EXCITING NEW 30+30W STEREO AMP: CIRCUIT DETAILS

Australia's Top Selling Electronics Magazine

Electronics Australia

AUGUST 1988
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AUSSIE SUCCESS IN EL DISPLAYS

DOES A 'TINGLE' MEAN YOUR APPLIANCE IS DANGEROUS?

- ★ SUPER-VHS VIDEO ON THE WAY
- ★ LOW COST CAPACITOR METER
- ★ MICROWAVE RADIO RESEARCH
- ★ ULTRA TINY SHORTWAVE RADIO

Coming next month in Electronics Australia

Playmaster Twin 30W Amplifier

At last – full construction details for our lastest amplifier design, which gives excellent performance at a budget price. It's particularly easy to build and get going, too!

Aussie tape cart player breakthrough

Radio stations throughout the world rely on tape cartridge players, but it took an Australian development to make them really suitable for stereo operation. One of our feature stories next month explains what the problem was, and how it was solved right here in Australia.

Super timer

Ever wanted to measure the speed of a bullet, a golf ball or a snail? Here's a low cost project that will measure time intervals from microseconds to 999.9 seconds, with quartz crystal accuracy.

**Note: although these articles have been prepared for publication, circumstances may change the final content of the issue.*

KIT COMPUTER REVIEW

By Jim Rowe

Reprinted in part from the December 1987 issue of Electronics Australia', by arrangement.

A couple of weeks ago I discovered that Dick Smith Electronics was about to release a new AT clone in low-cost kit form. So when the opportunity came to assemble an advance sample kit for this review. I jumped at the chance.

Particularly when I learned that the kit was essentially a 'knocked down" machine, which didn't involved any soldering or the tedious low-level assembly - just bolting pre-assembled (and tested) modules together and plugging in cables to connect them all up.

By the way, the modules making up the kits are all going to be available separately, so you don't have to buy them all at once. This also means that you could buy them separately.

The kit itself goes together to make a standard 8-slot AT level machine, with space on the motherboard for up to 1 megabyte of RAM and able to run at any of four clock speeds: 6MHz, 8MHz, 10MHz or 12MHz. It features a 200W switch-mode power supply and a choice of video, I/O, disk controllers and drives, all housed in a standard two tone bone coloured box. There's also a choice of either 84-key or 101 key keyboards.

In theory then it all sounds great. But how did it turn out in practice?

Everything seemed to be attractively packaged, and protected against damage.

There is literally no soldering to do in assembling the kit, because all cabling is supplied ready assembled. All you need to do is identify where they go, and connect them up.

Needless to say, there are various links and DIP switches to check on the various boards, before you mount them and connect things up.

You have a choice of video/ graphics adaptor card as there are three available. These are a mono adaptor (MDA) with parallel printer port; a colour adaptor (CGA), also with printer port; or an extended colour graphics adaptor (RGA), with the usual multiple modes including Hercules.

All in all, the whole job took about 3 hours to assemble.

When it was complete, I hooked it up to the monitor and turned on the power. Everything sprang to life very smoothly.

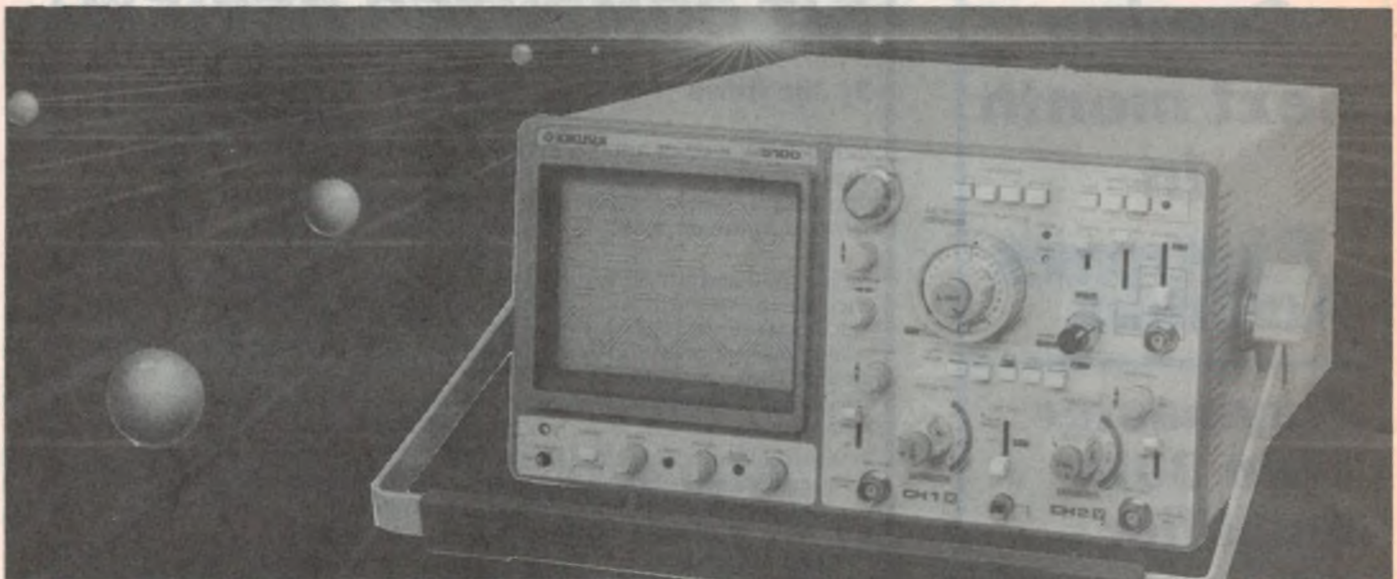
How does it perform? Not too badly at all. I sooled Peter Norton's Advanced "System Information" utility onto it, and it came up the following CI (computing index) figures for the kit's CPU performance compared with an original IBM PC/XT:

CLOCK SPEED	CI RATING
6MHz	5.1
8MHz	7.7
10MHz	9.2
12MHz	11.7

I for one certainly enjoyed putting the sample kit together. All I have to do now is work out how I can afford to buy one — preferably the one I've already put together!

Needless to say, you'll find the A computer kits at all Dick Smith Electronics stores, and at many of its larger dealers.

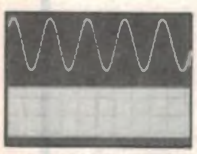
Kikusui's 5000TM Series.



It's the standard features that make Kikusui CRO's exceptional.
The COS-5000TM series offers standard features, normally only found on expensive, higher bandwidth scopes.
Consider:

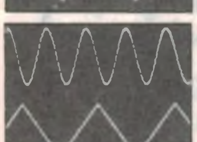
1 Bright and sharp signal traces with Automatic Linear Focus. This eliminates the need to readjust the focus during measurements between timebases. Even in high intensity, there are no blooming effects.

2 'Simultaneous' triggering of both CH1 and CH2. The VERT MODE displays both signals whether they are synchronised or not. An indispensable facility when troubleshooting between working and faulty boards.



CH1
TRIG:CH1
CH2

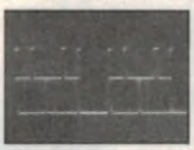
CH1
TRIG:CH2
CH2



CH1
TRIG:
VERT MODE
CH2

3 Auto setting of the optimum triggering level. In AUTO TRIG LEVEL LOCK, a peak to peak detector locks onto and tracks the trigger signal. There is no need to reset the trigger level between measurements.
The Manual Level Control provides superior triggering of complex waveforms or very low level signals.

4 Stable viewing of complex waveforms. The VARIABLE HOLDOFF control allows the easy viewing of waveforms such as uP or video signals with multiple triggering edges, caused by different frequency and level components.



NO HOLDOFF

WITH HOLDOFF

5 Simultaneous display of original and magnified waveform. Kikusui's ALTERNATING SWEEP MODE allows both the original waveform and the selected magnified portion to be viewed simultaneously.

ORIGINAL
MAGNIFIED

6 Advanced new design using energy saving circuitry. The newly developed Dynamic Bias Circuit [PAT PEND] automatically controls the power consumption of the unit. Another feature in Kikusui's policy of continued innovation.

Features	5100TM	5060TM	5041TM	5021TM	5020TM
Bandwidth	100MHz	60MHz	40MHz	20MHz	20MHz
Channels	3	3	2	2	2
Vertical Sensitivity	1mV/DIV	1mV/DIV	1mV/DIV	1mV/DIV	1mV/DIV
Max Sweep Speed	2ns/DIV	5ns/DIV	20ns/DIV	20ns/DIV	20ns/DIV
Delayed Sweep	YES	YES	YES	YES	NO
Trigger Modes	CH1, CH2, VERT MODE, LINE, EXTERNAL				
Alt. Sweep	YES	YES	NO	NO	NO
Delay Line	YES	YES	YES	NO	NO
Accel. Voltage	18kV	12kV	12kV	2.2kV	2.2kV
Warranty	2 YEAR WARRANTY ON PARTS AND LABOUR				
Probes	2 QUALITY SWITCHABLE PROBES INCLUDED				

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EMONA
'THE TECHNOLOGY HOUSE'

Volume 50, No.8

Electronics Australia

August 1988

AUSTRALIA'S LARGEST SELLING ELECTRONICS MAGAZINE – ESTABLISHED IN 1922

Super VHS video

The first S-VHS video recorders for Australia's PAL system are planned to arrive later this year. Starting on page 10 we explain how S-VHS differs from ordinary VHS, the results you can expect from it and what it's likely to cost you.

Projects to build

Our construction projects this month include the circuit details of our new Playmaster 30W per channel stereo amplifier, a very flexible TV field strength meter for antenna evaluation, a low cost capacitance meter adaptor and first details of a new "real world" interface for almost any personal computer.

Imaging & Display

This month's special feature on imaging and display electronics includes one story on Toshiba's new 2 million pixel CCD sensor for HDTV, another on a new development in electroluminescence by an Australian firm, and details of the largest mobile display screen in the world. (See page 106)

ON THE COVER

Charles Rener of Melbourne firm E'Lite Luminescent International demonstrates a sample of his firm's impressive new ultra-thin, flexible EL display panel, in low cost plastic encapsulation. (Picture courtesy ELI)

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For reader services see back of magazine.
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ELECTRONICS AUSTRALIA is published monthly by Brehmer Fairfax Pty. Ltd., Double Bay Newspapers Pty. Ltd. and General Newspapers Pty. Ltd. trading as Federal Publishing Co., 180 Bourke Road, Alexandria, N.S.W. 2015.

