capable of switching at least 10 amps.

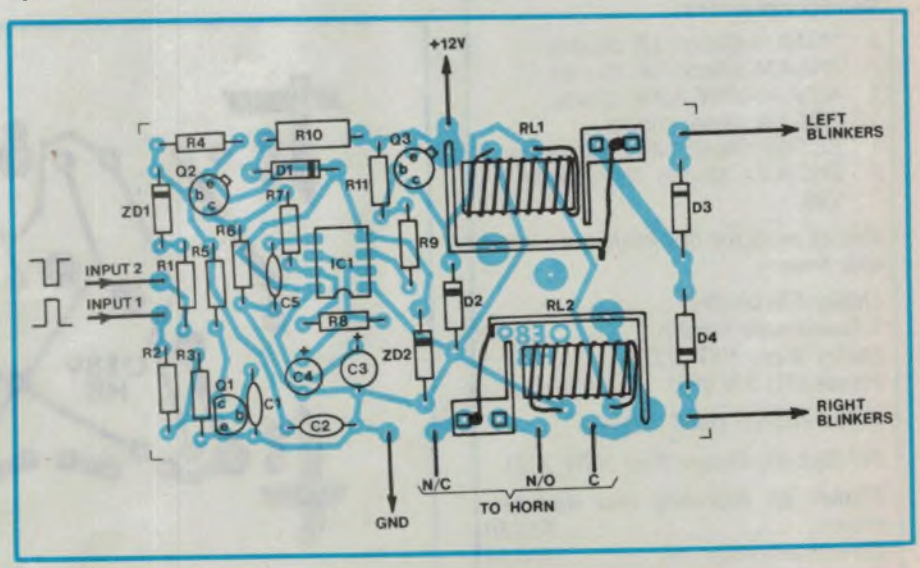
Construction of the PCB is very easy, and the usual check for correct orientation of the polarised components is about all that is required. The IC should be mounted in a socket, to make replacement easy should the IC become faulty when the unit is fitted to the car.

After assembly and the usual checks, connect the unit to a 12V DC power supply. Using a short length of hook-up wire, connect input 1 to the +12V supply and check that the relays pulse on and off at an approximate rate of 1Hz. Also check that connecting input 2 to ground causes the relays to pulse in the same manner. If the unit works so far, it remains to install it in the vehicle.

Installation

Installation is simply a matter of mounting the unit in the car and connecting the required wires. The first decision is where to mount the unit, although near the alarm module is probably the best place. Obviously it should be mounted out of sight, so an enterprising thief cannot get to it and silence the alarm easily.

Prior to mounting the unit, attach the wires that will be needed, using a heavy gauge for the 12V supply, ground, horn and blinker wires. The ground wire should be attached to the car chassis, as



The layout diagram. Make sure the diodes used for D3 and D4 are heavy current types, as they need to pass the current for the blinker lights.

Hazard light flasher for car alarms

close to the unit as is practicable to keep excess wire lengths to a minimum.

The 12V wire should come from a fused point that is not switched by the ignition switch. Most cars have a fuse block, and the supply wire for the unit could be connected to the fuse supplying the headlights for example. The current required by the module itself is around 250mA when operating, and 5mA when on standby, so it will not drain the car battery. If you want a separate power circuit for the module, fit a fuse with a rating of 15A or so.

The wires to supply the blinkers should be run along an existing loom, held in position with tape or plastic ties. This minimises the possibility of the wires being damaged and shorting to the car chassis as a result of the normal heat and vibration.

The wires need to be connected to the blinkers, with one wire to the left side blinkers, and the other to the right side. It is probably easiest to attach the wire to the lamp socket, by connecting it in parallel with the existing wiring. If this is not possible, locate the wire that supplies the blinker light, and fit a connector to join everything together.

You can test the system so far by holding the relay (RL1) contacts together, and observing that the blinker lights come on. They won't blink, just remain lit while the relay is held on. This is because the blinker lights are normally energised from the car's blinker unit, which provides the on-off switching when power is fed to the blinker unit from the blinker switch.

Because the blinker switch is off (it should be, anyway), no feedback to the car's blinker unit will occur, and this part of the circuit will be isolated. If strange things happen, you may need to trace the circuit of the blinkers using the manual for your car. However, this is most unlikely unless your car has a rather non-standard blinker system.

The next wire to run is that for the horn. Most cars have a horn button that, when pressed, connects the horn wire to ground. This may energise the horn directly, or operate a relay used to drive the horn. However, some cars may switch the 12V supply via the horn button, and for this reason the relay contacts (RL2) have been left isolated from either ground or 12V. You will need to establish how the horn is operated, or simply connect the N/O and the C (common) contacts of the relay across the horn button itself.

If one of these wires is ground, then connect the common contact of RL2 to a point on the car chassis to simplify the wiring.

If the ignition switch isolates the horn, you could run a wire directly to the horn (or the horn relay) and connect the common contact of RL2 to the 12V supply used to power the flasher unit. Because the 12V supply to the unit will be fused, protection is provided in the event of a problem, although the fuse rating in this case will need to be able to handle the combined current of the blinkers and the horn. Again you can check the system by holding the relay contacts (RL2) together and confirming that the horn operates.

You may have decided not use the horn feature, as the alarm's own siren may be sufficient anyway. In this case, you can delete RL2, (but not D2), and the associated wiring to the horn.

Finally, run a wire from the alarm module to the flasher unit, and connect it to either input 1 or 2, depending on the type of output the alarm produces in the triggered state. You can easily test this by setting off the alarm, and seeing which input of the flasher unit responds.

Once everything is connected, a test of the unit should set all blinkers flashing and the horn sounding in unison with illumination of the blinkers. If all that doesn't attract attention, then it's difficult to say what will!

PARTS LIST

1 PCB coded OE89HB
1 plastic case – 31mm x 55mm x 90mm
1 or 2 12V high current relays
Screw, nut and washer

Resistors

All 1/4W, 5%: 1 x 1k, 1 x 2.2k, 1 x 4.7k, 1 x 22k, 5 x 47k, 1 x 470k.
1W 10%: 1 x 10ohm

Capacitors

3 0.1uF disc ceramics
1 1uF/16VW low leakage electrolytic (RBLL)
1 100uF/16VW Low leakage electrolytic (RBLL)

Semiconductors

2 1N4004 silicon 1A diodes
2 1N5404 silicon 5A diodes
1 4.7V 400mW zener diode
1 15V 1W zener diode
1 BC548 silicon NPN transistor
2 2N2907A silicon PNP transistors.

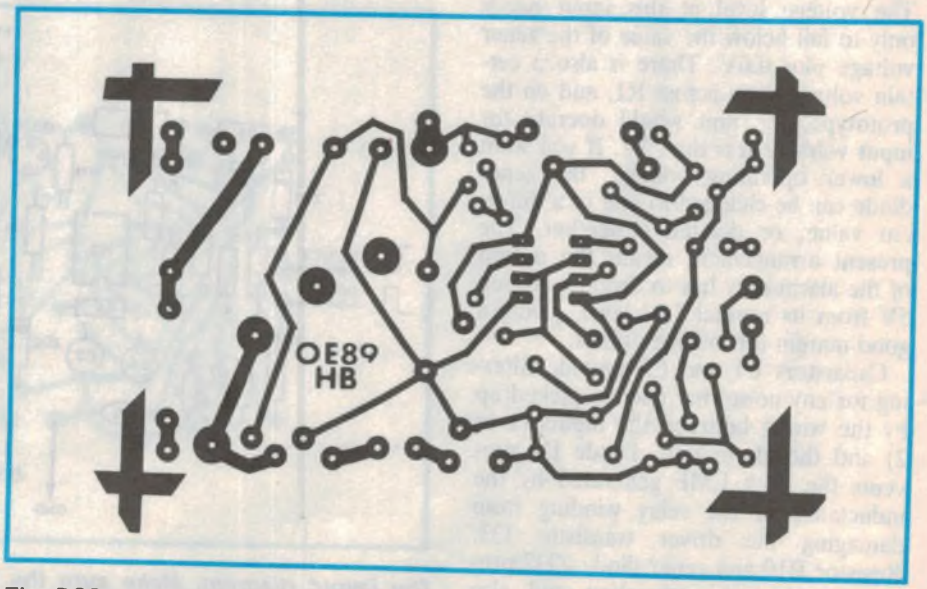
Kits of parts for this project are available from:

Oatley Electronics
5 Lansdowne Parade,
Oatley West, NSW 2223.
Phone (02) 579 4985

Postal address (mail orders):

PO Box 89, Oatley West NSW 2223.

Flasher kit including case and two relays..... $19.50
Kit with one relay only..... $16.50
Post & Packing charge..... $2.00



The PCB artwork for this project is shown full size.

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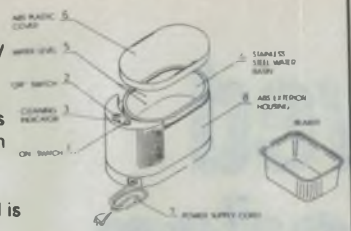

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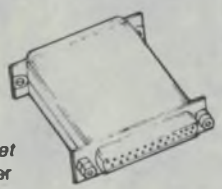

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Construction Project:

New, improved Teletext decoder – 3

In this third and final article dealing with our new Teletext decoder, we describe the optional TV tuner module. This fits into the main case, converting the decoder into a fully independent Teletext receiver. Any of 6 preset stations can be selected using the decoder's IR remote control.

The two preceding articles in this sequence gave details of the basic Teletext decoder and its matching IR remote control unit. You may recall that in its basic form, the unit has no TV tuner circuitry – being designed to accept composite video signals from an external TV tuner, receiver or video recorder.

While this saves money, it may not be all that convenient – especially if you want to use the decoder with a TV receiver which lacks a composite video output (and this would be most), or a video monitor which is not being used in conjunction a VCR.

As it happens, these shortcomings can be overcome quite easily and cheaply with the addition of a small TV tuner module to the basic decoder circuitry already described. The tuner module described here has been especially designed to match the decoder, and fits neatly inside the original case alongside the main PCB.

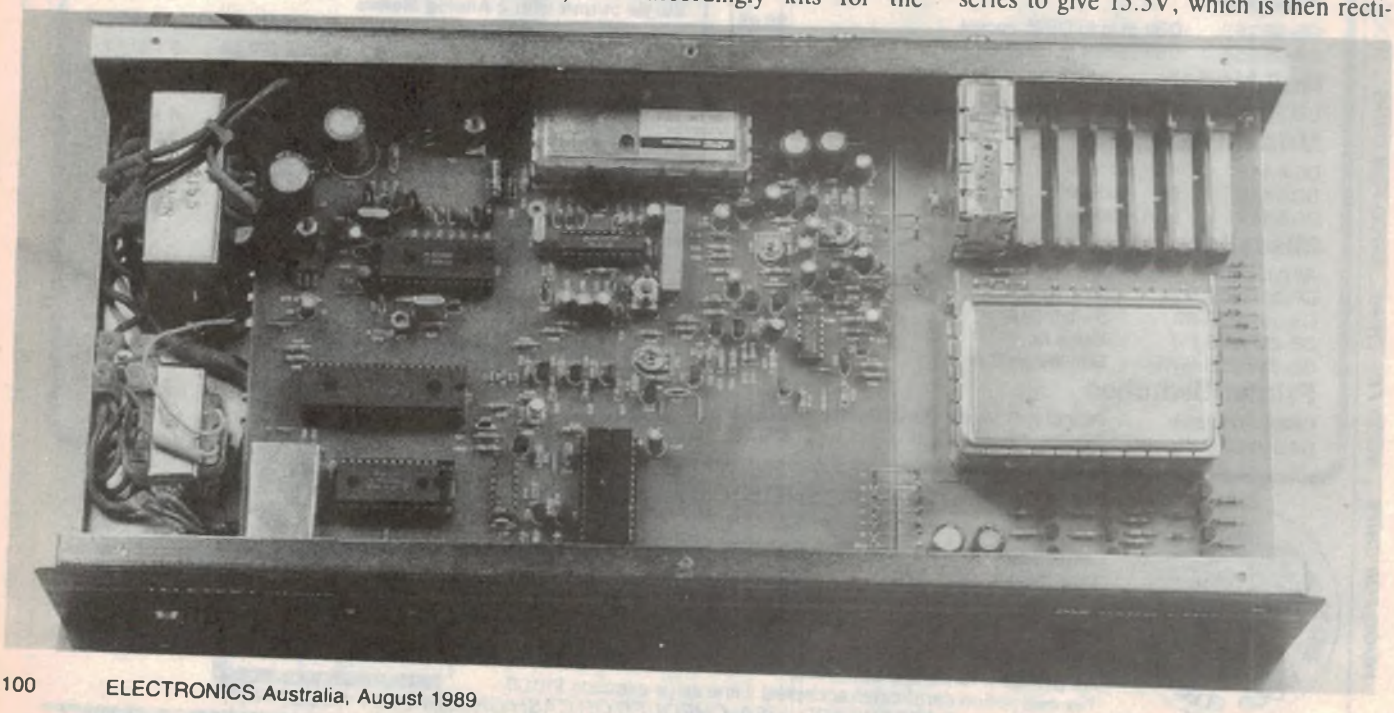
With the tuner module added, the decoder becomes a complete and independent TV receiving unit with Telelext facilities, and with all functions selected via the IR remote control. All that is needed for viewing either Teletext or normal TV programmes is a standard video monitor or TV receiver.

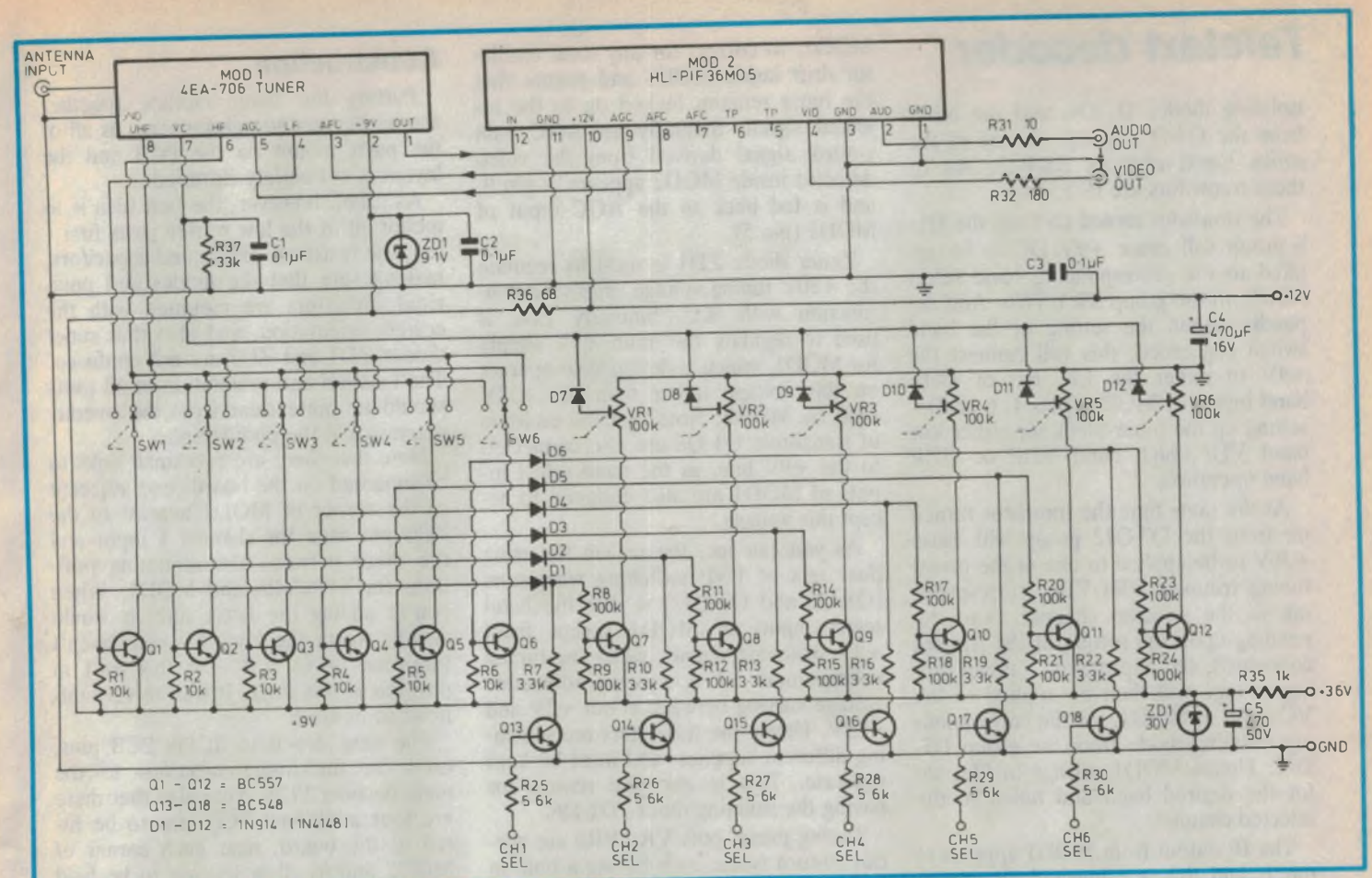
As with the main Teletext decoder, the development work for this new TV tuner module has been done by the R&D Department at Dick Smith Electronics, and accordingly kits for the module will only be available from that firm. However the cost for the tuner kit is very reasonable, at only $69.95. Its number in the DSE catalog is K-6361.

As you can see, all of the additional TV tuner circuitry fits on a compact PC board measuring 173 x 115mm, and coded ZA-1667. This even includes the six combination channel band switches and fine tuning pots, which are ultimately adjusted from the rear of the Teletext decoder case.

Note that although the TV tuner module requires a +36V DC input, for the tuning, the Teletext decoder power supply as described thus far only provides +12V and +5V. To provide the higher voltage required when the tuner module is added, it is necessary to add a second smaller power transformer, four more diodes and an additional electrolytic capacitor.

The additional transformer has two secondary windings, producing 7.5V and 7V respectively. These are connected in series to give 15.5V, which is then recti-





The complete schematic for the TV tuner module itself, based on two pre-aligned subassemblies.

fied. However by referencing the second rectifier and filter electro to the output of the main supply, rather than to ground, it is arranged to produce the +36V required.

How it works

At the heart of the tuner module are two pre-built and fully aligned 'black boxes' – or more accurately, tinplated boxes – which perform most of the work. One is a complete VHF-UHF front-end block (MOD1), while the other is a complete video IF/video detector/sound IF/FM sound detector block (MOD2).

The MOD1 block is actually a Murata type TUMUF4EA-721 tuner module, capable of tuning over all Australian VHF and UHF TV channels with its internal varicap system. It covers the channels in three switched bands – VHF low (channels 1-5), VHF high (channels 5A-12), and UHF (channels 21-69), and also has facilities for both AFC (automatic frequency control) and AGC (automatic gain control). Both of the latter are used here, to ensure high performance.

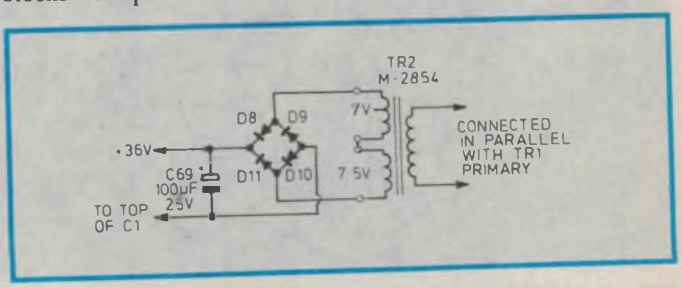
The matching MOD2 video/audio IF and detection block is made by Hwa Lin Electronics in Taiwan, and designated as type HL-PIF 36MO5. Although measuring only 81 x 54 x 25mm, it is a high performance unit, with a well-shaped bandpass characteristic and good rejection of adjacent carriers.

Essentially these two blocks perform all of the real signal processing of the tuner as a whole. MOD1 selects the desired TV signals and converts them down to the IF band, with the picture carrier translated to 26.875MHz and the sound carrier to 31.375MHz. Then MOD2 amplifies these IF signals and performs video detection, producing both the video signal itself and the 5.5MHz intercarrier sound IF – which it then amplifies further and finally passes through an FM detector, to deliver the audio signal.

All of the remaining circuitry in the tuner module is to either provide these two signal-processing blocks with power or control signals, or to extract the final video and audio. In fact most of the circuitry by far is for channel selection and tuning, as we will now explain.

When one of the channel select buttons of the IR remote control unit is pressed, to select one of the six pre-set channels, one of the six 'channel select' outputs on the main Teletext board will go to logic high – i.e., about +3.5V. As these outputs are connected to the six control inputs on the tuner module, one of these inputs will thus be taken high as well.

The effect of this will be to turn on one of the six NPN input transistors Q13-Q18 (BC548), causing its collector-emitter resistance to drop. And this in turn will provide base current to turn on the two PNP transistors associated with the input transistor concerned – one from the Q1-Q6 group, via one of the



The additional power supply circuitry required on the main decoder PCB, when the TV tuner module is added.

isolating diodes D1-D6, and the other from the Q7-Q12 group via one of the series based resistors R8-R23. All of these transistors are BC557's.

The transistor turned on from the Q1-6 group will cause +9V DC to be applied to the corresponding band select switch, in the group SW1-SW6. And depending upon the setting of the band switch concerned, this will connect the +9V to either the LF, HF or UHF band inputs of MOD1 (pins 4, 6 or 8) – setting up the tuner block for either low band VHF, high band VHF or UHF band operation.

At the same time the transistor turned on from the Q7-Q12 group will cause +30V to be applied to one of the preset tuning trimpots VR1-VR6, corresponding to the selected channel. And depending upon the setting of the trimpot concerned, the appropriate varicap tuning voltage will then be applied to the VC input of MOD1, via the corresponding isolating diode from the group D7-D12. Hence MOD1 springs to life, set for the desired band and tuned to the selected channel.

The IF output from MOD1 appears at pin 1, and this is connected directly to input pin 12 of MOD2. The video and audio then appear from pins 4 and 2 of MOD2, respectively.

An AFC correction signal derived from the FM sound detector inside MOD2 appears at pin 8 of that block, and is fed back to AFC control pin 3 on MOD1, to correct for any local oscillator drift inside MOD1 and ensure that the tuner remains locked on to the selected signal. Similarly an AGC gain control signal derived from the video detector inside MOD2 appears at pin 9, and is fed back to the AGC input of MOD1 (pin 5).

Zener diode ZD1 is used to regulate the +30V tuning voltage supply, in conjunction with R35. Similarly ZD2 is used to regulate the main +9V supply for MOD1, which is designed to operate on this voltage rather than the +12V used by MOD2. Note that the emitters of transistors Q1-Q6 are also connected to the +9V line, as the band select inputs of MOD1 are also designed to accept this voltage.

As you can see, the reason for using dual sets of PNP switching transistors (Q1-Q6 and Q7-Q12) is that the band select inputs of MOD1 accept fixed +9V switching signals, while the tuning voltage input VC accepts an adjustable voltage varying between about +2V and +25V. Hence the transistors are switching different supplies, and must be kept separate. This is also the reason for having the isolating diodes D1-D6.

Tuning preset pots VR1-VR6 are special 10-turn types, each having a built-in indicator 'dial'. In fact the band select switches SW1-SW6 are also built into the pots as well, with the same spindles used to operate both switches and pots. The switches are operated by pressing the spindles in and turning, while turning without pushing in operates the tuning pots.

Construction

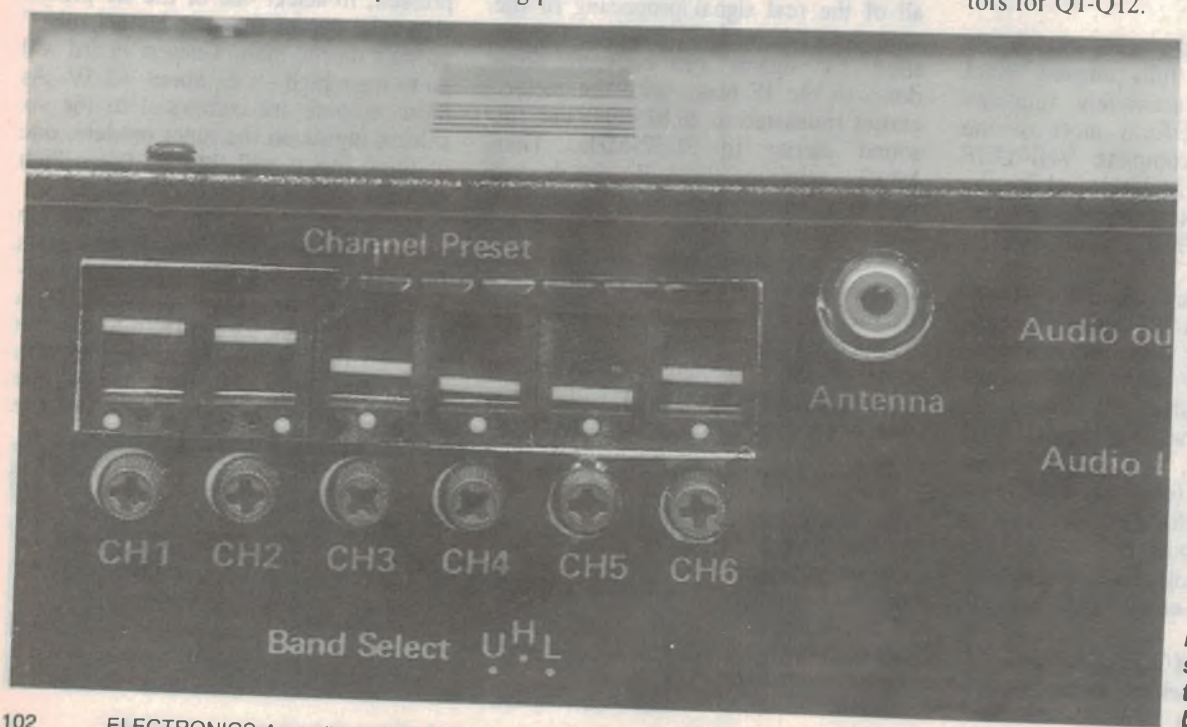
Putting the tuner module together should be very straightforward, as all of the parts mount on the PCB and the layout is not unduly cluttered.

