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Electronics Australia

OCTOBER 1987
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Volume 49, No.10

Electronics Australia

October 1987

AUSTRALIA'S LARGEST SELLING ELECTRONICS MAGAZINE — ESTABLISHED IN 1922

Printing goes hi tech

In a modern printing plant, computers help run the presses while robots keep them stoked up with paper and cart away the printed copies. Read all about it in our feature starting on page 24 . . .

Built your own DI

If you're into professional audio, here's a project that's sure to interest you. It's much cheaper than comparable commercial units. See page 64.

Special telecomms feature

New developments in fibre optics are mind boggling. Catch up on them, plus the coming ISDN revolution and more in our feature starting on page 116.

ON THE COVER

The control console of a modern printing press, the Harris M1000A at Hannanprint. Also shown is the new Philips KR786 66cm stereo colour TV (Courtesy Philips Industries). See our stories on pages 24 and 104.

Features

Entertainment Electronics

Projects and Technical

News and Comment

Departments

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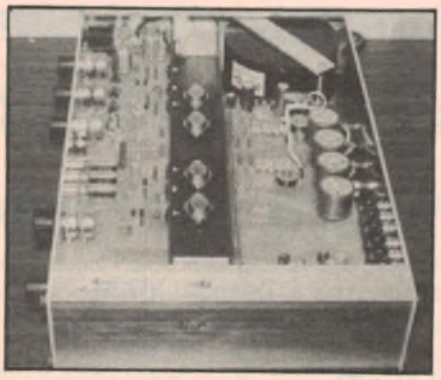
Letters to the editor

Kits revisited

I have followed with interest the Playmaster 60/60 project and the discussion regarding kits and the supply of parts. I offer my own observations.

After my attempt to purchase a 60/60 kit were thwarted by long waiting lists I proceeded to build the amplifier around a PC board from Australia. This culminated in my saving neither time nor money. I'm trade qualified in electronics and probably have better access to components than most hobbyists. Despite this the parts took me six months to gather from around the Pacific, and cost (less the metal work) in excess of $NZ400 (all parts were new and at less than retail cost).



The author's version of our 60/60 amplifier, built up "from scratch" rather than a kit.

I can envisage people saying, "but that's our point, these parts should be available at our local dealer". If they were I think it reasonable to think they would be less costly as part of a kit, for the following reason. If the necessary parts are prepackaged as a kit, the mass production nature of doing so ought to bring down the cost.

There is no question, in my case, that time included, scratch building was vastly more expensive than a kit. Added to this, it didn't teach me anything about the technical side of the amplifier that a kit wouldn't have. The extra skill required was in the areas of procurement and metalwork. Further, if you do scratch build you should really be technically competent to carry out your own trouble shooting. Professionals generally won't be interested and I have seen cases of people spending a lot of money on parts, never to get the project operative because of this problem. Kits are usually easier to get serviced (at least one supplier offers service).

In closing, thanks for the excellent design. It worked straight off and has given no problem. Most of the time it is used in conjunction with a CD player and I'm very pleased with the resulting sound.

(Name withheld)
New Plymouth, NZ.

Australia Card 1

Two months on, and because of the letters with adverse comment which appeared in the June issue, I write to agree with your editorial in the April issue which pointed out some good reasons against the issue of the "Australia Card".

There are further reasons. With reported numbers of 364 Medicare locations and 55 other Government locations (not to mention others which will undoubtedly be installed), with on-line access to the central card file and the ability of thousands of government employees to use that access, it can be guaranteed that a significant leakage of information on Australia Card holders will occur.

It can also be guaranteed that some of that information will be used against some of the cardholders by unscrupulous employees aroused for other nefarious purposes. Statutory penalities against unauthorised use of information in the register will not stop determined efforts.

After all, much information on or about moves or proposals by Federal and State governments or about ministers is obtained by the media through "leaks" from public servants in spite of statutory penalties for such actions.

And there is another lot whose aim is to benefit by "computer crime" and, of course, we have the "hackers" out there who regard the gaining of access to the files of a computer connected to modems as a challenge not to be denied.

I pointed all of these things out in a letter published in the July 1986 issue of the "Australian Computer Society Bulletin".

D.J. Paule, MACS
North Caulfield, Vic.

Australia Card 2

I refer to your editorial viewpoint concerning the much debated "Australia Card". It gives me great pleasure to see respected publications, like yours, coming out against this iniquitous piece of legislation.

History seems to prove that any sort of beautifully engineered limitation on the rights of the individual, no matter for how noble a cause, inevitably corrupts. It is my opinion that any legislation of this sort is intrinsically bad, and is open to all manner of modification and change, as deemed "necessary", by certain people, none of which does anything to promote trust or personal freedom in the community.

Your comment on the lack of security associated with large, multi-user databases needs little elaboration. When people like the Australian Computer Society start objecting to something in their special field, the average citizen needs to listen.

I would join you in your appeal for people to write to their Federal Members on the issue, if it isn't already too late.

Linley R. Wilson,
Smithton, Tas.

Comment: Although the editorial concerned was written by my predecessor, I too view the planned introduction of the Australia Card with a great deal of concern. At the risk of arousing the ire of the same readers who berated him for "bringing politics into the magazine", I also believe that EA and electronics people in general should not be afraid to comment when they see electronics and other technology used in ways they consider to be detrimental to society at large. Many of the abuses of technology in the past might well have been avoided, if technical people had spoken out rather than kept silent.

ACS licensing

I refer to an article published in the August 1987 edition of *Electronics Australia* titled "'Piggy Back" Broadcasting Reaches Australia".

The article incorrectly states that " . . . because ACS is regarded as a specialised communications service, rather than broadcasting to the public at large, its licences will be issued under the Radiocommunications Act rather than the Broadcasting Act."

On 2 April 1986, the Minister for Communications stated in his press release foreshadowing the introduction of

Continued on page 138

Editorial Viewpoint

Are we really serious about electronics manufacturing?

Shortly after I had written last month's editorial on the difficulties faced by our manufacturers in getting long-term finance, one of our advertisers called my attention to another incredible situation in the area of customs tariffs.

Now perhaps I'm naive, but I always thought that if there was any justification for having a customs tariff, it was on the basis of protecting our local industry. The fact that it might raise a bit of extra revenue was incidental — or so I thought.

The basic idea was to impose a relatively *high* tariff on the import of fully assembled equipment which competes with locally made products, to give the local firms a hand in the home market. And if the local manufacturers needed to import some of the components for their products, presumably these would attract a relatively *low* tariff by comparison. Right?

No, wrong. In reality, an enormous amount of complete equipment comes in with only 2% tariff applied, especially if it comes from "developing countries" like Taiwan, Korea, Hong Kong, and Singapore. But on the other hand, quite a few of the components needed by local manufacturers are dutiable at relatively *high* rates. For example many kinds of LCD and other display attract a tariff of 15%; lithium batteries, 25%; and such basics as switches, fuses and relays, a whopping 30%. Make sense of that, if you can!

Surely it's the exact opposite of what tariffs are supposed to be all about. One would be excused for thinking that the Government is really using the customs tariff quite cynically as simply another source of revenue, and couldn't care less about local manufacturing — despite all its rhetoric.

When are we in Australia going to realise that it's OUR manufacturing industry we need to encourage, not those of the so-called "developing countries". Many of these are so far ahead of us now in manufacturing that WE'RE the ones that need special help, not them.

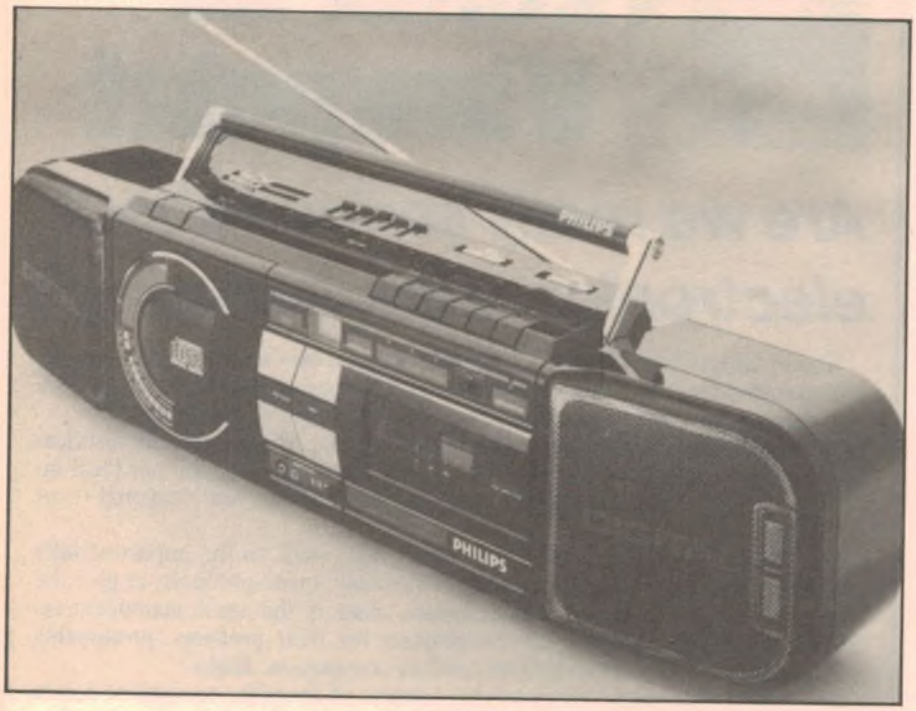
If we are ever going to stem our woeful balance of payments haemorrhage, the experts tell us that the development of a solid, export competitive *hi-tech manufacturing industry* will be crucial. This won't happen while manufacturers can't even build up a reasonable base in the home market, because of unfair competition from imported complete equipment. Charity begins at home!

So let's put an end to this crazy customs tariff situation, and fast. If we're still convinced about the need to use tariffs for protection, let's whack them on complete equipment at least as much as on components. Or if we've decided to brave the world without protection, let's take the tariffs off components as well.

What about it, Senator Button and Co — are you really serious about Australia's electronics manufacturing industry?

Jim Rowe

What's New In Entertainment Electronics



Compact CD/cassette/radio combo

The most compact sound machine yet offered by Philips incorporates a CD player, AM and stereo FM radio, cassette tape deck with built-in microphone, five-band graphic equaliser and two-way four-speaker sound — yet weighs less than four and a half kilos. The D8883 is the third "Compact Disc Sound Machine" released by Philips, who invented the compact disc itself.

Being smaller than its predecessors, this unit is even more appealing to those who want portability. But smaller does not mean that functional aids have been neglected. The CD player's six keys select "next" and "previous" for skip in either direction; "cue" and "review" for high speed forward or backward search of the disc. An "introscan" facility gives the first four seconds of all tracks for a quick impression of the disc's contents; normal play can be started at any time.

A two digit LCD display monitors all the CD functions. The radio tuner section has automatic FM stereo decoder, LED stereo indicator and an LED power display.

However, the styling of the D8883 is likely to be equally important with those paying around $650 for a comprehensive, completely portable Sound Machine. The case is black with matt silver trim. All switches or keys are functionally grouped. Product marketing manager Glen Wallace says that a pearl white case will also be available soon.

Brief technical details are as follows:

CD section:
frequency range 30-20,000Hz
signal to noise ratio 80dB

Amplifier section:
output power 32 watts PMPO, 2 x 8 watts MPO (±1dB; D<10%)

Speakers:
2 x 130mm woofers with in-cone tweeters.

Dimensions:
660x172x156mm (WxHxD)

New microphones from Beyerdynamic

Beyerdynamic has announced the release of the M700 N(C) dynamic unidirectional microphone and the MCE80 unidirectional condenser microphone. Both the M700 and the MCE80 are from the new Beyerdynamic "Tour Series" of stage mics.

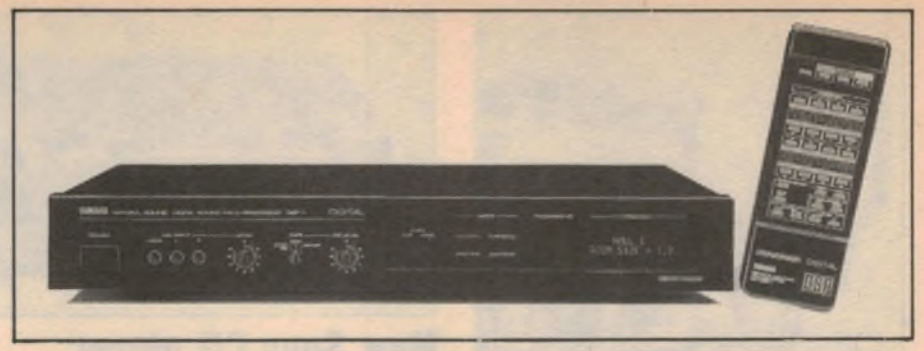
The M700 is one of Beyerdynamics' top models, due especially to its true hypercardioid polar pattern which is insensitive to feedback. Since its frequency response reaches 40Hz in the low frequencies, it is suited for the pick-up of instruments as well as for vocalists. The M700 also features presence boost, a built-in pop filter and built-in hum compensation. The rugged design of its brass mesh basket protect the microphone element against damage.

The MCE80 is designed for the professional vocalist and can be operated either by a 4.5V battery located in the microphone shaft, or by a phantom power supply (12-48V) from stage equipment. The supercardioid polar pattern gives the professional singer various sound colorations by changing the distance to the microphone. The MCE80 has a well balanced frequency response and can also withstand very high SPL without distortion. A built-in footfall filter avoids interference below 100Hz and a built-in filter offers protection against popping noise.

The M700 and MCE80 both featured in Billy Joel's world tour which was recently in Australia.

For further details contact Hi-Phon Distributors, Unit 1, 356-358 Eastern Valley Way, Chatswood 2067.

Digital sound field processor from Yamaha



Yamaha has released its award-winning DSP-1 Digital Sound Field Processor — a unit which is claimed to recreate the sound and feeling of Carnegie Hall or a live rock concert around your favourite armchair.

Connected to an existing hifi system and fed through an inexpensive, 4-channel amplifier, the DSP-1 delivers the distinct acoustic patterns of reverberation, echo, presence and ambience measured in actual performing environments.

Using powerful computers, Yamaha's engineers analysed all aspects of the acoustic performance of a series of auditoriums, ranging from major European concert halls to intimate jazz clubs and large rock concerts, and recorded each digitally. They took into account the room size, degree of sound reflection or "liveness" of the venue (determined both by its construction and the audience size) and also the time between the direct sound and the first non direct sounds reaching the listener's ear. Subsequent reflections (bounced) off near walls were not included because they tend to "muddy" sound.

Any one of 13 standard sound field modes is instantly re-creatable through the DSP-1's full-function 30-key infra red wireless remote control unit. Alternatively, you can fully exploit the DSP-1's powerful 16-bit analog-to-digital converter to program your own audio parameters — so you can create your own venue dimensions, the size of the audience, its acoustic properties — even where you would like to sit.

The DSP-1 is an audio component which is simply added to any conventional stereo system. It is ideally configured with six speakers, using a low power 2/4 — channel amplifier, such as Yamaha's M-35, to drive the front and rear "presence" speakers. Yamaha's new bookshelf or wall-mountable NSS-1's are ideal for this purpose. The DSP-1 processed signal is fed through the four presence speakers, while the normal untouched audio signal travels through the main speaker pair, driven by the existing amplifier. This results in total "surround sound" realism.

If your enthusiasm, budget or lounge-room doesn't run to six speakers, then the DSP-1 can still produce an actual "live concert" sound through four speakers.

In addition the Yamaha DSP-1 has three separate "surround sound" modes, including Dolby Surround. Dolby Surround can be played back with the lifelike realism of a big cinema environment, employing the DSP-1's digital sound processing.

Yamaha's DSP-1 won the 1986 Australian CESA (Consumer Electronics Society of Australia) award for technical innovation last year. It is now available in limited quantities at $1499 RRP.

Lightweight video camera from Philips

The new Philips VC6830 Camcorder is designed for one hand operation and features a built-in VHS-C recorder, all weighing less than one and a half kilos. Philips believes it is the only camcorder that comes with its own soft carry-bag — a boon for the home movie buff and traveller.

Philips says it chose the VHS-C system because it combines portability, with the ability to play back only any VHS recorder using the motorised adaptor supplied. Recording time is up to 60 minutes on one cassette. With optional RF converter, audio and video can be played back direct from the camcorder through any TV receiver without the need of a normal video recorder.

The VC6830 uses a CCD (charge-coupled device) image sensor which replaces the old style camera tube. The CCD gives high picture quality sensitivity and great durability. The camera also features a 6:1 power zoom lens and built-in microphone and is easy to use, even for a novice.

It has an automatic focus device which scans the image and still operates perfectly for scenes with little light. Control can be switched over to manual at any time. The lens aperture is also controlled automatically for the best illumination in all conditions. As the camera can operate in normal lighting down to 15 lux, spotlights are not necessary.

The electronic viewfinder is a miniature built in video monitor which can also be used to check back your recordings.

Recommended retail price of the VC6830 is $3,399.

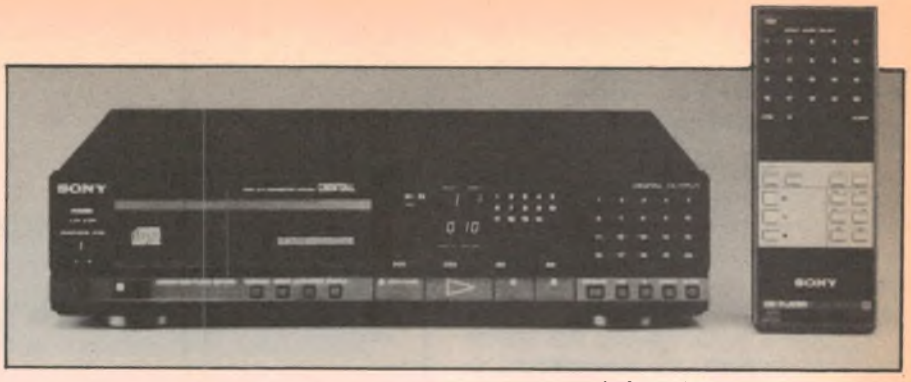
Lightweight headphones

From Sennheiser Electronic comes the HD50, a new lightweight stereo headphone set.

Principally designed for "walkman" type use, the HD50 offers an attractive slimline design and a very high degree of user comfort. It should therefore appeal to those portable users who demand excellent bass response together with clean, uniform sound reproduction similar to that found in domestic hifi.

The HD50 is equally suited for use with compact disc, stereo TV/VCR and conventional hifi equipment.

Further information is available from Cunningham Consolidated, 15a Anderson Road, Thornbury 3071.



New Sony CD player

Sony Australia has released the CDP-M70 CD player, replacement for the CDP-65 which was one of Sony's success stories in 1986.

Major features of the player are: a 16-bit digital filter with 4 times over sampling, resulting in improved phase characteristics; a unilinear converter system which prevents the generation of jitter and reduces the digital signals' influence on the analog signal; plus a dual D/A converter system which eliminates time lag between left and right channels. The use of separate left and right D/A converter is not normally found in units priced under $1,000.

The M70 has random music search (RMS), enabling up to 20 tracks to be programmed for playback in order of preference, and shuffle play, where the player itself selects the track playing order at random. Also provided is a 5-way repeat mode and a wireless infrared remote commander, operating to a distance of 7 metres. The remote key pad has 20 key direct music selection — simply push any key 1-20 and you directly engage that numerical track on the disc in the player.

The CD-M70 is compatible with all Sony audio and video equipment and is specifically designed with its external dimensions to be aesthetically compatible with Sony's MIDI range of audio systems.

The CDP-M70 is available through the Sony dealer network at a suggested retail price of $899.00.

Professional CD player

Straight Wire Audio has announced the CDQue, a professional CD player with a one-button cueing system designed to make it especially suitable for broadcasting work. The unit also features dual D to A converters, phase perfect digital filtering, four times oversampling at 176kHz, opto-isolated remote controls and indicators, and high current balanced outputs capable of driving 1000 feet of twisted pair.

The deck features the highly respected Philips transport, with SWA's own electronics. Optional features include an up-speed crystal for "playing songs a bit faster", or a true variable speed controller for production work.

Outputs are at +4dBm, electronically balanced and sourced from male XLR connectors. Frequency response is 2-20,000Hz +/-0.3dB; dynamic range is 96dB, channel separation 94dB; THD is quoted as .003%. Error correction is by cross interleaved Reed-Solomon code (CIRC).

The CDQue is made in the USA. It is designed to mount in a standard 19" rack and measures 3.5" high and 11" deep.

Further information is available from Radio Manufacturing Engineers, Unit A, 30-32 Skarratt Street, Auburn 2144.

Third VHS-C Camcorder from VHS

Complementing JVC's line up of Mini VHS (VHS-C) camcorders and to make live recording accessible to a broader range of users, the GR-C11EA was recently released to join JVC's existing VideoMovie lineup featuring the GR-C7EA and GR-C9EA.

Incorporating all the miniaturisation of its GR-C9EA forerunner, the GR-C11EA is a camcorder that combines simple operation, high performance and portability. It weighs in at a mere 960 grams.

The GR-C11EA offers infrared autofocus and zooming capability with a 3:1 zoom lens. Other features include 1/2" field-storage CCD image sensor, one hour recording on a single tape in the LP mode, HQ system for high quality pictures, 12 Lux low light sensitivity and zero frame editing for glitch-free edits.

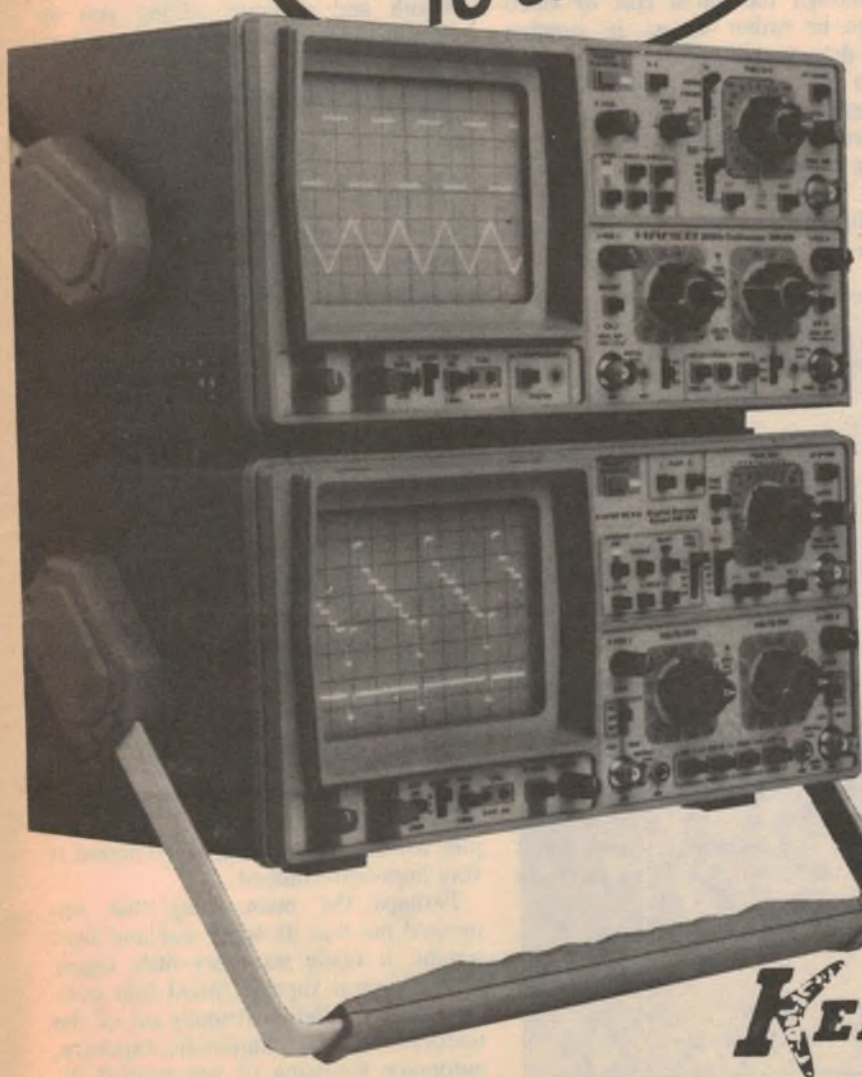
Commenting on the release of the GR-C11EA Mr Edwin Koemans, managing director of JVC distributor Hagemeyer (Australasia), said he believed the GR-C11 will further contribute to the growth in the camcorder market.

"The release of the GR-C11EA, with zoom capability now means we have a range of three VideoMovie cameras. In Australia there are around 2.5 million VHS video recorders in homes, and they all have the capability to work with any one of our VideoMovie cameras. With the additional GR-C11EA we now cater for every person's needs, from a simple one touch camera in the GR-C9EA, the combination of auto focus and zoom in the GR-C11EA and the full featured playback unit the GR-C7EA".

Recommended retail price of the GR-C11EA is $2399.

Two of our best Performers

NOW TURBOCHARGED TO 5MHz



HM205

an outstanding Oscilloscope with digital storage

This new oscilloscope offers all the features of a state-of-the-art **20MHz** realtime instrument. In addition it provides digital storage capability for signals between **50s** and **0.3ms** duration, with a max. sampling rate of **5MHz.** Especially when working with comparatively slow phenomenae, the **HM205** can easily replace considerably more expensive digital storage scopes.

2 Probes x 1/ x 10 incl.

HM208

the high tech Storage Scope with 20MHz sampling rate

The **HM208**'s high sampling rate of max. 20MHz facilitates storing of relatively fast single shot events. Max. memory is **4096 x 8** bit, conveniently divided into two independent blocks. **XY-storage** capability enables easy viewing and recording of characteristic curves and Lissajous figures. An XY-recorder output and the optional **GPIB-Interface** allow full integration in automatic measurement systems. With more than **5000** units sold, this is one of Europe's best selling digital storage scopes.

2 Probes x 1/ x 10 incl.

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NEW PRODUCT REVIEW:

Sony's EVM-9010P Video 8 "Combo"

Sony has just enhanced the versatility of its 8mm video format significantly, with the release of a compact and portable VCR-colour monitor combination designed for selling, training and reporting applications. Jim Rowe had the opportunity to try one out himself a few weeks ago, and here are his reactions:

As some readers may remember, I've been a home movie (film) enthusiast for quite a few years now. Originally I started on the old standard 8mm, then moved to 16mm to get better quality, and finally changed back to super-8mm when the cost of 16mm became too daunting. And generally I've found super-8 pretty good in terms of picture sharpness and stability, with reasonable sound quality.

Nowadays, of course, even super-8 is fairly expensive — about $23 for a 15m roll of sound film, which runs for only about 3-1/2 minutes. No doubt this is why film is steadily giving way to video. Even though the initial cost of video tends to be rather higher, its running cost is dramatically lower. And even I have to admit that the convenience of video tends to be rather attractive!

I have to confess that even though I'm "in electronics", it did take me quite a while to warm to video. For a long time its picture sharpness and stability left a lot to be desired compared with film, and the gear was pretty big and clumsy by comparison. With the early video gear there was virtually no capability for even simple editing, either — making it almost impossible to put together even a simple narrative.

Needless to say these limitations have been gradually sorted out, and the latest video gear is much more impressive. Even the editing situation is much better than it was, although for really smooth and accurate editing you do seem to need some pretty fancy and expensive equipment.

To my mind there's really only one main limitation left: the inability to display your video movie properly on a large screen. I guess we'll have to wait for HDTV (high definition TV) and better projection monitors before this becomes a reality. Ah well, the impossible still takes a little longer!

Sony's release of the Video 8 system a couple of years ago seemed to me to herald a new era in the transition to video for the home and office, even though many greeted it at the time with cries of "Oh no — not ANOTHER video format!". Its high performance and very compact form make it particularly suitable for these applications — initially much more so than the existing VHS and Beta formats, although the firms committed to these have since met the challenge and come up with comparable gear.

I was lucky to be able to get some first-hand experience with one of the Sony Video 8 camera-recorders early last year, taking it on a business trip to Taiwan. I used it to record factory visits plus a little sight-seeing, and I found it very impressive indeed.

Perhaps the main thing that impressed me was its small size and light weight; it really was very little bigger than a typical super-8 sound film camera. And it offered virtually all of the features, too, like automatic exposure, automatic focussing (if you wanted it), automatic colour balance, adjustable speed power zoom — you name it. I

A closeup of the VCR section of the unit, located above the monitor as shown in the complete shot on the opposite page. It's very easy to use.

found it very quiet, too; in fact a pure delight to use.

And this was the larger, fancier model by the way — Sony has more recently brought out a more compact model again!

When I got back and replayed the material I'd taken, the reproduction itself was excellent — even though my camerawork in places left something to be desired (can't blame Sony for that!). The pictures were sharp and steady, colour balance was generally excellent even when shot under fluoros, and all of the sections where I'd relied on the autofocussing were well focussed. Even the sound was excellent, thanks to the Sony's PCM sound system.

I even tried making a dub from the Video 8 original over to VHS (sorry about that Mr Sony!), and the dub quality was also excellent — still better than most pre-recorded VHS tapes.

In short, Video 8 does very well indeed by any standards, and even more so when you consider it's all done with an ultra-thin tape only 8mm wide and running at a speed lower than a conventional compact audio cassette. The speeds are in fact 20.05mm per second for normal "SP mode", and 10.06mm/sec in the longer-play "LP mode".

Anyway, enough preamble. Let's talk about the new Sony EVM-9010P "Combo" unit. This is especially interesting because it's in some ways the reverse of the cam-corder concept: instead of combining the VCR with the camera, for taking the pictures, it combines it with the monitor for replaying them conveniently.

The reason for this is that the Combo unit is really meant for use as an audio-visual tool for business and industry, not so much as a piece of home video gear (although it would also be quite suitable for this).

Its prime use is likely to be for things like video reporting in the construction, real estate, investigation and insurance industries; delivering training programs and sales promotion material; and so on. Anywhere that an audio-visual record needs to be replayed quickly and with a minimum of hassle, in fact.

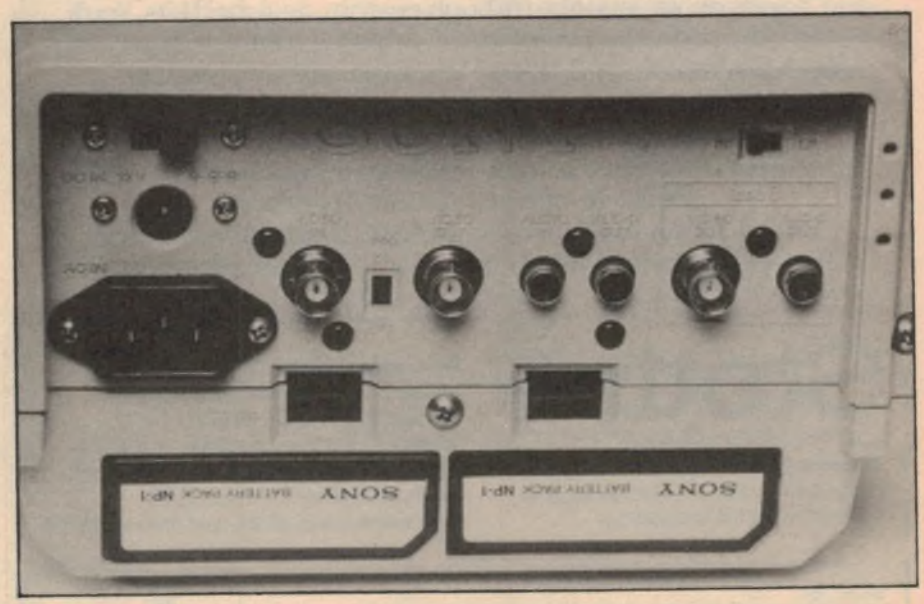
The EVM-9010P combines a full Video 8 VCR with a 9" black face colour monitor using a Sony Trinitron tube (not surprisingly!). The tube has a stripe pitch of 0.55mm, and is capable of 270-line resolution at the centre.

The complete unit measures 242 x 274 x 327mm, and has a mass of close to 8kg without batteries. This brings it nominally below the official limit for

safe carrying by female employees, although my impression after carrying it for a while was that you really wouldn't want to carry it too far. Perhaps it's the orientation of the fold-down handle: this runs at right angles to the long dimension, making it a little awkward to carry.

There are compartments inside the rear of the case to accept two rechargeable battery packs (type NP-1A), and these can be charged while in the unit. The EVM-9010P will operate for around 100 minutes from the two packs, but can also be operated either from the mains, or from a 12V DC supply. An adaptor cable is available to run it from a car's lighter socket, for example.

The inbuilt VCR is located at the top, above the monitor, and takes the stand-



A look at the back panel. The various video/audio connectors are at centre right, with the two rechargeable battery packs at the bottom. It also runs from either 240V or an external 12V battery.

Sony EVM-9010P

ard Video 8 compact cassettes measuring 95 x 62 x 15mm. It uses a rotary two-head scanning system for both video and sound, and delivers a nominal 230-line picture resolution in the faster SP mode. Both it and the monitor use the PAL colour system and are fully compatible with standard Australian TV receivers.

As you'd expect with a unit intended mainly for business use, there is no in-built TV tuner or modulator. Inputs and outputs are all composite video (1V p-p, negative sync, 75 ohms) and audio (-5dBs, high impedance in, low impedance out). In addition to the basic video and audio inputs and outputs, there is also a pair of outputs for an external monitor if required.

There are no recording level indicators or controls; this is all taken care of automatically. Similarly I could find no VCR tracking control; presumably this is automatic too. In short, the EVM-9010P is very easy to use and virtually foolproof.

What about the results? Well, during the few days that I was able to try out the unit shown, I tried making recordings from a number of sources and playing them back both via the EVM-9010P's own 9" monitor and an external monitor. The results were uniformly excellent, using the normal SP mode. The pictures were crisp and very stable, with good colour balance and very low noise. The PCM sound was also excellent, as you'd expect.

With the slower LP mode the resolution is understandably a little lower, but otherwise the performance is still OK for uses that are not quite as demanding.

Sony also sent along a pre-recorded cassette, with some commercials showing different applications for Video 8 in business. This also played back extremely well.

In short, the EVM-9010P seems a great little performer. All you'd need is a standard video camera, or a Video 8 camcorder, to have a complete basic video production system for business use. With a compact matching camcorder it would also be excellent for home movies, too.

The EVM-9010P is priced at $1995 plus sales tax, if applicable. It's available from Sony's Business and Industrial Division, which has offices in all capital cities except for Tasmania, where the office is in Launceston. There's also a New Zealand office, in Auckland. (J.R.)

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Air accident investigation enters the space age

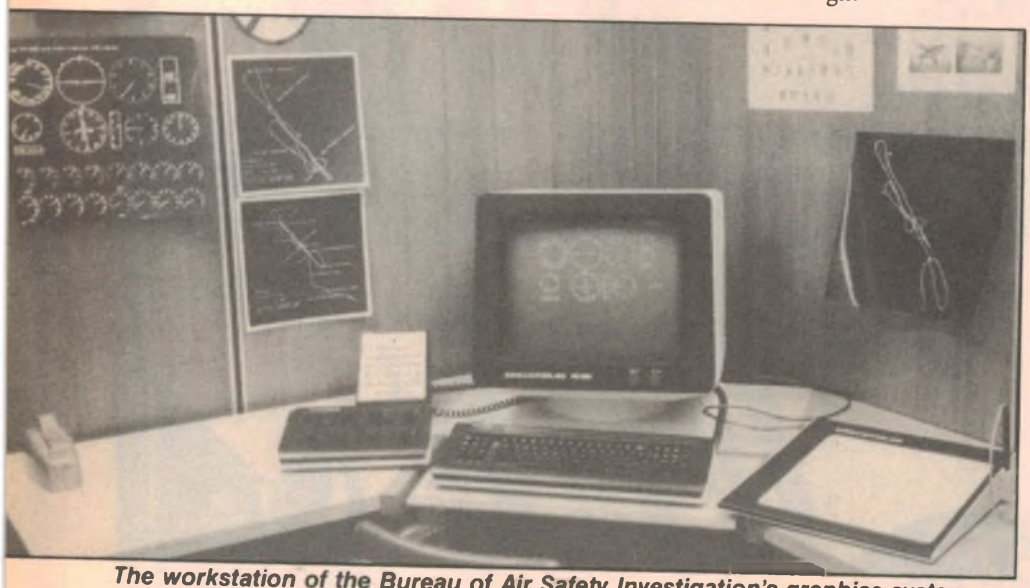
An air accident can be realistically recreated on a computer screen, even if no witnesses survived, thanks to a specially-designed graphics system now being used by Australian aviation authorities. The system opens entirely new horizons in the field of air accident investigation.

by PAUL GRAD

It may seem sad and even a bit gruesome. On a computer screen, air safety experts can realistically reconstitute, in the form of moving images, the last agonising moments of an aircraft's flight, following an accident in which a number of people lost their lives. Not only that, but they can try out various alternative scenarios of that fateful flight to find out what actually happened, what could or should have been done to avoid the tragedy and what can be done to prevent further such accidents.

The importance and usefulness of detailed air accident investigation are unquestioned. And nowadays, with modern animated computer graphics systems, powerful and versatile tools are available which only a few years ago were hardly even dreamt of.

It is still useful to perform inspections on the actual site of an air crash, but the new tools are expected to greatly enhance the ability of accident investigators to pinpoint the causes of an accident and to improve overall air safety and even aircraft design.



The workstation of the Bureau of Air Safety Investigation's graphics system, showing some of the instruments of a Boeing 747 cockpit. On the walls are prints of reconstituted flight paths.

A graphics system for air accident and incident investigation has become very valuable since it was introduced to Australia, about 18 months ago, according to its user, the Bureau of Air Safety Investigation.

The Bureau was until recently a section of the Federal Department of Aviation, and is now part of the Federal Department of Transport and Communications.

The system has shown the power and flexibility to satisfy most of the investigators' graphics requirements, for the applications developed so far by the Bureau. It has been used by the Bureau for three main applications: aircraft instrument panel display, flight path and flight animation, and instrument landing path and animation.

The graphics are produced from the data contained in the flight data recorders taken from the aircraft, or derived from experiments conducted in flight simulators.

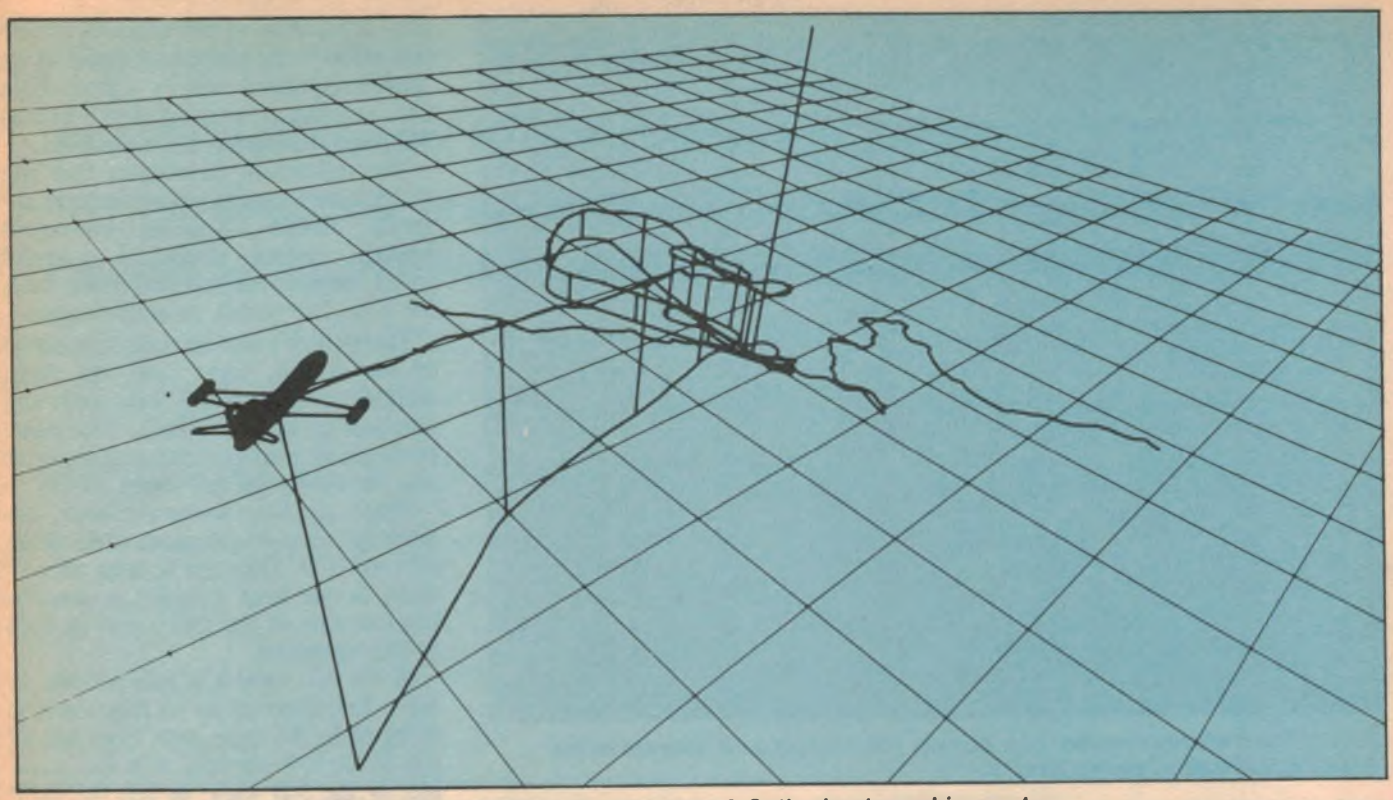
The system was installed at the Bureau in Canberra in June 1984. Following a trial period and the addition of some equipment to extend the system's capabilities, the Bureau started using it in earnest.

One of the first incidents the Bureau analysed with the new tool was the accident with a Westwind jet operated by Pel-Air which crashed into the sea off Sydney in October 1985, killing both pilots.

Bureau investigators suspected that cockpit instrument failure caused the accident. They duplicated the instrument failure in a simulator, and verified that it became very difficult to control the airplane.

They then entered the data thus obtained into the graphics system and, together with data from the airplane's flight data recorder, saw the confirmation of their suspicions.

The pilots could not control the airplane because they were flying at night over the sea and experienced a loss of information from their instruments with-



An example of a simulated flight path produced by the Evans & Sutherland graphics system.

out having any external reference points.

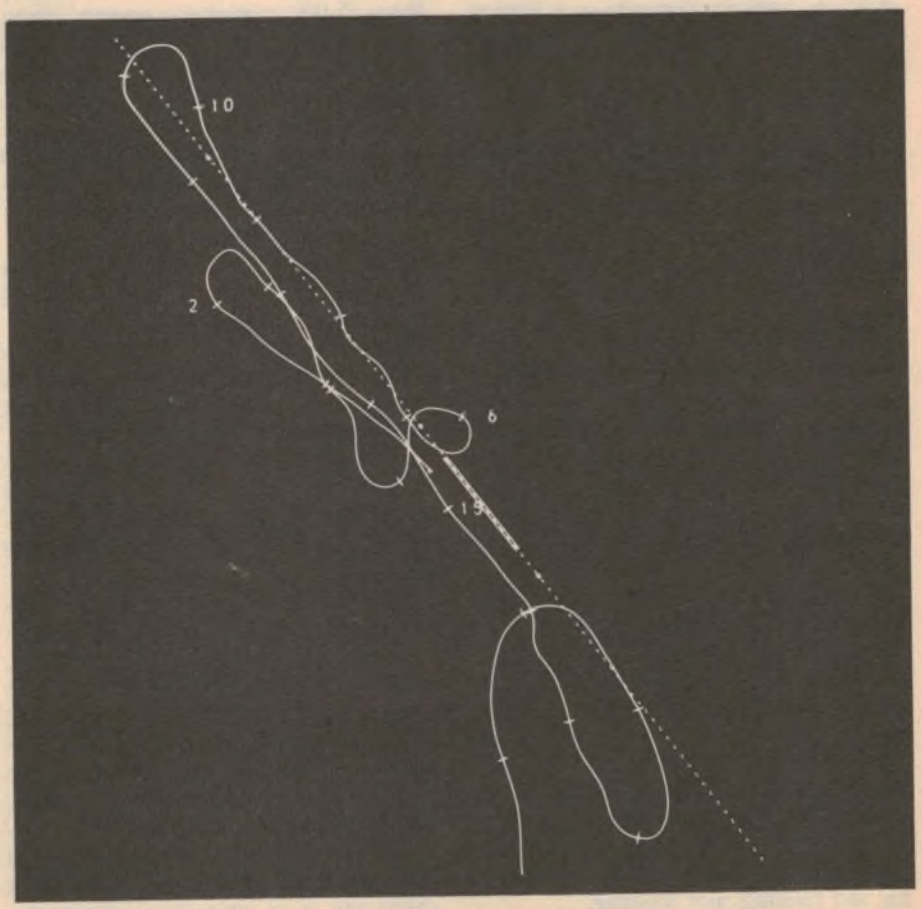
The combined use of both the simulator and the graphics system was specially valuable in this case, because the flight data recorder could not by itself show conclusively that the pilots could not control the aircraft.

When first installed, the Bureau's system included the following hardware: one PS300 graphics unit supplied by Evans & Sutherland of Salt Lake City, Utah; a Versatec plotter hosted to the unit; and a PDP-11/73 host computer with a 1.75Mb memory.

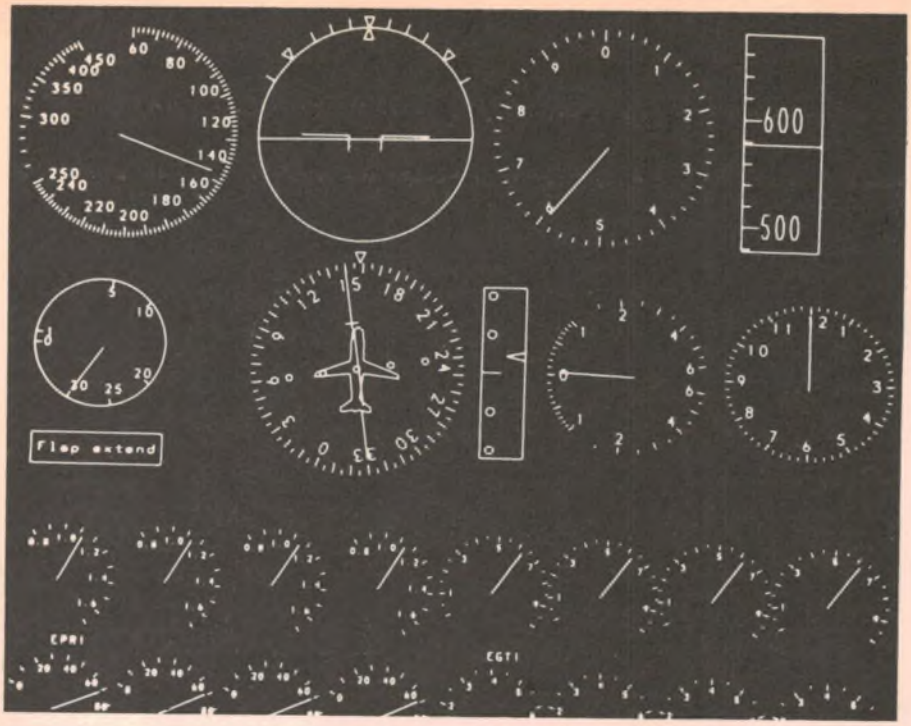
The unit initially consisted of a 19" monochrome screen, one data tablet, interactive devices, 1Mb of main memory, 1 single-sided floppy drive, and version A1.V01 of the operating system. In March 1986, version A5.V05 of the unit's operating system was installed.

The need for longer animation times (the times, usually two or three minutes, during which an event such as a flight is shown) led the Bureau to install, in May 1986, a further 2Mb of memory in the unit.

The system was chosen because, according to the Bureau's specifications, it should have the following capabilities: to display a flight path in two and three dimensions and manipulate the views in real time; to animate an aircraft on its flight path and to display any available



This is a re-enactment of an accident in Dacca, Bangladesh, about two years ago, during bad weather. A Fokker F27 aircraft missed the approach to the runway, continued its flight and crashed into the ground.



Part of the instrument panel of a Boeing 747 cockpit as it appears in the Evans & Sutherland workstation.

pitch and roll information; and to animate the basic instruments of a Boeing 747 instrument panel and run it in real time.

The requirement that these applications be in real time limited the choice of the graphics system to a vector scanning type. Although recent advances in raster systems have improved their performance in real time animation, vector scanning systems are still considered by the Bureau to be superior for real time animation.

The PS300 is a high performance distributed interactive vector scanning system based on the Motorola MC68000 processor. Any size or make of host computer can communicate with the PS300, as long as it can accept RS-232C and RS-449 asynchronous serial communication using Start/Stop protocol.

In most applications the host computer is used for running analysis programs and for file storage. All processing of the data contained in flight data recorders is performed in the host computer. The data is then transferred to the PS300 and the PS300's software allows selecting — by means of the interactive devices — the objects to be displayed and performing the objects' transformations such as scaling, translating and rotating, and zooming.

All objects to be displayed are created as vectors and stored in the PS300's own memory. The PS300 has the capability to process and display about 45,000 average-size vectors (about 50cm in size) and up to 90,000 small vectors (of maximum size 2.5mm) in each refresh cycle (1/30th of a second).

Real time interaction allows an image on the screen to respond instantly to input from interactive devices, permitting complex objects in three dimensions to be manipulated in real time.

The interactive devices consist of a keyboard, function buttons, control dials and a data tablet.

The keyboard has 12 function keys which can be programmed to perform tasks such as cycling through an object list to select an object for processing, for example scaling or varying the image's intensity; resetting, stopping and starting the animation; and displaying messages on the screen to aid the user.

The 32 programmable function buttons can be used to activate or deactivate display functions. For example, causing objects to come on or go off the screen, or allowing depth cueing.

The programmable control dials permit general manipulation of the displayed image, for example scaling, translating, rotating, and zooming.

The data tablet is normally used to copy accurately geographic data from charts and as an interactive pointing device to control the cursor which is displayed on the screen.

The Bureau's instrument panel display application of the graphics system can animate the instrument panel of an aircraft equipped with a digital flight data recorder. Currently only a Boeing 747 panel description file is available.

The instrument parameters that can be displayed simultaneously include airspeed, altitude, heading, instrument landing system deviations, vertical speed, engine rpm and fuel flows, leading edge flap transit extension angles.

The Bureau's second main application of the system, flight path and flight animation, displays the flight path and animates up to four aircraft. Four viewports can be displayed simultaneously or any one chosen for full screen display.

There are four views available: azimuth (plan), side elevation, front elevation and 3-D. They can be seen alternatively in one large viewport or simultaneously, one of the four views in each of four viewports.

In the 3-D view it is also possible to see a formation of up to four aircrafts flying along the same path, from behind any of the four aircrafts. It is also possible, in the 3-D view, to see the flight from inside the cockpit of any of the four aircrafts.

The third main application, instrument landing path and animation, calculates the flight path from the ILS (Instrument Landing System) information recorded by the flight data recorder.

The animation is displayed in two viewports. A larger viewport contains either an azimuth view of the flight path and the runway, a three-dimensional view, or a pilot's view of the approach to the runway. A smaller viewport, below the larger one, contains a view of the flight path perpendicular to the runway centreline.

Animation times of up to two minutes are possible, in real time. Longer times are possible if less views are used.

Future applications may include a colour monitor to improve clarity, specially in complex three-dimensional views. A raster extension consisting of monitor and processing board would allow full-colour solid modelling, further improving the display's realism.

The Bureau's computer systems manager, David Nicholas, said the animations produced by the system are very realistic and similar to a motion picture. Specially realistic is the reconstruction of a cockpit during flight, which is pretty much as the pilots see it. Since most air safety investigators are themselves pilots, this realism is specially valuable, as it also gives them a "feel" for what actually happened, he said.

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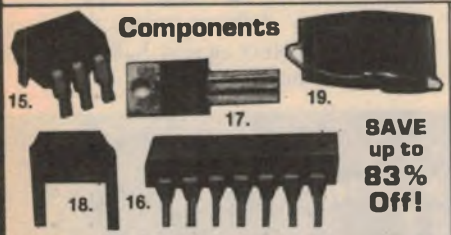

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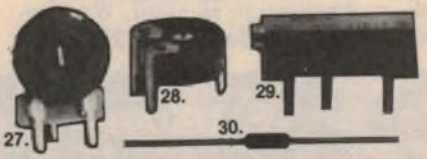

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Fig. 32

Size	Cat. No.	Reg.	Sale
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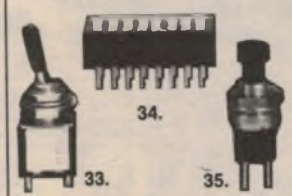

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Silicon Valley firms bid for contracts:

Early SDI deployment is good news for some

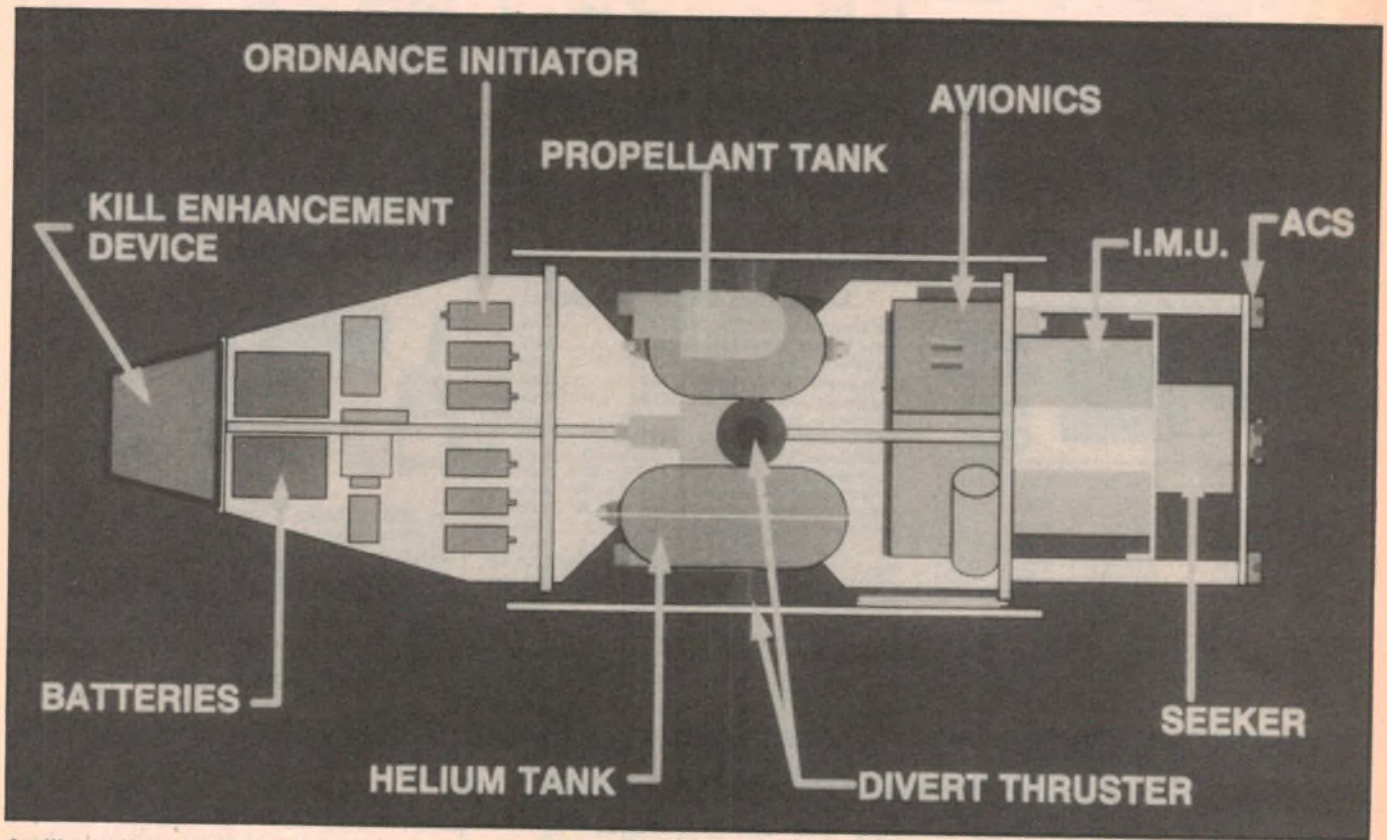
For many of the electronics firms in California's Silicon Valley who have bid for, or received contracts as part of President Reagan's "Star Wars" program, the prospect of its early deployment is good news. But for others, it could spell disaster.

by JOHN SCHNEIDAWIND

In December 1982, Joe Wetch had it made. He had a secure job with Rockwell International in Hanford, Washington, and a beautiful home. He could have rested on his laurels as the inventor of the world's first nuclear-powered satellite.

But Wetch, 59, was tired of working for a large corporation. And his 1960s dream of using nuclear energy to create high-powered reconnaissance satellites was going nowhere. So, Wetch sold his house, moved to California's Silicon Valley and formed a company to design 50-megawatt satellites that can see through clouds and detect the movement of enemy missile silos.

Today, Wetch's Space Power Inc. of San Jose is one of dozens of Silicon Valley firms to win lucrative research contracts for the Strategic Defense Initiative, (SDI) the costly space-based "Star Wars" defence system that is designed to protect against ballistic missile attacks in the 1990s.



An illustration released by the US Department of Defense, showing the basic construction of one of the first projected SDI weapons: an ERIS rocket, or "Ex-atmospheric Re-entry vehicle Interceptor Subsystem".

With 234 contracts totalling nearly $US2 billion from 1983 to 1987, the Valley's share of star wars research pool ranks second only to the Los Angeles metropolitan area, according to Federation of American Scientists, a Washington-based group that monitors SDI contracts.

Early deployment

But the SDI research gold mine may be playing out. By early August, a senior group of Pentagon officials was expected to approve the design of a limited "star wars" system that would be processed into service by the mid-1990s.

The Reagan administration is pushing for early deployment of the partial program, costing $US40 billion to $US60 billion, as a way to safeguard it from future spending cuts or elimination. This plan would consist of ground- and space-based rocket systems aimed at incoming missiles, complemented by hundreds of communication and reconnaissance satellites orbiting Earth.

That's a far cry from President Reagan's original proposal, a grandiose system of lasers and particle beams that were supposed to render nuclear missiles "obsolete". His full SDI proposal would cost as much as $US1 trillion to deploy, and would not be rolled out until the late 1990s at the earliest.

But with the smaller price tag of a pared-down program, many SDI contractors are worried that if any production contracts are awarded, the pool of money for SDI research will dry up.

"In the rush to see deployment get done, you wind up not paying attention to little SDI research contracts that could pan out," said Bill Barletta, deputy program director for Beam research at Lawrence Livermore Labs, which has won more than $US450 million in SDI research contracts.

Lockheed ABM missile among the first

A pared-down SDI program wouldn't hurt Lockheed Missiles & Space Co. of Sunnyvale, which has scooped up more than $US1 billion in SDI contracts since 1983. The company has a $US468 million contract to develop the ex-atmospheric re-entry vehicle interceptor subsystem (ERIS), a rocket system designed to collide with incoming warheads in space. It would be one of the first weapons to be rolled out if SDI is deployed by the middle of the next decade.

Lockheed successfully demonstrated a prototype of the ERIS rocket in 1984, when it smashed into a dummy warhead over the Pacific Ocean. The current ERIS missiles weigh more than a tonne and cost $US5-10 million to build and launch.

Lockheed hopes it will eventually be able to reduce the weight to no more than 300 pounds and the cost to around $US100,000 a piece. But that may take several more years of intense research. If a decision is made to deploy ERIS by the mid-1990s, Lockheed may not have enough time to lower the cost and reduce the weight by that much.

Others less fortunate

Unlike Lockheed, the dozens of smaller companies that have sprung up in Lockheed's shadow, largely on the strength of SDI research funding, the future isn't as certain.

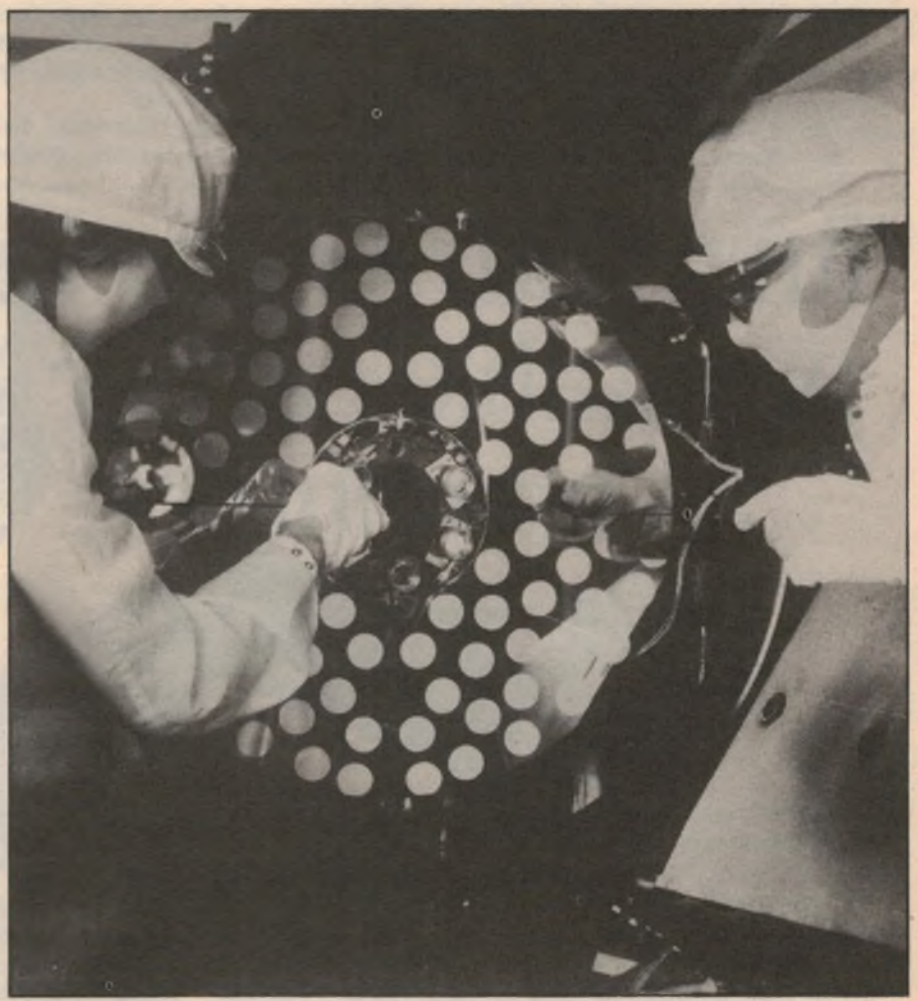
Congress has threatened to slow down "star wars". The Democrat-controlled House of Representatives already has cut the Reagan Administration's funding request for the program in half to $US3.1 billion this year, though the Senate has yet to approve the cuts.

What's more, there are signs that even the Pentagon is divided over how and when to develop "star wars". Analysts say the dispute has left many contractors reluctant to invest in SDI research without some assurance that the program will pay off.

"Most of this research work is being done at break-even, or at a small loss, said Bill Deatherage, a defence analyst for Dean Witter Reynolds in New York. "The contractors don't know if the program will pan out."

Even officials from Lockheed Missiles & Space, has some of the most secure SDI programs in the country, say that pursuing the contracts is much riskier than before. Chief among the concerns are the divisions within the administration and Congress over SDI's purpose.

"SDI is marching to some different technical drummers," said Richard Wallner, director of strategic defence at Lockheed Missiles & Space. Wallner



Lockheed engineers assemble a primary mirror for the large Optics Demonstration Experiment (LODE), which is a project seen as contributing to the development of an SDI laser battle station. This would be designed to detonate ballistic missiles during their boost stage.

said that compared with other defence programs, "profit margins aren't as high. It's enormously difficult to go out and compete."

During the first four years of the "star wars" program, Congress did most of the budget cutting without rigorous internal review by the Pentagon. The result was hundreds of research contracts for scores of companies. There is even a venture capital arm of sorts, called the New and Innovative Concepts Program administered by the Energy Department's San Francisco office, where companies could get money for risky research.

Money hard to get

But there are signs that SDI money may be getting harder to come by. In June, the Defence Acquisition Board, a panel of senior Pentagon officials, began evaluating SDI spending requests for the first time. Later this year it is expected to approve a plan to deploy the space-borne defence system in the mid-1990s.

Some members of the Joint Chiefs of Staff are said to be skeptical of early deployment because it would mean spending more money on SDI projects at the possible expense of ongoing weapons systems programs. Early deployment could also rob funds from longer-term research programs at research labs like Lawrence Livermore.

The board's deployment decision is eagerly awaited by Silicon Valley defence contractors, many of whom are already taking a wait-and-see attitude before investing substantially in SDI research.

Valley contracts ready

"We would be willing to put up some of our own money to develop SDI programs," said Jon Jenny, chief engineer at ESL of Sunnyvale, which has an $US11 million contract to develop a network for supercomputers that would track incoming missiles. "But we're not putting in a lot of money into SDI for the moment," Jenny said.

Other companies, such as Logic Devices in Sunnyvale, have avoided going after SDI contracts because they don't foresee a definite production program in the years ahead.

"We have to focus our opportunities," said Bill Volz, a vice president at Logic Devices, which makes digital signal processing components.

But for other firms, "star wars" may still continue to be a bonanza. Acurex of Mountain View, which last year received 25% of its $US60 million in revenues from SDI contracts, expects that side of its business to jump to 33% of sales this year. Acurex's SDI business comes from its recent Air Force contract to upgrade the Laser-Hardened Materials Evaluation Laboratory at Wright Patterson Air Force Base in Dayton, Ohio.

Joe Wetch, the president of Space Power, believes SDI research contracts will survive no matter what Congress does to the program. Space Power's sales grew to $US1.2 million last year, a threefold increase over 1985; this year, the firm expects sales to total $US2.5 million.

Wetch, who helped put a nuclear reactor in space aboard the Atlas Agena B rocket in 1965, says that even if "star wars" is eliminated as a program, many components of it will survive.

Using information gleaned from the "star wars" contracts, Wetch believes Space Power has cornered the market on nuclear-powered television satellites that can blanket an entire continent, he said.

That's a business that could hold even greater promise than "star wars", Wetch says.

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- 6 months warranty!

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256K RAM Single Drive, Graphics and Disk Controller Card. **$795**

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20 M/Byte Hard Disk, 360K Disk Drive. 1 Serial, 1 Parallel Port (Includes Timer Disk)
Single 360K Floppy Disk Drive ..... **only $1,750**
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Assembled & Tested in Australia!

- 1 M/Byte Main Board
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Dimensions: 360(W) x 175(H) x 405(D)mm

MICRODOT 5¼" DISKS!

DESCRIPTION	1-9 BOXES	10+ BOXES
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- 10 Way Dip Switch
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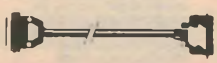

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- Suits IBM* PC XT and compatibles
- 25 pin "D" plug (computer end) to Centronics 36 pin plug

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Tired of paying out more for Japanese Disk Drives? These "direct import" Hong Kong disk drives are the solution! They feature Japanese mechanical components, yet cost only a fraction of the price!

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Drive with DTC controller card
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5¼" DISK STORAGE

Efficient and practical. Protect your disks from being damaged or lost!
Features...

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- Smoked plastic cover
- Lockable (2 keys supplied)
- Dividers/spacers

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SENDATA DIRECT CONNECT MODEM

- CCITT V21 300 baud full duplex
- CCITT V23 1200/75
- Bell 103 300 Full duplex
- Bell 202 1200 Half duplex
- Auto answer, auto disconnect
- LED display for Power, TX, RX, CD
- AC power adaptor included
- DB25 pin connector
- Telecom Approval N° C83/37/1045

Cat. X19120 ..... **$295**
(SOFTWARE FOR VIATEL ... $95)

CANON A-50 PRINTER

- Serial Impact Dot Matrix
- 180 C.P.S
- Near Letter Quality Mode
- 1.4K Buffer

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Quality paper at a low price! 2,500 sheets of 60 gsm bond paper.
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Cat. C21005 15 x 11" ... **$67.95**

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VERBATIM DISK SPECIALS!

All prices 10 disk boxes!

Description	1-9 boxes	10+boxes
5¼" 1S/2D	$24.95	$22.50
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3½" 1S/2D	$47.50	$46.50
3½" 2S/2D	$49.50	$48.50

"NO FRILLS" DISKS!!

Now you can buy absolute top quality disks that are also the cheapest in Australia! They even come with a 5 year guarantee, which indicates the quality of these disks. So why pay 2-3 times the price for the same quality?

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$10ea	$9ea	$8.50ea

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3½" "NO FRILLS" DISKS!

1-9 PACKS	100+PACKS	100+PACKS
$35 (PER PACK)	$34 (PER PACK)	$32 (PER PACK)

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SAMSUNG 12" 20MHz COMPOSITE MONITOR ONLY $149

FEATURES...

- High contrast, non-glare screen
- High resolution 80 or 40 character display

SPECIFICATIONS...
Picture tube: 12" diagonal and 90° deflection
Phosphor: Available in Green (P39) or Amber
Video input signal: Composite Signal
Polarity: Negative Sync
Level: 0·5V-2·0Vp-p
Scanning frequency:
Horizontal: 15.734 KHz + – 0·1%
Vertical: 60Hz
Video bandwidth: 20MHz
Active display area:
218(H) x 160(V)mm
Display character:
80 characters x 25 rows
Input terminal: RCA Phono Jack
Controls:
Outside: Power Switch, Contrast, Brightness, H-Shift, V-Size
Inside: H-Width, H/V hold, H/V linearity, Focus
Power supply: 110/120V 60Hz, 220/240V 50Hz
Dimensions:
308(W) x 307(H) x 297(L)mm
Weight: 7·3 Kg
Shipping weight: 8·3 Kg

Cat No	Description	Price
X14514	(GREEN)	$149
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- Female to Female
- Saves modifying or replacing non-mating Centronics cables
- All 36 pins wired straight through.

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Cat. X15664 **Female to Female**
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Only $24.95

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12 months warranty!

HUNG CHANG (RITRON) 20 MHz DUAL TRACE OSCILLOSCOPE

- Wide bandwidth and high sensitivity
- Internal graticule rectangular bright CRT
- Built in component tester
- Front panel trace rotater
- TV video sync filter
- Z axis (Intensity modulation)
- High sensitivity X-Y mode
- Very low power consumption
- Regulated power supply circuit

COMPONENT TESTER is the special circuit with which a single component or components in circuit can be easily tested. The display shows faults of components, size of a component value, and characteristics of components. This feature is ideal to troubleshoot solid state circuits and components with no circuit power. Testing signal (AC Max 2 mA) is supplied from the COMPONENT TEST IN terminal and the result of the test is fed back to the scope through the same test lead wire at the same time.

CRT

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

VERTICAL

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

HORIZONTAL

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

TRIGGERING

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

X-Y OPERATIONS

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

COMPONENT TESTER

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

OTHER SPECIFICATIONS

Intensity Modulation: TTL LEVEL (3Vp-p). Positive ..... brighter.
BANDWIDTH: DC - 1MHz MAXIMUM INPUT VOLTAGE: 50V (DC + AC Peak)
Calibration Voltage: 0.5Vp-p +/- 5%, 1KHz +/- 5% Square wave.
Trace Rotation: Electrically adjustable on the front panel.
Power Requirements: AC: 100, 120, 220, 240V 20W
Weight: 7kg approximately
Size: 162(H) x 294(W) x 352(D)mm.

Cat. Q12105 ..... **only $849**
(tax exempt only *$695*)

Bulk orders, schools, please phone (03) 543 2166 for special low pricing

METEX M-3650 MULTIMETER

20A, 3 1/2 digit frequency counter multimeter with capacitance meter and transistor tester.

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

NEW!

CHECK THESE FEATURES...
- Push-button ON/OFF switch
- Audible continuity test
- Single function, 30 position easy to use rotary switch for FUNCTION and RANGE selection.
- Transistor test
- Diode test
- Quality probes
- 1/2" High contrast LCD
- Full overload protection
- 20 Amp
- Built in tilting bail
- Capacitance meter
- Instruction manual

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

Cat. Q91550 ..... SAVE $16, **Special $149**

METEX 4500H MULTIMETER

10A, 4 1/2 digit multimeter with digital hold, transistor tester and audible continuity tester.

The Metex 4500H is perfect for the technician, engineer or enthusiast who requires the higher accuracy of a 4 1/2 digit multimeter. This meter is exceptionally accurate, (just look at the specifications), and yet, still retains an exceptionally low price!

The Metex 4500H features digital hold which is normally only found on very expensive multimeters. This enables you take a reading and hold that reading on display even after you have removed the probes, simply by pressing the hold button.

NEW!

CHECK THESE FEATURES...
- Readout hold
- Transistor Tester
- 4 1/2 digit x 1/2"(H) LCD
- Audible continuity tester
- Push-button ON/OFF switch
- Quality set of probes
- Single function, 30 position easy to use rotary switch for FUNCTION and RANGE selection.
- Built in tilting bail
- Instruction manual
- Full overload protection
- hFE test
- Battery and Spare fuse
- Diode Tester
- Vinyl case

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

Cat. Q91560 ..... Save $16, **Special $159**

SAVE $30

METEX 3800 MULTIMETER

This instrument is a compact, rugged, battery operated, hand held 3 1/2 digit multimeter for measuring DC and AC voltage, DC and AC current, Resistance and Diode, for testing Audible continuity and transistor hFE. The Dual-slope A-D Converter uses C-MOS technology for auto-zeroing, polarity selection and over-range indication. Full overload is provided. It is an ideal instrument for use in the field, laboratory, workshop, hobby and home applications.

Features...
- Push-button ON/OFF power switch
- Single 30 position easy to use rotary switch for FUNCTION and RANGE selection.
- 1/2" high contrast LCD.
- Automatic over-range indication with the "1" displayed.
- Automatic polarity indication on DC ranges.
- All ranges fully protected plus Automatic "ZERO" of all ranges without short circuit except 200 ohm Range which shows "000 or 001"
- High Surge Voltage protection 1.5 KV-3 KV.
- Diode testing with 1 mA fixed current.
- Audible Continuity Test
- Transistor hFE Test

SPECIFICATIONS
Maximum Display: 1999 counts 3 1/2 digit type with automatic polarity indication.
Indication Method: LCD display
Measuring Method: Dual-slope in A-D converter system.
Over-range Indication: "1" Figure only in the display.
Temperature Ranges: Operating 0-C to +40-C
Power Supply: one 9 volt battery (006P or FC-1 type of equivalent)

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

SAVE $30

METEX 3530 MULTIMETER

This instrument is a compact, rugged, battery operated, hand held 3 1/2 digit multimeter for measuring DC and AC voltage, DC and AC current, Resistance and Diode, Capacitance, Transistor hFE and Continuity Test. The Dual-slope A-D Converter uses C-MOS technology for auto-zeroing, polarity selection and over-range indication. Full overload is provided. It is an ideal instrument for use in the field, laboratory, workshop, hobby and home applications.

Features...
- Push-button ON/OFF power switch
- Single 30 position easy to use rotary switch for FUNCTION and RANGE selection.
- 1/2" high contrast LCD.
- Automatic over-range indication with the "1" displayed.
- Automatic polarity indication on DC ranges.
- All ranges fully protected plus Automatic "ZERO" of all ranges without short circuit except 200 ohm Range which shows "000 or 001".
- High Surge Voltage protection 1.5 KV-3 KV.
- Capacitance measurements to 1pF
- Diode testing with 1 mA fixed current.
- Audible Continuity Test.
- Transistor hFE Test.

SPECIFICATIONS
Maximum Display: 1999 counts 3 1/2 digit type with automatic polarity indication.
Indication Method: LCD display.
Measuring Method: Dual-slope in A-D converter system.
Over-range Indication: "1" Figure only in the display.
Temperature Ranges: Operating 0-C to +40-C
Power Supply: one 9 volt battery (006P or FC-1 type of equivalent)

Cat. Q91540 **Normally $139**
SPECIAL $109

SAVE

WELLER WTCPN SOLDERING STATION

The WTCPN Features:
- Power Unit 240 V AC
- Temperature controlled iron, 24 V AC
- Flexible silicon lead for ease of use
- Can be left on without fear of damaged tips!

The best is always worth having.

Cat. T12500 ..... **R.R.P. $149**
SPECIAL, ONLY $129

CORDLESS RECHARGEABLE SOLDERING IRON

- Built in solder point illumination
- Easy replacement of solder tip
- Protective stand which also functions as charging unit
- Sponge pad attach to stand
- Plug pack power adaptor
- Includes Nicad battery
- Instruction manual
- 12 months warranty

Cat. T12480 ..... Normally $79.95
SPECIAL, $69.95

SAVE $30!

SCOPE 60W SOLDERING SYSTEM

- Infinitely adjustable temp. 200 C to 470 C. Sliding control selects desired tip temperature (LED readout monitors tip temp.)
- Safety holder features ceramic burn-proof bush and can be converted to left-hand-side
- Soft and cool hand grip in pliable rubber.
- Screw type connector prevents accidental plug removal and guarantees solid contacts.
- Temperature lock allows production supervisors to control soldering temperatures.
- Anti seize tip retention design reduces risk of thread seizure by removing locking nut to cooler end of barrel.
- Optional 30W soldering pencil is available for finer work.

Cat. T12900 ..... **Normally $229**
SPECIAL, $199

PC BOARD HOLDER

Better than an extra pair of hands! A must for all PCB work.

Cat. T12444 ..... **$9.95**

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H10467 153 x 76 x 228mm $16.95
93/8/V
H10465 203 x 76 x 228mm $17.95
93/10/V
H10466 254 x 76 x 228mm $18.95
93/12/V
H10468 305 x 76 x 228mm $21.50
93/17/V
H10470 430 x 76 x 228mm $29.95

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

FREE STANDING, FOLD UP MAGNIFIER

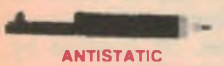
An economically priced "hands free" magnifier, lets you take care of all those tricky fine detailed jobs so often encountered in electronics, or any of many other practical uses such as home, work, hobbies etc

Cat. T10020 Normally $14.95
SPECIAL, ONLY $12.95

REGULAR SOLDER SUCKER

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

Cat. T11271 ..... $11.95



ANTISTATIC SOLDER SUCKER

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

Cat. T11281 ..... $13.95

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1.5 metres of specially treated braid for removing solder from PCB's etc Simply place the braid against the solder and apply the soldering iron The melted solder is drawn up into the braid!

T11320 1.5 metres $1.95

NICADS!

Save a fortune on expensive throw away batteries with these quality Nicads and Rechargers!

Size	Desc.	1-9	10+	100+
AA	450 mA.H.	$2.95	$2.75	$2.50
C	1.2 A.H.	$9.95	$9.50	$8.95
D	1.2 A.H.	$9.95	$9.50	$8.95

COMPUTER CABLE

CIC6 6 conductor computer interface cable. Colour coded with braided shield (to IE422 specifications) Copper conductor 6 x 7/0.16mm.

1-9 metres	10+ metres
$1.90/m	$1.70/m

CIC9.100 9 conductor computer interface cable. Colour coded with mylar shielding. 9 x 7/0.16mm.

1-9 metres	10+ metres
$2.50/m	$1.95/m

CIC12 12 conductor computer interface cable. Colour coded with mylar shielding. 12 x 7/0.16mm.