Typeset and printed by Hannanprint, 140 Bourke Road, Alexandria, NSW for The Federal Publishing Company Pty Ltd.
Distributed by Newsagents Direct Distribution Pty Ltd, 17 Doody Street, Alexandria NSW 2015
Registered by Australia Post – publication No. NBP 0240 ISSN 0313-0150
*Recommended and maximum Australian retail price only.

Letters to the editor

Computers & history

Way back in 1972, a youthful edition of Jamieson Rowe wrote a penetrating Editorial about computers and their use and misuse. (See EA, May 1972, page 5.)

Among other points in the Editorial, he chided computer "experts" for devising programs that forced the user to adapt his system to the computer's requirements, rather than have the computer serve the user's needs.

Unfortunately, the past sixteen years has taught these so-called experts nothing. In promoting the "paperless" society, computers are instrumental in the destruction of important archival material and in the loss of vital business records.

A case in point: For a hundred years, a Hobart firm had conducted its business in longhand, in vast journals that recorded who bought what on any day of the week back into the 1860's.

These records are still available, and are invaluable to any researcher delving into the history of the City.

About eight years ago the Company computerised its accounts and since then the only information available has been that which the computer deigns to reveal.

Any enquiry about a particular batch of material is now met with the remark "The computer doesn't hold that kind of information". It can tell you the total value of a year-old invoice, but not the nature of the items that made up the invoice. I am advised that invoice details are kept only until the account has been settled and are then discarded as useless data. Only totals are kept, as taxation records.

In fifty or a hundred years from now there will be no records available to historians. Computer discs or tapes will be virtually unreadable, as witness the vast amount of video material recorded on Philips NV1500 cassettes but now inaccessible because the machines to play the tapes are obsolete and no longer available.

There can be no doubt that computers are a valuable tool in business. They make possible instantaneous processing of accounts and in many cases can provide statistical information that could never be produced in any other way.

However, by encouraging the destruction of paper records, the machines are responsible for what will one day be a gaping hole in the Nation's history.

Jim Lawler (MTETIA),
Hobart.

Video longevity

Your magazine comments on the good qualities that the latest video camcorders have with regard to overall video and audio quality and ease of use etc. You fail to make mention of the longevity of video recordings which, from personal experience seems to be fairly limited.

From my own video recordings, it seems evident that the video quality steadily deteriorates with time, whether they have been used much or not, and even though the tapes have been stored in proper places when not in use. I have not noticed a similar deterioration in my 8mm movie films, despite their limitations and their much greater age.

Unless the latest models are any better in this regard, it would seem that people should not expect their video recordings to last for a very long time (not much more than a few years) especially with regard to the picture quality. I wonder if you could comment on this matter?

K.T.,
Hurstville, NSW

Comment: None of us on the present staff of EA has sufficient direct experience of videotape life to be able to comment, K.T. Perhaps other readers may care to buy into this one. Like you, I've certainly not found much deterioration with old movie films. By the way, we do like correspondents to give their full name and sign their letters, as a mark of good faith.

Computer simulation

Because of its important implications, Frank Linton-Simpkins' article about computer simulation Vs reality was marred only by its brevity (May). One can only infer that programmers (and their overseers) may be asked to design a simulated scenario for which they're incompetent. Not only has WW2 battle lore been lost – imagine making a warship a firetrap – but basic skills too in our craze for "high-tech".

Not a single foundry in the entire US could pour a flawless pipe casting for NASA, which then had to cut up an old battleship's 16-inch gun tube. The latter was guaranteed flawless, yet it had been made 50 years earlier. Even "commonsense" often seems to have been lost.

Recall that US Defence Secretary McNamara once parrotted those Pentagon loonies who wanted to build an "electronic fence" all the way across Vietnam's DMZ. How mesmerised by technocracy can one be?

Surprisingly, Frank made no allusion to that scientific charlatanry of charlatanries, SDI; which would demand a multi-million step computer program to control the hardware, yet it could only be de-bugged by issuing a Go-to-War order! Who needs a "high-tech" Pearl Harbour debacle?

George Lindley,
Redfern, NSW

Amplifier "light-show"

I was most intrigued with the item in your April "News Highlights" concerning the Australian Monitor AM1600 power amplifier. In particular, the claim that it has been used to drive a 2000 watt spotlight.

Assuming the lamp concerned was a 115 volt type, the effective load resistance when lit would be about 6.6 ohms. To fully light such a lamp the AM1600 would have to be operating in bridge mode. (The power figures quoted are the total of both channels) Now, the resistance of any lamp is much lower when it is cold or only dimly lit. The cold resistance of a 2000 watt, 115 volt lamp is in the vicinity of 0.6 ohms! Also there is a considerable time lag between applying a voltage to such a lamp and having it reach its final brilliance and hence resistance. This results in a large current surge when the lamp is first switched on to a normal mains supply. Fuses and switches must be suitably overrated to withstand the surge which is in the order of 250 amps.