As usual, however, the best idea is to mount all of the low profile parts first – i.e., the resistors, diodes and capacitors, making sure that the diodes and polarised capacitors are mounted with the correct orientation, and also that zener diodes ZD1 and ZD2 are not confused. The location and orientation of all parts should be quite clear from the overlay diagram and the photographs.

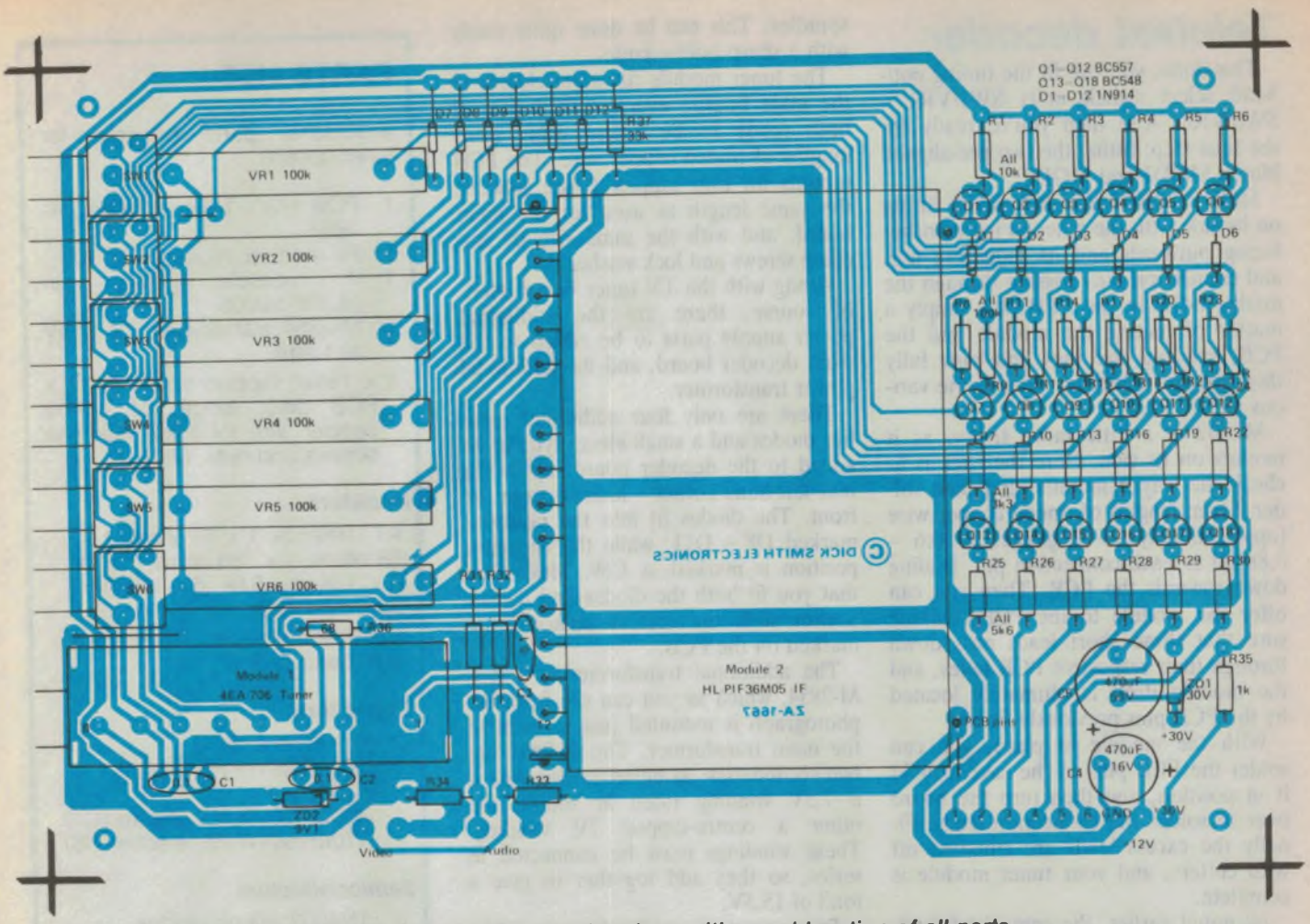
Note that there are two small links to be mounted on the board, one adjacent to the corner of MOD2 nearest to the PCB pin used for channel 1 input and the other between the mounting positions for SW6/VR6 and MOD1. When you're adding the latter link, it would also be worth checking that you haven't forgotten to fit R36 – if this isn't in position at this stage, it will be very difficult to fit later!

The next step is to fit the PCB pins, used for the interconnections to the main decoder PCB. Note also that there are four additional PCB pins to be fitted to the board, near each corner of MOD2 and to allow its case to be held down securely and connected to signal ground.

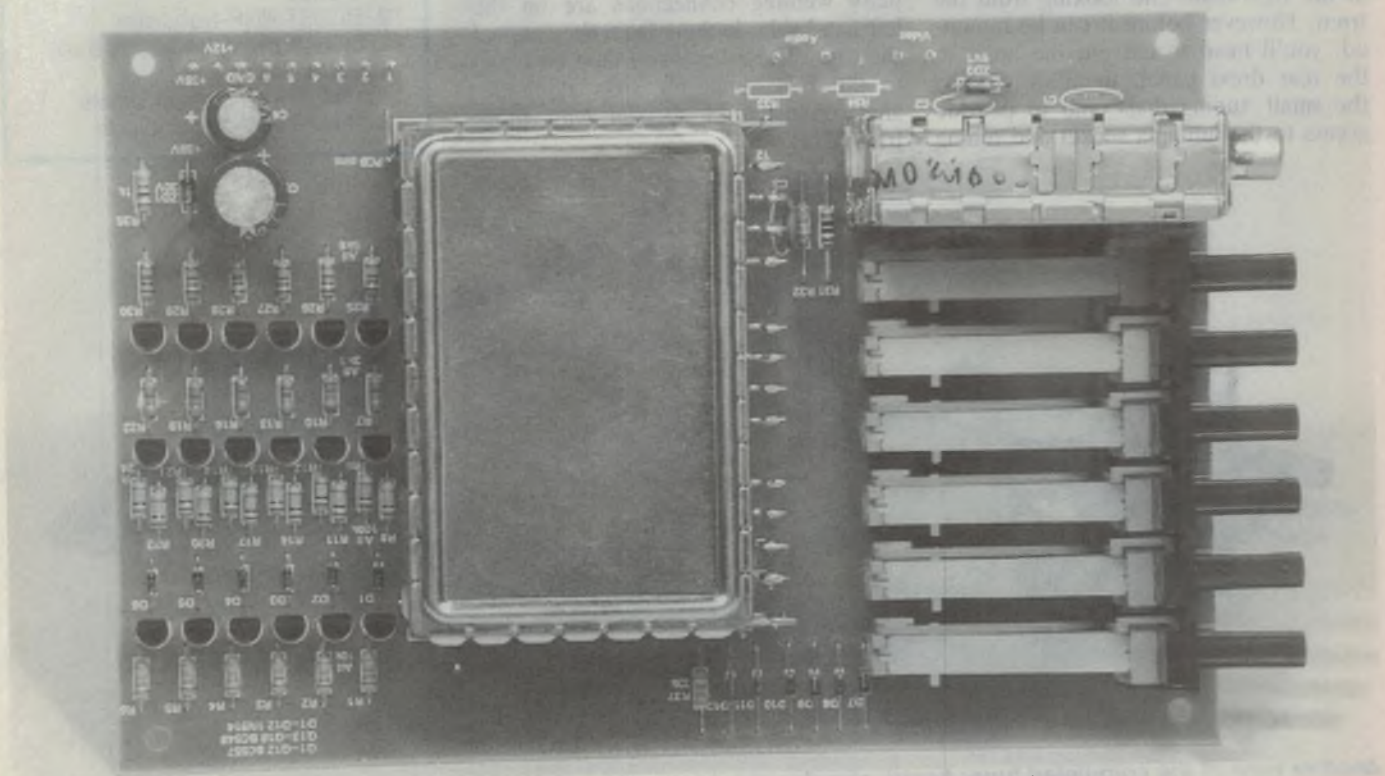
Then fit the transistors, this time not only making sure that you fit them with the correct orientation, but that the NPN (BC548) transistors are used for Q13-Q18 and the PNP (BC557) transistors for Q1-Q12.



A close-up of the rear of the decoder case with the tuner module added, showing the tuning pots and band switches.



Above: the overlay diagram for the tuner PCB, showing the position and location of all parts.



A top view of the completely wired tuner PCB, for comparison with the wiring diagram above.

This done, you can fit the tuning pot/-band select switch units SW1/VR1 – SW6/VR6. And then you're ready for the final step: fitting the two pre-aligned blocks MOD1 and MOD2.

MOD1 is fairly straightforward, fitting on its side with the antenna input socket facing outwards and its mounting lugs and connection pins passing through the mating holes in the PCB. It's simply a matter of mating the module and the PCB, pushing the lugs and pins fully through, and soldering them to the various pads.

MOD2 is a little more tricky, as it mounts on its side. Here the trick is to check the way it mounts, and then solder 20mm lengths of tinned copper wire (approximately 18-20 gauge, or 0.6 – 0.8mm) to each connection pin, leading down towards the PCB. Then you can offer the module to the PCB, making sure that these short leads pass down through their respective PCB holes, and the module itself is ultimately located by the PCB pins previously fitted.

With the module in place, you can solder the PCB pins to the case to hold it in position, and then turn the board over to solder the connection leads. Finally the excess leads are trimmed off with cutters, and your tuner module is complete.

As noted earlier, the completed module fits neatly inside the decoder case, at the right-hand end looking from the front. However before it can be mounted, you'll need to cut out the holes in the rear dress panel, to allow viewing the small 'tuning dials' and to provide access to the antenna socket and tuning spindles. This can be done quite easily with a sharp hobby knife.

The tuner module fits quite closely to the main board, with the PCB pins of both ready to be linked using short lengths of tinned copper wire. The PCB mounts on four tapped 15mm spacers, the same length as used for the main board, and with the same size of machine screws and lock washers.

Along with the TV tuner board itself, of course, there are the additional power supply parts to be added to the main decoder board, and the additional power transformer.

There are only four additional rectifier diodes and a small electrolytic to be added to the decoder board, up in the rear left-hand corner – looking from the front. The diodes fit into the positions marked D8 – D11, while the capacitor position is marked as C69. Make sure that you fit both the diodes and the capacitor with the correct polarities, as marked on the PCB.

The additional transformer is a type M-2854, which as you can see from the photograph is mounted just in front of the main transformer. The M-2854 has two secondaries, as noted earlier; one is a 7.5V winding rated at 10mA, the other a centre-tapped 7V winding. These windings must be connected in series, so they add together to give a total of 15.5V.

To connect it up in this way, first mount the transformer so that the primary winding connections are on the left-hand side, looking from the front of the case. These leads can then be taken to the B-B connector strip alongside, and connected in parallel with those from TR1.

PARTS LIST

(Additional parts required for tuner option)

1 PCB 173 x 116mm, code ZA-1667
1 RF module, Murata 4EA-706
1 IF module, Hwa Lin HL-PIF36M05
1 M-2854 transformer 7V, 7.5V at 10mA
4 x 15mm tapped spacers, 17 x PCB pins, length of tinned copper wire for links, machine screws and nuts, etc.

Resistors

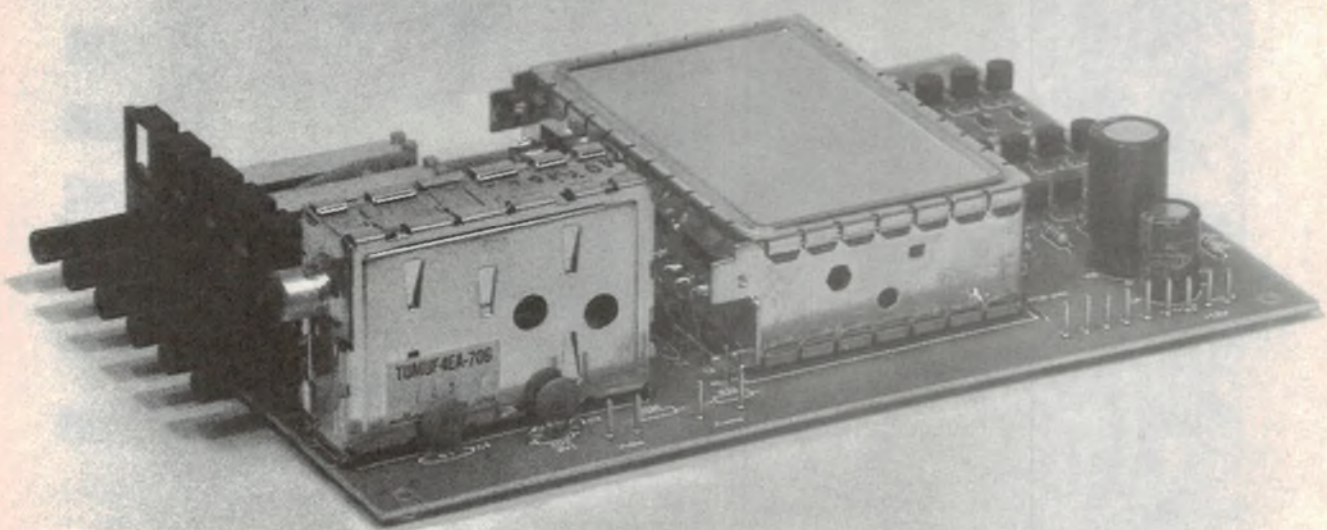
All 1/4W 5%: 1 x 10 ohms, 1 x 68 ohms, 1 x 180 ohms, 1 x 1k, 6 x 3.3k, 6 x 5.6k, 6 x 10k, 1 x 33k, 12 x 100k
6 100k multi-turn tuning pot with band switch

Capacitors

3 0.1uF ceramic
1 100uF 25VW RB electro (C69)
1 470uF 16VW RB electro (C4)
1 470uF 50VW RB electro (C5)

Semiconductors

4 1N4002 silicon diodes
12 1N4148 or 1N914 silicon diodes
12 BC557 PNP transistor
6 BC548 or BC547 NPN transistor
1 1N4751 30V zener diode
1 1N4739 9V zener diode



Another view of the completed tuner board, showing the way that the IF module is mounted on its side.

Now you'll find that looking from the front, the leads from the centre-tapped 7V secondary are on the top of the left or 'western' side of the transformer, and those for the 7.5V winding are on the right or 'eastern' side.

Still looking from the front of the case, take the two leads from the 'southern' end of each winding, and solder them together, insulating the junction. Leave these leads at their full length if you wish, until you can verify that the connections are correct.

Then cut short the centre (black) lead on the western side, insulating it if necessary to ensure that it can't contact anything. Finally take the two leads coming from the 'northern' end of each side, and connect them to the two unused PCB pins up at the rear left-hand corner of the main decoder PCB, adjacent to the four newly-added diodes D8-D11.

Firing it up

Once you've added the extra power supply components, fitted the TV tuner module itself and connected it up to the main PCB via the 13 interconnection links, you're ready to turn on the power and check things out.

There's really only one critical voltage to check: the +36V line for the tuner module, which passes to the new module via the interconnection link nearest the front of the case. With the power applied, this link should measure very close to +36V, with respect to earth (e.g., the case of MOD1 or MOD2).

If it measures within a volt or two of this value, all is well and you can turn off and shorten the two 'southern' transformer secondary leads, if you wish, for neatness. Just don't forget to solder the connection again, and to insulate it so that there can be no accidental shorts.

If on the other hand the voltage at the link measures only about +18V, you must somehow have connected the secondary windings of TR2 so that they are opposing, and producing almost zero nett voltage. In this case you'll have to turn off, and reverse the connections to ONE of the secondary windings – i.e., swap the connections to its 'north' and 'south' ends. This should remedy matters, and bring the link voltage up to the required +36V.

Note that you should only reverse the connections to one of the two secondaries. If you reverse both, you'll still have them fighting one another.

Incidentally while you're checking the voltage on the interconnection link nearest the front of the two PCBs, you might also care to check that on the next link. This should be +12V.

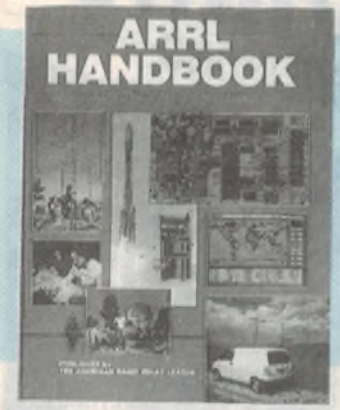
At this stage there is only one step remaining – to set up the six preset channels in the TV tuner module, to suit the channels in your area. This is done in much the same way as for a VCR.

You'll need to hook up the antenna input to a suitable TV antenna, and either feed the decoder's RF output to a TV receiver, or its direct video and audio outputs to a suitable monitor. Then it's simply a matter of selecting each of the six channels, using the IR remote control, and then adjusting the appropriate bandswitch and tuning pot to get optimum reception on the channel concerned.

The pots and bandswitches are numbered from the extreme right-hand end of the case, looking from the front.

Note that the tuning is best done with the decoder switched to TV mode, rather than Teletext, because the Teletext display is only updated from time to time, and also tends to change in a more 'digital' fashion. It is much easier to see the effect of tuning adjustments with a normal TV picture.

Books & Literature



Amateur 'bible'

THE 1989 ARRL HANDBOOK, edited by Bruce Hale, KB1MW. Published by the American Radio Relay League. Hard covers, 215 x 285 x 60mm. ISBN 0-87259-166-2. Recommended retail price $49.95.

The 66th edition of this world-famous and highly regarded manual – nominally written for the radio amateur, but used as a reference by all manner of people involved in radio communications. The first modest volume appeared way back in 1926, and it's been growing in size and stature ever since.

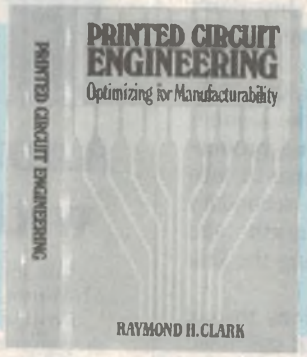
As usual, there's a wealth of information for both beginner and experienced worker, on both the practical and theoretical aspects of radio. From basics of electricity and lumped circuit components to the design and construction of solid state UHF transmitters, it's all there. Including things that you wouldn't expect to find, like the design formulas and nomogram for helical resonators, an explanation of OSI (Open System Interconnection) and the basic specifications for RS-232C and IEEE 488 data transmission standards.

This edition is not dramatically different from last year's 65th edition, but various chapters have been updated and expanded. There are new sections on oscilloscopes, spectrum analysers, digital frequency synthesis and phase-noise measurement. And among the new construction project designs there are a 500MHz frequency counter, a microprocessor-based memory keyer, a digital audio keyer, an inductance meter and a 1500W HF linear amplifier.

If you don't yet have a copy of the ARRL Handbook in your reference library, or your most recent copy is getting a little elderly, I'd suggest that this one would be a good choice. You'll almost certainly find it of great value, even if you have no intention of ever becoming a radio amateur. On the other hand if you *are* an active amateur, or hope to become one, it'll be an even better investment.

It really is a most comprehensive reference work on just about every aspect of modern radio communications, and by current standards also good value for money.

The review copy came from Dick Smith Electronics, which has copies available from all of its outlets. It's listed by DSE as catalog number B-2222. (J.R.)



PCB design

PRINTED CIRCUIT ENGINEERING – Optimising for Manufacturability, by Raymond H. Clark. Published by Van Nostrand Reinhold, 1989. Hard covers, 160 x 237mm, 244 pages. ISBN 0-442-21115-5. Recommended retail price $115.50.

This is essentially a reference book for professional design and production engineers involved in manufacturing printed circuit boards. The author has a great deal of experience in this area, having worked in this area for some years and written a previous book on the subject. He is based in San Jose, on the edge of California's 'silicon valley'.

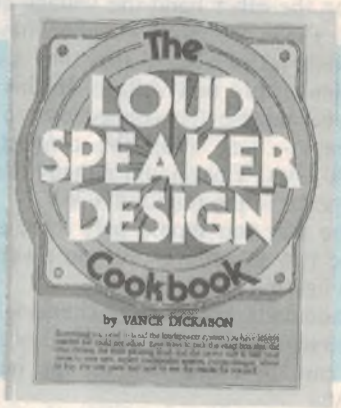
In this book he deals with a host of 'nitty gritty' details concerning current practice for PCB design, material specification, manufacture, testing and quality control. And it's all covered in a comprehensive manner, with sections on even such basic aspects as studying specifications, specifying tolerances, reading engineering drawings, and the best ways to set out procedures for NC drill programming.

As you'd expect from an up-to-date book on this subject, there is a lot of emphasis on multi-layer boards and the special design and manufacturing requirements for these to meet international standards.

The text throughout is clear and concise, with an adequate number of illustrations.

In short, it appears to be a well thought-out and executed book, and one that should be a valuable reference for those in the business of producing professional PCBs.

The review copy came from Australian/NZ distributor Thomas Nelson Australia, of 480 La Trobe Street, Melbourne 3000. (J.R.)



Loudspeaker design

THE LOUDSPEAKER DESIGN COOKBOOK, by Vance Dickason. Published by the Marshall Jones Co., 1987. Soft covers, 217 x 280mm, 96 pages. ISBN 0-8338-0194-5. Price $37.95.

First published in 1977, this is the third edition of *The Loudspeaker Design Cookbook*. While basically a complete guide to speaker enclosure design for the home constructor, the book also offers enough depth of information to suit a professional manufacturer. The author covers each subject with relevant background material (definitions and history), works through a condensed mathematical analysis with additional design tables, and concludes each topic

with plenty of practical advice and design hints.

The first four chapters provide a detailed analysis of the common (domestic) enclosure designs, including closed-box, vented-box, passive radiators and transmission lines. The following chapters deal with the actual cabinet construction, mid and high-frequency drivers, active and passive crossover design and driver testing procedures. For those interested in further reading, the appropriate references are listed at the end of each chapter.

Overall, the book is a nice balance between theory and practice, with the various concepts of loudspeaker design presented in a refreshingly direct manner – unfortunately many authors tend to become bogged down in the esoteric nature of a more theoretical approach. The section on loudspeaker (driver) testing is particularly valuable for example, since a number of alternative methods are often described for determining a particular parameter. This allows the results to be cross-checked against another testing method, which ultimately leads to more reliable readings. Also, the author's guidelines require a minimal amount of test gear – the ideal situation for a home constructor.

Amongst publications of similar size and print quality the book may seem expensive, but the amount saved by building your own enclosures would more than justify the investment – not to mention the amount plain old-fashioned fun involved. Nevertheless, the information is as concise and well presented as any reference book, and may be regarded as a reputable authority on loudspeaker enclosure design.

Copies are available from all outlets of Dick Smith Electronics, and are listed as catalog number B-3613. (R.E.)

An introduction to hifi – Part 24

Hifi on Headphones

Magnetic, crystal and moving coil headphones – types – characteristics – subjective aspects.

Particularly since the introduction of stereo, the use of headphones has become an important part of the hifi scene, in some cases by choice and in others of necessity. This chapter deals with various types of headphones, their characteristics and the way in which their sound differs subjectively from that of loudspeakers.

by NEVILLE WILLIAMS

In the early days of 'wireless', headphones – often described as 'earphones' – provided the most practical way to listen to the then available signals.

From 1923 onwards, with the emergence of public broadcasting and the availability of more powerful receivers, loudspeakers rapidly gained favour, especially for family listening. Headphones, however, were still widely used with professional and communications equipment until well after World War II.

Most such headphones were of the so-called 'magnetic' type, using the same basic principle as originally adopted for telephone earpieces or 'receivers'.

As shown in Fig.1, a thin flexible soft-iron diaphragm is supported by the casing just clear of the tips of two soft-iron pole pieces which are attached, in turn, to a small permanent magnet. Magnetic attraction causes the diaphragm to be distended slightly towards the pole tips, while still leaving a clearance of something less than a half-millimetre.

The incoming audio current passes through coils wound around the pole-pieces. In the presence of an audio signal, the varying magnetic field created by the current interacts with that from the permanent magnet, varying the pull on the diaphragm and causing it to vibrate, thereby generating corresponding sound waves.

Because of the inherent mass and stiffness of the metal diaphragm, headphones of this type suffer similar limitations to the old horn-type magnetic loudspeakers: a natural resonance at a few hundred Hertz, resulting in a so-called 'metallic' quality. They also exhibit quite high harmonic distortion, due to the fact that the diaphragm drive is one-sided or *unbalanced*.

These problems do not seriously prejudice their use for voice communication, but these original 'magnetic' headphones have long since been rejected for high fidelity listening.

Crystal headphones

In the 1950s and '60s, an assortment of 'crystal' earphones appeared on the market, being essentially miniaturised counterparts of the crystal (or piezoelectric) loudspeakers discussed in the last chapter.

Involving few metallic components, they could be made very small and light, as well as lending themselves to mass production. Many, in fact, were designed to plug directly into the ear canal, being intended for use with portable radio sets and tape players.

A few special quality models have been released over the years for monitoring situations but, in general, crystal headphones have slotted into a utility role rather than as a medium for hifi listening.

As with crystal loudspeakers, their impedance is predominantly capacitive, measuring many thousands of ohms at low and mid frequencies. This may not present a problem where sufficient signal drive voltage is available but, with ordinary low-impedance drive circuits, their effective sensitivity is likely to be poor compared with magnetic units.

Our best advice is that, in the unlikely event of being offered high performance crystal headphones, hifi enthusiasts should make very sure that they are compatible with their equipment before laying out hard cash.

Two pair of stereo headphones from Arista. The HD-1000 pair at left have 'circum-aural' muffs, while the MHD-12 pair at right have foam pads.

The HD 250 stereo phones from Sennheiser are of the 'circum-aural' type.

Dynamic headphones

Not surprisingly, the widespread adoption of dynamic – or moving coil – loudspeakers in the early 1930s raised the question as to whether it would be possible to use the same principle for headphones. If the drive units could be made small enough and light enough, they would presumably offer equivalent frequency response and much reduced distortion.

In his book *About Your Hearing*, Gilbert Briggs of Wharfedale fame claims a pioneering role with moving coil earphones designed in 1936 and released in 1937. They were discontinued in 1939, however, as too cumbersome and too expensive to justify continued production. But by 1967, when the abovementioned book was published, Briggs notes that 27 British firms had entered the market which he'd abandoned following his '1937-39 flop'.