1-9 metres	10+ metres
$2.70/m	$2.50/m

CIC16 16 conductor computer interface cable. Colour coded with mylar shielding. 16 x 7/0.16mm.

1-9 metres	10+ metres
$3.90/m	$3.40/m

CIC25 25 conductor computer interface cable. Colour coded with mylar shielding. 25 x 7/0.16mm.

1-9 metres	10+ metres
$4.90/m	$4.40/m

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We have a great range of panel meters at great prices!

Cat.No.	Description	Price
Q10500	MU45 0-1mA	12.50
Q10502	MU45 50-0/50uA	12.50
Q10504	MU45 0-100uA	12.50
Q10510	MU45 0-5A	12.50
Q10518	MU45 0-1A	12.50
Q10520	MU45 0-1A	12.50
Q10525	MU45 0-20V	12.50
Q10530	MU52E 0-1A	14.50
Q10533	MU52E 0-5A	14.50
Q10535	MU45 VU PMetre	14.95
Q10538	MU65 0-50uA	16.95
Q10540	MU65 0-1mA	16.95
Q10550	MU65 0-100uA	16.95
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H10110 120x65x38mm	$ 2.95
H10112 120x65x38mm (Metal top)	$ 2.95

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2155 240V 6-15V 1A Cat M12155	$9.95	$8.95
2156 240V 6-15V 2A Cat M12156	$14.95	$13.95
2840 240V 9V CT Cat M12840	$5.95	$4.95
2851 240V 12-6V CT 150mA Cat M12851	$6.95	$5.50
2860 240V 15V CT 250mA Cat M12860	$5.95	$4.95
6672 240V 15-30V 1A tapped Cat M16672	$14.95	$13.95

IC SPECIALS!

8087 CHIPS!

8087-3 (4.77MHz) $269
8087-2 (8MHz) $385
8087-1 (10MHz) $585
80287-6 (6MHz) $475
80287-7 (8MHz) $679

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Speech synthesiser chip, needs programming to work.

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

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

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$27.00	$26.50	$26.00

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(WORLD MODEM CHIP)

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$19.95	$17.95

41256-15

1-9	10+	100+
$7.95	$6.95	$5.95

4164

1-9	10+	100+
$3.95	$2.95	$2.75

27128

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

27512

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

6116 LP-3

(150ns)

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

NE5534AN

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

6264

1-9	10+	100+
$7.95	$6.95	$6.50

2732

1-9	10+	100+
$8.95	$8.50	$7.95

CA3130E

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

INS8250

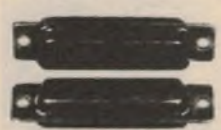
1-9	10+	100+
$29.95	$27.95	$26.95

ZN429

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

ADC0820

1-9	10+	100+
$24.95	$22.95	$20.95



DB25 CONNECTOR SPECIALS!

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

DB25 MALE (P10900)

1-9	10+	100+
$1.00	$0.90	$0.80

DB25 FEMALE (P10901)

1-9	10+	100+
$1.20	$1.00	$0.90

RITRON 19" RACK CASE

Tremendous Value! Dimensions 480(W) x 134(H) x 250(D)mm.

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SPECIAL, ONLY $42.95

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These superb rack mount cabinets will give your projects a real professional appearance! Just look at these features...

- All dimensions conform to the International Standard
- All aluminium construction
- Choice of black or natural finish
- Deluxe brush finish anodised front panel
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- Ventilated lid

A = Internal Height mm
B = Rear Width mm
C = Depth mm

A	B	C	Finish	Cat.No.	Price
38	430	254	Natural	H10401	$49.50
82	430	254	Natural	H10402	$59.50
126	430	254	Natural	H10403	$69.50
38	430	254	Black	H10411	$59.95
82	430	254	Black	H10412	$69.95
126	430	254	Black	H10413	$79.95

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Diecast boxes are excellent for RF shielding, and strength
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H11451	100 x 50 x 25mm	$ 5.95
H11452	110 x 60 x 30mm	$ 6.50
H11453	120 x 65 x 40mm	$ 6.95
H11461	120 x 94 x 53mm	$11.50
H11462	188 x 120 x 78mm	$13.50
H11464	188 x 188 x 64mm	$28.50

RELAYS

1-9	10+	100+
S.P.D.T. 3A connectors		S14060
$1.50	$1.30	$1.10
D.P.D.T. 3A connectors		S14061
$1.95	$1.75	$1.30
S.P.D.T. 12V Coil 10A 240V		S14114
$4.95	$3.95	$3.75

SPECTROL MULTIDIALS

MODEL 15-1-11

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

MODEL 16-1-11

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

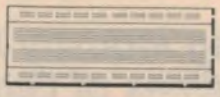
MODEL 21-1-11

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

CODE KEY PAD

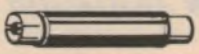
- Telephone type digital keypad.
- Four digit, changeable code
- Over 5000 possible combinations
- Power consumption: 5mA standby 50mA alarm
- Two sector LED and 1 arm LED.
- Wrong number lockout
- 12V DC operation
- Relay output
- Panic button
- Normally open tamper switch
- Dimensions: 145 x 100 x 37mm
- ACP3 compatible.

Cat. A13014 ..... R.R.P. $79.95
SPECIAL, ONLY $69.95



BREADBOARDS

Cat. No.	Description	Price
P11000	100 Holes	$ 2.75
P11005	640 Holes	$10.75
P11007	640+100 Holes	$14.95
P11009	640+200 Holes	$17.50
P11010	1280+100 Holes	$26.95
P11011	1280+300 Holes	$32.50
P11012	1280+400 Holes	$39.95
P11015	1920+500 Holes	$59.95
P11018	2560+700 Holes	$69.95



TV INTERFERENCE FILTER

Cuts CB/Ham signals interference.

Cat. L11048 $5.95

ELECTROLYTICS (PCB MOUNTING)

16 VOLT

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

25 VOLT

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

35 VOLT

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

50 VOLT

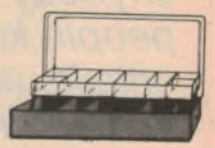
Cat.No.	Description	1-9	10+
R15404	0.47uF	$0.25	$0.22
R15414	1uF	$0.25	$0.22
R15424	2.2uF	$0.30	$0.25
R15434	3.3uF	$0.30	$0.25
R15444	4.7uF	$0.40	$0.35
R15464	10uF	$0.40	$0.35
R15484	22uF	$0.40	$0.35
R15514	33uF	$0.40	$0.35
R15524	47uF	$0.50	$0.45
R15534	100uF	$0.60	$0.55
R15544	220uF	$0.90	$0.80
R15564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

63 VOLT

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

CANNON TYPE CONNECTORS SPECIALS

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



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Features a clear plastic lid for easy identification of contents. Up to five, adjustable lower compartments, plus a self elevating upper tray for smaller items.
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Errors and omissions excepted

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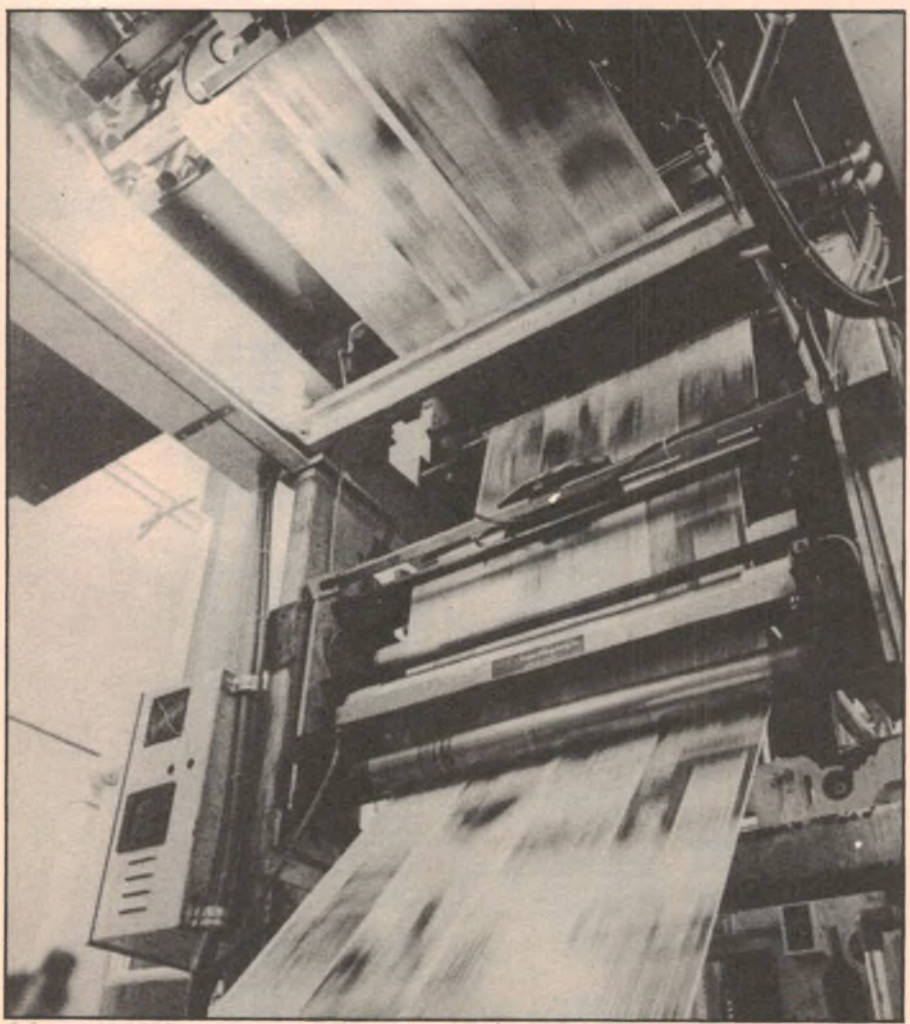
Electronics plays a major role in modern printing

The printing industry has come a long way since the times of Gutenberg and Caxton, anybody will readily agree. But how many people know what a modern printing plant entails, and to what extent electronics, in this as in so many other fields, has opened up entirely new horizons?

by PAUL GRAD



A large M-1000 press can deliver up to 44,000 complete products per hour.

Anybody who sees, for the first time, a modern large-scale printing operation will probably be impressed by the sight of an endless stream of newspapers or magazine sections being moved and stacked at a speed hard for the eye to follow, and by the large volume of material that accumulates at the end of the process.

He should be no less impressed by the quality of the printed material, the beauty, colour rendition and realism of many of the printed pictures.

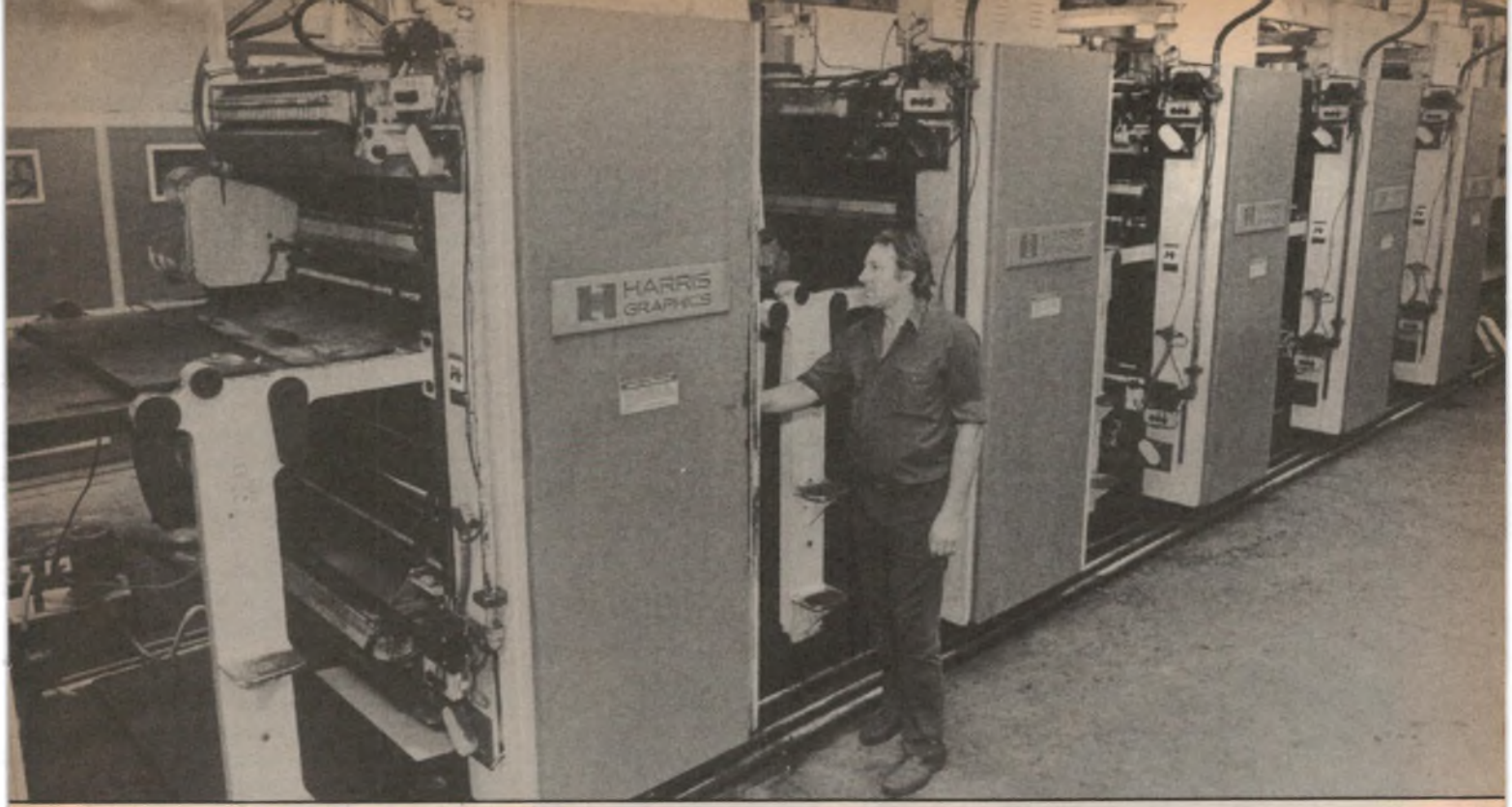
It becomes immediately apparent that precision and economical operation are essential here — and that's, of course, where automation and electronic measurement and control become specially significant.

The Hannanprint plant in Sydney's suburb of Alexandria, where *Electronics Australia* is printed, provides a good illustration of a modern printing operation and of the role of electronics in it.

The Alexandria plant is the largest printing installation in New South Wales and the second largest in Australia, with operating machinery owned jointly by Hannanprint and the Fairfax group. About 50 titles/month, mostly magazines and newspapers, are produced there, including all of the 20 or so magazines — *Electronics Australia* among them — published by the Federal Publishing Company.

The printing plant includes eight "heatset" web offset lithographic presses, where all the magazines are printed, and two "coldset" presses, used mostly for local newspapers made of somewhat lower-quality paper.

The heatset presses, all supplied by Harris Graphics of the US, run at a much higher speed and are of more modern design than the coldset presses. In heatset presses the print on the paper is heated in an oven where the print's water and ink solvents are evaporated, while in coldset presses the print is dried by absorption into the paper and by oxidation through exposure to the atmosphere.



Each of the large M-1000 presses at Hannanprint has eight printing units in series. Five of the units can be seen here. The paper web moves towards the background in this photo.

Two of the heatset presses are of the large M-1000 type and are run by a Texas Instruments PM550 controller. The other six work on a motor-driven potentiometer, with all functions of the press coming from a rotating cam which functions like a mechanical computer.

To appreciate the possible scope of electronic control in a large-scale printing plant such as the Hannanprint works it is necessary to have a general idea of the entire operation, from the delivery of the paper to packaging and despatch of the final product. Following the printing process as carried out in one of the two large M-1000 presses provides a good illustration of what's involved, since the M-1000 is one of the most sophisticated presses currently available.

At the Hannanprint works the paper is delivered to a storage room in large reels weighing about 850kg. From here the reels are picked up and transported by robots to one of the presses.

The large M-1000 presses have each a length of about 36m, a height of 5m and width of 4.5m. The paper is fed into a press from the reels via an infeed unit.

From the infeed unit the paper goes through a series of four printing units, one for each of the four colours — black, blue, red and yellow — which perform the actual printing.

The large M-1000 presses at the Hannanprint works actually consist of eight printing units in series, fed by paper from two reels. However, the paper web from each of the two reels goes through four of those units and passes either above or below the other four.

Each printing unit has two (upper and lower) plate cylinders and two (upper and lower) transfer or "blanket" cylinders. All cylinders are arranged vertically, allowing a simple horizontal paper conveyance system without idler rollers between printing units. The paper passes through the blanket cylinders.

From the printing units the paper goes through a hot-air oven or "dryer" to evaporate water and ink solvents. It is important to avoid applying excessive heat during the short time interval the paper takes to pass through the oven. Too much heat can cause the paper to become brittle, damage the ink film and affect the colour.

When the paper leaves the oven the print's water and solvents have been evaporated but the ink film on the paper is still semi-fluid. The remaining non-volatile ink vehicle resins are made to solidify in a system of chill rollers, to prevent smearing, setoff and marking during the folding and finishing operations.

Chill rollers also control the tension of the paper relative to the folder, in the next and final stage of the printing sequence.

Each of the two large M-1000s is driven by two main 150HP, variable-speed DC motors, which drive the press line shaft through V-belts. The line shaft consists of connecting driveshafts coupled to the driveshafts of each unit by flange couplings.

The drive motor speed is adjustable by means of a thyristor power control to up to 44,000 impressions per hour. Thus each of the large M-1000s can deliver up to 44,000 complete, folded products per hour, for each group of four printing units.

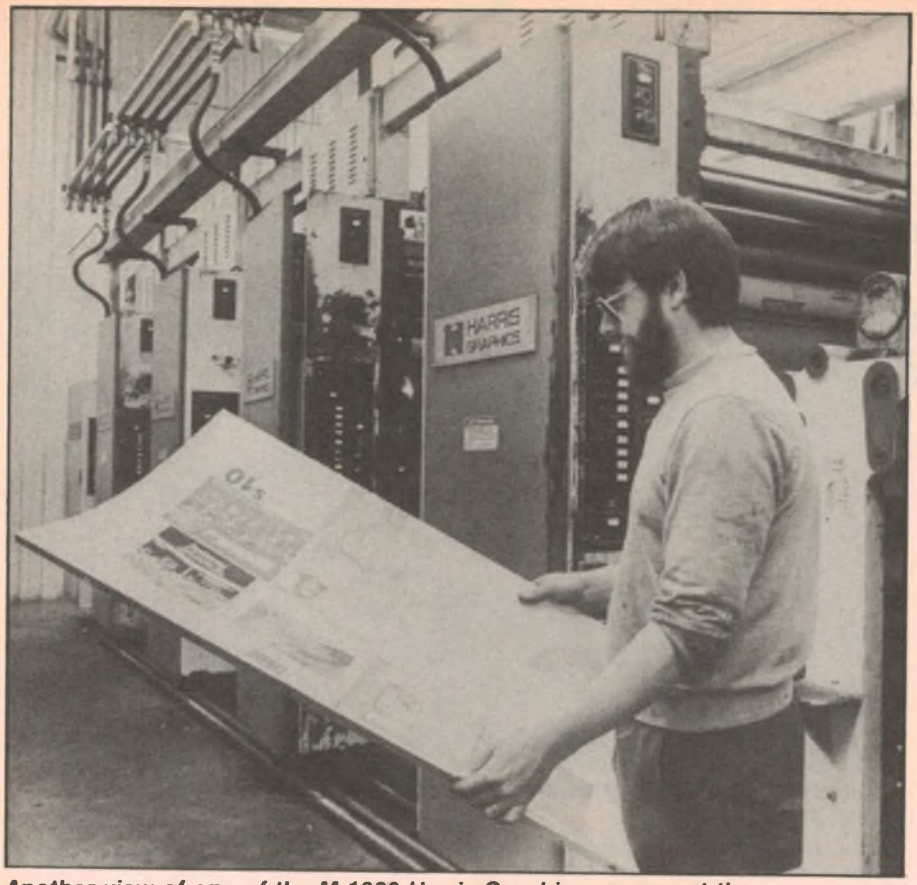
The press system can be stopped by air-applied brakes on the driveshaft between every other unit. Running at a typical 1000 RPM, the M-1000 press can be made to stop, in an emergency, in three or four revolutions, i.e. in five or six seconds.

The finishing end of the press delivers either finished products such as folded newspapers or brochures or folded sections of magazines or books. Robots are again employed to take those either to a wrapping area or, in the case of magazine or book sections, to a bindery area.

In the bindery areas the magazines and books are assembled, stacked and counted and in some cases labelled and addressed for direct mailing to individual subscribers.

As can be seen the printing process is extremely complex, involving a large number of operations which have to be well co-ordinated. They also require many checks and controls.

The quantities that have to be co-ordinated include the speed with which the paper moves through the press, the



Another view of one of the M-1000 Harris Graphics presses at the Hannanprint plant. The paper web comes from the infeed, in the background of the picture, from which it enters the series of printing units.

amount of ink and of water delivered for printing, and the temperature at the oven and at the chiller plant.

Electronic measurement and control systems are employed in several of those operations. Apart from the PM550 press controller and the system of robots used for transportation, there is an energy management sytem for the chiller plant and oven, a system of transducers and liquid crystal displays to measure and indicate the ink level in the ink tanks, a system of ultrasonic and capacitive sensors to control the filling of ink ducts from which ink is conveyed to the plate cylinders, a densi-control system to open or close the ink ducts delivering the ink from the ink tanks to the press, and laser counters to count the number of copies in the stackers.

Through various inputs received from an operator in a central control console or through signals received automatically from various sensors located throughout the press the PM550 controls the whole operation of the M-1000 presses' drive systems, including the motors' speed and acceleration, the movement of all rollers of the system supplying ink and water to the plate cylinders, the rotational speed of the chill rollers, and the oven and chiller temperatures. It can also make adjustments to the rotational speed and lateral positioning of the paper web passing through the press, to maintain accurate registration of the various colours.

The PM550 controller consists of a central control unit (CCU), input and output modules, operator interfaces and programming and troubleshooting tools.

The CCU is a programmable logic controller (PLC) and a programmable process controller (PPC) combined in one unit. The CCU contains two independent 16-bit microprocessors.

One of the microprocessors acts as the PLC or logic processor and executes the ladder logic, timers, counters, move, compare, integer add, and integer subtract decisions. The other is the executive controller, handling all the communications through the two RS-232C ports and the differential line; it also performs the loop processing and special functions as requested by the logic processor.

Apart from the main console area, there are several interfaces located throughout the plant, by which an operator can communicate with the PM550. The loop access module (LAM) is the operator interface for the analog portion of the process control system. The time/counter access model (TCAM) displays and permits adjusting the timer and counter functions programmed into the memory of the PM550. Both the LAM and the TCAM can be located remotely (up to about 300m) from the CCU. Up to eight LAMs and eight TCAMs can be intefaced with the CCU.

The VPU200 video programming unit is a programming and troubleshooting aid to the PM550. It is a self-contained, microprocessor-based, high-resolution video display unit featuring an integral keyboard and a disk drive. It can be used to draw ladder logic diagrams on its screen for evaluation prior to storing into the CCU memory.

Now let's take a closer look at some of the crucial stages and at some of the electronic controls of the printing operation.

The infeed unit automatically maintains a preset constant paper tension under all operating conditions. A floating "dancer" roller coupled to a strain gauge translates tension disturbances into speed control signals for a variable-speed-driven roller. This has the effect of braking the paper against the pull of the other parts of the press.

The lithograph printing plate which is the template from which all prints are taken is made of a special, light-sensitive material. The text and pictures to be printed are formed photographically on the lithograph in a process similar to that of a standard photographic print. The portions of the lithograph which have been exposed attract ink but repel water, whereas the opposite applies to its unexposed portions.

The plate cylinders take standard lithographic press plates, after bending on a plate bender. The print image, which is made of a mixture of water and ink, is transmitted from the plate cylinders to the blanket cylinders which in turn transmit the print to the paper. This happens through direct contact with a pneumatically-applied pressure.

If the print were transmitted directly from the plate cylinders to the paper the image quality would be inferior. The ink/water mixture is thinner and more evenly distributed in the blanket cylinders than in the plate cylinders. Each plate cylinder receives an ink/water mixture via two independent systems of rollers, one for water and one for ink.

A fountain roller picks up ink from an ink fountain. The ink is conveyed through a system of rollers to three final rubber-covered rollers in direct contact with the plate cylinder. The rotational

There is a central control console for each of the M-1000 presses.

speed of all these rollers and hence the rate at which they deliver the ink is directly coupled to the press' line shaft and is therefore under direct control of the PM550.

The water delivery system works similarly. A pan roller picks up water from a water pan. The water is then delivered to the plate cylinder via a system of water transfer rollers. Again, the rotational speed of the water rollers is directly coupled to the press' line shaft.

Control of the final product's quality is exercised at various stages. No information on the suitable water/ink mixture to be injected into the plate cylinders comes with the lithographic printing plate. However, the proofs from previous printing jobs provide important information on the desired mixture.

Additionally, an independent control called the Densicontrol can be exercised. This controls the quantity of ink delivered to the ink roller system, by means of opening or closing the ink duct connecting the ink tank to the ink duct roller. By adjusting ink keys (similar to butterfly screws) along the duct, the opening between the duct and the ink duct roller controls the amount of ink trasferred from the duct to the ink rollers and finally to the plate cylinder and to the paper.

The Densicontrol also controls the water pan roller, although there is also

Almost all of the press' functions can be controlled from the central console area.

a manual control for the pan roller in each printing unit.

The Densicontrol is also located in the central console area and, although independent of the main PM550 controller, is coupled to it.

It has its own 16K byte memory containing important information on the water/ink mixtures of previous jobs. The printers in the plant use that information, as well as the proofs of previous jobs, to perform the Densicontrol adjustments leading to the desired results for the current job. They also keep an eye on the quality of the printed material as it leaves the press to enter the stackers.

The Densicontrol includes an MM-8086/16 microprocessor from Micro Memory Inc of California. Its memory module contains its own address and data registers.

Following the Densicontrol adjustments, it is possible to ensure that there is a perfect match in the prints from the four printing units. This is done via the register production control, which permits adjusting the plate cylinders' lateral position and also permits retarding or advancing them.

Two AC motors for each plate cylinder, a lateral and a circumferential motor, do the trick. Although the motors run at constant speed they are made to run at short time intervals which are controlled either manually, from the central console area, or automatically via a signal sent to the PM550, by means of cross-field scanners located on both sides of each paper reel.

The scanners detect and match up the exact position of "register marks" printed on the paper from the plates in the plate cylinders.

Independent controls can be exercised on the lateral and circumferential motors, and these controls are also coupled to the PM550.

To prevent the paper from wandering across the blanket cylinders, two photoelectric scanners, one on each side of the paper, have their eyes concentrated on four little rectangular marks, one for each colour and hence for each printing unit, on the centre of the web. If the paper wanders off centre, a voltage signal is transmitted to the control system causing a tilt-box to move the paper back to alignment.

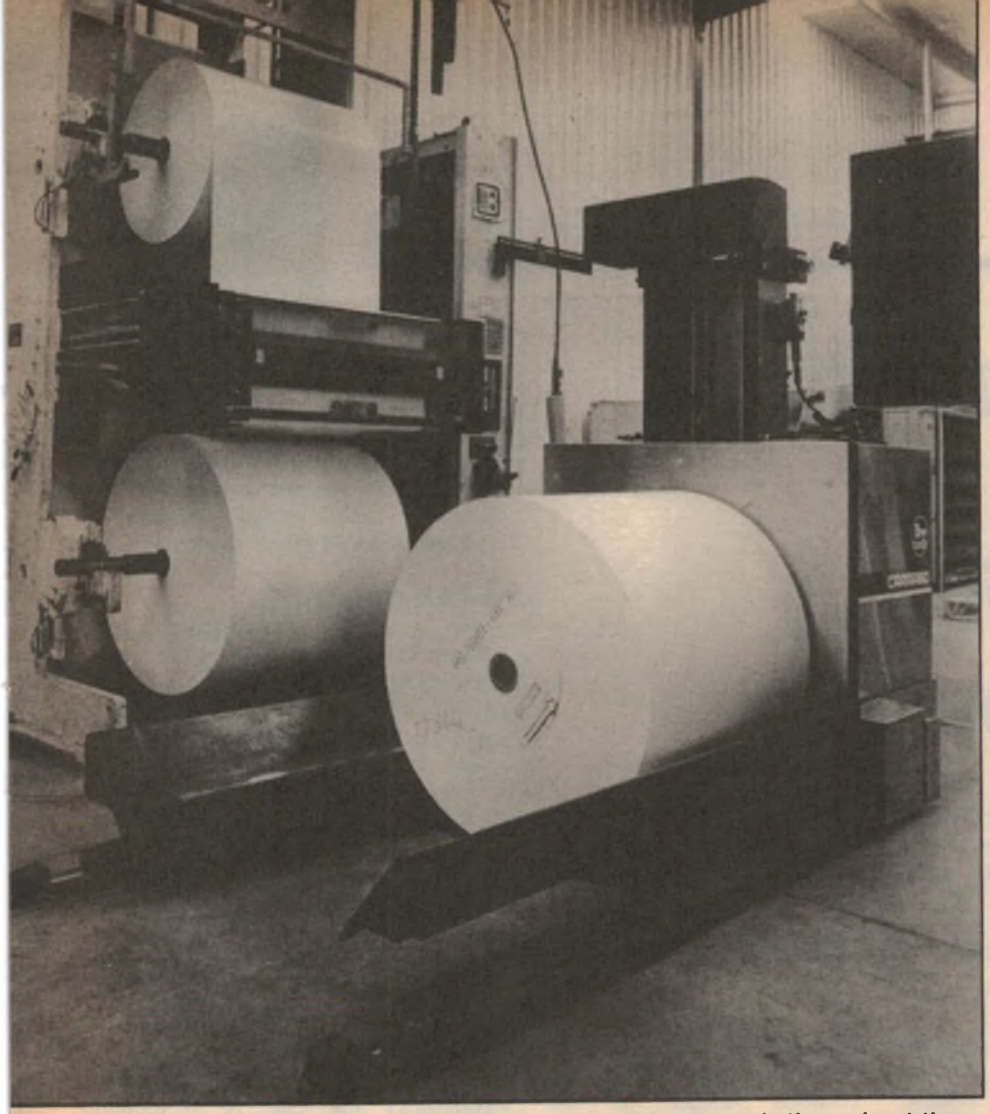
There are four such paper guides, two before the paper comes into the printing unit and two before it gets into the folder. There are two tilt-boxes for each paper web, one on the infeed and one before the folder.

A cut-off control (one for each paper web) causes the paper to be cut at the right place before it enters the folder. This is done through a small scanning head which tracks the dots printed on the paper. As it scans each dot, the head relays an impulse to the cut-off control.

The energy management system on the oven and on the chiller plant includes a thermocouple for air temperature control and an infrared gun to measure the temperature of the paper web, immediately after it passes through the oven. Both the thermocouple and the gun provide feedback to the set point entered at the PM550. Typical temperature values in the oven are 120°C for the paper and 200°C (depending on ink coverage and press speed) for the air.

The transportation robots, also called automated guided vehicles (AGVs), although not directly related to printing, constitute another interesting electronics application. Humming along at a walking speed of just under 4km/h, they are

The transportation robots, or automated guided vehicles, are among the most conspicuous electronic gadgets at the Hannanprint plant.



Automated guided vehicles are used to transport paper reels throughout the printing plant.

among the most conspicuous gadgets in the plant.

There are six of them at the Hannanprint plant, all supplied and installed by Sydney-based Sam Technology, the Australian representative of the Swedish manufacturer Tellus-Carrago.

Each of the robots is guided by an AC inductive loop system created by guidewires in tracks buried under the concrete floor. Each AGV has six antennas, with which it follows the magnetic field created by the guidewires.

Through coils the antennas sense the strength of the magnetic field. This is relayed to a Z-80 digital computer onboard the AGV, which directs the AGV to the middle of the guidewires, where the signals from the antenna coils are of the same strength.

Various guidewire frequencies are used (2725Hz, 3433Hz, 4600Hz, and 5200Hz). Each AGV can be programmed to follow a certain guidewire with a certain frequency. Thus one can have several guidewires running in the same track, and followed by several AGVs. One can then separate the tracks to lead the AGVs along different paths.

There are two robot systems at the Hannanprint plant, a paper handling system and a finished product system. There are two stationary Falcon digital computers in the plant, one for each system, which act as traffic controllers for the robots.

Several sets of instructions are entered into the AGV Z-80 computers, in the form of cal-tables. About 50 such tables are used for the paper handling system and about 150 tables for the finished product system.

Workers push buttons to call an AGV to a pick up point. The stationary computers tell the AGV which table to select; the AGV's internal computer then takes over and follows the table's instructions.

To help guide the AGVs through the plant there are optical communication points throughout the installation. Whenever an AGV passes such a point it communicates with the stationary control computer which registers the AGV's location.

The AGV's guidance system also includes sensors on the ground. If, for instance, a paper reel or an AGV is on the spot on top of the sensor, another AGV is prevented from coming to the same place. The order for the AGV to come is registered and accepted by the stationary computer, but is communicated to the AGV only when the spot is free.

With all these systems a speed and accuracy of operation can be attained which are hardly possible without them, and significant savings can be gained in manpower and materials.

Printing, like many other businesses, has become highly competitive. Profit margins have been reduced and it has become essential to minimise costs. Since printing has traditionally been a labour-intensive industry, automation and electronic control have become critical. Regarding the cost of materials, it is most important to use paper economically in a printing plant, although economical use of other materials such as ink can also be important.

All the gadgetry described has, of course, been installed after careful planning and it is now quite clear that without it the plant's productivity, together with the quality of the final product, would not be achievable.

The future trend in the printing industry is in the direction of greater automation and even more electronics.

It is a fair prediction that ultimately the current printing system with a mixture of ink and water will be completely superseded by laser printing. Future systems will employ optical character recognition. A master template will be scanned by an optical scanner and the information thus obtained will be digitised. The digitised data will then be used to run a laser printer which will "burn" the text and pictures on to the paper web with a "toner" in a process similar to that employed by modern copiers such as the Xerox machines. The colours on the master template will be modelled directly by a computer which will also accurately supply the information needed for printing.

The whole process will be entirely automatic. It will be possible for a single operator at a computer workstation to perform all necessary steps from the preparation of the master template to the delivery of the final printed product.

But that's still a little way off!

FORUM

Conducted by Neville Williams

What's currently current, and does it actually flow?

With so much discussion in the community about the three Rs — 'readin, 'ritin and 'rithmetic — it may be an appropriate time to let A.C. of Lillian Rock, NSW, have his say. As a teacher himself, he feels that it is about time that the electrical/electronic fraternity sorted out their own terms and expressions.

His letter opens with a bouquet of sorts for this journal, but it turns out to be a rather left-handed complement in respect to our ability to explain clearly ideas which he considers to be, themselves, rather suspect. The letter begins as follows:

I have just seen EA's "Basic Electronics", and I must congratulate the authors on an excellent job in putting over fundamental concepts in a way that the beginning student can grasp. Experienced people tend to forget how difficult concepts can be but, as a teacher, I have been helped a lot by the students to appreciate their position.

My immediate reaction to the above is to recall just how far back that "Basic Electronics" material really dates. It started out as a private, spare-time venture to write a basic textbook, which would hopefully explain the fundamentals of hobby-level electronics, in the clearest possible way. As I remember, this was just before I joined the magazine in late 1941.

I ran out of spare time, however, and the material was ultimately re-arranged and run in "Radio & Hobbies" as a series of self-contained, contributed articles. They proved popular and were subsequently expanded and up-dated in collaboration with Jim Rowe and Phil Watson, and re-run as the "Basic Radio Course" between August '63 and November '65.

As such, they became recommended reading for radio clubs and tuitional groups throughout Australia and were duly re-issued in 1966 as the Basic Radio Course handbook. Further editions followed but, while the fundamental concepts remained valid, their application in practical equipment became dated, to the point where a complete re-write would have been necessary. We never found the time to tackle it, however, and the book was allowed to slip gracefully "out of print".

That A.C. should still be commending the text in 1987 is a compliment indeed but, as I said, he goes on from there:

I would like to discuss some terms which I feel make the understanding of electrical concepts more difficult. Tradition has left us with these terms and perhaps we accept them with less questioning than we should.

Firstly, there is the old A.C. and D.C. problem, where we find ourselves expressing things which literally mean "alternating current current", &c. We could easily use A.C., A.V., D.C. and D.V. without the current and voltage words at all. However, we are so conservative in these areas that it would be difficult for such beautiful simplicity to catch on.

A standard style

By way of general comment, we have always sought, in planning the magazine, to standardise on practices which will hopefully make it easier to produce, easier to read and easier to comprehend.

- In abbreviations, we use capitals in preference to lower case because we consider them to be visually more recognisable. Therefore DC rather than dc, AC rather than ac, etc.
- We minimise the use of full points in abbreviations, in line with current newspaper composing style: DC rather than D.C., AGC rather than A.G.C., and so on.
- We tend to follow current technical terminology for ease of recognition while, at the same time, avoiding or pointing out awkward or dated practices.

Consistent with the above, I share A.C.'s dislike for the expressions "AC current" and "DC current" and normally seek to avoid them. I find "AC voltage" and "DC voltage" less awkward, however, in that they avoid direct repetition and can be excused as referring to the voltage resultant of an alternating or direct current. Spelt out, "alternating voltage" flows naturally but "direct voltage" doesn't, if only because the word "direct" can have other connotations.

At this point in time, I would hesitate to use the suggested abbreviations "A.V." and "D.V.", if only because one would have to append an explanatory footnote in the text.

However, if correspondent A.C. (his initials are a confusing coincidence) should decide to go it alone in pioneering their use, I would commend to him the idea of dropping the full points, or at least being consistent in his own text. Abbreviations without full points are easier to type, save space, are visually

tidier and easier to recognise.

His letter continues:

Then we come to the "current flow" thing. Charge flows, but current does not. Experienced people may say "we know what we mean" but we are not helping the student to understand by talking about "the flow of a flow of electrons".

In "Basic Electronics", in the phrase "as a measure of current flow" — I could quote many other examples — the word "flow" can simply (and correctly) be omitted. In cases like "When a current of one amp . . . is flowing in a circuit" we can say "when there is a current of one amp in a circuit". Overall, we stand to save on typing, ink, trees, as well as being conceptually more sound.

He's right — or is he?

Touche, A.C., although some may argue that he's being unduly pedantic. In talking about the direction of lines of force in a magnetic field, even that one-time technical "bible", the "Admiralty Handbook of Wireless Telegraphy" refers quite routinely to electric current flowing towards the reader" — probably because the basic idiom is so widely used.

Standing on the bank of an estuary, any one of us might casually inquire whether the tide or the current — both words implying water in motion — is ebbing or flowing or running this way or that!

Admittedly, just about any text to which one may refer, agrees that electric charges consist basically of a surplus or a deficiency of electrons and that "a flow or drift of electrons along a definite path is called a current of electricity".

But the notion of "current flow" is rooted in history, as I pointed out in an article entitled "Current — which way does it flow" (Dec '79) and "Forum" (March '80). Benjamin Franklin is said to have likened electricity to "some kind of intangible fluid", with electricity in motion being thought of as a "current".

Galvani, Volta, Oerstedt, Fleming and others accepted and formalised the concept, basing their further findings on a quite arbitrary assumption that electric current flowed from positive to negative.

Then, around 1900, Rutherford, Bohr and Thompson were able to show that "electric current" had nothing to do with fluids, being really a flow or drift of electrons from negative to positive — a contradiction that has had to be explained to students ever since.

But ingrained habits die hard; we know about electrons, these days, but we still have that flawed "intangible fluid" word "current" stuck in our electrical vocabulary. If we really want to set the record straight, we might be better advised to scrap it and replace it with "electron" (flow).

That really defies imagination!

In the meantime, when next I/we notice the disc on my/our electricity meter whizzing around madly, I/we must remember not to speculate as to how much current is flowing — or how much more expensive will be the electricity bill. Electricity (like most other commodities) is expensive; bills simply get bigger!

But there's more to come.

A hoary one (for me) is that wretched thing called E.M.F. Despite much research, I have never been able to justify it. For a start, we are not talking about force at all; its unit is work per unit charge, not force. Again, I am sure that E.M.F. is just a tradition and an unfortunate one at that. Why not P.D.? A P.D. adequately describes it — a difference in potential — and helps to indicate that it exists between two points.

But how can we manage without the term E.M.F. as applied to the open circuit volts across a battery? Simple — call it O.C.V. And what is so special about O.C.V. anyhow? We don't seem to need a similar term for the short-circuit current of a current source, which is entirely analogous.

A useful term or not?

I looked up the term in the Macquarie dictionary and, while it appears as emf, alternative abbreviations were shown as e.m.f., EMF and E.M.F. Having just retyped the paragraph above I'm quite happy to retain the format referred to earlier for the remainder of this discussion: EMF.

For my part, I've never had a lot of use or affection for the term. On reading the above quote, I was reminded of "wattle" day. I learned about it in my country primary school and, every August, we would turn up with sprigs of wattle. It was the thing to do at the time. But, since then, I've never encountered anyone to whom it means any more than a vague, nostalgic memory.

Whether EMF can be discarded quite as lightly as A.C. suggests, is something else. A 1931 edition of the "Admirality Handbook" makes a clear distinction between EMF and PD. I quote:

Wherever there is introduced in any part of an electrical circuit another form of energy capable of being converted into electrical energy, we say that an electromotive force (E.M.F.) is acting in the circuit.

If between any two points in a circuit electrical energy may be converted into another form of energy, we say that a potential difference (P.D.) is established between the two points.

On this basis, the two terms are complementary, not synonymous. The voltage across the terminals of a battery (chemical/electrical energy) is EMF.

Too soft on a correspondent!

Dear Mr Williams,

Re the June 1987 "Forum":

I agree with your response to D.S., who was concerned with the pace of technological change, but I feel that you did not go far enough in your reply.

D.S. evidently feels that there is a need out there — a market, if you like — for large remote controllers with a few large buttons. Since such devices are no longer being manufactured, he should wake up to the fact that he has identified a unique business opportunity.

Determining the remote control codes for a range of popular consumer products will be time consuming but otherwise straightforward. Various circuit ideas have been published in EA, but he may prefer to develop his own. Either way, he might be surprised at the number of state-of-the-art components he would select to lower his parts count, power consumption, &c. He would certainly discover that there is a great deal more to electronics than knowing how to handle a soldering iron — like economics.

May I also add a comment on his observations about stereo TV sound: at least he has that option. Those of us in country areas, not served by ABC FM, must watch what we have renamed the "Sunday Mono Special.

W.H., Woomera SA

FORUM

That between any two points in a dissipative load across the battery (electrical/heat energy) is PD.

The Macquarie dictionary offers without comment the definition "electromotive force".

ITT's impressive "Reference Data for Radio Engineers", in a chapter on Maxwell's Equations, defines it thus: "By electromotive force is meant the work required to carry a unit positive charge around the loop".

A.C. takes up the theme in a manner suggesting that it's really what he's most concerned about. Perhaps the appropriate thing is to let him have his say, abbreviations and all, without further interruption:

The case against EMF

I think EMF is really tied up with a difficult concept — inductance — although it may be so because of our terminology. We seem desperately to need "back emf" in the context of inductance and here, I feel, the term creates problems.

If we look at the basic circuit elements, R, L & C, their response to electrical stimuli can be expressed succinctly as:

$$V = Ri$$

$$V = L\frac{di}{dt}$$

$$i = C\frac{dv}{dt}$$

All three equations apply to a convention where the current enters the positive terminal of the element. They show us that resistance responds to the magnitude of the stimulus but that L and C respond to their rates of change. Very consistent, very symmetrical.

So why do we need "back emf"? Surely it is just an emf or, better still, a pd. After all, the characteristic which so distinguished L from R is not that it sometimes produces a back pd but sometimes a forward pd, i.e. in the opposite direction that one expects with a resistance. The analogy with C is that sometimes current leaves its positive terminal, but we have never needed a term "back amps".

When describing what happens when we try to increase the current through an inductor, we typically use the term "back emf". Why don't we need the term for a resistor? After all, the direction of the pd in each case is identical.

Perhaps this strange terminology arose at a time when the current/voltage relationships for R, L and C were not clearly understood. The absurdity reached its peak when there was a minus sign (V = –L. di/dt) but hopefully that practice is dead.

Another source of "back emf" is the D.C. motor. The D.C. armature has many interesting concepts (like increasing speed by weakening the field) which are difficult enough, without giving the impression that it plays fast and loose with voltage directions. For the direction of its pd is entirely consistent with what one expects from a resistor.

So what can we do, if we have the will? Simply give up emf and use pd, without "forward" or "back". We can use OCV for open-circuit pd's or sources (recognising that we freely mix units and quantities). We will improve understanding and save typing.

Who does it concern?

While A.C.'s letter may have been prompted by his reading of the "Basic Radio Course", the above discourse on EMF has more to do with formal electrical courses and textbooks, such as those with which he is probably involved.

In practice, electronics hobbyists, enthusiasts, technicians and servicemen need little more than to recognise the term, should they meet it, as being broadly synonymous with "voltage". The concept of "back EMF" provides essential — if superficial — insight into transformer action and a reason why motors overheat if they are overloaded.

It is highly debateable whether anyone seeking knowledge at the "Basic Radio Course" level needs detailed clarification, and even more debatable whether they would be helped by a "mathematical" approach relying on "di/dt". A whole lot more 'rithmetic would need to be absorbed before that stage of comprehension is reached!

Curiously, A.C. makes only oblique reference to the direction of current (flow) — which as I've already indicated, is often a source of considerable confusion for newcomers to electronics, particularly in the context of electron flow through valves and solid state devices.

How A.C.'s approach would work out as the basis for totally new-look reference material for students doing formal courses I'm not so sure, but quite a few of A.C.'s peers should get to read his submission, and may care to offer their twenty-cent's worth.

And that would seem to be what the correspondent has in mind at the end of his letter:

If discussion is needed, I can think of no better place than "Forum".

A.C. (Lillian Rock, NSW).

Remote control devices

W.H., whose letter appears in the accompanying panel, gives no clue as to his own technical background, but he was obviously not very impressed by D.S.'s idea that gee-whiz technology is being exploited ahead of actual consumer needs (June '87, p.38). He cites, as examples, remote controllers that are over-miniaturised and the provision of TV stereo sound with a picture that is currently too small to justify it.

It's surprising that W.H. didn't take a tougher line with us, because we tended to agree that, particularly for older people some present-day controllers could be difficult to use in the subdued light of a TV viewing room, as compared with that in a lab or showroom situation.

In effect, W.H. is justifying not only the use of high-tech components but the basic credo of marketing: you produce what you think you can sell to best advantage. In this present context, it adds up to controllers that are hopefully even smaller, cuter and more clever than those offered by your competitors. If they attract more customers than you lose, you're ahead!

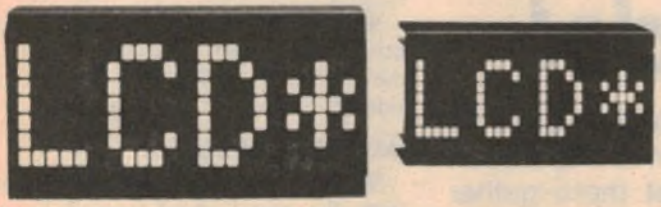
Whether or not you agree with this, W.H. has a point in regard to stereo TV sound: D.S. at least has the option of not using the facility, which is more than that open to many country viewers.

A few weeks ago, I spent a fortnight holidaying in a country town and while, during the cold, dark winter evenings, I was grateful for the colour TV receiver in the corner, I was also very conscious that there were effectively only two programs from which to choose, as compared to five in Sydney. Fortunately, the holiday period coincided with the ABC's new program schedules, but I can well understand country viewers' plea for a wider choice.

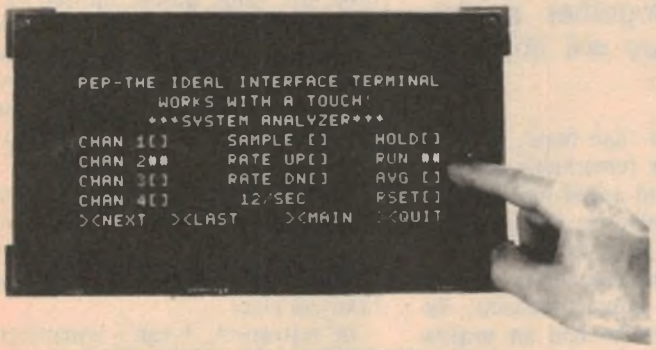
I would also add a commendation for the ABC's FM-stereo radio service. A number of AM stations were to be heard, but the FM signal was unmistakeable — clean and noise-free, and an obvious boon for those who enjoy the classically orientated programming. Even if your tastes in that line are limited, it's good to have the option of listening when the mood fits.

ALPHANUMERIC DISPLAYS

NOT ONLY . . . . . LARGE CHARACTER L.C.D's



- 65mm AND 100mm CHARACTER SIZE
- 4 MODULE CONFIGURATION WHICH IS X-STACKABLE
- WIDE OPERATING TEMPERATURE RANGE -30 °C TO +85 °C
- REFLECTIVE, TRANSMISSIVE OR TRANSFLECTIVE VERSIONS AVAILABLE

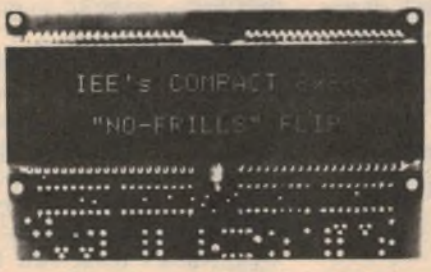


INTERACTIVE DISPLAY

- DC PLASMA UNIT IN EITHER 12 ROWS × 40 CHARACTER OR 8 ROWS × 32 CHARACTER VERSIONS
- VACUUM FLUORESCENT UNIT IN 6 ROWS × 40 CHARACTER VERSION WITH CANNED MESSAGES FACILITY

ALPHANUMERIC L.C.D's

- SINGLE 5VDC POWER SUPPLY
- PARALLEL ASCII INPUT
- FORMATS INCLUDE 1×8, 1×16, 2×16, 4×16, 1×20, 2×20, 1×24, 1×32, 1×40, 2×40, 4×40, 1×80, AND FULL GRAPHICS



"NO FRILLS" VACUUM FLUORESCENT

- 1×20, 2×20, 1×32, 1×40 VERSIONS
- SINGLE 5VDC SUPPLY
- SIMPLE PARALLEL ASCII INTERFACE

BUT ALSO . . . . . .

ELECTROMAGNETIC ALPHANUMERIC AND NUMERIC DISPLAYS, KEYPADS, L.E.D.'s, L.C.D's BEZELS, RESOLVERS, TRANSDUCERS AND MORE.

Small jobs can win you friends!

Thumbing back through my notebook, I found quite a collection of small stories which somehow seem to have been passed over for longer items. Rather than let them gather more dust, I've strung several of them together as my contribution for the month. Who knows? They will hopefully contain hints which some may find useful.

Take the first story, for example, which concerns a local schoolteacher who called into the shop with a rather wry look on her face and a large Toshiba "Bombeat" mains/battery cassette radio in her hand.

She normally used it at home but had taken it to school on occasions to play odd tapes to a class. This day, she had loaned it to another teacher who returned it an hour later, with a very red face and the cassette compartment door in a large envelope, together with a small spiral spring and a tiny dark plastic spigot about 4mm across. He wasn't aware of having done the wrong thing but the door mechanism had fallen apart in his hand!

She wondered whether I could possibly fix it — because, without the door, there was nothing to hold the cassette in place . . .

I agreed to have a look at the problem — but without much enthusiasm. The tiny plastic spigot had obviously broken away from the inner surface of the main panel but, from what I could see from the front, there was little chance of effecting a mechanical repair with any kind of pin, screw or bracket. Nor was I very optimistic about being able to glue it back in position.

A phone call to Toshiba in Sydney was anything but reassuring. No, they knew of no way of effecting a reliable repair, their only option in the past having been to replace the entire front section of the moulded cabinet. Unfortunately, replacement panels were now no longer available from Japan or anywhere else.

More in despair than hope, I rang a friend who has a remarkable memory for such things and asked him whether he knew of any adhesive that might do the job. His first reaction was to eliminate the ones that wouldn't, such as "Tarzan's Grip", contact cement, Superglue, &c. Then he had an inspiration:

"You know, a lot of those cabinets are moulded from polystyrene, with a filler added to produce a metallic look. Why not try a polystyrene cement? Hang on just a minute . . . " He returned to the phone a few moments later with the news that he had a small tube of it on his shelf, which I could borrow if I liked to "pop across". It was called "Britfix", he said, and was one of a group of similar products — "Faller Expert", "Testor", etc — normally stocked by hobby shops for model work.

Next morning, I pushed the spigot gingerly and it didn't fall off!

Later, with the adhesive on hand, I removed the front of the cabinet and propped it up in such a way that gravity would help hold the spigot in place. With a smear of adhesive on both surfaces, I manoeuvred the broken spigot into position and left it to cure overnight.

Next morning, I pushed the spigot gingerly and it didn't fall off! So I worked out how the spring fitted, clicked the door back in position and re-fitted the front of the cabinet, ready for one very relieved teacher. I warned her to treat the cassette door gently, but as far as I know, it's still "hanging in there"!

Since then I've used Britfix to repair other cracks and oddments which, in the normal way, would have been considered "ungluable". Handy stuff!

Jammed cassette

Speaking of teachers, another lady from the same school hurried in one morning and sought my urgent assistance. A departmental blank cassette had jammed in her portable tape recorder and, short of resorting to violent measures, she hadn't been able to free it.

It was jammed, all right, with multiple layers of tape wound tightly around the capstan drive spindle and with the mechanism still holding the cassette firmly in place.

In retrospect, I can't remember exactly how I freed it, other than by fiddling the controls and nudging the capstan system backwards with the aid of tweezers and a dentist's probe — a tool which more than earns its keep around my workshop.

Sufficient to say that I managed to free the cassette, without any great trauma and suffering no more damage than half a metre or so of slightly wrinkled leader tape.

It was only when I went to wind the tape back into the cassette, with the aid of a pencil, that I noticed a curious thing: the takeup hub appeared not to have any teeth to engage the take-up spindle. No wonder the tape had wound itself around the capstan! Not surprisingly, when I handed the faulty cassette back to the teacher, she told me to: "shot it in the bin; it's already cost me more than it's worth!"

In fact, I put it up on a shelf as a curiosity — and promptly forgot about it. That is, until some weeks later when a member of the family sought my help with a cassette "that won't play". That was hardly surprising, because the tape had obviously broken and been wound back into the cassette.

When I took it apart, I found that the tape and trailer had parted company, calling for a spot of judicious repair

work with a razor blade and splicing tape. Then followed the usual fumbling when I tried to reassemble everything. The first time around, the take-up hub slid out of position and ended up, out of sight, in one corner of the case.

At that point I did a double-take. The effect from outside was just as if the take-up hub had no teeth! I reached up for the other cassette, took the top off and there it was: a perfectly normal take-up hub, tucked away out of sight in one corner of the case. I'd been fooled!

Presumably, it had come off the production line in that condition but I didn't know which manufacturer to blame: it was branded only "NSW Government Stores Dept, Made in Hong Kong."

"Bird" recorder

"This recorder thinks it's a bird": said a client as he put a neat but somewhat elderly Tandy portable cassette recorder on the counter.

"How do you mean?"

"It chirps! Listen."

He pressed the Play tab and I was greeted with the sound of someone making a speech — punctuated by the so-called "chirps". To my ears, they could better be described as squeaks.

Turning the volume right off, I listened closely to the tape mechanism and there was no mistaking where the squeaks were coming from.

"But they're a lot louder than that on some tapes", the owner protested, "even louder than the one you just heard".

I explained to him that his recorder used a built-in microphone and that noise from the tape mechanism, only centimetres from it, could easily intrude on a voice from a metre or more away. It would be especially the case if the voice was more distant or weaker, such that the automatic gain circuitry in the recorder had to advance the gain in an effort to compensate.

"Well", he said, "treat it as a spare time job and fix it if you can do so easily. But, if it looks like running into real time and money, forget it. I'll put the money towards a new one!"

When I got around to looking at it a little later, I checked the recorder first with a couple of other cassettes but the noise persisted. So I removed the back for a closer look.

It didn't take long to work out that the squeak had to do with the friction clutch mechanism driving the take-up spindle. It involved two concentric shafts, the outer one driven by the main belt, transferring drive to the inner one by means of a felt pad. This, in turn, drove the take-up spindle.

Watching it carefully in operation, it was apparent that the inner shaft was rotating erratically and almost certainly producing the squeaks. But, having in mind the owner's request about not spending too much time or money on the job, I held back from the next obvious step of dismantling the whole mechanism.

But, at the same time, I was not about to plaster it with oil and risk clogging everything up.

Instead — hoping for the best — I directed a short burst of WD-40 at the felt pad, reasoning that it would probably find its way down between the concentric shafts. It did and the mechanism began immediately to operate more smoothly.

Assured that I was on the right track, I put a single drop of machine oil near the pad and, as it dissolved into the WD-40, I gave it another short burst to flush it down between the shafts. I let the mechanism run for a couple of minutes and repeated the dose but, by that time, it was operating as smoothly and as quietly as it had ever done. As far as I know it still is!

WD-40 is a very useful product to have on the service bench, one vital role being its ability to carry a film of lubricant into otherwise inaccessable places.

. . . servicemen often have to do the occasional good deed . . .

Changing the subject from cassette recorders, my next small item concerns a largely "goodwill" job that backfired.

In an established business, servicemen often have to do the occasional good deed, sometimes for a local charity, at other times for those who cannot afford the cost of a full scale service job.

I had a phone call recently from a pensioner couple who have relied upon me for years to keep their TV sets in operation. They still rely on me, even though they now live somewhat outside the area that I serve.

The latest call concerned a breakdown in the couple's hifi system, more particularly in the radio tuner. Over the phone, I was reminded that it was an ageing Heathkit AM/FM-stereo tuner which they had bought years ago from the constructor. It had suddenly gone completely dead. Could I have a look at it for them?

I didn't relish or rush the job and explained to the owner that having it fixed in the usual way might cost more than the age of the tuner warranted. Unless it proved to be something very simple, it might mean a trip out to look at it, time back at the workshop working out a totally unfamiliar circuit, fixing it and delivering it back again.

The best I could suggest was that, if he brought it to the shop, I would treat it as a spare time job and let him know

. . . there on my oddment shelf was a transformer marked 15-0-15 volts

if and when it was fixed. That would at least save the time and the cost of a double house call.

He turned up with the tuner next morning, complete with manual and, as circumstances worked out, I had a few minutes that evening to have a quick look. It didn't take long to establish that the power transformer had an open-circuit primary winding, and would have to be replaced.

And that's where luck was on my side — or so I thought. The manual showed a power transformer with a 16-0-16 volt secondary, and there on my oddment shelf was a locally produced oddment transformer marked 15-0-15 volts. It was meant for PCB mounting, but a check with a rule indicated that I should be able to slip it into the assembly bracket belonging to the original American transformer.

That way, I wouldn't even need to drill new mounting holes. I didn't proceed any further at that point but when the owner rang next morning to see whether I had found out what was wrong, I was able to pass on the good news. The power transformer had burned out, but I happened to have an inexpensive replacement on hand and should be able to substitute it without too much hassle or too much expense.

His sigh of relief was plainly audible over the phone!

Later in the day, I removed the original transformer, slipped off its clamp and crimped this over the core of the replacement unit, with the aid of my bench vice. A couple of bolts, five new leads and the job was done.

Unfortunately, when I switched it on, the tuner remained stubbornly silent — which was not to be wondered at when the HT supply was measured at about 6 volts. How come?

It was then I discovered the embarrassing truth: the oddment transformer marked 15-0-15 volts was actually 5-0-5

Serviceman

volts! So here I was with the original faulty transformer dismembered and a contrived replacement of no use!

There was nothing for it but to confess my discomforture and the inevitable delay to the owner, and take the first opportunity of buying a new transformer with the appropriate secondary voltage. But, of course, it cost real money and fitting it entailed a good deal of extra work.

The trouble was that, having completed the job, I didn't have the heart to go back on my earlier assurance that: "it shouldn't cost too much!"

Ah well: you win some; you lose some!

Within days of the foregoing situation, I had a call from another pensioner couple who wanted me to have a look at their bedside clock radio — "one of those digital flip-over types", they explained. "The radio still plays, but the clock part seems to have stuck!"

Once again, I encouraged the couple to bring it in to my shop because, as I explained, digital clock radios are now so cheap, that repair work is often not worthwhile.

When they did bring the clock in a few days later, they had decided that they wanted it fixed if at all possible. It was an early Sony model, but it had been given to them as a present and had a strong sentimental value.

I had never had occasion to get inside the particular model before probably because people replace them when they fail, rather than try to have them repaired.

It was like trying to clean a chook while still keeping the entrails in one piece!

To get this one to bits, I had to try cautiously various external screws to establish which ones held the parts together and which ones anchored the "works" inside the case.

Having established what was what, I then had to tease the works out — removing the knobs from the shafts and the push buttons from the various rods until it started to come. The clock mechanism stayed behind and, as I pulled at the radio, various still-attached wires became taught and tangled around bits of the metalwork.

It was rather like trying to clean a chook while still keeping the entrails in one piece!

Still bolted inside the cabinet, I could now see the clock motor. It wasn't jammed and the obvious inference was that the winding was open-circuited. That would have been it! I didn't fancy the job of chasing a replacement motor for an early model clock radio, and then installing it in that confined space.

To check on it, however, I tugged speculatively at the plastic cap which had been crimped over one junction of the 240V mains leads, running from the power cable to radio, clock and, presumably to a neon type internal light.

As it happened, the lead came away in my fingers and a quick check with the multimeter established that the open-circuit was indeed in the mains lead to the motor, not in the motor itself. Whew!

Since I couldn't easily get into the crimped plastic cap, I spliced the clock lead into the corresponding radio lead, bound the junction securely and prepared to get the entrails back into the chook!

All I can say is that the factory workers who must have assembled those clock radios in years gone by, had skills which were not possessed by your fumble-fingered Australian serviceman.

By the time I got it all back together, I was quite startled when it worked!

I had also taken a silent vow: never ever to open up that particular receiver again!

Finally this month, a little item which is not a servicing story in the normal sense of the term, but I couldn't help thinking that it was an interlude which could have about it the "shades of things to come".

It happened when Mrs Serviceman and I were invited to a relative's place for a Saturday evening meal and a long overdue "chinwag".

Electronics could not have been further from my mind but, when I sat down in the lounge room, I became aware of a brand new video cassette recorder set up on a table near the family TV set.

It transpired that the daughter of the house, another teacher in a private school, had brought it home with the idea of taping something for use in class during the following week.

It also transpired that she wanted me

I doubt that I've ever seen a poorer picture!

to check over the various connections to make sure that she got a good recording. So much for my escape from electronics!

Worse still, when she attempted to replay a tape that someone had made at the school the previous day, I doubt that I've ever seen a poorer picture. It was smeared and crawling with "noise".

When I walked over and switched the recorder to receive off-air pictures, the result was not much better. I checked the switches, the incoming antenna to the recorder and the cable to the receiver antenna circuit. Everything seemed to be in place.

In the process, I spotted an RF gain booster switch on the back of the recorder — but "on" or "off" didn't seem to make all that much difference.

Almost automatically, I think, I picked up the trailing cable link between recorder and receiver and wiggled a couple of the connections. And with what a result: the picture did all sorts of strange things, but there were momentary flashes when it seemed to come good. It looked very much like a cable fault.

Fortunately, my relative is something

of a handyman, with a workbench, an overhead light, tools and even a rather venerable soldering iron. And there I headed, cable in hand.

Or I should say: cables. For the connecting cable turned out to comprise two: one that had obviously come with the video recorder, plus a 25cm extension of quite different cable, with a male "Belling Lee" type plug on each end. As I looked down at the centre pins, I realised immediately that the centre conductor from the cable was just sitting in the hole, with no sign of solder or crimping to establish a reliable joint.

But, when I took the connectors apart, it was to find an even worse situation. The coaxial cable which had been used had no substantial braiding at all — just a wrap of foil. The connectors which were supposed to grip the woven braid had simply bitten right through the foil so that all four connections were faulty — two inners and two outers. You can't do worse than four out of four!

Fortunately, there were three or four fine steel wires under the foil, and I managed to wind these around the clamp at each end to establish continuity. A couple of spots of solder on the tips of the pins took care of the centre leads.

When I went back inside and asked my young relative about the odd cable she recalled that it hadn't come with the recorder. One of the men teachers had picked it up from an electronics store on his way to the school. I sincerely hoped that it was an aberration, but I feared that it might be symptomatic of a whole faulty batch!

Anyhow, the repaired cable fixed the off-air picture completely. But the off-tape picture still wasn't right.

Closer inspection reminded me of the playback tracking knob and, on checking it, I found it turned hard one way. When I centred it by means of the indent provided, the picture came good immediately.

And then I noticed the Dolby sound recording switch with which this particular recorder is equipped and, sure enough, it was in the "off" position.

Last but not least, I had to check and reset the station tuning adjustments, most of which showed signs of having been fiddled blindly.

That done, we made a new trial recording and the unit came up with picture and sound that was virtually indistinguishable from the original transmission.

Ah me! At various times, I've had to pay an emergency visit to one or other of the local schools to sort out antennas or other connections which have been the victims of heavy handed fiddling. Or to re-set adjustments which a teacher or student (or both) have twiddled blindly, in an attempt to get results.

But, as electronic gadgetry multiplies in kind and in number in schools and elsewhere, heaven alone knows what we're going to be faced with in the foreseeable future. The possibilities for confusion and misadjustment seem endless.

TETIA Fault of the Month

Philco 1A47

Symptom: No vertical scan. 30V OK at output transistors but no oscillator activity. RP37 (820Ω 0.5W) open circuit.

Cure: Replace SCR THR2 (16121). This provides DC for the vertical oscillator via a devious route. RP37 fails when excessive AC enters the circuit. This fault is often intermittent, weeks or months apart.

Long-time EA record reviewer:

Julian Russell: a man who lived for his music

Many of our readers will remember the gifted musician and critic Julian Russell, whose authoritative and lively reviews of classical records were a regular feature of EA for over 25 years — from March 1960 to January last year. Julian passed away in July, and well-known Sydney critic Roger Covell wrote the following piece to commemorate his passing. We reprint it here by kind permission of the Sydney Morning Herald.

Julian Russell, who died in Sydney on July 16 at the age of 86, followed a lively and varied musical career before becoming widely known as music critic of *The Sun* newspaper.

He studied the piano with one of the most famous teachers of his generation, Tobias Matthay, at the Royal Academy of Music, London. While still a student he worked as a rehearsal pianist in the early 1920s for one of the opera companies founded and directed by Sir Thomas Beecham, laying the foundations for the intimate love and knowledge of opera that marked his later career as musician and writer.

After travelling with Anna Case as her accompanist to New York, he returned to London to act as a rehearsal pianist for the Diaghilev Ballet Company at a time when its principals included such renowned dancers as Massine. He stayed with Delius in France and was a friend of the composer-scholar Philip Heseltine, better known as Peter Warlock. He joined a J.C. Williamson touring company in South Africa, appearing in *The Constant Nymph* with Guy Bates-Post and continued to work with J.C.W. as an assistant conductor and occasional actor.

After returning to London he came to Australia via another South African tour. He worked with Gladys Moncrieff and with the conductor Andrew MacCunn, and also played the piano for films at the Prince Edward Theatre.

Gregarious in nature and a gifted raconteur, he became a friend of many prominent writers, artists and musicians from the 1930s onwards.

He wrote music reviews for *The Daily Telegraph* in Sydney during Brian Penton's editorship and later began a long association with The Sun as music critic, also writing on films, ballet and television. In addition, he wrote a regular record review column in *Electronics Australia* for nearly twenty-six years. He broadcast on music for the ABC, acted as an adjudicator for The Sun Aria and other competitions and also had a series of radio sessions at one time on French cooking, one of his lifelong interests.

He is survived by his widow, Mrs June Russell.

by ROGER COVELL

Who said Men don't cry ?

To say that men don't cry is to say that men don't have emotion. It is to say that man is not moved by the birth of a child; by the visual splendour of nature, or the sensitivity of a song.

It was the emotional desire of Saul Marantz which set him on the mission of establishing standards in the science of sound reproduction that were to surpass laboratory levels of excellence and become the statement in technical superiority.

For 35 years Marantz has maintained that proud tradition whilst elevating the concept of sound reproduction to an art form.

The PM94 Stereo Amplifier, the latest in a line of new era Marantz audiophile components, has won Australia's highest award for excellence, the CESA Hi Fi Grand Prix, and is consistently winning acclaim from internationally prestigious publications like "Hi Fi News and Record Review" of the U.K.

So listen with your heart and experience the expression of emotion through the science of sound: Marantz.

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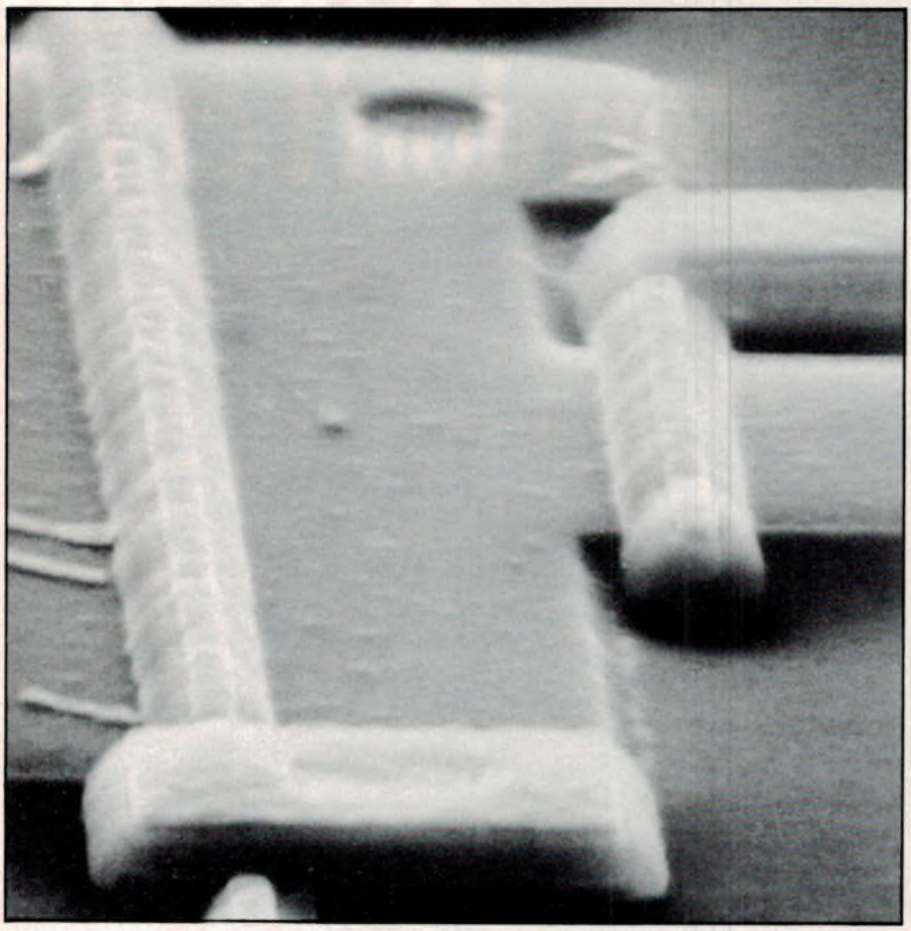
News Highlights



IBM makes smallest ever FETs

IBM scientists working at the company's Yorktown Heights research centre have moved IC technology into unexplored dimensions, by producing experimental FET transistors with features measured in units of only 0.1 micron. The new devices exhibit the highest ever values recorded for silicon FET transconductance, making them also the highest gain devices ever produced.

In developing the new devices, IBM researchers were aiming for the size and performance needed to produce the next generation of ultra-large scale integrated (ULSI) circuits. Logic chips based on the new devices have the potential to hold millions of active elements, each switching in times as low as 10 picoseconds — ten times faster than current devices.

The experimental devices are N-channel MOSFETs. The next step, according to the developers, is to come up with equivalent CMOS devices.

There were many hurdles to be overcome in developing the new devices. Basically these were predicted by scaling theory, a tool itself developed by IBM researchers in the 1970s. Scaling theory allows the prediction of geometric and electrical constraints that will apply as device size decreases.

For tenth-micron technology, scaling theory predicted that physical limits were being approached: at room temperature, voltages large enough to properly switch the tenth-micron transistors on and off would, in time, damage them. The IBM solution was to change the physical characteristics of the devices by operating them in liquid nitrogen, about 321° below zero (Fahrenheit) where lower speed of signal-carrying electrons significantly rises, allowing transistors to operate faster.

The electron-beam lithographic tools IBM used to make the tenth-micron transistors are capable of writing lines many times smaller than those possible with conventional optical lithographic methods.

IBM used these advanced electron-beam tools to solve the difficult problem of linewidth control and accurate pattern placement associated with writing the complex line patterns needed for tenth-micron technology. The E-Beam tools IBM used are capable of writing pattern with dimensions several times smaller (0.02 — 0.05 microns) than the tenth-micron FET linewidths. The IBM tools are currently being used to explore the characteristics of structures — for example, metal conduction lines — in this even smaller range.

ACS Story: POSTSCRIPT

After our last issue was printed, there was a further development in our exclusive story on the closure of Appliance Control Systems. The deal with Singapore entrepreneur Mathew Goh fell through, and all of ACS's production plant was bought by Bow Electronics Ltd, of Osborne Park WA. So the technology has stayed in Australia, after all — good news indeed!

Australian census data on CD-ROM disk

Supermap, the first product of Space-Time Research, is a CD-ROM containing Australian census of population and housing along with associated software. The software runs on an IBM PC or compatible with a high resolution colour monitor. The data is stored on a CD-ROM, and the CD-ROM player is connected to a PC.

One way this disc can be used would be to ask the system to work out the percentage of Victorians with an income of more than $30,000, break the results into regional divisions, and then produce the result in "map" form. This process can be completed in under a minute.

A large retailing group is a good example of an organisation which could make use of this CD-ROM. Say their marketers wish to establish a typical profile of persons purchasing a given product on the group's credit card. By structuring the credit card data identically to the census data it is possible to compare the resulting maps of credit card purchases and population/housing conditions.

Space-Time Research is also offering consulting services: storing databases on

CD-ROM, developing techniques for mapping statistical data and investigating population/housing problems.

For further details contact Jack Massey or Jeff Leeuwenburg at Space-Time Research on (03) 614 2871.

Philips and Sony announce final specifications for CD-I

Following the June 17th announcement by Philips and Sony formalising the release of the full-functional specifications for Compact Disc Interactive (CD-I), Sony Australia has released the final specifications, giving software providers all of the information necessary to begin designing and developing applications.

The CD-I standard specification, developed by Philips and Sony, provides a complete format which allows interactive applications containing music, speech, natural still and animated pictures, graphics, computer programs, and computer data. It is an international system for the delivery of multimedia applications to the institutional market.

CD-I players will be easy to operate devices that will fit easily into any home entertainment or school/educational system. The player can be incorporated into a stereo system like a regular CD player and will be able to play existing CD discs. It also can be plugged into a TV like a VCR. Accessed by a simple remote control device, the CD-I player's built-in controller allows users a tremendous amount of interactivity with the application. CD-I discs are expected to have application in such areas as entertainment, information, education, self-help, etc.

The release of CD-I product in Australia will be some time off yet, as the final technical specification will not be published until later this year, which would possibly result in the product not being available in Japan or the US until late 1988.

IBM developing computer for space

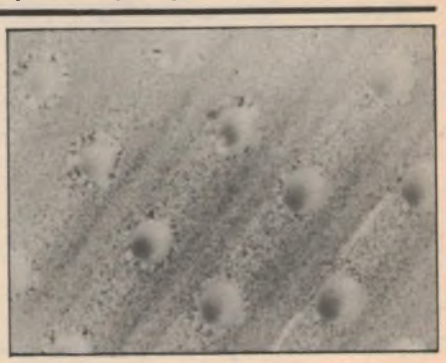
IBM is developing a working model of a general purpose space-based computer that will use Very High Speed Integrated Circuit (VHSIC) technology for enhanced performance and operation in the harsh space environment.

IBM's Federal Systems Division (FSD) facility at Manassas, Virginia, will develop the working model — a brassboard processor — to demonstrate the computer's capability of operating in space. FSD is doing the work under a 30-month, $US13.9 million contract in phase 2 of the Generic VHSIC Spaceborne computer (GVSC) project for the US Air Force's Space Technology Centre.

The GVSC could be used as one of the computing elements that make up the Air Force's advanced onboard signal processor, a high-speed, fault tolerant processing system for space use. A VHSIC test chip developed by FSD was operated successfully by the Air Force in phase 1 of the project that was completed in January.

The brassboard processor will be built on the US Air Force's standard 1750A instruction set architecture that FSD enhanced in phase 1 to provide more memory and speedier performance for space computing.

New material for erasable optical recording



Researchers at Philips Research Laboratories in Eindhoven have found a highly promising new group of materials for *erasable* optical recording of either analog or digital signals. These are semiconductor materials such as gallium antimonide (GaSb) and indium antimonide (InSb) "doped with" other elements, as in the manufacture of semiconductor material for IC chips.

The new compounds have a number of specific properties that make them suitable for the repeated recording and erasure of information with a laser beam. Information is read out by a familiar laser-optical technique used in Videodisc and Compact Disc.

The essential differences between the various laser-optical systems are in the material in which the information is recorded and the way in which the information is "written" on the disc. Videodisc and Compact Disc are pressed, with the information contained in the pressed pattern. In the DOR system (Digital Optical Recording) the user can record information once only; this is done with a laser beam which melts a pattern of holes into the material (hence the term WORM: "Write Once Read Many Times").

Other methods and materials have long been sought that could be used indefinitely for recording, readout and erasure of information. The difference in reflection between the crystalline form and the non-crystalline (amorphous) form of the same material was a good starting point.

With the Philips technique, information recorded by rapidly heating small areas in a thin layer of crystalline material to slightly *above* melting point with a fairly powerful laser beam. These small areas then solidify (the "supercooled phase"). This produces amorphous areas in the crystalline material and these can be detected optically by the variation in reflectance. The differences in reflection are quite sufficient for digital readout and sufficiently well-defined for the reproduction of analog video signals.