The idea of connecting such a load to an audio amplifier is to say the least novel as it would present a gross overload to the output stage/s. That the amp should be fed from a CD player is even stranger since the wide dynamic range and sharp peak transients of CD are antithetic to the sluggish response of such a large lamp.,

I have just one question: did the "impressive light show!" referred to come from the lamp or from within the amplifier?

(Name supplied,
but withheld by request)

Editorial Viewpoint

If it's not the fire, it's the smoke and water!

I'm sorry if the magazine ends up reaching you a little late this month (and perhaps next month too, I fear), but we're working under considerable difficulty at present.

Early in the morning on Sunday June 26, our office building suffered a disastrous fire. By the time the valiant firefighters were able to bring it under control, almost half the three-storey Federal Publishing building had been totally gutted.

EA's own editorial and advertising offices were not reached by very much of the fire itself, but did succumb to a tremendous amount of damage from both water and smoke. We lost almost all of our stocks of back copies, and quite a lot of our reference library – although we were very lucky, as many of our most precious bound volumes and historic reference books were saved.

Since then, we've been clearing up the mess and salvaging what we can – as well as setting up temporary office facilities elsewhere in the building.

Luckily too, although our word-processing computers were fairly badly damaged by the water and smoke, the company's computer experts were able to rescue most of our magazine files stored on the hard disks. So production wasn't set back by nearly as much as we first feared.

Like most of the other people in Federal Publishing we're going to be rather cramped for a few months, and working under makeshift conditions while the building is being rebuilt. Please excuse us, therefore, if the magazine does turn up a little late again next month – although we'll try to prevent this if we possibly can.

This last month certainly seems to have been one for setbacks, both for myself and the magazine. On the home front we were burgled twice in a fortnight, with the thieves taking among other things first my camera and an Icom IC-780 transceiver (which I had taken home briefly for review), and then the personal computer I was using to write articles at home. The fire has capped it all off quite dramatically!

Despite the setbacks, I can assure you we'll be pressing on, working to bring you the best magazine we possibly can each month. So if you've just taken out a subscription, in response to my "Special Editor's Offer", rest assured that you've made a good investment.

And if you've been meaning to subscribe but haven't yet got around to it, please note that we can't afford to hold the current special offer price beyond this issue. Now's the time to get that sub in, if you want to move before the price rises!

PS: My grateful thanks to the many people who responded to my personal plea for subscriptions. Thanks too to those who sent personal messages, saying nice things about what we've being doing to the magazine.

Jim Rowe

What's New In
Entertainment Electronics

New Pioneer shelf hifi system includes CD player

Pioneer Electronics has launched a new home hifi system that includes a true component compact disc player, at a price that takes it within the reach of even the most modest budget.

The new Prologue system incorporates a turntable, double cassette deck, AM/FM tuner and component compact disc player, bringing quality and advanced features with a price tag of just $999.00.

Prologue's component compact disc player (PD-Z71) boasts features such as twin D/A converters for improved sound reproduction, digital filter, random play and 20 – track random-access programming, just to name a few.

Prologue's stereo amplifier also features a built-in 5 band graphic equalizer and power output of 22 watts per channel, to drive the free-standing speaker system with clarity and authority. The 2-way bookshelf-type speaker system features a 16cm cone woofer and 6cm cone tweeter.

The total system is completed with the double cassette deck offering soft-touch mechanism and added features including normal/high speed tape copy facility; the analog control AM/FM tuner; and belt-drive turntable with DC-servo motor and static balance type, straight tone arm.

Prologue's low price tag does not mean that Pioneer has stinted on quality and, to prove the point, the company has applied a full 3 year warranty on prologue – including the CD player and its laser optics.

JVC introduces Super VHS video recorder

On May 12th in London, JVC announced what it claims is the world's first Super VHS Euro System VCR – the HR-S5000.

Although it is not expected to be released on to the Australian market until later this year, Super VHS is expected to take off rapidly in Australia.

The superb picture quality of Super VHS is reflected in the HR-S5000's refined new design. Featuring an open-out control panel that doubles as a cassette-slot cover and a thick acrylic window to protect the fluorescent display, the HR-S5000's appearance is one of sleek, uncluttered elegance.

To ensure that none of that Super VHS qualtiy is lost, the HR-S5000 has a built-in wideband tuner capable of detecting a much wider range of video signal frequencies than before. And for the best possible picture quality in both the SP and the LP modes, a Super Double Azimuth 4-Head (Super DA-4) combination video head system – based on JVC's tested and proven Double Azimuth 4-head (A-4) system – has been incorporated. First rate picture quality in VHS recording and playback is also ensured by HQ (High Quality) picture improvement circuits.

For the ideal audio counterpart to its Super VHS picture, the HR-S5000 offers near-digital Hi Fi Stereo sound. Two rotary FM audio heads combined with an advanced L/R channel independent switching noise reduction circuit provide sound reproduction that is vastly superior to conventional audio tapes.

The HR-S5000 can also function as an editing recorder of near professional quality, incorporating a flying erase head for precise insert editing and the Zero Frame Editing system for assemble editing. An audio dubbing circuit is also provided.