By then, one-time descriptions like 'heavy', 'cumbersome' and 'metallic' had also given way to 'lightweight', 'comfortable' and 'high quality', with headphone listening rapidly becoming an accepted part of the hifi stereo scene.

'Loudspeaker' drivers

Because it was the most accessible approach, many of the dynamic headphones introduced to the post-war hifi market comprised, essentially, of two miniature (50-70mm) loudspeakers housed in shells rather like the two halves of an emu egg.

Typically, the oval shells of a pair of middle-aged Japanese-made Goldring dynamic headphones, which we still have on hand, measure about 10cm tall, 9cm wide and 5cm deep. They are fronted by a gold anodised grille, with two matching pressure relief ports at the rear. The shells are cushioned with a removeable pad, while the head band is adjustable and padded.

While quite bulky and by no means light, the treatment gives them a soft and friendly feel – at first encounter, anyway.

'El cheapo' look-alikes aside, one can reasonably expect that equivalent models from reputeable sources would incorporate drivers with magnets, cones and voice coils selected for the role, and with the shells physically styled and acoustically treated for the best available end result.

With outside noise largely excluded, and operating so close to the ears, the drivers can be expected to produce an ample sound pressure level (SPL) with only milliwatts of input, thereby minimising cone break-up and non-linear distortion.

Again, being damped by both the front and rear air loading, cone resonance effects are held in check, flattening frequency response. Subjectively, high frequencies are projected directly into the ear canal, while the captive air inside the cushion surround also conveys low frequency pressure waves efficiently to the eardrums.

Not surprisingly, most such headphones are capable of sound quality far better than is available from traditional magnetic earphones and, indeed, from unpretentious loudspeaker systems. How much better depends largely on the time and money the manufacturer has invested in the design.

However, while any number of such headphones are still in use, many people find them too cumbersome for prolonged listening and, in a warm environment, too hot around the ears. Nowadays, most stereo headphones are much smaller and lighter, using specially developed ultra-compact drivers.

Some retain paper-based cones; others use a dome type diaphragm similar in configuration to the squawker and

Earphone, headphone – What's the difference?

EARPHONE: a general term signifying a small transducer for converting electrical energy into sound waves, and so designed that it is meant to fit into the ear or be held close against it.

INSERT EARPHONE: specifically, the kind of earphone meant to be inserted at least partially into the auditory canal.

HEADPHONE: An assembly combining an earphone and a headband or other attachment designed to hold it against the ear.

EARPHONES (or a pair of earphones): two small transducers as above, presumably interconnected and intended for left and right ears. Since the term does not cover a headband or other attachment, it would imply transducers worn in and supported by the ears.

HEADPHONES (or a pair of headphones): two earphones, presumably intended for left and right ears and fitted with a headband or other support attachment.

HEADSET: most commonly signifies a headband and/or other attachment supporting one or two earphones and a microphone, as used for 2-way communication.

tweeter loudspeakers discussed in chapter 21. A few up-market models include their own diminutive tweeter. (See *EA* September 1982, p.46 for a review of Sennheiser's HD230 two-way dynamic headphones)

Closed & open types

Quite a few current headphone models still enclose the external ear or *pinna*, this being appropriate for situations where it is important to shut out unwanted household noise or, alternatively, to avoid disturbing other occupants. This type may also be preferred for monitoring purposes, to preserve optimum low-end bass response.

In practice, enclosed ear headphones are not essential in many domestic listening situations. Headphone listeners may well prefer to remain reasonably aware of other people and activities in the room, rather than be isolated in their own private sound cocoon.

In an effort to get away from 'circumaural' muffs, designers directed considerable effort in the early 1970s to the 'supra-aural' approach – earphones faced with foam, which could rest gently against the pinna. That the sound would be heard with this approach was never in doubt; the problem was to combine minimal pressure and aural ventilation with adequate bass response and listening privacy.

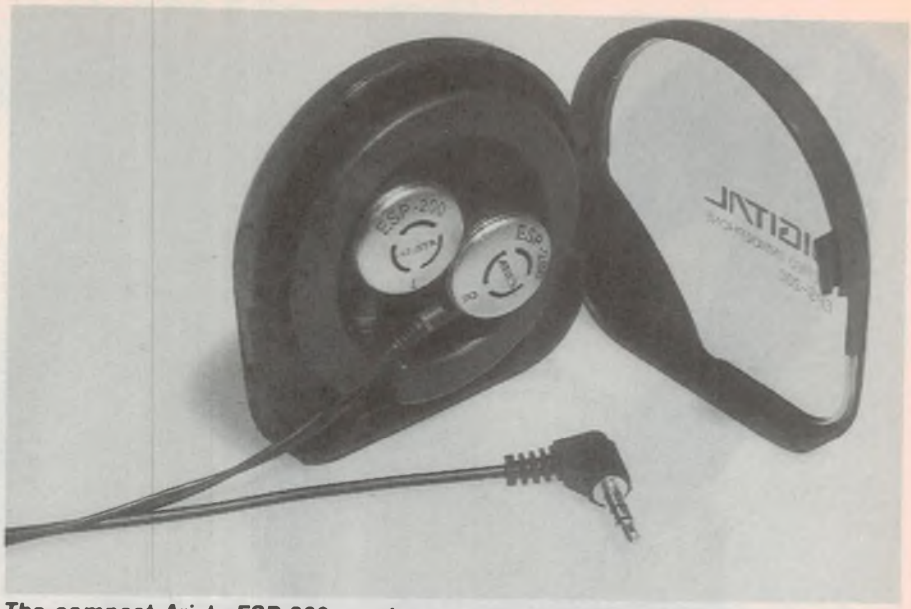
Nowadays, many successful audio/hifi consumer headphones are based on the supra-aural approach. Sennheiser's popular 'Open Aire' models, for example, combine specially designed drivers, virtually surrounded by foam and supported inside very light plastic shells.

In headphones of this general type, the front pads range downwards from about 90mm diameter – which is large enough to cover the ear, without actually enclosing it. Somewhat smaller and less conspicuous headphones like Sennheiser's HD-40s have a diameter of 70mm, while models developed for use with personal portable stereo systems are much smaller again, nestling partially within the pinna.

Earplug models

Popular with joggers, earplug types are designed to be inserted directly into the ear canal and held in place by a very light headband, a clip rather like that fitted to spectacles, or a special moulding intended to lock into the pinna.

While some of these smaller 'phones are designed down to a price, others are credited with quite startling performance, raising the question as to whether they should be considered for use with full-scale home hifi systems. We'll say more about that later but, first, some observations about impedance and drive circuits.



The compact Arista ESP-200 earphones, designed to plug directly into the ear canal but shown here in their pocket-sized carry case.

Headphone impedance

Originally intended for use with crystal detectors and valve equipment, most traditional mono magnetic headphones exhibit a nominal impedance of around 2000 ohms. They are still popular with hobbyists interested in building small radio receivers.

Piezoelectric or 'crystal' headphones, as mentioned earlier, have an essentially capacitive impedance and require a compatible drive circuit. Neither traditional magnetic nor crystal headphones need concern us further in this present article.

From the outset, the majority of dynamic headphones had a nominal impedance of a similar order to that of contemporary loudspeakers – commonly 8 ohms, but typically in the range from 4 to 32 ohms. For mono headphones, the figures represented the combined impedance of the two earphones. For a stereo system, the quoted impedance is normally for each earphone, separately. There are exceptions, however, with Sennheiser in particular favouring much higher values.

In actual fact, the impedance of consumer hifi stereo headphones can be – and is – a fairly arbitrary figure because, unlike loudspeakers, they are not normally intended to provide a specific output load for a domestic stereo amplifier.

Indeed, if a pair of 8-ohm headphones were inadvertently connected across the voice coil terminals of such an amplifier, with the volume control at anything like its normal setting, they would probably be wrecked forthwith – to say nothing of the listener's eardrums!

Even with the volume control prudently retarded, the signal/noise ratio would most likely be poor. This is because residual background hum and

Headphone phase:

Whether connected in parallel or series for mono, or kept partially separate as for stereo, headphones should always be wired so that the diaphragms move towards the respective eardrums with signal half-cycles of the same polarity, and away from the eardrums on the alternative half-cycles.

When correctly connected and fed with a mono signal, the sound source will appear to be between the two earphones - subjectively inside the listener's head. Out of phase, the signal tends to be dispersed or disembodied.

With stereo headphones and signals, a centre-stage voice should also appear to be inside the head, with the supporting sound extending outwards to the left and right. The phones are normally marked to distinguish left from right and should be worn accordingly, to preserve the correct left/right sound perspective.

Mono headphones can be worn either way around.

noise from the power amplifier, negligible on loudspeakers, could well be clearly audible on phones.

The simplest method of feeding dynamic headphones, as adopted in many domestic amplifiers, is via series resistors from the active left and right voice coil output circuits. A typical value would be 390 ohms, 1 watt, selected such that a normal volume control setting will produce about the same subjective loudness from both headphones and loudspeakers.

Simple series feed has the advantage of accommodating well to a wide range of headphone impedances. Despite this, some designers favour the use of a resistive divider to secure a lower impedance drive source – even though it may necessitate the inclusion of a supplementary headphone output control.

Still another approach involves the provision of a separate low power output stage to drive the headphones, normally with its own local negative feedback.

Whether given headphones work best with a high, medium or low impedance drive source is open to considerable debate, because the design criteria for headphone drivers and the environment in which they operate is much less consistent than that for loudspeakers.

In principle, a separate inbuilt headphone driver stage makes good sense, especially if it adds little to the overall cost. But whether any difference will be apparent or worthwhile will depend, as much as anything, on the nature of the particular headphones and the perception of the listener.

Electrostatic 'phones

One other type of headphone warrants special mention at this juncture – those using the capacitive or electrostatic principle, as already discussed in connection with microphones and loudspeakers.

A very thin, partially conductive plastic membrane is supported just clear of a metallic surface being, at the same time, attracted towards it by an electrostatic charge. An audio signal voltage, applied to either element, adds to or subtracts from the charge, causing the membrane to vibrate and produce sound waves.

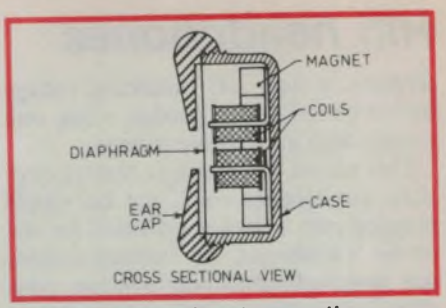
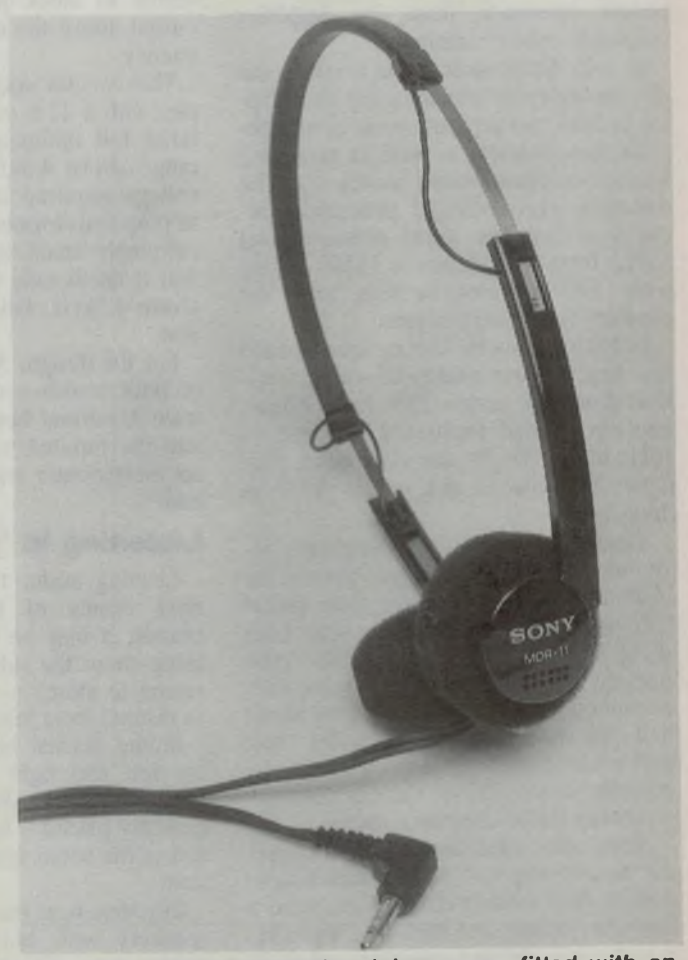


Fig.1: While refined over the years, moving iron headphones still use the same principles as seen in the earliest telephone 'earpieces'. They have no place in today's hifi scene.

This obviously parallels the earlier explanation of a magnetic earphone (Fig.1) but with the vital difference that a plastic membrane can have much less mass and stiffness than a metal diaphragm, thereby minimising problems with system resonance and uneven response over the working range. It also lends itself to a balanced configuration (Chapter 23, Fig.6b) – minimising harmonic distortion.

In early model electrostatic headphones, as with their microphone coun-

The Maruni HV-3000R 'Studio Monitor Series' headphones, a fairly heavy example featuring rare-earth metal magnets and circum-aural muffs.



Sony's compact MDR-11 headphones are fitted with an adjustable headband and soft foam earpads, giving reasonable but not total isolation from ambient sounds.

Hifi headphones

terparts, a high DC polarising voltage had to be fed to the 'phones, along with a fairly high audio drive voltage.

This meant, in practice, that electrostatic headphones could not be simply plugged into a socket provided for dynamic headphones. An external adaptor was required, containing a mains powered high voltage supply and a step-up transformer for the audio drive signal. It added to the already steep price and deterred purchasers, other than the almost cult following that insists on electrostatic transducers.

Electret electrostatics

In the mid 1970s, permanently polarised or *electret* electrostatic headphones made their appearance, with Sennheiser models 2000 and 2002 being reviewed repectively in the March 1978 and June 1981 issues of *Electronics Australia*.

While the need for a mains powered HT supply had been eliminated, they still needed an external black box containing twin step-up transformers, to permit operation from the amplifier voice coil output terminals.

In fact, Sennheiser made a virtue out of a necessity by arranging for the adaptor to feed two separate pairs of electrostatic headphones, as well as providing loudspeaker/headphone switching. The company also included protection circuitry to limit the sound pressure level (SPL) from the phones to 117dB, along with LED indicators to show when the circuitry was being activated.

In both instances, the reviews praised the quantity and quality of sound available from the series 2000 headphones, quoting a rated frequency response of 16Hz to 22kHz. At the same time, they drew attention to the cost – $349 in June 1981.

That order of SPL and frequency response is no longer unique, Sennheiser claiming similar figures for their model 230 twin-driver dynamics a year later (*EA*, September 1982). The 230s could operate directly from most amplifier headphone jacks, and retailed for about half the price. However, while their performance was commended, reviewers favoured the sound of the electrostatics – echoing the loudspeaker scene.

About the same time, AKG brought out its two-way K-4 headphones which, despite their modest dimensions, were a two-way design combining a dynamic driver and electret tweeter, crossing over at 4.5kHz.

As indicated in Fig.2, the woofer is

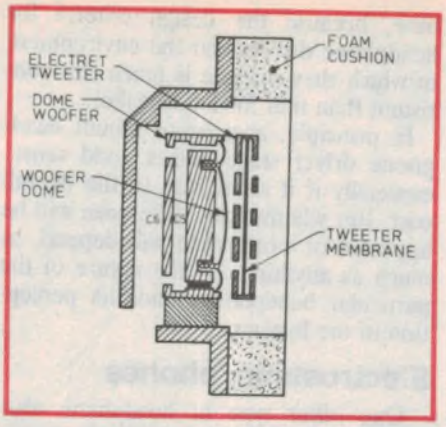


Fig.2: An AKG headphone combining a dome type dynamic woofer with an electret electrostatic tweeter, fed by a miniature step-up transformer. It can operate directly from a normal dynamic headphone feed socket.

deep inside the casing. Using a high efficiency rare earth/cobalt magnet and a moulded polycarbonate diaphragm, it can operate directly from a normal amplifier headphone socket. Its rated low-end response extends to 16Hz but, at the top end, the body of the tweeter serves to block physically its residual output above the nominal crossover frequency.

The tweeter uses the electret principle, with a 12.5 micron chromium-sputtered foil optimised for the frequency range above 4.5kHz. The higher drive voltage required is provided by a 1:15 step-up transformer, which can be made extremely small by virtue of the fact that it needs only to handle frequencies above 4.5kHz, falling off steeply below that.

For the design, AKG claimed the best of both worlds – the ability to operate from a normal headphone drive circuit and the reputed sonic 'transparency' of an electrostatic transducer for the top end.

Listening to 'phones

Leaving aside, for the moment, the rival claims of different types and brands, it may be helpful to say something about the subjective effects of listening to stereo sound on headphones, as distinct from loudspeakers.

In the normal hifi set-up, signals for the left and right channels are reproduced by twin loudspeaker systems, typically placed 3 to 4 metres apart and across the room from the listening position.

Listeners hear the sound of both loudspeakers with both ears and, in so doing, react subconsciously to the different content of the respective channels – and to the slightly phase displaced versions of each received by their left and right ears.

By a near-miracle of cerebral processing, the complex sonic information can be resolved into a sonic image of the original sound stage, with instruments and/or voices distributed from left to right and, to a lesser extent, from front to back. Incidental reverberation effects may also convey an impression of the original performance environment, as well as that of the listening room itself.

An important factor in a loudspeaker listening situation is a sonic awareness that the principal sound source is where it usually is – in front of the listener. The ears deduce this by the way the incoming sounds are deflected by the pinna, on their way into the respective auditory canals.

In the case of earphones, however, the sound is generated very close to the ear and conducted directly to the eardrum, without effectively involving the pinna – not even in the case of circumaural headphones.

While commonsense might insist that the performers are somewhere out front, the sonic impression is that the sound sources are positioned on left and right directly in line with the listener's head. Centre-stage sounds, in fact, appear to be inside the head, as noted in the panel.

The effect is if the listener is on stage, right in the middle of the action. And because neither ear can hear what is being fed to the other one, the left/right separation may appear to be exaggerated.

Blending systems

The apparent over-separation can be brought more into line with loudspeaker listening by introducing deliberate bridging resistance between the two channels, as shown in Fig.3. Typically the components involved would be housed in a small box plugged in series with the normal headphone connection.

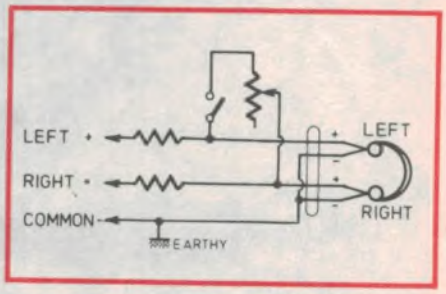


Fig.3: A simple resistive blending circuit. Values would depend upon the impedance levels, but 100 ohms for the fixed resistors and up to 500 ohms for the pot would be typical.

The Sennheiser HD50 headphones, a compact pair with adjustable headband and soft foam pads for comfortable listening.

More elaborate schemes have been devised, using inductors and capacitors as well, which can introduce selected orders of time/phase delay into the cross feed.

Unfortunately, while such schemes may bring the separation more into line with that intended for, and experienced with, loudspeakers, they cannot move the apparent sound source out front where it should be.

A still further point is that, being projected directly into the ear canal, the higher frequencies may be heard to better advantage than otherwise. They may, in fact, be exaggerated if the headphones are fed from a higher impedance source than envisaged by the designer.

Fortunately, in most amplifier systems, both treble and bass response can be brought into line with listener expectations by adjusting the appropriate controls.

These remarks are not made to discredit headphone listening, but rather to alert the newcomer to what to expect. Some enthusiasts even prefer good quality headphones to the loudspeakers they can afford. But, in any case, for those situations where loudspeaker listening is unacceptable, hifi headphones are far and away better than enforced silence!

Choosing headphones

Hifi headphones currently on offer range from fairly large circum-aural models to small but highly commended insert types that plug directly into the auditory canal. This leads naturally to the question as whether they are functionally interchangeable; whether miniature headphones can be used with large systems and vice versa.

The short answer is 'maybe', but the complete answer is more involved.

The indications from equipment suppliers are that medium to large size headphones are normally preferred for use with home hifi systems. They look the part, they are less likely to be mislaid or sat-upon, they are already fitted with a 6.35mm stereo plug and they come with cords up to 3 metres long – allowing greater freedom of movement for the listener.

Equally, very compact headphones, pinna and insert types are a natural choice for personal portable equipment and joggers. They come with a much shorter cord and a 3.5mm stereo plug.

In between are compact headphones, with 'in-between' cords, 3.5mm plugs and 6.35mm adaptors – intended for in-between roles!

Since this article concerns mainly the provision of headphones for domestic hifi systems, interest will centre mainly on the larger sized models.

As with loudspeaker systems, the same broad advice applies: check out what is available, read the specifications, take notice of reviews and inquire of friends who have – and use – headphones. And if possible, try to test out the likely models with your own equipment, before making the final decision.

Known-brand headphones priced at around $50 with a rated response of, say, 30-16000Hz or better should provide acceptable sound, esqecially for older listeners whose top-end response is likely to be limited, anyway. But, having said that, it is reasonable to assume that more expensive models with higher specifications will be capable of somewhat better reproduction.

In reaching a decision, full account should be taken of earlier remarks about weight, size and comfort. What feels okay for 30 seconds may be quite different after 30 minutes or more. Borrow some typical heaphones, if you can, to provide some kind of reference as to what is too heavy, too tight, or too anything.

Seek guidance, also, as to the compatibility of your likely choice with your existing equipment. Most dydnamic headphones will work from most amplifier headphone sockets, but some higher impedance headphones – 600 ohms or more – may require more voltage drive than is available from the direct headphone output of some tape decks.

And, finally, a word of warning for the unwary: modern hifi stereo headphones are capable of delivering a very high sound pressure level to the eardrums. A figure of 117dB, as mentioned earlier, would be intolerably loud for most people, if propagated from loudspeakers.

Because headphone devotees are accountable to no one else, they can all too easily over-stress their ears for long periods with one inevitable result: cumulative hearing loss. So, enjoy your headphones, but use them sensibly! EA

New Products

LCD depth sounder

Imark Communications has released the Ray Jefferson LCD-600 LCD Display depth sounder.

The sounder is a 160 metre (525ft) compact, lightweight depth sounder which utilises a 4" x 3" ultra twist LCD screen instead of the usual 4" chart paper, to display the sea bottom, reefs and fish beneath the vessel. The ultra twist anti-glare LCD features 160 x 128 pixel (20,480 pixels) resolution and a wide viewing angle. An Electro-luminescent back light is provided for night time viewing.

The LCD-600 has five depth ranges as follows: 0-10, 0-20, 0-40, 0-80, and 0-160 (and 0-320 on the 50kHz version) metres.

One of the most important features to have on an LCD sounder is a 'white line' facility, which enables the operator to distinguish weeds and fish near the ocean bottom from the sea bed. The white line feature on the LCD-600 is said to work excellently.

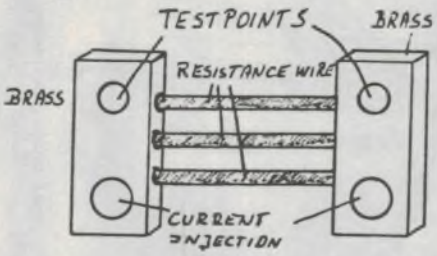
A 'zoom' facility enables the operator to zoom in to view any 5 metre section of the displayed range, by halving the screen until the desired range is displayed across the entire screen. This action immediately multiplies the resolution of the display.

New 900 series relay

Cornell Dubilier Electronics has announced a new, UL/CSA approved 900 series relay. The 900 series is a downsized version of the 700 series relay for PC board applications.

The relays offer 4 different foot-prints and 6 different schematics, not available on earlier relays, with standard (360mW) and sensitive (180mW) coils and lower mW coils are possible if needed. Nylon and flame retardent covers and bobbins, and contact ratings from milliamps to 10 amps are available.

For further information contact Crusader Electronic Components, 73-81 Princes Highway, St Peters 2044 or phone (02) 516 3855.



15A, 150A shunt resistors

Cosine Industries has announced two newly designed shunt resistors, the TR15 rated at 150mV for 15A and the TR150 rated at 150mV for 150A.

Both resistors have an inaccuracy better than 1%, a temperature coefficient of 60ppm per °C and can be overloaded for a short period of time. They are an inexpensive alternative way of measuring AC or DC current without a panel-meter and without interrupting the circuit.

Mounted at a convenient position inside a project (ideal on the front panel with banana sockets) they are connected in line with the output. If the need arises to temporarily measure a current, a digital multimeter can simply be plugged in (e.g., for the TR15 78.3mV equals 7.83A; for the TR150 47.4mV equals 47.4A).

The TR15 retails at $6.60, while the TR150 retails at $33.60 (incl. sales tax).

For further information contact Cosine Industries, 43 Brownie Street, Jamboree Heights 4074 or phone (07) 279 1607.

Submersible mains connectors

The Buccaneer range of 3 pin 250VAC/10amp environmental connectors have now been approved by the State Electricity Commission of Victoria for operation under IP68 conditions.

The approval enables these connectors to be safely operated at 10m (33ft) depth, equivalent to 100Kpa (15psi) for 16 hours at rated voltage and current.

This makes them very suitable for applications involving dangerous voltages, where complete protection from the environment is paramount.

Buccaneer is also available in 2 to 9 pin and BNC verisons, to the same IP68 specification.

Further information is available from Ericsson Components, PO Box 95, Preston 3072 or phone (03) 480 1211.

Switchmode modules

Advanced Solutions now has available the Lindmark Switching Power Modules, and an evaluation kit. These modules incorporate all the complex and difficult-to-design circuitry for switching power supplies, simplifying considerably the job of designing your own power supply.

The PCB-mount modules are very compact, and are available in power ratings up to 400W. Efficiency of the 400W module is over 97% with resistive load. The standard modules incorporate 4500V isolation from input to output, and an isolated control input provides good regulation with simple feedback circuits.

The units operate at very high frequencies (325-650kHz) and produce a sinusoidal output voltage, so RFI is minimal and output transformer design is relatively easy. The modules are absolutely protected against short circuits.