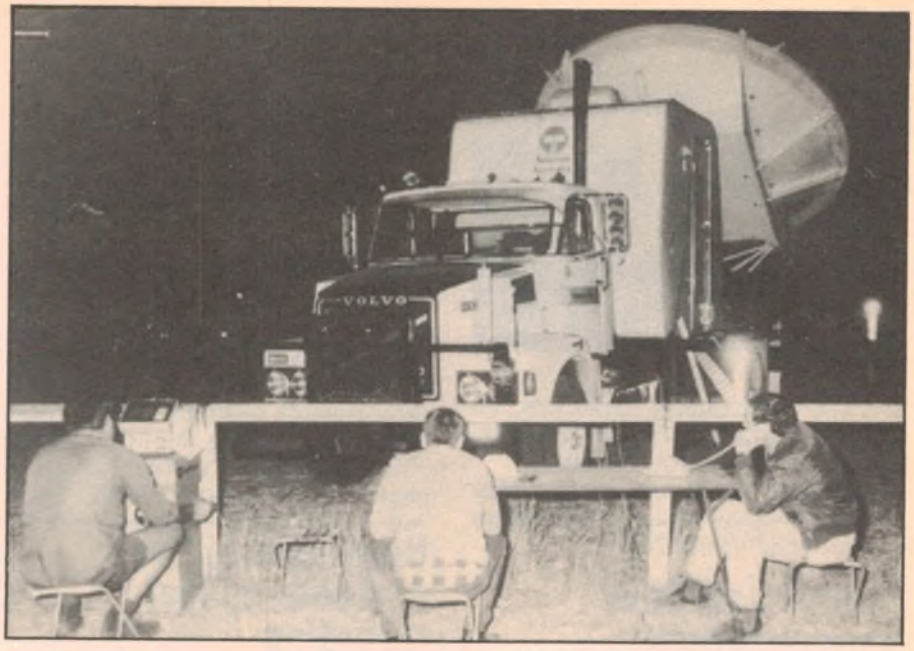
Because the crystalline form of materials is the most stable, all materials naturally tend to change into this phase. This effect can be used to erase the information on the disc. Heating to just *below* melting point with a laser beam will return the material to its fully crystalline state.

These materials have a long shelf life, which is of course very important. They are insensitive to ordinary ambient temperatures and to humidity. Information can be erased and re-recorded about a thousand times, which is quite satisfactory for consumer applications, but not enough for professional use. Existing non-erasable discs can be played on equipment developed for erasable recording.

Philips stresses that the results described refer only to laboratory research and not to any marketing or manufacture of new products.

News Highlights

TINES used again for Wynn's Safari



Telecom Australia's Transportable Iterra Network Services Earth Station, or TINES was again used this year to provide telecommunications facilities during the gruelling nine day long 6500km Sydney-Darwin "Wynn's Safari". This followed its successful use for the first time in last year's event.

TINES is Telecom's larger mobile satellite earth station, and is mounted on a Volvo turbocharged N10 truck. The four tonne unit is packed with ultra sophisticated electronics including a 4.6 metre fold down antenna dish. The ITERRA unit is specially modified for Outback Australia usage and is capable of operating in temperatures up to 50°C and in 95% relative humidity.

TINES allowed Wynn's Safari organiser Automotion Australia, the competitors and the media covering the event to utilise the full gamut of telecommunications services provided by Telecom. This meant STD, ISD, text and voice lines — providing facilities for extensive media coverage from the lonely overnight stops in the bush — from locations that had no communications at all.

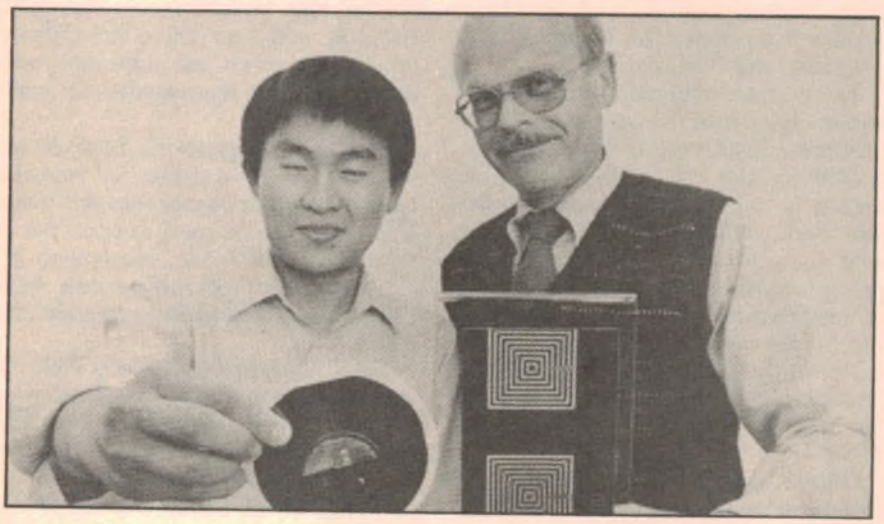
The facilities allowed use of facsimile for newspaper reports, and the transfer of photographs to newspapers by the use of a Nikon NT 1000 picture transmitter — the machine that was the basis for the scoop photographs out of Fiji during that country's recent crisis.

Another important facility was the ability to make voice reports to radio stations, as well as maintain contact with the event Sydney Headquarters for search and rescue reasons.

For competitors it meant the luxury of telephoning home from "Back O' Bourke". The Telecom facilities included gold phones, normal handsets, and even new card phones which accept credit cards such as Bankcard or American Express!

The TINES unit was manned by a Telecom crew who travelled up to 600 kilometres a day, and then set up their facilities within 45 minutes of reaching each night's base.

Just ask any of the Wynn's Safari contestants — even ET never had it so good!



Tiny microphone fits on a chip

A tiny silicon microphone that could serve as the "ears" for robotic systems, has been developed at the University of California, Berkeley. Only one fiftieth the size of a postage stamp, the highly sensitive microphone, or acoustic sensor, is small enough to fit on a silicon computer chip. Its small size holds the potential for significant miniaturization of hearing aids and for other medical applications.

The new microphone will also allow for more economical and efficient production of computerised speed-recognition systems and hearing-aid technology, according to its inventors. Its ability to detect minute changes in air pressure could additionally prove vital for controlling extremely refined robotic action in manufacturing or other technologies.

An added benefit is that the microphone can be easily mass produced, report Professor Richard S. Muller and Eun Sok Kim, graduate researcher, both of Berkeley's Department of electrical Engineering and Computer Science (EECS).

According to Muller, the new microphone contains the thinnest diaphragm or artificial "eardrum" ever reported. It is also more sensitive and versatile than current acoustic sensors, because it can be built on a computer chip together with the integrated circuitry to analyze what it "hears".

For example built into the head of a robotic drill, the sensor could "hear" or detect very small changes in sound or air pressure that would indicate exactly how far the drill had cut.

Racing by remote control

A new Radio Smart Modem (RSM) which will allow some of the "driving" of a racing car to be done by engineers in the pits, has been announced by local data communications manufacturers, NetComm (Australia). Fitted in the NetComm sponsored Nissan Skyline 2.4 Turbo racing car, the RSM will be tested under rigorous race track conditions, reaching speeds of up to 270 km per hour.

Completely designed and manufactured in Australia, the modem provides an error-free duplex data path over any standard two way radio system or cellular phone system. Both mobile and remote sites can be accessed over radio channels, unrestricted by expensive telephone lines.

"The Radio Smart Modem will enable us to do what other racing teams in the world have only dreamed about, including the multi-million dollar world of Formula One racing," says Dennis Horley, NetComm Racing Team.

Important information on turbo temperature, engine tune, oil pressure and engine revs can be monitored by the engineers in the pits, as the radio smart modem is linked to the car's inbuilt engine management system. Previously, development work on the engine management system was done by strapping a spare seat for an engineer in the car and he would enter data into a lap top computer. The disadvantage of this method was the extra weight in the car which would not normally be there under racing conditions.

A further data link allows engineers to communicate with the driver via a high resolution Epson terminal screen. The driver can concentrate on driving without having to watch the gauges continually, while the engineers monitor the condition of the car from the pits.

Driven by Murray Carter and Dennis Horley, the NetComm car will compete in the remaining rounds of the Australian Touring Car Championships, the Adelaide Grand Prix, plus major events in the Australian Endurance Car Championships, including the James Hardie 1000 and the Calder 500.

First compliance certificate for cellular radio phone

The first Compliance Statement Certificate under the provisions of the Radiocommunications Act 1983 has been issued by the Department of Communications Australian designed mobile radio for use in cellular mobile services (car telephones).

The first equipment to comply with the new Ministerial Standard is the FM9000 mobile radio, designed and manufactured by Philips Industries in Victoria.

"Provisions of the Radiocommunications Act 1983 governing licensing and equipment standards enable the Department of Communications to better manage the electromagnetic spectrum", a DoC spokesperson said.

The first compliance test was conducted in the Department of Communications' laboratory in Brisbane.

"The FM9000 mobile radio complied with all the requirements of Ministerial Standard M313, which covers radios used in cellular mobile services', the spokesperson added.

News Highlights

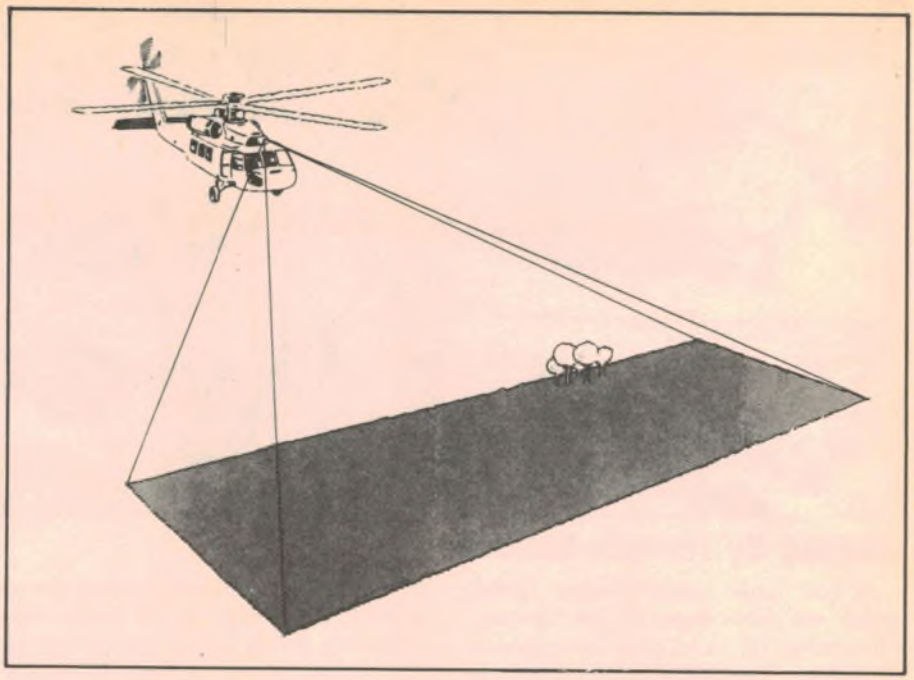
Adelaide firm wins defence contracts

Adelaide company C.J. Abell, a subsidiary of Vision Systems, has won Australian Defence Department contracts worth $850,000 to develop an infra-red surveillance system to identify military targets.

The surveillance system, to be developed for the Australian Army, will be capable of pin-pointing equipment or personnel over great distances by sensing body warmth or engine heat. It also will be able to be used in search and rescue operations, but will have a far greater field of view than existing equipment. This will enable vast areas to be covered much quicker.

C.J. Abell will develop a field prototype of what will be known as the Kuru Muna thermal imaging system, over the next six months. Kura Muna is an Aboriginal word meaning eye in the dark.

Company founder Dr Chris Abell, who now is a director of Vision Systems, says the Defence Department has given his firm three contracts to "develop and supply electronics and processing modules of a field trials prototype wide-field-of-view thermal imaging system."



"The Kuru Muna infra-red system has been under development within the Defence Science and Technology Organisation of the Department of Defence since 1984," Dr Abell says.

"It draws on ten years of DSTO research and development into infra-red detection and thermal imaging. Kuru Muna will be unique in that it will operate over an extremely wide field of view.

"It will be able to take in an area 47 degrees horizontally and five degrees vertically as far as a high-resolution camera lens can see."

Big sales for locally made editing gear

Australian developer and manufacturer of audio, video and film editing equipment, Sontron Instruments anticipates being able to establish distribution agencies in Europe, Japan and Canada, following equipment sales worth $2 million during July.

Managing director Graham Thirkell says that more than 55 of the firm's Editron synchroniser editing systems have been installed in film video and audio production houses in Australia, then USA and Hong Kong, most in the last 18 months. An extensive marketing drive is currently under way in London.

The technically advanced Editron systems have been used in the production of "Crocodile Dundee", "Light Horsemen", "Australian Made", "Mad Max", and "Ground Zero". They are used by AAV Australia, Film Australia, Soundfirm, Australian Broadcasting Corporation, ATV10, TCN9, Video Corporation and many others in Australia. The Editron is also used in the preparation of CD Masters in Australia's only CD plant, operated by Disctronics, a subsidiary of Pro Image Ltd.

"Drive-up" ATM a success

Mothers with small children are among the enthusiastic customers at Australia's first "island" drive-up automatic teller machine (ATM), which was recently opened by the Capital Building society at Geelong, Victoria.

The teller machine, supplied by Philips is a free standing design mounted beside a driveway and has, in its first month of operation, become the society's busiest ATM.

Capital's chief general manager, John McVey, explained that the new ATM stands under a huge brightly-lit canopy which spans the drive way of the Geelong West branch at Pakington and Aberdeen Streets.

Manager at the branch, Kay Apano, says that mothers with children in their cars particularly appreciate the convenience of not having to get out of the car to make withdrawals or deposits. "It's a real winner" she says. "Its as simple as pulling into a service station. In fact, the ATM could be mistaken for a short stylish petrol pump."

New seaphone for Qld/NSW mariners

To meet increasing demand by mariners for improved Seaphone coverage southwards along the Goldcoast and northern NSW coastal waters, OTC's Maritime Communications Group is trailling a new remote base station at Mount Springbrook, near the Qld/NSW border.

"Should current tests prove the new site superior in terms of coverage and performance, then OTC will move permanently to Mount Springbrook later this year", explained Jim Simpson, OTC Maritime, Product Manager.

OTC hopes to improve its existing Brisbane Seaphone service operating from Ocean View, near Mount Mee, and covering the coast from Double Island Point in the north, down to Southport.

Already fitted with two VHF channels 16 and 23 operating around the clock, early tests of this new site indicate reliable Seaphone coverage from Yamba in northern NSW all the way to Mooloolaba, (Point Cartwright) on the Sunshine Coast and 150kms seawards.

3 GENERATIONS TO MEET YOUR DSP PERFORMANCE NEEDS.

GENERATION	DEVICE	TECHNOLOGY	CYCLE TIME (ns)	TYPICAL POWER (W)	ON-CHIP MEMORY				TOTAL MEMORY SPACE	I/O			
					RAM	ROM	EPROM	CACHE		PARALLEL	SERIAL	DMA	TIMERS
1ST	TMS32010	NMOS	200	.9	144	1.5K	–	–	4K	8	–	–	–
	TMS32010-14	NMOS	320	.9	144	1.5K	–	–	4K	8	–	–	–
	TMS32010-25	NMOS	160	.9	144	1.5K	–	–	4K	8	–	–	–
	TMS32011	NMOS	200	.9	144	1.5K	–	–	1.5K	6	2	–	1
	TMS320C10	CMOS	200	.165	144	1.5K	–	–	4K	8	–	–	–
	TMS320C10-25	CMOS	160	2	144	1.5K	–	–	4K	8	–	–	–
	TMS320E15	CMOS	200	.3	256	–	4K	–	4K	8	–	–	–
	TMS320C15	CMOS	200	.225	256	4K	–	–	4K	8	–	–	–
	TMS320C15-25	CMOS	160	.25	256	4K	–	–	4K	8	–	–	–
	TMS320E17	CMOS	200	.325	256	–	4K	–	4K	6	2	–	1
	TMS320C17	CMOS	200	.25	256	4K	–	–	4K	6	2	–	1
	TMS320C17-25	CMOS	160	.275	256	4K	–	–	4K	6	2	–	1
2ND	TMS32020	NMOS	200	1.5	544	–	–	–	128K	16	1	†	1
	TMS320C25	CMOS	100	1.0	544	4K	–	–	128K	16	1	†	1
3RD	TMS320C30	CMOS	60	1.0	2K	4K	–	64	16M	••	2	‡	2

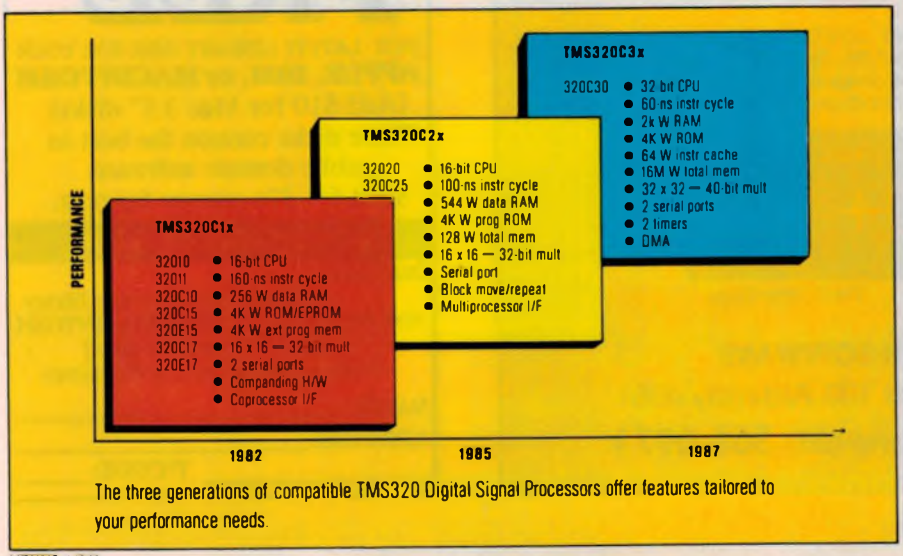
† External DMA •• Unlimited ‡ Internal/External DMA

The Texas Instruments TMS32010, introduced in 1982, was the first digital signal processor in the TMS320 family. Since then, Texas Instruments has demonstrated its dedication to the advancement of digital signal processing by expanding the family to include enhancements of earlier generations as well as more powerful new generations of digital signal processors.

The 3 generations of the TMS320 Digital Signal Processors are:

- TMS320C1x – 1st generation
- TMS320C2x – 2nd generation
- TMS320C3x – 3rd generation

For additional information on any of the TM320 products, contact VSI Electronics, Australian distributor for Texas Instruments.



The three generations of compatible TMS320 Digital Signal Processors offer features tailored to your performance needs.

VSI

THE SOURCE OF
Texas Instruments
COMPONENTS

VSI Electronics (Aust) Pty. Ltd.,
16 Dickson Avenue, Artarmon,
NSW 2064, Australia.
Telephone (02) 439 8622.
Telex AA22846.
Facsimile (02) 439 6435.

Queensland (07) 262 5200.
Victoria (03) 543 6445.
South Australia (08) 267 4333.
Western Australia (09) 328 8499.

NEXUS II/062

News Highlights

Radio 2SM upgrades studio facilities

Sydney's AM radio station 2SM has recently upgraded its studio with the installation of new equipment featuring a Sound Workshop Series 34 console.

With its Series 34, 2SM is able to produce commercials, and offer clients a package deal that includes copy writing all the way through on to on-air broadcasting.

"By offering this service to clients, we are able to fill a gap in the commercial production industry, especially as it relates to producing ads for radio," says Nigel Coleman, 2SM sound engineer.

Distributed by Amber Technology, the Sound Workshop Series 34 is a modular 24 bus audio record/mix console that is said to be simple to operate, but complete in its functional abilities.

Australian made surgical laser demonstrated

Gold Coast laser manufacturer Laser Dynamics demonstrated its first production "Scalibre" CO_2 surgical laser at the recent Hitec '87 Exhibition, following on from a preview at the Australian Conference on Lasers and Spectroscopy

at Surfers Paradise.

The recently listed company is currently completing a $500,000 expansion of its production and research facilities near Southport, which will more than double production capacity.

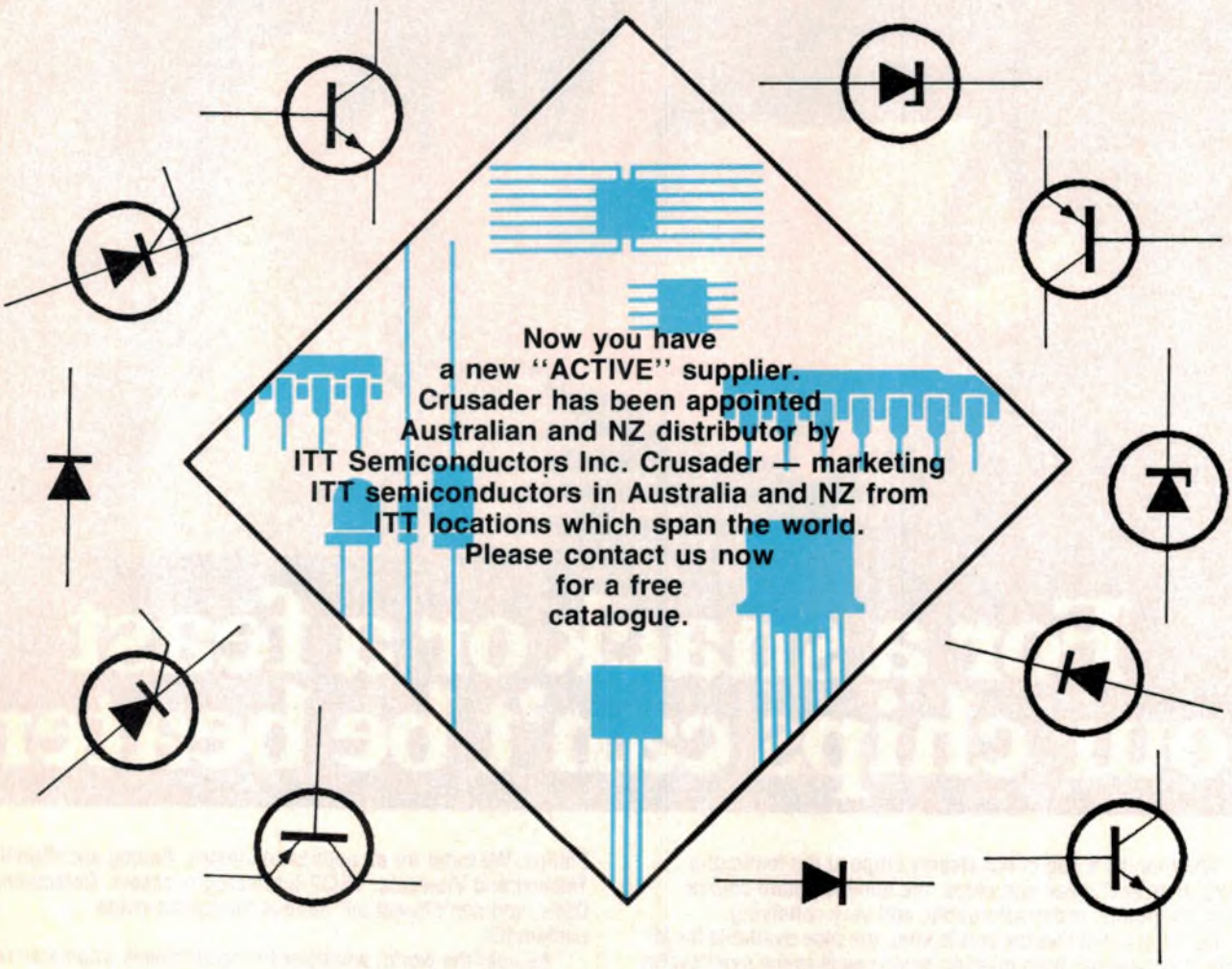
This year LDL has increased its staff from 13 to 42 people, with emphasis on researchers who will develop nine new laser systems for production. The lasers have been designed by the University of Queensland's Uniquest Division, a 15% shareholder in LDL.

CRUSADER

GOES

ACTIVE

WITH ITT SEMICONDUCTORS



CRUSADER ELECTRONIC COMPONENTS PTY LTD

81 Princess Hwy, St. Peters NSW 2044. Phone (02) 516 3855, 519 6685, 517 2775. Telex 123993 Fax (02) 517 1189.

APPOINTED DISTRIBUTORS

Sydney: George Brown & Co Pty Ltd, 519 5855. Geoff Wood Electronics Pty Ltd, 810 6845. **Wollongong:** Macelec Pty Ltd, 29 1455. **Canberra:** George Brown & Co Pty Ltd, 80 4355. **Newcastle:** Novocastrian Electronic Supplies, 62 1358. **Melbourne:** Nalmos Pty Ltd, 439 5500. Jesec Components Pty Ltd, 598 2333. George Brown & Co Pty Ltd, 878 8111. **Brisbane:** L. E. Boughen & Co, 369 1277. Colourview Wholesale Pty Ltd, 275 3188. St. Lucia Electronics, 52 7466. **Adelaide:** Protronics Pty Ltd, 212 3111. **Perth:** Simon Holman & Co, 381 4155. Protronics Pty Ltd, 362 1044.

News Highlights

Subs competition winner

The lucky winner of the subscription competition run earlier this year in EA and other Federal magazines was Mr Laurie Wiggins, of Mascot, NSW, shown here (right) receiving his prize from Air New Zealand's John Arnold. Mr Wiggins won a trip for two to the USA, flying Air New Zealand and staying in both Honolulu and Los Angeles.

NEWS BRIEFS

- ***Parameters*** is now the Australian distributor for the Grundig range of oscilloscopes, which includes 20MHz and 50MHz dual trace models.
- ***Parameters*** has also formed a joint venture company with Japan's ***Yokogawa Electric***, to market and instal process control systems and test and measurement products. The jointly owned company has been named Yokogawa Parameters, and is 60% owned by the Japanese principal.
- ***Hills Antenna Systems Division*** in Adelaide has merged with Melbourne-based ***Antenna Engineering***, a subsidiary of Kabelmetal Electro of Germany. The merged company has been named Radio Frequency Systems.
- Kim Ryrie has stepped down from the position of managing director of ***Fairlight Instruments***, to concentrate on new product development. The innovative company's new chief executive is Philip Small, formerly general manager. Former DFCL managing director Ian Pollard has been appointed chairman.
- Switch manufacturers ***Swann Electronics*** and ***Wilco Electrical*** are merging, to produce an operation with an annual turnover of around $60M.
- ***Philips Industries*** is closing its colour TV factory in Clayton, Melbourne later this year. Over 200 jobs will be lost in the closure, which has been blamed on declining sales. The firm's radio communications factory in the same suburb will not be affected.
- Sunshine Group subsidiary ***Printronics China Ltd***, linked to the local PCB maker, has won a third contract in the People's Republic of China valued at $A10 million. The contract is for design, planning, supply, installation and commissioning of a multi-layer PCB factory at Huang Pu in Guangzhou province. Printronics is also taking 35% equity in the joint venture company which will own and operate the factory.
- HF radio equipment manufacturer ***Wagner Industries*** has moved to larger and more modern premises at 48-56 Chapel Street, Marrickville. Telephone (02) 519 4666, fax 519 4019.

Silicon Valley NEWSLETTER . . .

US Senate moves to ban Toshiba

Toshiba is not the only one licking its wounds following the passage in the US Senate of an unprecedented legislative measure to bar the $US22 billion-a-year Japanese giant from doing any business with the United States during the next two to five years, in retaliation for selling propeller milling equipment to the Soviet Union.

In the United States, thousands of people employed by Toshiba, as well as users of Toshiba semiconductors and even dozens of companies involved in technology exchange agreements with Toshiba, are trying to prepare for what — at this point — seems an inevitable ban on Toshiba.

To be sure, a total US ban may prove devastating to Toshiba, which could lose more than $US4 billion in annual sales. Already the company has lost its two top executives. Chairman Shoichi Saba and president Sugichiro Watario have resigned in disgrace, as Japanese cultural tradition forced them to accept responsibility for the action of a subsidiary in which Toshiba has a 50.8% majority interest.

The bashing of Toshiba products on television by a dozen US Congressmen before millions of American and Japanese viewers may leave a public relations scar that will take a long time to heal. Even if the Congress is somehow unable to have its outrage converted into anti-Toshiba legislation, the company's US sales are due to suffer severely from the scandal which has probably created a "don't-buy-Toshiba" attitude among consumers. Already the Pentagon has barred the company from doing any more business with US defence contractors, which will cost Toshiba several hundred million dollars in annual sales.

Toshiba has already initiated a lobbying campaign in Washington against a ban through US lawyers, and has issued open invitations to the Pentagon to develop a better export control system. Many believe, however, that it may prove difficult for the company to halt the Congressional moves against the company. The revelation of the sale of sensitive propeller milling equipment to the Soviet Union and subsequent devastation to the West's advantage in anti-submarine warfare, came at the height of trade tensions between the United States and Japan.

If the Congress succeeds in its legislative efforts, the ban would mean some 4,000 US-based Toshiba employees would lose their jobs. Not surprisingly, most of these workers expressed confusion and anger over the threatened boycott.

"I feel so helpless" said Carol Kearney, the personnel director at Toshiba Semiconductor in Santa Clara.

But unlike many other Toshiba operations in the US, there is still some hope for Kearney and her 200 colleagues that their jobs may be spared. That is because the Senate resolution includes a provision that would allow Toshiba to continue to sell semiconductors.

Semiconductors are considered critical to US national security, and the absence of Toshiba from the US semiconductor market may endanger large portions of the overall US electronics industry, which depends on Japanese-made memory chips and other components.

Already the possible ban on Toshiba has sent cold shivers down the spines of US electronics executives. For one, Toshiba is currently the only supplier of a particular high-performance 1 megabit DRAM chip. Already several US-made computers have been designed around the high-speed Toshiba chips, and their ban could sink the effort to bring such systems to the market.

Toshiba's Santa Clara semiconductor division. Some 4000 American employees may lose their jobs if the US ban is applied.

80386 bug saga

Intel engineers are still frantically working to re-engineer the company's 80386 microprocessor in order to rid the chip of a nasty bug. But already the hype is starting to build for the introduction of the successor of the 386, the 80486.

To be sure, the 386 is such a hot chip, even in its flawed form, that customers can't get enough of them and had to be put on allocation. The current 386 packs some 275,000 transistors onto a single piece of silicon. In fact the complexity of the circuit design is said to be responsible for allowing the bug to slip through the various simulation and testing procedures.

Now Intel may put as many as one million transistors onto the 486, according to some industry insiders.

Intel itself isn't saying anything about

the 486 other than that it is a product that is indeed on the drawing board. But everyone knew that. "Nothing about the 486 is really final," commented Intel spokeswoman Sandra Duncan.

As for availability, don't expect the 486 to be introduced for at least two years. In fact, the timetable for introduction may depend in large part on how the market for 386-based systems develops and holds up against competing processors.

Intel has decided it wants to be the sole source of the 386 and the company is not likely to hurt the sales and profitability of the 386 by introducing a competing processor until it is absolutely necessary for such product to be available.

Natsemi to buy Fairchild?

The rumours are getting stronger that National Semiconductor may be interested in buying all or part of Fairchild. They are fueled by other rumours that Fairchild's proposed management buy-out plan is either dead in the water, or has totally unravelled.

It is already some months since Fairchild said it was close to reaching a deal that included its management, Fujitsu, Intergraph, and a number of venture capitalists, but nothing has happened since then. The popular explanation is that several of the participants in the deal have become scared about Fairchild's alleged large negative cash flow.

If the buy-out plan has indeed fallen apart, it may well mean the end of Fairchild as we know it. It is likely that Schlumberger will decide, or may already have decided to sell the company in large chunks.

That is where National Semiconductor comes in, and even Advanced Micro Devices and LSI Logic, whose names have also surfaced as being interested in buying part of the company.

National Semi certainly has the cash to pull something like this off. The company recently secured close to $200 million in equity financing.

For Charlie Sporck, the takeover of Fairchild would fulfill his wish of the late 1950s to become president of Fairchild. Soon after being passed over for the job, Sporck left Fairchild to raise National Semiconductor from a near-certain death and turn it into Silicon Valley's largest chip maker.

LSI Logic's Wilf Corrigan and AMD's Jerry Sanders may have similar sentimental reasons for wanting a piece of Fairchild, where both served as executives.

Sematech not impressed by California offer

Despite its superior infrastructure for any high-tech-orientated venture, California may not end up playing host to the semiconductor industry's $1.5 billion Sematech research consortium, as the state's bid to lure the venture was hardly competitive with bids from 12 other states. Members of Sematech's Site Selection Committee said they were disappointed with California's presentation which was termed "amateurish, disorganised, and bland".

The state offered Sematech only one potential site that could accommodate Sematech's plans to be in operation by the end of this year. In addition, California is offering Sematech just $3 million in financial assistance, compared to New York which is offering $10 million, and Florida which has proposed as much as $20 million in seed money.

States like Florida are making strong pitches because of the benefits Sematech could bring to their area. Besides spending a lot of money locally, Sematech will also create close to 1,000 new jobs, and will generate a lot of business for local support industries, including hotels, universities, etc.

Still, California remains a favourite among many Sematech officials, as the availability of semiconductor engineers, top-notch engineering schools, and the supporting equipment and materials industries are major considerations.

But instead of making a serious bid, representatives from California's Department of Commerce did little more than "wave the California flag," as one participant in the meeting said.

Defending his state's position, Ken Gibson, director of the department, said California can't "just walk into a meeting and commit the taxpayers to a $25 million subsidy for a group of wealthy businessmen. We really do want Sematech here, but in California, business pays its own way."

WHICH SWITCH?

Toggle Switches

Ultra Miniature DPDT
The contact rating to size ratio is very high with this miniature toggle switch. Ideal for models, miniature portable instruments, or any use where a high quality miniature switch is required.
Cat S-1245
$3.50
1.5A 240V

SPDT
Body 8mm x 13mm, clearance 17mm.
Cat S-1173
$1.65
2A 240V

DPDT
Body 13mm x 13mm, clearance 17.5mm.
Cat S-1174
$1.80

4PDT
Body 13mm x 21.5mm, clearance 20.5mm. Cat S-1175
$5.95
2A 240V

Heavy Duty DPDT
Amazing contact capacity!
Although this switch is miniature in size, it offers an enormous contact to size ratio. Ideal for use where high power levels are involved and small size is of prime importance.
Cat S-1168
$3.75
10A 125V

Right Angle PCB Mounting
With extended right angle lugs for soldering direct to pcb. No mounting nuts required (there's no thread anyway!)
Cat S-1180
$2.50

Standard DPDT
Same general features as SPST Cat S-1215.
Cat S-1216
$2.25
1.5A 240V

PCB Mounting Push Button
Has right angle legs for pcb mounting through panel. 120V AC. Cat S-1253
$2.95

Waterproof Toggle
Fully sealed SPST toggle for low voltage applications. Toggle has rubber boot to ensure complete waterproofing. Ideal for marine use and other hostile environments. Cat S-1195
10A 12VDC $7.65

Standard DPDT Centre Off
Rugged bakelite case, chrome toggle, red and black On/Off/On indicator plate and heavy duty solder lug terminals. This switch features heavy duty contact rating. Makes ideal motor reversing switch eg electric aerial on cars.
Cat S-1217
$2.50
1.5A 240V

Piano Key DPDT
Ideal for audio and electronic projects. Superbly engineered and has a white toggle. Cat S-1393
$3.50

Illuminated SPST (12V)
Intended for automotive use. The soft glow from the toggle is not distractive, but means the switch can quickly be located. 12V lamp operates from supply being switched.
Cat S-1214
$3.95
16A 12VDC

1987 ARRL Handbook
All the updates on basic and advanced information, theory and a fascinating section on satellites.
Cat B-2220
WAS $49.94
$39.95

UHF/VHF Manual
This huge hard covered manual deals with the techniques and equipment applicable to frequencies above 30MHz with particular emphasis on microwaves. Cat B-2054
$39.95

Encyclopedia of Electronic Circuits
This comprehensive reference book is the A-Z of electronic circuits: It will save you valuable time searching for a particular circuit, plus eliminates all guess work in deciding whether 'that' circuit will meet your requirements.
Cat B-1760 $59.95

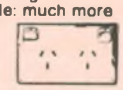
Basic Electronics Theory
With projects and experiments. Starts with very basic principles and ends with computers — with just about all aspects of electronics in between. Ideal reference work for tech, school students, etc.
Cat B-1615 $27.45

Bits 'n'

Line Switch
High impact plastic moulded switch for insertion in any cord for remote on/off. Ideal for putting on/off switch in a floor standing lamp.
Cat P-5515
$5.95

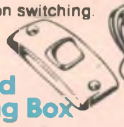
Blank Plate
Same size as power point, but blank: ideal for gap-filling when you move points, switches etc. Cat P-5535
$1.99

Double Power Point *10A Rating*
Replace old single outlets with a double: much more convenient.
Cat P-5560
$11.50



Wall Board Clip
Can be mounted from the front. Mount power outlets, switch plates, on any cavity wall (other than brick) without the need for a mounting block.
Cat P-5530
99¢

Architrave Switch
Standard architrave switch — can be used to replace old, worn out units in your home. Positive action switching.
Cat P-5570
$4.55



Standard Mounting Box
Mount power points, plates, etc. on any surface including brick. Cat P-5531
$1.99

Extension Cord
3 core cable already fitted with plug and socket. 7.5A rating.
5m: Cat P-5595 **$6.25**
10m: Cat P-5600 **$9.45**
30m: Cat P-5605 **$33.95**

Em-Bezel Away!

Miniature LED Bezel
Low current drain (20mA @ 2 volts) but offering high visibility. Smart chrome bezel, needs a 7mm hole.
Red Cat S-3528
RGreen Cat S-3529
$1.20

Dual Colour LED Bezel
Two LEDs in one bezel — ideal for two-state indication (on/off, etc.). Operates on 1.3-1.5V @ 25-30mA.
Cat S-3530
$4.60

Miniature Neon Bezel
A favourite because of is tiny size. Requires only 7mm mounting hole, and the bezel itself is chrome-coloured.
Cat S-3552

12V Bezel
A very attractive medium size bezel using a 12V LES bulb. The body of the bezel is chrome plated. Requires an 11mm mounting hole, and obviously 12 volts AC or DC.
Red Cat S-3510
RGreen Cat S-3512
$1.65

240V Neon Bezel
Intended for 240 volt projects, this bezel can be wired direct to the mains. It has a series resistor actually mounted inside the bezel case.
Cat S-3550
$1.25

$1.60

DSE Zippy Boxes
There is only one genuine 'Zippy' box — the one with the all round deep ribbing. Don't be fooled by inferior copies — this is the one used by the major electronics magazines because of its versatility. Insist on the one and only — genuine — Zippy Box which comes complete with both aluminium and plastic lids.

Small — UB5
(28 x 54 x 83cm)
Cat H-2855 $2.30
10 up $2.05

Medium — UB3
(41 x 68 x 130cm)
Cat H-2853 $3.15
10 up $2.80

Large — UB1
(50 x 90 x 150cm)
Cat H-2851 $3.80
10 up $3.45

Giant — UB2
(60 x 113 x 196cm)
Cat H-2852 **10 up $4.70** $5.25

You can't refuse

Fuses
Wide range of fuses in both popular styles: M-205 mini (approx. 20 x 5mm) and the popular 3AG(approx 32 x 6mm). Remember, the lower the current rating of the fuse you use, the greater the protection afforded. **All fuses 'fast blow' type for greatest protection.**

3AG TYPE

100mA Cat S-4449	1.5A Cat S-4465	15A Cat S-4477
150mA Cat S-4451	2A Cat S-4467	20A Cat S-4479
250mA Cat S-4453	3A Cat S-4469	25A Cat S-4481
350mA Cat S-4455	5A Cat S-4471	30A Cat S-4485
500mA Cat S-4457	7.5A Cat S-4473	35A Cat S-4487
1A Cat S-4461	10A Cat S-4475	

M-205 TYPE — 25¢ — **10 up 32¢**

250mA Cat S-4412	1A Cat S-4421	
500mA Cat S-4415	2A Cat S-4423	
	5A Cat S-4425	

Slo Blo Fuses
90¢ — **10 up 85¢**

M-205 TYPE	3AG TYPE
250mA Cat S-4300	250mA Cat S-4350
310mA Cat S-4305	500mA Cat S-4355
500mA Cat S-4310	1 AMP Cat S-4360
1 AMP Cat S-4350	2 AMP Cat S-4365
2 AMP Cat S-4320	5 AMP Cat S-4370

Auto Blade Fuses
50¢ — **10 up 45¢**

5 AMP Cat S-4505	20 AMP Cat S-4520
7.5 AMP Cat S-4507	25 AMP Cat S-4525
10 AMP Cat S-4510	30 AMP Cat S-4530
15 AMP Cat S-4515	

DICK SMITH ELECTRONICS PTY LTD

IC Sockets

18 Pin DIL Socket 35¢
Cat P-4180 **10 up 30¢**

28 Pin DIL Socket 50¢
Cat P-4245 **10 up 45¢**

14 w/wrap Pin DIL Socket $1.70
Cat P-4260 **10 up $1.60**

14 Pin DIL Socket 25¢
Cat P-4140 **10 up 20¢**

16 Pin DIL Socket 30¢
Cat P-4160 **10 up 25¢**

24 Pin w/wrap DIL Socket $2.99
Cat P-4268 **10 up $2.70**

20 Pin w/wrap DIL Socket $2.49
Cat P-4264 **10 up $2.25**

Australian Radio Frequency Handbook

This is the second edition of this best selling introduction to scanning! This edition has been updated and contains hundreds of NEW frequency listings.

B-9600 **$6.95**

Australian Marine Radio Handbook

This book will help boat owners find out just how simple choosing, fitting and using a marine radio can be. Cat B-9604

$6.95

Australian CB Radio Handbook

A complete guide to CB Radio including latest marine radio service detail. How to conduct yourself on air. The latest edition includes the new regulations and channel allocations. Cat B-2325

$6.95

Electronics Notebook Vol 3

The latest in the series. You've benefited by the information in the first two: now keep right up-to-date. Cat B-3634

$3.25

Pieces

Hobbyists . . . experimenters . . . bargain hunters . . .

Announcing a great new "seconds" centre at DSE!

Demo models . . . stock repairs . . . samples . . . etc. — all at discount prices at DSE's new Seconds Centre at our Chullora (Sydney) store. Most items have normal DSE 90 day warranty!

PLUS!!! Hobbyist's Junk Bins — full of economically unrepairable items, broken samples, etc. etc. — so popular for parts, bits'n'pieces — even to try repairing yourself! (Obviously, no warranty or repairs offered on items from junk bins).

Only at DSE Chullora Store!

Metal Cabinets

Beautifully made cabinets to suit a huge variety of projects, especially those with meters, control, etc. which need to be mounted on the front panel. They consist of an aluminium base, slots, and self-tapping screws complete with cup washers. All-in-all a case you'd be proud to put your prestige projects into. They come in an attractive two-tone finish.

102 x 56 x 83mm
Cat H-2741 **$4.95 each, 10 up $4.45**
150 x 61 x 103mm
Cat H-2742 **$6.25 each, 10 up $5.50**
150 x 76 x 134mm
Cat H-2743 **$7.65 each, 10 up $6.55**
185 x 70 x 160mm
Cat H-2744 **$8.90 each, 10 up $7.55**

Aluminium Cases

Superb range of cases based on a specially made 18 gauge aluminium extrusion giving cases which are ultra strong, ultra reliable. The extrusion measures 76 x 102mm — and is available in three different lengths. Internally, there are four slots for insertion of pcb's without use of screws (pcb width 92 or 71mm). End plates fasten into corners of extrusion with PK screws. Includes 2 end plates and 8 screws.

76mm length Cat H-2420 **$10.95**
102mm length Cat H-2425 **$12.95**
153mm length Cat H-2430 **$14.95**

Plastic Instrument Cases

95 x 45 x 145mm

This precision instrument case, exclusive to Dick Smith Electronics has a unique snap together design – no screws required. With front and back panels included this case is ideal for small projects. Cat H-2503

$12.55
10 up $11.55

200 x 65 x 160mm

A superb case for all 'instrument' type projects, and many more. Case splits apart for ease of working, comes complete with 4 rubber feet and assembly screws. Cat H-2505

$16.95
10 up $15.25

Semi Savings!

Cat No.	Description	Was	Now
R-7040	Capacitor Pack Polyester	-	12.60
R-7050	Capacitor Pack Ceramic	-	6.25
Z-1604	BF184 NPN Transistor	1.71	.99
Z-2072	2N3460 N-CH Fet	.25	.20
Z-2130	2N3053 Gen Purp Sw	.20	.15
Z-4070	LED 5mm Circ. Red/Green	.80	.70
Z-4912	74LS11 IC Triple 3 input AND Gate	.85	.15
Z-4931	74LS31 IC Delay Line	.35	.30
Z-4992	74LS92 IC Low Schottky	1.65	1.49
Z-5010	7400K Quad 2 input NAND gate	.55	.10
Z-5011	7401K Quad 2 input NAND open cct/coll	.55	.35
Z-5015	7405 IC Hex Inverter Open cct/coll	.70	.35
Z-5018	7408 IC	.35	.25
Z-5020	7410 IC Triple 3 in NAND gate	.50	.35
Z-5023	7413 IC DL4 in NAND Schmitt Trig.	1.05	.10
Z-5024	7414 IC Hex Schmitt Trigger	.81	.70
Z-5030	7420 IC D. 4 input NAND gate	.63	.25
Z-5035	7430 IC 8 input NAND gate	.63	.40
Z-5076	7476 IC TTL	.70	.60
Z-5085	7485 IC 4 Bit Mag Comp	1.00	.85
Z-5086	7486 IC Quad Excl OR gate	.30	.25
Z-5092	7492 IC Div by 12 Cntr	.90	.25
Z-5095	7495 4 Bit L-R Shift Reg	.70	.50
Z-5263	74123 IC DL, Re-Trig. Monostable	.70	.60
Z-5267	74157 IC Quad 2 Input Mplxr	.70	.60
Z-5298	74LS240 Octal Buf/ Line Dvr	2.00	.45
Z-5300	74LS95 Oct. Dvr Tristate	3.60	.80
Z-5374	74C157 Data Selector Quad 1 of 2	4.95	1.50
Z-5378	74C221 Monostable D. Schmitt	3.85	.70
Z-5644	4044 Flip Flop R/S Quad	1.65	.70
Z-5945	74HC240 Oct. Buff/ Line Dvr	3.85	.25
Z-5965	74HC373 Oct. Transparent Latch	4.95	1.00
Z-6010	CA3100 Op Amp Wideband 36DB	7.95	7.16
Z-6816	MM5865N Timer IC Universal	6.05	4.00
Z-9206	2513 Character Gen.	17.55	8.95

Diecast Aluminium Boxes

These are the ones with channelled walls for easy pcb mounting — and they're ideal for RF circuits because the lid forms a very effective screen. They're also great for circuits involving heat — remember diecase aluminium makes a great heatsink. And these boxes will withstand incredibly high temperatures: up to 600°C! Complete with screws.

190 x 60 x 110mm Cat H-2201 **$17.30 each, 10 up $15.55**
150 x 50 x 80mm Cat H-2206 **$11.05 each, 10 up $10.95**
120 x 40 x 65mm Cat H-2211 **$8.05 each, 10 up $7.25**
100 x 25 x 50mm Cat H-2221 **$6.25 each, 10 up $5.65**

Aluminium Heatsinks PCB Mounting

Just right for today's projects with everything mounted on the pcb: two heatsinks that also mount on the pcb. Designed to be soldered direct to the tracks, with their fins mounted vertically for even more heat loss. Two handy types to choose from:

Large: H pattern, 30 x 30 x 30mm, drilled to take a single flat-pack semiconductor
Cat H-3495
$2.65

Small: U pattern, 17 x 15 x 30mm high. Again, drilled for a single flat-pack, with tapped 4BA hole. Cat H-3490
$2.05

Plugs & Sockets

3.5mm Miniature

Plug Red Cat P-1132 **Black** Cat P-1134 **40¢** **10 up 35¢**

Stereo Line Socket

Cat P-1238 **$1.50** **10 up $1.40**

Stereo Plug Cat P-1140 **75¢** **10 up 70¢**

Stereo Socket Cat P-1240 **$1.40** **10 up $1.30**

Stereo Plug Cat P-1166 **$1.10** **10 up $1**

Stereo Socket Cat P-1266 **90¢** **10 up 85¢**

Line Socket

Mono: Cat P-1264
Stereo: Cat P-1286
90¢
10 up 85¢

Line Socket

Red Cat P-1410
Black Cat P-1412
45¢
10 up 40¢

Battery Holders

BATTERY SNAP

Suit 216 Cat P-6116
25¢ **10 up 22¢**

BATTERY HOLDER 3V CHASSIS/PCB MOUNT

Cat P-6220
$3.75 **10 up $3.50**

4 x "AA" SIZE HOLDER — SQUARE

Cat P-6124
70¢ **10 up 65¢**

8 x "AA" SIZE HOLDER — RECTANGULAR

Cat P-6128
$1.20 **10 up $1.10**

6 x "AA" SIZE HOLDER — RECTANGULAR

Cat P-6116
95¢ **10 up 90¢**

Audio Adaptor Plugs

3.5mm Stereo Socket to 6.5mm Stereo Plug
Cat P-6500 **$1.30 (10 up $1.15)**

6.5mm Stereo Socket to 3.5mm Plug
Cat P-6505 **$1.30 (10 up $1.15)**

6.5mm Socket to 3.5mm Plug Cat P-6510
$1.30 (10 up $1.15)

3.5mm Socket to 6.5mm Plug Cat P-6520
$1.30 (10 up $1.15)

2 x 3.5mm Stereo Plugs to 1 x 3.5mm Stereo Plug
Cat P-6525 **$4.50 (10 up $4.00)**

RCA Socket to 6.5mm Plug Cat P-6530
$1.30 (10 up $1.15)

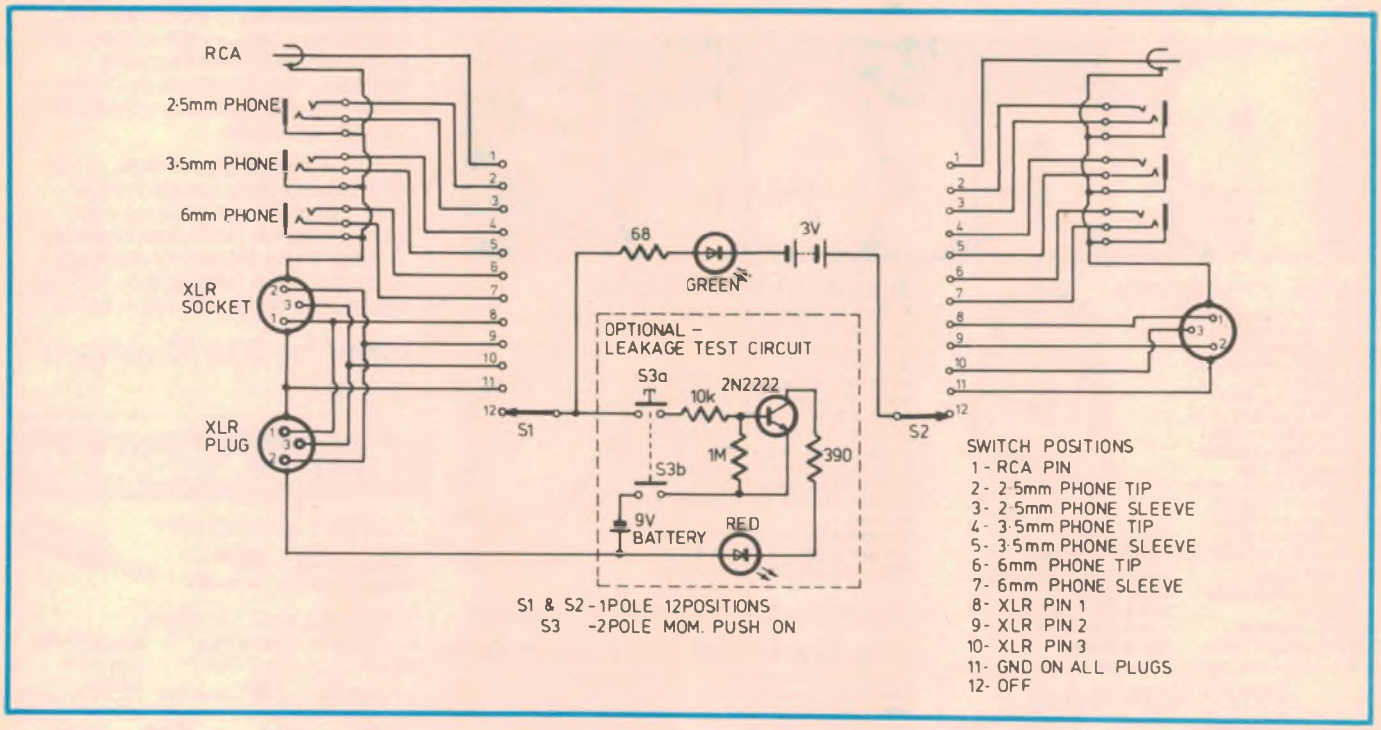
6.5mm Socket to RCA Plug Cat P-6550
$1.30 (10 up $1.15)

3.5mm Socket to RCA Plug Cat P-6540
$1.30 (10 up $1.15)

RCA Socket to 3.5mm Plug Cat P-6560
$1.30 (10 up $1.15)

Circuit & Design Ideas

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



Cable tester

This circuit was designed to test audio cables as used by musicians and clubs using audio equipment.

By using stereo phone sockets (2.5mm, 3.5mm, 6.5mm) mono plugs used on cables may be checked as well. A cannon XLR plug and socket were used on one side to give a greater flexibility.

Short leads with back-to-back stereo phone plugs are used to adapt the phone sockets to suit line sockets. The same may be done to the RCA socket.

With the use of two single pole twelve position switches, it is possible to check over a hundred different combinations of audio cables.

While the unit is also able to check for short circuits to ground from the centre pins, the optional circuit within the dotted line will check for a high resistance leak to the ground side of any cable plugged into the left hand side. With the circuit values shown, resistances of up to one megohm can be detected.

Keith Wilkinson-Reed,
East Devonport, Tas. **$10**

Car accessories timer

This timer was designed to switch on the "accessories" supply in a motor car for a ten minute period. It avoids the frustration of your passengers having no radio simply because you need the car keys to open to boot or petrol cap.

A single pushbutton serves three functions. With the relay off, it starts the timer and switches on the relay. With the relay on, it resets the timer to give a further full ten minutes delay. And by holding the button in for about one second, it switches the relay off.

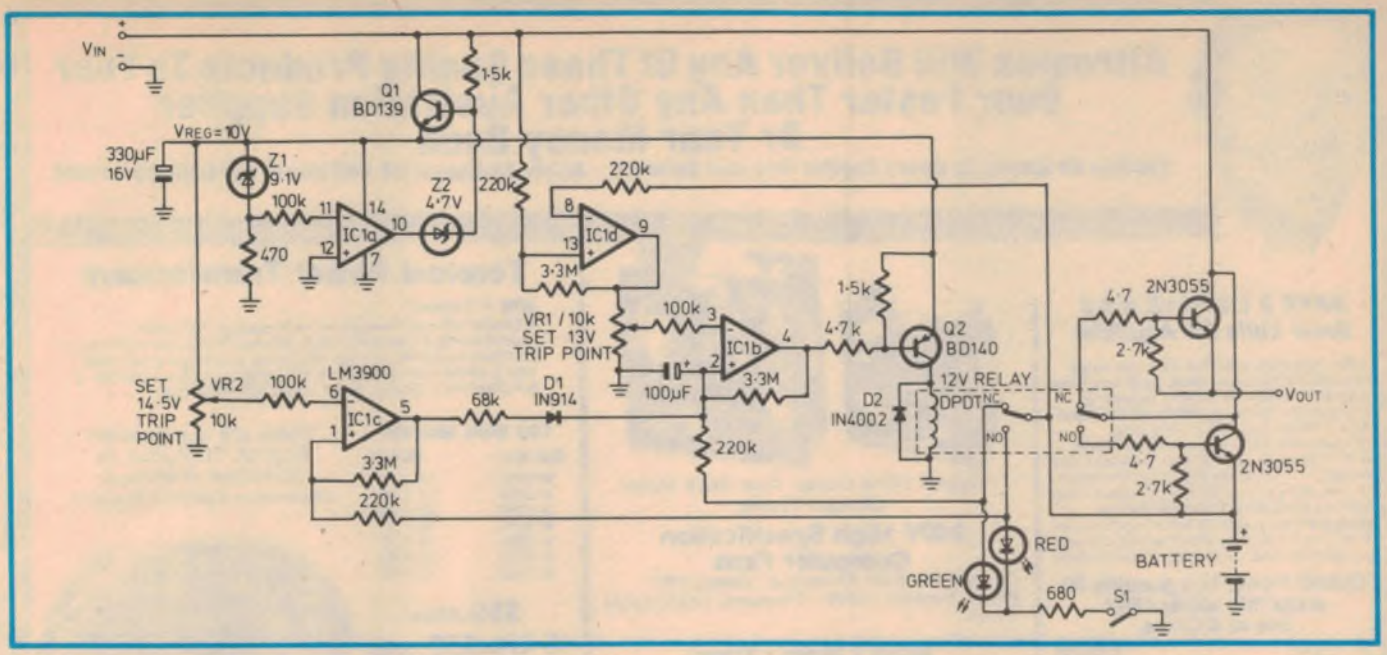
Here's how the circuit works. Pressing the pushbutton generates a 40 millisecond pulse via monostable IC3d. This clears the counter (IC4) and sets the flipflop (IC2a/IC2b), thus turning on the relay via Q1 and enabling the oscillator, IC3b. Also the LED lights, to indicate that the circuit is on.

IC3b clocks the counter at about 3Hz. The Q12 output of IC4 thus goes high after approximately 680 seconds, resetting the flipflop. The relay turns off and the oscillator stops.

Holding the pushbutton in causes C1 to charge via R1. This provides a delay so that the counter has time to clear. If C1 is still charged when Q3 of IC4 goes high (about 1.3 seconds later), the flipflop is reset.

Exact timing depends on the hysteresis levels of the 4093, and may require tuning by adjusting the timing resistor on IC3b. Shorter time delays can be provided by selecting a different output from IC4.

Peter Stoddard,
Muswellbrook, NSW. **$20**



Improved battery charger controller

This is an improved version of the controller published in the September 1986 issue. The original circuit proved to have a few problems in some readers' applications, so I developed this more rugged version with automatic shut-down.

As before, the circuit allows battery charging whenever the battery voltage is below 13V and disconnects the battery from the charger when battery voltage reaches 14.5V. Typical chargers include solar panels and mains powered chargers.

An LM3900 quad Norton op amp IC1 is used for voltage regulation, voltage comparison and finally as an OR gate. A relay is used to switch to the battery charger.

IC1a is used as a voltage regulator and, in conjunction with Q1, sets the voltage of Vreg to about 10V.

IC1b monitors the battery voltage when the relay is switched off, via the RLY1a position C contact. When the voltage drops below 13V, the output of IC1b switches the output of OR gate IC1d high. This turns on transistor Q2 to switch on the relay.

At this stage, the battery is connected to the battery charger via relay contact RLY1b in position 2. IC1c now monitors the battery voltage via the RLY1a contact at position D.

When the battery voltage reaches 14.5V, the output of IC1c goes high and this is coupled into the positive input of IC1b via D1. This causes the output of IC1b to go high again, switching off Q2 and the relay. This disconnects the charger from the battery.

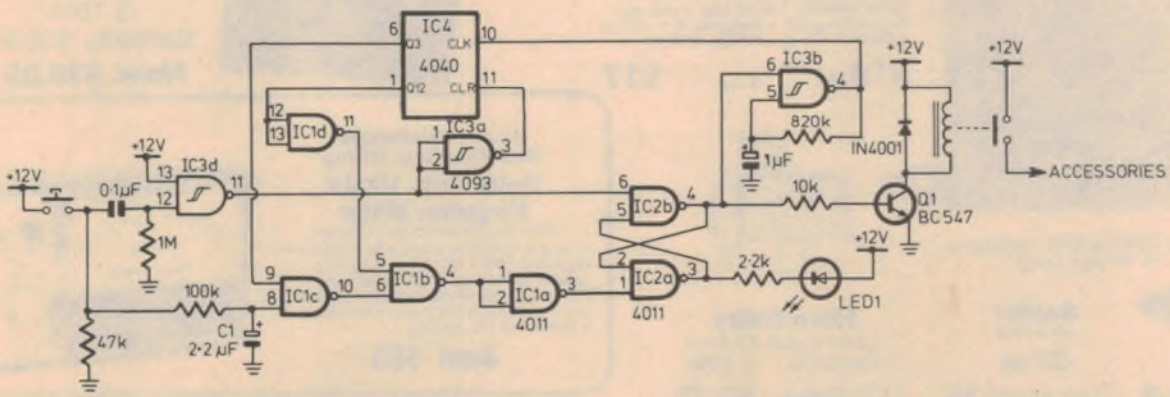
IC1d is used to introduce hysteresis into the 13V trip point reference voltage, to prevent chattering of the relay contacts.

Note that when the charger is disconnected from the battery, the charger voltage is directed via the RLY1b contact to Vout. This voltage can then be used to operate a similar charger circuit.

The LEDs are used to indicate the charger status. The green LED indicates when the charger is disconnected from the battery and the red LED indicates that the charger is charging the battery.

Setting up is simply a matter of adjusting VR1 and VR2 so that the relay switches on with battery voltage below 13V and switches off above 14.5V. Note that if a mains operated charger is used, a 4700uF/25VW capacitor or larger should be connected between Vin and ground.

W. Jolly,
Nambucca Heads, NSW. **$15**



Altronics Will Deliver Any Of These Quality Products To Your Door Faster Than Any Other Australian Supplier Or Your Money Back

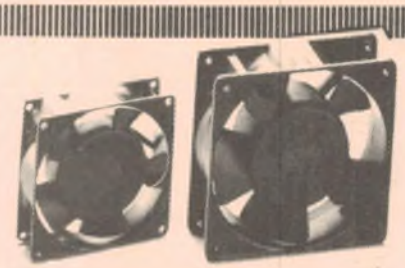
(Within 24 Hours To Every Capital City and Suburbs - Allow Additonal 24 - 48 Hours For Country Areas)

SAVE $ $ $ SAVE $ $ $
Great Little PA Amplifier

This natty little amplifier includes some remarkable features which, until now have only been available on very expensive commercial items e.g. **Balanced Mic Input**- This enables you to run very long microphone leads without troublesome interference or hum pickup. **Balanced line output** - This enables you to run the speaker lines right alongside the microphone line without instability. **Constant voltage design** allows you to switch on one speaker circuit or all circuits together without any noticeable variance in output sound level.

Output Power is a genuine 30 watts into either 100V line or 4 Ohms.

A 2000 ..... **$259**



Rugged Ultra Quiet- Now With Metal Diecast Frame

240V High Specification Computer Fans

Durable Die Cast Aluminium Venturi PBT Plastic impeller of 94V—0 material. Shaded pole motor.

80mm x 80mm x 32mm

Air Flow 45 C.F.M. **Input Power** 16W **Speed** 2300 RPM **Noise Level** 31 dba. **Cat. F 1020**

$24.50ea 4 or More **$22.50**

120mm x 120 x 38mm

Air Flow 80C.F.M. **Input Power** 25W **Speed** 2600 RPM **Noise Level** 43 dbA. **Cat. F 1030**

$24.50ea 4 or More **$22.50**

Fan Finger Guards

F 1022 (for 80mm Fan) **$1.50**

F 1032 (for 110mmFan) **$1.50**

Toroidal Power Transformers

Why a Toriod?

• Smaller size and weight to meet modern "slimline" requirements • Low electrically induced noise demanded by compact equipment • High efficiency enabling conservative rating whilst maintaining size advantages • Lower operating temperature • Simple, quick single bolt mounting

160 Watt Models

Cat.No.	SEC.V
M 3050	12 + 12
M 3055	18 + 18
M 3060	25 + 25
M 3065	30 + 30
M 3070	35 + 35
M 3075	40 + 40
M 3080	45 + 45

$59.95ea

5 Up **$55.00ea**

300 Watt Models

Cat.No.	SEC.V
M 3085	12 + 12
M 3086	18 + 18
M 3088	25 + 25
M 3090	30 + 30
M 3092	35 + 35
M 3100	40 + 40
M 3105	45 + 45

$69.95ea

5 Up **$65.00ea**

These are the Genuine English TOROIDS as Specified in various Electronics Australia Projects

Dimensions & Weight

160 VA Models 110 Diam. 45mm H. 1.8Kgs. Leads 200mm

300 VA Models 125 Diam. 45mm H. 2.5Kgs. Leads 200mm

Super Compact Transformer Delivers 12, 15, 24, 27, 30V At Up to 10 Amps Just The Shot for 12 & 24V Supplies & Charging; Circuits

Multipurpose 120VA Transformer

Another Quality Transformer from Altronics. The M 2175 is wound on expensive grain oriented steel. Look at the size! Just 110mm Wide by 65mm High by 65mm Wide. Weight 1.25Kgs. **M 2175**

Primary 240V
Secondary 1 0—12V @ 5A,15V @ 4A
Secondary 2 0—12V @ 5A,15V @ 4A

1—9 **$39.95** 10Up **$35.00ea**

Piezo Tweeter 150W

95.3mm Diam. Piezo Speaker Suitable for HiFi applications. **Frequency Response:** 3K to 40KHz **Sensitivity:** 104db @ 2.8V **Cat. C 6100**

$16.95 4 Up **$15**

150W HiFi-PA Piezo

144.8 x 54mm Rectangular Piezo Horn Speaker suitable for HiFi and Sound Reinforcement. Full 90 deg. horizontal dispersion angle • **Freq.Res.** 3 to 40KHz • **Sens:** 110db @ 2.8V **Cat. C 6120**

$18.95 4 Up **$17**

Engineers Multimeter

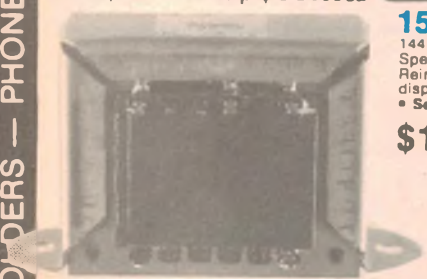
$10 Off This Month

Includes Continuity Buzzer

20,000 Ohms/Volt DC • 8,000 Ohms/Volts AC. Mirror backed scale • Overload protected. 10 amp DC current range. Unique carry handle doubles as a bench stand.

RANGES
DC Voltage
2.5, 10, 50, 250, 1000V
AC Voltage
10, 50, 250, 1000V
Decibels
—8db to +62db
DC Current
5, 50, 500mA
Ohm meter 0-6 meg. Ohms in 3 ranges,50 Ohms centre scale.
Size 135 x 91 x 39 mm
Includes Battery Tester

Q 1018
Normally $39.95
Now $29.95



Heavy Duty Unit Suitable For Boards Up To 400mm Long

Horn Relay
12-16V coil 20 Amp Contacts . **S 4130**

1/2 Price $3.75

Solder
200g Reel
$7ea
10 or More **$6**

Check Appliances And Electrical Wiring

Build This 1000V Megohm Meter

(1985 Successor to the "Megger")

It uses a transistor inverter to produce a regulated 1000V DC supply which is applied to the insulation under test. Insulation resistances between 2M Ohm and more than 2000 Ohm can be measured. **K 2550** (See EA July'85)

Just $55

Manufacturers, Contractors, Resellers Visit Our Wholesale Booth At The Sydney IREECON Exhibition September 15th — 18th at Sydney Show Grounds

Get a System for Mum and the Kids
Full Security System

Fantastic system for this price. Frankly we were amazed at the performance of this very compact system.

Very simple to connect and operate - New Technology has enabled very compact overall dimensions (master unit only 180 x 100 x 65) hence ideal for concealing amoung book shelves etc.

S 5310 ~~$99~~ **$75**

Look At The Features

EXIT DELAY 30-35 secs. **ENTRY DELAY** 10 secs. **DC SOURCE** AC adaptor 240/9V DC Supplied **BATTERY BACKUP** 9V Nicad rechargeable - additonal cost S5024 $14.50. **AUTO RESET** 3 minute operate cycle and auto reset **RANGE** Reliable to 30ft.(9M) **LOW BATTERY INDICATOR** included.

Accesories Included for the One Low Price

4 Sets Reed Switches for Window/Doors 1 Roll flg. "8" cable. 1 External Type Horn Speaker. 1 AC/DC plug pack adaptor. Now there is now excuse for not Protecting yourself, your family and all your hard earned possessions!

Strobe Signal Lamp

Uses Xenon Strobe tube for High energy strobe flash output at a rate approx. 1 per second. Fantastic light energy output for the DC power used. DC Input 12V 320mA Dimensions 97 dia.90H

S 5455 Blue
Was $24.50
NOW $19.00

Sealed Lead Acid Batteries

These rugged high performance batteries are ideally suited for systems where uninterrupted DC power is required i.e. Security Systems, Computers, Solar Power Systems etc.

Three Models To Choose From

S 5065	12V/1.2AH	**$22.95**
S 5067	12V/2.7AH	**$34.50**
S 5069	12V/4.5AH	**$45.00**

Mains Transformer Bargains

Great For All Sorts of Projects

M 2851 240 — 12.6V at 150mA
Was $5.50 Now $4.99

M 2155 240V—6.3V,7.5V,8.5V, 12.6V, 15V at 1A
Was $7.95 Now $6.00

Quality Long Life Hand Tools

All stainless steel construction with insulated handles. Ideal for the hobbyist and tradesman alike.

Diagonal Cutter	T 2700	$9.95
Flat Nose Plier	T 2710	$9.95
Needle Nose Plier	T 2720	$9.95
Curved Needle Nose Plier	T 2730	$9.95

Buy the set of 4 for Only $30 and Save

Mylar Stereo Phones With Dynamic Mic

Simply Brilliant Mylar Stereo headset and Dynamic Mic combination. **Phones** 30-18KHz 28 Ohms, 6.5mm stereo Jack Max. input 400mm **Mic.** 84db, 600 Ohms, 6.5mm Mono Jack

$32.50 NOW $29.50

New Model IRD Has Fantastic Range

Infra Red Movement Detector

With Two Mode Lens

Features:

- Lens simply 'snaps' to either **wide angle** (range 40 feet) for normal use or **Normal angle** (range 80 feet plus) for corridor applications.
- Snazzy integral mounting bracket allows corner 90 deg. mounting as well as normal surface mount (This is a fantastic feature as these work best in corners and are visually unobtrusive)
- 12V DC Powered
- Built-in test lamp
- Alarm output SPDT 30V 1a

S 5301

Why Pay $150 or More

Our Price **$99ea**
10 or More **$90ea**

N.B. These professional detectors use state of the art circuitry to achieve ultra reliability in operation. They are currently specified by several "Name" commercial Security Companies.

Fantastic for Heatsink Cooling with Amplifiers, Power Supplies, Inverters etc.

New DC Brushless Fan

Electronically commutated DC motor ensures low vibration and ultra long life

120mm x 120mm x 38mm

Voltage	24V DC
Current	330mA
Speed	3100 RPM
Air Flow	23 C.F.M.
Noise Level	32dbA

F 1040 ..... **$29.98**
4 or More **$28.00ea**

Desk Mounted Lamp Magnifier

If you have trouble with fine PCB work or component identification but still want both hands free, this is for you.

C 9050

Quality Australian Made Product

TECHNICAL INFORMATION Illumination: 22W Fluorescent **Weight:** 8.16kg. **Lateral extension:** 254mm **vertical extension:** 254mm

Now Only

UV EPROM ERASER

Cat D 1450

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 for 9 chips (less for less chips).

• **Erase up to 9 chips at a time** • Chip drawer has conductive foam pad • Mains Powered • High UV intensity at chip surface ensures thorough erase • Engineered to prevent UV exposure • Long Life UV tube • Dimensions 217 x 80 x 68mm • Weight 670 grams

Magazine Binders for Your EA's and ETI's

Holds 12 magazines, each on a spring out wire rod. Just the shot for each years set of EA's ETI's or any of your favourite magazines. **Cat. B 9999**

$8.50

Phone Double Adaptor 1/2 Price

P 0995 **$4.50**

High Definition Computer Monitor New 2 DIN Series 4

The New 2 DIN Computer Monitor has a high performance Non Glare CRT designed to reduce eye strain and improve concentration. Coupled with the non-glare screen is a rock solid Video display and high resolution characters.

SPECIFICATIONS:

Screen	Green Phosphor - Non glare 14
Front Controls	Power On/Off, Contrast, Brightness
Rear Controls	Vertical size, vertical hold.
Bottom Controls	Horizontal hold, horizontal position.
Input Impedance	75 Ohm/10K switch selectable
Bandwidth	18MHz
Resolution	900 lines at centre screen
Input/Output Connector	RCA
Input	Composite Video 1V P-P

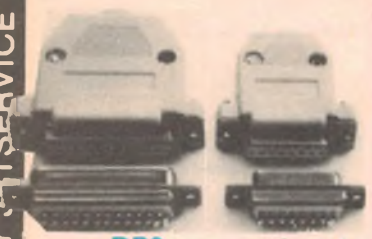
D 1115 **$229** This Month **$199**

Definitely Australias Best Value In a High Resolution Monitor

Save Up To 50% On Top Quality D Series Connectors!
Fantastic Value

D Series Computer Connectors. Gold Plated Professional Series

Items Marked • are 1/2 Price or Less



		WERE	NOW
DB9			
P 3000	Male 9 Pin	2.95	1.95
P 3010	Female 9 Pin	3.25	1.60•
P 3020	Male PCB Rt/L	3.75	3.60
P 3030	Fmale PCB Rt/L	4.50	3.25
P 3040	Male PCB mnt.	2.95	2.85
P 3050	Fmale PCB mnt.	3.95	3.25
P 3090	Backshell cover	1.95	1.29
DB15			
P 3100	Male 15 Pin	3.25	2.50
P 3110	Fmale 15 Pin	3.85	1.90•
P 3120	Male PCB Rt/L	4.35	2.95
P 3130	Fmale PCB Rt/L	5.50	2.75•
P 3140	Male PCB mnt.	3.85	1.90•
P 3150	Fmale PCB	4.85	2.40•
P 3190	Backshell cover	2.20	1.10•
DB25			
P 3200	Male 25 Pin	4.95	2.45•
P 3210	Fmale 25 Pin	5.50	2.75•
P 3220	Male PCB Rt/L	4.95	3.95
P 3230	Fmale PCB Rt/L	6.90	3.45•
P 3240	Male PCB mnt.	4.95	2.45•
P 3250	Fmale PCB mnt.	6.25	3.10•
P 3290	Backshell cover	2.20	1.10•

High Quality — High Power Ratings
Polypropylene Loudspeakers

Virtually all the famous "Name" loudspeaker makers now use Bextrene or Polypropylene Cones with their drivers. The advantages are considerable - less cone flexing or "break up", improved bottom end response and reduced enclosure sizes.

One of the problems of course, has been the high cost of P-P drivers. Fortunately, **with Altronics direct import prices, you can now be the owner of any of these fine speakers for a fraction of what you'd expect.**

Note: the conservative power ratings, the massive magnets employed and high order sensitivity specifications with these fine Drivers.

Brief Specifications (All 8 ohm Voice Coil Impedance)

6 1/2" Woofer/Midrange
30 Watt RMS-50 Watts Max

C 3055 **$24.50**

Frequency Response fo—3000Hz **Resonant Frequency** 36Hz **Sensitivity** (1M/1Watt) 87db (+ or -2db **Voice Coil** 25mm **Nett Weight** 900gm **Electromagnetic Q** .48 **Magnet** 280 gm.

8" Woofer
60 Watt RMS 100W Max

C 3060 **$49.50**

Frequency Response Fo—3000Hz **Resonant Frequency** 33Hz **Sensitivity**(M/1Watt) 90db (+ or -2db) **Voice Coil** 38mm **Nett Weight** 2200 gm **Electromagnetic Q** .4 **Magnet** 836 gm.

10" Woofer
60 Watt RMS 100W Max.

C 3065 **$65.00**

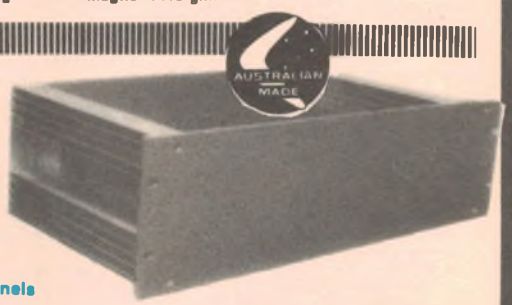
Frequency Response fo—3000Hz **Resonant Frequency** 30Hz **Sensitivity (1M/1Watt) 92db** (+ or -2db) **Voice Coil** 38mm **Nett Weight** 2650 gm **Electromagnetic Q** .23 **Magnet** 836 gm.

12" Woofer
100 Watt RMS 150W Max

C 3070 **$99.00**

Frequency Response fo—2000Hz **Resonant Frequency** 23Hz **Sensitivity** (1M/1Watt) 93db (+ or -2db) **Voice Coil** 38mm **Nett Weight** 3620 gm **Electromagnet Q** .22 **Magnet** 1410 gm

High Energy Rack Case



The use of Super Heavy Duty Heatsinks as Rack Case sides now allows a myriad of Amplifiers, Power Supplies, Battery Chargers etc. to be built in an "Off the Shelf" rack case.

Fantastic for Stereo Amplifiers—Each Heatsink will accommodate an audio output stage of approximately 120W with normal efficiency and dissipation.

A Great Chassis for Heavy Duty Power Supplies and Battery Chargers. We suggest the mounting of Rectifier Bridge or diodes on one Heatsink and the Regulator devices on the other.

Order With Either Black Or Natural Anodised Front Panels

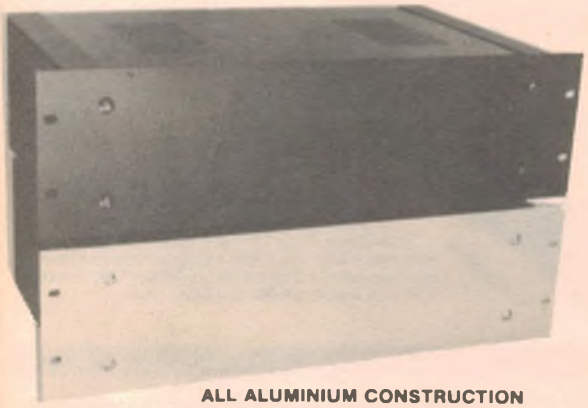
H 0417 Natural Anodised Front Panel **$89.00** H 0418 Black Anodised Front Panel **$89.00**

Specifications:

Heatsinks Altronics H 0590 **Front Panel** 3 unit Rack size 480mm x 132mm x 3mm **Base** 1.0mm steel, ventilation slots provided **Top Cover** 1.0mm steel, ventilation slots provided **Internal Dimensions** 125 x 370 x 250mm **External Dimensions** 130 x 440 x 252mm plus standard front panel **Finish** Black anodised aluminium plus powder coat black top/base.

PROFESSIONAL SERIES RACK CABINETS

Now your preamps, Amps, Control Modules Monitor Panels etc. can look every bit as good as Technics Nakamichi and other top manufacturers.



ALL ALUMINIUM CONSTRUCTION

FEATURES: These beautifully crafted rack cabinet boxes will give your equipment a real 1st class appearance with removable top and bottom cover panels • All dimensioning conforms to the International Standard • Natural or Black finish • Ventilated lid • Deluxe finish front panel • Individually cartoned • Supplied in Flat Pack Form - Easily assembled in minutes - **Side Elevations:-** D=254mm C (Internal Chassis Height) • B (mounting Bolt Centres).