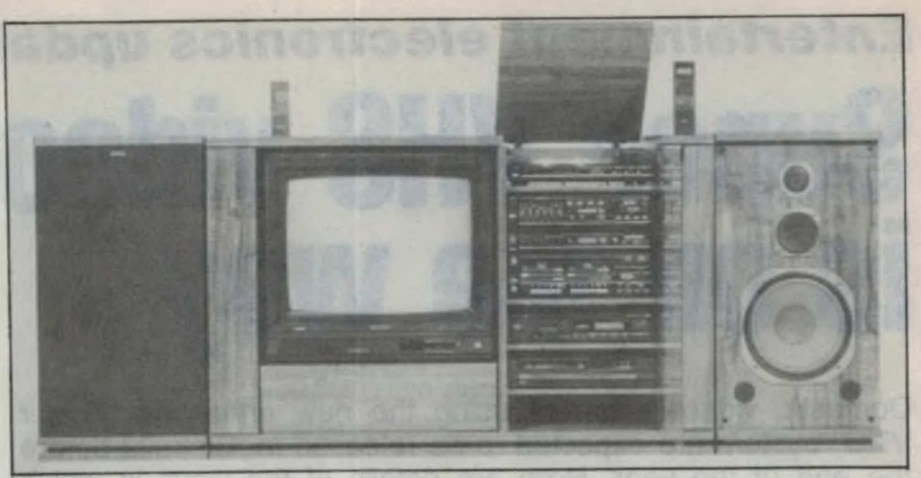
Integrated Home entertainment package

Sanyo has introduced its AV-7000 integrated audio and visual home entertainment system.

The four-in-one audio system comprises an FM stereo/AM synthesiser tuner with pre-settable station memories, a double cassette deck with high speed and synchronised dubbing and Dolby B Noise Reduction, a semi-automatic turntable, 5-band graphic equaliser and 16-selection programmable compact disc player. The amplifier boasts power of 55 watts RMS per channel.

The 12" (30.5cm), 3-way speaker system has removable speaker fronts with the speakers encased in a woodgrain finish to match the cabinet.

The 63cm hifi stereo colour television features a family-sized, monitor-look screen, a high fidelity stereo/bilingual system, and an infrared remote control unit that can control up to 30 functions.



One of the latest generation TV sets offering superior audio, the CPP 2601S boasts a high fidelity stereo/bilingual reception system, with a 6 watts per channel audio output. The unit has a 99 channel synthesiser tuner system with a 32 programme memory. Other features include plug-in facilities for VCR, video disc and video camera.

The AV-7000 with hi-fi television, compact disc player, synthesiser/tuner, double cassette deck and turntable is priced to sell for around $4195-00.

Compact Philips systems include vertical CD

Vertical compact disc decks are the highlight of a new range of Philips 4-Play (3-in-1 plus CD) audio systems.

The vertical CD was strongly featured at the recent international Consumer Electronics Show in Las Vegas, and was instantly popular with both dealers and the public. With the vertical system, the compact disc is inserted into the deck in the same way a hi-fi cassette deck is operated. This method is faster and easier than the horizontal CD tray system, and the disc can be viewed through the front panel.

Three 4-play systems are available with vertical CD: the XC3006B shelf unit with a recommended retail price of $959; SC3115B floor standing system at $1129 and the deluxe hickory walnut SC3149 at a recommended retail price of $1249.

Each system features 60 watts peak music power, dual cassette facilities, high speed dubbing, continuous play, and five band graphic equaliser. The CD player has 20 track memory, random access, and digital display. An AM/FM stereo radio, digital tuner, 12 pre-set channels and belt drive turntable with magnetic cartridge, completes the Philips 4-Play combinations.

Two new Tannoy speakers

Tannoy has released two further consumer loudspeakers, the M20 Gold Mk2 and the Jupiter S, to complete its Planet Series, a family of high quality hifi loudspeakers to serve all levels of the consumer market.

The M20 Gold Mk2, shares the dimensions of the existing Mercury S and has flush fitting baffle and full length grille. It has the facility for bi-wiring from the amplifier and boasts gold plated terminals. It is finished in Walnut or Black real wood veneer.

The Jupiter S is a twin 8" system with a high sensitivity of 91dB and peak power handling of 150 watts. When coupled with the extended low frequency response, this system is capable of dramatic performance. The Jupiter S will be available in Black Ash vinyl only.

The Tannoy Planet Series of loudspeakers are available from Hi-Phon Distributors.

Home video arcade

The Nintendo System is a complete video games package which includes ROB, the world's first interactive games robot. ROB is totally wireless and operates via photosensors which read signals directly from the screen. Also included is the Zapper light sensing gun, Control Deck, two Controllers and two Games Packs. Each part can also be bought separately.

In order to start playing with Nintendo you need only get the Control Deck and a game or two.

The Nintendo System plugs directly into any standard TV and is instantly ready to play. Everything is constructed of durable, high impact resistant plastic for long, trouble free life. ROB even has clutch driven motors which disengage if he's interrupted while moving as a further safety feature.

There's a great range of games in the current Nintendo library and more are being added all the time. All are based on popular established games and have varying levels of play from beginner to "you'll never get this good". Dick Smith Electronics carry all in the current Nintendo library which include sports, action and even program-yourself games.

The Deluxe Pack which includes the control deck, ROB the interactive robot, Zapper light gun and two games (Cat Y-7860) retails for only $399, from Dick Smith Electronics stores.