A handbook is available giving detailed theoretical and practical advice on using the Lindmark modules to construct switching power supplies. Also available is an experimenter's kit, consisting of a fully-built, multi-output power supply, which can be measured, dismantled, modified and rebuilt, to establish a working familiarity with the power module operating principles.

Further information form Advanced Solutions, 47 Karril Ave., Beecroft 2119, or phone (02) 872 1981.

Two-way FM radio

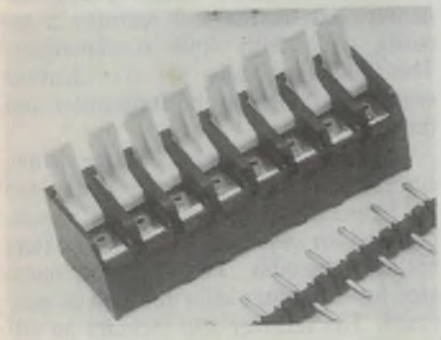
The Nady PRC-5 is a low power pocket sized 49MHz FM transceiver with integrated earphone/microphone, designed for hands-free communication over distances up to 200 metres. It is suitable for use by motorcyclists, building site workers, rescue teams and the like.

The compact integral earphone/microphone picks up audio through the user's ear canal, minimising external noise and avoiding the need for a cumbersome mic boom. The unit offers a choice of either VOX (voice-operated switching)

or PTT (press to talk) operation, and operates in simplex mode with reception automatically muted during transmission.

Dimensions of the PRC-5 are 112 x 63 x 33mm. Power source is a 9V alkaline battery. The receiving side uses double conversion, with IF's of 10.7MHz and 455kHz. Squelch open sensitivity is 0.5uV, with 0.75uV required for 12dB SINAD.

Retail price of the Nady PRC-5 is $149.99 each, and the units are available from Down Under Communications, 6 Alva Court, Fawkner 3060 or phone (03) 359 9720.



Subminiature terminal blocks

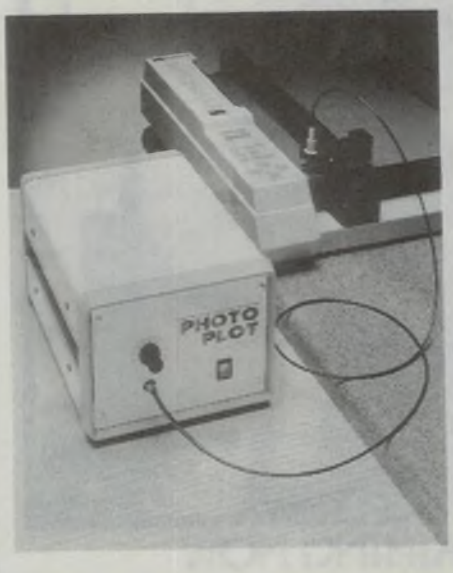
Augat/RDI (Reed Devices Inc.) has just announced the release of two new products, the 2M and 2S series terminal blocks.

RDI's screwless terminal block, the 2S series, makes connections without the use of tools, by simply placing the solid or stranded, 16 through to 24 AWG wire into the opening and pushing down the lever. This also permits the re-termination of wire.

The solder-in 2SV and depluggable 2SVD versions both provide 0.200" centre spacing and are available in 2 – 16 positions, featuring end-stackability while maintaining centre-to-centre spacing. Rated 10A/150V, the block has gas-tight connection that surpasses Ul and CSA specifications for wire pull-out, secureness and heat rise.

The 2M series is truly miniature, with just 0.500" high connections and 0.200" centre spacing fitting worldwide standards perfectly. Rated 20A/300V UL, this low-profile terminal block is also end-stackable and offers 2-24 terminal positions as well as solder-in or depluggable vertical, right angle and 45° mounting styles.

For further information contact Augat, Unit 21/26 Wattle Road, Brookvale 2100 or phone (02) 905 0533.



Photoplot imaging system

Photoplot is a high intensity UV light generator which transmits a fine beam of light through a fibre optic cable to a light pen, inserted in the pen holder of a standard flat-bed pen plotter. A sheet of ultra-violet light sensitive film is placed on the bed of the plotter and the data is sent from the computer in the normal way. The light pen draws onto the film with a beam of light, exposing the film as it moves. A pressure sensitive switch in the light pen switches the light beam on when the pen is in the down position, and off when it is raised. After exposure the film is developed quickly and easily by means of a two-stage immersion process using industry standard fixer and developer.

Photoplot can be used with any Computer Aided Design System which supports a pen plotter. No special hardware or software modifications are necessary and, unlike many conventional pen plotters, Photoplot can be used in normal room-light conditions.

Photoplot is quick and easy to install and operate and enables the user to produce 1:1 phototools directly onto film. Tracks and pads are deep black, with far better edge definition than can normally be achieved with an ink pen.

For further information contact Jemal Products, 5 Forge Street, Welshpool 6106 or phone (09) 350 5555.

4T Cermet trimpot

Murata has released the 'Cerastat' series 1102 which is a sealed four turn trimpot using a cermet element. In view of the extremely small diameter (only 7.6mm) of the series 1102, a considerable saving in board space can be achieved.

The inbuilt planetary drive offers precise setting, in a case size normally considered standard for single turn trimpots.

Sealed to withstand any wave soldering and immersion cleaning, the series 1102 is suitable for all industrial applications.

General specifications for the series 1102 include a resistance range form 10 ohms to 2M (in 1, 2 and 5 values per decade); a power rating of 0.5W at 70°C (300V max); a resistance tolerance of +/−10%; and a temperature coefficient of 100ppm/°C.

Further details from IRH Components, 32 Parramatta Road, Lidcombe 2141 or phone (02) 648 5455.

RF adaptor kit

National electronics components and cable distributor Acme Electronics has released the Greenpar 50 ohm 'Between' Series Adaptor kit.

The kit comes complete with spanners, couplers and a selection of connector faces. These adaptor faces include BNC, SMA, N, UHF and TNC.

Using a coupler, these faces can be screwed together to provide the desired combination required by the user.

The kits are housed in an attractive plastic case and are available from all Acme branch offices and agents, throughout Australia as Acme part number C47-50.

New Products

Remote control system

Oatley Electronics has recently introduced to its product range a pre-assembled receiver and transmitter combination, which is mainly intended for the remote control of mechanically operated devices. The system is very similar to the remote controls used by some garage door manufacturers. It can also be used for operating doors, gates etc.

The system comprises a fully assembled and cased transmitter together with a fully assembled receiver PCB and components assembly. Both transmitter and receiver are crystal locked on the 27MHz band, and don't require a licence for operation.

The system has a range of approximately 200 metres and features a security code with 4096 combinations. This code is easily set by identical switch assemblies in the transmitter and the receiver.

The receiver includes 3 large heavy current relays which are for the motor 'UP' operation, motor 'DOWN' operation and for switching an optional external light assembly. The light relay operates for 3 minutes after the unit is activated. The receiver also includes an adjustable motor current sensing circuit, which will reverse the motor rotation if an object accidentally blocks the path of the door on the 'DOWN' travel.

Limit switches (microswitches) are required, and are connected to the receiver in order to set the open/close or up/down travel limits.

Connection diagrams are included with the units. The transmitter and receiver are priced at $43.50 and $116.90 respectively.

More information can be obtained from Oatley Electronics, PO Box 89, Oatley 2223 or phone (02) 579 4985.

Autophone/fax switch

A product which allows use of a facsimile machine without installing a second phone line has just been lauched in Australia. Called PHAXswitch, the device is made and marketed by Banksia

Information Technology (BIT) in Sydney.

The device which is being sold through facsimile and office product dealers, and consumer electronic outlets such as Dick Smith Electronics already has Telecom approval (C89/14B/96).

With incoming calls from automatic fax machines, PHAXswitch detects the call tone and switches the call to the fax, whereas with manual machines, the PHAXswitch answers the phone with a digitised voice message which says: "This is a BIT PHAXswitch answering your call. If you want to send a fax say fax after the tone, otherwise wait until the phone is answered."

The machine then waits two seconds for the word "fax". If the caller says "fax" PHAXswitch will switch the call to the fax machine. If the caller does not say anything in the two seconds, the call is switched directly through to the phone which rings in the normal manner.

Developed by well known technology innovator David Hartley, the device has the advantage of Australian design and Hong Kong manufacturing. It sells for around $350.

Further details from Banksia Information Technology, Suite 205, 2nd Floor, 83 Longueville Road, Lane Cove 2066 or phone (02) 418 6033.

Surface mount LCC socket

Methode Electronics has designed this socket to accept the newest post moulded plastic chip carriers conforming to JEDEC specification MO-047.

Now available from Adilam Electronics, the socket offers a protective package in both through board and surface mount configurations to take advantage of conventional and vapour phase soldering techniques. The exclusive high pressure contact system eliminates the need for gold plating while assuring a reliable, cost effective way to mount leaded chip carriers.

For further information contact Adilam Electronics, Suite 7, 145 Parker Street, Templestowe 3106 or phone (03) 846 2511.

Display Technology Feature:

EL display panels challenge CRTs and LCDs

Electroluminescent (EL) technology is rapidly emerging as a very strong competitor for cathode ray tubes and liquid-crystal panels, in the area of high resolution information displays. Sharp Corporation in Japan is one of the leading players in this area, having developed EL display panels which combine the high contrast, brightness and resolution of CRTs with the light weight, economy and flat profile of LCDs.

Based on its innovative technology, Sharp has succeeded in producing high-definition EL display units with a resolution of 4 lines per millimetre, and a dot density providing the same detail as 1024 x 800 dot CRTs. The EL displays are monochrome, and produce the yellow-orange 'amber' colour generally acknowledged as being easiest on the eyes.

Unlike conventional LCD displays, which depend on either ambient light or external back lighting for illumination, the EL display is a self-contained solid state *emitter* of light. This allows convenient viewing in low lighting conditions. In addition an EL display offers a much wider viewing angle than LCD displays – typically as high as 160°.

By using the same simple input signals as those used by CRTs and developing simplified interface circuitry, Sharp has also been able to achieve a high-speed EL display that responds far more rapidly than LCDs, and virtually as fast as CRT displays. This makes them far more suitable for displaying real-time graphics and other rapidly changing information.

At the same time, the energy consumption of the new EL displays is very low – closer to that of LCDs than to CRTs. This has been achieved, Sharp says, through two important developments: high-voltage MOS driver ICs and a high-efficiency thin film panel structure for the EL display itself.

Being solid state devices, the new EL displays are durable and have a high degree of resistance to damage caused by vibration and impact. This makes them suitable not only for portable use in general, but also for applications involving severe environmental conditions, such as outdoors or in cars, boats or aircraft.

In short, the new EL displays are shaping up as the technology which combines the desirable features of most existing display devices: compact form, bright and high resolution display, high speed, low power consumption and rugged reliability.

EL basics

Luminescence is a phenomenon in which a substrate releases photons as it changes from an excited state back to the ground state. When excitation is due to an electric field, the phenomenon is called 'Electro-Luminescence' (EL).

Luminescent material comprises a host material and luminescent centres. Typical materials for thin film (TF) EL are shown in Table 1. The energy release (luminescent wavelength) or luminescent colour varies depending upon the combination of host material and luminescent centres. The combination of zinc sulphide and manganese (ZnS:Mn) has the highest luminant effi-

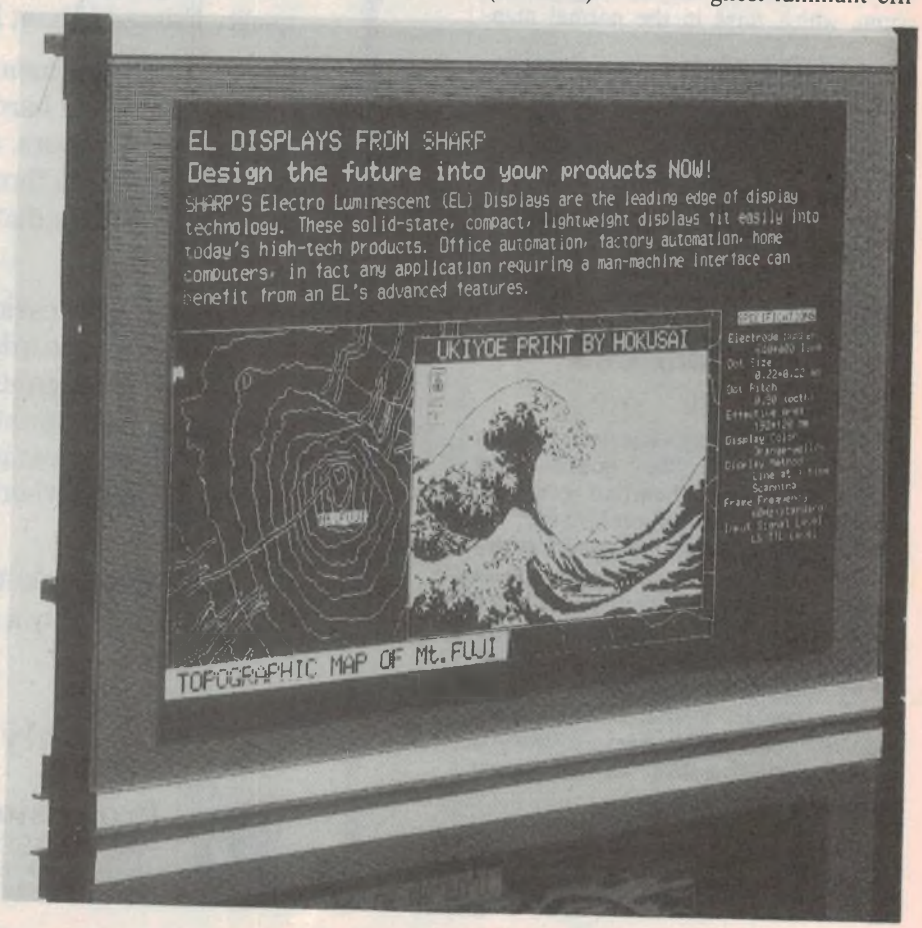


Table 1: Typical Materials of TFEL		
Host Material	Luminescent Centre	Luminescent Colour
ZnS	Mn^{++}	Orange — Yellow
ZnS	Tb^{+++}	Green
CaS	Eu^{++}	Red
SrS	Ce^{+++}	Blue

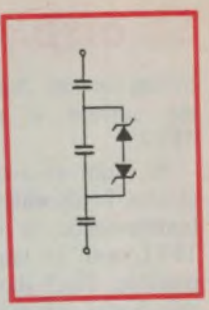


Fig.4 (right): The equivalent circuit for a thin-film EL display.

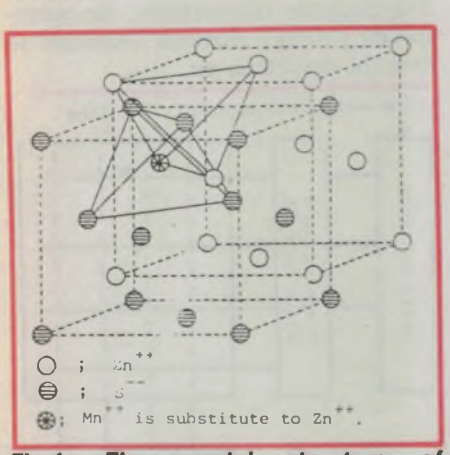


Fig.1: The crystal structure of ZnS:Mn.

ciency of those currently in use.

The crystal structure of ZnS:Mn is shown in Fig.1. ZnS, the host material, has a zincblende structure and Mn++ ions, the luminescent centres, are substituted into Zn sites. Therefore, each Mn++ ion is surrounded by S−− ions in tetrahedral sites.

An actual EL device has a double insulating layer structure, with a luminescent layer placed between two insulating layers like a sandwich, so that the electric field is applied effectively to the luminescent material for stable luminescence. Fig.2 shows the structure of a section of the EL panel and its materials.

Fig.3 shows the energy structure of ZnS:Mn++ thin film El (TFEL) with a double insulating layered structure. The mechanism of electro-luminescence is divided into the following three phases, according to this energy structure:

1. Excitation of the host material by a high electric field. (hot electrons).
2. Impact excitation of Mn++ centre from its ground state to an excited state.
3. Luminescent decay of the Mn++.

A TFEL equivalent circuit is a combination of capacitors and Zener diodes (see Fig.4). The luminescent layer is conductive when it is luminant, and capacitive when it is not luminant.

Basic characteristics

Electrically, thin film EL panels are considered as capacitive loads, with the luminescent layer itself having zener diode characteristics, but connected to electrodes through insulating layers which provide conduction only for alter-

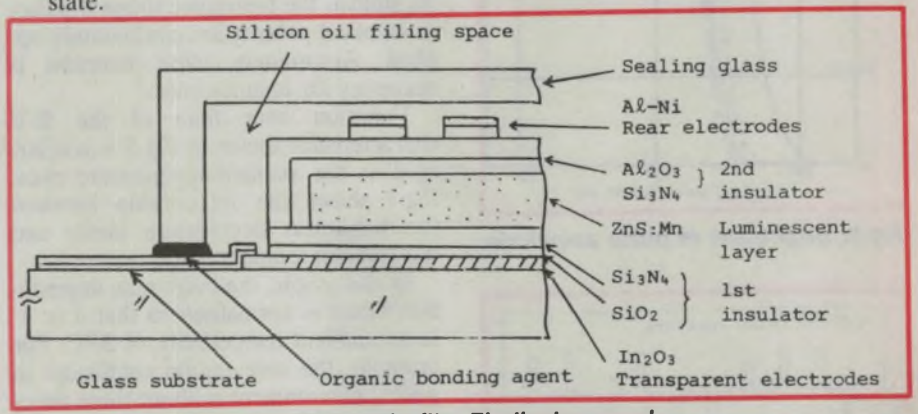


Fig.2: The structure of Sharp's thin-film EL display panel.

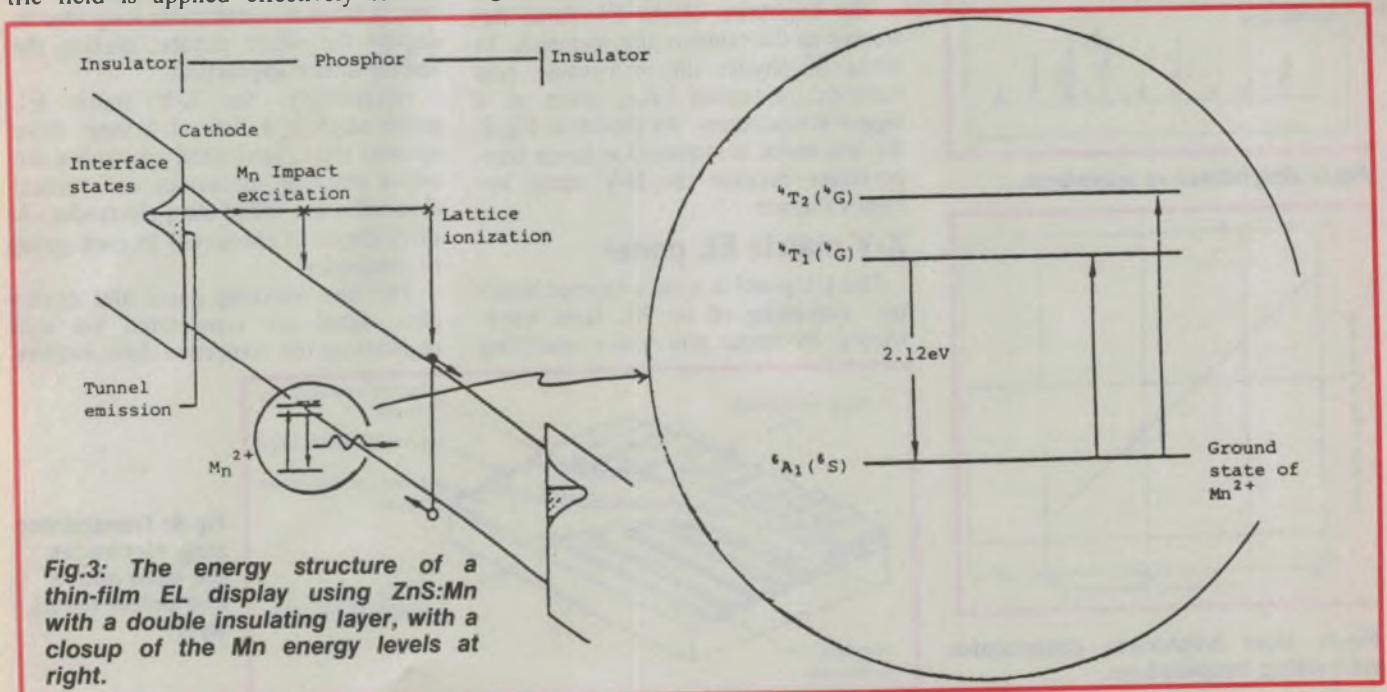


Fig.3: The energy structure of a thin-film EL display using ZnS:Mn with a double insulating layer, with a closup of the Mn energy levels at right.

nating current. Accordingly, an alternating current is required for driving TFEL.

In order to avoid the application of electric fields which do not contribute to luminescence, it is desirable to drive TFEL with as minute an AC pulse as possible. Fig.5 shows a typical relationship between applied pulse height and luminance intensity (brightness-to-voltage or B-V characteristics) and its variation with time.

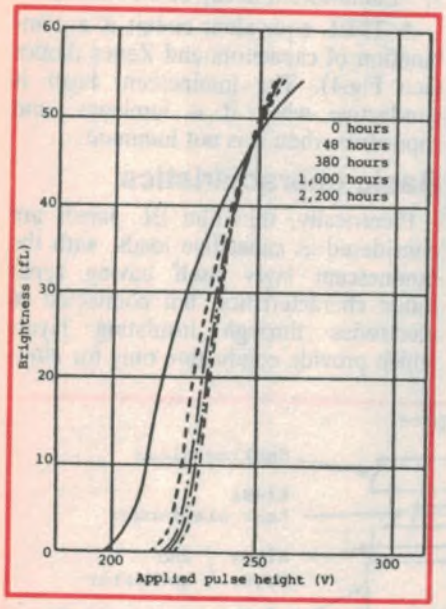


Fig.5: Brightness vs pulse amplitude.

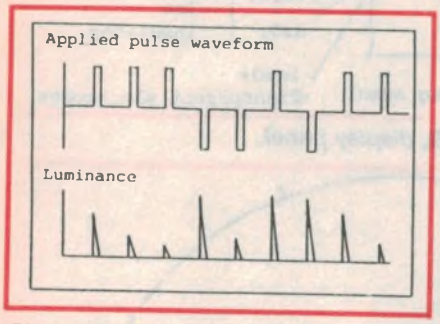


Fig.6: Brightness vs waveform.

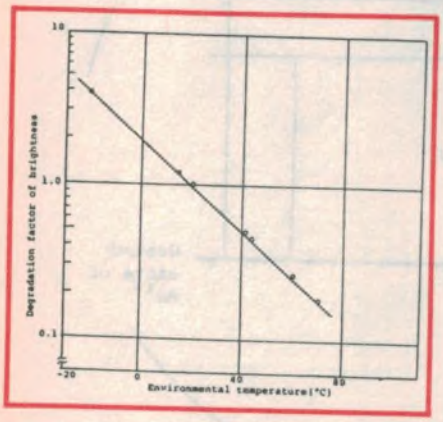


Fig.7: How brightness deteriorates with rising temperature.

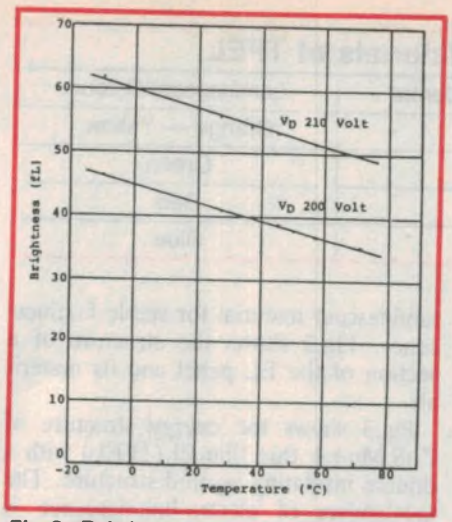


Fig.8: Brightness vs temperature.

Fig.6 shows the relationship between applied pulse waveform and luminance. As shown, the luminance drops if pulses of identical polarity are continuously applied. Accordingly, *pulse inversion* is necessary for luminescence.

Variation over time of the B-V characteristics shown in Fig.5 is accelerated as the ambient temperature rises. Fig.7 shows the relationship between the brightness degradation factor and the ambient temperature.

In this graph, the brightness degradation factor is normalised so that it is '1' at an ambient temperature of 20°C. For example, the acceleration coefficient in a 60°C environment is about three times that in a 20°C environment.

The brightness of the EL panel decreases as the temperature increases. In terms of physics this is because non radiative relaxation takes place at a higher temperature. As shown in Fig.8, the luminance is increased at lower temperatures because the B-V curve becomes sharper.

X-Y matrix EL panel

The EL panel is a multi-layered structure consisting of an EL layer sandwiched by upper and lower insulating layers. All parts of the panel, except the back electrodes, are made from transparent thin-films. The horizontal Al-Ni electrodes and vertical transparent electrodes are arrayed to be intersected at right angles to each other, so as to constitute a X-Y matrix. (see Fig.9).

When AC pulses are applied across these two groups of electrodes and a high electric field is applied to the specified electrode intersections, the corresponding picture elements illuminate to form the desired image.

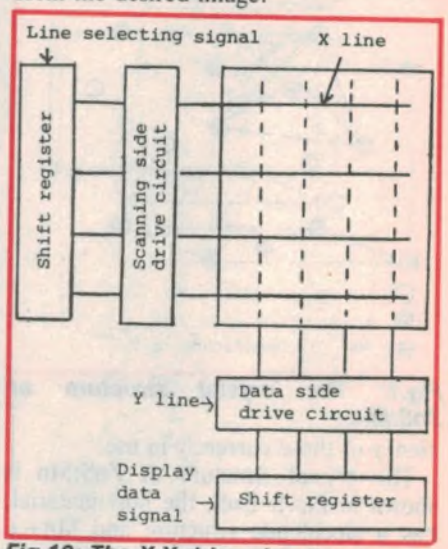


Fig.10: The X-Y drive circuitry.