SIX NATURAL AND BLACK FINISH MODELS — The Black or Natural finish cabinets are each available in 44mm, 88mm or 132mm high models. Mounting hole centres conform exactly to International Racking Specifications both vertically and horizontally.

Cat. No.	Finish	A	B	C	Were	Now
H 0401	Natural	44	34	38	$59.95	$50
H 0402	Natural	88	57	82	$69.95	$62
H 0403	Natural	132	89	126	$85.00	$79
H 0411	Black	44	34	38	$59.95	$52
H 0412	Black	88	57	82	$79.95	$70
H 0413	Black	132	89	126	$89.95	$80

Nifty Little Chassis Maker and Pan Brake Bender

Make Your own Chassis and Cases and Save a Fortune

Please Note: This product is a genuine Pan Brake Bender allowing you to make quite complex chassis boxes, lids, trays etc. - It is made from solid steel and is not to be confused with inferior Non Pan Brake simple benders currently sold by our competitors.

Value Plus

T 2400 ..... **$99.95**

Brilliant Solar Panel Array 18V @ 400mA

Fantastic for Trickle Charging 12V Battery Systems

18V at up to 600mA under ideal sunlight conditions, Intended for charging 12 volt systems such as Car, Caravan and Boat batteries etc.
Cat. A 0220

Was $119
Now $99

BANKCARD HOLDERS— PHONE ALTRONICS TOLL FREE 008 999 007 FOR NEXT DAY JETSERVICE DELIVERY

Superb Eleco Wireless Microphone System uses Dual Diversity Receivers for Long Range, Noise Free Pure Fidelity Reproduction.

Now Available In Australia For Less Than $1,000

Altronics proudly release the Eleco System - Used Worldwide by Entertainers i.e. Rolling Stones, Dire Straites, Tina Turner and 1000's more!

Superb Microphone Reproduction Compares with Shure, Beyer and AKG

Unique Microphone design completely Eliminates "Dangling" Antenna

Breathtaking performance without signal drop-out or noise interference. The Eleco Wireless Microphone System is virtually the ultimate in an Entertainers Microphone system (or for any roving microphone application for that matter!)

All the annoying wireless microphone characteristics such as "drop out", static and noise are completely eliminated by use of **auto switching dual diversity receivers.** The output of each receiver is continually monitored, with the strongest and clearest signal always selected. **Dynamic Range exceeding 100 db** is obtained by employment of a Patented special Parabola level compressor and Dynamic expander.

The operating range is a minimum of 50 metres (often this can be extended to 200 metres and more in normal circumstances).

Several Frequencies are available to aleviate cross interference when two or more systems are used in proximity.

Brief Specifications Frequency 202.1, 202.9, 203.7 MHz (Please specify if you have a preference)
Mic Carrier Power 50mW (Max) **Mic Antenna** built-in **Dynamic Range** over 100db **S/N Ratio** better than 90db **Frequency Response** 20Hz to 16KHz + or - 3db **Mic Battery** 4 x AA cells **Battery Life** over 24 hours continuous operation **Receiver Sensitivity** 12db/micro volt for 60db S/N ratio **Pre emphasis/De emphasis** 50us. **Receiver output** unbalanced 6.3mm phone jack and balanced 3 pin cannon type. **Output Level** (adjustable) Unbalanced 0-2.5V Balanced 0 to + or - .3V into 600 ohms. **Receiver Power Supply** 200 - 260VAC.

Prices

(A) Dual Diversity Receiver **$729.00**
(B) Entertainment Microphone (hand held type) **$349.00**
(C) Lavalier Type Microphone **$349.00**

Bonus Offer SAVE $78 **Choose Receiver and Either Microphone For Just $999**

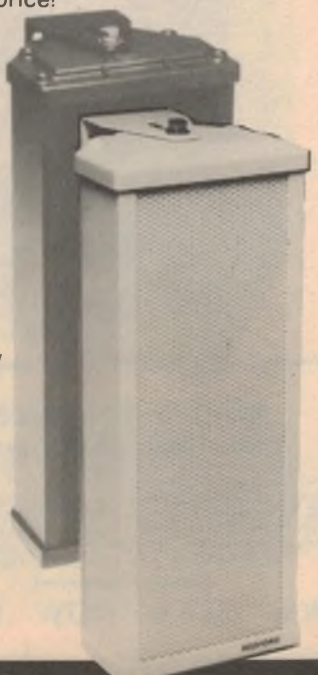
Please Note 3 different operating frequencies are available (you will need to specifically nominate desired frequency only if the equipment is being used in proximity with other Eleco Systems on the 200MHz band.

Frequencies

C 0111	Dual Diversity Receiver	202.1MHz	$729
C 0113	Dual Diversity Receiver	202.9MHz	$729
C 0115	Dual Diversity Receiver	203.7MHz	$729
C 0121	Entertainment Microphone	202.1MHz	$349
C 0123	Entertainment Microphone	202.9MHz	$349
C 0125	Entertainment Microphone	203.7MHz	$349
C 0131	Lavalier Microphone	202.1MHz	$349
C 0133	Lavalier Microphone	202.9MHz	$349
C 0135	Lavalier Microphone	203.7MHz	$349

AT LAST Design Quality Weather Proof Speakers And Sound Columns By *Redford*

• Rugged extruded aluminium construction • Superb powdercoat industrial paint finish • Engineered in Australia • Excellent reproduction • Superior to imports — Yet just a fraction of the price!



Altronics proudly announce the release of the superb ***Redford*** Weatherproof Speaker and Sound Column Range. Imagine a wide range speaker system which is highly directional and with efficiency approaching that of reflex horns!

Redford is the solution for high quality sound reproduction outdoors. The Five Models to choose from "Fill the Bill" from applications on boats to high grade paging and music entertainment installations.

RUGGED EXTRUDED CONSTRUCTION

These vibration free enclosures are constructed from die extruded heavy gauge aluminium and finished with incredibly durable industrial powdercoat enamel. The speaker ends are sealed via gaskets and tough moulded "LURAN S" UV resistant end caps. The end result is "Good Looks" together with assured rugged durability for the Australian environment.

EXCELLENT REPORDUCTION

The drivers have been chosen for wide range,low distortion, mid range "presence" (essential for high grade vocal work) and high efficiency in general. **Power Capacity** for short term use, the drivers will safely handle 150% of rated power. Acoustic wadding is used to dampen Bass resonance. **Weather Proof Construction and use of "Doped Cones"** Foam plastic and cloth is sandwiched between Baffle and Front Grill to prevent water ingress. A first for ***Redford*** is the use of a patented cone moisture repellant process for all models.

Wide Range Weatherproof Extension Speakers For Your Stereo System

Great For The Back Patio,Swimming Pool, Games Room, Den, Pool Room Etc.

Dimensions 260mm wide x 170mm high x 150mm D. (Mounting brackets are included)

10 Watt 16 Ohm (Max 15 Watt)
Single dual doped cone driver 16 ohm impedance is employed to give a generally correct volume balance with main speakers - an added bonus is your amplifier load is kept to respectable limits!! Great for back patio, Den, Boat Deck etc.

C 0938	White	**$99ea**	**$190 per Pair**
C 0940	Black	**$99ea**	**$190 per Pair**

20 Watt 8 Ohm (Max 30 Watt)
Use 2 special dual doped cone drivers for those wanting a bit more umph!

C 0943	Black	**$139ea**	**$260 per pair**
C 0944	White	**$139ea**	**$260 per pair**

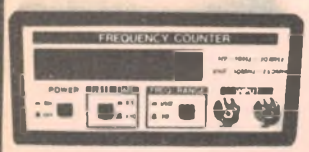
100 Volt Line Models For Use With Professional PA And Music Systems
Using a "Doped" wide range drivers and fitted with grain oriented steel line transformer. Output cable allows connection to 10W/5W/2.5W with 10 watt models, 20W/10W/5W with 20 watt models and 40W/20W/10W with the 40 watt versions.

C 0941	**10W/100V line Black** $119ea	$220 per pair
C 0942	**10W/100V line White** $119ea	$220 per pair
C 0945	**20W/100V line Black** $169ea	$299 per pair
C 0946	**20W/100V line White** $169ea	$299 per pair
C 0950	**40W/100V line Black** $225ea	$399 per pair
C 0955	**40W/100V line White** $225ea	$399 per pair

Great Test Gear At Bargain Prices

150MHz Frequency Counter

A frequency counter is invaluable for the accurate alignment and testing of many modern electronic circuits.



SPECIFICATIONS:-

Frequency Range	10Hz - 150MHz
Gate Time	1 sec, 6 sec.
Accuracy	+/- 1 count
Max. Input	20V P-P
Sensitivity:-	
• 10Hz - 30 MHz	25mV - 100mV
• 10MHz - 150MHz	100mV - 300mV
• Power requirement	9V DC at 100mA

Use Our 9V Plug Pack **M 9004**

Q 1520 ..... **$199.00**

Audio Frequency Generator

Often in testing audio circuitry it is necessary to have an accurate and adjustable audio signal source available. This little generator even allows you to test 455KHz IF stages!

SPECIFICATIONS:-

Frequency Range	10Hz - 1MHz
Accuracy	+/- 3% + 2Hz
Output Waveforms	Sine/Square
Output Level	Sine : 8V RMS Square : 10V P-P
Output Attenuator	0,-20 db,-40 db and fine adjust.

Q 1540 ..... **$249.00**

RF Signal Generator

An RF signal generator is an absolute must when it comes to radio servicing. With provision for both internal and external modulation this generator is a winner.

SPECIFICATIONS:-

Frequency Range	100KHz - 150MHz In 6 Ranges
RF Output Level	100mV RMS
Accuracy	+/- 3%
Modulation:-	
• Internal (30% Depth)	1KHz
• External	50Hz - 20KHz
• Crystal Locked Oscillator	

Q 1550 ..... **$199.00**

Brilliant Auto Ranging Digital Multimeter

Autoranging with Memory Function for Relative Measurements

Free Select either a carry Case or Holster this Month with your Q 1075 at no charge

Specifications

DC Voltage: Ranges 5(200mV, 2V, 20V, 200V, 1000V) **DCV Accurancy** 0.5%+ 1 DGT **AC Voltage: Ranges** 4 (2V, 20V, 200V, 750V) **ACV Accuracy** 0.75% + 5 DGTS **Input Impedance** 10M Ohm Min. **DC Current: Accuracy** 20mA—0.75% + 1 DGT 10A-1.50% + 5DGTS

Holster

What's this? For want of a better name we've named this thick rubber "cliparound" protector a "Holster" Great protector for field use, dropping on concrete floors etc.

Q 1077 **$9.50**

Carry Case

Keep your **Labtech** DMM looking like new for years!

Q 1076 **$9.50**

EA's Greatest Amp Project In 10 Years

'Sixty-Sixty' Integrated Amplifier Kit

(EA May,June,July '86)

Features:

• 60 watts per channel into 8 ohm loads • Very low noise on all inputs - better than CD performance • Very low distortion • Excellent headroom • Tape monitor loop • Tone controls with centre detent and defeat switch • Mono/stereo switch • Toroidal power transformer • Easy-to-build construction • Very little wiring.

Performance Specification

Power Output — 8 ohms 62W **Distortion** - Less than .0% at 1kHz. **Frequency Response** - Phono Inputs - RIAA/IEC equalisation within + - 0.5db from 40Hz to 20kHz Line Level Inputs — -0.5db at 20Hz and -1db at 20kHz **Input Sensitivity** - Phono 1kHz -4.3mV • Line Level - 270mV. **Hum & Noise** - Phono - 69db • High Level Inputs - 103db. **Tone Control** - **Bass** - + -12db at 50Hz **Treble** - +-12db at 10kHz. **Damping factor** - At 1kHz and 30Hz - greater than 80 **Stability** — Unconditional.

K 5060 **$299**

Beginner Constructors Can Build this Amplifier Kit — It looks terrific and will last you a lifetime. **Save $200 or More on comparable performance commercial units.**

"This New Amplifier offers a standard of performance far ahead of anything we have previously published and ahead of most commercial integrated Stereo Amplifiers".

"It is half to one third of the cost of an imported Amplifier with equivalent power output and performance". *Says Leo Simpson Managing Editor Electronics Australia Magazine.*

The reproductive purity of these speakers simply amazed us. The secret, of course is the DANISH VIFA Drivers. VIFA drivers are used in many top selling imported systems such as Bang & Olufsen, Rogers, Mission, Jamo, DCM Timewindow etc.

Build These Fantastic New Playmaster HiFi Loudspeakers

See Electronics Australia Sept '86

$449 full kit K 5090

If your budget won't run to the $600 to $800 needed for a fully imported pair of equivalent speakers, these are the ones to go for.

Medium Sensitivity Low Cost Multimeter

• 10,000 Ohms/Volt DC • 4,000 Ohms/Volts AC • Fuse and diode overload protection • A total of 19 ranges • Uses 1 x AA cell (included) **with mirrored scale Ranges - DC Voltage**— 0.25, 2.5, 25, 250, 1000 **AC Voltage** 10,50, 250, 1000 **DC Current** 0.1, 10,500ma **Resistance** 0-10 Meg. in 3 ranges • Safety off position to protect the meter movement. Feature packed. **Q 1015**

Sturdy Movement

Was $27.50 NOW $20.00

LOOK
Great Projects To Build

Fantastic New Kit From EA
Super Large LED Display Module
(Display 150 x 60)

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

External DC Supply Required 20 - 24V at 150mA

K 1225 **$49.95**

This Natty Single Button Security Lock Is Just The Shot For Your Garage, Workshop, Wine Cellar Or Front Door

4—Digit Combination Lock

This electronic combination lock has a four digit security code which is entered using a single pushbutton switch. For added security, each number of the code must be entered within certain time restraints. Once the correct code has been entered, the circuit triggers a solenoid operated door catch to unlock the door.

Altronic Kit Housed in sturdy Jiffy Box.

K 1925 ..... **$35.00**

Excludes Solenoid Door Catch
(Available from your local Security Store)

TRANSISTOR ASSISTED IGNITION WITH DWELL EXTENSION

Dead easy to build and (even better) there are only 3 electrical connections required to the car wiring system.

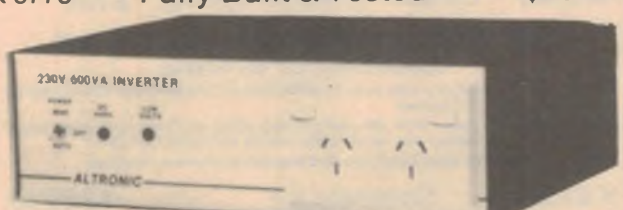
K 4010 ..... **$39.50**

The Power House Arrives
Massive 600 Watt Inverter
Operates from 12 or 24 Volt systems via internal wiring connections

Big brother to our 300W Model this brilliant design can be internally connected for either 12 or 24V operation. Full 600 watt output — and that will power a fantastic array of appliances e.g. Lighting, Electric Motors, Electric drills, Hi Fi, TV Sets, Computer.

An absolute must for House Power or for the Truck, Tractor etc.

K 6770	Complete Kit	**$399.00**
K 6775	Fully Built & Tested	**$499.00**



With Soldering Stations Costing $150 and More, This Represents Excellent Value

Temperature Controlled Soldering Station
(EA Sept.'86)

Controls the temperature of your standard soldering iron. Suitable for irons rated from 20W—75W - Standard soldering iron plugs straight in, no need for modification.

The Altronics Kit comes complete — Pre-punched and silk screened. **K 6400**

$35.00

Zener Tester

Used with your multimeter - Reads exact zener voltage up to 60V. **K 2620**

$12.50

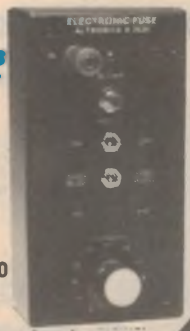
Save A Bundle On Those Dangerous Pesticides
Build EA's Great Ultrasonic Pest Repeller

EA's "Pest Off" generates frequencies between 23KHz and 64KHz claimed to be the best for driving off most vermin and beasties. **K 1600**

$39.95

Blowing Fuses Blowing Your Cool? You Need
The Electronic Fuse

K 2535 **$32.50**



All you do is clip the unit across the DC fuse holder (fuse removed), dial up the required current (max. 10A) and if the circuit draws more than this then the circuit "trips" or opens. Thus power is removed from the device.

Features: Fast blow - slow blow setting • Manual reset button • LED fuse tripped indicator • Operates off 1 single 9V battery (not supplied) • Two current ranges 0-1A & 0-10A • Any current setting available up to 10A • Current Settings easily adjustable via a pot and calibrated scale. • Housed in a rugged Jiffy Box.

A Must for prototyping and service work. No Electronic workshop should be without one.

Mosfet Power Amp Module 150 Watt

Here is a high power, general purpose power Amplifier module suitable for HiFi, guitar and PA applications employing sturdy, reliable **MOSFET's** in the output stage.

K 5120 **$75**

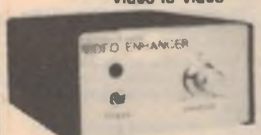
SPECIFICATIONS:
Power Output
150W RMS into 4 Ohms
100W RMS into 8 Ohms
(At onset of clipping)
Frequency Response
20Hz to 20KHz +0 -0.5db
10Hz to 60KHz +0 -3db
(Measured at 1 W and 100W Levels)
Input Sensitivity
1 Volt RMS for full output
Hum
98db below full output
Noise
114db below full output
Total Harmonic Distortion
0.006% @ 1KHz 12W
0.03% @ 10KHz 12W
Stability
Exceptional (tested to full output driving 3.3uF into short circuit at 10KHz).

DIGITAL PHOTO TIMER **$79.50**

This classy digital timer allows precision timing for photographic processing from 1 second up to 9 minutes 59 seconds in 1 second increments.

Features: Large easy to read LED displays. Hold switch which interrupts timing and focus switch which bypasses the timer settings. **K 1850**

Video Enhancer
Sharpens up your picture when Copying Video to Video



Here's a **simple** but **effective** video enhancer that is super **easy** to **build** at a fraction of the cost of commercial models. Unit sharpens picture detail, and can actually improve the quality of a copy by amplyfying the top end of the video signal **K 5825**

$42.50

Screecher Car Burglar Alarm

This alarm drives off wouldbe thieves with an ear splitting modulated tone. Once activated it is near impossible to stay within the confines of the car.

Features: Entry Delay • Exit Delay • Alarm Timer • Lamp Flasher • Three second soft alarm reminder. Piezo siren produces modulated tone of 110db at 1 metre. Simple to build and install. **Two Sensor Inputs**

K 4360
$34.50

Ultrasonic Movement Detector

This Ultrasonic Movement Detector provides added protection against illegal entry via an open window etc. Connects directly to an alarm with a normally open input. Detects any movement up to 3 metres within an angle of 30 degrees. Will operate directly off 12V i.e. Car Battery etc.

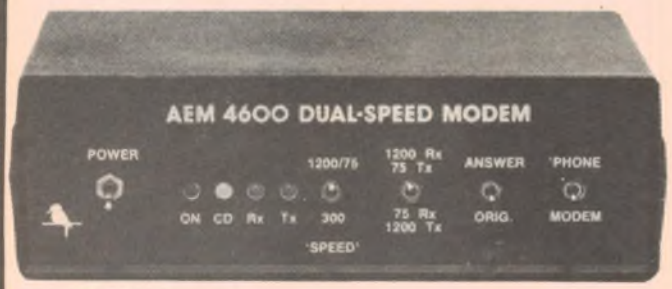
K 4400
$29.50

Excellent Kit Projects to Build

A 'Dual-Speed' Direct-Connect Computer Modem

Features: The project supports 300 Baud full duplex operation and 1200/75 Baud half duplex operation. That is, you can transmit and receive at 300 Baud in both directions or 1200 Baud one way, 75 Baud the other. A switch has been incorporated allowing you select either 1200 baud.

K 9600 **A Fantastic Performing Modem** **Only $169**



EA DUAL TRACKING POWER SUPPLY

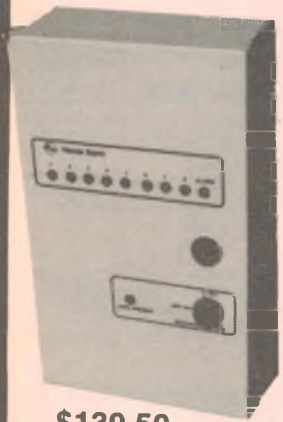
The Ideal Power Supply For The Audiophile Experimenting With Linear Op Amp Designs

• Floating Ground• Meter Switchable V to A • Voltage adjustable to within 10mV • Output + or -1.3V to + or -22V at 2 Amps + 5V @ 1.0 Amps. **K 3320**

$129.95

Super Low Price on Famous EA 8 Sector Alarm System Kit

(See EA Mag.Jan '85)



Features:

- Alarm has 8 separate input circuits - 8 sectors can be monitored independently.
- Each input circuit is provided with an indicator LED and a sector On/Off switch.
- Individual sector isolation allows the user to have some areas of the premises habited while others remain protected e.g. Inside Off/Outside On.
- Inputs accept both normally closed and normally open sensors.
- Two inputs provided with an entry delay between 10-75 seconds).
- Internal trip warning buzzer—alerts owner/occupant of pending alarm operation—great for the "forgetful" amoungst us. This buzzer is pre-settable between 5 and 55 seconds prior to Alarm.
- Unique circuit detects automatically when any N/O or N/C loops are either open circuit or dead short. **e.g. someone trying to bridge reed switches etc.**
- Switched output can be used to send a silent alarm through an auto-dialler circuit or similar.

$139.50

12/240V Inverter for Small Appliances

Low Power Design also Works as a Battery Charger

The inverter is ideally suited to powering low wattage mains appliances from the car battery while camping. This considerably improves the comfort level of the civilised camper. Similarly, it has uses in boating. Typically, it can be used to power an electric shaver, electric blanket, electric can opener or a 40W light bulb. Alternatively, back in the home (or still on the camp site). Frequency sensitive items such as belt or idler driven turntables can be powered at a very precise crystal controlled frequency for accurate sound reproduction. If speed variation over a small range is required, then a switch is provided to change from the crystal based 50Hz signal to a variable oscillator. **K 6705**

$79.50

Laboratory Power Supply

3-5 Volts at up to 5 Amps

Designed by Electronics Australia, this supply has been one of our most popular kits. Our version incorporates refinements and is now housed in an attractive, tough "ABS" instrument case. This all new compact version has been made possible by the use of a highefficiency Toroid Power Transformer. So you win four ways - less heat, less weight - Greatly enhanced appearance and easier to build - **Remember the Altronics Kit is fully drilled and punched.**

10 Turn Output Voltage Control Option

(K 330 is normally supplied with standard pot)

K 3301 ..... **$22.50**

Auxiliary + and -12V Output Terminals Option

(Fixed Outputs Independent of Variable Main Output)

K 3302 ..... **$12.50**

FANTASTIC HI TECH - HI SPEC

Audio Oscillator and Function Generator

This Ultra low distortion oscillator is comparable with the very best laboratory standard sine wave oscillators. As well as having very low distortion it has excellent envelope stability, square wave output and output metering.

2 Models to choose from (metered and unmetered)

• Frequency range 10Hz - 100KHz in 4 ranges • Output level 3V RMS max adjustable • Attenuator Odb, -10db, -20db, -30db, -40db, -50db plus fine adjustment • Output impedance — 600 ohms unbalanced • Output waveforms — sine and square.

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Active direct injection unit for stage and studio

This low cost DI box offers performance and facilities only found on the most expensive units. It converts a high impedance unbalanced input to a low impedance balanced output.

by ROB EVANS

The so-called "DI" box has become an essential part of studio and sound reinforcement equipment, its humble features found hiding in many a dark stage corner.

Although the expression "direct injection" may sound like a technique used in Artificial Insemination, (as some have suggested!), it is simply the process of connecting an electric or electronic musical instrument directly to the balanced microphone input of a mixing desk. This system avoids the use of a microphone, which is often placed in front of a loudspeaker of the instrument's stage amplifier. The signal received by the mixing desk is of a much higher quality with a DI box, for it avoids the non-linearities of the loudspeaker to microphone signal path.

As a bonus, more than ten of the described DI's could be built for the price of a high quality microphone. Good for the pocket as well as the ears!

Designed for the rigours of professional use, the DI is housed in a diecast box and uses rugged flush mount switches.

A DI box is designed to electronically "look" like a microphone to the input of the mixing desk, yet essentially offer no loading or degrading effects to the instrument source. Hence the unit is designed to have a high input impedance, while providing an output level and impedance similar to a microphone.

Balanced lines

High quality mixing consoles and microphones use the balanced line principle for their interconnection. This system enables very long cable runs to be used, with little losses or interference problems in a "hostile" environment (e.g., a strong mains field from a lighting dimmer rack)

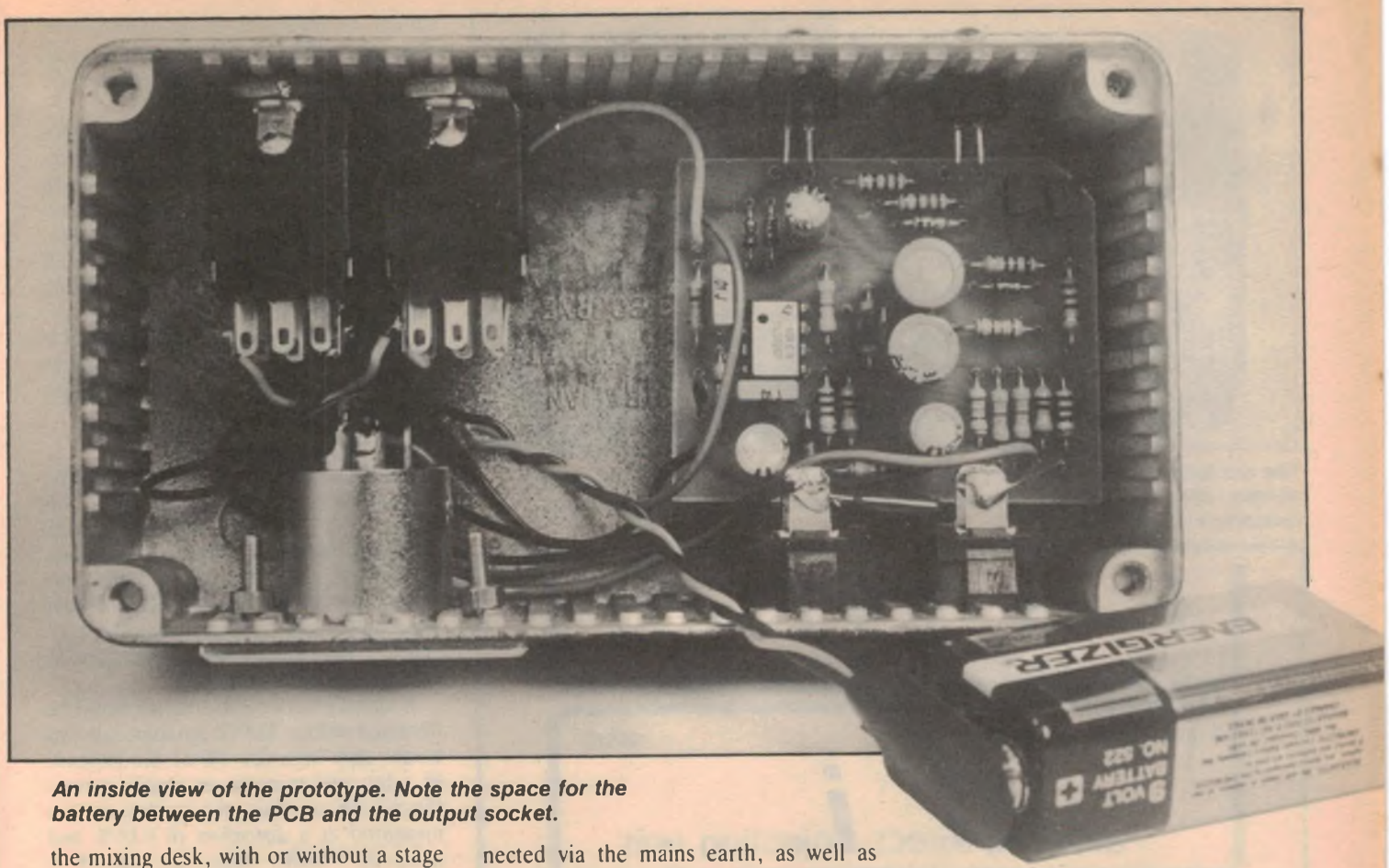
The standard balanced audio system uses a two core shielded cable terminated in XLR-style three pin connectors. Pin 1 is connected to the shield, while Pins 2 and 3 carry the signal, Pin 2 being 180 degrees out of phase with Pin 3.

This "antiphase" signal is received by a differential or subtracting amplifier, which will produce an output proportional to the *difference* in signal between pins 2 and 3. That is, any signal *common* to both lines will be ignored. Such is the case for induced hum, which will appear on both signal lines and thus be rejected by the differential amplifier.

The transmitting and receiving of these balanced signals has traditionally been achieved with transformers. This method is slowly yielding to the active balancing system, utilising low cost op-amps. Appropriate high quality transformers are very expensive, and can suffer from distortion and lack of shielding.

DI features

For a relatively simple device, the DI box requires a number of features for it to be completely effective in serious studio and stage use. It is generally used to couple a bass guitar or synthesiser to

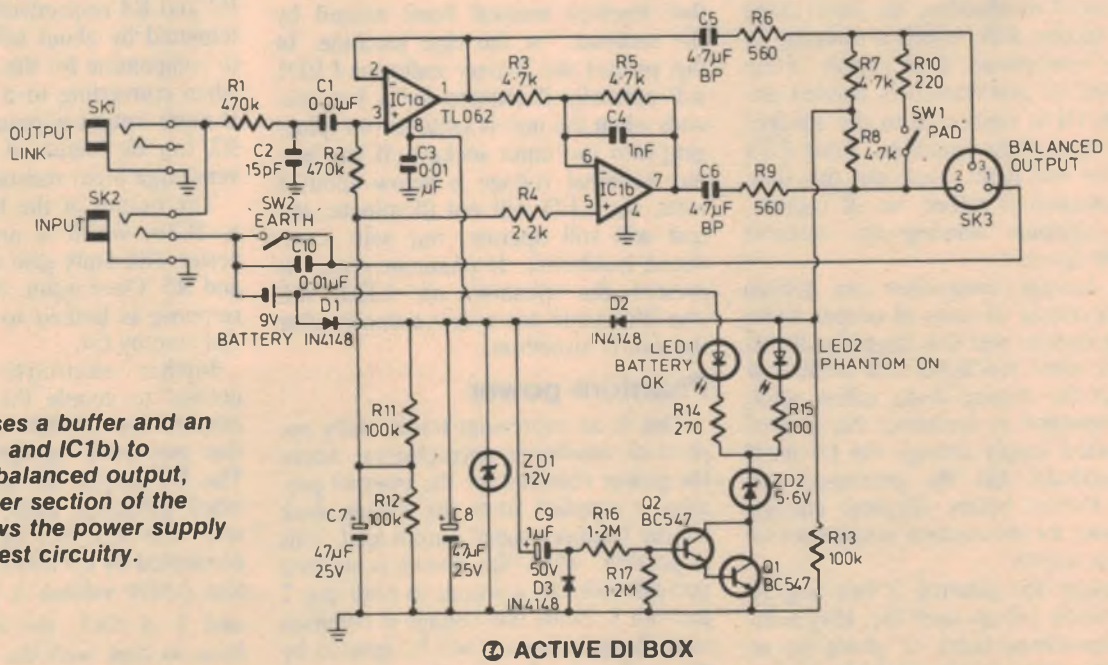


An inside view of the prototype. Note the space for the battery between the PCB and the output socket.

the mixing desk, with or without a stage monitoring amplifier.

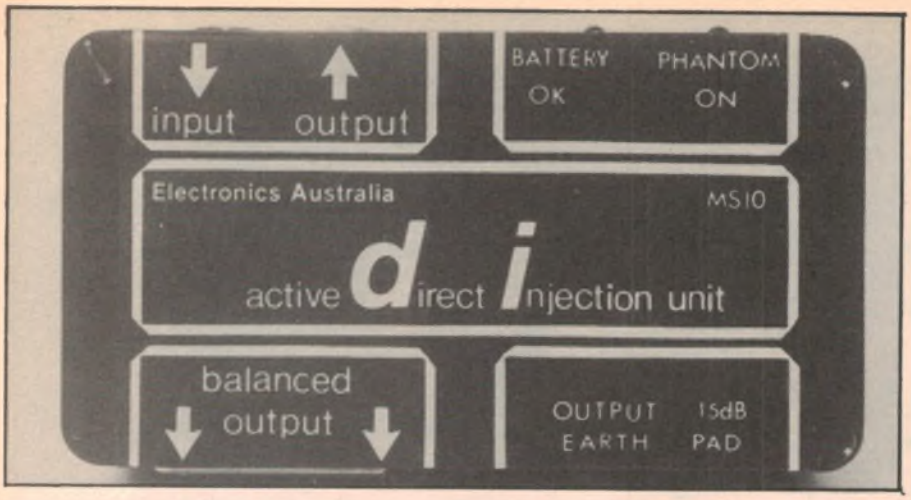
If a stage amplifier is used, an "earth loop" situation can easily develop, often causing a loud hum in the system. The "loop" in this case is due to the desk and instrument amplifier being connected via the mains earth, as well as the signal cable shield (Pin 1 of the XLR connectors). A switch is included in the DI box to disconnect pin 1 from the input earth when this situation occurs. Naturally, when the instrument (e.g. bass or acoustic guitar bug) is connected only to the DI box, the earth must be continuous.

A "pad" switch has been included to reduce the output of the DI by 15dB so

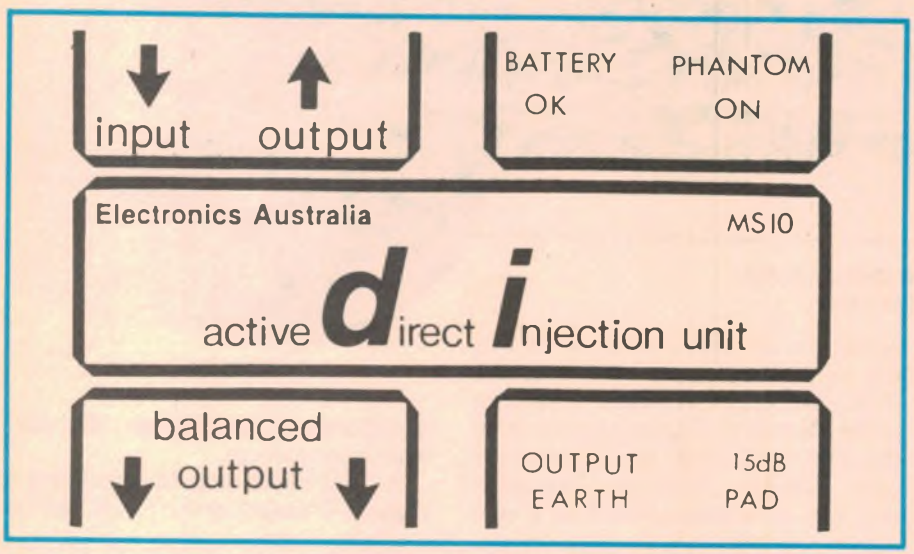


The circuit uses a buffer and an inverter (IC1a and IC1b) to produce the balanced output, while the lower section of the diagram shows the power supply and voltage test circuitry.

② ACTIVE DI BOX



The Scotchcal front panel was trimmed to allow easy access to the box lid screws, although the battery rarely requires replacement. The actual size artwork is shown below.



as to avoid overloading the input stage of the mixing desk, which is designed to accept microphone level signals. Only one level of attenuation is needed unless the DI is connected to the speaker output of a stage amplifier. Some DI's allow for this input level, but this style of connection is rather out of fashion, most engineers wanting the cleanest possible signal.

The average synthesiser can deliver up to a couple of volts of output when playing chords, and this large signal will produce some red lights and rather red faces at the mixing desk, unless some DI attenuation is available! Because of the limited supply voltage the DI itself can overload, but the prototype can take +15dBm before clipping; enough headroom for the nastiest synthesiser or pre-amp output.

Although the internal 9 volt battery will virtually last its shelf life, they have an embarrassing habit of giving up at the most inappropriate moment –leaving that inspired musical burst missed by the audience, or the tape machine. In this project the battery indicator LED1 will normally illuminate for a few seconds when the unit is switched on (plugging into the input socket). If the battery terminal voltage is below about 8 volts, the LED will not illuminate; the unit will still operate, but with a reduced headroom. If phantom power is present, the "phantom on" LED2 will also illuminate for a few seconds after the unit is turned on.

Phantom power

This is an expression traditionally applied to condenser microphones, where the power required for the internal pre-amp is supplied from the mixing desk via the balanced signal output lead. This is possible when the power is applied through suitable resistors to *both* pin 2 and pin 3. Since this voltage is common to both signal lines, it will be ignored by the audio signal processing system. A similar arrangement at the microphone end allows the pre-amp to draw a small current, pin 1 acting as the power earth as well as the audio shield.

Phantom power is becoming quite common in studios and sound reinforcement mixing desks, and only a few extra components were required to include this facility in our DI. Standard phantom power circuits (e.g., as per DIN 45596) are loosely adhered to by mixing desk manufacturers. Therefore our circuit components have been chosen for the DI to operate over a wide phantom power range, this voltage automatically taking over from the battery.

Circuit description

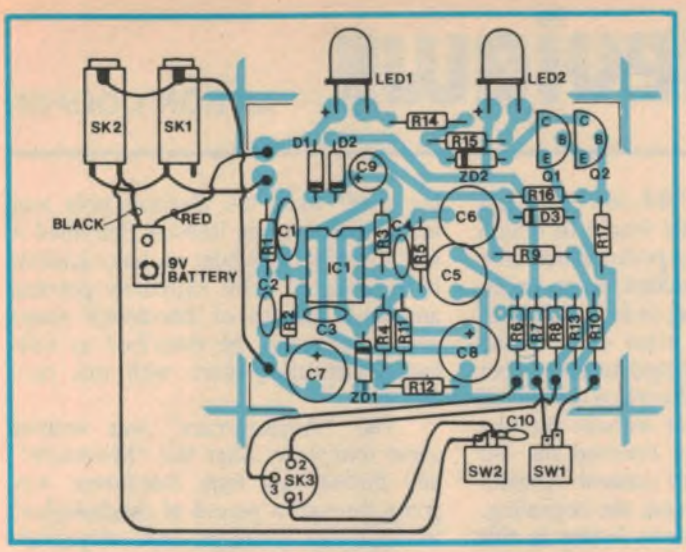
The basis of the circuit is a TL062 dual op-amp arranged as a buffer followed by an inverter, the two outputs supplying the in-phase and out-of-phase signals respectively. The TL062 was chosen for its high input resistance and extremely low power consumption: about 0.5mA from 9 volts. This leads to an excellent battery life.

A slightly better noise figure could be obtained with a TL072 op-amp, but this would only be a few dB at the expense of a ten fold increase in supply current (5mA). In our lab, the prototype was measured at a distortion of 0.06% and noise of —86dB, both with respect to 0dBm.

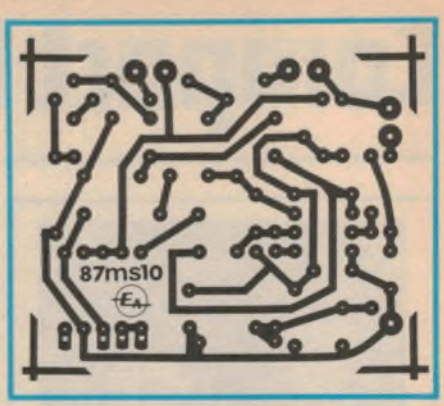
An input at SK2 is applied to IC1a via a low pass filter, R1 and C2 (to remove any RF or other interference), and AC coupled by C1. R11 and R12 voltage divide the supply rail in half to provide a bias for IC1a and IC1b, via R2 and R4 respectively. The input is attenuated by about 6dB by R1 and R2, to compensate for the inherent 6dB gain when converting to a balanced system. If more output is required, the value of R2 can be increased. IC1 itself has a very large input resistance (1T ohm!).

The output of the buffer stage is fed to IC1b, which is arranged as an inverter with unity gain determined by R3 and R5. Once again, the high frequency response is limited to about 20kHz, in this case by C4.

Bipolar electrolytic capacitors are needed to couple the op-amps to the output, due to the variety of voltages that may occur in the output circuitry. The DI output has no DC component when operating from the internal battery, the 4.5 volt op-amp bias being decoupled by C5 and C6. When a phantom power voltage is present at pins 2 and 3 of SK3, the output capacitors have to cope with the opposite polarity of the previous situation. Normal elec-



Right: Full size PCB artwork (code 87ms10).



Left: Internal wiring and component overlay. Note C10 mounted on the terminals of SW2, and the solid wire used to connect the PCB to SW1.

trolytics would get quite upset!

Pins 2 and 3 of SK3 are supplied by R6 and R9, setting the nominal output impedance at about 600 ohms. R10 is connected across the output by SW1, the "pad" switch, reducing the output by 15dB for high level signal sources.

When phantom power is applied to pins 2 and 3, R7 and R8 couple this voltage via D2 to the op-amps supply pin (8). D1 is then reverse biased due to the higher phantom voltage, preventing current flow to the battery. Extra ripple filtering is provided by C8, while ZD1 prevents the supply rail rising above 12 volts.

According to phantom power standards, a 48 volt supply should have a source resistance of 3.4k ohms, and for 24 volts a 600 ohm source. It is debatable that these standards are always applied, but our circuit current of less than a milliamp allows a wide range of conditions to be corrected by ZD1.

The ring connection of the stereo input socket is wired to the negative battery terminal, and the earth lift switch. This enables the power circuit to be completed when an instrument is plugged in, via a mono jack lead. The input tip connection is linked to the output link socket, so the signal may also be sent to a stage amplifier for monitoring.

When power is applied to the DI, C9 will charge to the supply rail (D3 discharging it on power down), providing base current to Q2. This will cause the Darlington pair Q1 and Q2 to saturate for a few seconds, as set by R16, R17, and C9. If the supply voltage is greater than the breakdown voltage of ZD1 (5.6 volts), plus the forward voltage of LED1 or LED 2, current will flow.

For a battery voltage of 9 volts, about 5mA will flow (as set by R14); illuminating LED1. The current through LED2 is mainly set by R7 and R8, in conjunction with the resistance and voltage of the phantom source.

The output earth switch SW2 disconnects the DI ground from pin 1 of the XLR socket SK3, C10 providing RF continuity. Although SW1 breaks the shield connection to the mixing desk, the phantom power still has a voltage return path via the mains earth (its presence causing the original earth loop!).

Construction

Start the construction by assembling all of the smaller components on the PCB (code 87ms10), paying particular attention to the orientation of the semiconductors and electrolytic capacitors. The two LEDs are soldered to the PCB with about 15mm legs, which are bent at right angles (in the middle). Because the assembled PCB is quite small and light in weight, the mounted LEDs will easily support one side. The other side is supported by short lengths of solid wire (component leg offcuts about 15mm long), soldered between the "pad" connections on the PCB, and the "pad" switch.

Next, solder lengths of lightweight hookup wire to all the input and output points on the PCB, as indicated in the component overlay. These will later be wired to the sockets, switches and the battery terminal.

The box should now be prepared by drilling (and filing) the appropriate size holes for the sockets, switches, and LEDs. Position these holes in the centre of the box height, using the pictures to get an idea of the layout along the sides. This positioning is not critical, but make sure a space is left for the battery to fit snugly between the PCB and the 6.5mm output socket.

Continued on page 69

DI side view, showing the instrument in and out sockets and the power test LEDs.

PARTS LIST

1 diecast box, 65x40x120mm
1 PCB,code 87ms10, 40x50mm
1 male 3 pin XLR panel mount socket
2 6.5mm stereo jack sockets (enclosed type)
2 miniature SPST rocker switches

Semiconductors
1 TL062 dual op-amp
2 BC547 NPN transistors
1 5.6 volt 1 watt zener diode
1 12 volt 1 watt zener diode
3 1N4148 diodes
2 5mm LEDs

Capacitors
2 47uF 25VW PCB mount electrolytics
1 1uF 50VW PCB mount electrolytic
2 4.7uF 50VW bipolar electrolytics
3 10nF greencaps
1 1nF greencap
1 15pF ceramic

Resistors (all 0.25W 5%)
1 x 100Ω, 1 x 220Ω, 1 x 270Ω, 2 x 560Ω, 1 x 2.2k ohm, 4 x 4.7kΩ, 3 x 100kΩ, 2 x 470kΩ, 2 x 1.2MΩ

Miscellaneous
9 volt battery and suitable snap connector, rubber feet, nuts and bolts, 2 x LED mounting kits, hookup wire.

Compact Disc Reviews

by RON COOPER

DVORAK

Symphony No.9 in E minor
"From the New World" Cleveland Orchestra
Christoph von Dohnanyi
Decca 414 421-2 DDD
Playing Time: 40 min 51 sec

PERFORMANCE
1 2 3 4 5 6 7 8 9 10

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

This work, the most popular and well known of Dvorak symphonies, is a real gem. It was composed after his arrival in New York from Czechoslovakia and is his impression and greetings of the "New World". It features hints from his acquaintance with the spiritual and plantation songs of black Americans.

Mrs Thurber, Dvorak's American employer, hoped that he would compose an American opera based on "The Song of Hiawatha", which Dvorak already knew from a Czech translation. A rather different possibility emerged from her suggestion — that his new symphony might perhaps be directly linked with Longfellow's epic. We have confirmation from the composer himself that the two middle movements were indeed inspired by that poem.

The scherzo was suggested by the dance of Pau-Puk-Keewis at the wedding feast, and the "Largo" recalls the funeral of Minnehaha.

Briefly, for those unfamiliar with the work, it has many very tuneful themes including "Going Home" with the principal ones brought together in a brilliant finale. It is a large orchestral work.

This recording is 3rd row seat and should be played fairly loudly to obtain the most from it. The performance here is quite brilliant, matched by an excellent recording balance; in fact it is probably from my own point of view the best version I have heard to far — not unlike an old Vox LP version conducted by Heinrich Hollreiser without the hiss and scratch. I always admired the old recording for its very natural tympani sound, most evident near the beginning. This CD version is even better in this department. If you feel your "New World" is getting old, this one is a great update.

BEETHOVEN

Piano Sonatas
Klaviersonaten
No.14, Op.27 No.2 Moonlight
Clair de lune
Mondscheinsonate
No.23, Op.57 Appassionata
No.8, Op.13 Pathetique
Vladimir Ashkenazy
Decca 412 260-2 ADD.
Playing Time: 58 min 11 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 a disc with everything going for it: Beethoven — his most popular piano sonatas, Vladimir Ashkenazy as performer, and combined brilliantly by Decca.

The "Moonlight" sonata was never known as such by Beethoven as the name originated some five years after his death when the German poet and music critic Ludwig Rellstab described it as "a version of a boat on Lake Lucern by moonlight." This extremely popular and most famous of Beethoven piano sonatas can only be described as brilliant, particularly here with this performer.

The "Appassionata" was written some four years after the "Moonlight" and during this time Beethoven was going through a period of psychological torment with his tragic increasing deafness. In 1802 he even contemplated suicide but in the end all this upset seemed to fuel his creative imagination. With this background there appears to be an extension of the boundaries of musical expression in this sonata. It could have been that Beethoven knew the nickname "Appassionata" though the first positive reference dates from 1838 when the sonata was published in a duet version.

The "Pathetique" sonata was written around 1799 — the autographed version is lost, but the title was certainly sanctioned if not originating from Beethoven himself. The word "Pathetique" is French and has a meaning of implying sombre grandeur (this is very evident in the slow movement) and is not to be confused with the withdrawn submissiveness associated with the English word "pathetic".

The sound on this disc is first rate, but I have heard better piano recordings — just.

There is a trifle amount of hiss, very quiet and only barely intrusive. The recording could be a trifle fuller in the lower register, but nitpicking aside this disc should be standard reportoire for everyone even if you're not all that excited about classical music.

BRUCKNER

Symphony No.8 in C Minor
L. Nowak edition
Lovro von Matacic
NHK Symphony Orchestra
Denon 35CO-1001 DDD
Playing Time: 74 min 12 sec

PERFORMANCE
1 2 3 4 5 6 7 8 9 10

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

Bruckner wrote nine symphonies (ten if his Etude is included) and the 8th and 9th are considered to be his best. The 8th has quite a magnificent structure, building up from the 1st movement and running through a scherzo and an adagio to a finale.

There are several versions of the work, this one being the Nowak edition with one part arranged by this conductor.

This is very serious music, similar in overall sound (and length) to Mahler but each distinctive in its own way. It is very different from the music of Beethoven, Mozart and Brahms. This work is not for the casual classical fan but quite rewarding for the serious listener. Bruckner's music is somewhat solemn and he saw the existence of God in beauty, yet his music is not religious.

The new recording by a Japanese orchestra under a very skilful Yugoslavian conductor who, as a boy was in the Vienna Boys' Choir, is very good indeed. I find it a little sad that he died just ten months after he made this recording.

A very interesting point of this performance is that it was made live, yet this was not evident to me until I read it in the notes. Japanese audiences are certainly extremely quiet — (I wish Australian audiences were!) except at the end when, rightly so, they let forth a well deserved applause.

MAURICE ANDRE

Trumpet Concertos
Handel
J. Haydn
M. Haydn
Telemann
Vivaldi
Viviani
Sir Charles Mackerras
English Chamber Orchestra
PolyGram 415 980-2 ADD
Playing Time: 66 min 19 sec

PERFORMANCE
1 2 3 4 5 6 7 8 9 10

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

This is a very interesting recording whether you are a fan of the trumpet or not. It starts with the standard repertoire in the form of the Haydn concerto, impeccably performed but unfortunately a dated recording, with just average sound. It is interesting to note that this concerto was written for the modern valve trumpet, at a time when this instrument was unheard of. It was Haydn's friend, the Vienna court trumpeter Anton Weidinger who invented this instrument.

The Haydn concerto No.10 is a fairly well known work with good appeal although its authenticity has recently been questioned. The first edition 1863/4 was for oboe and string orchestra but even cellists and double bass players soon adapted this cheerful and expressive work for their instruments.

Vivaldi concerto for two trumpets is stunningly performed here with Maurice Andre performing both parts by electronic synchronisation. This work represents the splendour of Venetian processions and is a well known work.

The Viviani work with organ also has much appeal, likewise the Michael Haydn work and the popular Telemann D major.

As this disc progresses it does improve soundwise but only to the good category with a somewhat bland bass light sound. Certainly not spectacular, as it might have been in the hands of Telarc for example. EA

DI BOX

Continued from page 67

The prototype case was rubbed down with a fine sandpaper, sprayed black, and a Scotchcal front panel attached. The sockets and switches may now be mounted and the circuit board installed. After mounting the LEDs in the mounting kits, the short lengths of solid wire can be soldered firmly to the Pad switch, thereby securing the PCB.

By referring to the component overlay, the hookup wire from the PCB can be cut to length and soldered to the appropriate sockets and switches. Don't forget the wires for the output earth switch, or the small capacitor mounted across its terminals. If it is difficult reaching some of the socket and switch connections with a soldering iron, they may need to be temporarily removed to attach the wires.

If the battery is still a little loose when installed, it may be held in place by a small piece of foam or polystyrene. This can be placed under the lid, before it is screwed down.

Using the DI

Connecting the DI to a system is very simple; the instrument or signal source plugs into the input, and the output is fed to a stage amplifier if used. Connect the balanced XLR output as if a microphone was the signal source, that is, plug into a microphone lead that feeds the input of a mixing desk.

Some interpretation of the battery indicator LED is possible. Although it will not illuminate if the battery is below about 8 volts, it gets quite dull as the voltage approaches this point.

The phantom indicator will light only if phantom power has been applied (via the XLR connections), *and then* the DI is switched on (by plugging into the input).

The output earth switch normally should be left in the "on" position, and switched off if an earth hum loop is present. When only an instrument (i.e. no stage amplifier) is used with the DI box, the earth switch should always be in the "on" position.

The pad switch will most likely be "on" for signal sources such as keyboards, pre-amp outputs, and high output bass guitars. The "off" position will probably apply to instruments such as acoustic guitars (with a "bug"), and normal bass guitars.

Our tests have shown that this DI is capable of very high quality results. Experience will show the best way to use it. EA

SUPERB NEW VIFA/EA 60 + 60 SPEAKER KIT!

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

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

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

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

D19 TWEETER SPECIFICATIONS:
Nominal Impedance: 8 ohms
Frequency Range: 2.5 - 20KHz
Free Air Resonance: 1 700Hz
Sensitivity 1W at 1m: 89dB
Nominal Power: 80 Watts (fo: 5.000Hz, 12dB/oct)
Voice Coil Diameter: 19mm
Voice Coil Resistance: 6.2 ohms
Moving Mass: 0.2 grams
Weight: 0.28kg
Cat C10301 ..... **$38**

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

Cat K86092 (speakers only) **$379**

Cat K86091 (complete kit) ... **$449**

VIFA/AEM 2 WAY SPEAKER KIT!

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

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

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

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

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

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

VIFA/AEM 3 WAY SPEAKER KIT!

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

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

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

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

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

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

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

ARGUS 726 ADJUSTABLE MAGNIFIER WITH LAMP

Absolutely perfect for close up work! Intricate PCB's, projects, etc will be a breeze under this superb, adjustable magnifying lamp
- Magnifies 1.75 times
- 40 watt incandescent lamp
- 2 spring-balanced arms, extendable to 95cm
- Adjustable head for optimum viewing angle
- Comes with desk clamp (interchangeable with base)
- Fantastic Value!!

Cat T10015 ..... **Our price $99**

MINI HAND HELD MEGAPHONE

Suitable for schools, sports meetings, boats, etc. Portable, lightweight and effective with anti howling dynamic microphone. High power output, low power consumption.
SPECIFICATIONS:
Size: 150mm diameter
Power output: 2/4 watt maximum
Effective Distance: 120 metres
Power source: 6 x "AA" batteries
Power duration: 6 hours
Weight: 0.6kg

$69.95

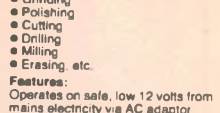
ARLEC SUPER TOOL

A versatile 12V electric tool for...
- Sanding
- Engraving
- Grinding
- Polishing
- Cutting
- Drilling
- Milling
- Erasing, etc.

Features:
Operates on safe, low 12 volts from mains electricity via AC adaptor (supplied). Light and easy to handle with touch switch and lock for continuous running. High torque motor. 10,000 R.P.M. Can drill 2mm holes in steel. 2 year guarantee

Contents:
- 12V Super Tool
- Plugpack AC adaptor
- 1 spherical milling cutter
- 1 wire brush
- 1 grinding wheel
- 4 drill bits, 0.6, 0.8, 1.0, 1.2mm
- Set of 5 chuck collets
- 6 eraser sticks
- Instruction sheets

Cat T12300 ..... **$59.95**



MIDRANGE HORNS

Use these quality, all metal, Piezo tweeters for great top end sound in your band speakers, disco sound system, etc. Rated at 30 watts RMS. In a system they will handle over 100 watts RMS.
Two sizes to choose from:
Size: 4"x 10½"
Impedance: 8 ohms
Rating: 30 watts RMS
Response: 1.5kHz - 14 kHz
Dimensions: 102 x 267 x 177mm
Cat C92082 **Normally $49.95**
This month only $39.95

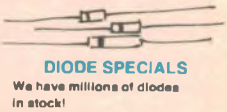
Size: 3"x 7"
Impedance: 8 ohms
Rating: 30 watts RMS
Response: 2kHz - 15 kHz
Dimensions: 76 x 177 x 145mm
Cat C92084 **Normally $29.95**
This month only $24.95

Dealers, OEM's, etc., phone (03) 543 2166 for wholesale prices

DIODE SPECIALS

We have millions of diodes in stock!

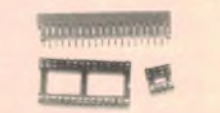
1-99	+	100+	1000+
IN4148 Small signal Cat Z10135			
3¢		**2½¢**	**2¢**
IN4004 400V 1A Cat Z10107			
4¢		**3½¢**	**3¢**



RECHARGEABLE ELECTRIC SCREWDRIVER

The perfect tool for professional or handyman!
- Long lasting NiCad battery
- Forward/Reverse Modes
- Detachable pistol grip
- Simple to use chuck
- 2 Flat tips
- 2 Philips tips
- Includes AC/DC charger

PERFORMANCE DATA:
Gears Ratio: 1:50
Max. R.P.M.: 150
Max. Torque: 3.2 (Newton Metre)
Screwing Capacity: 4 x 8/300, 5 x 8/220
T12200 ..... **$99.50**



IC SOCKETS (LOW PROFILE)

Save a small fortune on these "Direct Import" low profile IC sockets!

	1+	10+	100+	1000+
8 Pin Cat	**15c**	**14c**	**12c**	**09c**
14 Pin Cat	**16c**	**15c**	**14c**	**10c**
16 Pin Cat	**17c**	**16c**	**15c**	**11c**
18 Pin Cat	**18c**	**17c**	**16c**	**13c**
20 Pin Cat	**29c**	**28c**	**27c**	**26c**
24 Pin Cat	**35c**	**33c**	**32c**	**28c**
40 Pin Cat	**45c**	**40c**	**35c**	**30c**

PHILIPS SPEAKERS

"Unfortunately we cannot always guarantee Philips speakers to be in stock due to availability problems, nor can we guarantee the exact models listed. However, Philips equivalent or better will be supplied." -Rod.

Description	Cat.No.	Price
AD01610T8 (C12030)		**$24.95**
AD02160SO8 (C12040)		**$69.95**
AD80652W8 (C12042)		**$69.95**
AD070620M8 (C12045)		**$69.95**
AD12250W8 (C12050)		**$129.00**

ECONOMY 4 CHANNEL MICROPHONE MIXER (MM1)

Its size and simplicity makes this mixer very portable and easy to operate.
SPECIFICATIONS:
- 4 low impedance 600 ohm microphone inputs.
- Individual gain control for each microphone.
- Master volume control
- Power on LED.
- Inputs/Outputs - 6.3mm mono sockets.
- DC operated (9V battery only).
- Input impedance 600 ohm.
- Output impedance 1.5kohm.
- Signal/noise ratio 55dB.
- Frequency response 20Hz to 20kHz plus or minus 2dB.
- Weight 320 grams.
- Dimension 148 x 46 x 86mm.
- Torque variable range 1-22dB.
- Input sensitivity 1mV.
- Output level 90mV (at input 5mV).
- T.H.D. 0.01%.

Cat. A12001 ..... **$44.95**

TEXTOOL SOCKETS

P17016 16 pin	**$14.50**
P17024 24 pin	**$14.50**
P17028 28 pin	**$19.50**
P17040 40 pin	**$22.50**

.1uf 50V MONOLITHIC

Cat. R16080

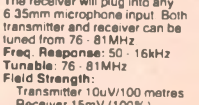
1-99	100+	1000+
30¢	**25¢**	**10¢**

KEY SWITCHES

	1-9	10+
Cat. S12500	**$4.95**	**$3.95**

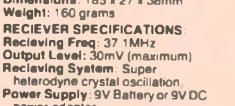
SENNHEISER HD 410 SL

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



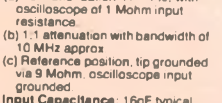
WIRELESS MICROPHONE RECEIVER WA100

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



CRYSTAL LOCKED WIRELESS MICROPHONE AND RECIEVER

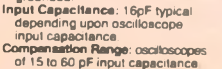
MICROPHONE SPECIFICATIONS:
Transmitting Frequency: 37.1MHz
Transmitting System: crystal oscillation
Microphone: Electret condenser
Power Supply: 9V battery
Range: 300 feet in open field
Dimensions: 185 x 27 x 38mm
Weight: 160 grams
RECIEVER SPECIFICATIONS:
Recieving Freq: 37.1MHz
Output Level: 30mV (maximum)
Recieving System: Super heterodyne crystal oscillation
Power Supply: 9V Battery or 9V DC power adapter.
Volume control
Tuning LED
Dimensions: 115 x 32 x 44mm
Weight: 220 grams
Cat. A10452 ..... **R.R.P. $113**
Our price, $99



DPM-200 PANEL METER

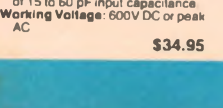
- **Ultra Low Power**
- **Separately Addressable Annunciator**
- **15mm Digits**
- **Bandgap Reference**

A low profile LCD DPM with a range of useful symbols as shown. The DPM 200 features 15mm 3½ digit display, and ultra low current consumption and a bandgap reference for high stability. It also features Auto-zero, Auto-polarity. 200mV fsd. It may be used in single-ended, differential or ratiometric modes. The fsd can be easily changed by the user to indicate any other units. The decimal points and symbols can all be driven from an internal source. Wide supply and symbols can all be driven from an internal source. Wide supply rail (5-15V DC) with a variable threshold low battery warning indicator. Supplied with mounting clips and comprehensive data sheet.
SPECIFICATIONS:
Accuracy: 0.1% + - 1 digit
Linearity: + - 1 digit
Samples/sec: 3
Temp. Stability: 50 ppm typical
Temp. Range: 0 - 50-C
Supply Voltage: 5 - 15V DC
Supply Current: 50uA typical
Max DC Input Volts: + - 20V
Cat. Q15510 ..... **$99.95**



MAINS MUFFLER

Sudden mains disturbances can seriously affect your computer equipment, and stored data. So why risk it when you can have a Mains Muffler, particularly when the cost of one failure is likely to be greater than the purchase price! So vanish those dangerous clicks and voltage spikes forever with the Mains Muffler!
SPECIFICATIONS:
Maximum total load: 1000W 4 AMP 250V 50Hz
Outlet Sockets
Attenuation: 150KHz - 47dB, 500KHz - 68dB, 10MHz - 66dB
Dual T Section:
VDR Transient suppression
Surge capacity 200 Amp 8 x 20uS
2 WAY Cat. X10089 ..... **$199**
4 WAY Cat. X10090 ..... **$299**

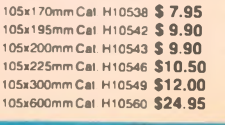


BESWICK 88100 PROBE SET

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 20 pF
Rise Time: 10:1 position less than 1.4ns nominal
Switch Function:
(a) 10:1 attenuation +/- 1%, with oscilloscope of 1 Mohm 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

$34.95



HIGH EFFICIENCY RADIAL FIN HEATSINK

Black anodised with a thick base plate, this radial fin heatsink can dissipate large amounts of heat for maximum efficiency. Designed by Rod Irving.

105x30mm Cat. H10520	**$ 3.50**
105x75mm Cat. H10525	**$ 3.50**
105x100mm Cat. H10529	**$ 4.90**
105x140mm Cat. H10534	**$ 6.50**
105x150mm Cat. H10535	**$ 6.75**
105x170mm Cat. H10538	**$ 7.95**
105x195mm Cat. H10542	**$ 9.90**
105x200mm Cat. H10543	**$ 9.90**
105x225mm Cat. H10546	**$10.50**
105x300mm Cat. H10549	**$12.00**
105x600mm Cat. H10560	**$24.95**

NEW! NEW! NEW! NEW! NEW!

CD PLAYER ADAPTOR

Many amplifiers have only one auxiliary input. This makes using a compact disk player as well as another auxiliary input inconvenient. Also the majority of CD players have an output voltage of 1·6 or 2 volts whereas the auxiliary input norm is 750mV. This CD adaptor allows dual auxiliary input, and one input has variable gain setting.

SPECIFICATIONS:
- Input 2 sets of 2 x RCA sockets
- Gain 150, 300, 600mV, 1V and 2V
- Output 2 x RCA sockets

A16020 ..... **$23.95**

SPEAKER CONTROLLER (TAA801)

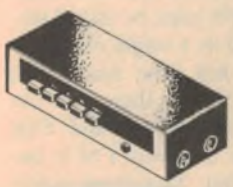
- Enables up to 5 pairs of stereo speakers to be switched on or off in any combination.
- Rated at 50 watts continuous per channel.
- Stereo headphone socket available for private listening.
- Constant minimum load circuit protects amplifier regardless of how many speakers are connected.
- Dual circuit breaker protection.

Cat. A16054 ..... **$59.95**

SPEAKER CONTROLLER (TAA803)

- Enables 2 amplifiers (or TV & Amp) to be switched to 4 pairs of speakers in any combination.
- Rated at 50 watts continuous per channel.
- Headphone output can be utilized without interfering with the speaker.
- Constant minimum load circuit protects amplifier regardless of how many speakers are connected.
- Each channel is protected separately by circuit breakers.

Cat. A16058 ..... **$59.95**



TAPE DIRECTOR (TAA802)

Ideal for those who do a lot of dubbing and recording. Features facilities for amplifier, auxiliary, 2 tape inputs and 2 amplifier, 2 tape outputs, by simply selecting and pressing the appropiate switch you are able to:
- Record from either tape unit while listening to another source through your system.
- Dub direct from tape 1 to tape 2 whilst listening to tape 1 or 2.
- Record from auxiliary to tape 1 or tape 2 while listening to auxiliary through the amplifier.
- Record from amplifier to tape 1 or 2 while listening to the amplifier.

Cat. A16056 ..... **$59.95**

ANTI VIBRATION MICROPHONE HOLDER

- Suspends microphones in an eight section rubber mount.
- Fits most standard body 25-30mm diameter micrphones.
- Standard 5/8" x 27 thread and 5/8" to 3/8" reducer.

A10065 ..... **$15.95**

STEREO WIRELESS TRANSMITTER

This unit was developed to allow portable compact disc players to be used in cars by transmitting the headphone output signal directly in to your stereo FM car radio. It will also transmit any mono/stereo signal from any headphone output to any FM receiver.

SPECIFICATIONS:
- Input 3·5mm stereo phone plug. Impedance 32 ohm.
- Mono/stereo switch has plug mounting clip.
- FM Transmission approx. 90·35MHz (Tuneable 89-91MHz)
- Range 15 metres. (below 15mV/m at 100 metres)
- Power 1·5V AAA size batteries (100 hours continuous use)
- Size 72 x 38 x 21mm

A16100 ..... **$69.95**

COMPACT DISC CLEANER

Even compact discs need to be kept clean otherwise the listening pleasure will be spoiled by drop outs or skips.
- Cabinet incorporates working base to place disc.
- Soft suede cleaning pad (with pad cleaning brush)
- Spray which will gently loosen contaminents and not damage discs.
- With disc cloth for handling discs.
- Replacement cleaning pad and spray available separately.

A10025 ..... **$19.95**

COMPACT DISC CLEANER PAD & SOLUTION

Replacement pad and cleaning solution for to suit above. (A10025)

A10026 ..... **$9.95**

ROTATING LIGHT

Motor driven rotating reflecting mirror with a flash rate of about 150 per minute. Large lens fit right to base, making unit weatherproof. Spare globe included.

SPECIFICATIONS:
- Available in Blue or Orange.
- 150 Revolutions per minute. (approximately)
- Shock absorbing rubber mounting legs.
- Connecting wire fitted through base.
- 12V DC 750mA.
- Base diameter: 102mm. Height: 140mm.

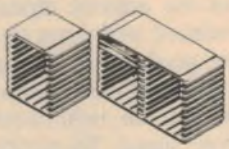
A15042 Blue ... **$42.95**
A15043 Orange ... **$42.95**

VIDEO/AUDIO TRANSMITTER

A small compact unit that allows transmission of video and audio signals (RF) to any TV set or VCR within a range of 30 metres (100"), simply by tuning in on Channel 11. Can be used as a transmitter for a video camera. With power on LED, on/off switch, audio and video leads and supplied with an AC adaptor.

Transmission: VHF, channel 11 (PAL)
Video Input: 75 ohms, 1V p-p
Audio Input: 600 ohms
Output Control: Audio-video fine adjustment
Power Sources: 9V battery or power adaptor.
Accessories: RCA to RCA audio lead. RCA to BNC video lead.
Size: 70(W) x 85(D) x 28(H)mm
Weight: 170 grams

A16150 ..... **$69.95**



COMPACT DISC STORAGE UNITS

- Holds 10/20 compact discs in their cases.
- Interlocking modular design allows vertical and horizontal interlocking.
- Discs slide into place horizontally making titles easy to read.
- Wall mount or free standing.

A10031 (10 discs) **$12.95**
A10032 (20 discs) **$19.95**

COMPACT DISC CASE

Standard replacement compact disc case.

A10030 ..... **$6.95**

PIR FLOODLIGHT

A perfect all night security device with dual element Passive Infra Red sensor. All weather outdoor operation. Features off, automatic test and manual on at your wall switch. Complete with wall mounting bracket, cable terminations and instructions.

SPECIFICATIONS:
Detecting range: minimum 6 to 15 metres with variable control.
Detecting zones: 5 at 15° short, 12 at 8° medium, 12 at long range.
Preset time: From 1 to 20 minutes with manual ovende.
Photocell sensitivity: Activates circuit at about 2 footcandles, off at about 8 footcandles of light.
Positioning Adjustment: 2 ball joints allow free adjustment to suit area.
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Power: 240V AC 50Hz

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RS232 BREAK OUT BOX

A simple way of monitoring RS232 interface lead activity. Interface powered, pocket size for circuit testing, monitoring and patching. 10 signal powered LED's and 2 spares. 24 switches enables you to break out circuits or reconfigure and patch any or all the 24 active positions.

SPECIFICATIONS:
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Indicators: Tricolour LED's for TD, RD, RTS, CTS, DSR, CD, TC, RC, DTR, (E)TC.
Jumper Wires: 20 tinned end pieces.
Power: Interface power.
Enclosure: Black, high impact plastic.
Dimensions: 85 x 95 x 30mm.

X15700 ..... **$94.95**

RS232 FAST CABLER

Makes RS232 interface configurating fast and simple. 3 slide switches enable line swapping functions, positive and negative voltages are displayed on 6 tricolour LED's.

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Connector: DB25 plug on 100mm cable and DB25 socket on 100mm cable.
Indicators: Tricolour LED's for pins 2(TD), 3(RD), 4(RTS), 5(CTS), 6(DSR), 20(DTR)
Switches: 3 Slide switches to swap leads.
Power: Interface power.
Enclosure: Black, high impact plastic.
Dimensions: 85 x 95 x 30mm.

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- 6 slot, 4 pins wired
- Medium sized
- Cnmp type

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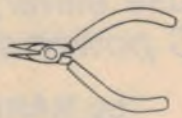

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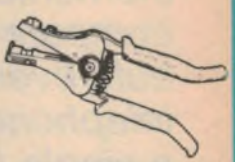

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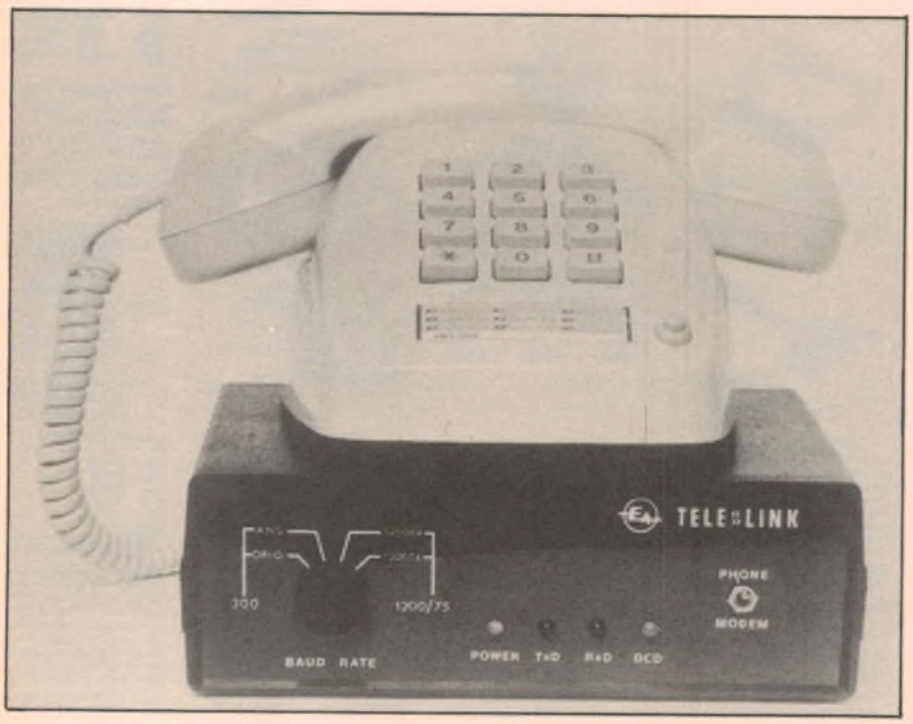
by MARK CHEESEMAN

Very often it is desirable to connect two computers together to transfer data from one to the other, or to connect a terminal to a large mainframe computer. Although this is relatively simple and inexpensive to do if the two devices are located within close proximity to one another, the expense of providing dedicated lines over long distances becomes prohibitive. Since an extensive network of lines already exists in the form of the Public Switched Telephone Network (PSTN), it seems logical to make use of this system for long distance communications.

The first attempts at transmitting digital signals by radio used on-off keying of a a carrier to represent the mark and space conditions of the original digital signal. While this worked well when signal conditions were good, when fading occured the receiver could not distinguish between this and an intentional break in the received signal. To rectify this problem the carrier was transmitted continuously, but shifted slightly in frequency to represent either a mark or space condition hence the name Frequency Shift Keying (FSK). This was done either directly, or by shifting an audio sub-carrier (AFSK).



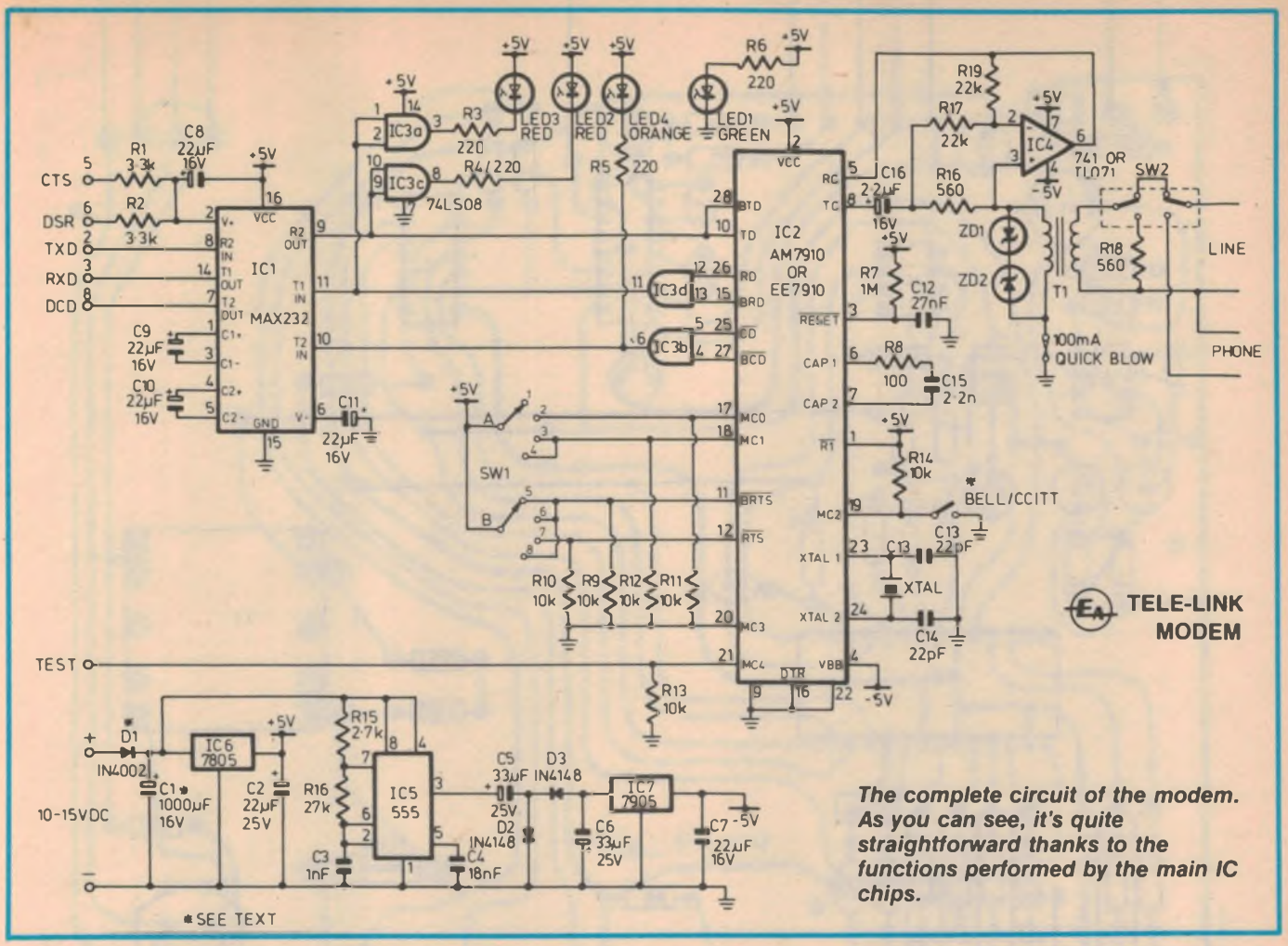
FSK is still the most common method used today for connecting computers and terminals over the switched telephone network or by radio. At first it may seem reasonable to connect the two computers directly to the telephone line, but in the modern telephone network there is no DC continuity between the two ends of a telephone link, the low frequency cut-off being of the order of 300Hz. In fact the signal may well be modulated onto a carrier to allow several "voice" channels to occupy one coaxial cable or satellite transponder. In the latter case, there is no electrical continuity between the ends of the link at all.

The device used to convert from digital pulses to analog tones is known as a Modulator-Demodulator, or MODEM.

In addition to the pair of tones used to transmit the data in one direction, a second pair of tones is generally used to transmit information in the reverse direction. This is called FULL DUPLEX communications and is generally much more convenient to use than HALF DUPLEX, where the line has to be 'turned around' before data can be transmitted in the other direction. However the bandwidth of telephone circuits limits the maximum speed at which data can be transferred, as the two data communications channels must be fitted into the same bandwidth as a single channel.

While this does not pose much of a problem at 300 baud, there is not enough room for two 1200 baud FSK channels within the bandwidth of a single telephone channel. Therefore at this speed it is generally necessary to use a lower baud rate for the "backward" channel. This is not much of a handicap if most of the data travels in one direction, such as a terminal accessing a database. In this case the fast 1200 baud link is generally used for the information travelling from the computer or database, while the slow 75 baud channel is used to transfer characters typed on the terminal keyboard back to the mainframe. Few people can type this fast anyway.

Although data communications rates



The complete circuit of the modem. As you can see, it's quite straightforward thanks to the functions performed by the main IC chips.

of up to 2400bps (bits per second) are common these days, they no longer rely on simple FSK techniques, but use PSK (phase shift keying). For 1200bps full duplex, each channel uses four distinct phase angles, and two bits are sent simultaneously. Although these faster speeds are often referred to as 1200 and 2400 baud, they are strictly only 600 baud, because the baud rate refers to the rate of modulation of the carrier, not the the number of bits per second.

These high bit rates require complex (and expensive!) modulating and demodulating circuitry and are not included in the design presented here for reasons of cost. In most practical applications the difference in performance between 1200/75 and 1200bps full duplex is not very significant as most of the data is flowing in one direction only.