Entertainment electronics update:

Super VHS video is on the way

Domestic video recorders using the new enhanced "Super VHS" system are expected to be released in Australia before the end of the year. Here are details of the ways in which S-VHS differs from the existing VHS system, and the kind of improved performance it offers.

by JIM ROWE

Early last year, the Victor Company of Japan (JVC) announced the development of a new enhanced version of the widely-accepted VHS video recording system, which it actually invented back in 1976. Dubbed *Super VHS* or S-VHS, the new system was initially only developed in a form compatible with the NTSC colour TV system, as used in the USA and Japan.

The first NTSC Super VHS model VCRs were released on the US and Japanese markets very early this year, and at about the same time JVC also announced that specifications had been finalised for the PAL/Secam version of Super VHS – to be known as the *Super VHS Euro System*. Since then various companies including JVC and Panasonic have announced that they will be releasing Super VHS Euro System VCRs on the market before the end of the year.

At this stage, to the best of my knowledge, the only "live" demonstration of Super VHS in Australia has been by Panasonic. Along with a number of other media people I was invited along to the demo, which was using an NTSC recorder and monitor specially imported from Japan – along with some matching pre-recorded tapes.

The results were very impressive indeed, with pictures so much brighter and sharper than existing home video that they almost seemed "too good to be true". Even hardened media types like yours truly agreed that it gave the kind of picture quality you normally don't see anywhere but on the monitors in a TV station previewing room.

In short, and judging by that demo, my impression is that S-VHS is much more than just another relatively minor "tarting-up" or refinement of the existing VHS system. The improvement in picture quality is quite substantial, almost lifting the system into the kind of performance you'd expect from HDTV (high definition TV).

Not much has been released in the way of "hard" performance figures for S-VHS, but the horizontal resolution is quoted as over 400 lines, compared with about 240 lines for conventional VHS. Apart from that it is said to offer significantly improved video signal-to-noise ratio and reduced crosstalk between the luminance and chrominance information, resulting in less colour streaking and fringing in fine details, and freedom from moire patterning with certain hues.

Like everything else in life there's a price to be paid for these improvements, as I'll explain shortly. But for the moment, let's look at the ways that the shiny new S-VHS differs from the old faithful VHS that we all know and love.

How it's done

If you've been following David Botto's series of articles on VCR operation, you'll know that colour video signals are not recorded on the tape in the same form that they're fed into and out

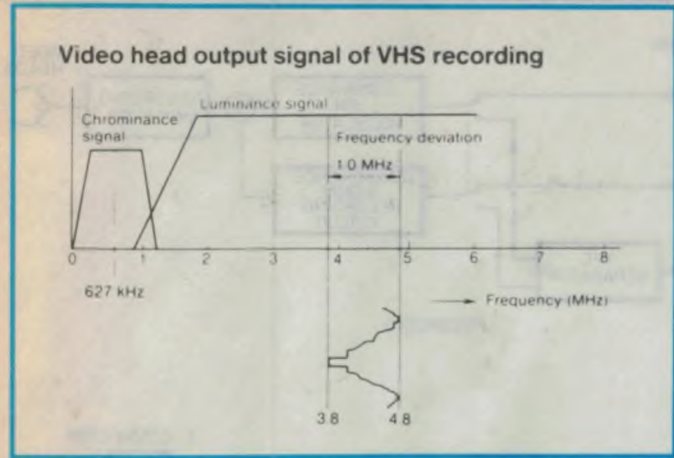


Fig.1: The recording system used for conventional VHS. The FM luminance subcarrier is deviated by 1MHz.

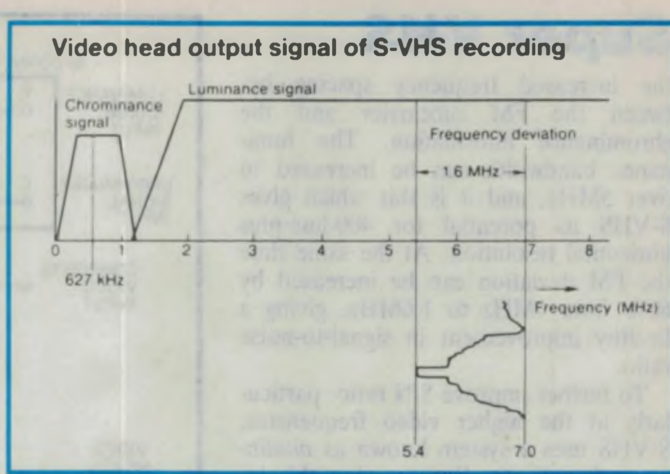


Fig.2: The system used in Super VHS. As well as being moved up by almost 2MHz, the FM subcarrier is deviated by 1.6MHz.

of the recorder. Instead the basic monochrome video or *luminance* information is separated from the colour or *chrominance* information for recording, and the two are recombined again during replay.

The luminance information is actually recorded using a process of frequency modulation (FM), with its subcarrier signal also used as a high-frequency bias for the recording of the chrominance signal – which is frequency converted down from its usual PAL colour subcarrier frequency of 4.43MHz to a much lower figure.