Driving principle

To display a picture on the X-Y matrix EL panel, voltage is applied to the X-Y electrodes which select appropriate pixels via the switching device connected to each electrode. If the required pixels are driven sequentially one by one, it takes a considerably long time to display the whole picture, making the display device impractical.

Accordingly, the X-Y matrix EL panel employs a 'line at a time' drive system. Here, horizontal electrodes are called scanning electrodes and vertical electrodes are called data electrodes. A drive circuit is connected to each group of electrodes.

The line selecting signal and display data signal are transmitted via shift registers to the respective drive circuits.

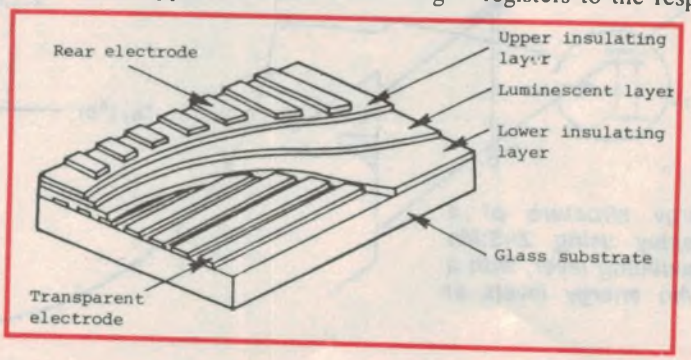


Fig.9: Transparent strip electrodes are used above and below the EL layer.

The line selecting voltage is applied sequentially to X-lines in synchronisation with the X-line scanning. Consequently, the added voltage for the X and Y lines is applied simultaneously to each intersection on one line as luminous and non-luminous voltage.

Since an EL panel is driven by alternating current, the polarity of the applied voltage is reversed for each frame, closing the AC cycle in two frames.

EL manufacturing

The process flow chart for an EL display unit is shown in Fig.11. The principal processes are briefly described below.

Photo-etching process: A wet photo-etching process is employed for the transparent electrode patterning and rear electrode patterning shown in the flow chart in Fig.11. Quality control of the photo mask and deionised water is crucial in this process.

Thin film coating: The luminescent layer, the insulating layers and the electrode layer of the TFEL are all made of thin films, several thousand Angstroms in thickness and coated by a physical vapor deposition process such as electron beam evaporation and sputtering. The TFEL is produced by carefully designed equipment in a completely controlled clean room, so that a uniform and defect-free thin film is coated on a large area substrate.

Sealing: Cover glasses are bonded to the substrate and silicon oil is injected between the two glasses, for protection against moisture. Dehydration of the oil must be done with great care.

IC mounting: High voltage MOS-ICs for EL panel drive are soldered onto the flexible substrate. For higher mounting efficiency, two 44QFP chips are mounted at the same coordinates on both sides of the double-sided flexible film substrate, using a special 'twin hot ram' solder reflowing method developed by Sharp.

Multi-lead connections: Since a TFEL panel contains a large number of fine pitch terminals, involves a driving voltage of 200V or higher and high peak current of no less than 40mA flowing through each terminal electrode, the teminals are connected by soldering which has excellent reliability over long periods. The soldering method features the combination of uniform pressurisation at terminal joints using the static pressure of gas, with local heating by an infrared spot lamp scanning method.

Display construction

The Sharp EL display unit comprises the following three components: an EL panel; the high voltage driver MOS-IC's on a flexible printed circuit board; and the display control board. The construction is illustrated in Fig.12.

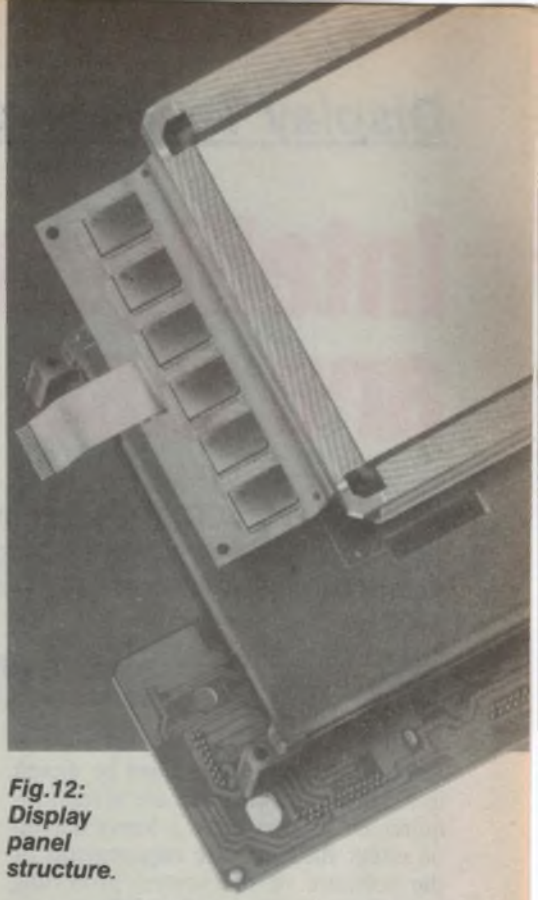


Fig.12: Display panel structure.

Fig.13 shows the functional block diagram of the unit. Presently, two different driving methods are used by Sharp: the P-N (p-shannel & n-channel) symmetric drive shown in Fig.13(a) and the P-P (push-pull) symmetric drive shown in Fig.13(b). The latter allows a reduction of approximately 45% in power consumption.

Further details of the Sharp EL displays are available from Manuco Electronics, 21 Agnes Street, Jolimont 3002, or phone (03) 650 3977.

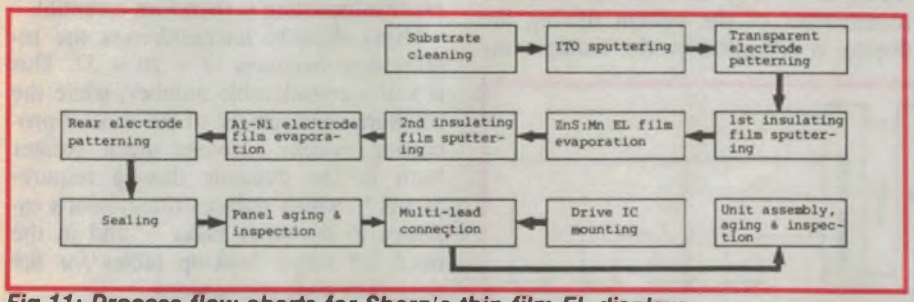


Fig.11: Process flow charts for Sharp's thin-film EL displays.

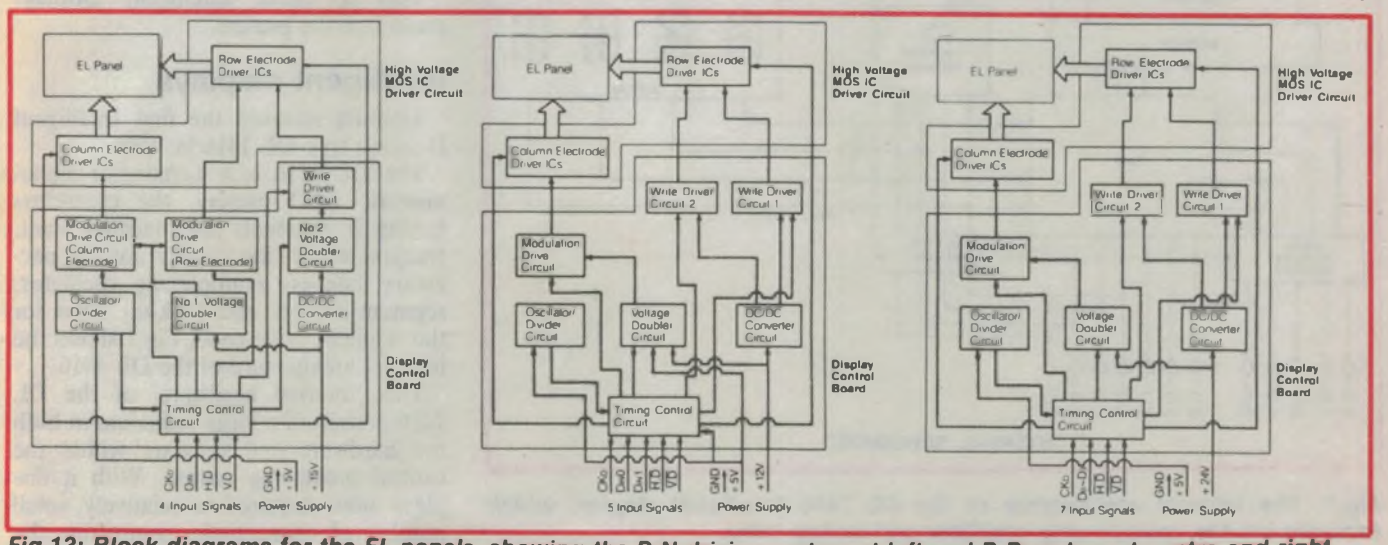


Fig.13: Block diagrams for the EL panels, showing the P-N driving system at left and P-P system at centre and right.

Display Technology Feature:

Intelligent LED displays are also programmable

The use of LED alphanumeric display panels with built-in 'intelligence' and attribute programmability can save not only external support hardware, but system software overhead as well.

by EDGAR SANDY
Semiconductor Product Manager, Siemens

When a bank of LED displays such as several 7-segment digits must be driven in a digital system, there are several requirements which place a heavy burden on either the hardware requirements or the software of the central processing unit of the system, or both. For example, if a six-digit display is to be driven in a non-multiplexed mode, then the display including decimal points requires 6 x 8 = 48 interconnect lines, each line requiring a latch/segment driver.

In order to reduce this hardware overhead, the display can be multiplexed – that is, the digits turned on singly but sequentially, at a rate above that at which flickering would be noticible. In this case, the number of latch/drivers and lines is reduced significantly. In the case of our 6-digit display considered above, it would fall to one 8-bit latch/-driver for the segments and decimal point, and one 6-bit latch/driver to control the six digits.

Although multiplexing therefore seems to be a good idea, the software requirement of the system driving the display is extended by the multiplexing routines. There is already considerable software involved in converting from hexadecimal or whatever system the central processor uses, to 7-segment code for driving the displays, whether multiplexing is used or not.

But the hardware/software requirements involved in driving six 7-segment displays may well be considered trivial, when consideration is given to more advanced alpha-numeric displays. These may typically involve 16 segments, plus a decimal point. In addition a six-character display is likely to be too small to provide useful messages, as typically 20 characters or more are required.

Non-multiplexed driving of this size of display would be impracticable – it would need 17 x 20 = 340 latches/drivers. Multiplexing is therefore essential.

Using discrete latches/drivers the requirement becomes 17 + 20 = 37. This is still a considerable number, while the software requirement of the central processing system becomes much greater both in the dynamic driving requirements – which reduces the system's capacity to do other tasks – and in the need for larger look-up tables for the necessary code conversions.

This is where Intelligent Displays come into the picture.

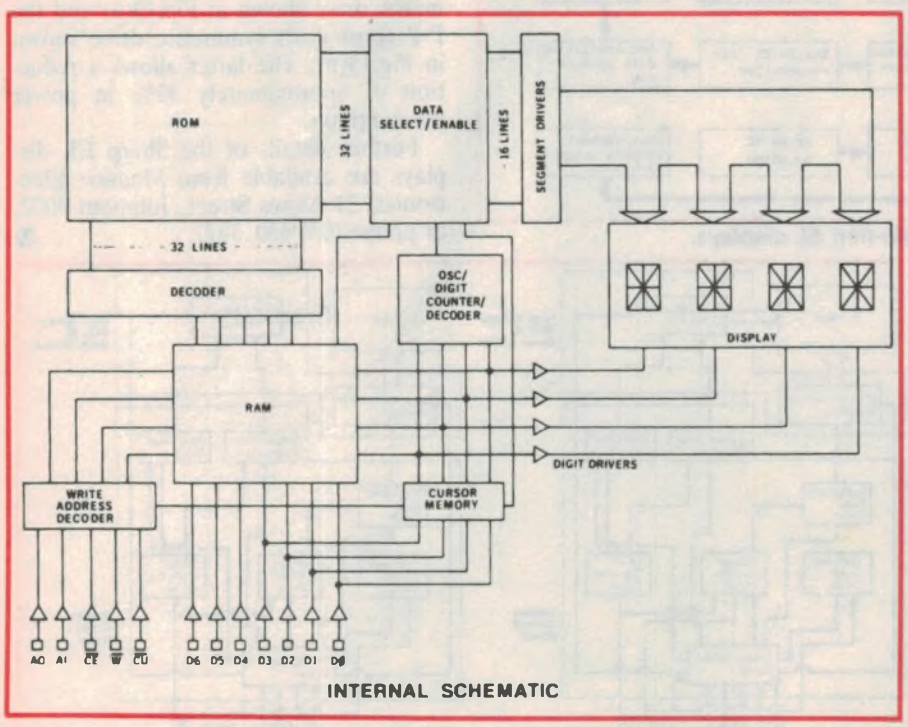


Fig.1: The internal architecture of the DL 1416 intelligent display, which includes latches, multiplexing oscillator and lookup table.

Intelligent displays

Litronix released the first Intelligent Display, type DL 1416 in 1977.

The DL 1416 is a 4-character alphanumeric LED display, the characters having 16 segments plus decimal point. Integral within the display are the necessary latches, multiplexing oscillator, segment drivers and look-up table for the segment drive code. Fig.1 shows the internal architecture of the DL 1416.

This 'internal hardware' of the DL 1416 permitted a large reduction in both the hardware and software within the central processing system. With it displays now required a relatively small number of connections, comprising the

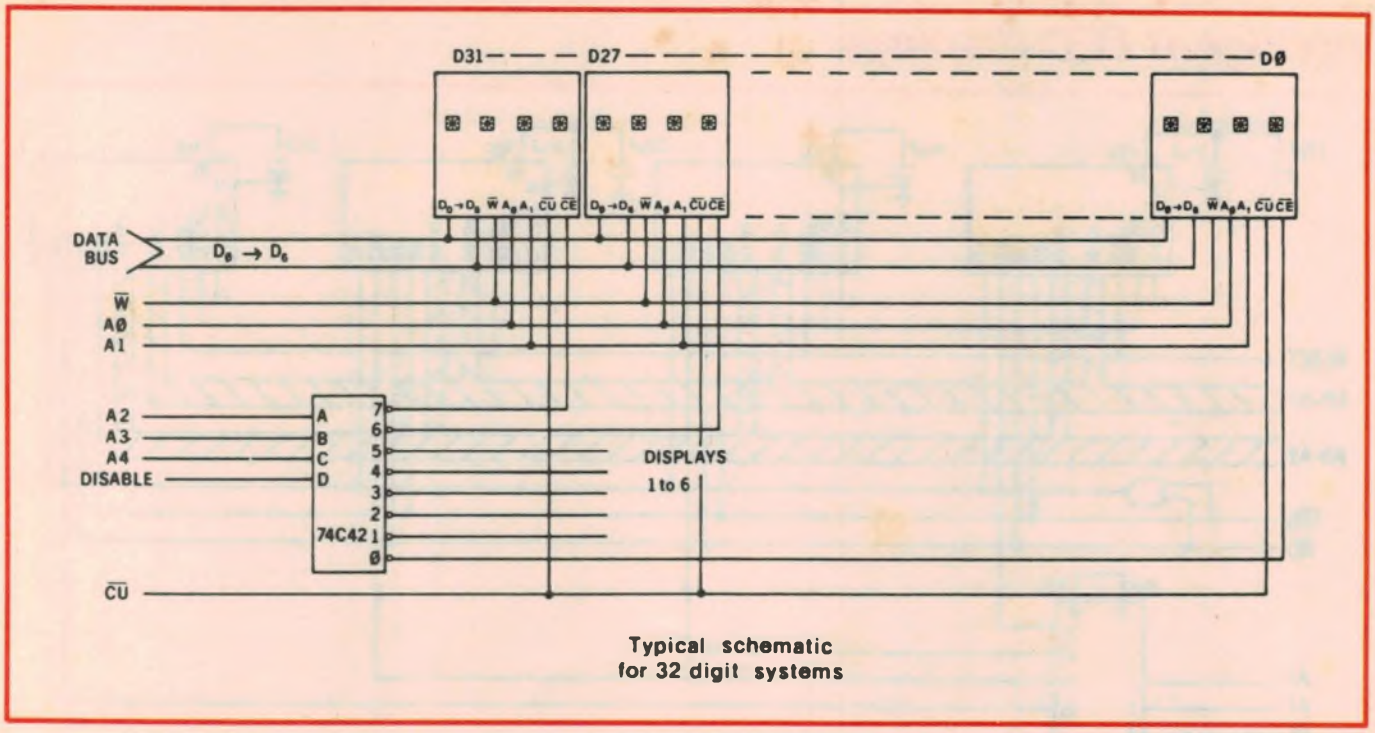


Fig.2: Interconnection of eight DL 1416 chips for a 32-digit display requires only one additional chip.

data bus, a few address and chip select lines, and the write line.

Data is passed to a display like the DL 1416 in ASCII code. Even in the case of a large display, say 20 or more characters, the only additional external device needed is for address decoding – for example a 74C421, as shown in Fig.2.

After the release of the first intelligent display device, other events took place as well as further developments of this type of display. Further developments produced additional displays including the DL 1414, DL 2416 and DL 3416.

In the area of 'other events', Siemens AG of West Germany acquired 80% of Litronix in 1977, and in 1982 acquired the remaining 20%. Hence in 1983 Litronix became the Optoelectronics Division of Siemens Components Inc., and now only 'old-timers' in the industry remember the Litronix name.

In due course some of the DL series of intelligent display devices became second-sourced by other manufacturers, while Siemens itself progressed to a new generation of such displays – the so-called *Programmable Displays*.

Programmable displays

In 1984 the multi-segment display PD 2816 was released, following in 1985 by 5 x 7 dot-matrix types PD 3435 and PD 3437. These latter types have already been phased out, having been superseded by types PD 3535 (with high efficiency red LEDs) and PD 3537 (with bright green LEDs).

The block diagram of the PD 3535 is shown in Fig.3, and a 16 character display configuration is shown in Fig.4.

The PD 3535 and PD 3537 are four-digit display system modules. The digits

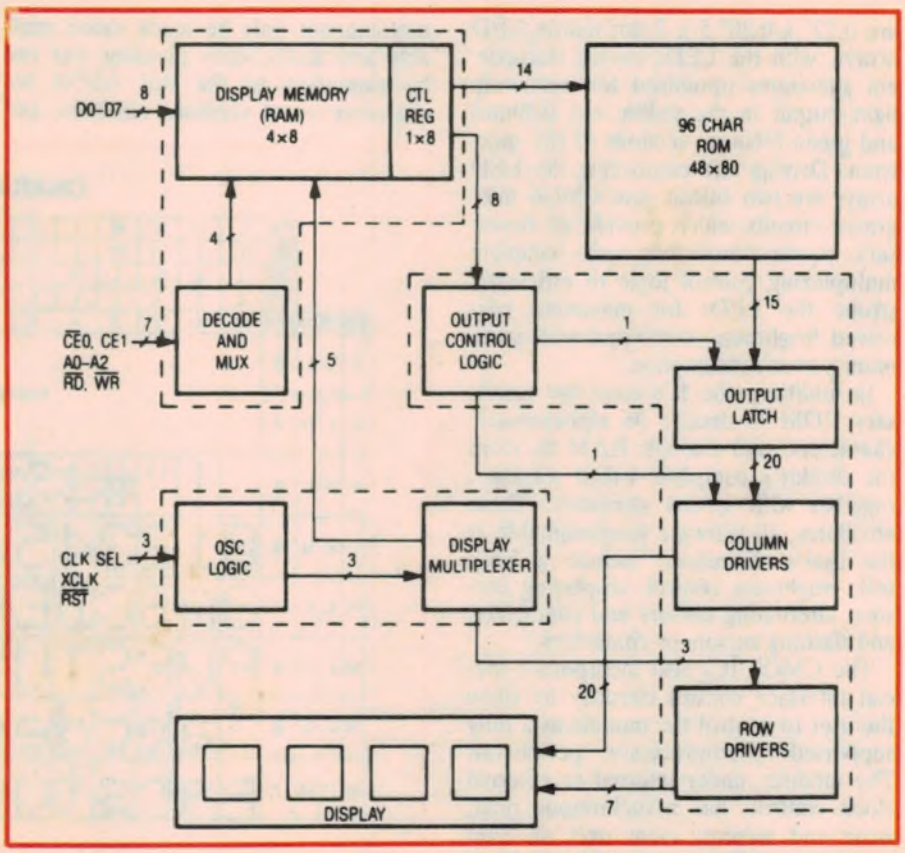


Fig.3: Inside the PD 3535 programmable display device, which displays four characters – each via a 5 x 7 dot matrix array.

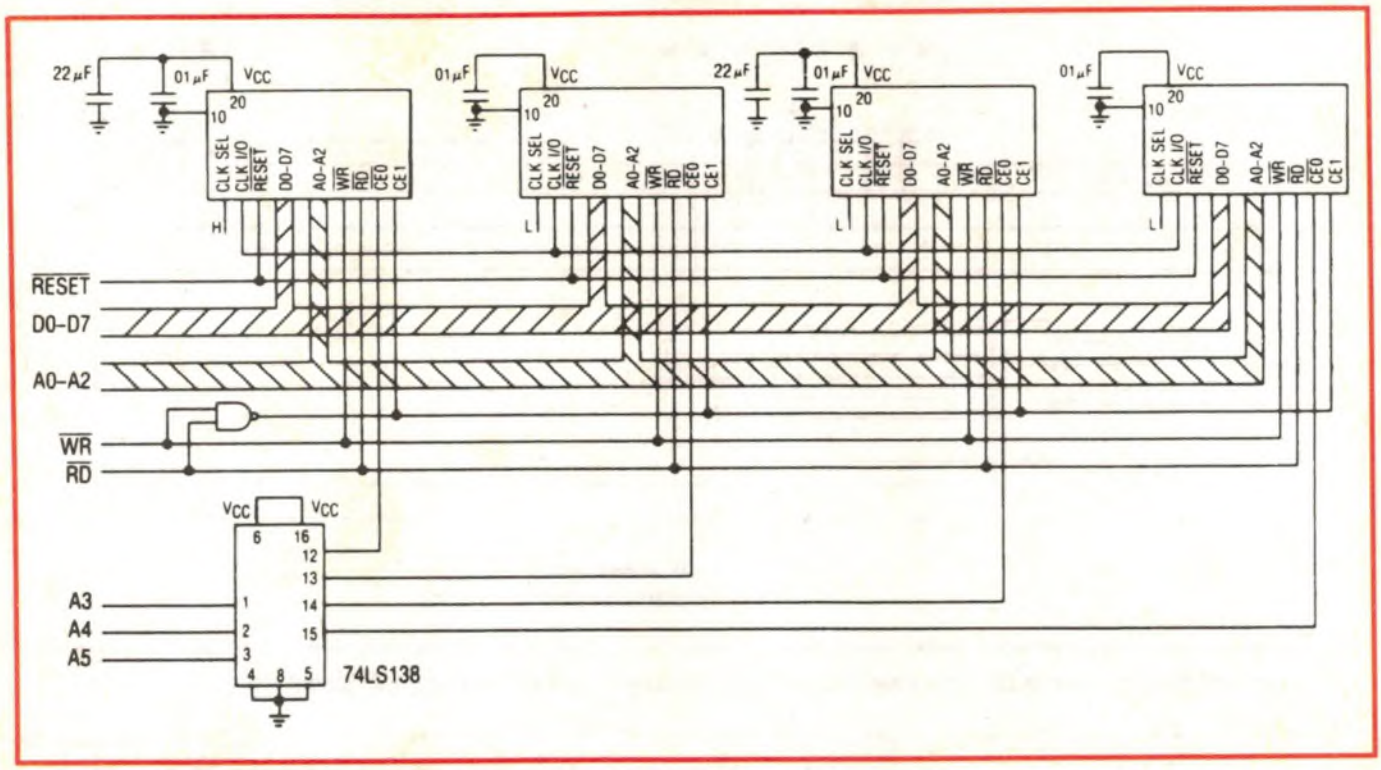


Fig.4: The way four PD 3535 programmable displays are connected together to produce a 16-character display. Again very little external hardware or software overhead is required.

are 0.27" x 0.20" 5 x 7 dot matrix LED arrays, with the LEDs having transparent substrates optimised for maximum light output in the visible red (630nm) and green (560nm) sections of the spectrum. Driving and controlling the LED arrays are two silicon gate CMOS integrated circuits which provide all necessary power transistors and complete multiplexing control logic to efficiently strobe the LEDs for maximum perceived brightness, combined with minimum power consumption.

In addition, the ICs have the necessary ROM to decode 96 alphanumeric characters, and enough RAM to store the display's complete 4-digit message, together with special attributes. These attributes, all software programmable at the user's discretion, include a lamp test, brightness control, displaying cursors, alternating cursors and characters, and flashing cursors or characters.

The CMOS ICs also incorporate special interface control circuitry to allow the user to control the module as a fully supported microprocessor peripheral. The module, under internal or external clock control, has asynchronous read, write and memory clear over an 8-bit parallel and TTL compatible bi-directional data bus.

Using a 5 x 7 dot-matrix, the characters can not only be made more readable and aesthetically pleasing, but can be expanded to the full ASCII 96-character set of symbols, numbers, and both upper and lower case letters. The character set is shown in Fig.5.