The Am7910 FSK Modem

What makes the task of building a 300/300 and 1200/75 baud modem extremely simple is a marvellous NMOS integrated circuit from Advanced Micro Devices called the Am7910, second sourced by Thomson Components as the EF7910. Contained in this package is a complete modulator and demodulator capable of 300 baud full duplex and 1200 baud half duplex with a 75 baud back-channel. It is also capable of operating on either the CCITT (European) or Bell (US) standards — hence the title "World Chip".

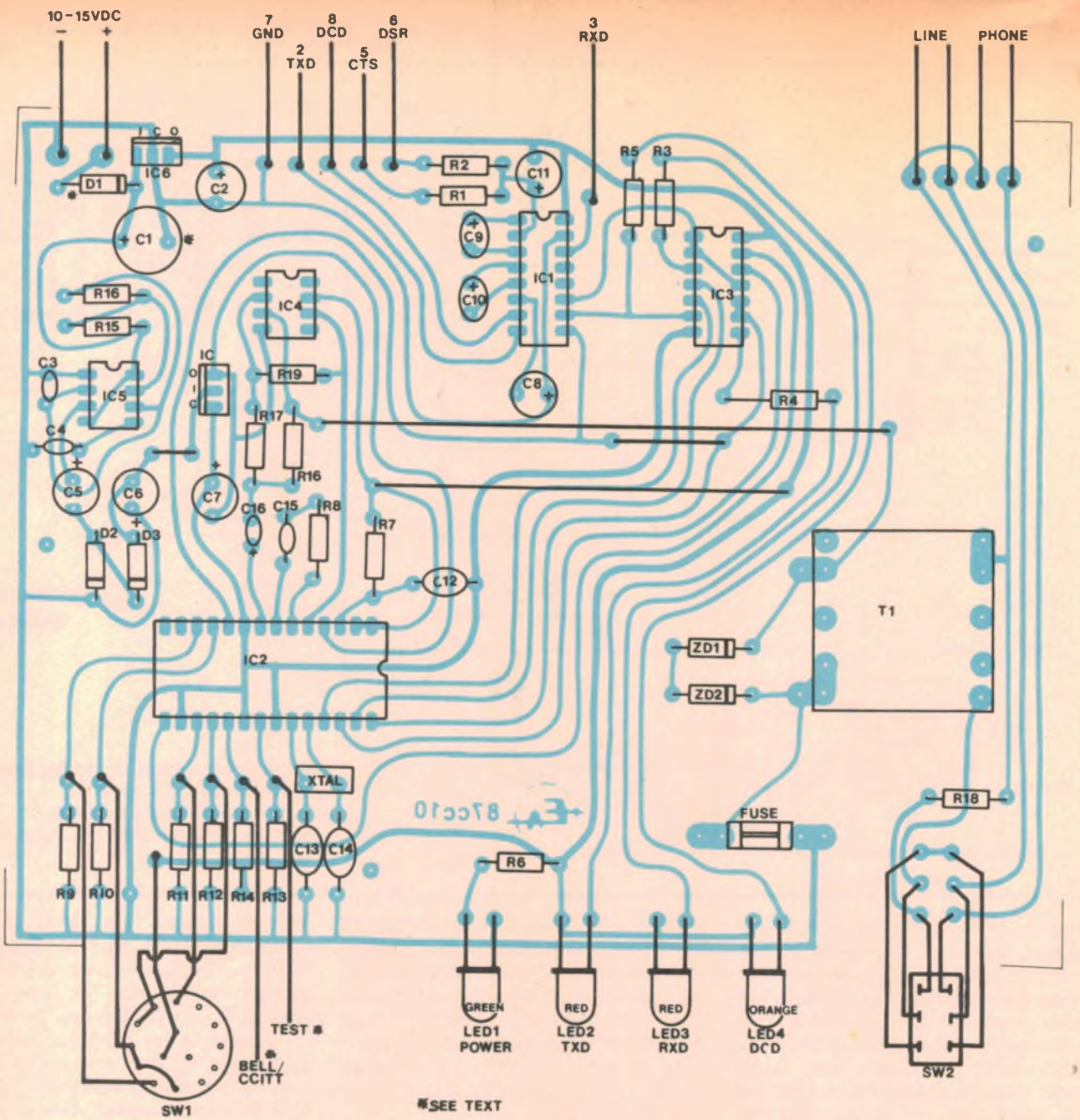
As the '7910 chip uses digital signal processing techniques, all internal operations are synchronised to an internal crystal oscillator. Therefore all the frequencies produced are extremely accurate — much more accurate than is possible with an RC or LC oscillator. The only external components required for the operation of the chip are a crystal and a couple of capacitors for the internal oscillator, and a resistor and capacitor for the analog receive filter.

Circuit Details

As this modem makes use of the 75 baud back-channel during 1200 baud half-duplex operation it is necessary to select between the received data and carrier detect pins of both the main- and back-channels, and also to drive the relevant transmit pin. Most of this switching is taken care of within the '7910 itself, using the mode control pins and the two Request To Send (RTS) pins. Only one channel may be enabled for transmit at any one time, and this is determined by RTS and BRTS. Note that for 300 baud communications the back channel is unused. Thus it is adequate to simply tie the two transmitted data pins together, as the unused one will simply be ignored.

The Received Data and Carrier Detect pins for the two channels are also selected by the RTS and BRTS signals in such a way that the same channel is not used for transmit and receive at the same time in the 1200 baud mode. The carrier detect and received data signals for the unused channel are driven high by the '7910, allowing simple AND gates from a 74LS08 chip (IC3) to combine the signals before feeding them to the MAX232. Although the signals need to be logically ORed, they are active-low signals and so AND gates need to be used.

The other two AND gates in the same chip are used to drive LEDs to in-



The PCB overlay diagram. The board is a generous size, to make it easy to wire.

dicate the flow of data to or from the modem. This helps in troubleshooting the system, as it indicates whether or not data is actually reaching the modem. The other two LEDs indicate power-on and Carrier Detect.

It is not possible to simply connect the input and output signals from the '7910 directly to the line transformer, as the strong transmitted signal would smother the weaker received signal. Telecom claim that the total line loss of a local telephone link can be up to 44dB, especially if both ends are connected through PABX systems. Therefore it is desirable to attenuate the amount of transmitted signal fed back into the receiver input, while allowing both signals to pass to or from the line with little attenuation. This problem is not unique to modems, or even telephone circuits in general. Just try to hear what somebody twenty metres away is saying while you are screaming back at them at the top of your voice!

Therefore to allow full duplex communications, a form of duplexer known as a line hybrid is used. The hybrid in this circuit is IC4 and associated components. For received signals, pin 8 of IC2 appears as earth, so any signal received from the 'phone line is attenuated by 3dB by the 560 ohm resistor, but the two 22k resistors give the op-amp a gain of 2, so the net voltage presented to pin 5 of IC2 is identical to the voltage on the line. The 560 ohm resistor also provides (approximately) the correct termination of the line for transmitted and received signals.

Transmitted signals are also attenuated by 3dB before being passed to the line transformer. However IC4 acts as a differential unity-gain amplifier with its differential inputs tied together. Thus provided we have an ideal op-amp, R17 and R19 are matched and R16 equals the line impedance, none of the transmitted signal will be fed back into the receiver input. However, due to wide variations in line impedance full balancing and attenuation is seldom if ever achieved and so a 560 ohm resistor is close enough. It is not worth the trouble

of putting a trimpot in and adjusting it for a perfect match, as it would be necessary to do so for each call made. Fortunately the '7910 has very good internal rejection of its own transmitted signal so this is not as much of a problem as it was in earlier designs.

Telecom regulations require an isolating transformer between any attachment and the telephone line to isolate the DC circuits of the device and the line. Until recently a blocking capacitor was also required, to limit the voltage presented to the line should 240VAC at 50Hz be accidentally applied to the modem side of the transformer. Recent relaxation of this regulation allows the use of a 100mA quick blow fuse which would be blown by the zener diodes if 240V was applied.

The printed circuit board has been designed to accept a variety of line transformers to ensure a ready supply of these items. The Ferguson MT620 transformer has a symmetrical pin arrangement which allows insertion either way around. The Arlec 45035, however, should be installed so that the pair of pins which are the more widely spaced are closest to the edge of the board.

A third transformer is also suitable, this being manufactured by Robert Ford & Co., model number RF1133. This transformer is only available in bulk quantities however. If using this transformer, check which pins are connected to the windings. The pin arrangement of this transformer is identical to the model from Arlec except that it has extra dummy pins to provide mechanical rigidity. Therefore, find the side of the transformer with the winding connected to the outer pins, and orient the transformer so that these pins are adjacent to the edge of the PCB.

The final element in the line interface circuit is the phone/modem switch. This simply switches one side of the line between the isolating transformer and the telephone socket. Also R18 is switched across the line side of the transformer, to maintain the balance of the hybrid when the line is disconnected.

The power supply is perhaps a little unusual, in that it allows the whole modem to operate from a single supply rail of 10 volts or so, with a total current drain of less than 200mA. It is thus eminently suitable for applications such as a mobile or portable packet-radio system, or whenever it is desirable to be able to power the system from a single DC supply from, say, a computer power-supply unit. D1 and C1 have been included on the power input to provide some noise filtering on the supply and to protect the modem against inadvertent polarity reversal. This diode and capacitor may be omitted if there is no possibility of supply reversal and the supply is adequately filtered. In this case replace D1 with a wire link.

The unregulated DC input is supplied to a 7805 regulator from which the positive 5V rail is taken. The unregulated supply also powers IC5, a 555 timer, which limits the maximum DC input to the modem to 15V. The 555 is set up as as an astable multivibrator oscillating at about 20kHz. The square wave output from pin 3 is fed to a charge-pump voltage converter, which generates a negative rail of approximately the same amplitude as the input voltage.

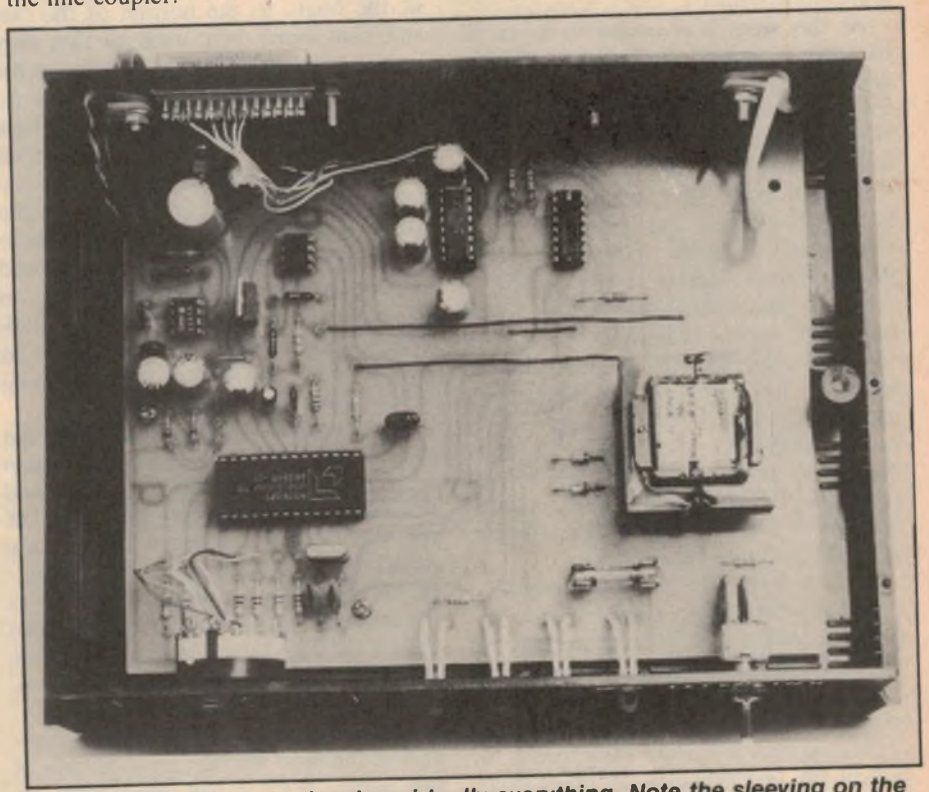
During the times when the output of IC5 is high, C5 is charged positively with respect to 0V through D2. When the output of the IC goes to 0V, C3 does not discharge to ground because D2 is now reverse biased. However, C5 still has almost full positive rail voltage across it and because its positive terminal is at 0V, its negative terminal is now at approximately minus the positive rail voltage. This forward biases D3 which causes C5 to discharge into C6, thus causing the negative rail to appear across C6. The output from the charge pump is then regulated by a 7905 regulator and filtered before being supplied to the modem chip and the op-amp in the line coupler.

There are in fact two more charge pump converters in the circuit, but these are hiding in the MAX232 chip. The first of these doubles the incoming 5V rail to provide the positive supply for the RS-232 transmitters. This 10V rail is then inverted to provide the negative 10V rail. This allows true bipolar RS-232 signals from a single 5V rail. The MAX232 also contains the transmitters and receivers to translate the TTL levels used within the modem to the proper RS-232 ones and back again. For more information on this chip, refer to the Solid State Update column in the August issue.

The Tele-link is constructed on a single sided printed circuit board measuring 170mm by 136mm. While a double sided board could have resulted in a smaller board without the need for any links, the much simpler construction of a single sided board greatly outweighs this. The board fits nicely inside a plastic instrument case measuring 200mm x 160mm x 70mm. This box has moulded-in supports for the PCB, in addition to plastic front and rear panels which may be removed conveniently for drilling.

Construction

Begin as usual by visually checking the PCB for broken or bridged tracks and check that all the holes are of the correct diameter. The first components to place on the board are the four wire



A look inside the case, showing virtually everything. Note the sleeving on the leads to the phone/modem switch.

Parts List

1 PCB code 87cc10, 136 x 170mm
1 plastic instrument case, 200 x 160 x 70mm
1 Scotchcal front panel, 195 x 63mm
1 600Ω line isolating transformer (see text) 1 DB-25 panel mounting socket
1 Telephone line cord and plug
1 Telephone panel socket
1 DPDT panel-mounting toggle switch
1 3-pole 4-way rotary switch
1 22mm diameter black anodised aluminium knob
1 TO-220 heatsink
1 2.4576 MHz parallel-resonant crystal
1 20 x 5mm 100mA quick-blow fuse
2 PCB fuse clips
1 12V DC Plugpack (if required)

Semiconductors

1 Am7910 or EF7910 'World Modem' chip
1 MAX232 single supply RS-232 transceiver
1 74LS08 quad AND gate
1 741 op-amp
1 555 timer
1 7805 positive 5V 3-terminal regulator
1 7905 negative 5V 3-terminal regulator
2 red 5mm LEDs
1 green 5mm LED
1 orange 5mm LED
2 3.9V zener diodes
1 1N4002 diode (optional — see text)

Capacitors

5 22uF 35VW electrolytics
2 33uF 25VW electrolytics
1 1000uF 16VW electrolytic (optional — see text)
1 2.2uF 16VW electrolytic
2 22pF ceramics
1 47nF greencap
1 1nF greencap
1 18nF greencap
1 2.2nF greencap

Resistors (all 1/4w 5%)

6 x 10k, 1 x 100Ω, 2 x 560Ω, 4 x 220Ω, 2 x 22k, 1 x 27k, 1 x 2.7k, 2 x 3.3k, 1 x 1M.

Miscellaneous

Hookup wire, 6BA hardware, cable clamps, spaghetti tubing.

links. Use insulated wire for the two long ones. Next insert the IC sockets for the '7910 and the MAX232, and the other two ICs if you wish to have these socketed as well.

At this stage it is advisable to insert the power supply components, as this allows the supply rails to be checked before plugging in any expensive ICs. Begin with the 2.7k and 27k resistors, followed by the diodes — being careful with orientation. Then insert the capacitors, noting again the polarity of the electrolytics. Finally mount the two three-terminal regulators and the 555.

Before proceeding any further, connect a DC supply of between 10 and 15 volts and check that the correct voltages appear at the supply pins of the (as yet unmounted) ICs. If there is any inconsistency with expected readings, remove the supply and correct the fault before proceeding further. Make sure that a heatsink is fitted to the 7805 regulator, as it will get quite hot otherwise.

If all is well with the power supply, insert the remaining resistors and capacitors, taking care with the polarity of the four electrolytics near the MAX232. Also put in the fuse clips, the crystal and the two zener diodes. The polarity of these zeners is crucial if the fuse is to protect the line properly, so make doubly sure that they are of the correct voltage and are inserted correctly. The 74LS08 and 741 ICs should also be inserted at this point.

The best way to insert the LEDs is to sit the board in the bottom of the box and then bend their leads so that they line up with the appropriate holes in the front panel before soldering them in. The line switch needs pieces of bare wire soldered to the terminals and then follow a similar procedure to that of the LEDs to determine the length of the wires. But before soldering these wires to the board, spaghetti sleeving should be slid over the wires and right up to the body of the switch to prevent inadvertent contact with the line. This is an important requirement for obtaining Telecom authorisation.

At this point mark out and drill the rear panel if you have not already done so and mount the DB-25 socket and telephone socket, leaving the cover off the latter for the moment. If you are powering the modem from the computer, the best way to bring the power to the modem is probably through a spare pin on the DB-25 connector. Otherwise pass the supply cable through a grommeted hole below the DB-25 connector.

The line cord passes through a grommet in the hole on the opposite side of the panel. Both cables should be secured with suitable restraints to prevent damage to the connections (this is also a Telecom requirement), and solder the cables to the board. Also connect the two sockets to the board at this point, and the baud rate switch. If you wish you may use PCB pins for all connections except those on the line side of the transformer. Finally solder the line transformer to the board. This has been left until last because its mass makes the board awkward to handle.

Now all that remains is to place the board in the box and screw it down. The mounting holes are located to line up with the pillars moulded into the bottom half of the box. Determine which pillars are used by the modem, and trim the others so they will not foul the mounting of the board. When sliding the front panel into the slots in the top and bottom halves of the box, make sure that the Scotchcal panel is not damaged as it is a rather tight fit.

Testing

The easiest way to test the unit is to connect pin 21 of IC2 (Am7910) to +5V. This places the modem in the 'Loopback' mode, which places the transmit and receive channels on the same frequencies and thus any character sent to the modem will be looped back to the computer. Power up the modem and check for correct operation with the selector switch in the 300 baud originate and answer positions, and also the 1200 baud transmit (1200TX) position.

To perform the actual test, simply connect a terminal operating at the appropriate baud rate to the modem and check that the characters typed on the keyboard are echoed back to the screen. When you have completed these tests, remove the wire from pin 21 of IC2 unless you intend to use the modem for half-duplex communications.

If you plan to use this modem for packet radio a link should be placed from pin 20 of IC2 to zero volts to instruct the '7910 to use the Bell tones, which are common on the packet frequencies. Also, all of the line interface components (T1, IC4 and associated components) may be omitted. The transmit and receive pins of IC2 are then connected via suitable buffering to the transceiver. Please note that while packet radio is a possible application for this modem, we have not tried this and therefore we cannot answer any technical enquiries relating to this application.

Space limitations prevented us from including the PCB pattern and front panel art in this article. These will be published next month along with some final comments and suggestions.

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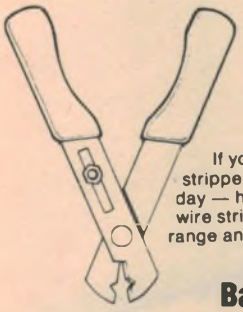
4 T-6035	Standard-Phillips hd	$3.95	9 T-6060	Heavy-Flat head	$1.95
5 T-6040	Popular-Flat head	$3.95	10 T-6065	Heavy-Phillips head	$1.95



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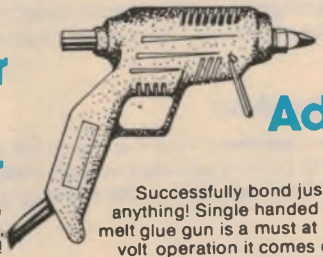

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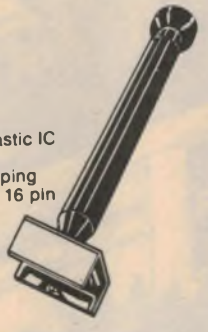

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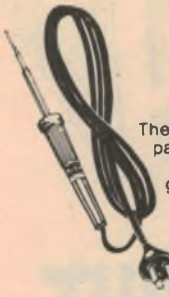

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The DSE Hobby Iron is the ideal work partner for the hobbyist, handyman, etc! Made by Weller you know it's good. Rated at 15 watts and mains powered! Cat T-1310

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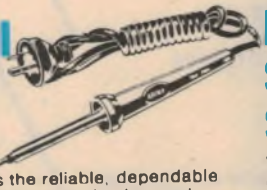

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The Adcola RS-30 is the reliable, dependable iron for general service or production work. Rated at 12 watts it comes complete with Triciad 3mm long life tip. Cat T-1820

$29.95

Professional Soldering Station

When you can't take any chances with your work — you need the best! The Royel Solder Station is it! Temperature sensing is done right at the tip and with zero voltage switching there's perfect control. From 200 to 400 degrees C range. Cat T-2050

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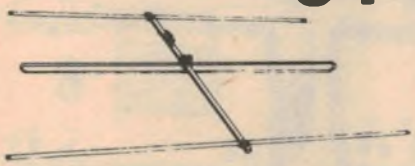

For top performance from your FM tuner! Try to find better value than this for a quality FM antenna — don't waste too much time though. Easy to erect with 300 ohms impedance. The reception will amaze you! Cat L-4064

UHF Band 4 Perfect for SBS 28! With Reflector!

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Here's the go! Superb TV/FM antenna ready for the holiday! Comes with 'gutter gripper' bracket, mini mast and 7 metres of 300 ohm ribbon. Cat L-4026

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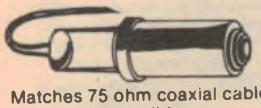

Matches 75 ohm coaxial cable to the 300 ohm ribbon terminals on you TV, tuner or antenna. Weather resistant for either indoor or outdoor use. Comes complete with coaxial plug connector! Cat L-4465

$4.35

75 Ohm 2-way Splitter

Need to run two devices off one antenna? Here's the inexpensive way to do it! Designed for indoor use it covers 50-890MHz. Cat L-4472

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Run up to 4 sets (when using 75 ohm cable) from one antenna! Quality plastic box with snap lid and nickel plated screw terminals for easy connection. Cat L-4474

Value $7.75

Universal Balun

Can be used for either 300 ohm ribbon cable or 75 ohm coaxial cable! Use it any-which-way. Ideal if you don't know which type to use! Cat L-4456

BARGAIN $2.95

The Picture Fixer

Is the signal lousy and your picture about the same? The DSE Mast Head Amplifier could easily put an end to the problem. Won't help clean up the rubbish but it's perfect for a weak signal. Comes with amplifier box and power supply! Cat L-4200

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This Is A Hold Up!

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Quality galvanised construction it's designed to mount any antenna from a vertical surface — barge board, chimney, wall, etc! 139cm long. Cat L-4150

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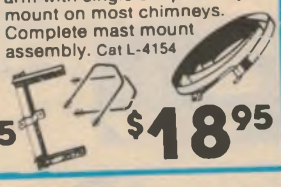
Chimney Mount

No, it's not the sort of thing that Santa is after — unless his antenna's falling down! Double arm with single strap is easy to mount on most chimneys. Complete mast mount assembly. Cat L-4154



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Super Saver Cables!

300 Ohm Flat Ribbon

Low loss 300 ohm ribbon for good reception areas! Cat W-2070

30¢ pm!

75 Ohm Coaxial Cable

Ultra-low-loss air dielectric 5C-2V. Ideal for long runs where minimum loss is required. Cat W-2082

50¢ pm

75 Ohm Cable Set

2 metres of quality 75 ohm coax fitted with TV coax plugs. Ideal for units, flats, etc! Cat L-4506

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SUPER $AVER!

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Robotics Trainer!

Build yourself the most advanced robot kit available! With Hero Jr you'll get first hand experience in the fascinating world of robots. He's used as a trainer in many institutions around the world. Program Hero with his own keypad or with your home computer. He'll remember dates, wake you in the morning, he can even be linked to your security system! Cat G-1005

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Computerized Weather Station

From the most respected kit builders in the world, comes the most advanced computer weather station! Features digital clock/4 year calendar, 4 digit accuracy, barometer, thermometer, wind vector, memory and more!
Cat G-2000

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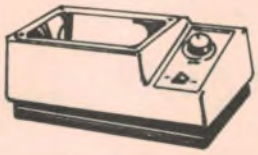
Ultrasonic Cleaning Bath!



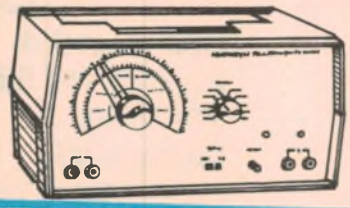
Ideal for jewellery, coins, components... almost anything! Cleans ultrasonically — without rubbing or scratching. 150mm x 100mm tray. Uses ordinary soap or softener. Cat G-2010

$299 Needs external 110V transformer

RF Generator

Hobbyist or technician you won't find better quality! Modulated and unmodulated signals from 310kHz to 110Mhz with calibrated harmonics to 220MHz. Cat G-4005

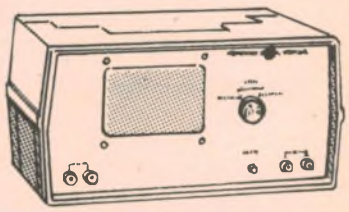
$199



Signal Tracer Kit

Save a heap of time on repairs! The signal tracer kit will check RF, IF, even audio circuitry quickly and easily. Ideal for any workbench! Cat G-4015

$189.95



DSE MAKES DOING IT YOURSELF — EASY!

DSE Metric Clock

Stay one step ahead! Metric time isn't far away so you'd better get used to it now. This brilliant kit gives highly accurate time with a large LED display. That's right!... a metric day is only ten metric hours long.
Cat K-3000

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4 Sector Home Security

Where else could you get 4 sector security at this ridiculous price? It's a bare bones controller but it's packed with features. Complete with on-board pcb connectors and instructions!
Cat K-3254

Value Plus!

$29.95

Short Form Kit
Case not supplied

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Any amateur will know how valuable an attenuator is and how expensive they normally are. Build it yourself and save! 0 to 63dB attenuation from 50 to 500MHz.
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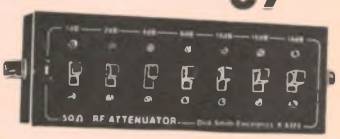

Optical Motion Detector

Perfect as part of your alarm system or as a door minder etc. An optical IC detects movement by changes in light level. Self contained and battery operated!
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Zener Diode Tester

Can't make out the markings on those diodes? Well, here's the answer! The Zener Diode Tester gives direct readout of Zener voltage of 400mW and 1W Zeners from 3.3 to 50 volts (2 ranges). Cat K-3051

$29.95

Fault Finding in a Flash

This low cost Transistor Tester Kit tests bipolar transistors, diodes, F.E.T.'s — even S.C.R.'s and P.U.T.'s. Simple enough to be built by a beginner!
Cat K-3052

$26.95

Accurate LCD Panel Meter

A versatile accurate panel meter with large LCD display. Ideal as a readout device on many projects for amateurs or professionals! PCB design allows for maximum flexibility. Cat K-3450

$49.95

3½ digit

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Save over 25%* on Scope irons

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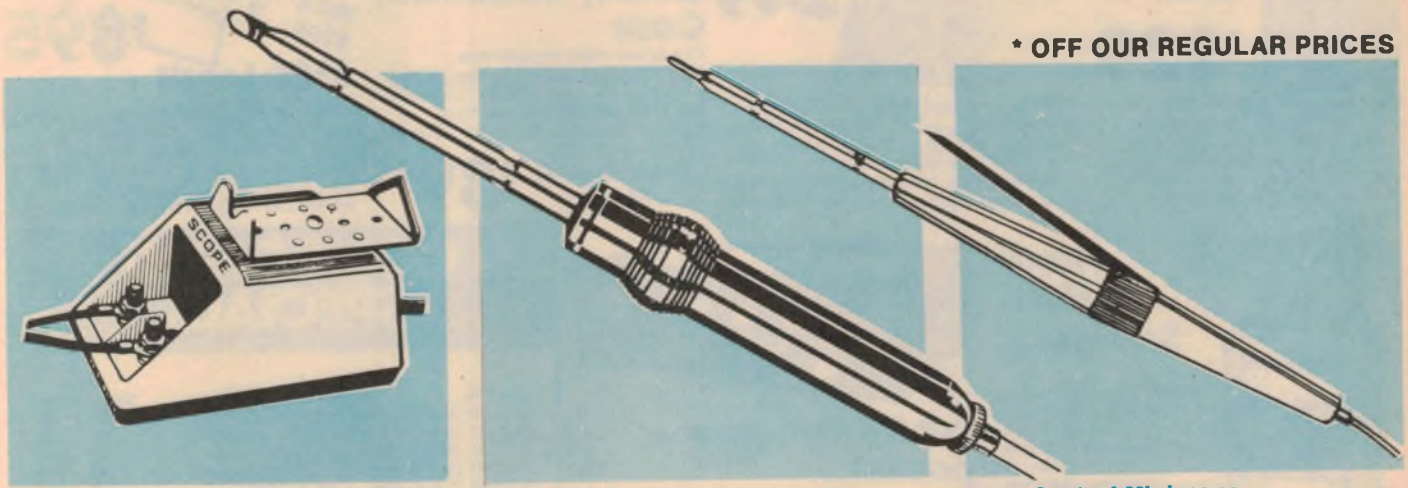

Perfect Partner Scope Transformer

Quality Australian made just for Scope Irons! Delivers 3.3 volts at 30 amps. Special low voltage is designed to help prevent damage to sensitive components. With electrostatic shield for extra protection! Rugged, reliable and complete with iron rest.

Cat T-1692

Normally $59.95

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150 watts — fast!! Superspeed

When the demands are on — there's only one iron that can deliver the goods, quickly and reliably! Delivers a huge 150 watts: in just 6 secs. from cold! You have complete control. With stainless steel barrel and spare tip and element. Use with Scope Transformer (T-1692). Cat T-1605

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SAVE $16!

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Mains Operated Desoldering

Anyone working with electronics needs one of these! A mains powered desoldering tool. Huge 30 watts — so it's fast! Single handed operation makes work easier! Cat T-1340

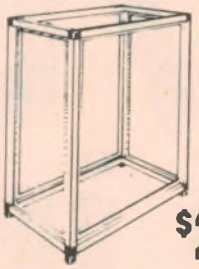
LCD Panel Meter

Build your own LCD Panel Meter and save! Design allows for maximum flexibility to cater for varied mounting arrangements. Ideal for amateur or professional! Cat K-3450

HUGE SAVING

$49.95

19" Zip Rack



$229

The secure storage rack for transceivers, hi-fi, etc! Easy to assemble unit measures 19"W x 24"H x 12"D. Cat H-2470

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The DSE Commander VHF transceiver is by far our most popular amateur kit. Now you'll save a massive $100! Covers the full 144 to 148MHz 2m band and it's packed with features! Cat K-6308

Sensational Saving!! $299

SAVE $50!

Huge Reduction!

It's incredible! We've slashed $50 off the amazing DSE Explorer Kit. Now you can have your own 70cm UHF transceiver for $$$ less than you ever thought possible! Cat K-6300

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Bargain Priced Auto-ranger!

Cat Q-1516

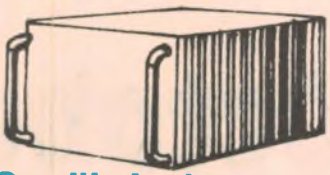
$129

Need a quality DMM that you can rely on? This one's it!! 3.5 digit with memory, auto or manual ranging, continuity buzzer, transistor checker, 10A AC/DC range... and more! And you can carry it in your pocket.

Data Hold DMM

$249

It's the 4.5 digit DMM which holds the reading till you've finished with it! Plus a huge 20A AC/DC range, buzzer, transistor/diode checker, capacitance... everything! Ideal for test and evaluation procedures. Cat Q-1600



Quality Instrument Case

One of our most popular size instrument cases from Horwood. You can't beat the quality! With removable front/rear panels, lids and front handles. Measures 203mm x 102mm x 254mm. Cat H-2455

Professional Finish $39.95

WAS $995

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$100 Less!!

Now you can save an amazing $100 off the incredible DSE Dual Trace CRO. Fantastic 20MHz bandwidth, inbuilt component checker, complete with 2 probe sets and much more! For a workstation that works!! Cat Q-1260

Hand Held Scanning

Better than most bench models! The superb Uniden Bearcat 100XL scanner with auto search/scan, 16 channels, 9 bands, selective scan delay... the list goes on! For quality, reliability and value — Nothing's better. Cat D-2813

$595

Put $200 in your pocket...

And the amazing Playmaster Series 200 Mosfet Amplifier on your shelf! Now you can save $200 and still get possible the best value Hi-Fi kit in the world!! Superb performance and a massive 100 watts per channel. Cat K-3516

Was $699

BUILD IT YOURSELF!

NOW $499

COMPONENT SPECIALS

Cat No.	Component Specials	Was	Now
R-4595	Cap Electro RG 40V 10,000MFD	$9.95	$6.95
R-4010	Cap Electro Axial 63V .47MFD	.49	.35
R-1937	2KR Trimpot Vert 5mm	.70	.49
R-2060	Cap Green 100V .015MFD	.20	.15
R-1402	Resistor GL-1 1W 1 Ohm	.17	.10
R-1960	2KR Trimpot Vert 10mm FR108D	$1.03	.50
R-6836	Pot Carbon 6mm 20K Ohm DG LIN	$4.55	$1.55
Z-6301	74C946 4.5 Digit LCD Driver	$29.95	$9.95
Z-6081	LM381 Dual Op Amp	$5.50	$2.50
Z-5291	74LS176 IC Low Schottky	$1.95	$1.20
Z-1080	AC187 Transistor Germanium NPN	—	$1.21
Z-1443	DD139 Transistor Silicon NPN	.95	.55
Z-1064	AC128 Transistor Germanium PNP	$1.21	$1.05
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A TV colour bar and pattern generator

Here is a design for an easy to build colour bar and test pattern generator, suitable for both servicing and closed-circuit or amateur TV. It provides high performance at a very reasonable cost.

by G.W. BLACK

A colour bar generator is an essential piece of test equipment for servicing colour television receivers. It can also be used to a lesser extent when working with monochrome television.

During the design stage of an amateur television (ATV) repeater for the Canberra district, the need became apparent for a good quality test pattern generator. To enable amateurs to assess their reception and equipment performance, the pattern generator should be as close as possible to the Australian Standards for television transmission. This colour bar generator was originally designed for inclusion in the ATV repeater, and later modified for use as a portable service instrument.

The colour bar generator has the capacity to provide eight different patterns, which are selected from a single thumbwheel switch on the front panel. The unit is housed in a plastic instrument case, and is powered by a 12 volt AC plug pack. On the front panel, RF on either channel 0 (or 1) is available from a 75 ohm connector. On the rear panel, RCA connectors are used to provide outputs for composite video together with horizontal and vertical sync pulses. The sync pulses are available in both positive and negative logic.

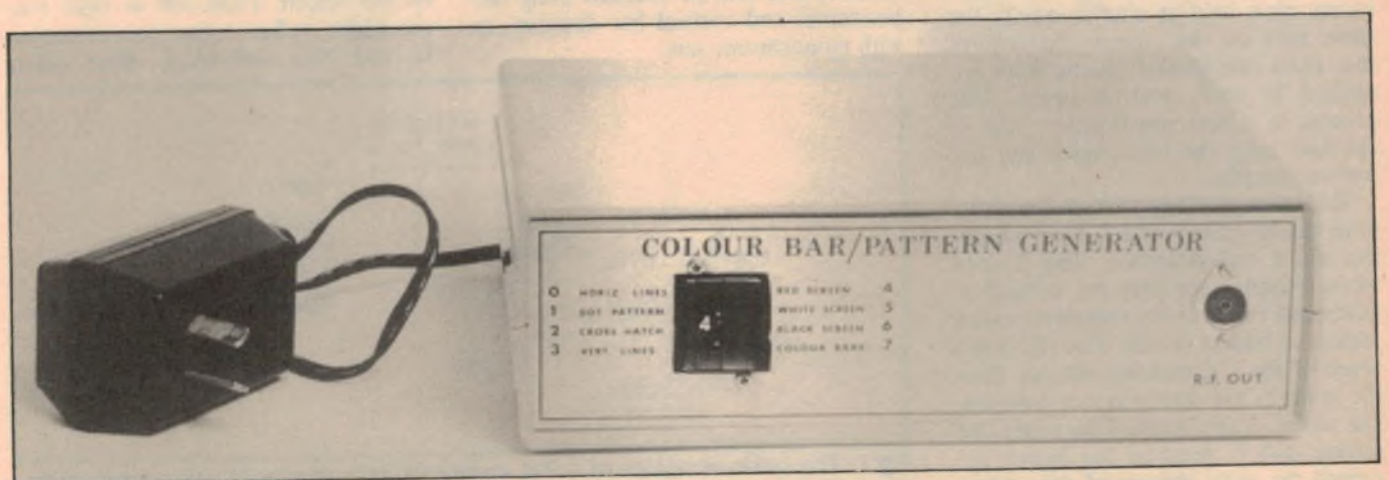
The eight patterns provided are colour bars, red screen, white screen, black screen, cross-hatch, vertical lines, horizontal lines and dot pattern. Synchronization and blanking are to CCIR (International Radio Consultative Committee) standard.

A detailed description of the operation of colour television would occupy many pages of this magazine, but a brief description will enable a greater understanding of this colour bar generator and its uses.

Fig.1 shows a horizontal sync pulse with the "colour burst" on the "back porch". The burst consists of approximately 10 cycles of 4.433619MHz signal, and in a "PAL" system the phase of the burst alternates every television line scan (hence the name "Phase Alternating Line"). This burst has two functions in a television receiver, firstly to indicate the presence of a colour transmission, and secondly to phase-lock an internal reference oscillator in the receiver (used to recreate the colour subcarrier which is suppressed for transmission). When a colour signal is received the colour is determined by the phase relationship between the colour signal and the reference oscillator. The colour operation of the television therefore relies completely upon the "burst".

The picture tube of a colour television receiver has three electron guns, one each for the red, green and blue images. Associated with each of the guns is a red, green and blue phosphor inside the front surface of the screen. Between the phosphor and the electron guns is a shadow mask. For correct operation of a colour receiver it is essential that the electron beam from each gun passes through the shadow mask and lands only on its own phosphor. This is referred to as purity, and is checked using the generator's red screen function. If the purity is incorrectly adjusted, other colours will be evident as well as the red. The white screen can also be used to check purity, but errors may be less evident than using the red screen.

The three electron beams are deflected over the screen by a magnetic field, which is created by a yoke fitted around the neck of the picture tube.



A thumbwheel switch is used for selecting the various functions.

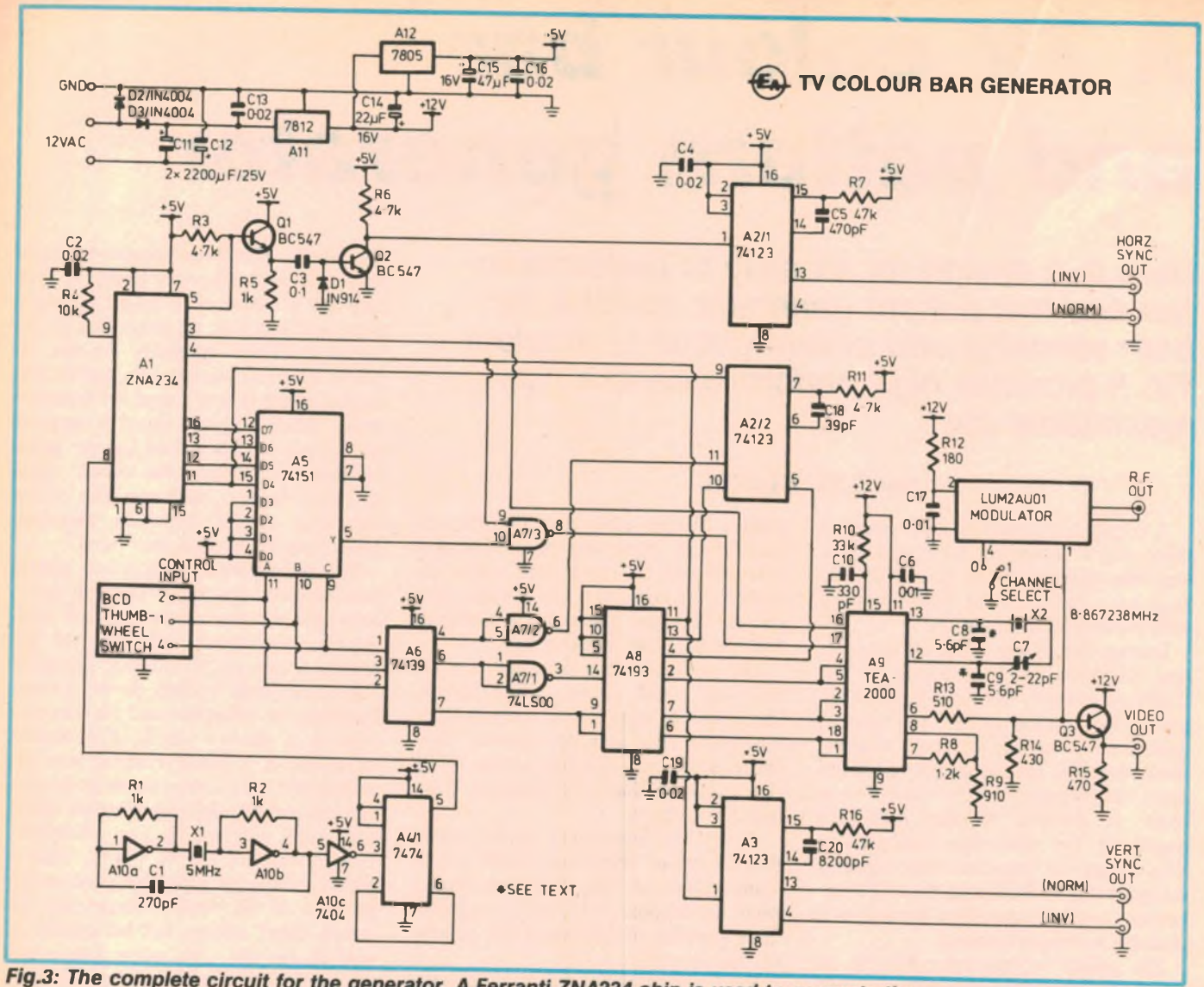


Fig.3: The complete circuit for the generator. A Ferranti ZNA234 chip is used to generate the patterns, and a Philips TEA2000 for colour encoding.

Since the three guns cannot physically be in the same position within the yoke, each beam has a differing amount of deflection applied to it by the yoke. For a good colour picture all three electron beams must land at almost exactly the same spot on the screen. To achieve this, extra individual magnetic fields are applied to each electron beam. This process is called convergence, and is checked using the cross hatch and dot pattern functions.

The horizontal and vertical bar functions can be used to check for pin cushion and barrel distortion. This is seen when straight lines near the vertical or horizontal edges of the television screen appear to bow in or out. This effect is a result of the fact that the distance from the yoke to the screen is not constant, but varies as the beams scan across the screen, and is worst as the beams approach the outer corners of the screen. This distortion is corrected by applying more complex wave forms to the electron beams.

The horizontal and vertical gain and linearity can also be checked using the horizontal and vertical bar displays, as with monochrome sets.

The colour bar function will of course check that all the colour circuits of the receiver are working correctly, by displaying the correct vertical colour bars on the screen. From left to right they are white, yellow, cyan, green, magenta, red, blue and black. Most colour

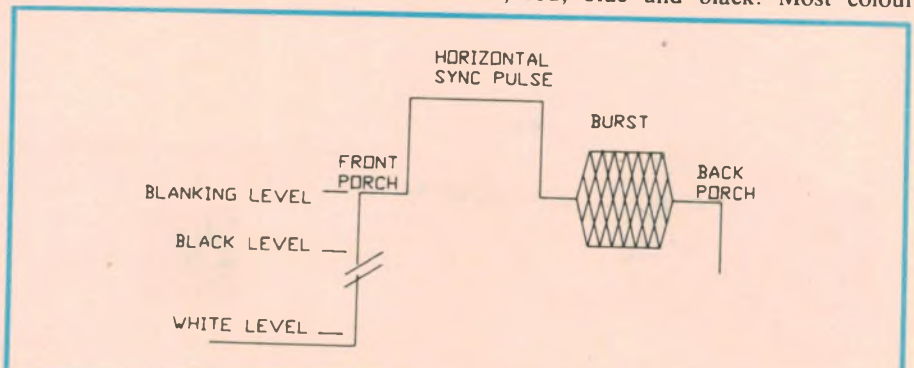
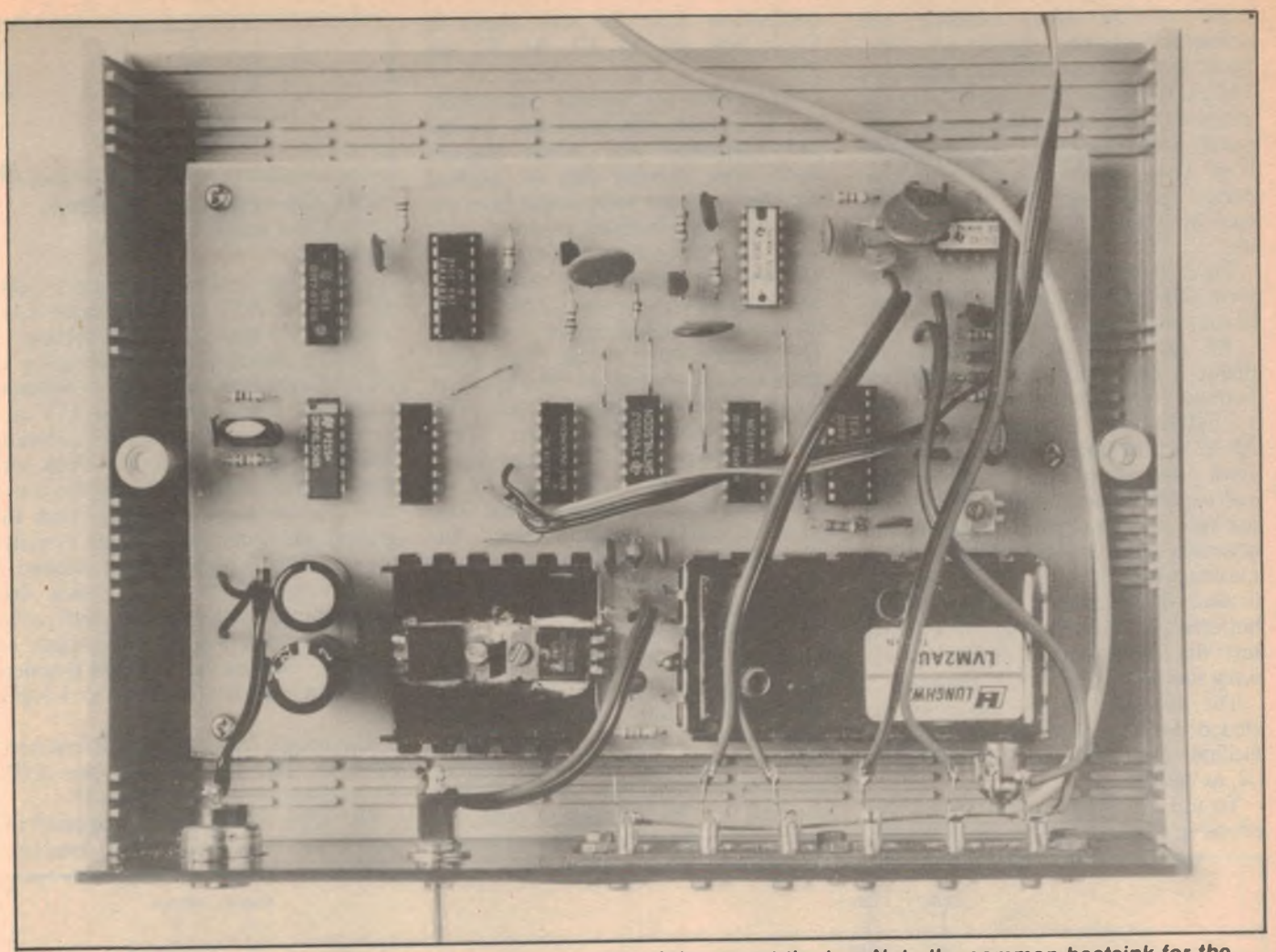


Fig.1: The basic structure of a PAL colour signal's horizontal sync pulse, with the colour burst on the "back porch".



A look inside the generator, with the front panel swung out of the way at the top. Note the common heatsink for the regulator chips.

television service diagrams show oscilloscope waveforms when a colour bar signal is applied to the receiver, thus a good comparison of waveforms can also be made by using this pattern.

One final check of a colour television's adjustments is the grey scale. While this pattern generator does not output a grey scale directly, by using the colour bar function and reducing the colour adjustment on the television to a minimum, a suitable pattern can be obtained. For correct performance a white bar should be seen on the left of the screen and a black bar on the right, with six levels of grey in between. There should not be any colouring of the greys, with the receiver's colour turned off.

The black screen function has no real purpose for testing television receivers, but was included as a background when using the ATV repeater's bulletin board facility.

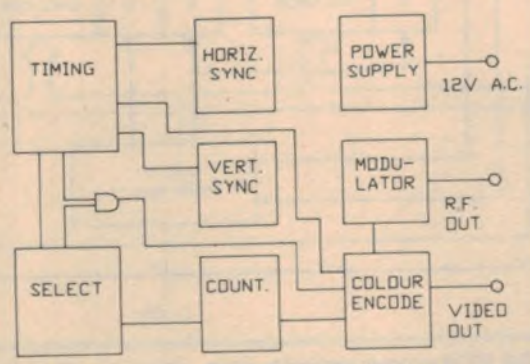


Fig.2: Block diagram of the generator, showing the signal flow paths between the functional sections. The ZNA234 chip forms part of the timing section, along with the 5MHz clock oscillator.

Circuit description

A block diagram of the colour bar generator is shown in Fig.2. All of the internal voltages are derived from an external 12 volt AC plug pack.

All of the signal timing is generated by a Ferranti chip ZNA234E, which is available from Multicorp, of 35 Wells Street, Redfern 2016. The use of this chip simplifies greatly the design of the generator's CCIR synchronization and blanking. Outputs from the ZNA234E are used to generate the horizontal and vertical sync pulses which are also available for external use.

The blanking signals from the ZNA234E are ANDed with other timing signals via the selector switch to provide all of the monochrome functions. The colour functions are generated by a counter, which is clocked by the ZNA234E.

All of the sync, blanking and colour/monochrome signals are combined in the colour encoder, which is a Philips TEA2000. The output from the composite video is available on the back panel, while modulated RF on channel 0 (or 1) is available via a 75 ohm connector on the front panel, being generated by a small VHF modulator module.

Fig.3 shows the complete circuit diagram. The following text should be read in conjunction with that diagram.

All the CCIR synchronization and timing is generated by A1 the ZNA234 Ferranti TV pattern generator chip from a 2.5MHz clock. As shown in Fig.4 the ZNA234 is capable of providing its own clock using an external 2.5MHz crystal and capacitor, but 2.5MHz crystals are not very easy to obtain. To provide the necessary clock a 5MHz crystal oscillator comprising A10, R1, R2, X1 and C1 is used. The output of the oscillator is buffered by another section of A10 and then the 5MHz signal is divided by two using one half of A4, a "D" flipflop.

The necessary layout has been included on the printed circuit board to facilitate using either 2.5 or 5MHz crystal, as desired.

To use a 2.5MHz crystal, follow the circuit in Fig.4 and delete the following components from the main circuit in Fig.3: A10, A4, X1, C1, R1, R2 and R4.

A1 provides a composite sync output, but to separate this signal into vertical and horizontal sync pulses requires much more circuitry than the method used here. A grey scale output from pin 5 of A1 is first buffered by emitter follower Q1, then clamped by C3 and D1. The resulting signal is amplified by Q2, and a negative-going pulse at the collector of Q2 is applied to pin 1 of A2/1. The negative edge of this pulse corresponds to the start of the front porch of the horizontal blanking pulse. A2/1, half of a 74123 monostable is set by C5 and R7 to time out after 7.5 microseconds. Outputs from pin 13 and 4 of A2/1 (Q and Q-bar) are connected to the rear panel as external trigger sources. Do not substitute a 74LS123 for A2 (or A3), as the resulting pulse length will be incorrect.

Composite blanking from pin 4 of A1 is applied to A3/1, another 74123. This monostable is set to time out after 100 microseconds. Since a line blanking pulse occurs every 64 microseconds, A3/1 is retriggered every line. During the frame blanking pulse A3/1 will time out and not be retriggered until the start of the next frame. This sequence

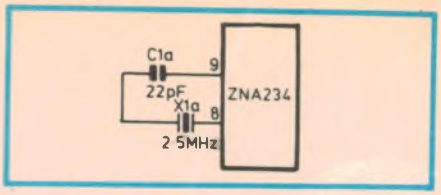


Fig.4: Alternative clock oscillator circuit, if a 2.5MHz crystal is available.

generates the vertical sync pulse at pins 13 and 4 of A3/1 which are again connected to the rear panel RCA sockets.

Pattern selection is obtained using a BCD thumbwheel switch. This emulates the digital control used in the ATV repeater. An input lead to a TTL device will float high to a logic one when left disconnected, so by connecting the common lead of the thumbwheel switch to ground, the codes produced are actually the complement of the number selected.

For selections "0" to "3", when the "4" output from the switch is high, only black and white displays are enabled. A high "4" disables A6, a 74139 decoder and forces all of its outputs to a logic one.

The output from A6 pin 4 is inverted by A7/2. This logic low disables A2/2 via its direct clear input on pin 11.

The high on A6 pin 7 is applied to pins 1 and 9 of A8, a 74193 counter.

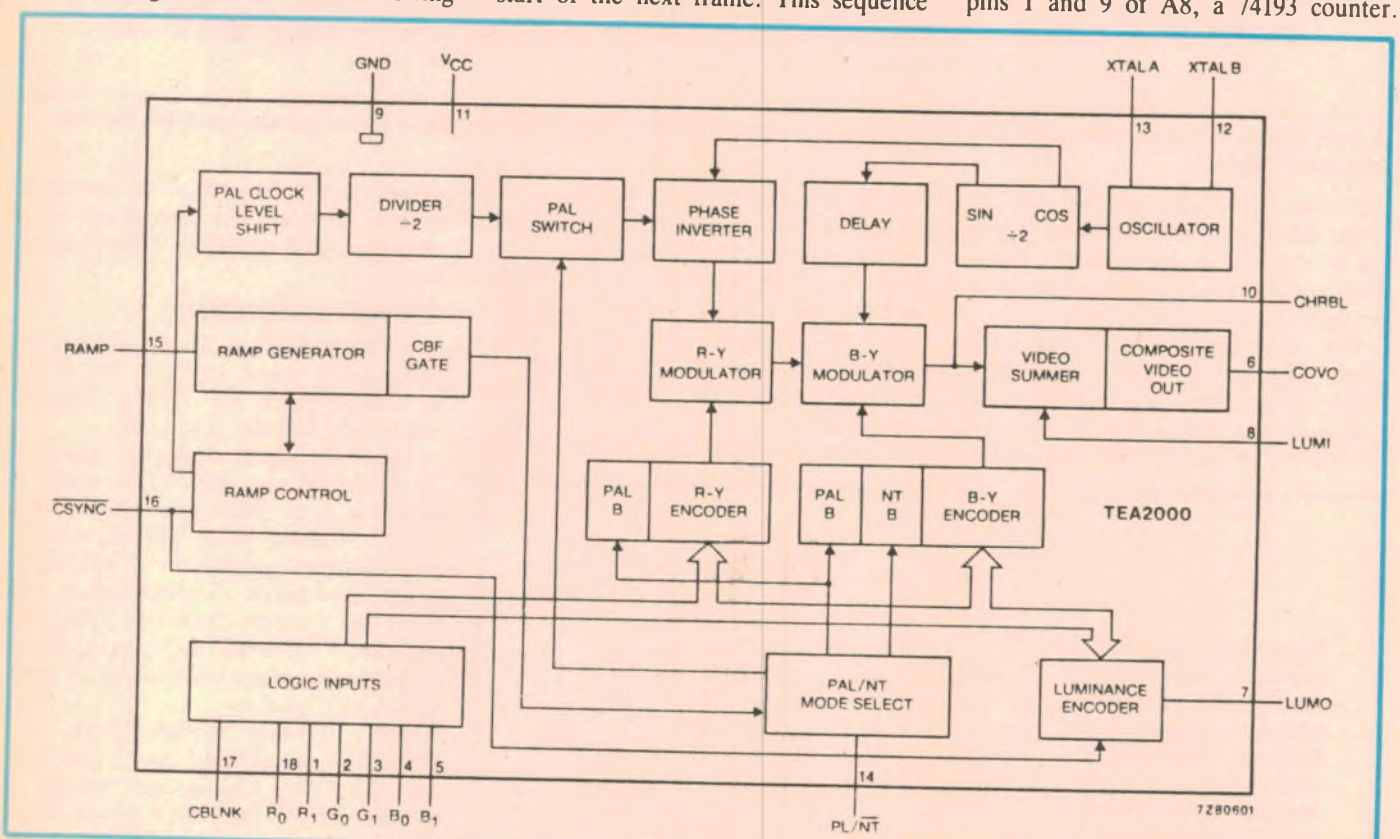


Fig.5: The internal block diagram for the TEA 2000 colour encoder chip, showing all of the functions it performs. (Reproduced here with permission of Philips Industries Holdings)

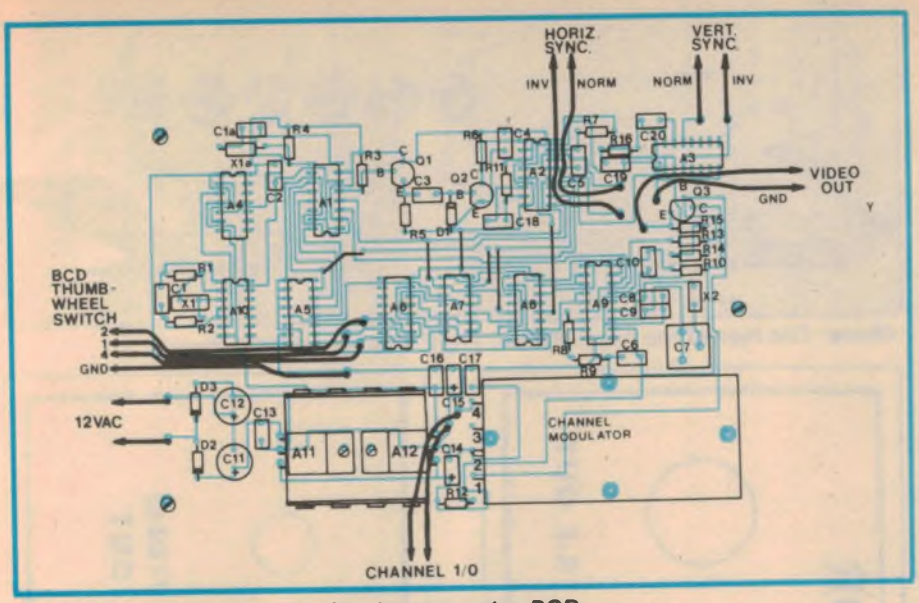


Fig.6: The overlay diagram for the generator PCB.

Pins 1 and 9 together with pins 10 and 15 (connected to +5 volts) comprise the parallel data input connections to the counter. Composite blanking signal from A1 is connected to pin 11 of A8, the parallel load input. Hence every time there is a blanking pulse, the parallel data from pins 1, 9, 10 and 15 is loaded into the internal registers. As these inputs are all logic high, all of the output pins 2, 3, 6 and 7 (pin 3 is not used) are latched high. The outputs from A8 are connected to the colour input pins of A9, generating a white colour code when all are high.

The white code forms the basis for all of the monochrome functions. By extending the blanking signal over the areas where the white is not required, the required black and white images are obtained.

A1 generates most of the basic signals required for the monochrome functions: all that needs to be achieved by the circuitry is to enable those signals to drive A9 correctly.

Other outputs from A1 that are used are horizontal lines, dot pattern, crosshatch, and vertical lines. These signals along with the composite blanking are all negative logic, but A9 requires the blanking to be positive logic. While A7/3 is nominally a 7400 NAND gate, when used with negative logic it can be considered by demogans theorem as an OR gate with invertors on each input. These invertors provide the positive logic that A9 requires.

For a selection of 0 on the thumbwheel switch, the "horizontal lines" output from A1 (pin 16) is selected by A5, a 74151 multiplexer. It is then routed via pin 5 of A5 to pin 10 of A7/3. Thus the horizontal lines are ORed with the composite blanking from pin 4 of A1. This then completes all of the signals necessary for A9 to display the horizontal lines pattern.

Similarly for selection 1 a dot pattern signal from A1 is ORed with the blanking signals and applied to A9. The same system is used to generate a crosshatch (selection 2) and vertical lines (selection 3).

For switch selections 4 to 7, colour

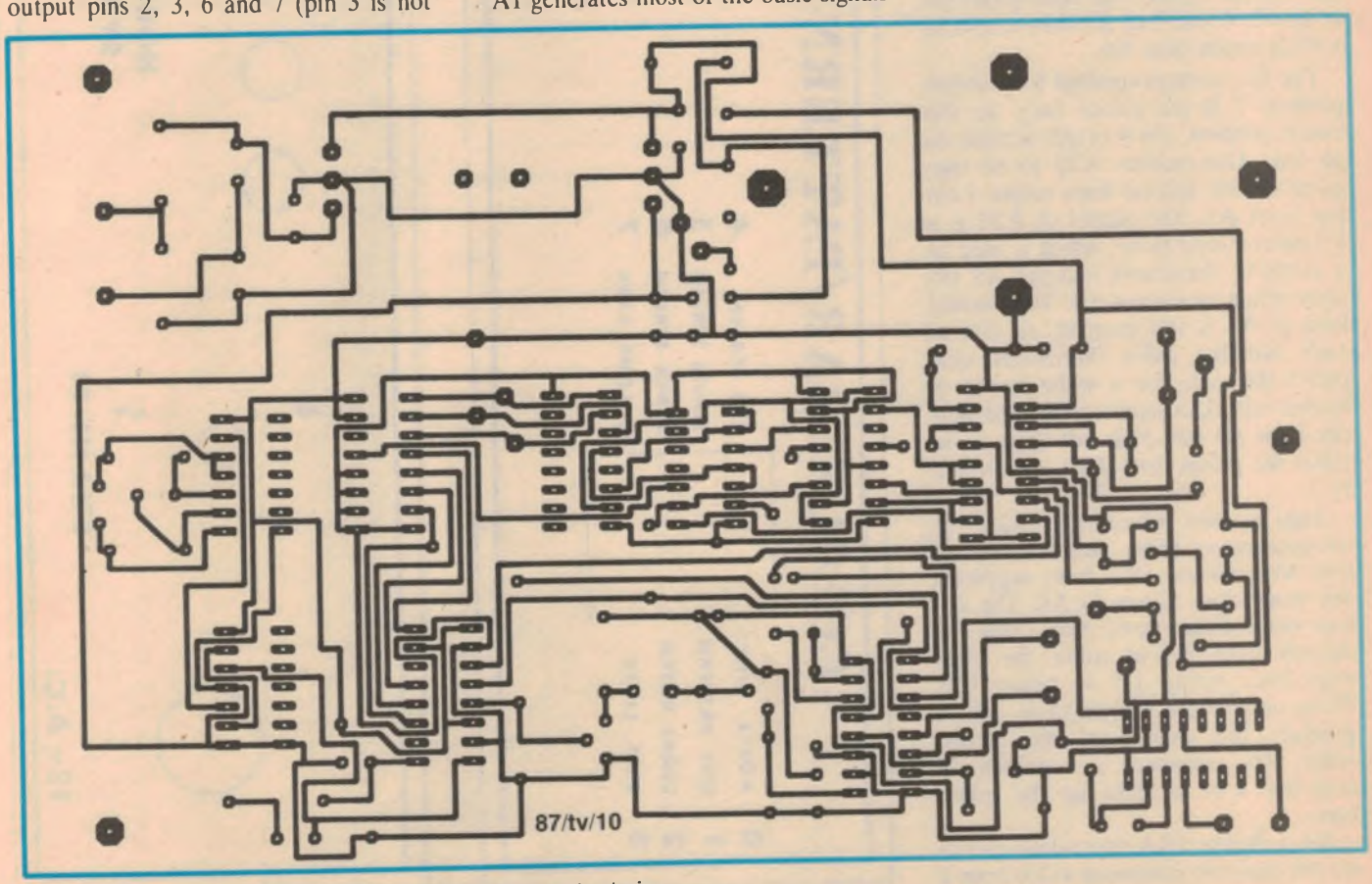


Fig.7: The generator PCB pattern, reproduced actual size.

patterns are selected. As the 4 output from the thumbwheel switch is now low, the output from A5 pin 5 will always be a logic high, since all of the other inputs of the multiplexer are tied to +5 volts. This allows the blanking to be inverted and passed to A9 with no modifications.

A6 is now enabled, since pin 1 is now low (from the 4 output of the switch).

For selection 4, input pins 2 and 3 of A6 will be logic one. This will set output pin 7 to a logic zero, while the other outputs are still a logic one. The low on pin 7 is connected to parallel inputs 1 and 9 of A8. This changes the outputs of A8 at each parallel load (blanking pulse). The colour code now presented to A9 represents a red screen.

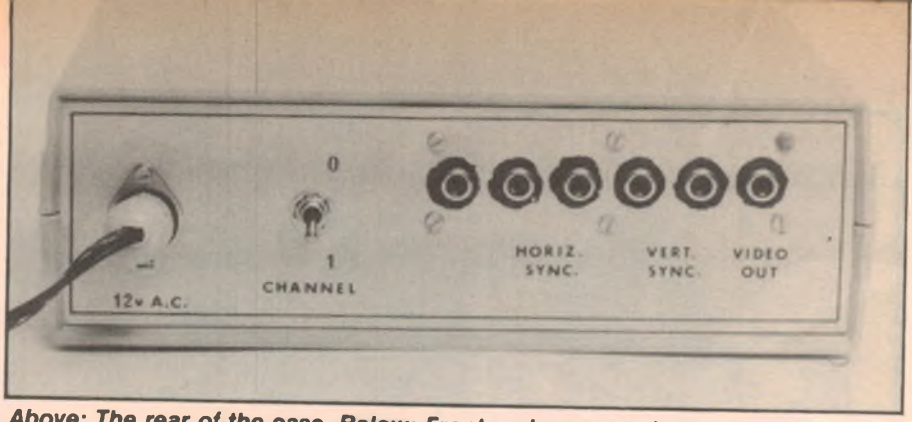
A white screen is produced from switch selection 5. In this condition A6 is configured as for the black and white functions, but now the extra blanking pulses are not used and a white output results.

When the thumbwheel is selected to position 6, pin 6 of A6 is made to go slow while the rest remain high. The low from pin 6 is connected to the master reset input of A8 via the invertor A7/1, and this forces all outputs of A8 to a logic low; at the same time it disables all the inputs. The code produced at pins 2, 6 and 7 of A8 then results in a black screen from A9.

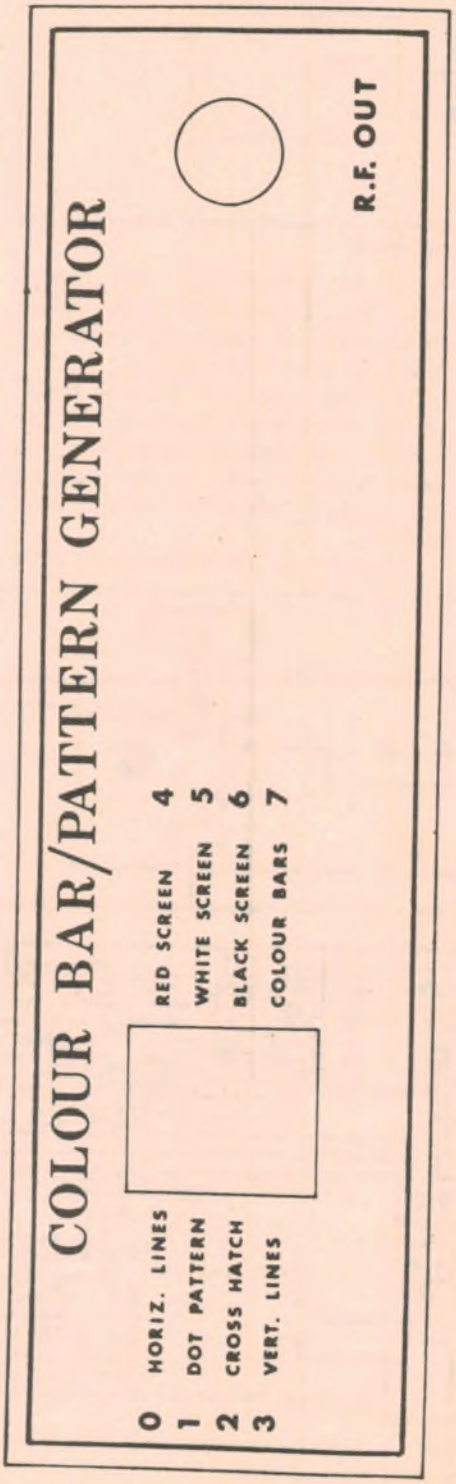
The final pattern selected from switch position 7 is the colour bars. In this switch position, pin 4 of A6 is made to go low. This enables A2/2 to be triggered by the vertical lines output f om pin 11 of A1. The output of A2/2 is a 0.2 microsecond pulse, which is used as a clock to decrement counter A8 (finally acting as a counter!). The parallel load of A8 is still enabled, so that at each blanking pulse (horizontal sync pulse) the code for a white screen is loaded into A8's latches. The first output from A8 (pin 3) is not used, so in effect the pulses from A2/2 are divided by 2.

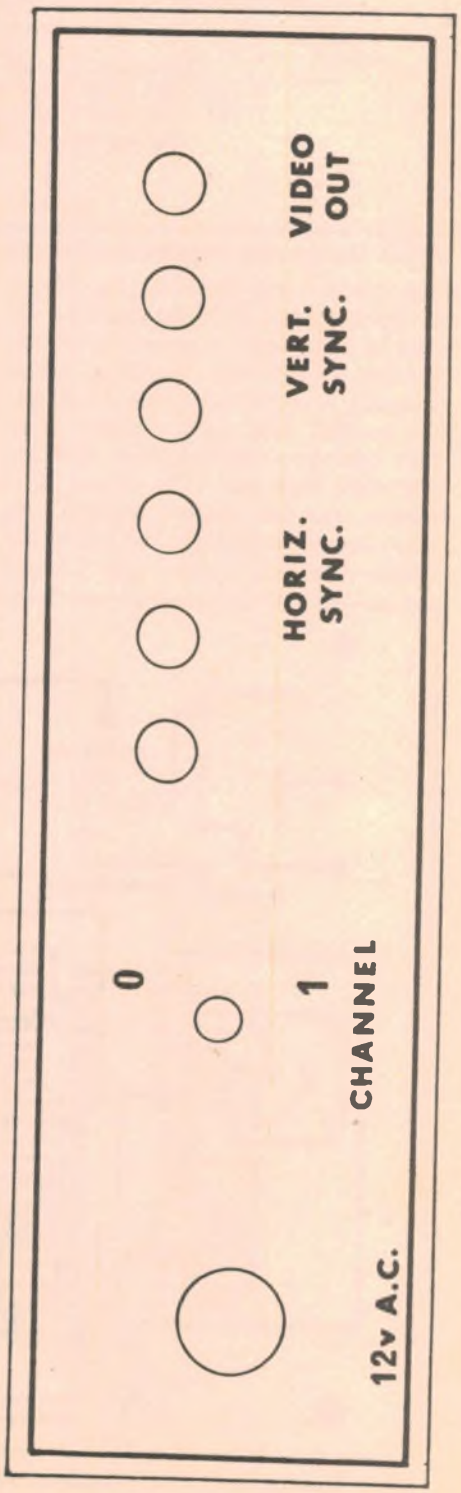
After sixteen pulses from A2/2 the terminal count down output from A8 (pin 13) inhibits A2/2 from supplying any more clock pulses to A8. The sixteen clock pulses from A2/2 cause the outputs from A8 to count the eight steps from binary 111 to binary 000. These outputs are connected to A9, to generate the colours in the correct order. This sequence is repeated on each line scan to make up the colour bars.

A9, a Philips TEA2000 colour encoder, will generate composite video from a



Above: The rear of the case. Below: Front and rear panel artwork.





PARTS LIST

1 plastic instrument case 200x160x65mm (Dick Smith H-2505)
1 PCB, code 87ms10
1 Scotchcal front panel
1 Scotchcal rear panel
1 12V AC plug pack
1 RCA panel strip (6 way) (Dick Smith P-1446)
1 RCA plug
1 co-axial TV panel socket
1 modulator LUM2AU01 (Dick Smith K-6043)
1 socket (to suit AC plug pack
1 8.867238MHz crystal
1 5.0MHz crystal (see text)
1 2.5MHz crystal (see text)
1 thumbwheel switch BCD
1 18 pin dip socket
1 16 pin dip socket
4 spacers
1 heatsink

Semiconductors

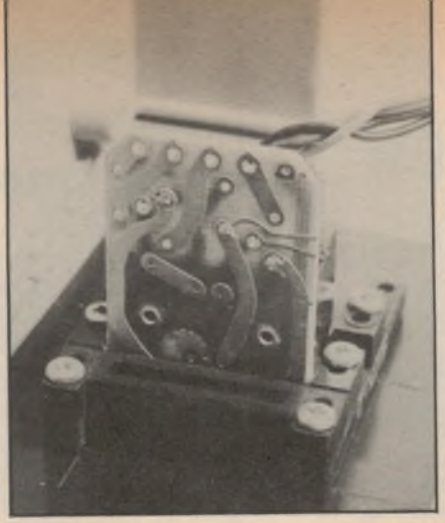
1 ZNA234 Ferranti TV Pattern Generator
1 TEA2000 Philips Colour Encoder
1 7404 invertor
2 74123 monostable
1 7474 flipflop
1 74151 multiplexer
1 74139 decoder
1 7400 nand
1 74193 counter
2 1N4004 diode
1 1N914 diode
3 BC547 transistor
1 7805 regulator
1 7812 regulator

Capacitors

2 2200mfd 25V PC electrolytic
1 22mfd 16V tant
1 47mfd 6V tant
5 0.01mfd ceramic
1 0.01mfd ceramic
1 0.1mfd ceramic
1 8200pf ceramic
1 470pf ceramic
1 330pf ceramic
1 270pf ceramic
1 39pf ceramic
1 22pf ceramic (see text)
2 5.6pf ceramic (see text)
1 2-22pf trimmer

Resistors

1 18OR
1 43OR 2%
1 470R
1 51OR 2%
1 91OR 2%
3 1K
1 1K2 2%
3 4K7
1 10K (see text)
1 36K
2 47K



The rear of the BCD thumbwheel switch, showing its connections.

8.867238MHz crystal, composite sync, composite blanking and colour inputs. Fig.5 shows the internal configuration of the TEA2000 IC.

Composite sync (negative logic) applied to pin 16 of A9 is supplied directly from pin 3 of A1. Composite blanking is applied to pin 17 of A9. This is supplied basically from pin 4 of A1, but with extra blanking added by A7/3 as already described.

Colour information is supplied from A9 to pins 1, 2, 3, 4, 5 and 18 of A9. The TEA2000 is capable of generating 64 different colours, but only 8 are used in this circuit. The 8.867238MHz oscillator crystal (twice the colour burst frequency), consisting of X2 and C7 is connected betweeen pins 12 and 13 of A9 (see Fig.3).

Capacitors C8 and C9 are only required if a "mask 1" version of the TEA2000 IC is used. The early versions of this chip sometimes oscillate at spurious frequencies if these capacitors are omitted. On the TEA2000 that I used, the following numbers were printed: "TEA2000 DSD86441Y". In the second number, "86" refers to the year of manufacture, "44" is the week of the year and "1" refers to the mask version. From this information it is easy to determine the mask version of the IC.

The TEA2000 is actually capable of either PAL or NTSC operation. By leaving pin 14 disconnected, the PAL mode of operation is selected. Tying the pin to ground would select NTSC.

To correctly position the colour burst information on the back porch (as shown in Fig.1), a timing circuit consisting of C10 and R10 is used.

Resistors R8 and R9 provide coupling of the luminance signal. These should be high accuracy components, since they affect the DC level of the composite video output.

The composite video output from pin 6 of A9 is attenuated by R13 and R14 to provide the correct video level for direct connection to the RF modulator. The signal is also buffered by Q3 to provide composite video output to the rear panel.

Pin 4 on the RF modulator is switched to ground for channel 0 of left open to select channel 1. The modulator operates from 6.2V DC, so an external 180 ohm resistor is required for current limiting the 12 volt supply.

A 12 volt AC plug pack is used to supply +12V and +5V to the pattern generator circuitry via a voltage doubler rectifier and two three-terminal regulators (A11 and A12).

Construction

By referring to Fig.6 the printed circuit board overlay, and to the circuit board itself, the position of all the components can be established.

Construction should start by installing all the resistors, followed by the capacitors — ensuring that the four electrolytic capacitors associated with the power supply are installed with the correct polarity.

The rectifiers, regulators and their common heatsink can now be installed. Ensure that the heatsink is as large as possible and there is good thermal conduct to the regulators by a coating of thermal compound.

Next install the six wire links in the centre of the circuit board, and the wiring associated with the thumbwheel switch and connectors on the front and rear panels.

In the original colour bar generator, IC sockets were used for only A1 and A9, the more expensive chips. But there is no reason why sockets should not be used for all the ICs if required.

Next install the two crystals required, considering the options regarding the 2.5MHz clock to A1.

Finally the signal diodes, transistors and ICs can be installed, again taking care of the orientation of these components.

Finally, I suggest that you check all the soldering, wiring and component orientation for mistakes before proceeding.

Testing and adjustment

If the construction has been completed without any mistakes, the colour bar generator should work when power is applied.