The actual scheme used in conventional VHS video recorders is shown in Fig.1. The luminance signal is used to frequency modulate a subcarrier centred on around 4.3MHz, with a deviation of 1MHz. In other words, the subcarrier frequency swings between 3.8MHz when recording sync pulse tips, up to 4.8MHz when recording peak white levels in the picture.

The chrominance signal is down-converted from being centred around its normal 4.43MHz colour subcarrier frequency, to become centred instead on 627kHz. This "rotational chroma" signal is then recorded in the usual way, using the FM luminance signal as its high-frequency bias.

To minimise crosstalk and interference between the two signals, the sideband information of the FM luminance signal must be prevented from significantly overlapping with the chrominance information, in the region around 1MHz. This is done by restricting the luminance bandwidth to about 3.2MHz – which is what gives normal VHS its horizontal resolution limit of around 240 lines.

In contrast, Super VHS shifts the FM subcarrier used to record the luminance information up almost 2 megahertz to a centre frequency of 6.2MHz, as shown in Fig.2.

The effect of doing this is that the luminance bandwidth and the FM deviation can both be increased, because of

Super VHS Euro System Specifications (625 lines/50 Hz)

1. Cassette Tape conforming to S-VHS Euro System standard	
High performance tapes	
SE-180, SE-120, etc.	: Full-size VHS cassette with an ID (identification) hole
SE-C30	: Compact VHS cassette with an ID hole
2. Recording Modes	
SP mode : tape speed	: 2.34 cm/sec
recording time	: 3 hours (with an SE-180 cassette)
LP mode : tape speed	: 1.17 cm/sec
recording time	: 6 hours (with an SE-180 cassette)
3. Video Signal Recording System	
Video input/output signal	: PAL signal, SECAM signal, or some other signals (such as MAC signals)
Luminance signal recording	: Frequency modulated (FM) recording
FM carrier frequency	
White peak	: 7.0 MHz
Sync tip	: 5.4 MHz
Deviation	: 1.6 MHz
Clip level	
White clip level	: 210 %
Dark clip level	: 70 %
Emphasis	
Main emphasis	: VHS standard emphasis
Sub emphasis	: Non-linear emphasis
Chrominance signal recording	: Colour-under phase-shift recording of quadrature modulated chrominance signal
Carrier frequency	627 kHz
4. Audio Signal Recording System	
Linear track recording	: Conforming to VHS audio recording method
FM recording	: Conforming to VHS audio recording method
5. Playback (signal) Performance	
Horizontal resolution	: More than 400 lines

Table 1: A basic summary of the specifications for the Super VHS Euro System. Separate luminance and chrominance signals are provided on playback, to feed to a matching S-Terminal.

Super VHS

the increased frequency spacing between the FM subcarrier and the chrominance information. The luminance bandwidth can be increased to over 5MHz, and it is this which gives S-VHS its potential for 400-line-plus horizontal resolution. At the same time the FM deviation can be increased by 60% from 1MHz to 1.6MHz, giving a healthy improvement in signal-to-noise ratio.

To further improve S/N ratio, particularly at the higher video frequencies, S-VHS uses a system known as *nonlinear subemphasis*. Exactly what this involves is not clear, as virtually no technical details have been released. However it appears to be a type of HF pre-emphasis during recording, and de-emphasis during playback – perhaps with compression and expansion as well.

The other main difference between S-VHS and conventional VHS is that the new S-VHS recorders are designed to feed separate luminance (Y) and chrominance (C) signals directly to a special video monitor, for the best possible playback quality.

With existing video recorders, it has always been desirable to feed the output video directly to a monitor, or the equivalent video input of a TV receiver provided with one. This inevitably provides better playback quality than using them to modulate an RF carrier for feeding into the receiver's normal antenna socket, because it avoids the inevitable bandwidth reduction and other degradation caused by the RF modulation and demodulation processes.