Besides an expanded and more readable character set, the PD displays have

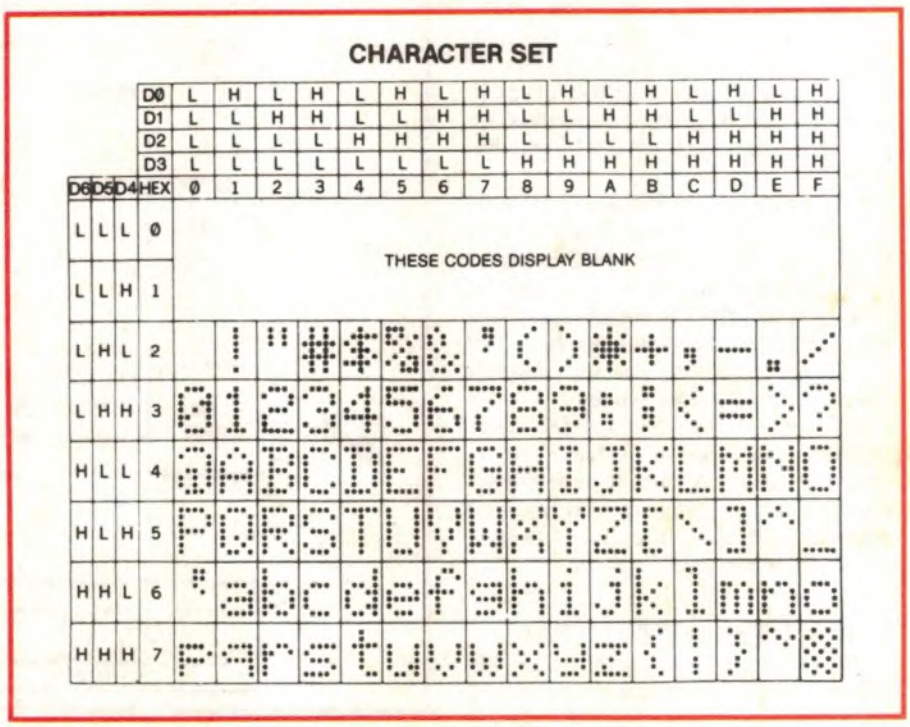


Fig.5: The character set which can be displayed on the 5 x 7 dot matrix LED arrays of the PD 3535 and PD 3537 displays.

several other additional attributes over their DL type precedents.

The data bus is bidirectional, so that the ASCII character information may be read back from the display, as well as written into it. This can permit a small reduction in memory requirements in the central processing system, but more importantly it can further reduce the software overhead of the system.

Programmable features include possibility of single or multiple blinking characters, programmable intensity, and asynchronous memory clear function. In order that displays of more than 4 characters, that is more than a single PD unit, can have synchronously blinking characters, one of the units can be made a 'master' and the remaining units slaved to this master. In Fig.4, the leftmost display is the blinking master, and the others are slaved to it.

The features of the PD 3535 and PD 3537 can be summarised as follows:

Four 6.86mm dot matrix characters in bright green (PD 3537) or high-efficiency red (PD 3535)
Readable from 4 metres
Built-in memory, decoders, multiplexer and drivers
Wide viewing angle, X-axis +/-55°, Y-axis +/-65°
96-character ASCII format (both upper and lower case)
8-bit bidirectional bus
Read/write capability
End stackable
Internal or external blinking clock
Built-in character generator ROM
TTL compatible
Easily cascaded
Less CPU time required
Programmable highlight attributes (single or multiple blinking function)
Asynchronous memory clear function
Character test
Display blank function
Programmable brightness level
Extended operating temperature range: -40°C to +85°C

Special functions

Other displays in the intelligent and programmable families include single digit 5 x 7 and semi-intelligent 8 x 8 dot-matrix types.

The 8 x 8 configuration does not have a character generator, but rather the dot pattern for each column has to be provided. This 8 x 8 display can be stacked in both X and Y directions and its dot pattern mode therefore permits large displays to show graphics or special effects, such as Chinese or Japanese characters.

Other displays of this sort include semi-intelligent displays in which the multiplex drive of the characters is an integral part, but the character generator is not included, so that non-English characters can be displayed.

Conclusion

Although intelligent/programmable displays are naturally more expensive than 7-segment or non-intelligent discrete character 5 x 7 dot-matrix displays, their use can greatly reduce the hardware and software overheads in particular designs for digital systems. Both of these factors reduce the time involved in system development, while reduced hardware also reduces assembly time – all important considerations where time is money.

Further information on Siemens intelligent and programmable displays is available from the author at Siemens Electronic Components, 544 Church Street, Richmond 3121 or phone (03) 420 7314.

NOTE: Intelligent Display and Programmable Display are registered trademarks of Siemens.

WHAT TYPE OF DISPLAY TECHNOLOGY WOULD SUIT YOUR APPLICATIONS?

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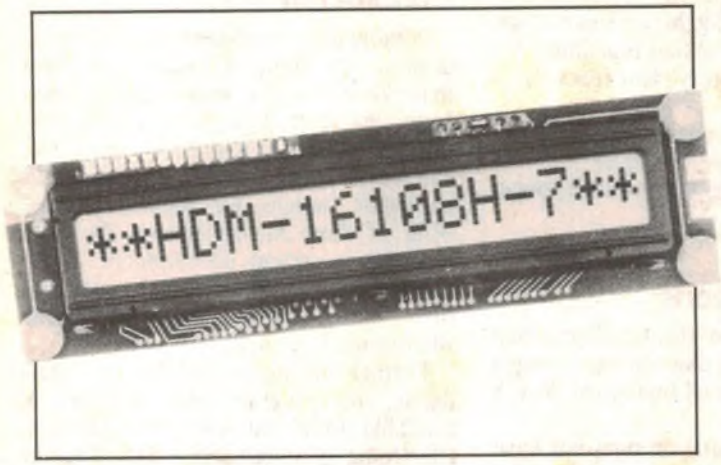

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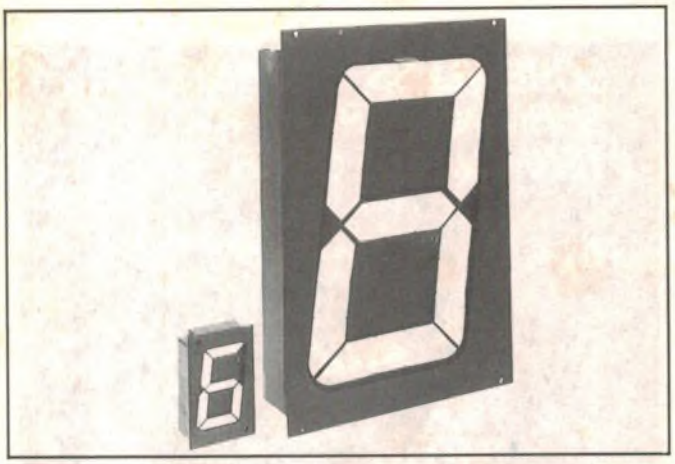

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- 57mm AND 100mm LED Seven Segment versions.
- ***WIDE RANGE EX-STOCK***

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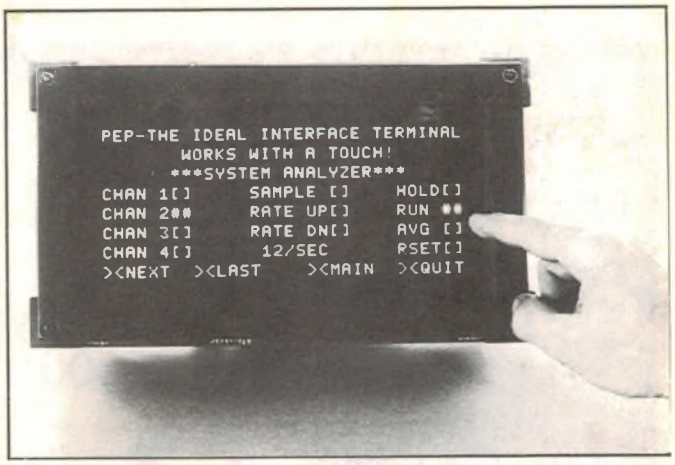

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Display Technology Feature:

Electromagnetic displays for outdoor uses

Large 7-segment displays based on bistable electromagnetic elements provide high readability and reliability in outdoor applications, and are finding increasing use in Australia.

Imagine making your way up the stairs of a six-story building. You reach the top, puffing and panting, and then wait in a small queue until it's your turn. You turn to look from the top of the long, steeply sloping water slide. Your heart begins to race and the adrenalin starts pumping. You have carried your mat all the way up to the top, and you are not going to leave it behind.

You have watched the others take the daring ride all the way to the bottom of the slide, off in the distance. Every time there is a scream at the top, then the disappearing body as it hurtles down, out of control, skimming along on the surface of the water. Now it's your turn. You take a deep breath, bend down and sit on your mat. You stop, the whole world stops.

Suddenly you hear yourself scream and you are hurtling down what looks like half of a blue pipe. There is nothing but blurs of people, fleeting images of distant scenery and the monorail. Faster and faster you go down the slide.

Suddenly, within seconds you reach the bottom of the 70° slope. You look up at the scoreboard and there it is – you have just registered the fastest-ever descent achieved on the Sea World Water Slide. The figures are clear enough for everyone to see on those big yellow electromechanical digits. You go back to the steps to try again, invigorated.

That's the story played out every day by thousands of people, on the Sea World Water Slide in Brisbane. A recent addition to this successful fun park is the scoreboard, which shows various speeds reached. Display of the numbers is achieved by the use of simple and reliable electromechanical displays, manufactured by Bodet in France.

Bodet electromagnetic displays are now being used in all sorts of applications, including scoreboards at cricket and football grounds, racetracks, petrol price signs at service stations, load indicators at weighbridges, road advisory signs, in steel mills, tramways and television.

The success of Bodet electromagnetic displays is due to a number of different factors, the main ones being excellent reliability, ease of installation and servicing – together with the extreme ruggedness needed for Australia's harsh environmental conditions.

The initial design was based on meeting the following criteria: wide operating temperature range, compatibility of modules within the series, very low

The scoreboard of the Sea World Water Slide, showing the high display clarity of the Bodet electromagnetic display modules.

Electromagnetic display panels

power consumption, long life, easy fixing technique and a rugged protective casing. The result of considerable development work was a complete range of H700 displays, offering many advantages.

The basic display module is a 7-segment digit display using bistable electromagnetic elements, and capable of displaying the numerals from 0 – 9 plus some characters such as A, C, E, F, G, H, I, J, L, P, O, S and U. Each segment of the display is capable of being individually controlled, in terms of setting (display) and resetting.

Each display is made up of seven bistable electromagnetic vanes, each one

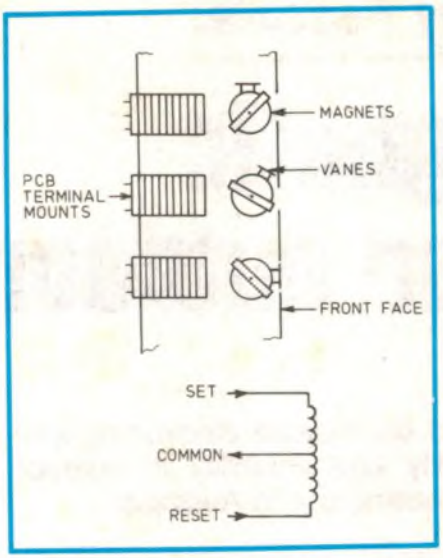

Fig.1: How the electromagnetic displays operate. Current pulses in the windings are used to switch between the two stable states for each segment ('on' and 'off').

driven by two coils. The rotating segment or vane includes a rotating magnet. A short current impulse in one of the two coils creates a magnetic field which changes the position of the rotating magnet and vane. (See Fig.1)

The vanes remain in their selected positions when at rest, due to the residual magnetic field.

As the segments are bistable, no power is consumed when the display is at rest. There is only a small amount of power required when a change or update is made to the display status. And because the segment vanes are locked in position electromagnetically, this gives a stable and reliable long-term display when required.

At the same time the small mass and simplicity of each moving element gives a very short response time, making the displays well suited for applications where the displayed information must be frequently updated.

The display modules have a rugged polycarbonate casing reinforced with 30% fibreglass. The casing is finished in a matt black colour, with the segment displays in either white or yellow. Character slope is 7° 30′. Each module is delivered with a receiver PCB for mutliplexing control, and an ID connector for flat ribbon cable.

For further information on Bodet electromagnetic displays, contact M.B. and K.J. Davidson, 17 Roberna Street, Moorabbin 3189 or phone (03) 555 7277.

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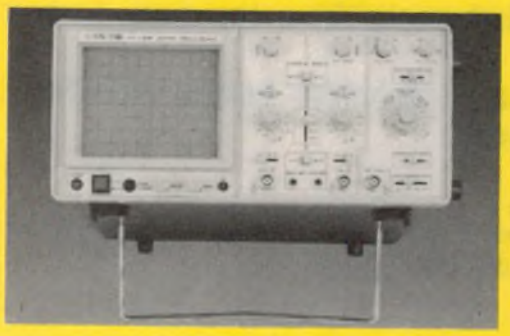

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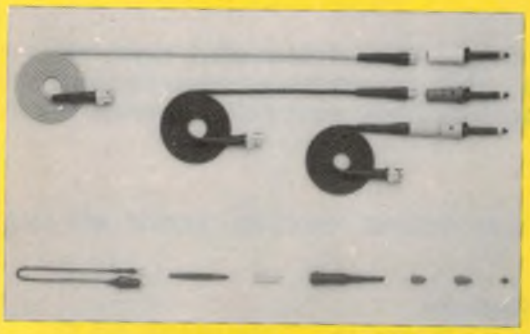

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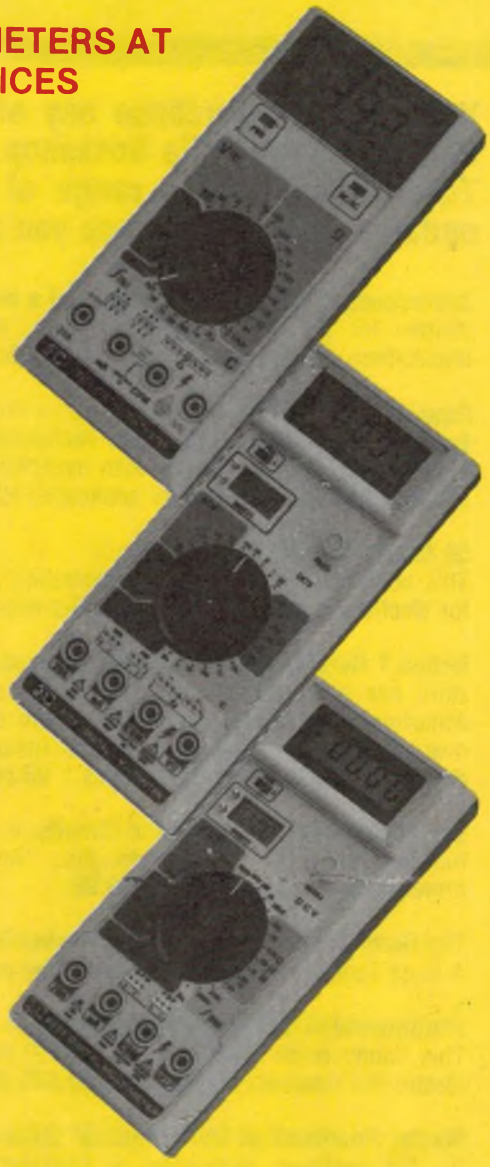

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ETS 1003	90003	1 x	Scope		100		10		30		3.0	67.68
ETS 1011	90011	10 x	10		15.0		100		3.0		1.2	57.48
ETS 1012	90012	10 x	10		16.5		80		4.0		2.0	81.72
ETS 1013	90013	10 x	10		19.5		60		5.0		3.0	89.28
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Solid State Update

KEEPING YOU INFORMED ON THE LATEST DEVELOPMENTS IN SEMICONDUCTOR TECHNOLOGY

AT&T develops multi-state tunneling transistor

Research scientists at AT&T Bell Labs in Murray Hill, New Jersey have demonstrated a new quantum device that functions as a tiny parallel processor, to dramatically reduce circuit complexity. Called a multi-state resonant tunneling bipolar transistor, it has been used to implement circuits usually requiring dozens of conventional transistors.

The new device operates at up to 24GHz or twice as fast as a typical high-speed silicon transistor. It was created by Federico Capasso, Alfred Y Cho, Leda Lunardi, Susanta Sen and Peter Smith, all of AT&T Bell Laboratories.

The world's first resonant tunneling bipolar transistor was demonastrated at AT&T Bell Laboratories in 1986 by Capasso, Sen and Arthur Gossard. Since then, however, scientists there have radically altered its design and greatly enhanced its capabilities.

"Although there is a great deal of work currently being done on quantum devices, this transistor differs greatly from previous ones," said David Lang, Director of Solid State Electronic Research Laboratory at AT&T Bell Laboratories. "Whereas normal transistors have been limited to two states, 'on' and 'off', this is the first transistor with multiple states: three or more".

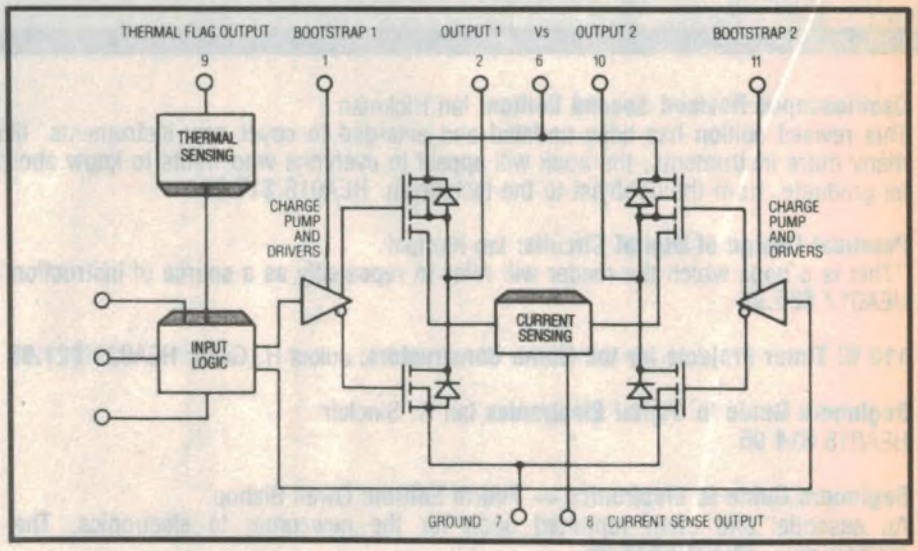
Capasso, head of the Quantum Phenomena and Device Research Department, explains why this multi-level, or multi-state capability is important. "Normally, the output current of a transistor increased steadily as input current rises," he said. "In the multi-state transistor, however, as the input current increases the output current peaks, falls off, then peaks again. It is this unique, multi-peak characteristic that produces the multiple states and allows a single device to do the work of many traditional transistors. It is like a microscopic parallel processor capable of performing many logic and analog circuit functions."

Although still an exploratory device, the multi-state transistor has successfully implemented such complex functions as parity bit-checking in digital systems and frequency multiplication.

Parity bit-checkers are circuits used to detect transmission errors in a digital transmission system. They normally use 24 conventional transistors to check four-bit words. The scientists at AT&T Bell Laboratories accomplished this task with just one of the new devices.

A single multi-state transistor performed the function of a frequency multiplier circuit by converting and amplifying an input signal of, e.g., 300 million hertz (megahertz) into an output signal of 1.5 gigahertz.

These circuit demonstrations suggest that in the future a much higher density of functions than in today's integrated circuits could be packed in the same area.



Natsemi-IR develop smart-power IC

The LMD18200 H-bridge driver, targeted at the smart-power market, can drive DC and stepper motors up to 1/4-horsepower. Integrated on the single chip are four power DMOS transistors and control logic, which includes internal current sensing, output short-circuit protection and two-stage thermal shutdown capability.

The features, performance, reliability and size of the LMD18200 make it suited for use in many motor-control applications. They include computer peripherals (tape and disk drives, printers and plotters), office equipment (scanners, copiers and FAX machines) and industrial automation (robots).

The LMD18200 is the first device to emerge from a five-year development agreement between National and International Rectifier, which will also market the part. The partnership marked the first alliance between two major semiconductor firms to develop power ICs for smart-power applications, and was signed to allow the compainies to consolidate a leadership position in the market.

The 3-amp H-bridge is fabricated with a multiple-technology process that uses CMOS and bipolar control circuitry at the front end and DMOS FET power devices as the outputs. The circuit operates at supply voltages from 12 to 55 volts, with a continuous output of 3 amps (6 amps peak). On-resistance of each of the four output MOSFETs is typically 0.3 ohm, and turn-on and turn-off switching times are typically 100ns.

Input voltage requirements provide high noise immunity and are CMOS and TTL compatible. The LMD18200 interfaces with PWM (pulse-width modulation) input signals and is suitable for both locked anti-phase (one-wire) or sign-magnitude (two-wire) forms.

Further information is available from National Semiconductor distributors in each state.

Toshiba develops 4 megabit EEPROM

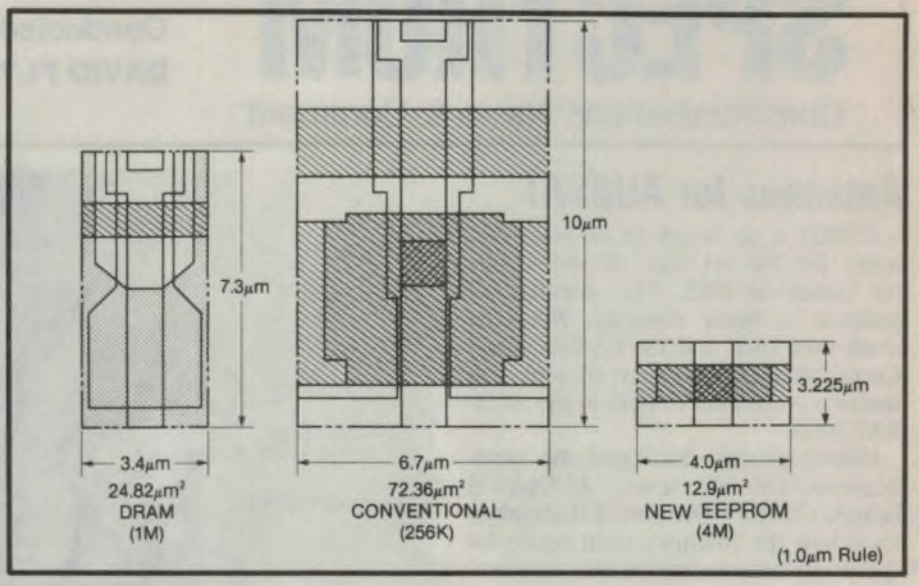
Among the various kinds of memory chips, EEPROMs (electrically erasable/programmable read-only memories) are one of the most promising devices for replacing floppy disks. These devices can retain programmed data even when power is off, and data stored in them can be electrically erased and rewritten. On the other hand, random access memory chips such as DRAMs and SRAMs lose data when power is cut off.

Unfortunately, current commercial production of EEPROMs is limited largely to 256-kilobit devices, which do not have enough capacity to replace floppy disks. It is difficult to attain a higher level of integration because of the complexity of the memory cell structure of non-volatile memory chips compared to DRAMs.

However a breakthrough development announced by Toshiba researchers simplifies the chip's cell structure. Their new design dramatically reduces cell size and the number of components.

By using this new technology, Toshiba has developed the world's first 4-megabit EEPROM. The new EEPROM has a readout time of 1.6 microseconds, more than 1,000 times faster than floppy disks, and its write time of 1.0 microsecond is equivalent to floppy disk speed.

In a conventional EEPROM, a pair of transistors (a memory transistor and a select transistor) form a memory cell to store one bit of information. This means, for example, that eight memory transistors and eight select transistors – 16 transistors in total – are required to store eight bits of information.



Toshiba scientists have created what is claimed to be revolutionary circuitry, in which two select transistors control a number of memory transistors. Using their advanced CAD system, they have found that a combination of eight memory transistors and only two select transistors is most efficient in terms of enhancing integration. That is, the new cell structure can represent eight bits of data with 10 transistors, in contrast to the 16 transistors required for conventional EEPROMs.

In the new cell design, eight memory transistors are connected in a straight row, and one select transistor is attached at each end of the row. Toshiba calls the new design 'NAND' cell structure because of its similarity to NAND-type logic structure, which outputs '0' only when all input signals are '1'.

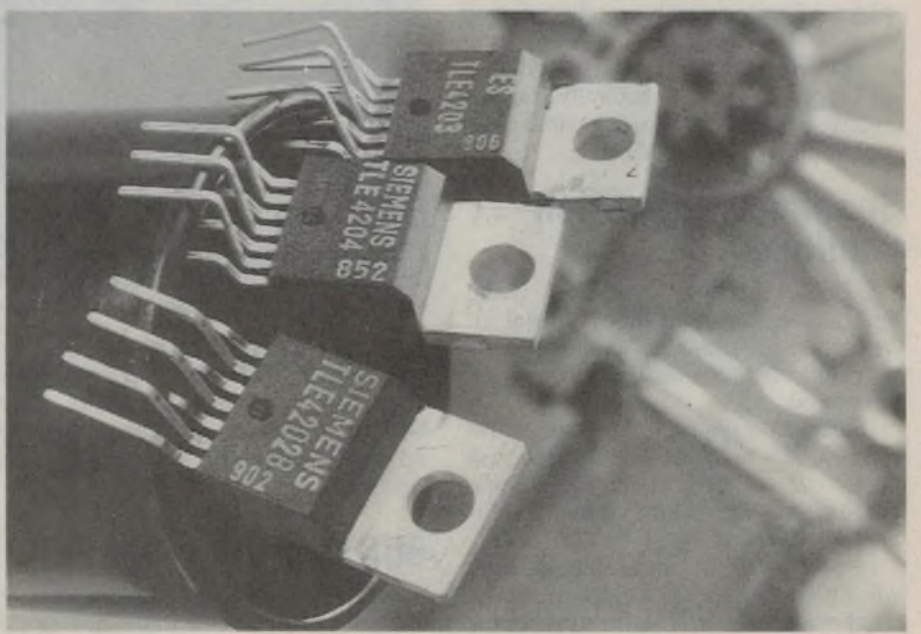
DC motor control bridges

Siemens now offers a series of monolithic motor bridges for the control of DC motors in automotive vehicles and industrial plants. The short-circuit proof circuits can accommodate voltages of up to 42V and currents up to I_{max} = 4A. Samples of the devices are available .

Clockwise rotation, counterclockwise rotation as well as defined accelerations and braking can be readily obtained by the application of suitable logic levels to the bridges.

There are three new power bridge devices which range from I_{max} = 2A (TLE 4204 B) through 3A (TLE 4204) to 4A (TLE 4203). The components are not only short-circuit proof but also protected against overtemperature. The temperature of the heat sink P-T66-7 may lie between –40°C and +125°C.

Motor bridge TLE 4203 with I_{max} = 4A employs and output stage without cross current. As a result, the speed of a DC motor can also be controlled by pulse-width modulation via the TTL compatible input.