Connect the 75 ohm output from the front panel to the aerial terminals of

Continued on page 142

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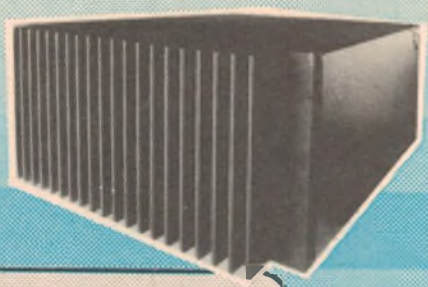

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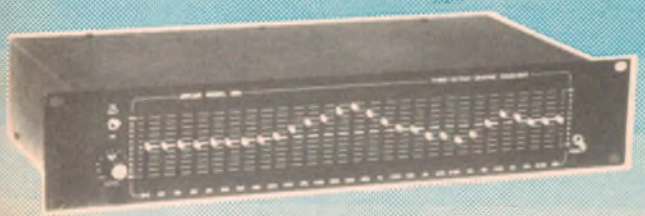

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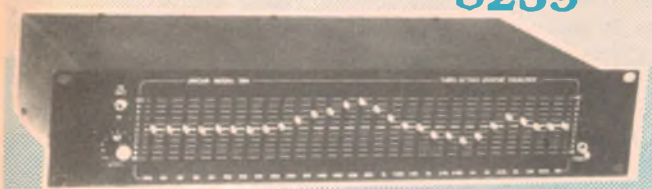

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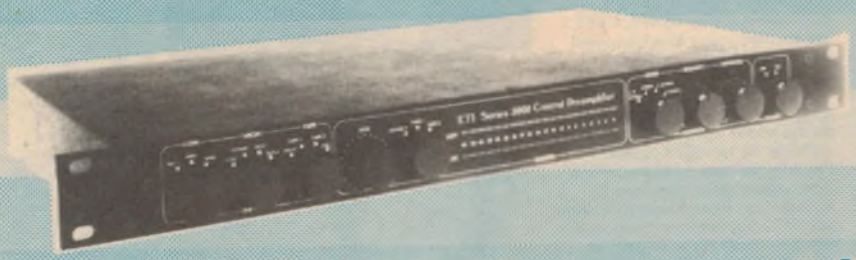

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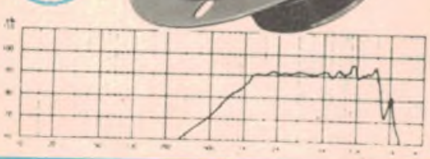
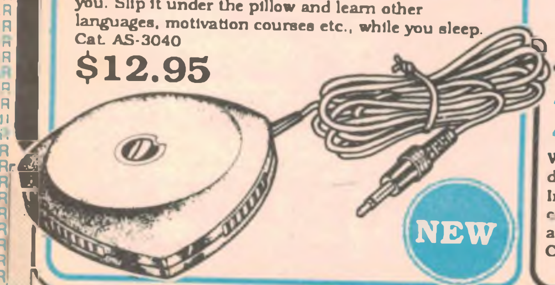


PILLOW SPEAKER

Great for night owls, don't disturb others around you. Slip it under the pillow and learn other languages, motivation courses etc., while you sleep.
Cat. AS-3040

$12.95



NEW

FROM RUSSIA WITH LOVE!

DIRT CHEAP!!

OSCILLOSCOPE SENSATION

Jaycar's Scoop Purchases reach the USSR!
We have been agonising for ages now about the oscilloscope problem - what can we do to bring the price of a good CRO down to the budget of the enthusiast. We have STOPPED SELLING the 20MHz Dual Trace class of CRO because of the price hikes. As at Aug 1987 we didn't have an oscilloscope to sell! And we call ourselves an electronics company!

SAVED BY THE USSR

Our plight has been answered by a shipment of Russian-made oscilloscopes. (See below). A well known distributor of professional test equipment had ordered a consignment of the CRO's and had cancelled the order due to long delays, etc. The goods were already on the water! The importer had a problem. So he called Jaycar. Frankly, we were a little wary of a piece of test equipment from a country that was not a mainstream supplier. Our concern went out the windows when we were given a sample CRO to evaluate! IT IS UNBELIEVABLY WELL BUILT. Its not "flimsy" like the low-end Asian CROs.
After seeing the sample, Jaycar willingly took over the consignment. The importer LOST MONEY selling the goods to us. His loss is YOUR GAIN however! We are able to sell you a magnificently built 10 MEG CRO at a great price!

JAYCAR IS BACK IN THE CRO BUSINESS

THE OSCILLOSCOPE ITSELF

As we said before, the CRO is very solidly constructed! It has a 3" (75mm) tube with square graticule and has an amazing DC-10MHz bandwidth. It comes with a set of 1:10 probes and has a convenient tilting bail which can be folded flush with the cabinet. Worried about spares? We aren't. But if you are you can buy a comprehensive spare parts kit for the CRO at the amazing price of only $20 extra. (CRO tube NOT included!) Like most electronic gear built this side of MARS most of the parts are bog standard. (Did you know that you can now buy Russian made 74LS, 4000 CMOS and most RAM?)
We are SO excited by this product we are seriously considering stocking a whole range of USSR made test gear (including more stocks of this particular CRO). The price is right and the quality is DEFINITELY right!
What more can we say? Check the specs, and hurry! We only have a VERY LIMITED QUANTITY!

Cat. QC-1910

$399

Spare parts kit
Cat. QC-1911
$20

NEW

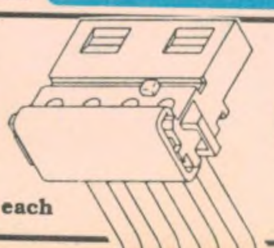
SPECIFICATIONS

Vertical Deflection system:	
bandwidth, MHz	0-10
rise time (transient response), ns	35
deflection factor (error 6%)	10mV/div-5V/div
input impedance, Mohms	1
input impedance with the external 1:10 voltage divider, Mohm	10
input capacitance, pF	40
input capacitance with external 1:10 voltage divider, pF	25
Horizontal deflection system:	
sweep rate (error 6%)	0.1us/div-50ms/div
sweep modes	free running, triggered
synchronisation: internal	in frequency
(with display size from 0.8 div up)	range up to 10MHz
external	in frequency
(from signals of 0.5-5V amplitude)	range up to 10MHz
useful area of screen, div (division value is 10mm)	8 x 10
accelarating voltage, kV	2
Operating conditions:	
ambient temperature, C	+10 to +35
relative humidity at +20 C, % not above	80
Power supply voltage at 50Hz, V	240
Power consumption, VA	25
Overall dimensions, mm	100 x 180 x 250
Mass, kg	3.5

CONCORD OPEN
SATURDAY 9am - 12pm

AT LAST!!

4 PIN DISK DRIVE PLUG



We must be asked so many times per day for this device and now we have finally found it. Top quality Insulation Displacement type with positive locking cover which insulates termination area and acts as a strain relief.
Cat. PP-0920

$6.50 10 up $6.00 each

NEW

WEATHER PROOF HI FI EXTENSION SPEAKERS

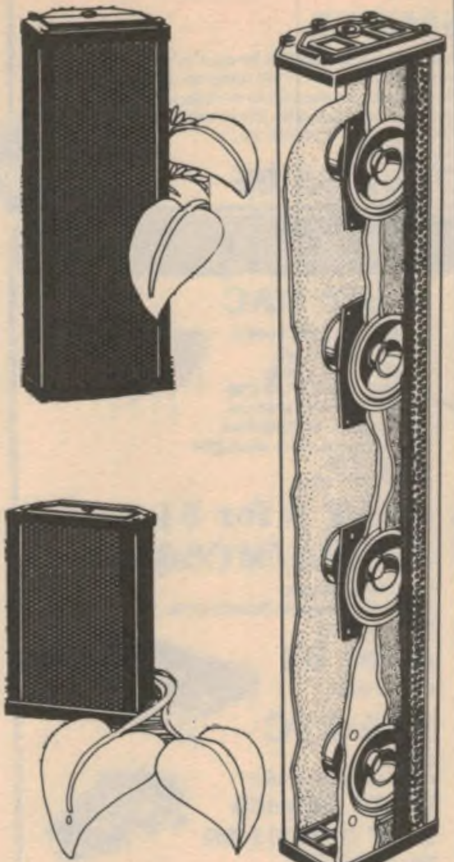
At last, Jaycar has available two models of the superb Redford outdoor speakers. Redford speakers feature: rugged extruded aluminium construction, superb powdercoat industrial paint finish, excellent reproduction, engineered in Australia, superior to imports - yet a fraction of the cost.

Rugged Extruded Construction

These vibration free enclosures are constructed from die extruded heavy guage aluminium and finished with incredibly durable industrial powdercoated black enamel. The speaker ends are sealed via gaskets and tough moulded "LURAN S" UV resistant end caps. The end result is "Good Looks" together with assured rugged durability for the Australian environment.

Excellent Reproduction

The drivers have been chosen for wide range, low distortion, mid range "presence" (essential for high grade vocal work) and high efficiency in general. Power Capacity for short term use, the drivers will safely handle 150% of rated power. Acoustic wadding is used to dampen bass resonance. Weather Proof Construction and use of "Doped Cones" Foam plastic and cloth is sandwiched between baffle and front grille to prevent water ingress. A first for Redford is the use of a patented moisture repellant process for all models.



10 WATT

Single dual doped cone driver 16 ohm impedance is employed to give a generally correct volume balance with main speakers - an added bonus is your amplifier load is kept to respectable limits! Great for back patio, den, boat deck, etc.
Size: 275(H) x 187(W) x 135(D)mm
Cat. AS-3040

$109 each

20 WATT

Uses 2 special dual doped cone driver for those wanting a bit more umph! - 8 ohms.
Size: 455(H) x 167(W) x 135(D)mm
Cat. AS-3042

$149 each

CORDLESS PHONE

The fabulous Portable Telephone that you can take anywhere around the house, garden or swimming pool. Microprocessor controlled with a range of up to 250 metres and absolute clarity.

Features:
- Simple to use and easy to install - just plug in
- Operating range up to 250 metres (800 ft)
- Security code system with 16,348 combinations
- Call function at base unit to alert handset
- Pulse dialling with audible tone feedback at the touch of a key

Cat. YT-7065

SAVE $70 WAS $269
NOW ONLY $199

AUSTRALIAN MADE MAGAZINE BINDER NOW IN STOCK!

Re-designed to really hold your magazines in comfort. Uses holes instead of slots to hold your mags. Will easily hold 12 issues of your magazine but can accommodate more if necessary.
SEE THE JAYCAR 1987-1988 CATALGUE FOR MORE DETAILS.
Cat. BB-7000

$7.95 ea
10 up $7.50 each

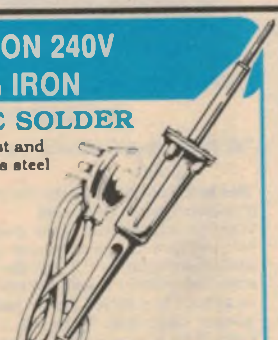
SAVE $5.55 ON 240V SOLDERING IRON

WITH FREE SOLDER

Ideal for the hobbyist and handyman. Stainless steel barrel, 240 volt.
Cat. TS-1450

ONLY
$15.95

Spare Tip
Cat. TS-1453
$2.20



GORE HILL OPEN SATURDAY AFTERNOON UNTIL 4pm

TO-3 HEATSINK BARGAIN

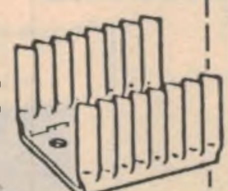
Manufacturers/OEM's - note we have a bulk quantity of TO-3 Minifin heatsinks available at a never to be repeated price.
Size 38mm x 38mm base x 26mm high.

Normally $1.95 each

SPECIAL

1-9	$1.00
10-99	$0.80
99-999	$0.60
1000+	$0.50

Cat. HH-8509

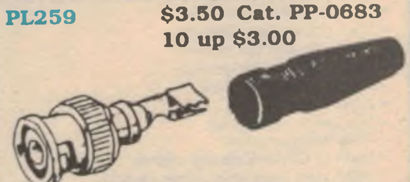


DIRT CHEAP!!

NEW SOLDERLESS PLUGS

Jaycar introduces a new range of extremely easy to use solderless plugs.

BNC	$3.50 Cat. PP-0652	10 up $3.00
RCA	$1.95 Cat. PP-0246	10 up $1.65
PAL TV	$1.95 Cat. PP-0604	10 up $1.65
PL259	$3.50 Cat. PP-0683	10 up $3.00



IEC MALE CHASSIS SOCKET WITH FUSE

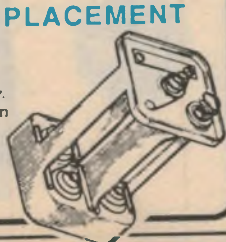
For those who require that extra safety feature of being fused. Even has a spare fuse. Electricity authority approved.
Cat. PP-4004

$5.95
10 up $5.50 each

"LANTERN" TYPE TORCH BATTERY REPLACEMENT HOLDER

Lantern batteries are getting expensive lately. With this holder you can use 4-D size batteries instead.
Cat. PH-9238

$6.50



DIGITAL MULTIMETER WITH FREQUENCY COUNTER

Cat. QM-1555

ONLY
$169

CLEAR OUT OF ALGERNON ROBOT KITS

We have a very limited quantity of these left. We can offer the Algernon Robot kit with the interface card and the motor control card as a package deal for **$199 SAVE $100**
The robot alone was $189.
We also have an additional quantity of interface cards and motor control cards at 1/2 price.
Interface card Cat. KJ-6120
was $69.95 NOW $35
Motor control card Cat. KJ-6110
was $39.95 NOW $20

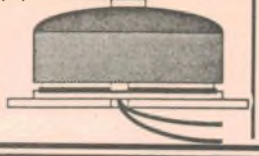
ALARM BELL

If you want something different for your alarm than a siren try a bell. These operate from 12V DC and are 100mm (4") diameter.
Cat. LA-5270

$14.95

LIMITED QUANTITY

NEW



SHOCK/VIBRATION SENSOR

This device is designed to be used in Normally Closed (NC) circuits. It will initiate an alarm when a vibration of considerable force strikes the protected surface (it is adjustable). Protect walls, ceilings, windows, safes, cabinets, etc.
Cat. LA-5068

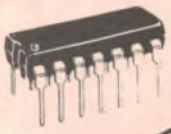
ONLY $5.95

NEW

SILLY SEMI SPECIALS

7410

Triple 3 input NAND gate
Normally about $1 each

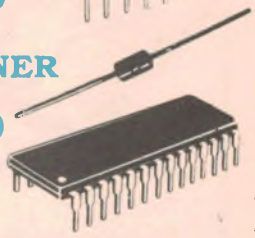


4 for $1.00
Cat. ZS-5810

6.8V 5W ZENER

NORMALLY $1.20 ea

5 for $1.00
Cat. ZR-1445



6810

A RAM
Normally worth $8. We have been selling for $2.50 each.

THIS MONTH

2 for $1 Cat. ZZ-8056

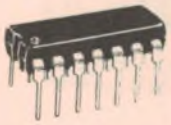
75451

Dual Peripheral positive "AND" driver
Noramlly $2 each

4 for $1.00 Cat. ZS-5950

8 BIT DAC

MOTOROLA MO13408LS
(Simular to DAC-08)
This is a high quality ceramic cased ± 1/2 LSB D/A convertor in a 16 pin DIL package. Settling time 300nS typical. Data sheet 25¢.
Cat. ZZ-6060
NORMALLY $5 ea

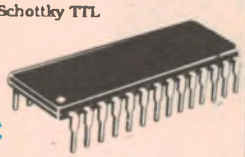


ONLY 2 for $1

8T-26A/MC6880A

Quad Bus Extender
16 pin DIL Motorola Schottky TTL
Normally $1.95

4 for $1
Cat. ZZ-8082



Z80 CTC

1.7MHz
Central Processing Unit

WERE $2 each
NOW 2 for $1.00
Cat. ZZ-8036

DIRT CHEAP!!

AEM 3506 "Uo SAT" SATELLITE DECODER

The University of Surrey (UK) maintains two satellites:- Uo-9 and Uo-11. Information transmitted is of an educational, amateur radio or technical nature concerning the satellites themselves. Very interesting!
You can pick up the Narrow Band FM (NBFM) signals from the satellites as they pass over with a simple antenna (at 145MHz), and say, a scanner or 2m receiver.
Audio FSK signals from the receiver are processed by project 3506 and presented to your computer as "RS-232". A simple 'Dumb Terminal' program will allow your computer to decode the signals and reproduce the text transmitted by the University on your monitor (or printer).
The Jaycar kit includes all specified components including MAX 231 chip, XR2211, metal case, etc.
Cat. KM-3063

ONLY $55.00

BRAND NEW KIT

UNBELIEVABLE BARGAIN BURGLAR ALARM CONTROL PANEL

Who would believe it? A TWO SECTOR professionally made burglar alarm panel for under $100!
Once again a SCOOP PURCHASE of distress importers stock is YOUR GAIN.

- YOU REAP THE BENEFIT!! With features like this
- Built-in siren driver
- 3 amp dry relay contact
- Earth ground protection
- Adjustable entrance time
- Adjustable alarm time
- Zone status LEDs
- Remote on/off option
- Prealarm provision
- Built-in Gell cell charge circuit
- Solid steel case with tamper switch
- DIP switches for zone isolation
- Front panel mounted panic switch

You could easily pay $200. (Some of our competitors charge this ANYWAY).
As a special October price (as October is a slow month and we need the money) we will pass this great alarm box on at the incredibly low price of $99.95 - that's right! UNDER ONE HUNDRED DOLLARS.
We only have a STRICTLY LIMITED quantity of these units for sale. They will not be sold to professional installers in bulk so that as many customers as possible can benefit from this bargain!
Cat. LA-5162

ONLY $99.95

DIRT CHEAP!!

P.S. Comprehensive 8 page manual included!

MORE VIATEL MADNESS!!

Yet another unbelievable deal.
Once again Jaycar has made a scoop purchase of - this time - Viatel ADAPTORS for your own TV sets! That's right, you connect them to your own TV via the antenna and to a telephone line as well. A nifty little infra-red wireless remote control is supplied so that you can operate Viatel from the comfort of your lounge chair!
We must emphasise that the goods offered are NOT BRAND NEW and are 'ex-rental'. They are in very good condition and fully operational when supplied.
The units were made in the UK by Zycor and are fully Telecom approved (C-82/39/641). They are branded "TELEDEK 2000".
Each unit presents beautifully in a quality furniture look wooden case measuring 410(W) x 90(H) x 215(D). The IR remote controller measures 120 x 60 x 37(max) and requires the occasional 9V cell.
The adaptor will drive an RGB monitor as well as a telly. It also has parts for a tape recorder and printer and a socket for full QWERTY keyboard. If you want to integrate VIATEL into your home entertainment system then this is definitely for you.
The full Philips VIATEL systems are all but gone now and we expect these to sell even faster! (We don't have nearly as many either). Because of the compact size, this offer is available to Mail Order customers as well as our personal customers - but be quick!
Naturally, documentation is included.
Cat. XV-2210 inc remote control pad

ONLY $199

NEW

Cat. XV-2212
Full QWERTY keyboard **$99**

BARGAIN HUNTERS MULTIMETER 43 RANGES

"A very good multimeter

- Lenin

This is the downside to the Russian CRO story (see elsewhere in these ads).
With the consignment of the great Russian oscilloscopes came a shipment of a rather dreary analogue multimeter. If ever there was a bog standard product it was this one.
At 215 x 115 x 90 you would hardly call it a 'pocket' multimeter. To be fair, it has far better specs than low sensitivity pocket types, and DOES have overload protection. It is also built like the proverbial brick outhouse! (And it's also a bargain).

BRIEF SPECS:

Sensitivity	20,000 ohm/V DC, 2,000 ohm/V AC
Volts	DC - 0 - 1000V, AC 0 - 1000V
Amps	DC 0 - 2.5A AC 0 - 2.5A
Ohms	0 - 5 Meg
Capacitance	0.02 - 0.05uF (with AC signal)
Relative Gain	-15 +2 dB
AC Freq. Range	45 - 10,000Hz
Dimensions, Mass	215 x 115 x 90 1.5kg!

Cat. QM-1030
Supplied with probes

$29.95

NEW

NiCad BATTERY CHARGER

NEW

This new charger is one of the simplest to use that we have come across. It will charge 4 - AA cells together, or 8 - AA cells together and 9V transistor battery. Complete with plug pack and battery holders. A switch determines which configuration you require.

Outputs are:
6VDC - 44mA for 4 - AA's
9VDC - 10mA for 1 - 216
12VDC - 44mA for 8 - AA's
Cat. MB-3510

$17.95

UNBELIEVABLE ELECTROLYTIC BUY

Through Jaycar's surplus stock buying scheme, we have purchased a substantial quantity of an electro that would normally be out of reach of the hobbyists pocket. This electro is made in Germany by ROEDERSTEIN!

DIRT CHEAP!!

6,800uF 63V LONG LIFE

ONLY $7.50!!

That's right ROEDERSTEIN brand long life, high ripple current etched electrodes, screw terminals - all class! And at a price below "Taiwanese". These are absolutely fantastic for power supplies for high power amps, etc.
Electrical to DIN 41332
Tolerance -10 +50%
Dimensions 50(D) x 80(H)
Terminal M5 screw

Cat. RN-6712 **$7.50**

QUANTITY DISCOUNTS

1 - 5	$7.50
6 - 10	$7.00
11 - 24	$6.50
25 - 99	$6.00
100+	$5.75

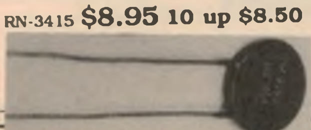
TV GAME/ COMPUTER SWITCH

Allows you to easily switch between two inputs to your TV. The input can be TV aerial, computer, video game or VCR. The output has a small length of coax and a 75 ohm standard plug. Input sockets are standard 75 ohm type. Grab one for when you will need it.
ANOTHER DISTRESS STOCK PURCHASE

NORMALLY $5.95
Cat. LT-3018
NOW ONLY $3.95

POLYSWITCHES

Ref: EA July 1986
The very latest in speaker protection. Polyswitch protectors are based on conductive polymers and act like re-settable solid state circuit breakers. RN3410 is suitable for protection of tweeters in systems up to 100 watts. It's rated at 50V & 0.5A. Nominal resistance is 0.4 ohms.
Cat. RN-3410 **$8.50 10 up $8.00 ea**
RN3415 will protect midrange and woofers up to 100 watts. Rated at 50V & 1.15A. Nominal resistance is 0.12 ohms.
Cat. RN-3415 **$8.95 10 up $8.50 ea**



AT LAST - DIRECT IMPORT HOOK-UP WIRE ON 25 metre ROLLS

Now all hobbyists can afford to have a roll of each colour hook-up wire by their workbench. Quality 13/0.12 tinned hook-up wire on plastic spools.

Red	Cat. WH-3000	Yellow	Cat. WH-3004
Black	Cat. WH-3001	Green	Cat. WH-3005
Brown	Cat. WH-3002	Blue	Cat. WH-3008
Orange	Cat. WH-3003	White	Cat. WH-3007

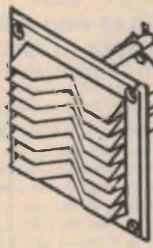
$2.95 per reel

SPECIAL INTRODUCTORY OFFER
Buy one roll of each colour - 8 rolls in all for only
$19.95
SAVE $3.65
8 pack Cat. WH-3009

PIEZO TWEETER

WITH WIDE DISPERSION LENS

The lens consists of 8 vanes set at a precise angle of 31°. These disperse the sound over a horizontal plane of 80°. Wider than could be obtained with a horn alone. This pattern is well suited for such applications as sound reinforcement systems and high efficiency Hi Fi systems.
#KSN1126A -
No crossover required.
Cat. CT-1920



SAVE $10 - $24.50

48V "USELESS" RELAYS

We were staggered by the demand for the ANRITSU 4MV relays advertised last year. They were an incredible bargain at 30¢ in quantities of 10. Some customers were buying hundreds at a time. We are now pleased to advise that we have purchased another (smaller) quantity. Unfortunately they cost us more, but we feel that they are still a bargain!
Cat. SY-4015

ONLY 50¢ ea

DIRT CHEAP!!

2 MELBOURNE LOCATIONS
45 A'Beckett Street City
887 Springvale Rd Mulgrave

ILLUMINATED ROCKER SWITCH

- Great for amps
- SPDT, 8A, 240V
- Illuminated actuater
- As used in P/Master 60/60
- Size 21 x 15mm
- Panel cutout 13 x 19.5mm

Cat. SK-0965
Catalogue Price $7.50 ea

SPECIAL
$3.95 ea 10 up $3.25 ea

DIRT CHEAP!!

Government Instrumentalities, Schools, Public Companies.
If you wish to purchase from us, simply send us your official order and we will give you a complimentary 30 day account.

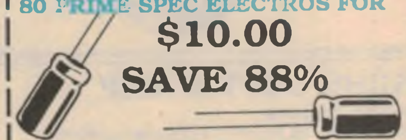
MIXED COMPONENT PACKS - SAVE HEAPS!! WITH JAYCAR

ELECTROLYTIC PACK

- Contains over 80 assorted electrolytics
- Most are normal stock lines
- Types supplied: 1, 2.2, 10, 22, 25, 47, 100, 150, 220, 470, 660, 4700, 10,000uF
- Voltages: 6.3, 10, 16, 25, 35, 40, 60, 63, 250V
- At our current prices these caps are worth $25.00
- They're only 12¢ per capacitor

Cat. RE-6280

80 PRIME SPEC ELECTROS FOR
$10.00
SAVE 88%



MIXED CAPACITOR PACK

Don't miss this bargain!
This pack contains approximately 150 assorted capacitors. Not junk values, most are normal stock lines. Here's what you get:

RT Electro	1, 4.7, 25, 100, 220, 470uF most 63V
RB Electro	1, 2.2, 25, 47uF
Greencap	100V - 0.0022, 0.01, 0.22, 1uF
Greencap	630V - 0.022, 0.1uF
Ceramic	4.7, 47, 220, 470pF, 0.022uF
Polystyrene	220, 820, 2200pF
1kV Ceramic	330, 470, 680pF

PLUS LOTS MORE
150 PRIME SPEC CAPACITORS
Cat. RE-6260
FOR ONLY $10.00

POT PACK

After the huge success of our Plessey pot pack, we present our new one.
This pack includes trimpots of various styles, switchpots and expensive slider pots. There is a minimum of 10 sliders, dual sliders sell for $5.50 each. If you only use two sliders, you will be in front, not to mention the trimpots. Typical values included are: 500, 2k, 5k, 20k, 100k, 250k, and 500k ohm. The pack includes at least 35 items. We estimate the current retail prices of pots in the pack to be over $32.
Cat. RP-3902
35 POTS/TRIMMERS FOR
ONLY $10.00

SAVE 87%

THIS TIME - A POTCORE PACK!

Potcores are expensive! Potcores are hard to get! The cost price of our FX2243 (Cat. LF-1250 $17.50) has doubled! This core will soon need to sell for over $30. Which makes our new pot pack an incredible bargain!
This is what you get as an ABSOLUTE MINIMUM
2 x pairs Mullard LA-1219 26mm dia. pot cores
AT LEAST one bobbin to suit
2 x pairs Philips/Mullard P3019 30mm cores (HB5 material A-1000) at least 3 bobbins to suit
1 x pair (or similar) P1814 18mm core HBA
3 x pair EP cores 21.5(H) x 24(W) (H5C2)
2 x EP bobbin (for smaller core, will not fit above EP core)
10 min ferrite adjusters for pot cores
PLUS a quantity of cores to make RF chokes, noise filters, etc.

WELL OVER $40 VALUE FOR ONLY $9.95!
Cat. LF-1280

We reserve the right to make changes to all packs if stock shortages occur.

BUILD AN ELECTRIC FENCE KIT - *HUNDREDS SOLD*

"ELECTRIC FENCE"

Ref: EA September 1982
Mains or battery powered, this electric fence controller is both inexpensive and versatile. It should provide adequate deteerent to all manner of livestock. Additionally, its operation confroms to relevant clauses of Australian Standard 3129.
(Kit does not include automotive ignition coil which is required).
Cat. KA-1109

$23.50

AUSTRALIAN MADE

ELECTRIC FENCE CONTROLLER

Cat. KA-1660
$59.50

Ref: EA December 1985
NEEDS NO AUTO COIL
This electric fence is a considerable development over the older design (which is still currently available). Because this new circuit uses a special output transformer it is far more likely to work well into false loads such as tall grass or dirty insulators. The new circuit has also less current drain but far higher overall performance. The Jaycar kit is supplied with a slightly different box than shown in the illustration. Also included is a length of HT cable and heavy HT connecting clip.

SUBWOOFER AMP

Ref: EA July 1982
State-of-the-art MOSFET technology combined with a low pass filter. Around 100W rms drive capability. Ideal for use with the Jaycar sub-woofer speaker (Cat. CW-2119). Amp will take line level (1V) input or connect direct to speakers. The Jaycar kit includes all PCB parts, heatsink and power supply filter capacitors.
Cat. KA-1452

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Cat. CW-2119

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The same wholesaler who sold us the antennas (see elsewhere these ads) is also no longer in the alarm business. We purchased a quantity of these and can offer them for less than 1/2 price.
The alarm is basically suitable for flats, units, one room, garages, etc., but it can also form the basis of a "build-up" system.

IDEAS FOR USING ALARM

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TSit it on your bookshelf. It can be switched on/off from the unit (it has a delay function, so it won't sound immediately). Use our plug adaptor to run from 240 volts (Cat. MP-3012 $18.95). It has provision for an external horn speaker, and uses 5 C size batteries for battery back-up.

MORE INVOLVED SYSTEM

The alarm can be the basis of a comprehensive system.
The unit can be screwed into a shelf, and hard wired from behind. A keyswitch can be used and mounted on a plate either just inside the front door, or even outside.
There is an output for NC and NO circuits.
NC can be used for window and door reed switches and passivve infra red detectors. NO can be used for panic buttons, smoke detectors and PIRS.
The unit can be switched for instant alarm, so if an intruder walks in the room the alarm sounds instantly.
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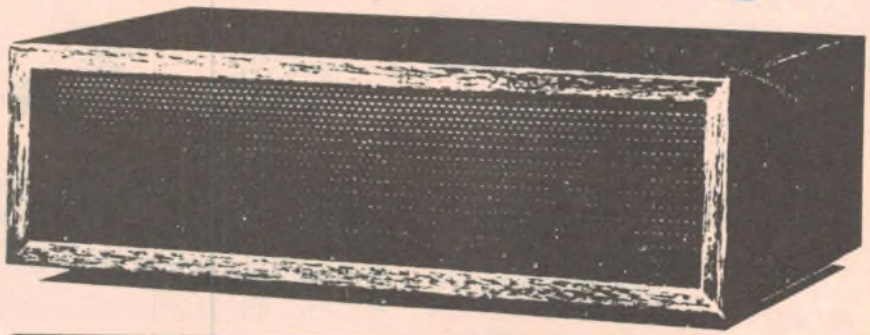
There is a built-in output relay which allows you to use any device which operates on 240V e.g. floodlights, diallers, etc.
We beleive this alarm at $49.95 is a bargain. That other big electronics retailer has the exact unit in their catalogue for $139.00.
If you can't afford a full system with panel and PIRS everywhere then this is the unit for you.
Power supply to suit Cat. MP-3012 $18.95
Cat. LA-5140

ONLY $49.95
SAVE $89

DIRT CHEAP!!

NEW



1GHz Digital Frequency Meter!

COMING SOON!

Ref: Silicon Chip (New Magazine) Nov '87
'Silicon Chip' Magazine, a new magazine to commence next month have produced as their first project an absolute ripper design.
It is a full 0-1GHz (1000MHz) DFM! Make sure that you get a copy of the magazine to read all about it. Jaycar will be doing the full kit but it won't be available until at least the end of November. We estimate the price to be around $300 which is incredibly cheap for a full 1 GIG Counter!

CAR REPLACEMENT GLOBES

Replacement globes for flashing switches/bezels for car alarms.
1) Most common. 12V push-in metal flange up 2 sides. Used in Red Light, Yellow Light, Piranha & Cobra.
Cat. SL-2638
2) Used in Yellow Light & others
Cat. SL-2637
3) Used in Yellow Light & others.
Cat. SL-2636

ALL $4.50 ea

TV COLOUR BAR & PATTERN GENERATOR

Ref: EA October 1987
This generator will produce: colour bars, red screen, white screen, black screen, crosshatch, vertical lines and horizontal lines and dot patterns - 8 patterns in all!
Separate outputs for RF (channel 0 or 1), composite video, horizontal and vertical sync pulses. The sync pulses are available in both positive and negative going logic.
The Jaycar kit includes all specified (or equivalent) components including Scotchcal front and rear panels, plastic instrument case etc:
Cat. KA-1691

$139.00

NEW KIT

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Jaycar will purchase your surplus stocks of components and equipment. We are continually on the lookout for sources of prime quality merchandise.
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D.I. (DIRECT INJECT) BOX

Ref: EA October 1987
This project is great for P.A. and stage sound reinforcement work. Its prime function is to convert high impedance unbalanced input signals to low impedance balanced outputs. It also cures earth loop, hum problems and doubles as a 'phantom' power supply for condenser microphones, etc!!
As usual the Jaycar kit includes all orginally specified parts including rugged die cast box, XLR connector, etc.
Cat. KA-1690

$39.95 **NEW KIT**

AT LAST! THE ELECTRONIC RAIN GAUGE KIT!

Ref: EA March 1987
(ELECTRONICS ONLY)
With the suitable mechanical parts, this kit will enable you to measure rainfall in your backyard or from the comfort of your lounge! It will measure from 1 to 999mm of rain, empties automatically with a remote display. The mechanical parts are cheap and readily available.
The Jaycar kit includes the reed switch and magnet, 74C926, LED 7 segment displays, PCB etc.
Cat. KA-1687

$49.95 **NEW KIT**

QUARTZ CRYSTAL CLOCK MOVEMENT

SUPPLIED WITH 3 SETS OF HANDS

Very compact unit (56mm square x 15mm deep) that can be used in your own design of clock face.
Self starting one second stepping motor has strong torque. Powered by 1 x 1.5V AA battery that lasts around 1 year. Accuracy is ±15 secs/month.
Cat. XC-0100

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Cat. LT-3166

NORMALLY $57.50
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$17.55
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Now you can switch up to a 40 amp 240 volt load with TTL device at a fraction of normal cost. That's right, Jaycar has another scoop buy where you get an incredible product at a price which you can now afford.
A solid state relay is a product that everyone will need one day. They are capable of switching extremely large AC loads with tiny signals that are directly isolated from the AC load. Even if you don't need one right now you would be crazy not to take advantage of the price while they last. We honestly doubt whether we will ever be offered stock like this again.
Each relay comes with complete data sheet, if requested. A special heatsink is required for the relay to work at full current but any heatsink of suitable size that has a small flat area will do. They even work well without a heatsink! (e.g. the 10A 55R will work at 5A with no heatsink at 20°C).

BRIEF SPECS:
- Load current rated to 30°C, using adequate (or recommended) heatsink
- On-state voltage drop @ rated output 1.75V max.
- Off-state leakage @ 600V and 100°C; 20mA
- Opto-coupler iso rating 3750V
- Output impedance 500 ohms
- Overall dimensions 72 x 45 x 37mm - compact!
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DIRT CHEAP!!

Cat	Description	1-9	10+
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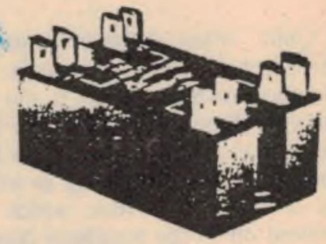
SY-4083	15 AMP (RMS) Screw terminals	$12.50	$10.50
SY-4084	15 AMP (RMS) 1/4" Q.C. Terminals	$12.50	$10.50
SY-4085	30 AMP (RMS) Screw terminals	$14.50	$12.50
SY-4088	40 AMP (RMS) Screw terminals	$19.50	$17.50
SY-4090	Heatsink for 10 amp relay	$10.00	
SY-4092	Heatsink for 15 amp relay	$10.00	
SY-4094	Heatsink for 30 amp relay	$15.00	



NEW CLOCK MOVEMENTS! PENDULUM DRIVER

This small module measuring 130(L) x 60(W) x 35(D)mm uses 1 x AA cell. It causes a suspended arm within the module to swing back and forth. A suitable pendulum can be attached to the bottom of the arm. (Note: pendulum driver is NOT a clock). Battery (alkaline) will last over a year.
Cat. XC-0110

$14.95

QUARTZ MOVEMENT WITH SWITCH CONTACTS

NEW

This is virtually identical to our XC-0100 standard movement except that it has a set of switch contacts that close every hour. These contacts can be used to trigger the "melody modules" (see elsewhere these ads).
Supplied with hands.
Cat. XC-0105

$16.95

MD-01 MELODY MODULE - 12 SONGS

This module consists of 2" speaker with electronics mounted on the speaker frame. A single AA battery holder is attached. When the switch wires are shorted the module plays one tune from its repertoire of 12. It cycles through the 12 until it comes back to the first. (Typical tunes are nursery rhymes). Cat. XC-0115 **$12.95**

MD-02 WESTMINSTER CHIME

This module (similar in appearance to the MD-01) reproduces a 'Westminster chime' when activated. It is also supplied with a neat little "test button" switch.
Cat. XC-0120

$14.95

MD-202 12 SONGS PLUS CHIME

If you hear O, give me a home where the Buffaloes roam. . . ' you know its 3 o'clock! After each tune a sombre chime rings out once for each hour of the day. Supplied with test switch. Really nifty!
Cat. XC-0122

$14.95

"TWINKLE, TWINKLE LITTLE STAR" MODULE

This tiny module measuring 45(L) x 30(W) x 4mm (thin!) is the module that you find in those crazy musical Xmas cards. When tiny spring switch contacvts are closed it plays 'Twinkle, Twinkle Little Star". Absolutely useless and eventually annoying. Great fun to build into anything ghastly!
Cat. XC-1030

$3.95

DIRT CHEAP!!

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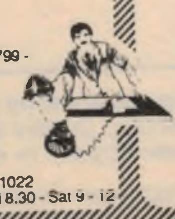

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Low cost techniques for making hobbyist PCBs

Here are details of low cost techniques for making printed circuit boards which are too intricate for direct transfer to the copper surface using a resist pen, but don't justify expensive rub-on transfers or the donut/tapes approach.

by IAN PAGE

Quite often hobbyists, particularly those who design their own projects produce circuitry which is too difficult drawing directly on the copper foil. The method to be described uses a template to produce pen drawings in indian ink on a transparent film, which is then printed on to the sensitised copper foil. The results are very satisfactory, and intricate circuitry can be handled to produce an excellent result, provided that neatness and care are exercised.

The key to this technique is the template, which comprises a rectangle of clear acrylic sheet of 1.25 to 2mm thickness. School set squares can be used, provided that enough clear area is available. But a rectangular shape is preferable, 100 x 50 being about right.

Template

There are two methods of drilling this to the accuracy required to locate ICs. The first is simple, and requires a piece of perf board with modular 0.1" spaced holes, which is used as a jig to locate the position of the holes that you require to drill in the template. Check the perf board carefully for misaligned holes, and if OK clamp it to the piece you are going to drill so that the rows of holes are parallel to the lower edge of the sheet.

With a 1mm drill and using a bench stand to ensure that the holes are perpendicular to the surface, drill a group of holes near the centre to correspond with, say, a 16 pin IC. You can drill for 18 or 20 pins, but the smaller number is less confusing to use, and the template can be moved along if larger ICs are to be drawn. Using the perf board as a guide, drill in the required places with a 1mm drill and follow with a 2.05mm drill. In line with the top and bottom rows of IC holes, and about 0.5" away, drill two adjacent holes (see Fig.1) and open these to 5/64". The purpose of these holes will be referred to later.

Now drill holes in other parts of the template corresponding to components such as transistors, resistors, capacitors, and so on. (Refer Fig.1). Lightly chamfer the holes on each side of the template.

Now glue some narrow strips of thin clear plastic to the underside, near the top and bottom edge (but not at the ends) to keep the template raised above the drawing surface. The thickness of these strips should be just enough to allow the template to be moved without smudging the ink lines. If these spacers are too thick, you are liable to get a "parallax" error on the drawing, which can result in the clearance between adjacent pads being reduced to nothing.

A second, and more accurate way of drilling the template is by use of a small lathe with vertical slide. The feed screws must be graduated, and if metric, will need to be translated to permit indexing at 0.1". Care should be taken to avoid backlash by moving vertical and cross slides in one direction only. An entirely accurate result is obtainable by this method. However, perf board is quite acceptable for most purposes.

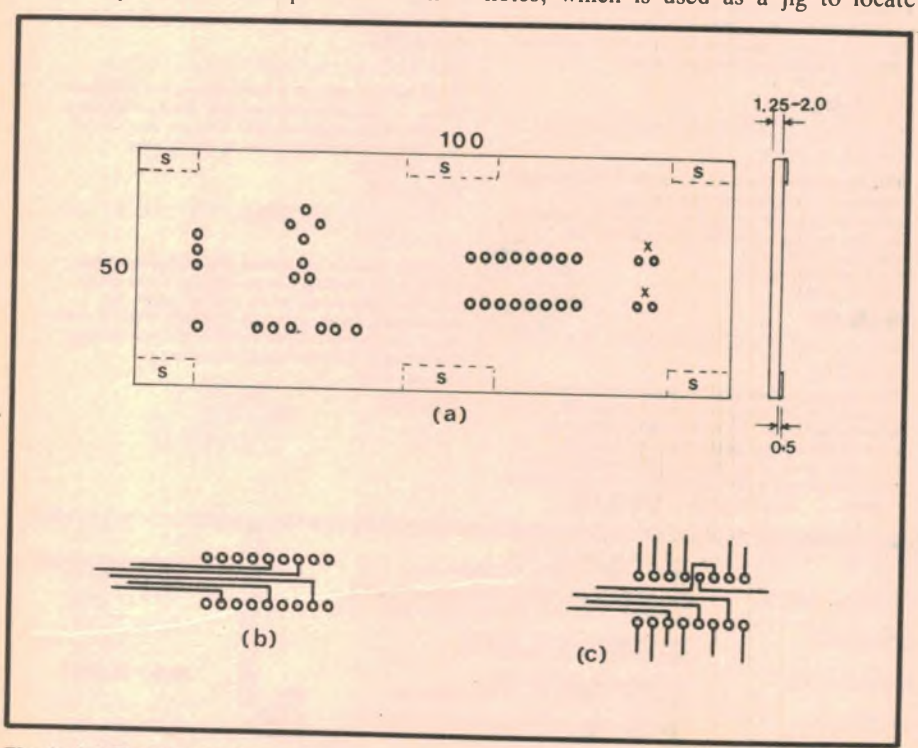


Fig.1: (a) The template, showing the 5/16" and 2.05mm holes, and the spacers glued to the underside; (b) Five tracks drawn with a 0.5mm pen; (c) The use of reduced diameter IC pads to allow between-pad conductor tracks.

Accessories

In addition to the template the following will be required:

A reservoir pen with 0.5mm diameter nib, such as Rotring or Stabilo.

An adjustable (hinged) draughting pen.

Typist's erasing shield.

White vinyl eraser.

Draughting film with one matte side. Tracing paper can be used, but efficient erasure is almost impossible, and the exposure time for printing is longer.

An additional pen with 0.35mm nib is useful to give greater versatility where a number of closely placed tracks have to be drawn. These pens are not cheap, so you may be content with just one which must be 0.5mm. A reading glass is also a useful accessory.

Using the template

Taking care to hold the pen vertically and with the lightest of downward pressure, place the nib in each hole where required, and run the pen around the inner circumference at least twice. See that there is a good flow of ink, lifting the pen slightly if necessary. A "donut" should result, the centre of which eventually will provide a centre for drilling the PCB.

If it is necessary to draw a track between two adjacent IC pads, this can be done by using the 5/64" holes previously referred to, but make sure you do this as one of the first operations so that, if there is a mishap, the result can be erased without having to worry about damaging adjacent pads or lines. 5/64" = 1.98mm, and this slight reduction in diameter increases the clearance between adjacent pads just enough to make it easier to draw a clear line between them. It is advisable to practice the whole manoeuvre on a piece of spare film.

You will need a steady hand, a good eye, and the magnifying glass will help. Use the adjustable pen to get a practicable width of track between IC pin pads and when you have it in the right position, run over the line twice to ensure an opaque line. Don't make the track longer than necessary to clear the pads, then change back to a wider pen.

Despite all these instructions, it is an easily repeatable procedure. If the track is dangerously close to a pad it is permissible to scrape a small segment off the pad with a sharp knife. In general, it is better to avoid the necessity for siting a track between IC pads, if the circuit can be arranged to avoid it. Just the same, there is considerable feeling of satisfaction in achieving a clear run with the track just where you want it.

Now complete drawing the IC by resiting the template.

Ink erasure

With draughting film, erasure is simple but can be messy if you're not careful. With the erasing shield in place (if necessary) and the vinyl eraser cut to a chisel shape, moisten it VERY slightly and you will find that it will remove the ink immediately without damage to the film. If too much moisture is used, it will creep under the shield and make a real mess.

An effective method (best done in private) is to moisten the eraser with your tongue, give it a quick wipe on your (clean?) shirt, and the moisture content will be about right.

Should you be unfortunate enough to damage the drawing beyond repair, the whole film area can be cleaned off by rubbing with methylated spirits, but be sure to remove the last vestige of ink smear.

Making the PCB

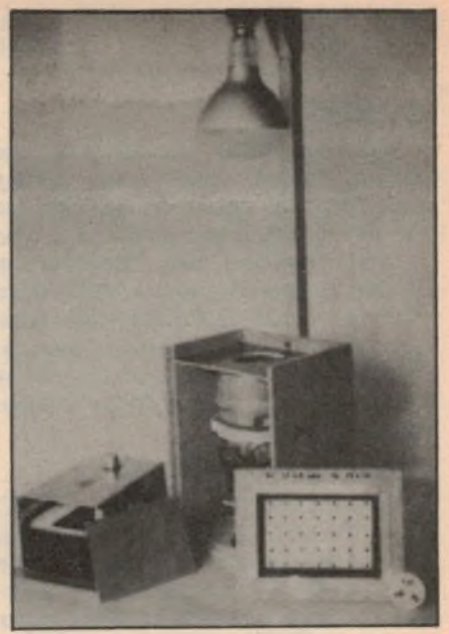
A small drawing board and tee square is a help in producing a PCB pattern. After making sure the circuit diagram is correct, use graph paper of 5mm or 0.25" squares on which to plan the PCB layout. Each square will represent 0.1" on the final board layout, so make sure enough room is allowed for components. After a rough pencil layout to establish the general plan, use a black ball point pen to mark IC pads and pads for other items like resistors, capacitors, links, and so on. Join these with black lines, but draw the component schematics with coloured lines, such as red for resistors, green for capacitors, blue for links and so on.

Contrasts will help avoid errors in copying the actual tracks on to the next drawing, which is done on 1/10" graph paper, i.e. actual size PCB diagram. You will probably use reams of graph paper (well a few sheets anyway) getting the layout to your liking.

Now using 1/10" graph paper (you can use plain paper, but the squared paper provides you with a built in measure of distance) make the final draft of your PC diagram, using colours as before to contrast with the tracks and pads which are to be traced in black ink. You can still correct errors or clearances at this stage, but will require correcting fluid as used by typists. When finished go over it closely to make sure there are no errors or omissions.

Tracing

Fasten the actual size diagram on the drawing board with adhesive labels or tape, keeping it square with the board.



Visible here are (L to R) the author's resist baking oven, his vacuum printing unit, and the printing frame itself.

Cut some draughting film, and fasten matte side facing up, over the diagram. If there are any tracks to be drawn between IC pads, do these first, and if necessary protect with a sheet of paper if likely to be damaged by the tee square or rule.

Complete the inking of all ICs in the top half of the drawing, together with other component tabs. Join these using the 0.5mm pen where feasible, and make sure that each track drawn terminates so as to slightly overlap the edge of each pad. Without moving the tee square go over each line a second time. DO NOT TRY TO HURRY, as you will end up with an ink smudge. Give the ink plenty of time to dry between stages. Go for a walk or make a cup of coffee.

Check with the reading glass that there are no missing bits or "open circuits" in the ink before you move down the drawing. By starting at the top of the drawing you avoid working over previously inked surfaces, with risk to the continuity of the inked lines. Move down the drawing, and when finished remove the film and hold it to the light to check for lines which are transparent. If there are any, they will need to be reinked. Check for small ink spots or irregularities which can, in most cases be removed with the edge of a sharpknife, taking care not to damage the film. Using a good erasing shield and the technique described above, some very good repairs can be made if needed.

Hopefully, you will now have a per-

fectly clear film with no signs of erasure, and no errors, from which you should produce an excellent PC.

Overlay

With the tracing removed from the drawing board, place some tracing paper over the circuit drawing and use the template and pen to ink in all the IC and component pads. Then mark in all the components and identify them with the values and/or reference numbers used for the schematic diagram. You will now have an accurate overlay which will help you to locate components on the PCB.

Copying PC artwork

Very often there is a need to copy PC artwork from a magazine. Some magazines avoid printing on the reverse side of the page on which the circuit is printed. The page is removed and the paper made translucent by spraying with a special solution, obtainable from dealers in drawing supplies. While still wet, the transparency is attached to the sensitised copper surface and printing carried out in the usual way.

If the reverse side carries printing, this method can not be used and the printed circuit pattern must be copied. A tracing can be made on clear draughting film, exactly as described earlier in this article. It may be difficult to trace the circuit without removing it from the magazine, but it is not a good idea to cut out the section carrying the circuit, so the best way is to have a photocopy made. Photocopies can be made on to clear film and while it might seem a good idea to print this image directly on to the copper, the fact is that the lines produced by the photocopier are not dense enough to shield the light effectively from the photo emulsion, and a tracing using indian ink, on tracing film is called for.

At this point it is important to appreciate that to get a good sharp image on the copper, the black ink surface should be in intimate contact with it. If, as described earlier, a tracing is made of a wiring layout, then the diagram, viewed from the inked side, is the same as the view obtained if the finished PCB is viewed from the component side with a strong light behind it. Therefore when printing, the inked side of the tracing can be against the copper.

However, when a tracing is made of a printed circuit viewed from the foil side, as shown in the magazine, the tracing must be used so that the non inked side is pressed on the copper. This means that the dense ink areas are separated from the copper by the thickness of the tracing material. Because of this the printed tracks may have slightly fuzzy edges, due to light striking obliquely on to the photo emulsion laying just under the "overhang" of the inked line.

For printed circuits which do not have very narrow tracks there need be no concern, but narrow tracks can be reduced in effective width through overexposure of the emulsion along the edges.

If this effect is not thought to be a problem, you can trace the magazine print, or a photocopy of it, directly, and the tracing placed with its inked surface AWAY from the copper. On the other hand, the problem can be avoided simply by placing the photocopy face down on a sheet of glass resting on an open box, with a light inside it, and making a tracing of the reverse side of the copy. The inked side of your tracing can now be placed against the copper for printing.

Tracing

Obtain a photocopy of the artwork, either on white paper or on clear film. If it is on white paper, tape it face down to a sheet of glass as described above, and tape some tracing film over it. If the photocopy is on clear film, tape it face down on a white surface to provide contrast, followed by tracing film on top.

Before commencing the inking, study the schematic diagram carefully to determine which tracks if any have to carry substantial current. In such areas the width of the tracks as printed should be maintained. For other areas, the 5mm pen you need for use with the template should be sufficient. As a guide, a 5mm track on 1/2-oz copper can handle about 600mA for a 10°C temperature rise.

However, the wider the track, the less chance there is of any discontinuity in the final circuit, and it is a good idea to have wider pens available, say 0.8mm or even 1mm. Over this width it is better to draw pairs of parallel lines and to fill the space between them using a fine tipped artist's brush.

It is also possible, of course, that the PCB contains very narrow tracks for which you may need to use the adjustable draughting pen. Success in using this depends upon your having good eyesight and a steady hand. Do a number of trial lines on scrap tracing plastic to get the pen set to the required width. Give the pen a final clean, load with a small quantity of ink, and go to it.

Make a very careful visual check to ensure continuity of the lines and end connections. Very wide areas such as heatsinks are best done on the printed board just before etching, using a resist pen to extend the photographic resist. Be very careful to ensure, by inspection of the inked surface against a strong light, that there are no gaps or transparent areas. It is also important not to overdo the thickness of the ink layers, as there is a danger that cracks may develop if the tracing is flexed.

Having got organised as to what you want to do, commence the tracing by using the template to ink in donuts for all components, joining them with the required width of line. Work from the top down, completing each area as you go to avoid the possibility of scratching previously inked lines. Also, if smudges occur, they can be more ea y removed if not surrounded by other . ıked areas. If the circuit uses curved tracks, as distinct from a rectilinear layout, the use of curved pen guides (French curves) may be necessary to achieve a neat result. It is again stressed that success depends upon taking your time, allowing the ink to dry thoroughly at each stage, and inspecting with the aid of a magnifying glass to ensure that there are no gaps in the ink, missing lines, or specks of ink, to cause "short circuits".

Next stage

To obtain uniform and repeatable results it is essential to use standardised procedures and equipment for sensitising and printing the circuit board. The following describes a system which I have found to give good results.

For lighting, a Philips 300 watt F/28 U/V lamp is used, at a height of 280mm above the PC board. This mounting height is suitable for boards measuring up to about 140mm square. If glass is used to clamp the tracing to the circuit board, an increase of 30% or more in exposure time can be expected, while if the circuit board is not perfectly flat, the tracing may not make close contact with it.

A vacuum printing frame can obviate these problems. First, a source of vacuum — this can be your own household cleaner, or, as in the printer to be described, it is the unit from a "retired" vacuum cleaner. The size of the frame will handle a circuit board up to 130 x 80mm, but dimensions and lamp mounting height can be increased as required, to handle larger boards.

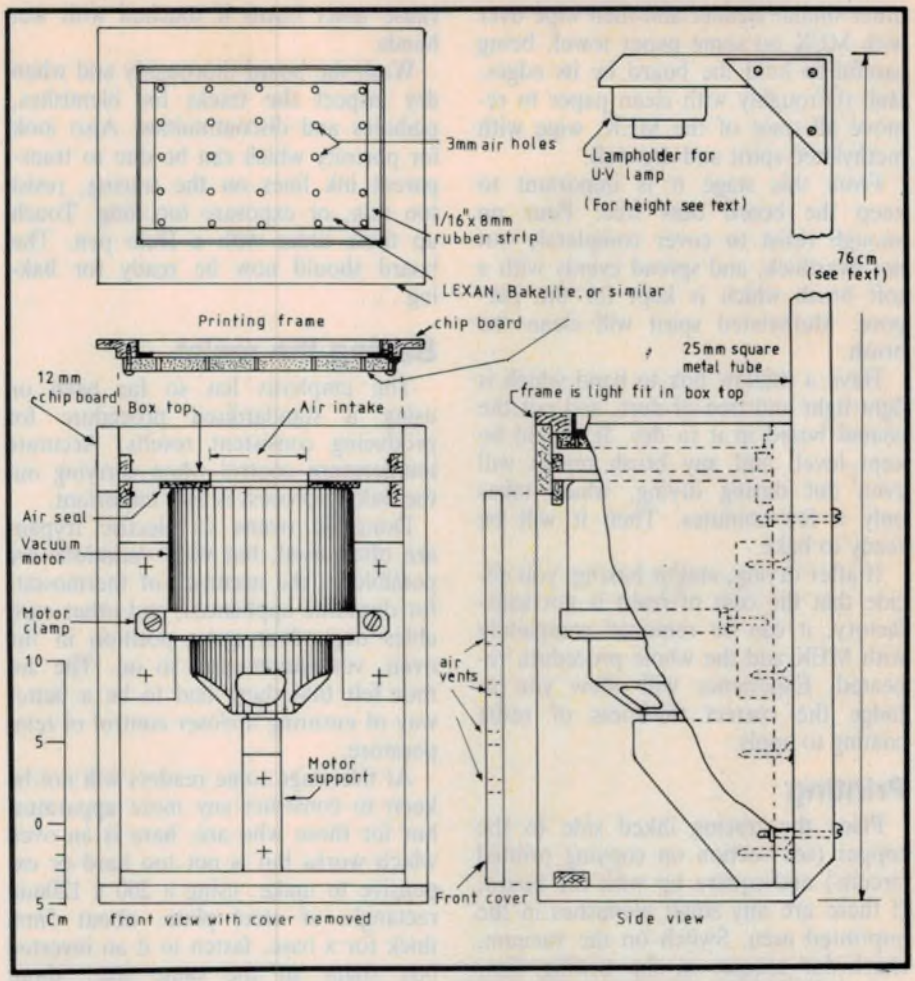
Making the printer

A box built of 12mm chip board, base 210 x 170mm, and 300mm in height with one side removable for access. A top of the same material 186 x 146 is fitted at a height of 270mm, and a 60mm hole bored in its centre. The suction unit is fastened to the underside, using felt to provide an air seal. The box sides extend 30mm above the top to support the printing frame, which consists of a 210 x 170mm piece of chip board.

The four edges of the frame should be rabetted, so that it will fit snugly into the top of the box to a depth of about 5mm. Cut a rectangular in the frame 155 x 105mm and tidy up the edges of the opening by gluing formica veneer, or fastening some 12 x 12mm aluminium angle (bent from sheet) to form an inner frame.

Obtain some smooth rigid material about 5 to 8mm thick such as Lexan, or Formica as used for electrical panels, and cut to a size which will overlap the frame. Fasten the Formica to the underside of the wood frame, and ensure an airtight joint. On the top surface of the Formica cement an 8mm wide strip of 1/16" rubber around the four sides, to form a shallow dish in which the circuit board will lie.

In use the inked tracing is cut just a little smaller than the overall dimensions of the rubber, with which it will form an air seal. The rubber should match the thickness of the circuit board, so that the tracing is kept flat. Any gaps between the edges of the PCB and the rubber strips should be filled with strips of board of the same thickness, so as to prevent the tracing being buckled by the vacuum pressure.



Construction details for the vacuum printing box and frame. It uses the suction unit from a discarded vacuum cleaner.

Just clear of the edges of the rubber strips, drill a series of 3mm holes through the Formica, at about 20mm spacing, and complete drilling over the whole area with a pattern of 3mm holes. A dimmer switch should be used to reduce the motor speed so as to produce a vacuum just sufficient to keep the tracing held firmly against the circuit board.

At the back of the box, fasten an upright and crosspiece to suspend the U/V lamp centrally over the frame, at a height of 270mm, or more if the diagonal measurement of the circuit board is to be more, then 150mm. For the printer described, the upright is 760mm high.

Tracing film

It is important, when using the vacuum printing frame, to see that the tracing is held in close contact with the board during printing. The tracing film should always be cut to a size which will ensure that all four edges are overlapping the rubber seal at the sides of the frame. That is to say, the tracing is always cut to this size, even when the circuit board is considerably smaller. Also, if tracing paper or differing grades of film are used it may be necessary to obtain new exposure times by trial.

Sensitising the board

It is very difficult to get the copper surface of blank PCB laminate clean enough by scouring to accept the resist evenly over the whole area, but here is a sure fire method: get some MEK, otherwise known as methyl ethyl ketone, from an oil company or industrial chemicals supplier. MEK is a solvent used to make PVC cement.

CCOPR12 resist, obtainable from DSE, is poly vinyl based and MEK is very effective for cleaning resist from PCBs, as well as being a good oil and grease remover.

Scour the circuit board with Ajax or

other similar cleaner and then wipe over with MEK on some paper towel, being careful to hold the board by its edges. Rub thoroughly with clean paper to remove all trace of the MEK, wipe with methylated spirit and dry well.

From this stage it is important to keep the board dust free. Pour on enough resist to cover completely but not overthick, and spread evenly with a soft brush which is kept for the purpose. Methylated spirit will clean the brush.

Have a shallow box to hand which is light tight and free of dust, and put the coated board in it to dry. It should be kept level, and any brush marks will even out during drying, which takes only a few minutes. Then it will be ready to bake.

If after drying, and/or baking, you decide that the coat of resist is not satisfactory, it can be removed completely with MEK and the whole procedure repeated. Experience will allow you to judge the correct thickness of resist coating to apply.

Printing

Place the tracing inked side to the copper (see section on copying printed circuits) and square up with the board. If there are any small blemishes in the unprinted area. Switch on the vacuum, check for creases in the tracing film, and support with strips of board where necessary. Cover the frame with cardboard to exclude light and switch on the lamp. Allow three or four minutes for the lamp to stabilise. When time is up, switch off the lamp and vacuum.

Exposure

The exact time is not critical, but it is a good idea to experiment by exposing a few strips of sensitised board with the light at a fixed distance, and at various exposure times. As a guide, using inking film with one matte side, manufactured by Bishop Graphics Inc., and the lamp at 28cm above the print surface, a good print should result with an exposure of 160 to 240 seconds. But the type of tracing material, and distance of lamp have a large bearing on exposure time. When you are satisfied with the result note details of tracing material used, distance, and time.

Developing

You can use commercial developer or caustic soda (sodium hydroxide). If the latter, a level 5ml spoon in 600ml of water should give complete development in under three minutes. Be careful when handling the caustic soda as it can cause nasty burns if touched with wet hands.

Wash the board thoroughly and when dry inspect the tracks for blemishes, pinholes and discontinuities. Also look for porosity which can be due to transparent ink lines on the tracing, resist too thin, or exposure too long. Touch up these areas with a Dalo pen. The board should now be ready for baking . . .

Baking the resist

The emphasis has so far been on using a standardised procedure for producing consistent results. Accurate temperature control when carrying out the baking process is also important.

Domestic ovens or electric frypans are often used, but wide variations are possible in the accuracy of thermostats for domestic appliances, and other variables dependent upon position in the oven, ventilation, and so on. The author felt that there had to be a better way of ensuring a closer control of temperature.

At this stage some readers will not be keen to construct any more apparatus, but for those who are, here is an oven which works but is not too hard or expensive to make: using a 200 x 120mm rectangle of steel plate, about 5mm thick for a base, fasten to it an inverted box shape of the same size, about 120mm high, folded from 20swg aluminium sheet. Close in one end, and at the other make a door, either hinged or sliding.

There should be no gaps to admit light. Pop rivet aluminium angles to the side about half way up, to support a sliding shelf. Finally fit in the centre of the top a short piece of aluminium tube into which a 0-150°C glass thermometer will just fit. The tube is closed at the bottom, to prevent the thermometer from dropping through, and is cemented into the top of the oven with Araldite so that the bottom of the tube is about 12-15mm above the level of the shelf. The shelf, also of aluminium, is bent up at the edges for rigidity and should slide easily on the brackets. Aluminium is used for construction because it does not rust, which could drop on the PCB, and its bright surface reduces loss of heat.

Heating

The oven is placed on one of the small quick heating elements of an electric stove which has simmerstat control. As a trial run, put the thermometer in place, and with the heat control at a very low position allow the temperature to increase to the maximum of 90°C.

The purpose of the steel base on the oven is to act as a heat sink, to even out the quick variations due to the element switching on and off — but increase of this, there will be a delayed response by the thermometer. Heating should not be hurried, and it may take up to 30 minutes to reach 90°, at which point the element should be switched off.

For PPCR12 resist, a time of 10 to 12 minutes between 90° maximum and 80° minimum is required. From time of switching off, stored heat in the system should maintain the temperature above the minimum of 80° for the time specified. If it shows signs of dropping below this, the element will have to be switched on again briefly, making due allowance for the time lag in thermometer response.

The same procedure is used to give the final bake after etching, which calls for 30 minutes at 100°C. In this case however, the element may have to be switched on for several short periods, to keep the heat close to the 100° required.

An alternative and better source of heat is an electric frypan large enough to accommodate the oven. If you can get an old pan which is still working, cut the sides down flush with the bottom if necessary. The thermostat control will give a much smoother control of oven temperature.

Etching

A suitable etching solution can be made by dissolving 500gm anhydrous ferric chloride in 1.5 litres of water. You can buy this quantity from any chemical supply house and it will make up enough to etch a considerable number of average size boards. Add the chemical slowly to the water, stirring well. It will get quite warm and you should avoid splashes. Store the solution in a 2 litre glass bottle with plastic cap.

An empty two litre ice cream pack makes a suitable tray for etching boards up to 150mm square. Before commencing, have a short length of PVC strip (e.g., a piece of wallpanel joiner strip) which can be used to up-end the PCB for frequent inspection.

After baking, allow the board to cool completely, then place it in the tray and cover with about 12mm of etching solution. At ordinary room temperatures and using fresh etch, the process should

Continued on page 138

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Understanding colour TV — Part 8

The complete PAL colour receiver (2)

In this last episode, the author looks in more detail at some of the circuit sections treated as blocks in earlier parts of the series. He also provides some useful pointers to help in tracking down colour problems.

by DAVID BOTTO

This month we'll start by considering schematics of some of the essential sections of the PAL TV receiver. These particular sections are the ones shown only as circuit blocks in previous parts in this series.

Of course *Electronics Australia* readers will appreciate that in PAL receivers using the latest technology, much of this circuitry is contained within a few integrated circuits. However examining these individual sections in discrete form helps us to properly understand the complete operation of a PAL TV set. Furthermore many older colour TV receivers, still giving good service, contain such discrete circuitry.

Fig.1(a) shows the schematic of a typical video demodulator. You will remember that the received signal information from the TV station passes first through the tuner and then through the vision IF stages to reach the demodulator.

Diode D1 is the video detector. An oscilloscope connected at point A would display the complete vision carrier signal. With a colour bar input signal the complete colour bar signal would be viewed.

You will notice that the frequency modulated sound IF signal is taken from point B to the sound IF stages. An alternative method of recovering the FM sound signal is also shown. Here a separate intercarrier detector is used for the 5.5MHz sound IF signal.

Decoder section schematics

Schematics of sections of the decoder circuitry were shown and discussed in earlier parts of this series. You'll recall that these included the synchronous demodulators, the phase detector, the PAL delay line circuitry, RGB drive amplifiers, the matrix circuitry and the subcarrier oscillator. In order to properly understand the complete PAL receiver we need to consider some additional circuit sections.

The output signal from the chrominance amplifier, consisting of the chroma signal and the PAL colour burst, feeds to the burst gate amplifier. (Please refer again to the colour decoder block diagram shown in part five).

Fig.2 shows such a typical burst gate and amplifier. A positive pulse from the line circuitry of the receiver switches transistor Q1 "on" during the line flyback period. This means that Q1 is switched "off" when the chroma signal is present.

Because the 4.43MHz PAL colour burst sits on the back porch of the line synchronizing pulse, this means that transistor Q1 amplifies only the colour burst signal. The chroma signal information is not allowed to pass. The resulting "gated" burst signal is then fed to the phase detector.

As described in part five, the output of the phase detector locks the subcarrier oscillator to the same phase and frequency as the +V chroma signal. The 7.8kHz ripple produced by the phase detector due to the swinging bursts then passes to a further stage which amplifies and shapes the 7.8kHz signal (Fig.3).

The 7.8kHz ripple is amplified by transistor Q1, causing L1 to "ring" at 7.8kHz. The arrow A in Fig.3 goes to the colour killer circuit, where the 7.8kHz signal is rectified. The resulting DC voltage is used to forward bias the chrominance amplifier.

When the PAL colour TV is tuned to a monochrome programme, a colour burst signal will not be received and the

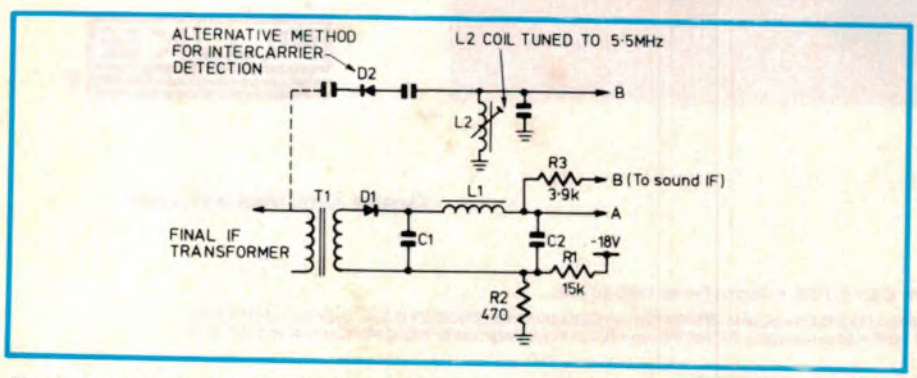


Fig.1: A typical video demodulator stage using discrete components, with the resulting video appearing at A. The 5.5MHz intercarrier sound IF signal can be tapped off via R3, or via a separate demodulator circuit as shown.

7.8kHz signal is absent. Since there is now no DC bias present, the chrominance amplifier will be cut off. This prevents colour splashes from spoiling the black and white picture. Fig.3 shows one type of colour killer circuit.

From point B in Fig.3 the 7.8kHz waveform is supplied to a bistable circuit (sometimes called a flip-flop), used to operate the PAL switch. The schematic in Fig.4 is that of one type of bistable circuit. The 7.8kHz signal "steer" the bistable, ensuring that each line of the demodulated V signal is kept correctly in phase with the transmitted V+ and V- signals.

We'll assume that at a particular moment in time transistor Q1 is conducting, and that transistor Q2 is cut off. When a triggering pulse from the receiver line circuitry arrives at point B it reaches the cathodes of diodes D1 and D2 via capacitors C3 and C4. Transistor Q2 is already cut off, but now transistor Q1 will be cut off by the negative pulse at the anode of diode D1.

As the current flow through Q1 ceases the voltage rises at the collector of Q1. By means of the current flow through resistor R3 the base voltage of Q2 becomes more positive so that now it is Q2 that conducts. As Q2 conducts its collector voltage falls and by means of resistor R4 the base voltage on Q1 drops. Now it is the turn of transistor Q1 to be cut off.

The circuit will remain in this condition with Q2 "on" and Q1 "off" until the next line pulse arrives at point B. This time the line pulse switches off Q2 and the Q1 again starts to conduct.

The outputs of the bistable are at points X and Y and consist of square waves that may be easily viewed on an oscilloscope. Through suitable circuitry these squares waves are fed to the PAL switch.

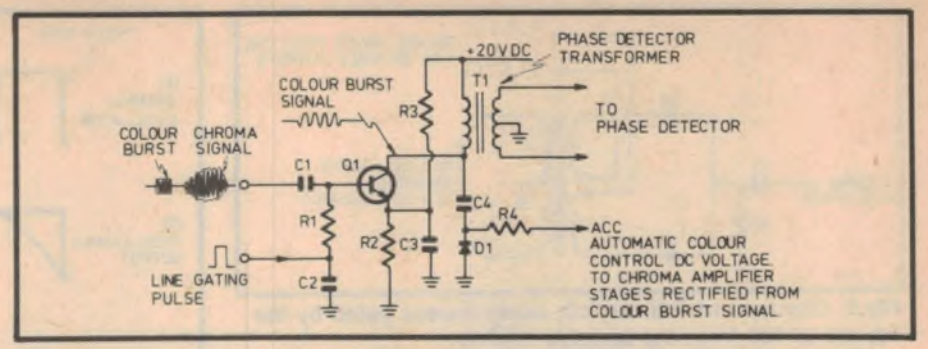


Fig.2: A typical colour burst gating stage, again using discrete components. Q1 only conducts during the line gating pulse, and hence only allows the burst to pass — not the chroma information.

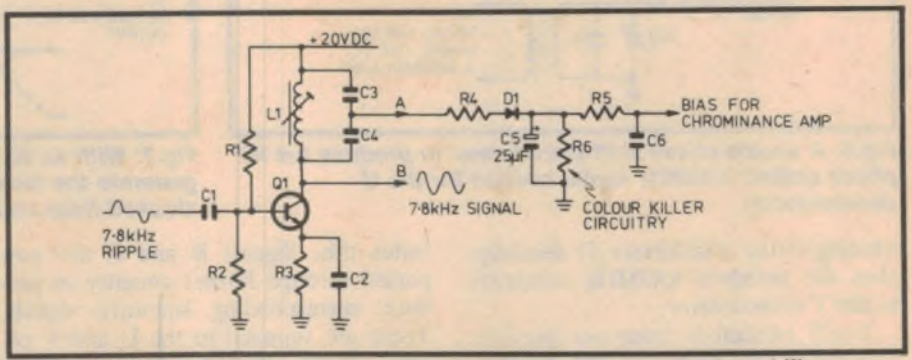


Fig.3: Simplified schematic of a shaper/amplifier stage and colour killer detector, using the 7.8kHz ripple signal produced by the PAL signal's "swinging burst".

Resistors R3 and R4 together with capacitor C1 and C2 serve to sharpen the output waveform. Resistors R5 and R6 keep the "gating" of diodes D1 and D2 at the correct operating point. To synchronise the bistable to the correct phase of the V signal the 7.8 kHz identification signal at point A is supplied to diode D3. The pulse through D3 "triggers" the circuit keeping the bistable in its correct mode.

An output from the 4.43MHz subcarrier oscillator is supplied by the power switch to the V synchronous demodulator. (As explained in part five). Fig.5 is the schematic of a PAL switch. These square waves from the bistable switch each diode on in turn. The result is that the input signal from the 4.43MHz subcarrier oscillator to the V demodulator is switched 180° every other "line" of the picture.

With the bistable in its correct mode the receiver PAL switch is kept correctly synchronised with the TV transmitter PAL switch. The secondary

A glimpse back into the past! John Logie Baird (right), the man credited with achieving the first colour TV transmissions in 1928, shaking hands with Sir John Samuel.

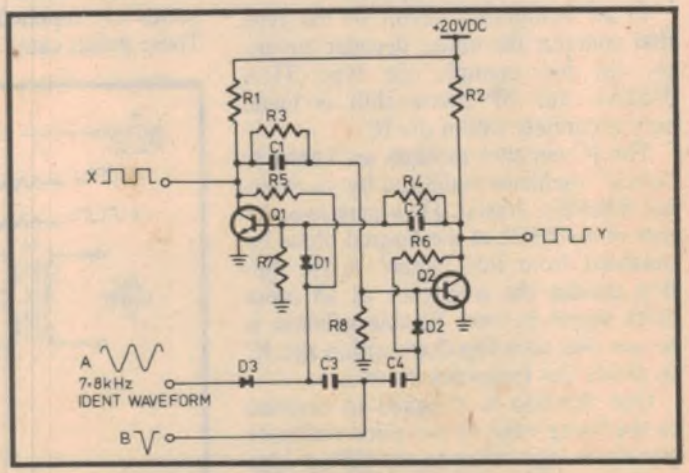


Fig.4: A PAL demodulator bistable flipflop, again using discrete components. The 7.8kHz ident signal is used to "steer" the flipflop in terms of phasing.

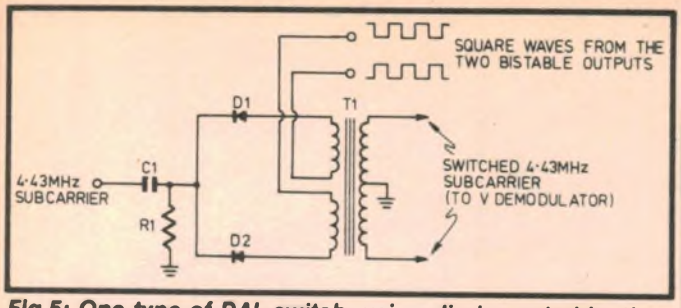


Fig.5: One type of PAL switch, using diodes gated by the square waves from the bistable flipflop.

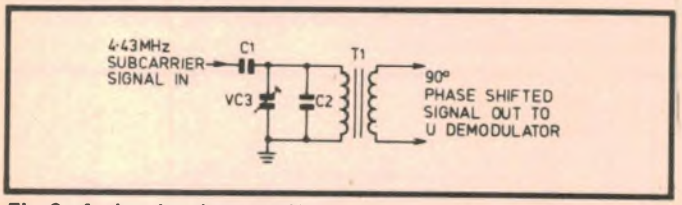


Fig.6: A simple phase shift circuit used to produce the 90° phase shifted 4.43MHz signal needed for the U demodulator.

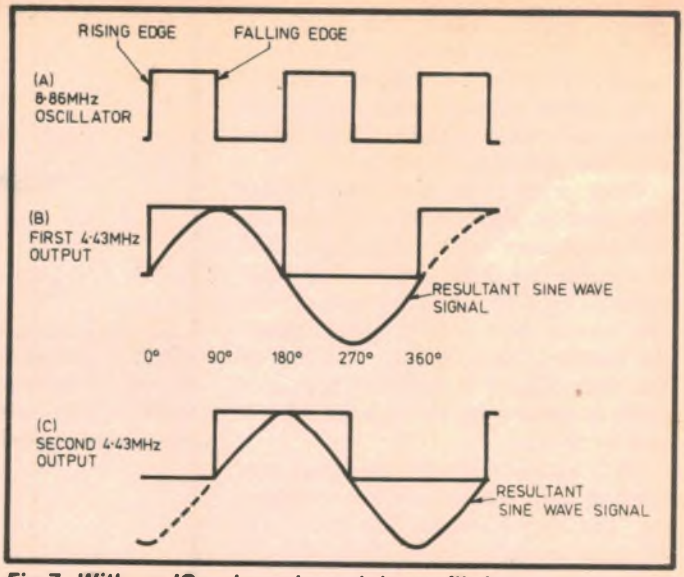


Fig.7: With an IC colour demodulator, flipflops are used to generate the local 4.43MHz subcarriers 90° apart in phase, clocked from an 8.86MHz "twice frequency" signal.

winding of the transformer T1 then supplies the switched 4.43MHz subcarrier to the V demodulator.

You'll remember from our previous discussions that there is a phase difference of 90° between the 4.43MHz subcarrier oscillator signals which are supplied to the U and V synchronous demodulators. In older colour TV receivers this was often accomplished as shown in Fig.6. Capacitor C1 an C2 and preset capacitor VC3 form a phase shift circuit to produce the required 90° phase shift before feeding the 4.43MHz subcarrier signal to the U signal demodulator.

This 90° phase shift depends for its accuracy on the close tolerances of C1 and C2, and also of setting of VC3. If these values change, as they sometimes do, the colour reproduction of the displayed picture will be impaired.

In an intergrated circuit of the type that contains the entire decoder circuitry, (as for example the type TDA 3652A), this 90° phase shift is made very accurately within the IC.

The IC circuitry includes an 8.86MHz "clock" oscillator stabilized by an external 8.86MHz crystal. How may two signals of 4.43MHz of the desired phase be obtained from this signal? A JK flip-flop divides the frequency of an input clock signal by two. So one solution is to use two such flip-flops within the IC to divide this frequency by two.

One flip-flop is designed to respond to the rising edge of the clock oscillator waveform, the other to the falling edge of the waveform. The result is that two 4.43MHz signals are produced, differing in phase by precisely 90°. Fig.7 illustrates this. Signals B and C are now passed through further circuitry to produce corresponding sinewave signals. These are supplied to the U and V colour signal demodulators contained within the IC.

Passive subcarrier regenerator

Because you may encounter this subcarrier regenerator in some PAL colour receivers, it is worth discussing its operating principles. In place of the internally generated subcarrier oscillator in a PAL receiver, a "ringing burst" circuit can be used. This is known as a passive subcarrier regenerator. (Fig.8).

The PAL "swinging burst" signal from the burst gate and amplifier is taken to the primary of transformer T1. From the bistable circuit which controls the PAL switch half-line frequency pulses are supplied to points X and Y. These pulses cause diodes D1 and D2 to conduct as the burst signal "swings" on alternate lines of picture signal.

In this way a "non-swinging" burst signal of fixed phase is produced, and feeds via capacitor C1 to the base of transistor Q1. Q1 has 0 volts DC at its base, and so does not conduct. However during the period when the burst signal is present on the transmitted signal, a positive pulse from the receiver line output transformer switches Q1 "on".

Coil L in the collector circuit of Q1, together with capacitor C2 and 4.43MHz crystal form a crystal-controlled "ringing" circuit. The 4.43MHz signal produced this way is now amplified by transistor Q2. It is then used in place of the normal local subcarrier oscillator signal.

Passive subcarrier oscillators may also be used in NTSC receivers. Because the NTSC burst is constant in phase, the switching circuit is omitted.