For further details contact the Communications Equipment Department of Siemens, 544 Church Street, Richmond 3121 or phone (03) 420 7318.

SPECTRUM

Communications News & Comment

Conducted by
DAVID FLYNN

Antennas for AUSSAT

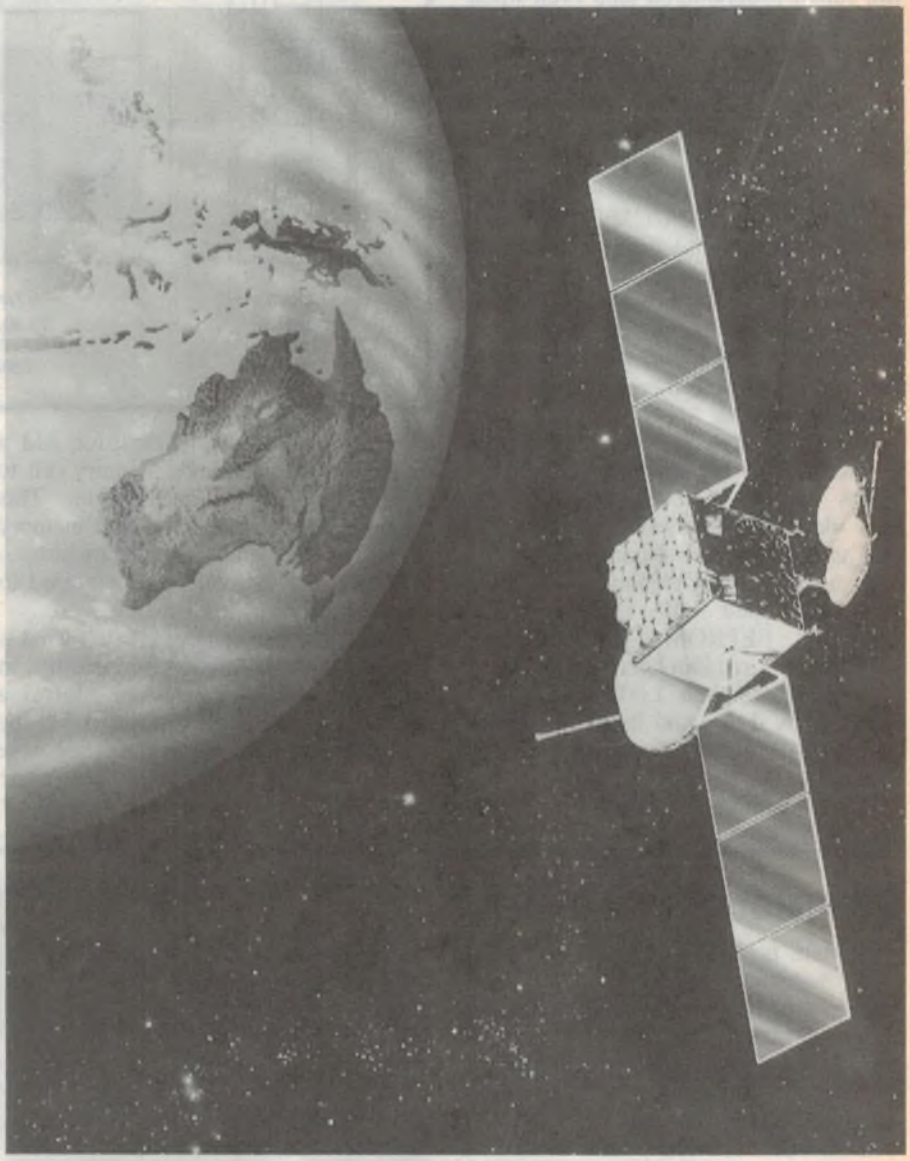
CSIRO is to design an on-board antenna for the AUSSAT-B series, due for launch in 1992. The antenna will produce a beam covering WA, the north-west shelf and the Christmas and Cocos Islands, and is part of a plan to increase Australian content in the AUSSAT birds.

Having already developed the specifications for all seven AUSSAT-B beams, CSIRO's Division of Radiophysics is now the country's main centre for spacecraft antenna design and measurement.

Meanwhile AUSSAT and Telecom are still vying for a role in distributing pay TV. The long-standing favourite is for direct satellite broadcasts (DBS), using high-powered spot beams to reduce dish size to barely 30cm using the latest square antenna designs.

Such an approach is best suited to Australia-wide services, and with terrestrial television now truly networked (and this influence set to increase under equalisation) it has been commonly assumed that this is the direction Pay TV will take.

The cat amongst the pigeons is Hoyts, whose submission calls for allocation of a single licence per city, with the licensee to provide a number of channels – an approach which naturally favours Telecom's plans for wiring cities with high-capacity fibre optic cable.



An artist's representation of one of AUSSAT's B-series satellites.

Seaphone expansion continues...

OTC's Seaphone service, riding higher than ever after the successful introduction of Auto-Seaphone, will grow to include an additional 18 sites by the year's end.

Under an expansion program worth close to $5 million, the network will then cover the western and eastern seaboards and other major coastal centres around Australia.

In some remote areas the facilities will be powered by solar panels, and a number will use UHF links to relay the signal to the nearest station.

Auto-Seaphone allows users of the VHF marine radio band to direct-dial domestic and international telephone calls from up to 100km at sea, and the expansion should help to reclaim some of the ground lost to Mobilenet when boating enthusiasts discovered that the cellular system had a handy seawards coverage.

BBS world

Take one computer, add a modem – and prepare to enter a whole new world of communications!

An essential criterion in my recent search for a portable PC was that it have an in-built modem, mostly so I could send stories down the line with a minimum of hassle. Little did I dream of the vast array of bulletin board systems I'd also find, and even less prepared was I for the sheer variety of special-interest boards.

Like many others I'd always considered BBS's to be a high-tech version of an elite members-only club, closed to all but the most expert programmers. How wrong can you be?

Not only are BBS's easy to use, they're also fun, and often instilled with that strange brand of humour which many 'technical types' share.

For communications enthusiasts I can recommend the following:

Shortwave Possums – Australia's first and foremost SWL BBS also includes items on FM and TV DX, AM broadcast band DX and scanning. The latest station schedules, reports and plenty of programs to download – call (02) 651 3055 (V21, V22, V2bis).

AMNET – of special interest to radio amateurs, AMNET also acts as a gateway into the packet radio system to limited and full-call licensees. (03) 366 7055 (V21, V22, V22bis & V23)

AMPAK is another amateur-oriented BBS with packet facilities on (07) 263 7070 (V21, V22, V22bis, V23, B103 & B212).

Also of interest are High-Tech, an amateur/packet BBS on (060) 25 1813 (V21, V22, V22bis, V23, B103 & B212) and the Dick Smith Electronics system on (02) 888 887 2276 (V21, V22, V22-bis).

Radio Australia's experimental BBS 'Matilda' has finished its trial at time of writing, but hopefully this excellent system will be back as a permanent fixture.

There are also a number of similar BBS's overseas, which I'll detail in a future column.

On The MOVE

With cellular phones, portable fax machines and laptop computers, who needs an office?

That's the question posed by European company Europa, who have launched their Mobile Office Vehicle Equipment concept – a total communications package on wheels, including the wheels themselves!

MOVE comprises a portable cellular phone with in-car adaptor, a pager and fax machine; a portable IBM-clone PC with 40 Mb hard disk and drives for both 3.5" and 5.25" disks, colour EGA monitor and desk-top printer; and for creature comforts, satellite TV plus a 60 watt six-speaker AV system!

Who'd be a UK scanner enthusiast?

The British DTI have been coming down with increasing force on scanner hobbyists, with the most recent prosecutions against five South London users resulting in fines exceeding $3000 and the confiscation of $5000 worth of equipment.

The hobbyists drew attention to themselves by swapping frequencies and information on the CB channels, and after months of monitoring were raided by a total of 25 police and DTI officers.

Having received fleeting fame as 'The South London Five' in England's socialist press, perhaps they'll be a bit more discreet next time around...

SBS sponsorship given go-ahead

The SBS (Special Broadcasting Service) has been given approval to raise additional funding through the broadcasting of sponsorship announcements. This decision is in response to a request from the SBS to the Minister for Transport and Communications, Ralph Willis, for permission to accept sponsorship for the 1990 World Cup Soccer Series and SBS Test Pattern transmissions.

Mr Willis said that although the SBS is presently almost wholly funded by the Federal Government, its ability to receive sponsorship has always existed via Section 79ZA(d) of the Broadcasting Act – subject to approval by the Minister.

Mr Willis stressed that his approval was confined to sponsorship announcements; it did not permit advertising of a kind seen on commercial televsion stations.

Vintage Radio

by PETER LANKSHEAR

Restoring a classic STC radio – 2

Last month's article described the condition and design details of an STC model 562 receiver that had seen better days. This article will cover the work that was necessary to make it once again a fully operational and useful radio.

Before launching into a description of the actual restoration work, I would like to give a few words of advice – even a warning.

With this receiver, as with others I have restored, at no time was any attempt made to 'fire it up' before restoration to see if it would 'go'. The initial checks had shown that it could not have worked anyway, and there would have been a chance of doing serious damage.

My advice in fact is to be very cautious about applying power to receivers that have not been checked over, for the chances are that the only thing heard will be the bubbling of overheated power transformer wax! It's a good rule to ALWAYS check out and service old equipment before switching on.

First priority

A thorough cleaning was essential before any serious work was undertaken, and this started with washing the exterior of the chassis. Provided that it is completely dried afterwards, electronic equipment is not harmed by clean water, but nevertheless care was taken to avoid excessive wetting of components.

A bucket of hot water, some detergent, an old paint brush and a pot scrubber dealt with the soluble grime. Stock was then taken of the physical damage. Some work would be necessary on the speaker socket at the rear of the chassis, but the worst damage was corrosion. Readily removable items like valve shields, filter capacitors, the power transformer cover and the tuning capacitor were taken off, to improve access to both themselves and the chassis.

Carborundum cloth and steel wool were used on the rust. Pitting of the surface required some hard work in places. When the sanding was finished, a commercial 'rust killer' containing phosphoric acid was applied to the affected areas to passivate the metal and provide a good painting surface.

Replacements

Before any repainting, the little white celluloid licence notice was removed from the rear of the chassis, and the rivets drilled out of the broken speaker socket.

At the time that the 56 chassis was made, some manufacturers – including STC – used large diameter valve and speaker socket holes and sockets to match. The damaged speaker socket was one of these and as there was no suitable replacement available, a piece of thin fibre board was cut to size, and a hole punched in the middle for a standard socket. A scrap of suitably coloured 'Formica' could have been used instead of the fibre.

Fortunately the open-circuited oscillator coil winding was not covered by other windings. A close inspection with an eyeglass revealed a green spot of corrosion at about the middle of the winding. It would have been possible to reuse the wire after joining the corroded ends, but a new winding was preferable and after counting the number of turns, wire of a similar gauge was wound on in the same direction as the original winding.

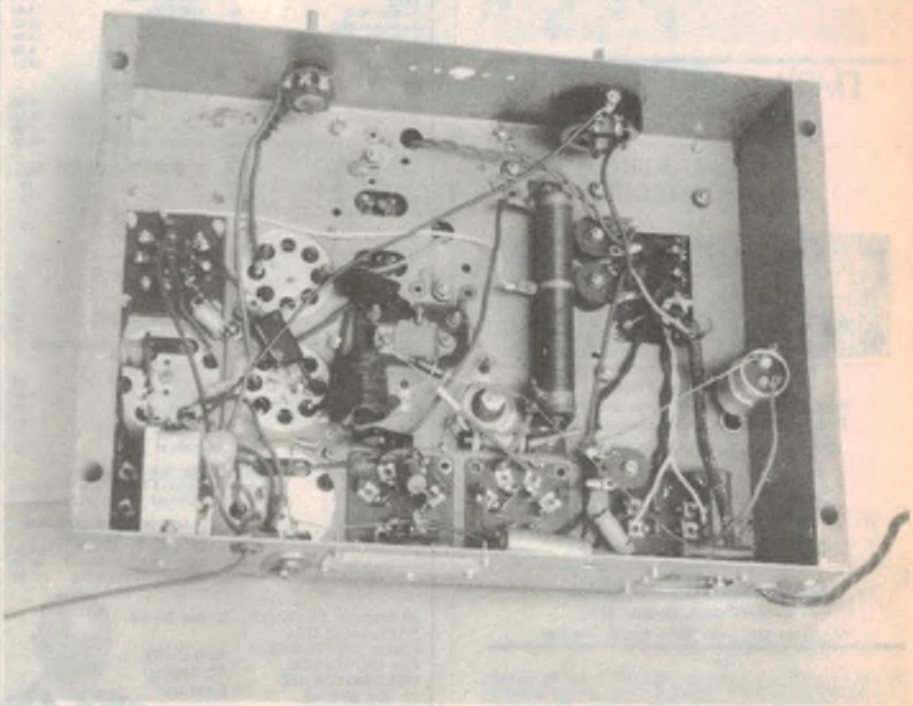


Fig.1: The underside of the chassis after servicing. Fortunately it was in better condition than the outside. Note the tubular HT voltage divider, a type popular with Australian manufacturers.

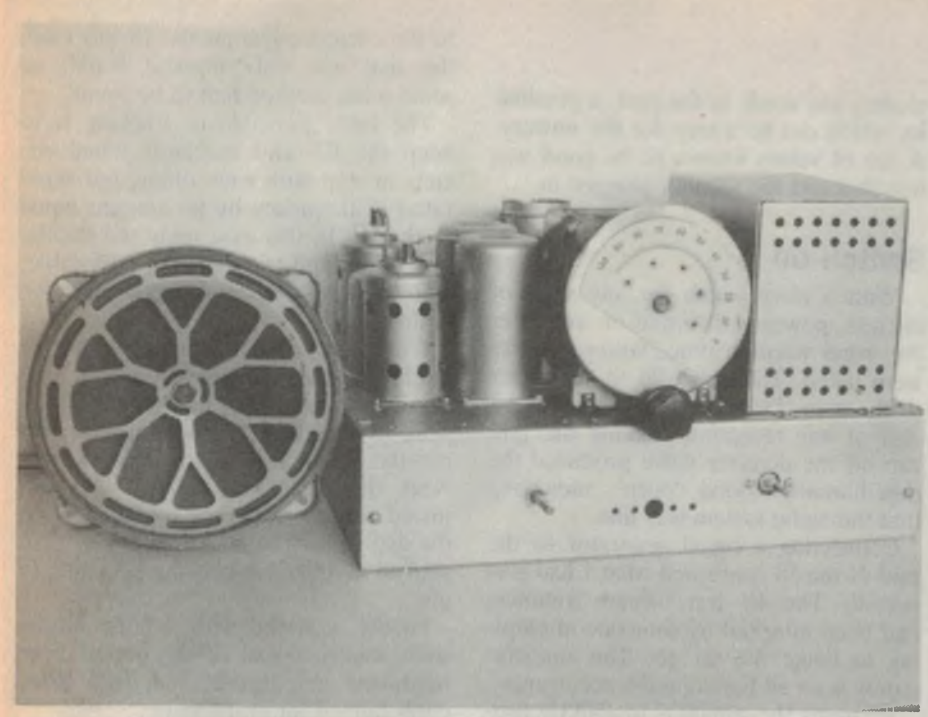


Fig.2: The finished chassis, looking a lot cleaner. As you can see the loudspeaker has an unusual framework in front of the cone.

Repainting

Prior to reassembly, the chassis was repainted. STC had used a distinctive paint finish. Best described as a metallic gold/pink, nothing even remotely like it is available commercially nowadays.

Some experimenting with aluminium paint showed that a good match came from mixing in some gold powder and red enamel! A couple of coats of this brew were brushed on and the chassis started to look respectable again.

The dial assembly, a popular type in early receivers, used a friction drive to the rim of a metal disc. Provided that there is no excessive wear or disc distortion, these drives only need some lubrication and perhaps adjustment of the collar controlling spring tension.

Tuning capacitor rust spots were removed with steel wool and the bearings were relubricated. Soft rubber mounting grommets were widely used for valve radio tuning capacitors and, as usual, these had disintegrated into a gooey mess. These mounts are now hard to find, but satisfactory replacements can generally be made from standard grommets.

With the capacitor remounted, attention was given to the grid leads of the 57 and 58 valves. Top grid leads deteriorate from exposure to heat and light, and are abraided by the edges of valve shields. Apart from the appearance of worn insulation, there is a possibility of contact to cans and shields. In this case, the detector and IF amplifier grid leads were in a bad way and were renewed.

Under the chassis

As the type 56 chassis was intended for a console cabinet, its size was generous, with plenty of room for the underside components. To be expected with the uncomplicated circuit, wiring was simple and easy to follow.

Most of the fabric covered wire was sound, but a couple of rubber insulated leads needed replacement. As a safety precaution, the power cord was replaced even though it appeared to be in reasonable condition.

Incidentally when renewing power cords in old sets, use fabric covered cable. Plastic coverings do not look right.

Earthing to a plated chassis is generally by direct soldering or solder lugs. These are not very satisfactory methods with the painted steel used for the 56 chassis, and STC had connected earthing points together with busbar wire. This should be remembered when replacing components.

Restoration of a receiver of this age requires a different approach from run of the mill post war models. Original components should be repaired wherever possible. Many carbon resistors and paper capacitors will have deteriorated sufficiently to warrant replacement, but they are, of course, practically non repairable.

In this case all paper capacitors showed considerable leakage when tested with a multimeter, and were replaced with modern mylar and polyester types of sufficient voltage rating. Block capacitors can often be emptied and the contents replaced by modern plastic types.

The main set of bypass capacitors 'C2' (see circuit last month) was a STC-made triple 0.25uF group mounted in a rectangular can. It was a simple matter to unclip the fibre tagboard and renew the contents with three 0.27uF 400 volt polyester units. This block of capacitors can be seen at the bottom left hand corner of the under chassis photograph.

Predictably, the original wet electrolytic filter capacitors had long since dried up. One with an iron case was badly corroded. This was discarded, but the other, being more presentable was retained – although disconnected – for appearance. Standard 16uF 450 working voltage tubular replacements were fitted under the chassis.

Note that high capacity replacements should not be used for input filter capacitors with valve rectifiers. To do so runs the risk of rectifier and possible power transformer damage. The dual cathode bypass capacitor C12 was replaced by a pair of miniature low voltage electrolytics.

STC model 562: VALVE OPERATING VOLTAGES

		Plate Voltage	Screen Grid Voltage	Grid Bias Voltage
Valve V1	Type 57	235	90	5.4
Valve V2	Type 58	235	90	2.2
Valve V3	Type 57	120	50	2.4
Valve V4	Type 2A5	225	235	14.0
Valve V5	Type 280	375 AC	425 DC	(Cathode)

ALIGNMENT FREQUENCIES: IF 460kHz. Padder 600kHz. Trimmers 1400kHz

Fig.3: A table of voltages for the set, as published by STC. The voltages in the restored set were found to be very close to these.

C8, visible in the underside picture, was a .0005uF (500pF) 'Chanex' paper capacitor inside a Bakelite case. To retain the case for its cosmetic effect, the contents were removed and a 250 volt tubular ceramic capacitor refitted inside.

Carbon resistors R1, 2, 3 and 6 had colourful labels on ceramic bodies and cast metal ends. These resistors always look the part in vintage equipment, but unfortunately each one was hopelessly high in value or open circuited. Standard one watt replacements were used.

The remaining resistors, all wirewound, were intact. This was fortunate in the case of the main voltage divider, and as it was wound with very fragile resistance wire, care was taken not to damage it in any way.

Wound on a fibre tube 20cm or so long and about 15mm in diameter, this type of voltage divider was frequently used in Australian receivers. Tappings were taken off with adjustable clips. BE CAREFUL – these clips should only be adjusted with extreme care. Normally there should be no need to touch them.

Switch-on time was approaching. First though, a careful check was made to see that were no incorrect connections – including any made in the past, a possibility which can be a trap for the unwary. A set of valves known to be good was installed and the speaker plugged in.

Switch on

With a close watch for any signs of distress, power was turned on and after the usual warmup time, voltage checks were taken. These proved to be similar to those in the table, but there was no sign of any reception. Taking the grid clip off the detector valve produced the time-honoured loud 'burp', indicating that the audio system was fine.

Connecting a signal generator to the grid of the 58 confirmed what I had suspected. The IF transformer trimmers had been attacked by someone attempting to make the set go. This unfortunately is an all-too-common occurrence.

Retuning the trimmers to 460kHz produced some life, but sensitivity was poor and the range of received frequencies seemed to be wrong. The oscillator tracking was obviously out of adjustment, but the problem was how to find the right settings.

Normally, dial calibrations are a guide to the correct adjustments. In this case, the dial was only marked 0-100, so some other method had to be found.

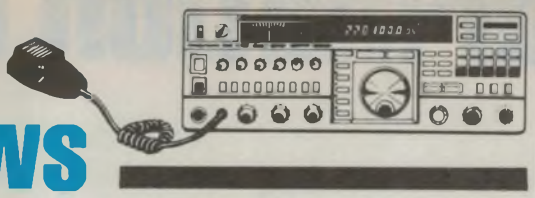
The basic principle of tracking is to keep the RF and oscillator tuned circuits in step with each other, but separated in frequency by an amount equal to the IF. In this case, only the oscillator padder and trimmers are adjustable, and the oscillator must track the RF tuning.

With a large aerial connected, and the tuning capacitor nearly closed, it was possible to hear the background noise peak as the padder was adjusted. This put the RF and oscillator coils in step. Next the oscillator trimmer was adjusted so that 1500kHz tuned to 5 on the dial scale. The RF trimmer was then peaked at 1300kHz and the set came to life.

Finally, a friend with a lathe turned some knobs typical of the period from hardwood, and fitted them with brass cores tapped for grubscrews.

To conclude a satisfying and rewarding project, the chassis was refitted into the cabinet. The set is working well again and, with a bit of luck and kind treatment, may well reach its century – by which time it will be an even more valuable piece of history.

Amateur Radio News



IARC sends books to Bangladesh

The International Amateur Radio Club in Sydney has air mailed two parcels of books and magazines to the International Radio Listeners' Club in Bangladesh, which is trying to re-establish itself after last year's disastrous floods. The floods completely destroyed the club's facilities, and it is hoping to get going by early next year.

IARC helps in disaster relief world wide, though its amateur radio station and links with the International Amateur Radio Network (IARN). Details of the Sydney IARC are available from the Australian director of IARN, Sam Voron VK2BVS, by phoning (02) 407 1066. The Club's station is located at 2 Griffith Avenue, Roseville in northern Sydney.

While grateful for the IARC parcels, the Bangladesh club would also appreciate further donations of books and magazines from other readers interested in helping. Parcels should be sent to Taimur Rahman, General Secretary, International Radio Listeners' Club, Konobary, PO NIIL Nagar, Dhaka, Bangladesh.

IARC now open to the public

The International Amateur Radio Club station in Sydney is now open to the public, to allow anyone with an interest in amateur radio to experience at first hand the excitement of making 'live' contacts.

The station has five operating positions, one with a TS440 transceiver set up for international work on the 14, 21 and 28MHz bands using 400W, and another with a second TS440 set up for contacts within Australia on 1.8, 3.5 and 7MHz using 100W. Other positions are for CB operation on 27MHz and 147MHz operation using a 100W transceiver. Antennas comprise rotating beams and fixed verticals on a 60' tower.

Membership of the IARC is free. Enquiries may be directed to Sam Voron VK2BVS at 2 Griffith Avenue, Roseville 2069 or phone (02) 407 1066.

Tiny new 2m handheld

Icom has just announced the release of the IC-2S, an extremely compact 144MHz/5W handheld transceiver offering all of the functions that have become expected nowadays – including adjustable power output (0.5W, 1W, 2.5W and 5W) and full scanning.

The IC-2S has receiver sensitivity of better than 0.25uV for 12dB SINAD; frequency stability of within 5ppm; 48 memory channels; programmable scan limits; optional call and DTMF squelch; an LCD display with auto-off backlight; and an external power jack which will accept 6-16V DC. It also comes in an aluminium diecast case which meets JIC grade II for moistureproofing.

The IC-2S should now be available from Icom dealers. Further details are available from Icom (Australia), 7 Duke Street, Windsor 3181 or phone (03) 529 7582.

Wagga Wagga Radio Convention

Wagga Amateur Radio Club Inc is holding its 36th Annual Radio Convention over the weekend of November 4-5, in Wagga Wagga. The convention is expected to attract radio and electronics enthusiasts from all over south-eastern Australia.

A variety of events is planned, including contests with prizes donated by various commercial organisations.

Further information is available from convention co-ordinator John Eyles VK2BXD, c/- the club at PO Box 294, Wagga Wagga 2650.

DSE donates 23cm gear for NSW repeater

Dick Smith Electronics has donated a pair of Yaesu FT-2311R 23cm FM transceivers to the NSW Division of the Wireless Institute of Australia, in order to establish a 23cm repeater for the Sydney area.

At present it is not known where in the band the repeater will be set up, as this will depend upon the band-plan finally adopted. But initially listeners can look forward to hearing the Divisional broadcasts from it, somewhere in the 23cm band.

Information centre

Conducted by Peter Phillips

Have you ever..?

Information transfer is a two way thing, and this month we seek it as well as dispense it. Perhaps some of you may be able to supply some answers or even a complete project, (and get paid), to assist those readers seeking information that we just haven't got time to research and supply ourselves. If you think you can help, we'd love to hear from you.

These columns have traditionally been used for us to help readers with problems associated with projects. This month however, I have purposely gathered together those letters asking us to provide circuits or articles on a particular subject. My aim is to present these requests to all our readers, in the hope that some of you may have already built the projects requested or be expert on the information being asked for.

If so, there are three ways we can present the information you may be able to supply. The first way is through these columns in the form of a letter. If you have a circuit, you could alternatively consider submitting it for inclusion in our Circuit and Design Ideas section, for which you will be paid (assuming we print it). Finally, you could go to the trouble of actually writing a fully-fledged article and/or developing a complete project.

If you choose the latter method, and we actually print it, we will pay you accordingly at a rate that depends on the quality of your article and the amount of work we have to do to be able to publish your submitted material. Perhaps you might like to enquire first before proceeding down this path, and we will be delighted to give you any advice you need.

But on to this month's letters. The first group is from readers seeking information rather than an actual circuit. Our answer follows each letter, but in most cases we haven't been very helpful.