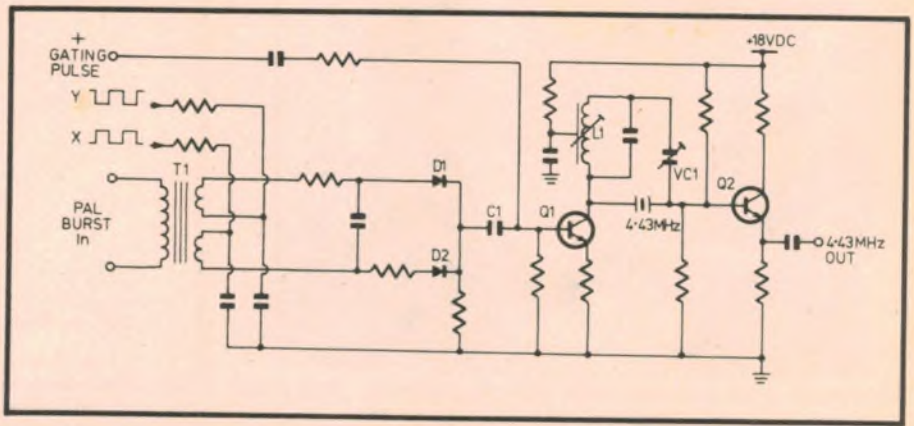


Fig.8: An alternative method used to produce the 4.43MHz local subcarrier signal, by direct regeneration from the signal's own colour bursts themselves.

Synchronization circuitry

The synch pulse separator circuits in a PAL receiver are similar to those of a monochrome TV. The separated horizontal and vertical pulses "trigger" the vertical and horizontal scanning oscillators in the TV. In this way the picture raster is kept exactly synchronized with the transmitter camera scanning.

Fig.9 shows a basic schematic of a synch separator stage. A composite video signal from the luminance stage is supplied to the input. The values of capacitor C1 and resistor R1 are so chosen so that only the synchronizing pulses can cause transistor Q1 to conduct. Line synch pulses pass via capacitor C2 to the line oscillator, and vertical synch pulses pass via capacitor C3 to to the vertical oscillator.

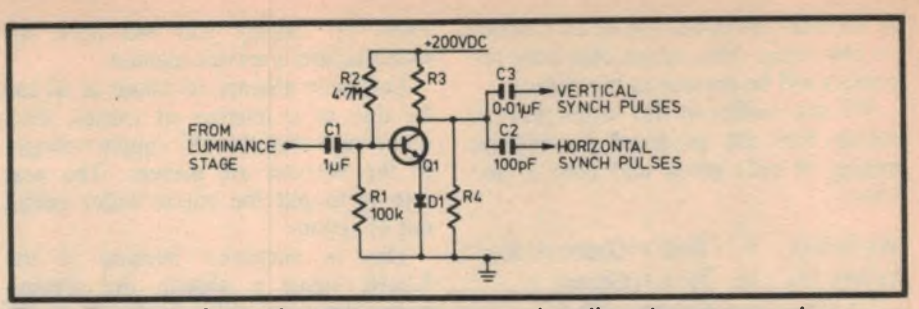


Fig.9: The basic form of a synch separator, using discrete components. Composite video from the luminance stage is stripped back to the synch pulses by Q1.

Line oscillator and line output stages

Special considerations apply to the line oscillator and line output stages of a PAL colour receiver. Higher power is required by the deflection circuits. There is also the need to provide a constant 24 to 27 kilovolt EHT voltage supply, from which sufficient current can be drawn for the three electron beams of the picture tube without the EHT voltage varying. The tube heaters are usually powered from a winding on the line output transformer.

Add to this the fact that various DC voltage lines are usually derived from the power generated by the line output transformer, often including the DC supply voltage for the vertical scan output stages. Any variations in these supply voltages immediately affect the picture and colour reproduction.

Fig.10 shows a simplified schematic of the line circuitry similar to that found in some late model receivers. The receiver power supply is of the self-oscillating type described in part seven. This type of power supply enables the television manufacturer to greatly simplify the design of the line stages.

In this way the cost of production is lowered and reliability is increased. However, you will appreciate that the line and power circuitry of various makes of modern PAL receivers can vary considerably.

Notice in Fig.10 that instead of a line oscillator stage using perhaps a single transistor, the line oscillator is contained within a single integrated circuit. This IC also contains the vertical scan oscillator and all the synch separation circuitry, plus other functions. A 25 volt DC supply form the power unit feeds through resistor R to a 5 volt regulator IC providing a regulated 5 volts supply.

Notice that several other DC supply lines are also powered from the windings of the line output transformer.

The line drive output from the IC feeds to transistor Q1 driving, via transformer T1, the line output transistor Q2. Q2 in turn drives the line output transformer T2. This transformer is of the diode-split type.

The complex dynamic convergence and correction circuits found in the older PAL TV's are not required. This is because of the advanced design of the modern colour picture tube.

Faulty colour reproduction

As with all electronic equipment, faults can occur. Suppose such a fault causes incorrect, or no colour at all on the displayed picture? Your knowledge of colour TV principles, including additive colour mixing will help to locate the cause.

A colour bar generator, together with a suitable oscilloscope is generally essential for this type of fault finding. The correct sequence of the colour bars viewed from left to right on the picture tube is:- White, Yellow, Cyan, Green, Magenta, Red, and Blue.

The picture tube itself can be responsible for colour display faults. For example if the tube has three separate electron guns, (and assuming all the other circuitry is in order), *complete* failure of one electron gun — perhaps

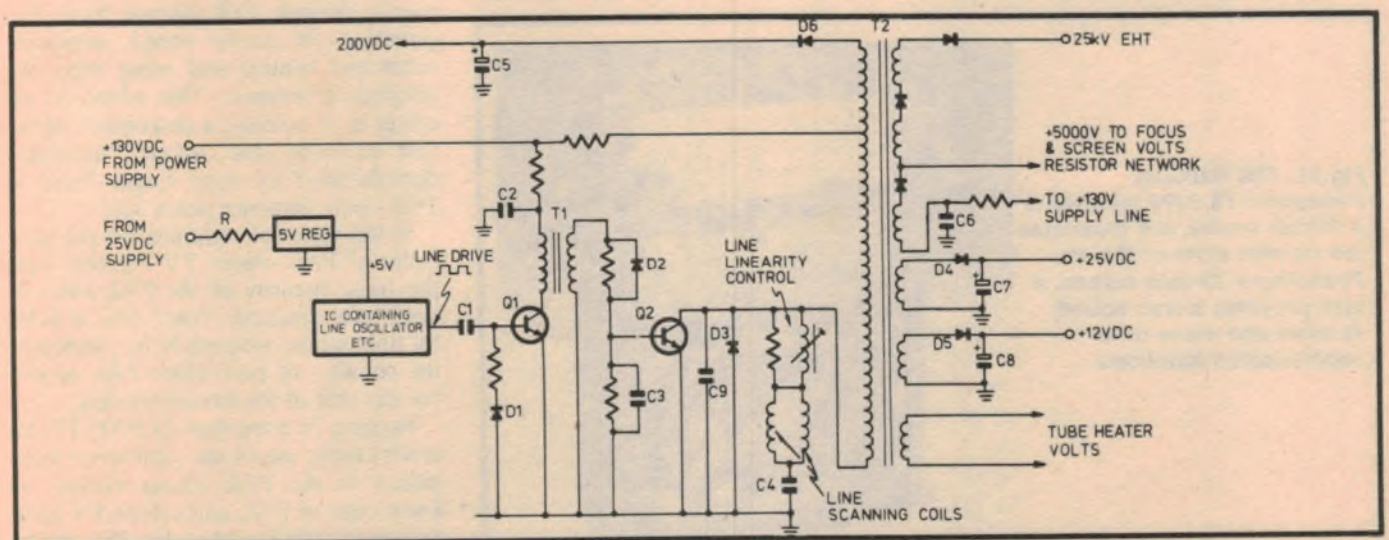


Fig.10: Simplified circuit for the line output section of a modern PAL colour receiver. The exact circuitry varies widely from one design to another, but this is the basic arrangement.

by internal disconnection of its cathode — can occur. This means that only two colours will be present in the picture.

We saw earlier in this series that the colour bars are produced by additive mixing of red, green and blue as follows:

White bar	=	Red + Green + Blue
Yellow bar	=	Red + Green
Cyan bar	=	Green + Blue
Green bar	=	Green
Magenta bar	=	Red + Blue
Red bar	=	Red
Blue bar	=	Blue

What will happen, if for example, the green electron gun fails completely? The white bar lacking green will red plus blue — magenta. The yellow bar lacking green will be red. The cyan bar lacking green will be blue. The green bar will be black. The magenta bar, lacking nothing, will still be magenta. The red and blue bars will still be red and blue. And so on.

A sequence of cyan, green, cyan, green, blue, black and blue will be displayed if the red gun fails. Failure of the blue gun will produce yellow, yellow, green, green, red, red and black bars in that order.

Failure of one of the RGB drive output transistors, usually mounted on the cathode ray tube base panel, can result in the complete absence of one colour. It can also cause the predominance of a single colour in the picture, depending whether the transistor has shorted or become open circuit.

If a fault occurs in decoder circuitry that consists of discrete components, or a number of integrated circuits, fault location is generally straightforward. However, usually you will need the manufacturer's service manual.

Complete absence of colour at all can be due to a number of causes. First make sure that the DC supply voltages to the decoder are present. The next step is to put the colour killer circuit out of action.

This is necessary because if the 7.8kHz signal is absent, the chrominance amplifier will not function. To disable the colour killer you'll probably need to consult the manufacturer's service data. If a good colour picture is now viewed, then the colour killer circuit is almost certainly faulty.

Absence of colour in the picture can often be due to the failure of the internal 4.43MHz subcarrier oscillator or its associated crystal. The oscillator output is easily checked with your oscilloscope. Check too the output of the chrominance amplifier,

Incorrect colours — viewed with the colour killer out of action — are caused by a variety of faults. If the 4.43MHz oscillator is slightly off frequency, incorrect colour bars will be displayed. Faulty burst gate circuitry may produce a strange effect of multi-coloured bars, each composed of several different horizontal colour stripes. A stopped bistable circuit results in a picture where every other line is the wrong colour. An inoperative output of one synchronous demodulator will obviously result in incorrect colours.

As an example, consider the results of the failure of the (R-Y) demodulator. Since no (R-Y) will be present, red, yellow and green signals will all become signals consisting of only minus (B-Y) signal voltages. These three colours will now be of the same hue but will have different amounts of saturation.

In the same way magenta, blue and cyan signals will now consist of only plus (B-Y) signal voltages of the same hue, but again will have different amounts of saturation. Examine the phasor diagrams shown in parts two and six of this series and you'll see that red, yellow and green become a greenish yellow in hue. Magenta, blue and cyan show as a slightly magenta tinged blue.

Failure of the luminance circuitry leaves only the colour information, and produces a fuzzy colour image that lacks all fine detail. We have only space to mention some of the causes of colour troubles in the PAL receiver. However, remember that symptoms can vary with different designs of colour TV's.

In the case of the latest PAL receivers all the decoder circuitry is enclosed in a single integrated circuit. So if any of the individual circuitry we have considered fails, then the IC must be replaced. Only a few external components need to be checked before changing the IC. However the "one-chip" decoder is extremely reliable, and seldom fails.

The modern PAL

Infra-red remote control handsets, special tuning facilities, teletext displays, stereo sound, digital and microprocessor circuitry, together with many other advancements, are some of the developments contained in the latest PAL receivers. For example, the TDA3562A "one-chip" decoder contains facilities enabling a TV receiver which incorporates this integrated circuit to be used as a direct RGB-driven computer monitor, etc.

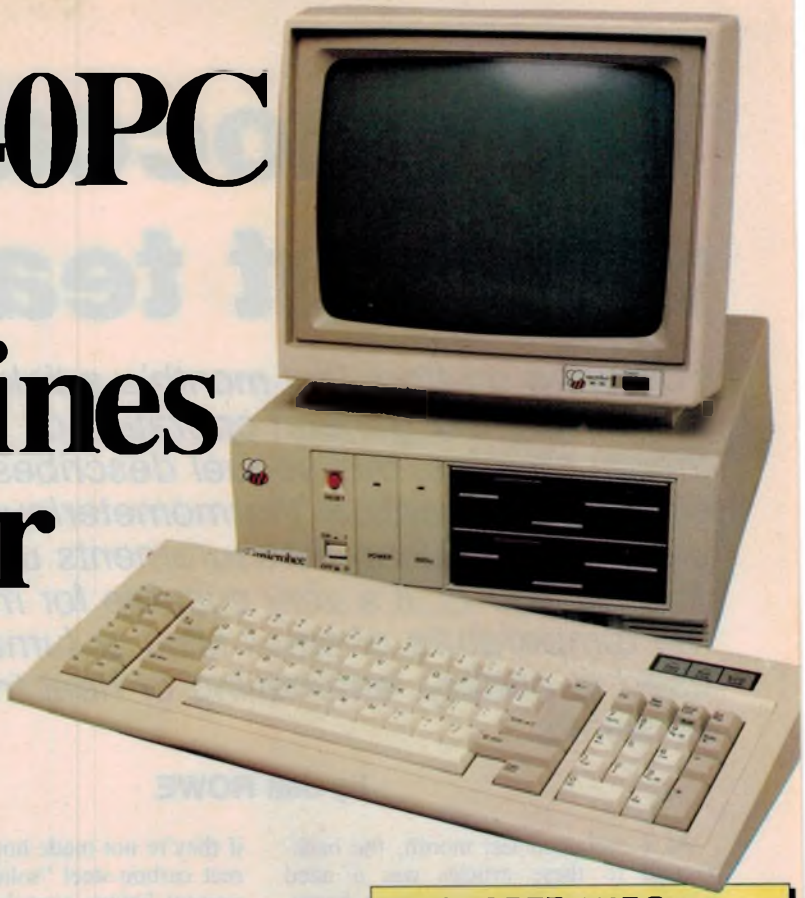
Fig.11 shows a photograph of the National Panasonic TX 3370 receiver. It uses a 33-inch FST picture tube, has provision for stereo sound, computer controlled teletext and many other sophisticated features. This advanced receiver is, in a sense, a descendant of the first scanning disc colour "televisor" demonstrated by John Logie Baird in 1928 - only fifty-nine years ago!

In this series of eight articles the principles of PAL colour TV together with the basic circuitry of the PAL receiver have been covered. You'll find it helpful to continue your study by examining the circuitry of both older PAL receivers and that of the newest models.

Keeping in mind that all PAL TV receivers make use of the same basic techniques of the PAL colour system. A knowledge of PAL and colour TV techniques is also essential for the understanding of the operation of modern video cassette recorders.

Fig.11: The National Panasonic TX 3370 receiver is a British model, but illustrates the current state of the art. Featuring a 33-inch screen, it also provides stereo sound, Teletext and many other sophisticated functions.

The new 640PC compares with machines costing four times its price!



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Keyboard:	*84-key, AT-style layout.*
I/O:	*Five full-length expansion slots. Real-time clock Serial and parallel ports*
Power supply:	*145 W switch mode power supply*
Software:	*MS-DOS v3.2 GW-BASIC 3.2 Licensed BIOS from Phoenix Technologies 16K internal ROM (expandable to 64K)*
Dimensions	*:140 x 340 x 412 mm (HxWxD)*

BYRNE & STEWART MIC121/1068

Thermocouples without tears — 2

Following on from last month's article discussing the general operation of thermocouples, this sequel describes a simple and practical thermometer/pyrometer capable of making measurements up to around 900°C. It's very suitable for measuring the temperature of small kilns or furnaces used in pottery, enamelling or heat treatment of metals.

by JIM ROWE

As I explained last month, the background to these articles was a need which arose to heat treat some home-made milling cutters, to harden them. In order to harden the cutters, which were made from "silver steel", they must be heated to about 780°C and held there for about 15 minutes. Then they must be rapidly cooled down, by quenching in water or some other liquid.

The temperature must be held at close to the correct value, or the parts won't harden properly and be ruined as soon as they're used. If they're made too hot before quenching, some of the carbon can be burned away; conversely if they're not made hot enough, the correct carbon-steel "solid solution" is not present before quenching, and the very hard Martensite crystals won't form.

The traditional way to judge the correct temperature is to go by the colour of the steel parts themselves. For example, 780°C is half-way between "cherry red" and "blood red". This may be easy for those that are very experienced, but if you're like me and only need to do it once every few months, it's surprisingly tricky. I've ruined a few cutters this way recently, and the last time it happened I decided that there simply *had* to be a better way.

There is, of course. The answer is to measure the temperature using a high-temperature thermometer, or *pyrometer*. These come in various kinds, some of which actually function by comparing the colour against a reference colour scale.

Commercial pyrometers tend to be quite expensive, and scarcely justified for casual hobby use. But it is possible to make a simple pyrometer using a thermocouple, which will do the job at surprisingly low cost.

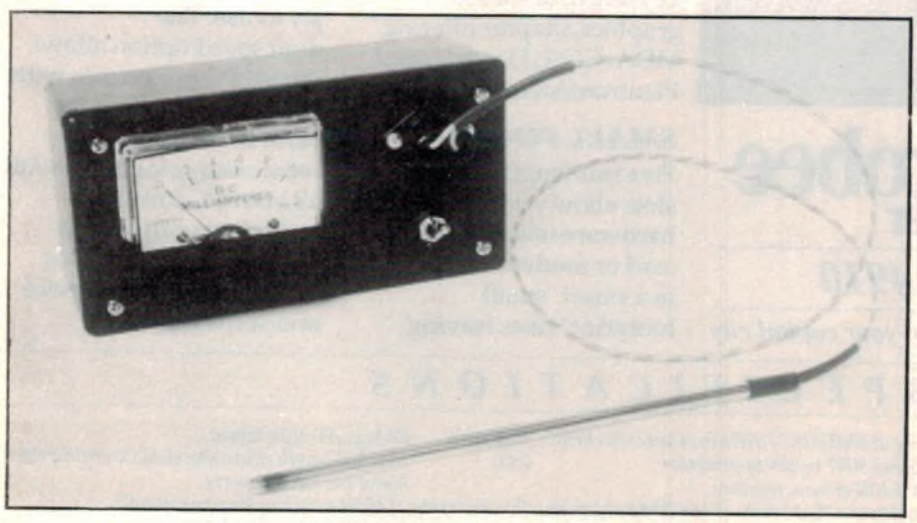
The little pyrometer to be described here uses a readily obtained type K thermocouple probe, based on a Chromel-Alumel junction. This type is currently the most suitable proposition for measurements to around 900°C, offering reasonable electrical output and stability combined with low cost. The probe I've used in the prototype unit and visible in the photographs was made to order by Richard Foot Pty Ltd, of 26-30 Tepko Road, Terrey Hills NSW 2084. It comes complete with stainless steel sheath and leads, and cost me a very reasonable $25 plus sales tax.

In a few months, it should be possible to buy similar probes based on a type N (Nicrosil-Nisil) junction, from Bell-IRH Pty Ltd of 32 Parramatta Road, Lidcombe NSW 2141. These are likely to be more stable in performance, but they're also likely to be more expensive.

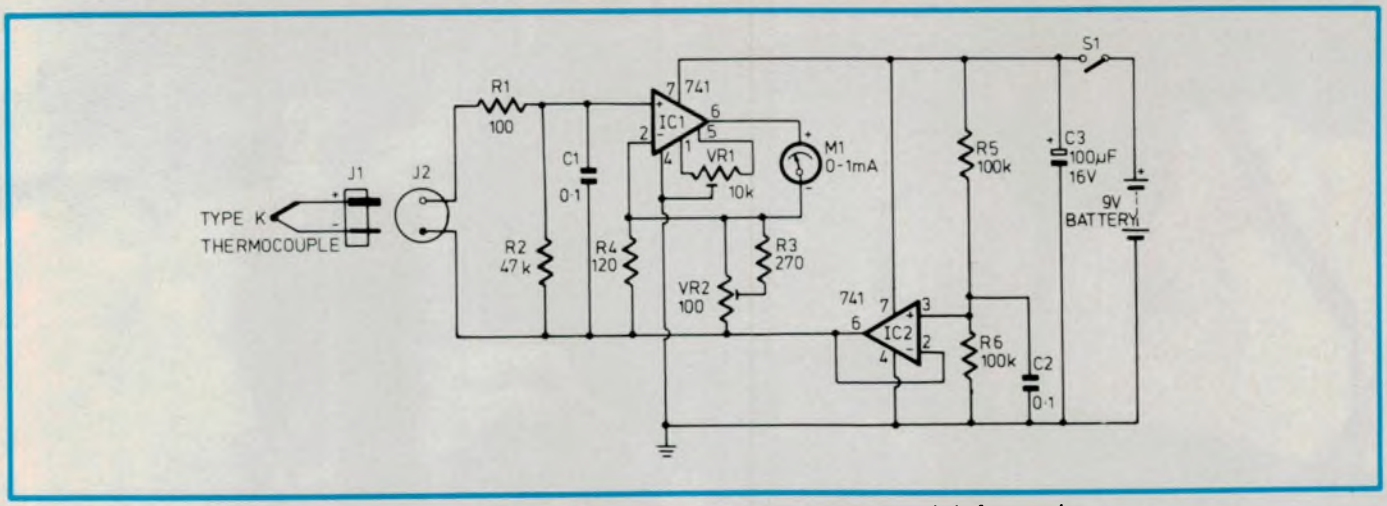
For hobby work the type K probe I've used is probably more than adequate, but if you're after the highest accuracy and stability, you might well want to use a type N probe when these become available.

By the way, the little pyrometer unit described here isn't restricted to being used with a type K probe. It can be used with type N, J, or E probes, or even with the much more expensive types R and S probes with a little modification. But I should stress that it's a simple unit intended for hobby measurements, not for very demanding and critical industry applications. Hooking it up to expensive platinum-based type R or S probes would be like using a cheap pocket compass to navigate your $50,000 cruiser (if you had one!).

Basically, although my motivation for



Using a type K thermocouple probe, this simple pyrometer is suitable for making measurements in kilns and furnaces up to about 900°C.



The complete circuit for the pyrometer. As you can see, it is very simple and straightforward.

designing the unit has been for measuring the temperature of steel parts being heat treated, it should also be quite suitable for measuring the temperature of kilns and furnaces used for pottery firing and jewellery enamelling. The type K probe is capable of operating at up to about 1100°C, while one of the newer type N probes would be capable of measuring up to around 1250°C. Type R or S probes would take you even further, to around 1400°C.

As discussed last month, thermocouples produce a small DC output voltage that is proportional to the temperature difference between the "active" and "reference" junctions. This means that what we need to produce a pyrometer, apart from the thermocouple probe itself, is a means of measuring small DC voltages. In other words, a DC millivoltmeter.

Of course one solution would be to use a digital multimeter. Many of these provide a suitable low voltage range, to be sure. But they're also fairly expensive, and it won't always be feasible to press one into use — particularly if you want the pyrometer for measuring the temperature of a pottery or enamelling kiln, for significant periods of time.

Another solution would be simply to connect the thermocouple probe directly to a small moving-coil meter movement. This will work in some situations, but generally it isn't satisfactory as the output of most thermocouples is too low at the temperatures of interest. For example even the highest-output type E probe produces only about 59mV at 780°C, while the more readily-available type K probe has an even lower output, of 32.45mV at 780°C.

When you consider that the majority of moving-coil meter movements have a nominal voltage sensitivity of 100mV full scale, regardless of their current sensitivity, it's obvious that reading these low voltages with any kind of accuracy would be very difficult.

The alternative is to use a small DC amplifier circuit, as shown. This effectively converts a standard and reasonably rugged low-cost 0-1mA meter movement into a DC millivoltmeter of any suitable full-scale deflection (FSD), say 50mV to suit a type K probe.

The circuit uses a couple of low cost 741 op-amp chips, and runs from a small 9V battery. It could also be operated from a 9V DC plug-pack supply, if you needed to run it for hours on end.

Circuit description

The basic amplifier configuration is shown in Fig.1. Resistor Rf is used to generate a voltage Ef in response to the meter current Io, and since the op-amp's negative input is connected to the top of Rf, Ef becomes the negative feedback voltage.

Since the op amp has a very high open-loop gain A, it will act to ensure that Ef follows the thermocouple voltage Ei very closely. As a result, the meter current Io becomes directly proportional to Ei, and inversely proportional to Rf.

So the circuit is essentially a linear voltage-to-current converter, whose ratio is determined by Rf. By adjusting the value of this resistor we can effectively give the meter any desired sensitivity in terms of input Ei in millivolts. For example if the meter is a 0-1mA type, making Rf 50 ohms will turn it into a 0-50mV meter. Similarly a value for Rf of 20 ohms will turn it into a 0-20mV meter.

Of course this assumes that a meter that is marked "0-1mA" does give full-scale deflection when it is passing exactly 1mA. Generally this is not the case, as meters have a tolerance of between 3% and 5%. For the present purposes this can be fairly significant, as a 5% error in measuring the output of a type K thermocouple at around 800°C can correspond to an error of about 50° in temperature.

In other words, we can't really just put in a 1% precision resistor for Rf, and assume that everything will be OK. Because of the tolerance errors in meter current sensitivity, calibration is going to be necessary.

You may also recall from the first of these articles that because the output voltage from thermocouples is not a linear function of temperature, we can't easily calibrate the meter in terms of temperature. It's best to calibrate it in terms of DC millivolts, and then use the method and table given last month (Table 2) to work out the corresponding temperature.

Now let's look at the final circuit. IC1 is the basic voltage-to-current amplifier, as shown in Fig.1. A standard low-cost 741 op-amp is used, as there are no special requirements here in terms of high input impedance or output drive capability.

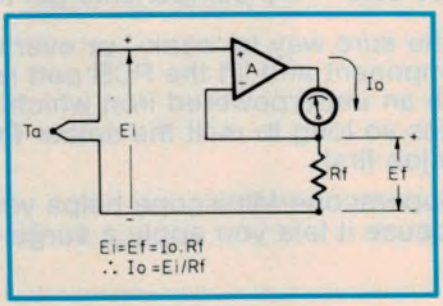
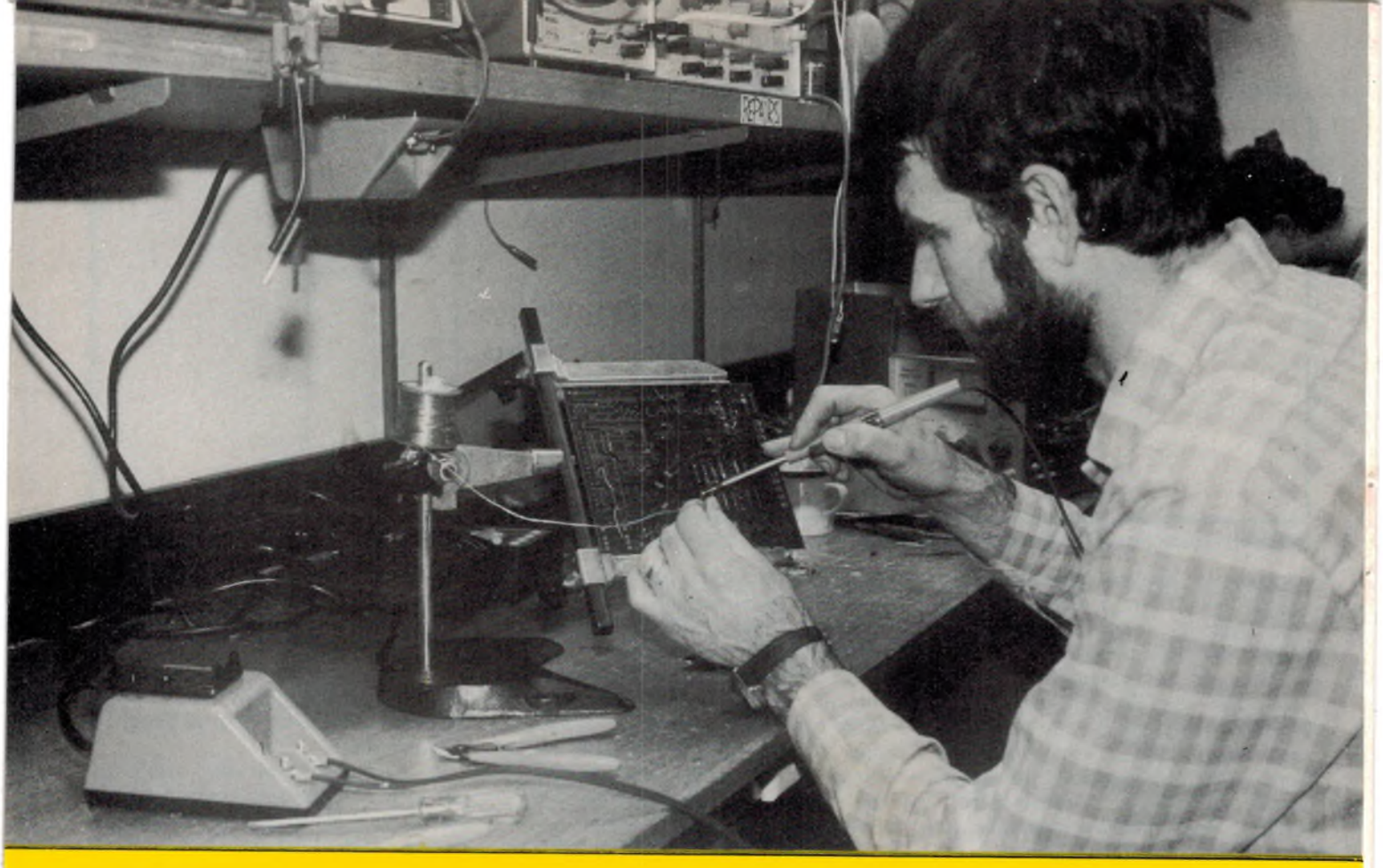


Fig.1: The basic circuit used in the pyrometer metering unit, to perform voltage-to-current conversion.



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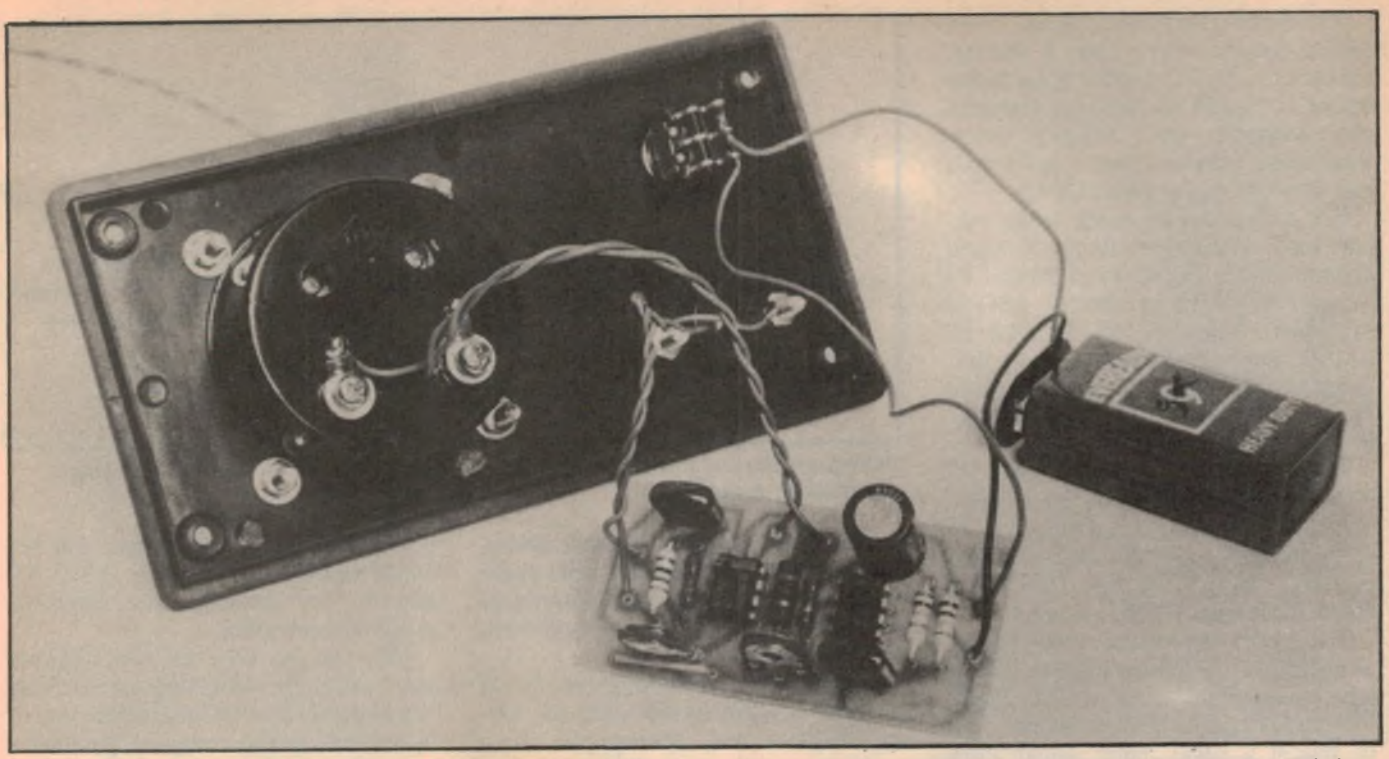


Inside the metering unit box. The small PCB mounts vertically in one of the moulded slots, between the meter and the battery.

PARTS LIST

1 PCB, 87t10, 62 x 31mm
1 plastic utility box, 41 x 68 x 130mm
1 0-1mA meter movement, 58 x 52mm
1 type K thermocouple probe (see text)
1 polarised 2-pin plug
1 matching 2-pin socket
1 miniature SPST or DPST toggle switch
1 9V battery and snap lead

Semiconductors

2 741 op-amp ICs, 8-pin DIL type

Resistors

1 x 100Ωs, 1 x 120Ωs, 1 x 270Ωs, 1 x 47k, 2 x 100k, 1 x 100Ω small vertical trimpot, 1 x 10k small vertical trimpot

Capacitors

2 0.1uF LV plastic
1 100uF 16VW electrolytic (PC mount)

Our estimated parts cost for this project, not counting the thermocouple probe, is $31.50. Suitable probes are available for $25 plus sales tax, as discussed in the text.

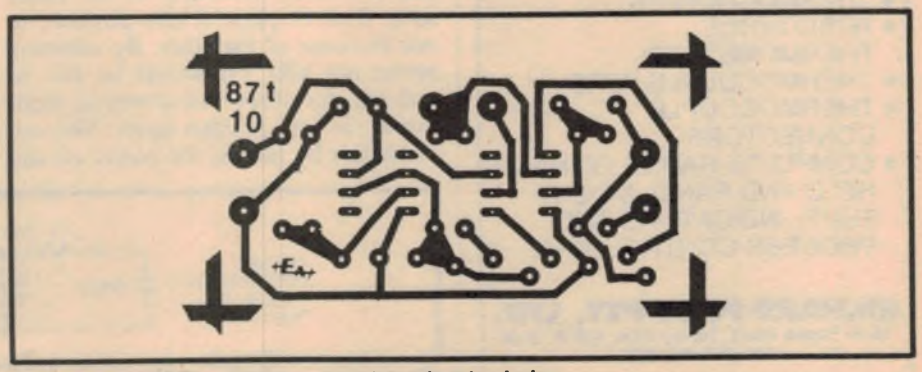
A second op-amp IC2 is used to split the 9V battery supply, in order to operate IC1 in the most linear part of its transfer curve. IC2 is connected as a unity gain voltage follower, with its input connected to a divider formed by R5 and R6. Its output is therefore midway between the two supply rails, and is used to establish the reference bias level for IC1. Capacitor C2 is to prevent any noise from being injected into IC1 via this reference line.

The thermocouple probe is connected to the input of IC1 via a simple network consisting of R1, R2 and C1. The function of R1 is to swamp out the effects of wire and connector contact resistance in the probe leads, while C1 is to bypass any RF signals which may be picked up by the leads. Resistor R2 is to prevent the input of IC1 from floating when the probe may be disconnected.

Trimpot VR1 is to allow nulling of IC1's input voltage offset, which can be as much as +/-15mV — quite small, but large enough to be significant here.

Finally VR2, R3 and R4 together make up the current feedback resistor, jointly replacing Rf of Fig.1. The idea here is to provide a resultant resistor whose value is variable over a small range, to allow adjustment which compensates for the tolerance error of the meter movement, and allows the pyrometer to be calibrated.

The circuit values shown provide a feedback resistor which can be varied from about 45 to 55 ohms — i.e., about 10% either side of 50 ohms. This should be adequate to allow the circuit to be set for an accurate 50mV FSD, with virtually any 0-1mA movement.



Here is the PCB pattern, reproduced actual size.

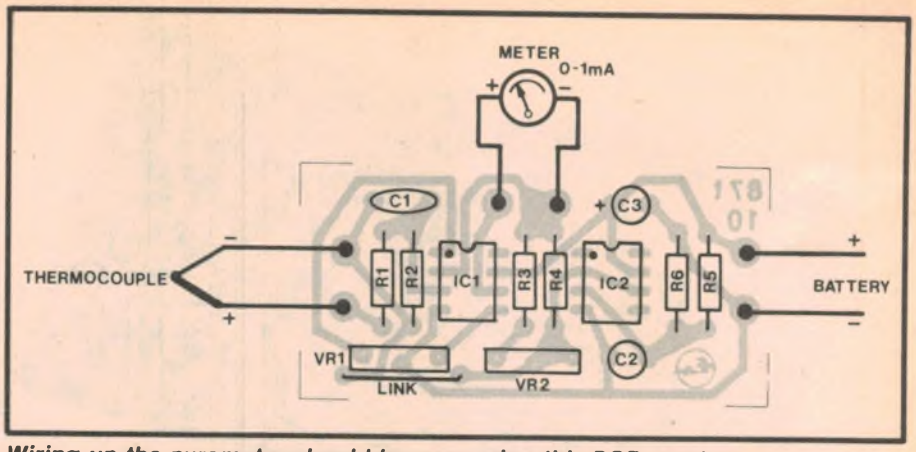
As shown, then, the circuit is intended for use with a type K thermocouple or any of the other types whose output is capable of being read reasonably accurately on a 0-50mV meter. This would include a type J probe or a type E probe (up to about 750°C).

For probes having much lower output, such as the types R and S, you'd need to modify the values of R3 and R4 to give the circuit an effective FSD of say 20mV. Values of 150 ohms for R3 and 27 ohms for R4 will achieve this, giving an adjustment range from about 18.6 to 21.25 ohms (i.e., about 6% either side of 20 ohms).

The circuit is built up on a small PC board as shown, measuring 62 x 31mm and coded 87t10. This is designed to fit vertically inside a small moulded plastic jiffy box, such as the type UB3 (Dick Smith Electronics H-2853, or similar).

The meter movement used in the prototype is a small rectangular 0-1mA type, measuring 57 x 52mm (Dick Smith Electronics type Q-2010 or similar). To be honest a larger meter would allow more accurate reading, and would thus be preferable, but this would also call for a larger and more expensive case.

I used a small polarised 2-pin plug and socket, of the type where the plug has two round pins of different diameters, to connect the thermocouple probe to the metering circuit. A miniature toggle switch was used for the on-off function.



Wiring up the pyrometer should be easy using this PCB overlay and wiring diagram as a guide.

Assembly of the metering unit should be fairly straightforward using the wiring diagram and photographs as a guide. In wiring up the PCB, I suggest that you fit the resistors and single insulated link first, then the capacitors, the ICs and finally the preset pots. Just make sure that you fit the ICs and the electrolytic capacitor with the correct orientation, and watch that you to fit the two preset pots in their correct positions.

After preparing the case and mounting the meter, power switch and probe socket in position, you can add the wires to connect these to the completed PCB, and to the 9V battery snap connector.

When all is completed, you should be ready to begin setup and calibration. The first step here is to carefully adjust the meter movement's physical zero setting, with the power off, so that it does indeed correspond to zero on the scale.

Now add the battery and try turning on the power — initially without the probe connected. All that should happen is a small movement of the meter away from its physical zero position, in one direction of the other. By adjusting preset pot VR1 you should be able to null out this offset, and return its reading to the zero position again. You can verify this by turning the power on and off a few times, making sure that the meter needle doesn't move. VR1 will now be set correctly, and you'll be ready for calibration.

This can be done in two different ways: either by calibrating the metering circuit purely as a DC millivoltmeter, or by calibrating the complete pyrometer at a known temperature — perhaps against another unit of known calibration. The first approach is likely to be by far the easiest, for most people.

Here again there are are couple of possible options. If you have access to a digital voltmeter or multimeter, even briefly, the easiest plan would be to calibrate the meter against the digital meter, using a variable power supply or a battery and voltage divider combination to produce a suitable test voltage of say 50mV.

It's best to calibrate at the metering circuit's full-scale deflection, for greatest accuracy.

If you don't have access to a digital meter of any kind, or even a good analog meter to calibrate against, I can only suggest that you try the simple test circuit shown in Fig.2.

With a fresh mercury call of the photographic type, it will produce 50.5VmV when connected to the input of the pyrometer metering circuit (instead of the thermocouple probe). So when connected, it should produce a reading of just greater than FSD on the meter. If not, adjust preset pot VR2 until this is achieved.

Note that the mercury cell should be

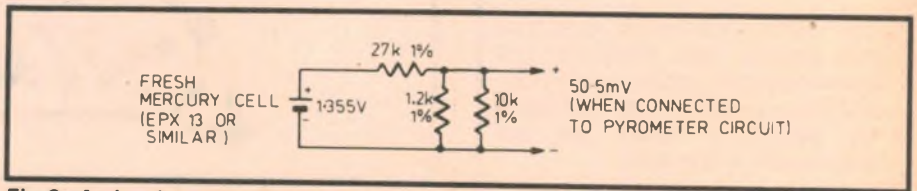


Fig.2: A simple test circuit for calibrating the metering circuit of the pyrometer.

of the type intended for photographic use, not for hearing aids. A suitable type is the Eveready type EPX-13.

The same test circuit can actually be used if you're able to calibrate the circuit against a digital meter. Here the digital meter will be able to show you any slight error in the voltage produced by the test circuit, and you can set VR2 to make the pyrometer meter read accordingly.

Having calibrated the metering circuit, you're finally ready to plug in the thermocouple probe — making sure, of course, that its leads have been wired to the plug correctly. With the unit I obtained from Richard Foot Pty Ltd, this was easy because the leads were provided with small labels marked "+" and "-".

Before closing, just a couple of tips about using the pyrometer. The first is that with thermocouple probes in a sheath, there is quite a significant thermal time constant involved. It takes a good couple of minutes, at least, before the thermocouple itself reaches a temperature close to that outside the sheath.

So if you're using the pyrometer to measure the temperature of a small kiln or furnace, the best approach is to let the thermocouple probe heat up with the kiln itself, slowly, and to stay inserted in it all of the time during which you need to make measurements. As well as allowing more accurate measurements, this will also subject the probe to fewer thermal heat up/cool down cycles — prolonging its life.

The other tip is simply to remember the correct technique for measuring temperature using a thermocouple. As explained last month, the thermocouple output voltage as measured by the meter is actually the *difference* between the Seebeck voltages generated by the active and reference junctions.

For accurate temperature measurements, then, what you need to do is make TWO measurements: one the pyrometer meter reading, and the other the ambient temperature (i.e., that of the probe cable and meter unit) using an ordinary thermometer.

Then from Table 2 given last month, or the equivalent table for the type of thermocouple probe you're using, look up the reference junction voltage which corresponds to the ambient temperature. This will allow you to work out the true active junction voltage, by simple addition: $Va = Vm + Vr$

where Va is the true voltage, Vm is the voltage measured by the meter, and Vr is the reference junction temperature as looked up from the table.

The final step is to go back to Table 2 with this corrected value for Va, and look up the true probe temperature.

It sounds a bit fiddly, and perhaps it is, but you soon get the hang of it. And in any case, it's a lot easier than trying to work out whether the colour you're looking at is blood red, cherry red, brick red or whatever!

Incidentally, if you want to check the temperature calibration of the pyrometer, this can be done by making use of the known melting points of various materials. For example pure aluminium (like that from an old saucepan) melts at 658°C, while zinc melts at 419°C. But note that for accuracy, you need to check the melting/solidifying temperature going each way (up and down), and take the average of the two.

Finally, if like me you want to know more about heat treatment of metals, I can recommend the paperbound book "Hardening, Tempering and Heat Treatment", by Tubal Cain, one of the Argus Workshop Practice Series.

TELECOMMUNICATIONS FEATURE:

What's happening to optical fibre

The technology of optical fibre transmission is developing at such quantum speeds that few experts would be game enough to predict what will come out of the laboratories in the next few years. Already the technology is offering cheap and virtually limitless bandwidth, with the potential cost of national and international communications tumbling.

by STEWART FIST

It's often the case that the most important events pass by with barely a whisper, while the least important are shouted from the rooftops. So it goes with communications.

This year saw the development of all-optical repeaters, radical new fibre types, and orders-of-magnitude jumps in the distances between repeaters and the bandwidth of fibre circuits. It is now clear that long-distance telephone and data links will eventually be very much cheaper and have capacities beyond our wildest dreams of a few years ago.

These changes are coming thick and fast. Take, for instance, British Telecom's recent announcement that it had found a way of boosting light signals without converting them to electricity. What we are witnessing here is the invention of the optical transistor, and it could well be as important as Shockley's original electrical semiconductor.

The obvious application of an optical amplifier is to boost the signals in long-distance terrestrial or undersea cables, but it could also be a central component in future optical computers. Scientists have understood the theory of laser amplification for many years, but until now no one has been able to make a device work in the field.

The boost to the light signal that British Telecom has achieved comes from a semi-conductor laser which is a tiny cube of crystalline material about the size of a grain of sand. The original laser beam from the fibre-optic cable enters one side of the crystal, and leaves the other at a greater intensity.

British Telecom, like other researchers, has put a steady voltage across these crystals to stimulate the production of photons. One photon enters the crystal and a lot are produced — the basic requirement of amplification — but the trick has been in keeping these newly energised photons from bouncing off the sides of the crystal and confusing the laser pulses.

BT's invention has been to coat the crystal with a non-reflecting surface, which cuts the internal reflection to less than one percent of normal, and at this level the laser amplification works extremely well. It is a bit like the anti-reflection coating that camera-makers use inside a composite lens to stop the fog on pictures.

Even more amazing is the fact that BT's light amplification process can work in reverse. Pulsed laser beams travelling in opposite directions down the same cable can be simultaneously amplified by the one semiconductor laser, provided that the pulses are at different frequencies.

The implications of this in terms of cheapness and reliability of optical fibre systems are staggering. Regenerators are the most expensive parts of light-wave links and also the components most likely to fail.

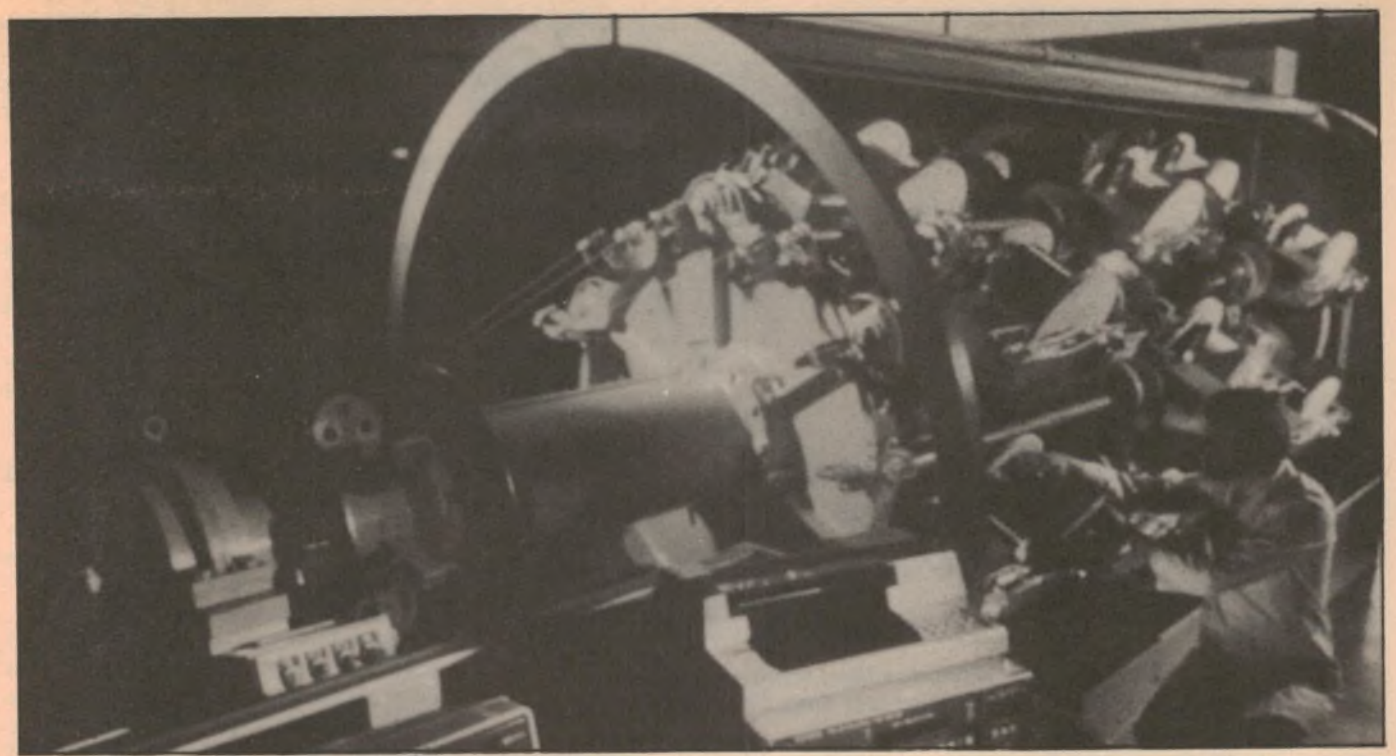
With current fibre optical systems we need to have regenerators to amplify, reshape and retime the signal every 30kms or so. These are reasonably complex electrical systems which convert the light pulses to electrical signals, amplify these, then use them to drive the next-stage laser.

The new Tasman 2 undersea optical cable to New Zealand, for instance, needs to carry 7,000 volts at both the Sydney and Auckland ends to power the complexity of electrical regeneration circuits under the sea. The copper power-cable alone adds very substantially to the overall cost (and to the weight and bulk), while the reliability of the numerous electrical components largely determines the expected life of the system as a whole.

It is obviously important, therefore, to reduce the distance between regenerators, and to a large degree this is fixed by the transparency of the glass used in the fibre.

We all know that window glass only 5 millimetres thick can show a distinct greenish tinge, because of its selective absorption of the red and blue wavelengths. Windows only absorb a small percentage of the light, but these losses take place in a light passage of only a few millimetres; transpose this to distances of 30 or more kilometres and you'll see the problem. The transparency of glass used in optical fibre cables needs to be extraordinarily high — to say the least.

Special silica glass used in current fibres is able to support distances between regeneration of about 30 to 50km, and the Japanese firm Sumitomo recently achieved a record of 120km by super-refining their glass. They removed the germanium doping that theory said would improve the transparency, and



Assembling an optical fibre cable. The individual fibres are layed into slots in a central core, then protected by an outer polyethylene sheath. (Courtesy Olex Fibre Optics)

reached low-absorption figure very close to the theoretical limit.

But 120km is nothing when compared to the potential of the new halide glasses now being produced by Corning Glass in the States. Halide glass is almost the optical equivalent of superconducting wire — a carrier system with almost no power loss over distance.

Whereas silica-based glass fibres have a best-case theoretical loss of about 0.15dB per kilometer, halide glasses seems able to reach 0.01dB/km in practice, with a theoretical limit in the dreamworld of only 0.001dB/km.

The costs of halide fibre might be ten times that of silica, but the decrease in the number of repeaters more than compensates.

A new Bell Laboratories report from its Lightguide Materials Group states that these new fluoride-based glass fibres have transparencies which could theoretically allow distances between regenerators of up to 3,600 kilometres — so under-ocean repeaters may no longer be necessary. A couple of jumps between Pacific Islands, and we are in the US!

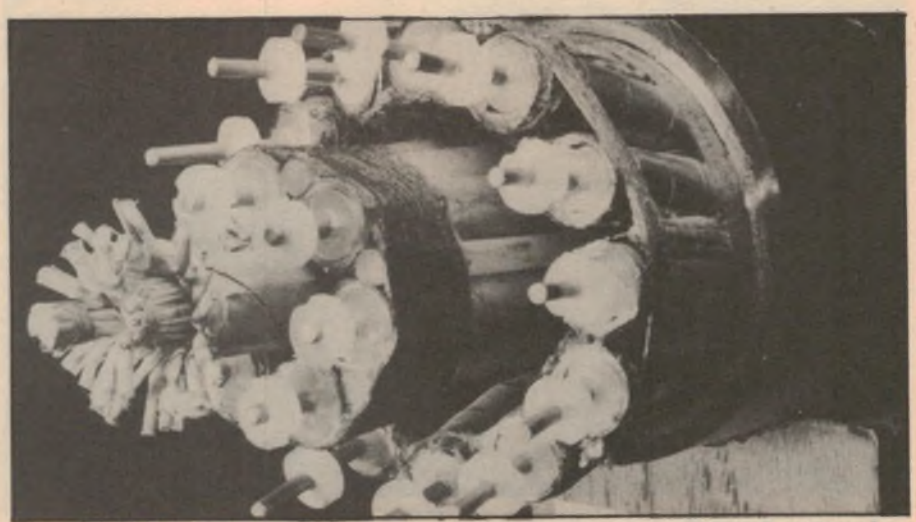
The present experimental batches of halide glass compositions are extremely brittle, and the fibremakers are having problems in the purification and drawing processes. Air is a major problem; minute bubbles get trapped in the material and it only takes a few of these to destroy the transparency of the system. But everyone seems confident that these problems will soon be resolved.

Without the need for repeaters and copper power feeds, dozens of optical fibres can easily be carried within each cable. It was the need for power and regeneration that established the reasonable limit to the number of fibres that could be included in each cable sheath.

But how much information will these cable fibres carry?

Bell Laboratories' report assumes a basic data rate along a cable of 1 gigabit (1,000 million bits) per second, but their own laboratories are leading the push to get more and more pulses out of a laser every second. A 1Gb/s pulse rate is now old-hat; four gigabits is regularly achieved in a number of optical laboratories.

Bell Laboratories has been concentrating on getting the pulse rate up — i.e. the pulse time down — and in designing lightwave multiplexing so that various signal sources can use the same fibre. Its scientists recently revealed that they had created a laser pulse time which lasted only 8 femtoseconds (10^{-15}, which is 8 quadrillionths of a second). If you were able to freeze light beams these pulses flowed past you in a



Closeup of a conventional copper/insulation type cable now being replaced by optical fibre cables. (Courtesy Olex Fibre Optics)

Testing an optical fibre cable for discontinuities, using an optical time-domain reflectometer or "TDR". (Courtesy Olex Fibre Optics)

fibre, you would find about a hundred of them to a millimetre.

Since light can circumnavigate the globe seven times in a second, you can get some feel for how much information there can be on a single fibre across the Pacific. We are talking here about pulse rates approaching 5000 gigabytes per second — in text terms, say 5,000 complete Encyclopaedia Britannica's every second on each fibre.

This is all in the realm of fantasy at present — these are lab experiments only. But a new optical fibre being produced for AT&T can carry 417 million bits per second now, and it is upgradable later to 1.7Gb/sec when the new lasers arrive. Translated into "real" communications this is a carrying capacity of 26,500 two-way telephone circuits or about 20 broadcast television channels on a *single fibre*.

This is a big jump already from the first generation of undersea fibre cables being installed at present. The first optical fibre cable across the Atlantic, TAT-8, will carry only 557 million bits per second overall, made up of only four channels at 140Mb/s — the internationally agreed rate set in 1984. The standard is already out of date.

How does this compare with Australia's existing undersea links? COMPAQ was laid in 1963 and carries only 82 voice circuits. ANZCAN which has linked us through New Zealand and Hawaii to Canada since 1984, and which is probably the last long distance metal cable to be laid across any ocean, carries 1380 telephone circuits.

Australia also has another thousand or so circuits available through the international satellite system — but satellites are droppping far behind cable in the race to provide high-capacity point-to-point communications.

Australia's first undersea optical fibre project, Tasman 1 which will link us to New Zealand and eventually on to the USA and Japan, will have three fibre pairs (six fibres) each with a capacity of 280 megabits/sec. This is 20,000 circuits each of 64 kilobit/sec which, with compression, can provide 60,000 voice channels for low quality telephone conversation.

What would a future twenty fibre, halide-glass, non-repeater cable with say 4Gb/sec rate provide? This is a reasonable level of technology to postulate within the next decade.

If you do your calculations you'll come up with a figure of about 3 million international telephone-grade lines — almost one for each household in Australia — which is getting rather preposterous. But the real point is that this level of service would probably be cheaper to lay, and certainly cheaper to maintain than our present links. If you don't have to worry about repeaters, you may as well lay a twenty fibre cable as a ten — the cost of the drawn glass is not a substantial part of the whole operation.

So it is not surprising to find that the US Office of Technology Assessment warned in January 1986 that the world had a potential "vast overcapacity in trans-Atlantic telecommunications by the mid 1990s." They were looking at the Atlantic, but the same could be said for our own region of the world.

It could well be that in the next decade it will be as cheap to phone Europe as it is to reach a nearby Australian country town. And when that happens the shift in both international trade and control of many international enterprises is going to be dramatic.

A Telecom Australia team laying fibre optic cable into the ground, using a direct ploughing technique. (Courtesy Olex Fibre Optics)

The ISDN man Cometh - ready or not!

Australia's telecommunications network is now undergoing the long and costly change into an Integrated Systems Digital Network. This will be good news for some users, especially large corporations, but not so good for the rest of us . . .

by STEWART FIST

If you look over the range of telecommunications services now available, you quickly realise how far we have come from the days when the telegraph and telephone provided the links that tied the British Empire.

Now our wires carry videotex, telex and teletext, electronic mail, facsimile, personal computer communications, packet-switching services and many more. But until now these services have been supplied by a number of telecommunications networks. The wires that carry your telephone conversations aren't also used for telex, for instance.

Sometimes these different networks only exist up to the exchange level — such as those supplying videotex and packet-switching — and we bridge to these through our standard telephone lines. But if you need high speed dedicated data lines a completely new set of wires needs to be installed, right up to your premises.

The aim of ISDN (Integrated Systems Digital Network) is to resolve the confusion caused by this hodge-podge of cables and controllers, and bring everything back into one composite whole. It is an international system which has been around since 1972, and this is the year that ISDN services come on-line in a number of countries.

STC's multiservice ISDN setup in the Office of the Future at Telecom Australia's Research Laboratories in Clayton, Victoria. (Courtesy STC)

Australian trials are already well advanced and Telecom seems to be ready to introduce the first ISDN commercial services in mid-1988, with the extension of the services to homes and small business a couple of years later. It will take some time for ISDN to reach the smaller town and country areas, but eventually all of Australia could have the system.

On present indications Australia will be one of the first countries in the world to introduce ISDN. For a while it will become another multi-use system superimposed on the confusion, but eventually it is assumed that the present systems will die and ISDN will remain alone. Whether this is realistic, or a technologist's pipe dream, remains to be seen.

ISDN is basically a network architecture that defines a common set of protocols for transmitting voice, data, facsimile and even video over ordinary telephone lines. In reality it is more to do with exchange-to-exchange connections than it is with links to your home.

It is perhaps characterised mainly by the fact that the primary exchange of information is in digital form, and therefore analog signals — such as voice and video — need to be translated into digital signals by *CODECs* before the system can handle them. This is the opposite of our present telephone system where a majority of digital signals from computers and communications devices need to be translated by *MODEMs* into an analog form for transmission.

The integrated system will obviously advance telecommunications services to some degree. It will be possible eventu-

ally to provide fast call set-up (two seconds), call diversion (where the person called is now at a different number), in-call signalling (which can take place during a connection), calling party identification, calling queueing with an indicator, on-line charge information and abbreviated dialling.

These lists of "probably" services are widely publicised by ISDN proponents, but when you look closely few are of central importance. They are the cosmetics of communications — the icing on the cake.

It is over generous to believe that the impetus behind Telecom's rapid development of ISDN is to provide new and better services for the customer. The main drive for an ISDN communications environment arises from the economies and flexibilities which the integrated nature of the network supplies to Telecom itself. One system to build — one service to maintain — one technical standard to enforce; that is the big attraction.

I am not alone in having a certain degree of cynicism about Telecom's motives. The US Gartner research group says that the reason most US communications carriers are promoting ISDN is "because of cost saving, rather than new applications for users."

"Carriers will simply emulate their existing services on ISDN," the Gartner report predicts.

If you look behind the scenes at the pressure groups that are driving us into an ISDN world, it is obvious that two groups have the most to gain. The hotly competitive American telephone companies see ISDN as an added service that will allow them to beat the newly emerging satellite communications companies, and the chip manufacturers see the gold at the end of the rainbow.

Only last December the US journal "Data Communications" commented that "ISDN remains an ill-defined and poorly understood wave of the future." And it went on to point out that "many of the world's chip makers see ISDN as their one great hope . . . it's the beginning of a whole new race."

In July of this year the annual IDC report highlighted ISDN internationally with the comment that it is "a long time off as a universal service offering." It also remarked that ISDN requires incredible investment. It's not the "everything" solution anyway, and is only partly specified.

The lack of specification is a real problem, although Australia's Telecom and OTC both seem to discount it in discussion. It has been said that the initial introduction of ISDN switches in Australia and elsewhere in the world may only support telephony-based signalling systems because of the uncertainty of the international signalling standard.

A complete terminal setup for ISDN, integrating telephones, fax, videotex and telex. (Courtesy STC)

ISDN uses a common signalling channel (or data link) between the customer and the Telecom network. Your home will still only have the one pair of wires, but this will carry two 64 kilobit/sec circuit-switched "B" channels (for voice or data) plus a single packet-switched (common circuit) 16 kilobit/sec "D" channel for the switching and control data.

It is the "D" channel that provides the only new service possibilities. In addition to its switching and control functions, it can also be used for "slow" data transmission, and for telemetry. Since it is always connected to your home system, it can be used to ready your electricity and water meters, etc.

This "2B+D" connection is for small business and home use, and it is known as the "Basic Rate Interface". This is the lowest level of service that you can have on ISDN. There's little point in screaming that you only want one telephone connection to your house — under ISDN you will effectively get two or nothing.

There will be some benefits from this system. You may want two telephones in your home, or you may need to transmit voice and data simultaneously using the twin channels.

The alternative to the Basic Rate in Australia is Telecom's "Primary Rate Interface", which is a nice PR term for the 30B+D connection — obviously intended for large organisations with PABX switching equipment. This uses a 2 megabit/sec line, providing 30 voice or data switched-circuit channels, plus the

An STC System 12 ISDN facility installed at the Research Laboratories of Telecom Australia, in Clayton Victoria. Courtesy STC)

common "D" signalling channel.

The Americans have decided to go with a primary rate system having 23B+D, which raises some incompatibility problems — but nothing that can of itself limit the international exchange of voice or data.

Telecom, however, has also been guilty of straying from the CCITT recommendations (CCS No 7) for the network signalling protocols — mainly because the international body hadn't reached its final stages of deliberation when Telecom moved to implement its own system. Luckily this is not critical in terms of international access, since any signalling incompatibilities can be overcome by translation at the OTC gateway. However it does present problems of another kind.

Telecom (and other proponents of ISDN) are very keen to point out that "The specification of a single multi-purpose interface by CCITT will eventually lead to economies of scale for chip manufacturers and equipment manufacturers. Hence, the longer term price trends for ISDN terminals should be lower than for specialised, service-dedicated or proprietary interfaces." (Telecom report)

This seems to say that the customer will get cheaper equipment because of the economies of scale in making chips which can be used everywhere — but it doesn't if you read carefully.

With ISDN the telephone subscriber must now have an analog-to-digital encoder plus a multiplexer to create the two logical channels (and the signalling channel) over the same wire circuit. These devices must be sophisticated enough to ensure that they perform well on both analog and digital connections, and they will therefore need some form of digital echo cancellation device. This is a very complex piece of equipment, and it probably won't come cheap.

Chips for Australian equipment will have to be manufactured specifically to Australian standards, since we no longer use the CCA No.7 standard. And anyway, the real point is that we don't need any chips at all in our telephones under the present system — whereas we will with ISDN. Methinks Telecom protest'th too much here — there is the remnant of a straw-man fluttering in the wind . . .

The other point is that a lot of existing PABX and digital communications equipment is going to be rendered superfluous by ISDN. It's going to be a great time to be in the second-hand equipment market, if you've got a need for A-to-D conversion or for analog circuit-switching gear!

This is only going to be a problem in the transition stage, and as Telecom will tell you, no change is ever possible which leaves everyone happy. But no one will be forcing you to use ISDN, for at least this decade.

There's no doubt that the larger companies will eventually get considerable benefits from ISDN, and perhaps some of the smaller ones may too. It is hard to see anything that will make home telephone owners overjoyed, but there are plenty of reasons why they should anticipate a substantial hike in communications costs.

That's right — not a drop, but a substantial hike.

For a start, ISDN is going to be horrendously expensive to implement. It is hard to know how much will be spent by Telecom, and impossible to predict what the private companies will outlay. But one thing is for sure, the costs quoted by Telecom will only be a small fraction of the actual — most will be hidden in the normal operating budget.

Cross-subsidisation will also extend the introductory costs of ISDN into the general community — the people who benefit the least will probably pay the most overall. Experience shows that Telecom and other PTTs always cut the apparent costs of new technologies by artifically holding the price down for the first few years, and making up the revenues by increasing charges to non-users. You can do this if you are a monopoly.

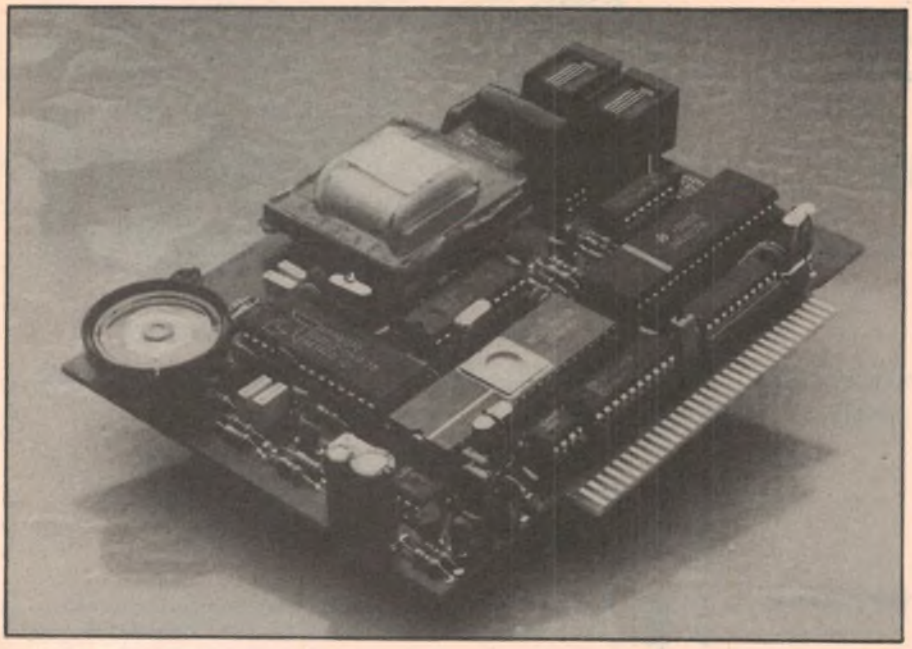
No one seems too keen to mention it, and Telecom certainly hasn't confirmed it — but it is obvious that a single communications system also incorporates the possibilities of a single charging system. If Telecom want to charge you on a bit-transmission basis for sending data down the line, they will also be able to charge on the same basis for local telephone calls. Remember everything is now digital — everything is just bits floating down the line.

Unless Telecom is willing to put in very "intelligent" clocking equipment that differentiates between voice and data communications, and between local and interstate/international calls — then every use of the ISDN system is likely to be charged on a per-bit rate.

Telecom has been trying to figure a way to do this for local data connections for years — they hate the way you can hitch your facsimilie or personal computer to a line and use it all day for only the cost of a couple of local calls — so now with ISDN they're going to have a way to charge you for everything!

TELECOMMUNICATIONS FEATURE:

NEW TELECOMMS PRODUCTS



Tiny modem-on-a-card for PCs

Compact, easy to use and offering all the major national and international baud rates, the Australian made Nice Inside modem is less than half-card size and plugs straight into any IBM PC, XT, AT, IBM compatible and even transportables.

The modem will operate at 1200 and 300 baud full duplex, under both the Bell and CCITT standards and also provides CCITT V23 operation at 1200/75 baud for Viatel. It has an extended Hayes' AT compatible command set and even holds one commonly used phone number in store to avoid having to type it each time. A built-in loudspeaker with volume control enables the user to monitor dialling and telephone operation.

A major feature of the modem is the ability to select the modem as any one of the PCs communications ports one to four.

The modem also provides auto-dial, auto-answer and auto-disconnect, will originate or answer at any speed and employs true baud rate scanning to match its operation to the remote modem.

The Nice Modem which will now be marketed Australia-wide and in export markets, has a recommended retail price of $849 in Australia. A less expensive version without 1200 baud full duplex operation, costs $599 and can be upgraded later, if required. Both come with communications and Videotex software.

Further information from the Nice Computer Company, Suite 3, 41 Rawson Street, Epping 2121.

Multi-standard modem module

Texas Instruments has announced the release of a high performance multi-standard modem module. The MOD3110 complies with CCITT, V22-bis, V22, V21 and V23 standards as well as the North American Transmission standards BELL 212A, 103 and 202.

The module also includes the modulator/demodulator and controller functions for automatic call and answer protocols, with either V25bis or the Hayes AT command set. The implementation of these standards allows the end user to access all videotex services and public databases from 300 bit/sec to 2400 bit/sec in full duplex operation.

Due to the highly integrated features of the MOD3110, an OEM can easily and quickly design a complete modem with minimal software and hardware effort. The MOD3110 incorporates the necessary interfaces for either a PC-based or standalone mounting and is well suited to a wide variety of applications such as Personal and Professional computers, workstations, point of sale and videotext terminals.

Further details from Texas Instruments Australia, Semiconductor Group, 6-10 Talavera Road, North Ryde 2113.

Modem offers ring-back security

The Australia made Nice Modem 2 has spent the past 12 months in constant use in bank branches, in Telecom exchanges and in many other businesses where field staff have to be able to access a mainframe computer — but security against computer "hackers" is important.

Besides offering a full range of all internationally used baud rates at around half the price of comparable machines on the Australian market, the modem

New OTC directory

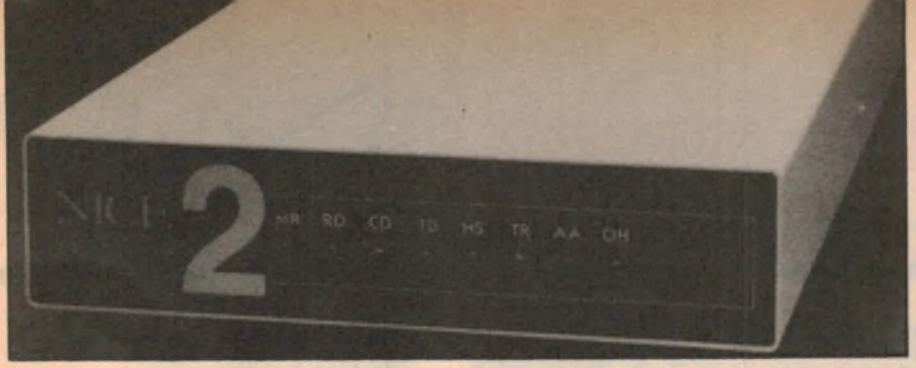
Quick and easy access to 1.5 million international telex numbers, and more than 100,000 facsimile numbers, is now available. OTC has introduced a new and sophisticated On-line Directories service, designed to provide more up-to-date information and offer a faster service for customers.

"With so many telex machines worldwide, and an ever-increasing use of facsimile machines, customers need a superior directory service", explained Tim Crossley OTC's Product Manager, Telex.

"The OTC On-line Directories service is fully automated, making it efficient and fast to use," said Mr Crossley. "Information is also updated regularly, which is a major advantage over printed directories".

First available to OTC Telex users, the service will be progressively extended to include OTC Data Access, OTC Teletex Austpac and electronic mail users.

Further information from OTC, 32 Martin Place, Sydney, or TLX AA120591.



also offers "Ring-Back Security". Under this system, a caller is asked for a name, a password and a telephone number. The Nice Modem then rings off and calls back the number to make the connection between computers.

Says Nice's Marketing Manager, "It is not absolutely secure, but it is one more level of hindrance to the hacker. I think of Ring Back Security as representing a good, strong padlock on a system, even if it's not quite equal to the lock on a bank vault. It is certainly the most secure modem in its price range."

Other exclusive features on the Nice Modem 2 include true baud rate scanning to match any remote modem; 10 commonly used numbers in store to avoid typing them in each time; the extended Hayes AT compatible command set and auto dialling, auto answer and auto disconnect.

Unusual in a machine at the price is 1200 baud full duplex operation plus 1200/75 and 75/1200 baud operation for information services such as Viatel. To overcome the inability of several computers to handle 75 baud, Nice Modem 2 is fitted with a constant speed interface which buffers a PC's 1200 baud output and sends it at 75 baud, doing the reverse with incoming 75 baud information.

The Nice Modem 2 also operates at 300 baud full duplex and handles both 300 and 1200 baud under the United States Bell 103 and Bell 212 modes and the international CCITT V21, V23 (Viatel) modes.

Further information from Nice Computer Company, Suite 3, 41 Rawson Street, Epping 2121.

Adaptive multi-carrier modem

The Trailblazer modem is claimed to be the most exciting development to emerge yet in modem technology, using novel adaptive multi-carrier techniques to achieve transmission rates far in excess of those possible with conventional modems under the same line conditions.

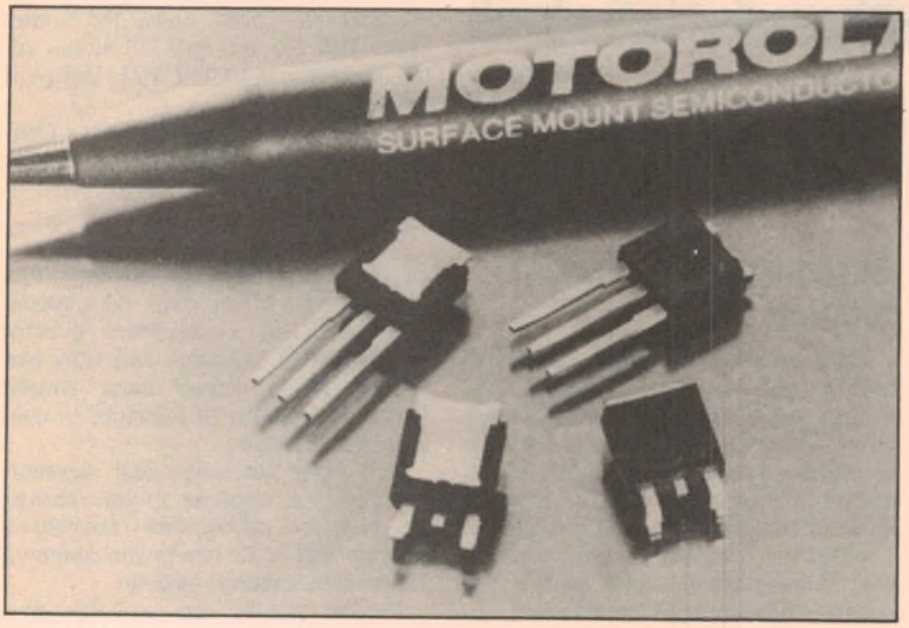
When two Trailblazer modems establish communications, they analyse the circuit characteristics and adapt to them. Rather than use one broad-band carrier they use a large number of closely spaced separate carriers, each carrying part of the main data stream. The result is a maximum effective throughput of 14,400bps and more over normal PSTN dial-up lines, coupled with a high degree of tolerance to noise and circuit defects.

Full error correction and automatic retraining in response to line changes are provided, along with conventional V.22bis and V.22 modes for communication with standard modems.

Further details are available from Rosser Communications, Suite 4, 1051 Pacific Highway, Pymble 2073.

Solid State Update

KEEPING YOU INFORMED ON THE LATEST DEVELOPMENTS IN SEMICONDUCTOR TECHNOLOGY



SMD power MOSFETs

Motorola has announced 16 new TMOS power MOSFETs in the surface-mountable DPAK package. These include general purpose N- and P-channel devices, as well as high voltage N-channel devices for high voltage and line operated circuits. Power MOSFETs with current ratings up to 10 amperes and voltage ratings up to 500 volts are available.

Motorola's DPAK is available in two styles. The devices are available with leads trimmed and formed for surface mount assembly, and are shipped either in 16mm tape and reel or plastic sleeves for high volume applications. The other package style has longer leads which can be used in either insertion mount or surface mount applications. These devices will be shipped in plastic sleeves.

The new surface mountable DPAK is less than half the size of the industry standard TO-220 package.

Typical applications for Motorola's TMOS power FETs include switching power supplies, solenoid and hammer drivers, disk drives, motor controls, lamp drives and other circuits that require space savings.

Zilog introduces "Forth" Super8

Zilog has further enhanced its microcontroller product family, introducing a new version of its 20MHz Super8 MCU equipped with machine level FORTH.

While FORTH is not widely known among general programmers, it has gained rapid popularity in the process control and automotive industries over the past five years.

The Super8, originally announced by Zilog last year, was designed to accommodate FORTH. Its architecture supports direct threaded code, for example, and the inner interpreter instructions, such as "enter", "next": and "exit".

Zilog also joined with California-based Inner Access Corporation in announcing a new compiler for the Super8 MCU. Known as the "metacompiler," it is designed for use on the IBM, PC/XT, PC/AT and compatible microcomputers. Systems developers can use the metacompiler to generate applications on the IBM PC for downloading to Zilog's Super8 emulator, or directly placed in read only memory.

Further information is available from George Brown Group/Protronics outlets or The George Brown Group, Marketing Division, 456 Spencer Street, West Melbourne 3003.

High power op-amp

The 1468 is a high voltage, very high power operational amplifier. It is capable of operating over a wide range of supply voltages from ±10V to ±50V and has a guaranteed minimum output current of ±10A (peak). The output stage is biased class AB for low crossover distortion and optimum linearity, and is protected against back EMF encountered when driving inductive loads, such as motors or solenoids.

Open loop gain with an 8 ohm load is 96dB minimum (108dB typical), input offset voltage is ±6mV maximum and input bias current is 30nA maximum. Internally compensated for unity gain, the 1468 delivers excellent dynamic performance for a device of this type, with a 4V/us slew rate and 4MHz unity gain bandwidth.

Further information is available from Reserve Electronics, PO Box 197, Wembley 6014.

Hybrid 12-bit ADC

Datel's new ADC-508 accomplishes an 12-bit analog to digital conversion in a maximum of 800ns. The converter is claimed to offer the best speed/power ratio available in a converter product today, with a maximum power dissipation of 1.9W. Its performance is based on a digitally-corrected sub-ranging architecture, enhanced by using a proprietary custom chip and unique laser trimming scheme.

Features include extremely low initial errors of 3 LSB's maximum for offset and gain errors, CMOS/TTL compatibility, and tri-state outputs. Novel features not available from other 12-bit, high-speed converters include a COMP BIN pin, an OVERFLOW pin, and a SAMPLE/HOLD pin. These pins provide different coding selections, indication of signals below and above the full scale range, and a means to improve throughput by putting a sample-hold back into the sample-mode before the existing conversion is finalized.

The ADC-508 features three pin-programmable input ranges: 0 to +10V, 0 to +20V and ±10V. the input impedance is specified at 1.75k ohms minimum for unipolar ranges and a mini-

mum of 3.75k ohms for the bipolar range to reduce stringent drive requirements. Power requirement for both models is ±15V and ±5V.

Typical applications include spectrum, transient, vibration and waveform analysis radar and video digitizing.

Further information is available from Elmeasco Instruments, with offices in most states.

Philips produces 1M-bit SRAM

Philips has produced its first functional submicron one megabit static random access memory chip, in its research facilities in Eindhoven. This is a major milestone in the submicron project co-operation between Philips and Siemens, which is partly funded by the Dutch and West German governments.

The laboratory samples are the first in the world produced in a six-transistor cell using full CMOS submicron technology, ensuring excellent products for battery operated and hand held applications. The device's typical access time of 25 nanoseconds is also the fastest yet achieved in this technology.

The chip size is 90 square mm with a line width of 0.7 micron, and has the highest packing density so far shown in the world. Volume production is foreseen in mid 1989.

Philips and Siemens are investing a total of 1,500 million guilders in the project. The Governments together contribute 500 million guilders. If investments in new facilities and equipment in Eindhoven, Nijmegen and Hamburg are included, Philips alone will spend some 2,300 million guilders.

256K latched CHMOS EPROMs

Intel has introduced two high-integration, latched EPROMs designed specifically for use in microcontrollers.

The two new 256-kilobit EPROMs, the 87C257 and 68C257, feature on-chip address latches that allow the memory's address and data pins to be tied directly to a microcontroller's multiplexed address and data pins. Thus the need for the external logic circuitry typically required in microcontroller-based systems, such as address latches and inverters, is eliminated.

In a basic system the reduction in chip count translates into board space savings of as much as 25%.

The new 87C2547 latched EPROM provides a compatible address interface to 8- and 16-bit microcontrollers such as Intel's 8051- and 8096-family microcontrollers. The 68C257 contains special circuitry that allows it to fit the specific addressing and control-line characteristics of 68-series microcontrollers.

130MHz hybrid video amp

Applications that require ultra-high resolution graphics have been limited — up to now — because of the speed of their video amplifiers. A new hybrid from TRW RF Devices, the CR2424 overcomes limitation. It provides:

- 130MHz minimum bandwidth at 40V swings
- 2.5ns typical rise and fall times at full output
- 15,000 volts/usec slew rate
- Low power consumption — typically less than 3W

The device drives capacitive loads directly or through transmission lines, with no output tuning and no need for critical external components.

For further information contact Total Electronics, 9 Harker Street, Burwood 3125.

Books & Literature

Op amp data

OPERATIONAL AMPLIFIERS 1987 SOURCE BOOK, edited by Harry Helms. Published by Technipubs/Prentice-Hall, 1987. Soft covers, 279 x 215mm, 32mm thick. ISBN 0 13 637877 3.

This is one of a series of source books published by Technipubs in the US, designed to bring together in reference volumes all of the current technical information provided by the "prime vendor" semiconductor device makers about their ICs. Other volumes in the series cover CMOS Devices, Linear ICs and Microprocessors.

The current volume is a compilation of the data sheets and application notes which apply to the newest and most widely used (in the USA) op-amp chips. As Editor Harry Helms stresses in his introduction, the compilation is selective; it doesn't cover all of the devices available, but concentrates on those that are regarded as "most significant" and "most widely used". For the Australian user this is probably a good thing, as many of the more esoteric devices probably aren't available here anyway.

As it is, the data on the 160-odd devices that are covered adds up to a pretty weighty volume. The pages aren't consecutively numbered, but they make up a total thickness of 32mm.

Basically the information is organised by manufacturer, but a number of indices allow you to easily track down devices by part code, functional description or application.

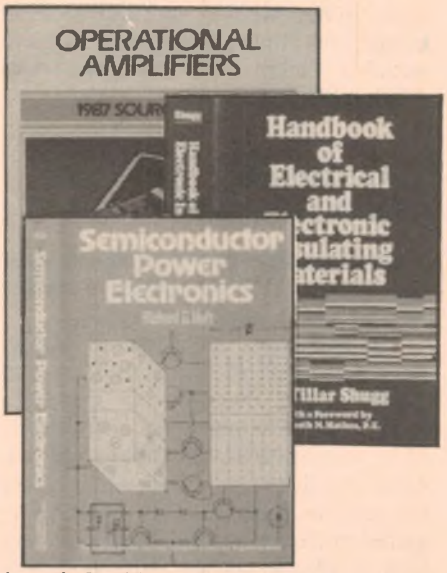
If you work a lot with op-amp devices, it would make an excellent book for the reference shelf. You might well be able to throw out a drawer full of dog-eared data sheets!

The review copy came from Prentice-Hall of Australia, but copies should be available at all technical bookstores. (J.R.)

Power devices

SEMICONDUCTOR POWER ELECTRONICS, by Richard G.Hoft. Published by Van Nostrand Reinhold, 1986. Hard covers, 236 x 160mm, 324 pages. ISBN 0 442 22543 1.

Here's another book covering a subject area which has been relatively neglected. In this case, it's the use of semiconductor devices — both transistors and thyristors — for controlling electrical power.



Of course it's a field that is still relatively new. The first applications of semiconductors were in the "thinking" area of electronics, rather than the areas to do with "muscle". It's only been in the last 20 years or so that they've really been applied for the control of high power.

This book deals with most of the main applications of semiconductors to power control, and with most of the devices in current use. The only exception is power FETs, which were apparently omitted because of the lower power capability of currently available devices compared with thyristor devices and bipolar transistors.

There are chapters on diodes and power transistors, thyristors, important circuit and component concepts, transistor switching regulators, transistor inverters, phase-controlled rectifiers and line-commutated inverters, cycloconverters, AC phase control, thyristor choppers and self-commutated thyristor inverters. Each chapter provides a list of reference works for further reading. Finally there are four appendices giving data on typical power devices.

The treatment throughout is thorough and systematic, making the book a good reference for the equipment designer and well as a potential text for engineering students.

The review copy came direct from the publisher, but copies should be available at all major and technical bookstores. (J.R.)

Text on insulators

HANDBOOK OF ELECTRICAL AND ELECTRONIC INSULATING MATERIALS, by W. Tillar Shug. Van Nostrand Reinhold, 1986. Hard covers, 237 x 160mm, 598 pages. ISBN 0 442 28122 6.

Over the years there have been upteen books on conductors, semiconductors and their properties — but very few on insulators. In fact I can't remember seeing one. According to the author of the foreword in this book, there have been virtually only two others ever produced, one in Germany and the other in the USA, and both about 25 years ago. Apparently they've both been out of print for some time.

It's almost as if insulators have been ignored, on the basis that because they don't conduct, they must be somehow boring or not worthy of study. Yet when you think about it, insulators are just as essential as conductors for correct operation of any kind of circuit. After all, without insulators there'd be no way to guide currents where we want them to go, and not where we don't!

Mr Shugg has certainly remedied the lack of information on insulators, with this new manual. It's very comprehensive, dealing with virtually every kind of insulating material apart from those based on asbestos (because of their toxicity) and certain adhesive materials.

After an introductory section on history and basic properties of insulating materials, the book then deals with each major group of materials in turn. These include thermoplastic and thermosetting moulding compounds, extrusion and embedding compounds, magnetic wire enamels, coatings and impregnants, dielectric films, papers and boards, tapes and coated fabrics, tubing and sleeving, mica products, ceramics and glasses, and dielectric gasses and liquids. In each category, the various specific materials available are treated in a very systematic fashion.

In short, it is a concise reference manual covering virtually all modern insulating materials and their properties, and should be invaluable for anyone involved in electrical or electronic design work.

The review copy came direct from the publisher, but copies should be available at all major and technical bookstores. (J.R.)

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THE RS-232C (V.24) SERIAL DATA INTERFACE

Many data terminals, modems and multiplexers are designed to exchange data via the RS-232C serial communications interface. Many of the more professional printers and plotters are also designed to accept data in this form, rather than via the "Centronics" parallel interface.

Serial interfacing standard RS-232C was originally published by the Electronic Industries Association (EIA) of the USA in August 1969. It is intended to standardise serial communications between computers, data terminals and indeed virtually . any type of data terminal equipment (DTE) or data communications equipment (DCE), at data rates of up to 20,000 bits per second.

Strictly speaking the RS-232C standard is now technically obsolete, having been superseded by standards RS-449 and RS-422/423. However it is still in very wide use for relatively low speed data communications, particularly where this involves personal computers.

The European/International equivalent interface standard corresponding to RS-232C is the V.24 standard specified by the International Telegraph and Telephone Consultative Committee (CCITT). In fact the two names tend to be used interchangeably, although the name RS-232C is more widely known.

Basically, RS-232C covers "serial" data communications — that is, where the code bits making up each character in a message are sent in serial fashion, one-by-one along a single circuit. This is in contrast with "parallel" communications, where each bit is sent on a separate line (although the characters themselves are still sent serially).

Although the full RS-232C standard covers both synchronous and asynchronous (start-stop) communication, most applications of RS-232C are asynchronous. This means that each group of data bits representing the code for a separate character is preceded by a "start" bit, whose purpose is to announce to the receiving end that a new character code is arriving. The receiving end equipment uses the start bit as a timing reference, allowing it to strobe the following data bits correctly into its receiving register.

Following the data bits for each character code there is also a recovery period, whereby the communications circuit is allowed to return to the "mark" or "idle" state for a time equal to the transmission time for one, 1.5 or two data bits. This period is considered to consist of one or more "stop" bits, as the case may be, and its purpose is to separate the end of one character code from the start bit for the next. With asynchronous transmission this separation is important, because there are no implicit timing relationships between the code groups for each character; the receiving end locks on to each group separately, upon arrival.

The asynchronous technique of data communication originated with electromechanical teleprinter machines, which were developed around 1906.

The RS-232C communications standard uses voltage levels to represent the two binary logic levels "1" (truth) and "0" (falsity). For the actual data circuit, a negative voltage is used to represent binary 1, and a positive voltage binary 0. The negative or logic 1 level is used as the marking level between character code groups.

The actual voltage levels used to represent a 1 or 0 are specified in terms of a range or "window" of acceptable levels, over which the receiving end must be capable of accepting and decoding the data correctly. This is to allow for component tolerances and voltage drops along the communications line. Thus a logic 1 is specified as any voltage between –5V and –25V, while a logic 0 is specified as any voltage between +5V and +25V.

Note that the voltages representing 1 and 0 don't have to be symmetrical with respect to signal ground. The only requirement is that each level remains within its respective "window". So a signal can swing between –12V for 1/mark and +5V for 0/space, for example.

The other basic electrical parameters

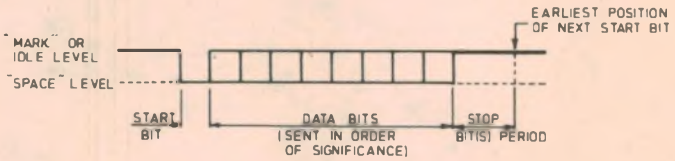


Fig.1: The basic format used to transmit a character code in asynchronous data communications.

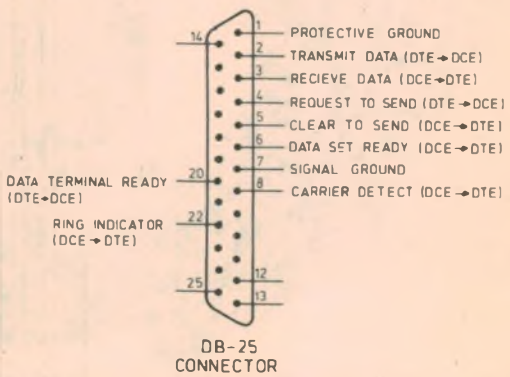


Fig.2: The main connections for a DB-25 connector as used for RS-232C serial data communication.

Communication rate	0 — 20,000 bits per second
Driver output voltage levels, maximum no-load	-25V logic 1 +25V logic 0
Driver output voltage ranges for loads between 3k and 7k ohms	logic 1: –15V (7k) — -5V (3k) logic 0: +15V (7k) — +5V (3k)
Driver output current, short-circuited	500mA maximum
Driver output impedance with power off	300 ohms minimum
Maximum driver output slew rate	30 volts per microsecond
Receiver input resistance	7k ohms maximum, 3k ohms minimum
Effective receiver input capacitance	2500pF maximum
Maximum receiver input voltage range	-25V to +25V

RS-232C/V.24

covered by the RS-232C specification are shown in Table 1. Note that a maximum slew rate is specified for the output of a data transmitter driving the line, of 30V per microsecond. This is intended to minimise crosstalk problems in multi-wire cables. The slower the voltage transitions, the lower the potential crosstalk due to mutual capacitance and inductance.

Along with the basic electrical specification, RS-232C defines a total of some 21 different connections or "interchange circuits", which may form part of a serial communications interface. It also specifies the corresponding pin numbers for each of these connections, based on the type of connector that has become accepted for RS-232C interfaces: the DB-25 "Cannon"-type connector.

Fig.2 shows the most important of these connections. The most basic of all, and those that are essential, are those associated with pins 2, 3 and 7. Pin 2 is the Transmit Data (TD) line, via which outgoing data leaves the equipment concerned; pin 3 is the Receive Data (RD) line, via which incoming data arrives; and pin 7 is the signal ground reference, common to both. A very simple RS-232C communications link may only use these connections, and virtually ignore the rest.

Essentially all of the remaining connections are provided in order to permit "handshaking" between the two pieces of equipment which are exchanging data. All of these lines, if used, use the reverse logic polarity to the main data lines: i.e., a negative voltage represents logic 0, and a positive voltage logic 1.

Pin 4 is Request to Send (RTS), which is a signal used by a data terminal (DTE) to ask if the communications equipment (DCE) and receiving end are ready for it to begin transmitting. The "answer" to this request returns via pin 5, Clear to Send (CTS), which goes to the positive polarity to signal if and when transmission can proceed.

Pin 20 is Data Terminal Ready (DTR), used by a computer or data terminal to indicate to the modem or other communications equipment that it is ready to communicate. Pin 6 returns a corresponding signal Data Set Ready (DSR), used by a modem or other data communications equipment to indicate to the terminal that it has established a communications link with another modem and is ready to accept data for transmission. Similarly pin 8 is Carrier Detect (CD), used again by a modem to indicate when it is receiving the other modem's carrier signal.

If handshaking is not implemented in a particular piece of equipment provided with an RS-232C interface, pins 4, 5 and 8 may be connected together and pins 6 and 20 similarly linked, to "fool" the other end into believing that handshaking is being performed. In fact this linking may be necessary in order to allow the equipment to communicate.

Various other handshaking signals and secondary communication lines are defined, but are only used in fairly esoteric RS-232C applications.

Frequently a cable used to link two pieces of equipment via their RS-232C interfaces may need to have a "crossover" in the lines connecting pins 2 and 3, so pin 2 at each end connects to pin 3 at the other.

No particular data code is specified for RS-232C communications. Probably the most often used is the 7-bit ASCII code, but other codes such as Baudot/Murray shifted 5-bit code or 8-bit EBCDIC may be used.

- Jim Rowe.

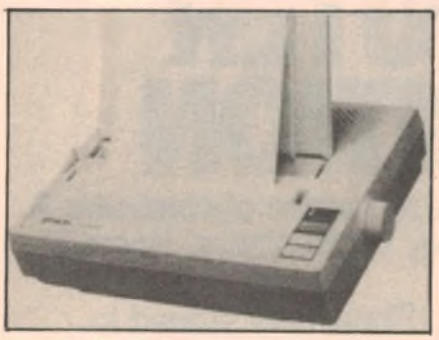
New Products

Studio CD player

The EMT 980 is a compact disc reproducer intended for professional use and especially designed for on-air broadcasting and studio work.

Manufactured in Germany, the EMT 980 provides operating functions which closely resemble those of broadcast turntables, including fader start control and monitoring capabilities. Additional features include editing capabilities (accessing any disc segment for preview of start), time indicator (including exact remaining duration of a track) and autostop at the end of a track.

For further information contact Amber Technology, Cnr Skyline Place and Frenchs Forest Road, Frenchs Forest 2086.



New 180cps printer

Epson's new LX-800 80-column dot matrix printer offers faster printing and throughput speeds with additional built-in functions.

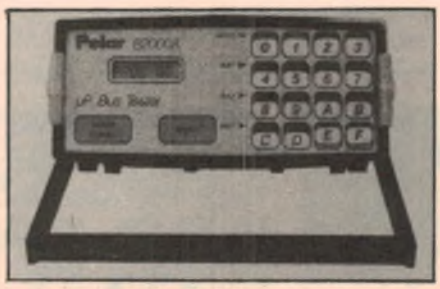
The LX-800 prints at 180cps in draft elite and 150cps in draft pica. The draft mode throughput now runs faster than previous models by a significant 25%. Other attractive features of the printer are the enlarged 3Kb print buffer and SelecType front control panel which allows auto single sheet loading.

In addition to Roman, Sans Serif is now included in resident fonts, which are easily accessible through the control panel in near letter quality mode. One can instantly switch the printer back to the draft mode through the control panel as well, without worrying about complicated DIP switches.

A tractor paper feed unit is already built in, with the single bin cut sheet feeder available as an option. The new ribbon cartridge prints 3 million characters, three times more than before.

The LX-800 offers download character capability of 6 characters, and elite, italic, super- and sub-scripts are supported in both draft and near letter quality modes.

For more information contact Epson Australia, 3/17 Rodborough Road, Frenchs Forest 2086.



Microprocessor system tester

The Polar B2000A is a low cost test instrument designed to be used for fault finding and testing microprocessor based boards, though no knowledge of assembly language programming is required.

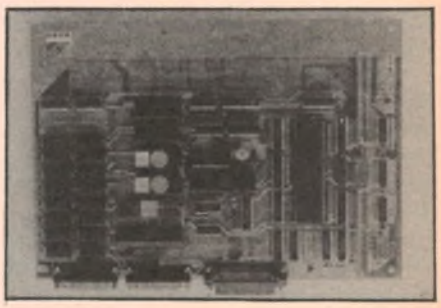
The B2000A does not test the microprocessor but is capable of testing the numerous other integrated circuits connected to the processor bus. These devices will typically include the memory ICs, the decoding circuitry and the input/output ports.

To test a microprocessor board using the B2000A the processor in the unit under test is removed and the B2000A is plugged into the vacant socket via a pod configured for the microprocessor which it has replaced. The B2000A is now capable of controlling the various devices on the bus.

The instrument has 16 lines which are connected via the pod to provide addressing information, and 8 lines for data. Another group of lines provide the control information such as read/write strobes etc. With these facilities the B2000A is able to communicate with the unit under test in very much the same way as the microprocessor does.

The B2000A supports Z80, 6800, 6502, 8085, 6802, 6809, 1802 and 8080 processors. All that is required to adapt to a different processor is a change of the external pod. A customer configurable pod is available to allow the more ambitious customer to configure the system for 8 bit processors that are currently not supported.

Further information from Emona Instruments, 86 Parramatta Road, Camperdown 2050.



68000 single board computer

The Avenue Electronics 68000 Single Board Computer is a high performance computing system based on the Motorola 68000 16/32 bit processor. With up to half a megabyte of main memory, RS232C communications and parallel printer output this computer is intended for a wide range of real-time applications such as simulation and process control.

Extensive use is made of PAL and HCMOS logic, resulting in a very cost-effective system. All bus signals are available and buffered so as to allow the system designer full access for specific I/O applications.

The board is equipped with 512K bytes of DRAM, 64K bytes of EPROM and 16K bytes of CMOS RAM with optional battery back-up. The 68000 processor runs at 12.5MHz and utilises a 6818A real-time clock. Two RS232C serial ports are provided, supporting both synchronous and asychronous protocols to 38,400 baud. A Centronics parallel printer port is also provided. Bus signals are available via board mounted IDC connectors.

As the computer is designed and manufactured in Australia by Interrupt

Systems, local hardware and software support is readily available. Software provided includes a monitor/debugger and system software in EPROM. A pascal cross-compiler (MS-DOS) that produces "romable" code is available separately.

Further details are available from Interrupt Systems, 1st Floor, 9 Robinlee Avenue, Burwood East, 3151.

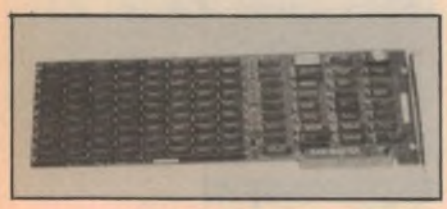
Silver oxide cells

Arista Electronics now carries a comprehensive range of high efficiency low drain silver oxide button cell batteries. Competitively priced, the silver oxide button cells will outlast the cheaper alkaline or mercury cell equivalents.

The batteries are recommended for many electronic devices such as cameras, hearing aids, watches, electronic measuring equipment and any other devices where size and voltage stability are important.

Silver oxide batteries work very efficiently both at high and low current levels as in the case of watches and hearing aids. They also have the benefit of working longer at peak voltage because of their flat drain curve.

For further information and the name of your nearest stockist contact Arista Electronics, 57 Vore Street, Silverwater 2141.

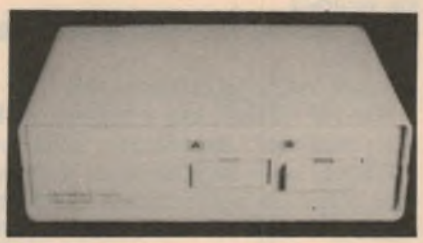


2Mb RAM card

The ERS-2000 card from Electronic Solutions provides an additional 2048Kb of memory for an IBM PC/XT, AT or compatible. Up to four cards can be fitted, mounting up to a staggering 8Mb of RAM.

Features of the card include on-board DIP switches to split the board's memory as either conventional or expanded memory; expanded memory accessing by a paging technique compatible with Lotus/Intel expansion memory specification; and all memory full socketed with parity check. Also available is a 14 day money-back guarantee. Fitting is also available at low cost. The board sells for $995 including sales tax.

For further information contact Electronic Solutions, PO Box 426, Gladesville 2111.



Centronics data switch

Alfatron has released a new range of economy model AB switches for both 36-way and 25-way cables. The switches are packaged in a solid metal enclosure, which makes them very rugged and their weight ensures that they are not easily dislodged when the switches are activated.

Applications are to switch serial or parallel channels between computers and printers or other peripheral devices. These switches are part of the growing range of interface equipment available from Alfatron.

Further information is available from Alfatron, 1761 Ferntree Gully Road, Ferntree Gully 3156.

Terminal for multiuser PCs

Kimtron Corporation has introduced a terminal for DOS and non-DOS multiuser PC systems, called the KT-70/PC. The terminal has a flat screen display and attractive ergonomic design. It has the following PC Terminal capabilities:

- PC 80 by 25 display format
- PC 256 character set
- PC video attributes on a character basis
- PC/AT style keyboard
- PC/XT scan codes generated from keyboard

Display features include 14" diagonal tube available in green, amber or paper white phosphor, complete with tilt/swivel adjustments. Additional features include calculator mode, screen saver, multiple programmable function keys, and two RS-232C communication ports (1 for data, 1 for printer). Optional features are four pages of display memory and a 5161 style keyboard.

The KT-70/PC works with PC-DOS, MS-DOS, UNIX, QNX, XENIX, THEOS, PICK and concurrent DOS operating systems. It is fully compatible with MultiLink and PC Slave.

For more information contact Datatel, 19 Raglan Street, South Melbourne 3205.

Stereo console is rack mountable

Logitek's Stereorack rack-mountable console is claimed to lead the industry in features and performance per dollar.

The Stereorack features six stereo mixing channels, the first five of which can be switched between either of two stereo inputs. The sixth channel is switched between a stereo input and an internal tone generator, resulting in a total of 11 available stereo inputs.

All of the inputs are line level, but any of the seven internal mic preamps can be wired to any combination of the inputs, to provide a wide variety of input configurations. Any source may be "panned", using the pan/balance pot turned by the concentric ring mounted on each channel gain control. The pot has a firm centre detent, to keep non-panned items directly at "centre".

The six mixing channels can be fed to either or both of two stereo output channels, program and preview, each of which fans out into a built-in 1x4 stereo DA. Left and right channel meters can be set to read either program or preview, using a front-panel switch. Masters for each output channel are on the back of the unit.

Further details are available from Radio Manufacturing Engineers, Unit 1A, 30-32 Skarratt Street, Auburn 2144.

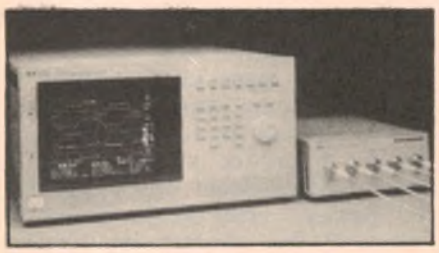
New Products

Fostex pro audio products

Melbourne's Warehouse Sound Systems has recently added Fostex professional audio products to its extensive product range. Current products include the following:

- The 4050 SMPTE/MIDI Autolocator, featuring comprehensive auto-location for tape recorders, inscription and synchronization to SMPTE time code, and timecode locking between MIDI and SMPTE.
- The 4030 synchroniser, which reads and resolves SMPTE and EBU standard timecodes with a resolution of 1/100 of a frame, enabling perfect master/slave synchronization between audio, video and film.
- The 4035 Synchroniser Controller, which offers complete transport control, auto-locating and data entry/display features. It will also fully support a system configuration of up to three slave transports.
- The E2 Stereo Mastering Recorder, which features a third cue channel located in the centre of the tape, intended for recording and playback of SMPTE time code.
- The E8 and E16 Multitrack Recorders, featuring 8 track 1/4" and 16 track 1/2" formats respectively, complete with Dolby C Noise Reduction.

For more information contact Warehouse Sound Systems, 787 Argyle Street, Fitzroy 3065.



20GHz digitizing scope

Hewlett Packard Australia has announced the HP 54120T colour digitizing oscilloscope, with a 20GHz repetitive bandwidth, a built in time-domain reflectometer (TDR), and four simultaneous-acquisition input channels. The new oscilloscope is designed for engineers involved with high-speed digital systems and devices, microwave systems and data-communications applications.

The oscilloscope provides all the benefits of its analog predecessors, but also makes several new contributions that will set standards for wideband sampling oscilloscopes:

- 6GHz passive probing (optional)
- ultra stable triggering
- 12-bit resolution
- improved DC and timebase stability
- 0.25ps timing resolution and 10ps timing accuracy
- 1% inherent transient-response flatness; and
- 9-inch functional colour display

The HP 54120T has a built-in TDR that measures impedance, reflection coefficient and distance from a reference plane. Its normalization capability eliminates measurement errors caused by cables and other connecting hardware. A built-in pulse generator provides the TDR's signal source.

The new unit can display histogram distributions of time or voltage based on user-specified sample size and time-or-voltage windows. Mean and standard deviation of the displayed histogram can be displayed with the push of a front-panel button.

The optional HP 54006A 10:1, 500 ohm and 20:1, 1k ohm passive resistive divider probe is available with the HP 54120A. For the first time, users can probe signals up to 6GHz in circuit nodes that do not have 50 ohm connectors.

Further details are available from Hewlett-Packard Australia, PO Box 221, Blackburn 3130.

Portable desoldering station

A versatile desoldering station manufactured by Cooper Tools in Albury, Australia, has been released by Weller. The DS600 is a temperature controlled desoldering station which is completely self-contained, only requiring a 240 volt power source for operation.

Designed for maintenance or service applications, the DS600 has features including a built-in air supply, a pushbutton vacuum control built into the desoldering tool handle, and a desoldering head temperature-controlled to 370°C. it has a lightweight all metal case, fitted with a carry handle. A convenient power cord storage area is included with a quick connect/disconnect locking plug on the iron lead.

The Weller DS600 Desoldering Station can be used in conjunction with Weller CSF Tips for SMD's, for flat or quad pack desoldering. After desoldering, a vacuum switch cleanly removes the SMD.

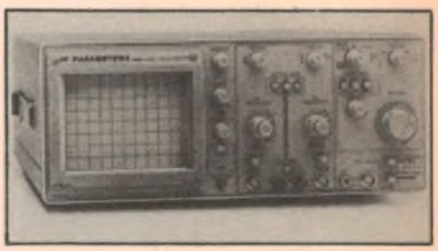
Further information is available from George Brown Group outlets, or the George Brown Group Marketing Division, 456 Spencer Street, West Melbourne 3003.

Low power switch-mode supply

The A50 is a low power switch-mode power supply for electronic assemblies. It is designed for OEM applications requiring 5 volts DC at up to 650mA, as well as a separate ±7 volts at 80mA for serial transceiver requirements. The unit is normally driven by an AC power pack (provided) but can also be ordered to suit 9-15 volt raw DC input.

Being switch-mode it runs quite cool, thus making it suitable for integration into units where poor ventilation exists. An on-board fuse protects the circuitry and the A50 can be optionally supplied with a standard power jack instead of direct cabling.

For further information contact Alfatron at 1761 Ferntree Gully Road, Ferntree Gully 3156.



New portable oscilloscopes

Parameters has released a new range of oscilloscopes, covering the general purpose market from 15MHz to 40MHz.

The range starts with the PA 615S 15MHz "super portable" dual trace oscilloscope. This instrument offers 2mV sensitivity up to 15MHz, automatic selection of chopped or alternate modes, plus automatic selection of TV line of frame display. Built into this 5.5kg package is the choice of AC, external DC (11V-30V) or built-in NiCad battery operation. Complete with handbook, 2 x 10:1 — 1:1 probes and 12 month war-

ranty, the PA 615S is suitable for "field" maintenance applications.

The 5502 20MHz 2-channel oscilloscope provides 1mV sensitivity, built-in component tester, CH1 output for use with a frequency counter, and variable trigger hold-off for observation of waveforms with complex trigger points. In addition, TV line and TV frame trigger is standard. The 5502 has a very effective cost performance ratio and is supplied with handbook, 2 x 10:1 — 1:1 probes and a full 12 month warranty.

Next in the range is the 5504 40MHz 2-channel, dual timebase oscilloscope. This scope offers features including 1mV sensitivity, channel 1 output, variable hold-off, delayed timebase, single sweep operation and scale illumination. The 5504 is designed for maintenance engineers working in telecommunications, computers, TV and the industrial control field. As with all Parameters oscilloscopes, the 5504 is supplied with handbook, probes and a full 12 month warranty.

For further information contact Parameters, Centrecourt, 25-27 Paul Street Nth, North Ryde 2113.

80386 SBC runs at 20MHz

Intel has introduced 20MHz versions of its 32-bit 80386-based Single Board Computers (SBC) for the Multibus architecture. The boards provide users with higher performance than previously offered and come standard with the numeric 80387 coprocessor.

Intel will continue to provide 16MHz versions of these boards, which have also been enhanced to include the 80387 numeric coprocessor. Previously shipped versions contained an 80287-based 80387 emulator.

The increased performance of the new boards is a direct result of the 25% faster 80386 clock rate. The addition of the 80387 math coprocessor provides users with a 4-6 times increase in floating point operations over the 80287 coprocessor.

The boards provide high end processing power for applications such as financial stock trader workstations, real-time data acquisition and control, and laboratory test equipment. they are supported by the iRMK Kernal, iRMX 286, Xenix and Unix System V operating systems, as well as any proprietary operating system written for the 8086 or 80286.

Further information from Intel Australia, Level 6, 200 Pacific Highway, Crows Nest 2065.

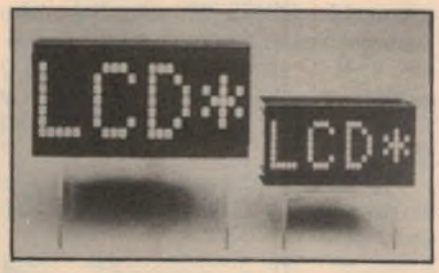
3/5-digit LED panel meter

The Acculex DP 300 micro size panel meter features a large 3-1/2 digit bright red LED display. The ultra compact meter features autozero, user selectable decimal point and automatic polarity display.

The dual-slope integrating A/D converter performs measurements at 3.33 conversions per second. Input ranges are ±200mV, ±2V, or ±20V to an accuracy of 0.1%.

Overvoltage protection to 350V DC, 1000 megohm input impedance and 86dB common mode rejection allow a mean time between failure of more than 500,000 hours.

For further information contact Novatech Controls (Aust), 429 Graham Street, Port Melbourne 3207.



Large character LCDs

M.B. & K.J. Davidson together with Industrial Electronic Engineers are pleased to announce the introduction of the Supernova system of large-character high-performance liquid crystal displays.

The Supernova system consists of stackable 4-character LCD modules and a serial-ASCII input controller card, and is well-suited to a variety of applications including flight information display systems, scoreboards, advertising message centres, industrial annunciators, and movie marquees.

These extra large display modules feature 5 x 7 dot matrix characters that can display upper and lower case letters, numerals, and punctuation symbols. The modules may be strung into lines up to 40 characters long. Supernova displays are available in character heights of 2.5" (65mm) and 4.0" (100mm), and feature a very wide operating temperature range of —30° to +85°C. They have very low power consumption (typ. less than 30mW per character, exclusive of backlighting) and feature advanced direct-drive LCD technology for excellent contract and viewing angle.

For further information contact M.B. & K.J. Davidson at 17 Roberna Street, Moorabbin 3189.

Compact DC-DC converters

A range of 5 and 10 watt DC-DC converters is now available with a wide input range of 40-80V DC. Outputs available are 4 and 12V with output and load regulation of 0.2% maximum. Ripple and noise is 100mV and meets VDE 0871 Class B Interference Standard, with an operating temperature of –10°C to 60°C.

The units feature short circuit protection, foldback over-current and reverse input protection and measure 51x51x10mm for the 5 watt unit and 91x41x18mm for the 10 watt. Both are PCB mountable.

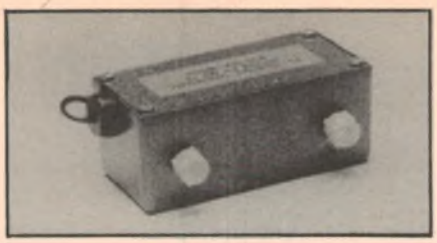
For further information contact Amtex Electronics, PO Box 10, Villawood 2163.

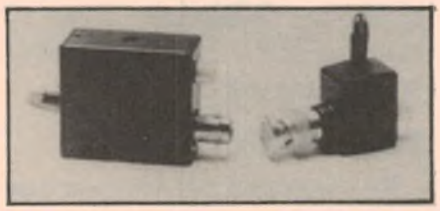
30W solder station

Scope has released a 30 watt solder station for high density PCB soldering. The new model offers infinite control of temperature through the range 200 — 470°C, with an LED bar reading of tip temperature.

Zero voltage switching, temperature lock and an optional 60 watt iron are other features of this new station. A floating earth model is also available for applications involving MOS devices.

For further information contact Scope Laboratories, 3 Walton Street, Airport West 3042.





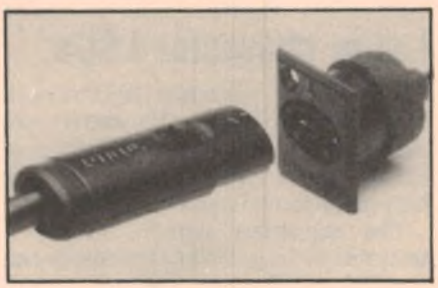
Fibre-optic links

Javelin Electronics has announced the release of two new fibreoptic products from Ventronics, to complement its range of CCTV accessories.

The first is a small video link with a range of 1.6km (1 mile), with a transmitter unit which connects directly to the rear of a video camera via a BNC connector. Called the IGA transmitter, it operates from a 12V DC supply (+/-10%) with a current drain of some 50mA. The companion receiver unit can be easily rack mounted in groups of 10, to fit a standard 19" rack.

The second unit is a small and panel mountable RS485/422 data link, also with a range of 1.6km (1 mile). A typical system uses 2 x RS485 IGA, 2 power supplies (+5V +/-5% at 150mA), four connectors and sufficient glass cable.

For further information contact Javelin Electronics, 19 Mary Parade, Rydalmere 2116.



High power audio connectors

Australian firm Utilux has developed a new high power audio connector series UX101 and UX501, which has the ability to transmit signals with a range from microvolts through to 30 amperes. The new connector system has characteristics claimed to be suitable for both low level electronic signals and AC power supplies.

The UX series comprises the UX101 (cable end connector) and the UX501 (panel mount socket), both featuring a "genderless" coupling system. The UX101 is a simple and effective connector capable of carrying 30 amps or power of 3000 watts, and complies with IEC safety standards. The UX101 mates with another UX101 or the panel mount socket UX501.

The UX501 features an acoustic compression seal for mounting into speaker boxes and panels. When panel mounted, the UX501 has the same profile as a standard XLR female socket.

The system is easily assembled using a soldering iron and screw driver. Contacts are supplied separately for soldering to the cable first, then snapped into the connector body. This eliminates the common problem of melting the insulator housing when soldering to heavy cables.

The UX series is made from high quality materials, e.g. copper alloy, silver plated contacts (gold plating optional) zinc alloy diecast outer shell and black thermoplastic rubber grommet. The connectors have been extensively tested by the Utilux NATA registered laboratory, and have the IEC flash symbol displayed. The series was awarded an Australian Design Award.

Further information is available from Utilux, 14 Commercial Road, Kingsgrove 2208.

Electrostatic detector

Rheem Protective Packaging Products has introduced a new, hand-held "Autostat" electrostatic detector (ESD).

Electrostatic discharge can seriously damage sensitive electronic components. The new meter identifies sources of static discharge in crucial areas, before they can harm products or shut down processing equipment.

The Autostat Model 224CL uses low power consumption CMOS circuitry and permanent factory calibration. Developed in the USA, it accurately measures static discharges from 200 to 25,000 volts in electronic assemblies or

service applications. Low level discharges can be safely detected from as close as 12mm and higher voltages from over 600mm.

For further information contact Rheem Protective Packaging Products, 3 Burrows Road, Alexandria 2015.

Very thin 10W switcher

Amtex Electronics has introduced a new range of very thin switching power supplies in a compact PCB mountable package, having a height of only 14mm. An important feature of this unit is an input to output isolation of 3.75kV AC. Case size is 93.5 x 63 x 14mm.

Input is 110V or 220V AC with a range of outputs of 5, 6, 9, 12 and 15V at 10 watts. Ripple and noise is 60mV p-p maximum with a line and load regulation of 1% maximum, and the output is short circuit and overcurrent protected.

Typical applications include modems, display terminals and industrial process control equipment requiring compact power supplies with high efficiency, light weight and small size.

For further information contact Amtex Electronics, PO Box 10, Villawood 2163.

Power line filters

High performance RFI/EMC/EMP power line filters are now available from Crusader Electronic Components.

These new filters are designed for filtering complete single and three phase supplies rather than separate lines. A complimentary range of single line filters are also available.

Apart from many vendor approvals, the UK manufacturer MPE Ltd (Liverpool) holds the following major qualifications.

- Nata AQAP — I Approval (supersedes Def. Stan. 05-21)
- RS5750 — Part I, Approval
- BS9000 Approval
- British Railways Board, Category A1, Approval
- 16 Separate British Telecom product approvals for multiline telephone filters.

RFI/EMI/EMC filters have wide applications in the EMC field where high performance is required. They are well suited for filtering the mains services of screened enclosures against both incoming and outgoing noise or transients. They are equally suitable for the protection of permanently wired equipment such as computer installations.

With the increasing importance of low frequency performance it should be noted that a range of the filters can offer 100dB at 10kHz, and good filtering even down to 1kHz.

Further information is available from Crusader Electronic Components, 81 Princes Highway, St Peters 2044.

New catalog

The George Brown Group has released a new short form catalog, incorporating a newly installed computer ordering system. Included is an easy-to-follow index with all products clearly grouped. The catalog contains the newly released Weller Range and the latest technology in integrated circuits from IDT, Zilog, Fairchild, Samsung, NEC and EDI.

The George Brown Catalog will be distributed to existing customers Australia wide and also made available to all new customers.

For further information contact the George Brown Group, 174 Parramatta Road, Camperdown 2050.

Shunt-diode barrier

Novatech Controls has released the MTL 758, which is the latest addition to Measurement Technology's MTL 700 series of shunt-diode safety barriers.

The unit has two channels, each with a working voltage of 6V and an end-to-end resistance of only 18 ohm. It is particularly suitable for energising low voltage, high-current devices situated in hazardous areas, such as gas detector heads, displays and 5V logic systems. The two channels can be used separately or in parallel, as required.

Two fixing studs mount and earth the unit on standard busbars.

For further information contact Novatech Controls (Aust), 429 Graham Street, Port Melbourne 3207.

Letters

Cont from page 5

ACS that "some of the ancillary services will require licensing under the Broadcasting Act . . . ". The policy principles published in 1986 make it clear that ACS are either broadcasting or non-broadcasting in nature, depending on the audience and material being transmitted and will be licensed accordingly.

FM sub-carriers are but one of a number of ACS technologies available in Australia. Other possibilities include the Vertical Blanking Interval (VBI) in a television picture and the sound and data capacity available from the B-MAC transmission system used for direct-to-home satellite broadcasting.

R.N. Smith,
First Assistant Secretary,
Broadcasting Policy and Planning Division,
Department of Communications,
Belconnen, ACT.

Vintage radios

Inspired by your April 1987 magazine with the section on restoring valve radios, I decided to set out repairing old valve sets.

First, I tried to build a radio from one of the circuit diagrams I had, but things weren't easy as this diagram had no component values marked. After taking a few wild guesses (all of which seemed logical), I turned it on. This promptly blew all of the four rectifying diodes feeding HT to the circuit, in a shower of sparks. The cause was a short-circuited filter capacitor. I abandoned the project and set out for easier game.

Two months later, whilst fossicking in an antique shop I struck gold! For $2 there was a busted valve radio. It was cased in red plastic splashed with paint, plus three of the four knobs were missing.

A couple of resistance checks showed me that the transformer coupling the detector to the AF amplifier was shot. I couldn't replace it because I couldn't determine the resistance of the windings, due to it being burnt out. So I worked out a substitute with a 100 ohm 5W resistor in place of the primary, another in place of the secondary and 0.047uF/600V capacitors linking their two ends. The radio works well with this substitute "transformer" and has been running for two days so far without any change in performance.

This won't be the last valve radio I repair, as I enjoy the satisfaction of seeing them going again.

Congratulations EA for producing another brilliant article.

James Webb,
Maryborough, Vic.

Comment: We're glad you found the article of interest. A lot of others seem to have enjoyed it too, so we'll run another story on the same subject soon. By the way, your RC network is not an ideal substitute for the burnt-out AF coupling transformer — you'll probably get better results by using a 5k/5W resistor or an inductor (i.e., the primary of an old speaker transformer) in the primary (plate) circuit, a 220k resistor in the secondary (grid) circuit, and a single 0.047uF/600V capacitor from plate to grid.

DROP US A LINE!

Are you concerned about something to do with electronics, and believe that others ought to know about it? If so, feel free to put pen to paper, or fingers to keyboard, and send us a Letter to the Editor. If it's clearly expressed and on a topic of interest, chances are we'll publish it — but we do reserve the right to edit those that are overlong, or potentially libellous.

Making PCBs

Continued from page 102

be complete in about 25 minutes. This time can be shortened by standing the tray in some hot water. However you must inspect at frequent intervals, to avoid over etching. If the etch has been used on previous occasions it will completely obscure the copper surface, and you will need to lift the PCB out of the etch at frequent intervals to check progress. Even if the surface of the resist is free of blemishes, over etching will cause undercutting of the foil tracks.

As soon as you are sure that all copper not covered by resist has been dissolved, rinse the PCB in water to halt the action. Pour the etch back into the bottle for re-use. It will remain potent indefinitely. Replacement of the etch is indicated by unduly long etching time.

Inspection

After washing and drying the etched board, use MEK to remove all traces of resist, and to clean the foil. Use a magnifying glass to inspect the tracks for open circuits, bridging, and other defects.

If there is any sign of porosity in the copper surface, there can be a number of causes: most likely are lack of opaqueness in the ink used on the tracing film, over exposure, resist coating too thin, or failure to bake the resist after development. It is well worth the effort to check every track electrically, and for this a buzzer with needle probes is ideal. Make point to point checks, which can show up omissions in the original track layout. If you are fortunate enough to possess a miniature electric drill, it is amazing what can be done in the way of adding forgotten items. Tracks which are incomplete because of a flaw can generally be repaired by soldering a fine wire bridge across the gap or even by covering with solder.

Drilling the board

If inking of the tracing has been done carefully, the holes in the "donuts" will centre the drill. A 0.9mm drill is about right for most components, but may be increased to 1mm if necessary. If a hand held electric drill is available, the best results are obtained by holding the PCB vertically in a vice, in a good light. This allows the drilled material to fall clear, and the whole procedure can be carried out quite quickly.

With drilling completed, clean off the top surface with solvent, and ink in the component positions such as links, resistors, capacitors, and so on, using the tracing previously prepared as a guide. By the time you have finished this, you will have discovered all the places where holes should have been drilled!

Final word

Ferric chloride is one of the most permanent stains I have come across. Spilt on vinyl floor covering, for example, it is there for keeps, resisting all kinds of solvents and bleach. Don't spill it on your lounge carpet! Since, for most hobbyists, there is likely to be a longish period between PC board manufacture, be sure to note down such things as the exposure time for the tracing material used, proportions for mixing developer, and so on, as it is disappointing to find the results are not what you expect because your memory has let you down. In this regard it is recommended that a number of test strips of board are coated, printed, and etched, to establish the optimum parameters which will ensure consistant results.

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Descript.	10+	100+	1000+
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7805KC	1.50	1.40	1.20
7812uC	.45	.44	.43
7815KC	1.50	1.40	1.20
7818uC	.50	.49	.48
7818KC	1.50	1.40	1.20
7905uC	.70	.60	.55
7912uC	.70	.60	.55
uA323KC	4.50	3.90	3.75

Plus 20% tax where applicable

TRANSISTORS

Desc.	10+	100+	Desc.	10+	100+
2SJ49	5.50	4.90	2SK134	5.50	4.90
PN2222A	.11	.09	PN2907A	.10	.09
PN3563	.18	.16	PN3565	.12	.11
PN3566	.15	.13	PN3567	.10	.08
PN3569	.18	.16	PN3639	.18	.16
PN3640	.18	.16	PN3641	.11	.09
PN3642	.11	.09	PN3643	.11	.09
PN3644	.15	.13	PN3645	.15	.13
PN4250A	.15	.13	PN4355	.18	.16
PN4356	.19	.17	MPSA42	.20	.15
MPSA43	.11	.09	MPSA55	.18	.17
MPSA56	.19	.16	MPSA92	.12	.11
MPSA93	.14	.12	SC141D	1.00	.90
BU126	1.90	1.85	BUX80	3.60	3.50
BU208	2.75	2.50	2SD350	3.90	3.75
BU326	2.25	2.15	BC547	.10	.09
BC548	.10	.09	BC549	.10	.09
BC557	.10	.09	BC558	.10	.09
BC559	.10	.09			

Plus 30% tax where applicable

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12 months warranty!

1-9	10+	100+
$145	$135	$125

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(*IBM is a registered trademark)

HARD DISK DRIVE FOR IBM*

- 20 M/Byte
- Seagate or Microscience hard disk
- Hard disk controller by DTC

Cat. X20010 ..... $695

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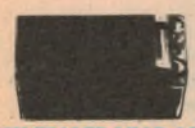
DISK DRIVE FOR APPLE* (6502 SYSTEM)

1-9	10-24	25+
$165	$150	$135

Plus 20% tax where applicable
(*Apple is a registered trademark)



12V SEALED LEAD ACID BATTERIES

Description/Cat.No.	1-9	10+
1.2 AH S15029	$12.50	$11.75
2.6 AH S15031	$17.70	$16.50
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GREY FLAT RIBBON CABLE IN 100 FOOT ROLLS

Cat.No. Desc.	1-3	4-9	10-99	100+
W12614 14 Way	19.50	18.50	18.00	14.00
W12616 16 Way	21.50	19.50	19.00	16.00
W12620 20 Way	29.50	28.00	26.50	20.00
W12625 25 Way	32.50	29.00	28.50	25.00
W12626 26 Way	34.00	32.00	29.00	26.00
W12634 34 Way	44.00	42.00	39.00	34.00
W12636 36 Way	49.00	47.00	42.50	36.00
W12640 40 Way	55.00	52.50	49.50	40.00
W12650 50 Way	62.00	59.50	58.50	50.00

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Cat.No.	Descript.	1-9	10+	100+
Q10500	MU45 0-1mA	8.50	7.95	7.75
Q10502	MU45 50-0-50uA	8.50	7.95	7.75
Q10504	MU45 0-100uA	8.50	7.95	7.75
Q10505	MU45 0-50uA	8.50	7.95	7.75
Q10510	MU45 0-5A	8.50	7.95	7.75
Q10518	MU45 0-1A	8.50	7.95	7.75
Q10520	MU45 0-20V	8.50	7.95	7.75
Q10535	MU45 VU	9.50	8.95	8.75
Q10530	MU52E 0-1mA	9.95	8.35	
Q10533	MU52E 0-5mA	9.95	8.35	
Q10538	MU65 0-50uA	12.50	11.35	10.90
Q10540	MU65 0-1mA	12.50	11.35	10.90
Q10550	MU65 0-100uA	12.50	11.35	10.90
Q10560	MU650 0-20v	12.50	11.35	10.90

Plus 20% tax where applicable

DIODES

Cat No.	Descript.	10+	100+	1000+	10K
Z10135	IN4148	0.03	0.02	0.015	.015
Z10105	IN4002	0.04	0.03	0.03	.025
Z10107	IN4004	0.05	0.04	0.03	.025
Z10110	IN4007	0.10	0.06	0.05	0.04
Z10115	IN5404	0.18	0.14	0.09	0.08
Z10119	IN5408	0.20	0.16	0.10	0.09

Plus 20% tax where applicable

TRANSFORMERS

Cat.No. & Desc.	1-99	100+	1000+
M12851 2851 240V 12-6V CT 150mA	3.50	3.30	2.90
M12155 2155 240V 6-15V 1A tapped	6.00	5.75	5.50
M12156 2156 240V 6-15V 2A tapped	9.00	8.75	8.50
M12840 2840 240V to 9V C.T. at 150mA	3.50	3.30	3.10
M12860 2860 240V to 15V C.T. at 250mA	3.50	3.30	3.10
M16672 6672 240V 15-30V 1A tapped	8.95	8.75	8.40

Plus 20% tax where applicable

NICADS

Cat No.	Description	1-99	100+	250+
S15020	AA .5AH	$2.20	$2.00	$1.95
S15021	C 1.2AH	$6.75	$6.50	$6.20
S15022	D 1.2AH	$7.55	$7.25	$6.90

Plus 20% tax where applicable

75 OHM COAX CABLE IN 100M ROLLS

Cat No.	Descript.	1-4	5+	10+
W11222	3C2V	25.00	24.00	23.00
W11224	5C2V	30.00	29.00	28.00

(5C2V WHITE OR BLACK)
LINE LOSS PER 100 FEET (33M 200MHz)
W11222 3C2V 6.2dB (Approx.)
W11224 5C2V 3.9dB (Approx.)

Plus 20% tax where applicable

TELEPHONE CABLE (200 METRE ROLLS)

Cat.No.	Description	1-9	10+
W11302	2 Pair	$24.00	$22.00
W11303	3 Pair	$29.00	$27.00
W11310	10 Pair	$120.00	$115.00

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Description	1-9	10+	100+
Cat.No.	boxes	boxes	boxes
S/S D/D C12440	$14.50	$13.90	$13.00
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Descript	10+	100+	1,000+	10,000+
D/S D/D	$1.00	$0.90	$0.80	$0.75

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FREE sample disk available on request!
(Please send $2 to cover postage)

VERBATIM DATA LIFE DISKETTES

Cat. No.	10+ boxes	100+ boxes
5¼" SS/DD	$22.00	$20.00
5¼" DS/DD	$25.00	$23.00
5¼" H/Density	$40.00	$38.00

Plus 20% tax where applicable

TANTALUM CAPACITORS

Cat.No.	Description	10+	100+
R16124	4.7uF 16V	$0.24	$0.18
R16125	10uF 16V	$0.25	$0.23
R16126	15uF 16V	$0.38	$0.36
R16128	22uF 16V	$0.42	$0.40
R16132	47uF 16V	$1.55	$1.20
R16134	68uF 16V	$1.80	$1.50
R16220	4.7uF 16V	$0.35	$0.33
R16224	10uF 16V	$0.38	$0.37
R16228	22uF 16V	$1.20	$1.00
R16300	0.1uF 35V	$0.13	$0.12
R16302	0.15uF 35V	$0.13	$0.12
R16304	0.22uF 35V	$0.15	$0.12
R16306	0.33uF 35V	$0.15	$0.14
R16308	0.47uF 35V	$0.15	$0.14
R16310	0.68uF 35V	$0.16	$0.15
R16311	0.82uF 35V	$0.18	$0.15
R16312	1uF 35V	$0.15	$0.12
R16314	1.5uF 35V	$0.24	$0.20
R16316	2.2uF 35V	$0.24	$0.23
R16318	3.3uF 35V	$0.29	$0.27
R16320	4.7uF 35V	$0.35	$0.33

30% Sales tax where applicable

FANS

Cat.No.	Descript.	1-9	10+	100+
T12461	240V 4½"	11.00	10.00	9.00
T12465	240V 3½"	11.00	10.00	9.50
T12463	115V 4½"	11.00	10.00	9.00
T12467	115V 3½"	11.00	10.00	9.50

(Fan guards to suit also available)

Plus 20% tax where applicable

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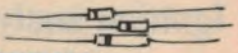
Cat.No.	Desc.	1-9	10+
P10960	Pin Line Male	2.50	2.00
P10962	Pin Chasis Male	2.30	1.90
P10964	Pin Line Female	2.95	2.75
P10966	Pin Chasis Female	3.10	2.90

Plus 20% Sales Tax where applicable

HORN SPEAKERS

Cat No.		1-9	10+
C12010	5" Plastic 10W Max	6.00	5.80
C12015	5" Metal 10W Max	6.00	5.80
C12012	12V Siren	9.90	9.60

Plus 20% tax where applicable



RESISTORS

¼ Watt E12 carbon
Bulk packed $6.50 per 1,000
Taped and boxed $6.50 per 1,000
$50.00 per 10K lots
¼ METAL FILM TAPED AND BOXED
$14.00 per 1,000 lot
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Cat No.	Description	1-99	100+	1000+
P10900	DB25 Plug	0.80	0.70	0.50
P10901	DB25 Skt.	0.90	0.75	0.60
P10902	DB25 Cover	0.80	0.65	0.55
P12210	Cent. Solder	3.50	3.15	2.50
P12200	Cent. Crimp	4.50	4.00	3.50
P10880	DB9 Plug	1.30	1.20	0.90
P10881	DB9 Skt.1.40	1.30	1.00	
P10882	DB9 Cover	0.60	0.55	0.50
P10890	DB15 Plug	1.30	1.20	0.90
P10891	DB15 Skt.1.40	1.30	1.00	
P10892	DB15 Cover	0.65	0.55	0.50

Plus 20% tax where applicable

LEDS 5mm STANDARD

Desc.	10+	100+	1000+	10,000+
Red	$0.10	$0.09	$0.08	$0.07
Green	$0.15	$0.10	$0.09	$0.08
Yellow	$0.15	$0.10	$0.09	$0.08

Plus 20% tax where applicable

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"Check for the latest memory prices!"

	10-99	100+	1000+	10K+
27512	$24.00	$22.00	$22.00	$22.00
4164-15P	$2.00	$1.70	$1.65	$1.60
41256	$6.00	$5.50	$5.00	$4.80
6116P-3	$3.00	$2.90	$2.20	$2.00
2716	$7.50	$7.00	$6.50	$6.00
27128	$7.00	$6.50	$6.00	$5.50
2532	$10.50	$9.50	$8.50	$7.5[illegible]
2732	$7.50	$6.10	$5.90	$5.50
27256	$9.00	$8.00	$7.00	$6.50
6264	$6.50	$6.00	$5.50	$5.00
2764	$6.00	$5.00	$4.50	$4.00

Plus 20% tax where applicable

RITRON II MONITORS

Swivel base monitor in stylish case.

Desc/Cat.No.	1-9	10+	50+
Green Cat. X14506	$145	$135	$130
Amber Cat. X14508	$145	$135	$130

Plus 20% tax where applicable

SAMSUNG TTL MONITORS

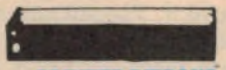
Cat No.	Desc.	1-3	4+
X14500	Green	$130	$125
X14502	Amber	$135	$130

Plus 20% tax where applicable

POLYESTER 100V "GREENCAP" TYPE

Cat No.	Description	1-99	100+	1000+
R15131	.001uF	0.06	0.04	.03
R15137	.0012uF	0.06	0.04	.03
R15138	.0015uF	0.06	0.04	.03
R15140	.0022uF	0.06	0.04	.03
R15142	.0033uF	0.06	0.04	.03
R15143	.0039uF	0.06	0.04	.03
R15145	.0047uF	0.06	0.04	.03
R15146	.0056uF	0.06	0.04	.03
R15147	.0082uF	0.06	0.04	.03
R15148	.01uF	0.07	0.05	.04
R15150	.015uF	0.07	0.05	.04
R15152	.022uF	0.07	0.05	.04
R15154	.033uF	0.07	0.05	.04
R15155	.039uF	0.07	0.05	.04
R15156	.047uF	0.08	0.06	.05
R15157	.056uF	0.08	0.06	.05
R15158	.068uF	0.08	0.06	.05
R15159	.082uF	0.08	0.07	.05
R15160	.1uF	0.09	0.08	.07
R15162	.15uF	0.11	0.10	.09
R15164	.22uF	0.15	0.14	.13
R15165	.27uF	0.16	0.15	.14
R15172	1uF	0.70	0.55	0.50
R15176	2.2u	1.20	1.10	1.00
R15178	3.3uF	1.50	1.20	

Plus 30% tax where applicable



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Cat.No.	3+	25+	100+
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Plus 20% tax where applicable

Information centre

Ignition analysis

I recently purchased a 6.5MHz oscilloscope which I would like to use for analysing automotive ignition systems and would appreciate your advice.

My problem is that although the oscilloscope shows the waveform (produced by sensing the coil lead) the waveform cannot be completely stabilised for accurate analysis. The timebase control has four frequency ranges: 10-100Hz, 100-1kHz, 1K-10kHz and 10-100kHz with a variable sweep adjustment and external synch socket.

Is it possible to modify the oscilloscope or provide a suitable external signal to synchronise the sweep with engine speed? (J.P., Morley WA)

• ***The easiest way to synchronise your oscilloscope sweep to the engine speed, is to use the external sync facility you mention. Another suitable capacitive sensor lead should be constructed, and attached to the cylinder No.1 firing lead, the resulting signal used to trigger the timebase sweep (via the external sync socket). The variable sweep control should then be adjusted to show all the cylinder firing waveforms across the screen in order.***

If the firing order is say, 153624 (6 cylinder engine), it may appear on the screen as 536241. If so, this will be because of triggering delays, which may cause the No.1 cylinder waveform to become "invisible" at the start of the sweep, and only visible at the end as the cycle repeats.

Vintage radio-circuit?

I was impressed by the article on Vintage Radio Restoration featured in EA some months back. I have had an Airzone 1937 radio standing around the place for a while and it stirred me to get it operational again, restoring it to its former glory.

However I've had some trouble with getting some information on it, particularly a circuit diagram. Could you please help me out as I am hesitant to prod into it until I get some understanding of it. The Airzone radio is the same pictured in April EA p13. It's a dual wave receiver, chassis type 526 model, superheterodyne with automatic volume control (AVC). If you could help me out it would be much appreciated. (P.W., New Town Tas)

• ***Unfortunately, we are not in a position to help with specific information on any commercial sets — old or new. However, if you would care to send further information on the valves it uses, we may be able to provide a circuit for a similar receiver of the same vintage and hopefully using the same valves. This may then help you get the set going.***

Series 200 amplifier

I have recently purchased and built the Playmaster Series 200 amplifier and have been having some trouble locating a possible fault.

When it was first powered up, everything seemed to be working correctly and I was particularly impressed with the noiseless switching on all inputs. After giving it a light workout for an hour or so, I noticed a peculiar smell coming from inside the unit. I turned it off immediately and removed the cover the notice the 47Ω resistor located near RL2 to be overheating, causing the smell. This overheating, I discovered after a lot of swearing and head scratching, was due to RF entering the unit as a result of insufficient earthing on the heatsinks. I earthed the heatsinks and after replacing the resistor, everything seemed to be back to normal, but it became evident at moderate volume that there was now a slight but annoying "click" whenever any of the inputs were changed.

I have tried replacing ICs 2, 3, 8, 9, 10, 102, 103 and 110 but this has proved unsuccessful.

Do you have suggestions as to what may be done to rectify this fault, or was I just lucky not to have this problem originally? (I.P., Lavington NSW)

• ***It seems most unlikely that the click is related to the overheating of the 47Ω resistor. The cause is more likely to be a difference in DC level between source and amplifier.***

First you should determine whether it is the source or the amplifier which is responsible for the click. This you can do by disconnecting all the sources (inputs) and switching between the different inputs. If the click is still there, then it is originating within the amplifier itself.

A possible cause could be the 0.08uF capacitor after IC8. This capacitor (depending on the type) can become short-circuited or resistive when overheated (due to soldering). This would shift the DC level at the inputs, which could result in a click. Replacing this capacitor would then be the solution for your problem.

NiCad charging

With regard to the Deep Cycle Charger for NiCads of March 1987, could you please tell me the value of resistors required for AAA batteries. As I have all sizes of NiCads, I am constructing the project with separate modules for each size batteries, using plug in connections.

Each module contains the pertinent resistors complete with battery hold and discharge LEDs. (F.C., Kawerau, NZ)

The key to calculating the circuit values for the charger is the mA/hr capacity of the battery. For example, the AAA NiCads from Dick Smith Electronics stores (Cat 5-3305) have a capacity of 180mA.hr. The charging rate is then calculated by the capacity divided by ten, which equals 18mA.

The trickle rate equals the charging rate divided by 5 to 3. This equals a range of 3.6 to 6mA. The discharge rate approximately equals the capacity divided by 5 or approximately 36mA. From the circuit and text the resistor values can be calculated from this data:

Rc = 390 ohms + 68 ohms
Rt = 680 ohms
Rd = 33 ohms
R1 and R4 are not used
(all resistors 0.25W)

We trust this information is sufficient for your needs.

Deluxe car alarm

I built the Deluxe Car Alarm (May 1984) some twelve months ago, from a Dick Smith kit. The alarm is performing well, however after reading your description of the sound output, I am sure my alarm is not producing the high pitched sound described. The closest description I can give, of the noise from

the horn, is a low pitched "barp" of about half a second duration.

I have replaced semiconductor 74C14 (IC6) which according to your article, produces the tone signal but this did not alter anything.

Entry and exit times are about as described, however the red indicator light has a pulse rate of about one and a half seconds, and the horn sound for nearly four minutes before resetting.

The last two items mentioned are of no real concern but I would like to have the alarm sounding as it should. (R.A., West Lakes Shore, SA)

• ***The signal which drives the loudspeaker consists of three parts: a 1Hz signal, a 100Hz signal, and a 1kHz signal. The "barp" sound you describe in your letter is the 100Hz signal switched on and off for half a second respectively. Apparently, the 1kHz signal is not coming through.***

You should check the PCB for possible bridges or discontinuities between IC6, IC7 and the transistors Q9, Q11, Q5 and Q7. The 1kHz signal is generated by IC6a.

It is also possible that one or more transistors of the loudspeaker driver (Q9, Q11, Q5 and Q7) are faulty. In that case you will have to replace those faulty transistors. It does not seem very likely that IC6 or IC7 are faulty.

It is difficult to tell why the alarm time is four minutes rather than two. Perhaps the electrolytic capacitor C2 is rather higher than its nominal 220uF. You can reduce the alarm time by reducing R3; 560k might be a good value.

The lamp flashing rate of 1.5s can similarly be reduced to 1s by simply replacing C6 by a 1.5uF capacitor.

Digital capacitance meter

I have built a digital capacitance meter from the August 1985 design. Unfortunately I can't get readings on the uF range. Readings are possible on the nF and pF ranges. Adjustments are possible on both these ranges using the trimpots provided. However when reading a value on the nF range if you turn the switch to the uF range, the readings freeze and stay on the display even if you remove the capacitor. To wipe out the value you either have to turn the switch to nF or pF, or turn the power switch off. The kit was bought from Jaycar Electronics. Any suggestions? (S.K., Alexandria NSW)

• ***The fact that the uF range does not work shows that either the gating oscillator or the reference oscillator is not working for this range.***

The most likely cause of this problem is a wiring error or open circuit on the range switch, so you should check the connections between the main PCB and the range-switch PCB carefully. Less likely but also possible causes are a faulty trimpot VR2 (22k), or the 6.8k resistor in series with it.

Benchtop power supply

I have recently purchased and assembled four kits for the Benchtop Power Supply (January 1985) from Altronics. Hopefully you can help regarding a problem that appears with all four kits.

If the supply has been off for a day or longer as soon as the power switch is turned "on", the 150mA mains fuse quite often "blows". This is with the load switch off, no matter what current limiting is applied nor voltage selected. All four units do the same. Sometimes, I'll replace the fuse three or four times before the unit works.

I would greatly appreciate it if you would find the cause of this problem and let me know how to rectify it. Other than that, it is a terrific power supply. (D.A.I., Adelaide SA)

•***The 150mA mains fuse specified for this project is probably marginal, particularly if the "quick blow" type is used. The remedy is to use a "slow blow" type, and perhaps increase its rating to 250mA. This will still provide sufficient protection.***

"Flag waving" on video

On occasions I am called up to repair relatives' TV sets etc, and at the moment I have two old colour sets which are planned to be used in children's rumpus rooms for amusement. The problem is that I need to modify them to prevent "flag waving" when being used with VCR's.

Could you supply me with the modification details if possible. The sets are an HMV model C221 (22") and a Rank Arena C2603 (26"). (G.H., Illawong NSW)

•***Unfortunately, we aren't in a position to supply modification information on particular commercial sets. For this, you'd be best advised to try contacting the service departments of the manufacturers concerned.***

However in general, what is usually required is to shorten the "fast" filter time-constant in the horizontal AFC (automatic frequency control) circuit, so it can better respond to the rapid minor fluctuations in horizontal sync pulse timing present in a signal from

a VCR. Sometimes it is also necessary to increase the "long" filter time-constant, to ensure that the overall horizontal locking stability is maintained.

Somewhere in the horizontal AFC circuit, you'll tend to find a filter with a series resistor, a small shunt capacitor and a resistor and larger capacitor in series also in parallel with the shunt capacitor. Generally what needs to be done is to reduce the value of the small shunt capacitor a little, and possibly increase the value of the larger capacitor. Sometimes, reducing the value of the resistor in series with the larger shunt capacitor can achieve much the same results.

Deep cycle NiCad charger

I was very impressed with the Deep Cycle NiCad Charger in your March edition. I own a camera which is powered by five standard AA size Nicad cells. The standard charger is a plug-pack arrangement with a rated output of 7.25V at 80mA, with a recommended charging time of 15 hours. During charging the five cells remain installed in the battery pack and connected in series. Could you please advise me whether it would be possible to use the charger to charge the five cells, instead of a 9V battery and what components, if any, would be required to be altered. (P.S., Braidwood NSW)

• *While it would be possible to modify the charger to charge the 5 cells in series, this is not recommended. The deep-cycle charger was designed to discharge each individual cell to a pre-set "end-point" voltage, and then charge each cell to capacity. The reason that the cells are "cycled" individually is because in any given set of cells, they are all slightly different from one another.*

After several charge/discharge cycles, it is possible to have several almost fully charged cells and one which holds considerably less charge. If this battery is then deeply discharged the "weaker" cell could begin to be charged up in reverse — damaging the cell.

While it is not possible to separate the cells if they are permanently connected together (as in a 9V battery) then there is no option but to charge them in series.

If, however, it is possible to separate the cells for charging, then any increased time and inconvenience in doing this will be more than offset by the increased time available between charges, and of the longer life of the cells overall.

Notes & Errata

4-DIGIT COMBINATION LOCK (August 1987, page 70, File: 3/MS/130): There are two C14s listed. The 0.15uF capacitor connected in parallel with R23 should be labelled C16. The text reference to possible reduction in the value of R21 to provide greater current for a striker solenoid is also incorrect. Since C14 (2200uF) supplies the energy to operate the solenoid, the value of this capacitor may be increased if necessary — but the value of R21 should not be reduced from the figure of 560 ohms shown.

HEADPHONE AMPLIFIER FOR CD PLAYERS (July 1987, File: 1/SA/78): Although the mains wiring is correctly referred to in the text and diagrams of this article, the colours mentioned for active and neutral are reversed. The Active wire connecting to the switch should be brown, and the

IR REMOTE CONTROL TRANSMITTER(June-July 1987, File 2/MC/24&25): Some constructors may have experienced a refusal of the ML923 chip (IC3) to work. A slightly highly supply rail than the original 12 volts is frequently required for reliable operation. This is most easily achieved by "jacking up" the output of the 7812 regulator IC with a diode. The PCB track to the "GND" pin of the 7812 should be cut, and a diode (1N914) soldered in place; anode (+) towards the IC. The 0.7V diode drop will be added to the output, thereby increasing the supply rail to about 12.7 volts. In extreme cases, two diodes may be used in series to give an increase to about 13.4V. Also, the main filter capacitor should be changed from 470uF to about 1000uF to maintain the regulator headroom.

Pattern Generator

Continued from page 89

your colour receiver, and tune to channel 0 (or 1). Select the appropriate channel on the pattern generator and apply power.

By altering the thumbwheel switch, each of the patterns should be displayed. Note that positions 8 and 9 are simply repeats of positions 0 and 1, respectively.

The only adjustment required is trimmer C7, to bring the burst frequency into a range that can be locked onto by your television receiver's reference oscillator. If C7 is incorrectly adjusted, all the patterns will work correctly except the red screen and the colour bar function.

To adjust C7, select 7 on the thumbwheel switch and observe the pattern on your receiver. Chances are that you will have colour from the first try, but if not adjust C7 until colour is obtained.

The optimum position for C7 is in the mid position of the range in which a colour display can be obtained. In other words, turn C7 clockwise until the colour display is lost, then turn it anticlockwise. The colour display will reappear, and then disappear again. Set C7 to half-way between the two points where the colour display disappeared. It may be possible that the colour display never disappears; in this case set C7 for the moving plates overlapping the fixed plates by 50%.

If the worst happens and the colour bar generator does not work, immediately switch the unit off and recheck your wiring. Assuming the wiring is correct, check for the presence of the +12V and +5V supplies. If these are correct then an oscilloscope will be necessary to find the faults.

A 2.5MHz square wave should be seen at pin 8 of A1, while various waveforms should be seen at pins 3, 4, 11, 12, 13 and 16. These waveforms can be traced through the circuit by referring to the text and the circuit diagram with the aid of an oscilloscope. Composite video should be seen at pin 6 of A9; the burst should also be evident at this point when looking at a line sync pulse.

The RF modulator is very sensitive to the level of video on pin 1. The video will be negative, with the sync tips at not less than 2.2V and the white level not greater than 2.7V for correct operation.

The heatsink for the regulators will get reasonably hot. If you intend to use the colour bar generator for extended periods, it would be best to drill a row of ventilation holes in the top of the rear panel to improve the air circulation around the heatsink.

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.

October 1937

Centralised Radio at Caulfield Hospital: Three panel centralised radio apparatus at the Caulfield (Melbourne) Repatriation Hospital has been installed by AWA.

The centralised unit comprises three special receivers mounted with associated 30-watt power amplifiers in a single rack. The output of these amplifiers is fed along armoured cable circuits towards one to nine. In each ward there is a junction box in which the three circuits are carried to each bed, where bedside controls are situated, enabling the patient to make a choice from any of the three programmes selected at the centralised receivers.

Water-cooled Valves for Ultra High Frequencies: An outstanding forward step in Ultra High Frequency operation has been made in the new Radiotron Water Cooled Valves 887 and 888. These types are capable of operation at the maximum power input of 1200 watts at wavelengths as low as 1.25 metres. An output of 750 watts is obtainable at a wavelength of five metres, with 3000 volts on the plate.

October 1962

The Saturn C-5: With the race to the Moon well and truly "on", US hopes are centred largely on the Saturn C-5, a rocket designed to lift payloads of over 100 tons.

The advanced Saturn will be the free world's largest rocket, and one of the first developed specifically for scientific space programs. Success of Saturn in launching expeditions such as the three-man Apollo mission to the moon will depend to a large degree on the reliability of the first stage booster, to be developed by Boeing.

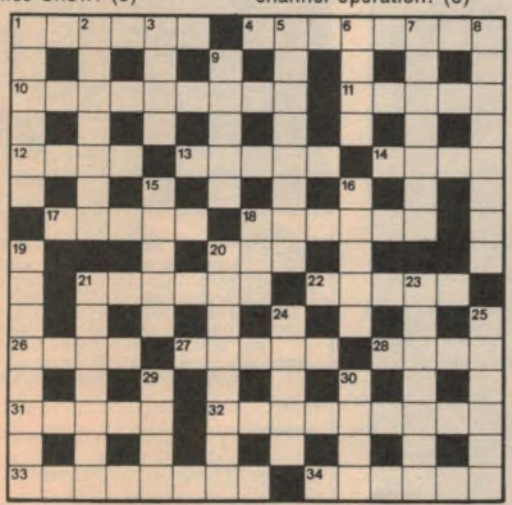
Tiros Weather Maps: An experimental technique which converts satellite cloud photographs to digital form, reconstructs them in a digital computer and then reproduces them as a Mercator projection has been developed by engineers of IBM's Federal Systems Division in America.

The technique makes possible the production of composite cloud photo maps over large land areas, including continents, for the first time. The maps can be made by automatically superimposing a number of reconstructed satellite pictures on a Mercator map of the same scale.

OCTOBER CROSSWORD

ACROSS

1. Low-level broadband noise. (6)
4. Primary measure. (8)
10. Effecting repairs. (9)
11. Corposant is such. (5)
12. Carrier on the TV set! (4)
13. Venue of major annual Electronics Show. (5)
14. U.S. Nobel Prizewinner in Physics, Isidor ——. (4)
17. Electronic pacemaker gets this beating. (5)
18. Jules Lissajous devised such. (6)
20. Select a transformer ratio. (3)
21. Type of communications channel operation. (6)

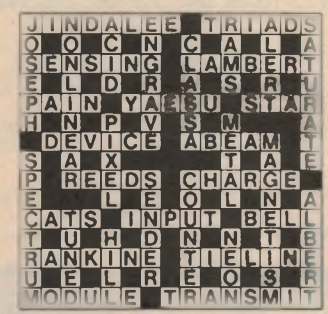


22. Channel for vision, the —— —— nerve. (5)
26. Discharge! (4)
27. Elementary particle. (5)
28. Amateur radio licence. (1,1,1,1)
31. British scientist extensively known for elastic law. (5)
32. Computer devices serving as transition between systems. (9)
33. Vibrate sympathetically. (8)
34. Apply this to get a strain gauge reading. (6)

DOWN

1. Layout of components. (6)
2. Part of typical electrical power system. (7)
3. Radiate. (4)
5. Set of soldering points. (3-5)
6. Type of cell. (2-2)
7. Mean. (7)
8. Non-electric illumination. (8)
9. Term related to image transmission. (5)
15. Activates by switch or catch. (5)
16. Diverts computer data. (5)
18. Communication of pictorial matter, briefly. (3)
19. Screen coating. (8)
20. Information service. (8)
21. Users of electroencephalographs and sphygomomanometers. (7)
23. Atomic variant. (7)
24. Russian space-vehicle series. (5)
25. Result of electric stimulation of muscles. (6)
29. Songwriter with record recordings, Jerome ——. (4)
30. Stay in telephone queue.(4)

SOLUTION FOR SEPTEMBER



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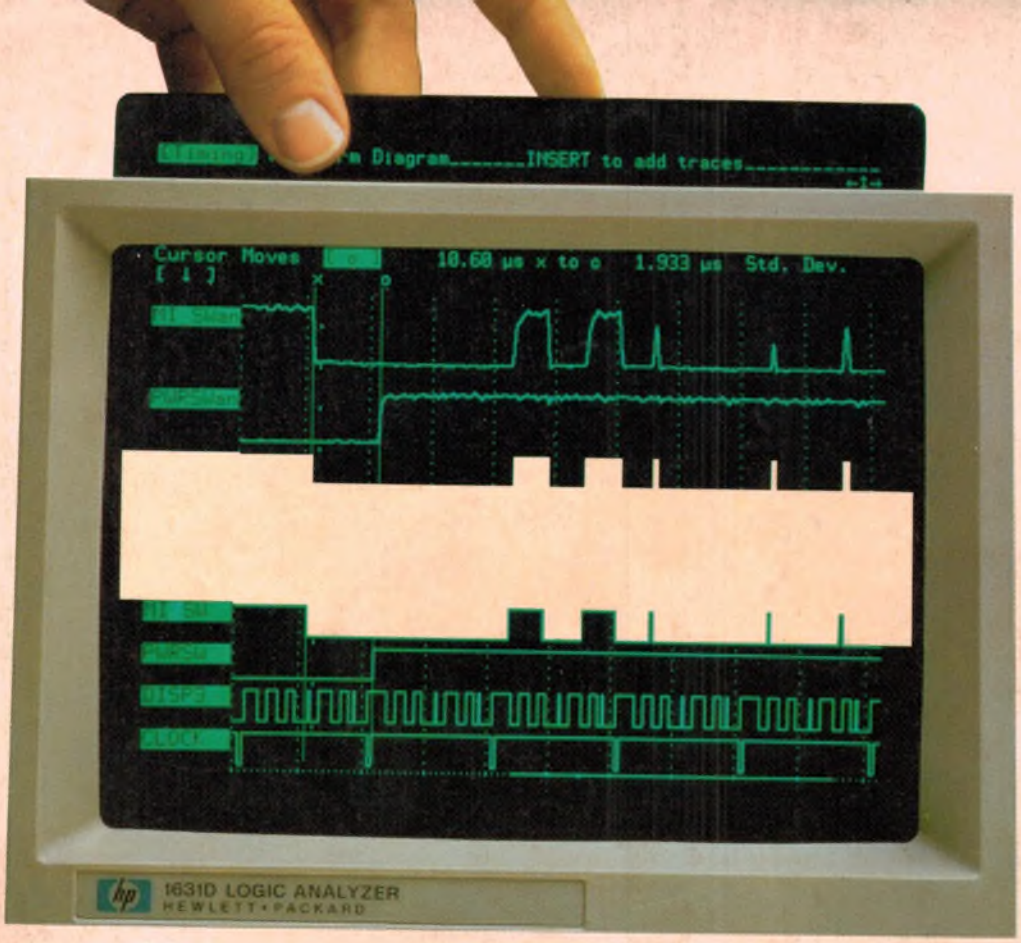

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