Plasma displays

I am writing requesting information on a kit that is becoming popular with electronic retailers – plasma displays. I recently purchased one of these amazing gadgets, and did quite a bit of experimenting with it at home.

I found, for example, that a fluorescent tube would light up when it was held near the display. After showing this effect to a friend, he stated that this was proof that the display would cause cancer! Is this true?

I also found that if a silver coin is placed on the glass surface of the lamp, a spark would travel from the coin to a finger held half a millimetre away. In fact, the spark would even cause a burning sensation and leave a black burn mark. As well, holding a LED by one lead and causing the other lead to touch the coin would make it light, regardless of the polarity of the LED. How can this be explained?

But returning to my main question: is there any danger in using a plasma lamp? I am not going to use it until I find out if it is completely safe to do so. (K.S., Penshurst NSW)

Asking around, it seems few people know much about the dangers or otherwise of the plasma lamp. Although I do not claim any expertise in this area, the effects described by K.S. strike me as those typical of a concentration of radio frequency (RF) energy.

Lighting a fluorescent tube using RF energy is an old trick, and I know that strange things occur in a strong RF field with other electronic devices. I suggest that the LED is lighting purely as a result of the excitation due to RF, and the spark discharge coupled with a burn mark seem classic examples of RF activity. I also seem to remember that RF burns either never heal or take a long time to do so!

As to any ill effects, I am reminded of the song 'Everything Gives You Cancer'. I am not taking lightly the suggestion by our correspondent's friend, but I am unaware of any statistics that correlate radio operators and a shortened life expectancy due to cancer caused by RF energy. But then, I did say I'm no expert in this, and I ask readers to help me out on this one.

And so to the next letter:

Who invented radio?

In a recent discussion involving several friends and a pint or two, the question of who invented radio arose. We all agree that Hertz discovered the spark discharge phenomenon and that Marconi had a big hand in developing the technology.

But one of my friends claims radio, or rather the principle of resonance associated with radio, was invented by Tesla and that Marconi stole the idea. I find this very hard to believe, but my friend is adamant. Please help me either convince my thick-headed friend or put me right. (B.H., Dapto, NSW)

I tend to agree with the THF (thick-headed friend), but I can find no proof except a lingering memory of a book tracing the life of Tesla. It's not world shattering, but I would like to know as well. Can any readers assist?

Portable fluorescent lights

I have a 12V fluorescent light that is currently faulty. Even though the circuit looks simple enough, the fault is beyond me, as I am a beginner in electronics.

I'm sure there are many other 'simpletons' like me who would like a brief outline of how these devices work. There are many varieties on the market, but they all seem to have only a transformer, transistor, a few capacitors and resistors.

Armed with a little knowledge, I'm sure they could easily be repaired, saving readers money. They're certainly not worth taking to the repairman. (P.B., Rockhampton Qld)

After reading this letter, I decided to drag out a similar light that was given to

me 'for spares'. As P.B. states, there is not much to the circuit, and repair should be easy enough. At least that's the theory.

The principle of operation is fairly basic: the supply voltage from the battery is converted to AC, stepped up with a transformer and applied to the fluorescent light. In other words, the circuit is one form or another of a solid state inverter. However, it is not quite that easy in practice.

My attitude to repairing a simple circuit such as this is to replace all the components first, and ask questions afterwards. This presumes that all connections and soldered joints have been checked for their integrity first, of course. But typical of most products these days, their country of origin is likely to be (a) anywhere other than Australia and (b) into using devices with an unfamiliar type number.

So replacing the active devices is not quite so easy, as the pin connections are not always readily identifiable, and neither is the type or polarity of the device. There are many circuits for a solid state inverter, and generalising is not easy. So my advice is to first confirm that the transformer is still functional by using an ohmmeter to test the various windings.

Then remove each active device and attempt to identify what it is. If the ohmmeter readings are inconsistent with either a transistor or an SCR, assume it is faulty and try a few substitute devices using an educated guess as to the polarity (NPN or PNP), the device type and the pin connections. Because the circuit will operate at a relatively high voltage, say 100V or more, use suitably rated devices. Tracing the circuit may give some clues as to what the device should be.

It's the best I can do P.B., as, quoting that well known purveyor of old sayings (anon) it seems the 'simple things in life are not always as simple as they seem'.

MIDI update

Readers may recall my review of a MIDI software package that has been developed to operate with the *EA* Universal MIDI-out Interface. The software is for an IBM computer (or compatible) and is full of great features. The author, John Loftus has since advised me that he has added even more features and improvements to the program, and is now offering version 1.1 of the package, called 'Maestro'. For further details refer to Information Centre in the March edition of EA.

220V operation

The next letter seeks information on the safety of using 240V/50Hz appliances with a 220V/60Hz supply. This is not so easy to answer, but first the letter:

I need to take various electrical items to an area that has a power supply of 220V, 60Hz. I understand that items with a purely resistive load will be OK, but I am concerned about those items with a transformer or motor. Although I seem to recall problems in this area, a friend who has been through the exercise assures me that he had no problems.

Was he just lucky, or is it OK to operate these appliances on the other supply system? (B.R., Maclean NSW)

Unfortunately, B.R. doesn't list the appliances, as a general 'yes or no' type answer is not really possible. From the voltage point of view, operating an appliance on a voltage that is 10% lower than its specified value is not likely to be a problem.

Many appliances that operate with a transformer include a 220V setting, selectable on the back of the item. Where this is not available, it is generally reasonable to suggest that the lower voltage will not affect the appliance. So, I would quite happily take my TV, video, radio, computer, amplifier and so forth to the 220V/60Hz supply area.

However, the change in frequency may cause some problems for those appliances fitted with a squirrel cage induction motor. This type of motor runs at a speed related to the frequency of the supply, and any increase in this frequency will cause a correspondingly higher motor speed. The change from 50Hz to 60Hz amounts to a 20% increase, and appliances such as the compressor in a refrigerator will therefore operate at a higher speed.

It is difficult to say whether this increase in speed will create problems for the mechanics of the appliance, as 20% is not a large increase. The only sure answer is to ask the manufacturer. This applies to any motor-driven item, such as an air conditioner, washing machine, fridge, or clothes drier. A check of the specifications for the appliance may however state that it can be used at 60Hz.

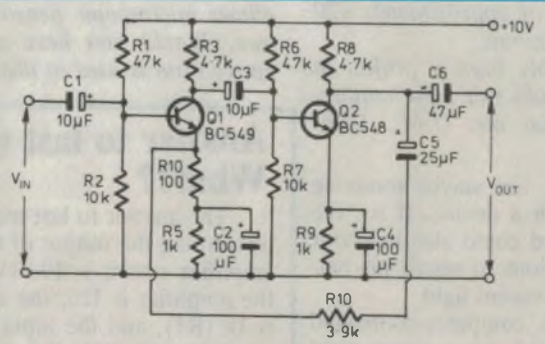
Similarly, some brands of turntables and tape recorders use synchronous motors that rely on the frequency of the mains to establish their speed of operation. While no danger exists on using these devices with a 60Hz supply, the resulting music will be 20% higher in pitch.

She'll be right

European equipment is usually characterised by a sleek styling, with the controls hidden by cunning design. Great for the decor, but a challenge if you are not familiar with the equipment. Faced with a classy European TV set that was 'failings to gerfunction' a friend of mine admits to the following story.

It seems the set, owned by a retired judge, had no picture. My friend initially surveyed the set and could not even find the on-off switch, or any controls whatever. Reluctant to show his ignorance, he proceeded to take off the back and noticed the damper diode had split in two. With the owner imperiously observing the proceedings, my friend tut-tutted with great aplomb, fitted a new diode, examined the set for other obvious faults and replaced the back.

He announced importantly that he would send his bill directly, and then



What??

The circuit shown is that of a two stage RC coupled transistor amplifier. Both stages are virtually identical, and feedback has been applied with R10. The question is: what is the approximate gain of the circuit? It may look complicated, but the answer can be obtained with only a few lines of simple mathematics.

packed up and left. To this day he never found out where the on-off switch was, or even if the set worked. But his bill was paid. Whew – how's that for confidence, or at least good luck!

Low distortion oscillator

On the same theme as the last letter, our next correspondent offers a suggestion concerning our new low distortion oscillator presented in March. The writer actually presented two ideas, the other of which will appear in the *Circuit and Design Ideas* column in a future issue.

Before presenting the idea, I must point out that the basis of this project was low distortion. Without actually implementing the idea and running distortion level tests, I cannot say whether the suggested modifications will alter the distortion figures or not. However, the idea seems a good one, so here it is...

Congratulations are in order for the new audio oscillator. Here is a modification that readers may like to try. In reference to the circuit diagram for the oscillator on page 101 (March '89), it just so happens that at the recommended output level of 2.5V RMS, the voltage swing across the preset RV3 in the thermistor mode is less than the conduction level of a double diode arrangement such as that used with D3-D6.

A similar set of diodes placed across RV3 does not appear to interfere with normal operation, but effectively dampens any thermistor bounce. (B.J., Nambucca Heads NSW)

12V stroboscope

I am looking for a circuit of a miniature stroboscope to operate off 12V DC with a strobe rate of approximately 120 to 180 strobes per minute.

There has possibly been a project in the past which would suit these requirements, but it eludes me. (I.M., Lalor Vic)

It eludes us too, but maybe someone has developed such a device. If so, the technology involved could also help our correspondent anxious to repair his battery operated fluorescent light.

We published a computer-controlled strobe project based on a commercial flash gun in our August 1987 edition which may be useful as a guide. By replacing the computer with a 555 timer, it is possible I.M.'s needs could be met. It's a start anyway.

Dolby A, B and C

I'm writing to ask if you have published an article over the past few years explaining the differences between Dolby A, Dolby B and Dolby C. Some hi-fi gear these days has all three varieties, and I'd like to know what the differences between them are. (J.B., Strathpine Qld)

I cannot find any recent article published in *EA* on this topic, and I confess I do not know the differences myself. I have always been very lukewarm on the benefits of Dolby noise suppression, and prefer to put up with the hiss rather than lose the music.

However, my bias aside, surely this is a topic many readers will be able to supply information on. So keep reading these pages J.B., as I'm sure someone will provide the answers.

The next group of letters are from readers seeking actual circuits. Again we have not attempted to supply the requested circuits, due to time constraints and all that sort of thing. The requests may give developers some food for thought for a possible magazine project, or perhaps someone already has the goods.

Watering system

I am after a circuit that will switch a solenoid operated misting sprinkler on and off every 15 to 20 minutes and mist for approximately 5 to 10 seconds to keep the moisture on the leaves of the plant cuttings.

I have been working with a simple circuit that uses blotting paper as the moisture sensor, but I really need a more sophisticated sensor. Is it possible to buy or make a moisture sensor?

I know there is an evaporation sensor block on the market which has two copper impregnated carbon rod electrodes moulded into a special epoxy resin which allows microscopic penetration of moisture. Would you have any idea what epoxy resin is used in this sensor, as this piece of equipment is very expensive? (B.S., Bungendore NSW).

Engineer Rob Evans researched this question and came up with the following reply:

Electronics Australia has not as yet described a timer circuit that directly suits your needs. However, constructing a timer with a suitable mark to space ratio should not be too difficult. For example, a couple of standard 555 timer chips could be run in series, with the first controlling the overall cycle time (15-20 mins) and the second setting the 'on' time (5-10 seconds).

Unfortunately, we are not familiar with the sensor you have described, or the hydroscopic epoxy resin. However a humidity sensor is available for about $24 from Farnell Electronic Components, who may be contacted on (02) 645 8888. The sensor's order code is 2322-691-90001. Note that this device is of the capacitive type, and will require some extra circuitry (such as an oscillator/detector) to provide a useful control voltage.

NOTES & ERRATA

PLAYMASTER 30-30 AMPLIFIER
(August 1988): The construction details state the total number of wire links on the PCB as 10 – in fact there are 11. Also, missing from the parts list are two 1k resistors and two 270 ohm resistors. (file: 1/SA/81).

PLAYMASTER 60-60, 200 ARTWORK
Just a short note to inform readers that the artwork for the Playmaster 60/60 and 200 amplifiers, previously believed to have been lost in the fire last year, has been located. If you require a copy, please consult the *Reader Services* section on the last page of the magazine.

EARWIG
(February 1988): The two transistors are listed incorrectly in the parts list as BC457. The should be BC547, as shown on the circuit diagram. (File: 2/TR/65).

Answer to last month's What??

The answer to last month's question concerning the output of the operational amplifier circuit is 10.91V. The gain of the amplifier is 120, the input resistance is 1k (R1), and the input voltage to the amplifier is 0.091V (91mV).

To find the gain of the amplifier, run a paper simulation. That is, disconnect the signal source, then apply 1V to R1. The resulting current in R1, and hence R2, will be 1mA, flowing towards the output. This requires a voltage of -10V across R4, causing 10mA to flow in R4. The total current in R3 is therefore 11mA, giving a potential across R3 of 110V. The output voltage will be 10V higher than this value, giving -120V. Thus the gain (output/input) is (-)120, where (-) means 'inverting'.

The actual signal voltage applied to the amplifier is 1V x R1/(rs+R1), which equals 0.091V. Multiply 0.091 by 120 and you will get 10.91V.

RGBI to PAL encoder

(Continued from page 83)

DC from the computer's own power supply. This does alleviate the tangle of power cords that seems to develop around the average computer these days.

As a hint for a place to find +12V, look at your CGA instruction card or user manual. You will probably find a light pen input on the card edge, and if so 12V will be available from there with no modification required to any board. Another place would be a spare disk drive power lead.

Whatever you do, be careful not to void your warranty. If you find the 12V from the computer, simply leave the 7812 (IC3) off the PC board and feed the external +12V to its output pin pad.

For the RGBI input lead, use up to one metre of 14-way ribbon cable, with every second lead as an earth connected to pin 1 or 2 of the 9 pin connector. This provides a transmission line type setup and reduces radiation from the lead as well as limiting interference to the converter.

I would suggest you do not pass the input cable leads through the PCB holes, but instead connect them to the pads on the underside of the board. All earth connections can be commoned together to one piece of wire and connected to the earth pad; a piece of heat-shrink tube will stop shorts and make the connection stronger.

To anchor the RGB lead when the board is mounted in its case, cut a piece of scrap PCB material to about 7mm wide and about 25-30mm long and screw this down to the case with the ribbon cable under it. This will allow the cable to take a jerk without ripping all those wires off the board.

Once all connections are made, set both pots VR1 and VR2 to approximately half travel and the trimmer capacitor to two thirds meshed. Now be brave, connect your supply up, turn on the TV, select the appropriate channel and adjust the fine tune to get a fully black screen.

If this can be achieved, connect the 9-pin plug to the CGA board and confirm that you have a working unit.

Setting it up

The only setting up now required is first the pot VR2, to give similar brightness to a TV channel. Then TC1 is adjusted to give good colour, with minimum interference or patterning on the brighter colours in the picture. Finally VR1 is adjusted subjectively for the best results whilst running a game or program which uses the intensity lead.

A good test program is the IBM program COLORBAR.BAS, which demonstrates all colours and shades, and certainly makes setting up a breeze.

If your unit doesn't work, go back and check your wiring for correct pin connections. Ensure both IC's are orientated correctly and that none of the polarised caps are reversed. Shorts between PCB tracks could also be a problem.

If you have something on the screen but it is not locked up correctly, try adjusting the vertical hold control on the TV if there is one fitted. Failing this try the unit on another TV.

To the best of my knowledge all CGA's use the same sync polarity, but if you wanted to use this arrangement with another type of video board it is possible to change the sync polarity. However I would suggest you check out the data sheets well before you go ahead.

So good luck and happy blasting. Now wouldn't it be great if the sound also came from the TV, as well as the picture? EA

Letters

(Continued from p.5)

screwdrivers, users may confuse tester designed for different purposes, thus placing them at risk of electrocution.

At the request of this Agency, the NSW Products Safety Committee informally examined the devices and sonsidered that the markings generally did not adequately identify the intended proper use of the tester. The Committee believed that the hazard only existed with low voltage screwdrivers and that new stock should incorporate an appropriate warning of the danger.

With the support of all other State consumer affairs agencies and the Commonwealth, consultation with industry was undertaken to determine unit costs, lead times, market effects and appropriate methods to implement a voluntary safety standard.

As a result of this consultation, the Agency does not consider that regulatory action is justified at this time, however the co-operation of manufacturers and importers is sought in complying with this safety standard.

The following requirements are now being sought on a national basis in relation to low voltage electrical test screwdrivers.

1. A moulded or embossed statement should appear on the handle bearing the word 'warning', followed by a statement indicating the voltage limits of the device. For example, if only intended for 6-12 volt use, it should show:

'WARNING: 6-12 VOLT USE ONLY'

2. The wording shall be printed clearly and legibly in the English language in upper-case letters with the word 'WARNING' at least 5mm in height and the remaining words at least 2.5mm in height.

Importers and manufacturers are required to ensure that the abovementioned labelling appears on goods imported or manufactured on or after 1st January, 1990.

Retailers are required to ensure that the labelling appears on stock on or after 1st March, 1990.

Enquiries should be made to the Trading Standards Branch – Steve Hutchinson, telephone (02) 895 0171

J Holloway,
Commissioner for Consumer Affairs,
NSW EA

Sexism?

After reading Brian Beck's letter in slightly amused and disappointed in his attitude regarding the subject. I too have been a long time subscriber of *EA*, although no where near as long as Brian. However, I do recall reading 'Kit's Column' in a previous issue. I decided to have a look in my back issues, and I found one in the June 1975 issue (p34).

I would just like to say that Brian's attitude seems somewhat extreme in the light of the fact that there is no evidence to suggest that 'Kit's Column' is in anyway offensive to anyone. I do wish, however, to support him in denouncing sexual harrassment of any kind – as Brian says in his letter, the reality is a long way from the fantasy projected in 'Kit's Column'.

I believe the majority of *EA* readers enjoy the entertaining reading within 'Kit's Column', and so I appeal to you to take steps with Jaycar to re-install this column in your excellent magazine. After-all, this is a democratic country.

Greg de Nys,
Portland, Vic

Comment: Thanks for the reaction, Greg. In any case, since the item concerned is part of an advertisement, we can do nothing unless a law is broken. EA

50 and 25 years ago..

"Electronics Australia" is one of the longest running technical publications in the world. We started as "Wireless Weekly" in August 1922 and became "Radio and Hobbies in Australia" in April 1939. The title was changed to "Radio, Television and Hobbies" in February 1955 and finally, to "Electronics Australia" in April 1965. Below we feature some items from past issues.

RADIO AND HOBBIES IN AUSTRALIA

August 1939

Facsimile transmission: One phase of radio which may have a big future is that of facsimile transmission over the air. This process allows any printed matter to be transmitted as a complete page and duplicated at the receiving end.

The original printed matter for facsimile transmission is analysed in elementary dots or lines. That is, the picture is traced across point to point in consecutive horizontal lines, and the density value of each point is sent over the transmitting medium. At the receiving end these dots must be recorded in their proper place and be of the same density as the original.

The Finch System makes use of this general method, and the elementary dot is .01 inch in diameter. Each traced line is about four inches long, so there are about 400 dots to the line. The period of the sweep across each line is one half-second, so the rate of change is in the order of 800 dots per second.

RADIO, TELEVISION and HOBBIES

August 1964

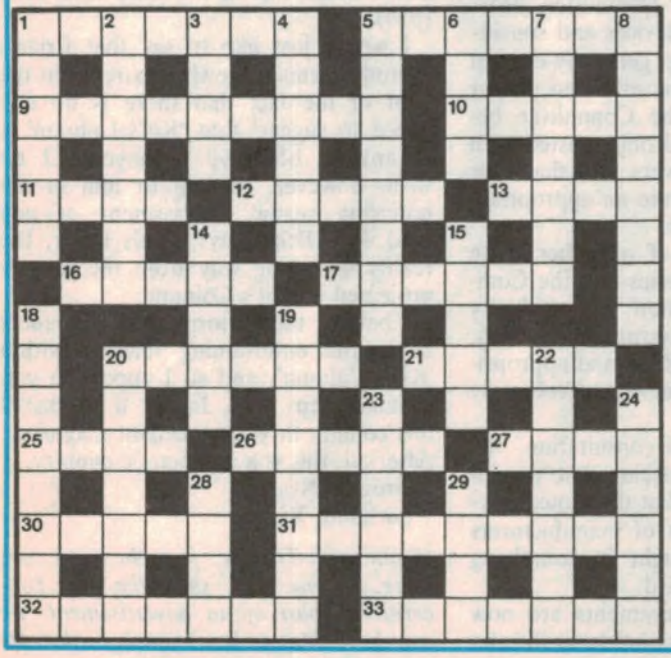
New transistor: Development of a unique new type of transistor, which extends the useful frequency range of these semiconductor devices upwards by a factor of 10 and which has 10 times the radiation resistance of present types of transistors, was revealed recently by the Sprague Electric Company, of North Adams, Massachusetts, USA.

Unlike conventional transistors, which consist of three layers of different types of silicon or germanium with the middle layer no thinner than 2,500 Angstrom units, the new Sprague Metal-Base Transistor consists of two layers of single-crystal silicon, separated by a layer of metal. This layer is only 100 Angstrom units thick (3 Angstrom units are approximately one billionth of an inch). This key centre layer is 25 times thinner than the thinnest possible layers used in present transistors. As a result, the new Sprague-developed device has an upper theoretical frequency limit of 20,000 megacycles, 10 times the highest frequency for transistors of conventional constructions.

AUGUST CROSSWORD

ACROSS

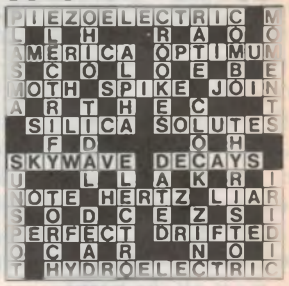
1. Sound control boards. (7)
5. Electronics technology uses this element. (7)
9. Name of angle of incoming beam. (9)
10. What clothes do because of electrostatic attraction. (5)
11. Seventh letter of phonetic alphabet. (4)
12. Inventor of battery, Alessandro -----. (5)
13. Phenomenom of CRO screen. (4)
16. Repetitive process. (5)
17. One who illegally enters computer system. (6)
20. Nationality of Max Planck. (6)
21. Distant planet. (5)
25. Maximum value. (4)
26. Usual domestic frequency for AC in US. (5)
27. Electronics eavesdroppers. (4)
30. Once-supposed medium for light waves. (5)
31. Name given to certain 6-core cable. (5-4)
32. Receptacles for plugs. (7)
33. Solar timer. (7)



DOWN

1. Instrument used in electrical measurements. (6)
2. Branch of study. (7)
3. A metal detector finds this vein. (4)
4. Device detecting a variable. (6)
5. Pertaining to a range of frequencies. (8)
6. Mathematical curves obeying a law. (4)
7. Electrician's tool. (7)
8. Nature of one battery terminal. (8)
14. Electronic theft deterrent. (5)
15. Special ability. (5)
18. Reduce to a low intensity. (8)
19. Sends out waves or rays. (8)
20. Electronic device, the ---- equaliser. (7)
22. Huge wave. (7)
23. Retains in memory. (6)
24. Concerned with stars. (6)
28. Logical state. (4)
29. Average figure. (4)

SOLUTION FOR JULY



EA marketplace EA marketplace

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Pre-Pak Electronics	NSW		●		●	●		
Preston Electronics	Vic	●	●	●		●		●
RCS Radio	NSW			●				
Rod Irving Electronics	Vic	●	●	●	●	●	●	●
Scientific Devices	Vic						●	
Sheridan Electronics	NSW		●	●	●	●		
Tandy Electronics	All		●		●	●	●	●
Wagner Electronics	NSW		●		●	●	●	

KEY TO CODING

A Kits & modules
B Tools
C PC boards and supplies
D Components
E IC chips & semiconductors
F Test & measuring instruments
G Reference books

Note that the above list is based on our understanding of the products sold by the firms concerned. If there are any errors or omissions, please let us know.

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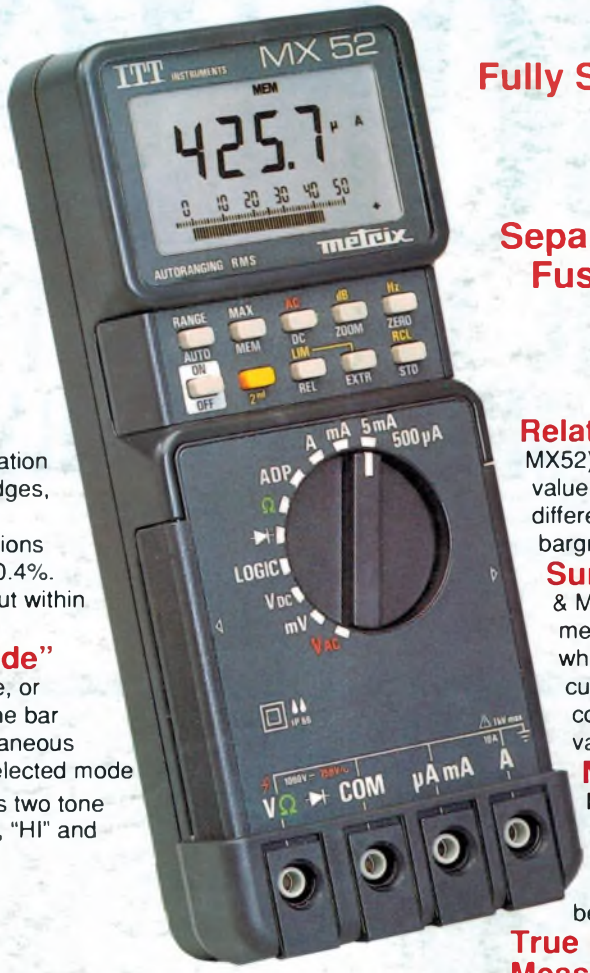

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Vac	500mV-750V	1.2%+2	0.75%+2	0.75%+2
Idc	500µA-10A	1.2%+1	1%+1	1%+1
Iac	500µA-10A	2%+2	1.5%+2	1.5%+2
Ω	500Ω-40MΩ	0.7%+2	0.3%+2	0.3%+2
Level	-40 to +60dB	—	—	±0.3dB
Frequency	10Hz - 500kHz	—	—	0.05%+1
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