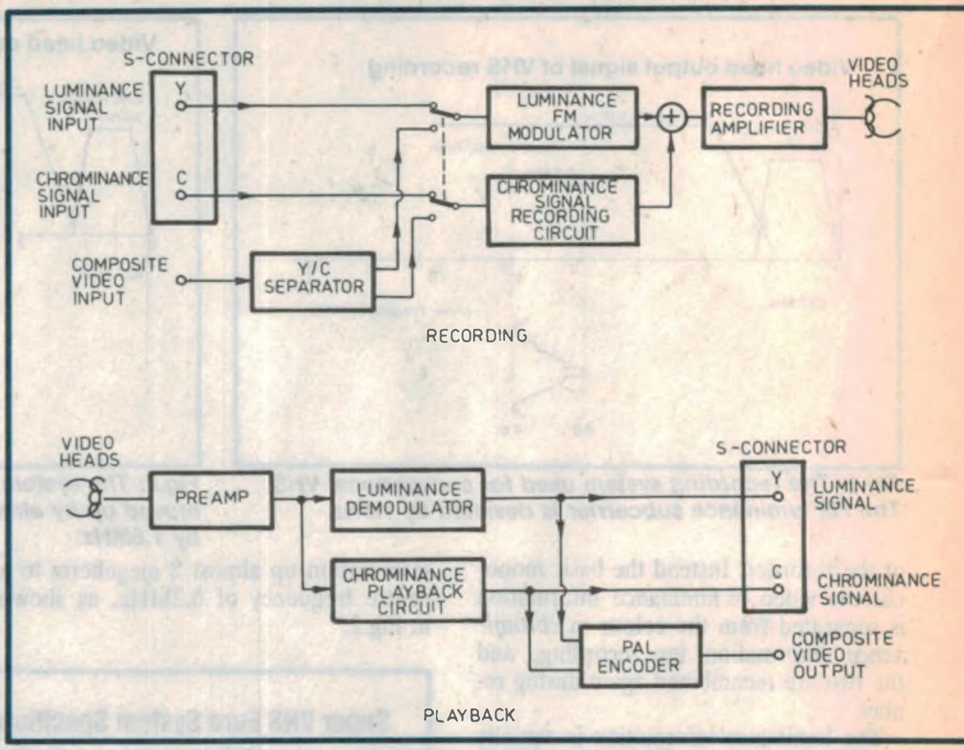


Fig.3: A typical S-VHS recorder will accept either composite or separate Y/C signals for recording, and produces both again on playback. For best results the Y/C signals must be used.

Essentially what S-VHS recorders do is carry this idea one stage further. Having separated the luminance and chrominance for recording and playback, they then simply restore them as they stand, as two separate Y and C signals. This avoids the process of combining them again as an encoded composite video signal, as in existing recorders, which inevitably involves some further signal degradation.

The video signal processing used in S-VHS recorders for recording and playback is therefore as shown in Fig.3. The machines are designed to accept either normal composite video (from a camera or RF front end), or already separated Y and C signals (from say another S-VHS recorder, during editing).

Special comb filtering is used to separate the luminance and chrominance information from incoming composite video. This is necessary because the wider luminance bandwidth of S-VHS allows it to record the full encoded bandwidth – not just that below the chrominance information. Simple filtering is therefore not sufficient. As the comb filtering to extract the luminance information involves a 1-horizontal-line delay, a similar 1H delay is applied to the chrominance signal to maintain the two in synchronism.

On playback the recorded luminance and chrominance signals are simply amplified and demodulated, and are then made available via the Y and C connectors to feed to a matching "S Terminal" – a high quality video monitor (or receiver) with separate Y and C inputs. The typical S Terminal also has a colour CRT with rather finer colour dot/stripe pitch than those fitted to normal TV receivers, rather like those fitted to high-res computer monitors. This allows it to take full advantage of the greater resolution available from S-VHS signals.

The S-VHS recorder will typically not provide only the Y/C outputs, but a normal composite video output as well via the usual PAL colour encoder. It may also provide a modulated RF output, as with current machines. But inevitably the playback picture quality obtainable via either of these alternative outputs will be poorer than via the Y/C outputs, because of the additional processing. In fact one estimate is that using the modulated RF output with a conventional TV receiver will probably "throw away" about 100 lines of horizontal resolution – most of the advantage of S-VHS, in fact.

In other words, to get the full advantages of S-VHS, you'll really need to use the Y/C playback system, and with a monitor or receiver designed to provide the matching Y and C inputs. Needless to say, these aren't going to be cheap. Nor does it appear likely that Y/C inputs can be fitted easily or cheaply to existing receivers or video monitors.

The down side

So to get those much sharper and cleaner-colour Super VHS pictures in your lounge room, you're going to have to pay a fairly high price: not just for a new S-VHS VCR, but for an S-Terminal receiver or monitor as well. I suspect you're not going to get much change out of $2500, if you want to be first on the block to upgrade to Super VHS.

The other sobering aspect about Super VHS is that it's only partially compatible with existing VHS equipment and tapes. Because S-VHS records the luminance information on an FM subcarrier 1.6MHz higher in frequency, S-VHS recordings can't be played back on a standard VHS recorder. And although your existing standard VHS tape can be played back on a Super VHS machine, this will only produce normal VHS picture quality of course. If you want to see your movies in glorious S-VHS, you'll have to buy new tapes.

Super VHS uses essentially the same videotape cassettes as existing VHS, except that they have a small identification hole to allow the S-VHS machine to tell when it has an S-VHS cassette fitted. S-VHS machines can in fact operate in either normal or Super modes, for both recording and playback – but will only work in S-VHS mode when an S-VHS cassette is fitted.

To get the optimum results from the S-VHS system, the new cassettes are fitted with the latest high performance tape. This has extremely fine cobalt-ferric magnetic particles and takes advantage of recent developments in binder formulation and coating technology. It is also "super calendered" to give it an exceptionally smooth surface.

The limited compatibility between Super and ordinary VHS is going to mean that firms who sell or rent prerecorded tapes will have to provide two separate versions of their movies, once Super VHS gets under way. Just when they thought it was safe to standardise on a single system!

There's no doubt that Super VHS does indeed represent a leap forward in home video performance. And I'm told there's a similar development coming shortly in the Betamax camp, to be called "Extended Betamax" or E-Beta. No doubt this is the way home video is likely to go, at least in the near future – along with further growth of the Video-8 format.

I guess a few years from now, we'll all have different VCRs and TV/monitors in our lounge rooms. And they'll probably be fitted with Y/C or similar separate-component video inputs. But for the present I wouldn't be surprised if the double price hurdle of having to buy both a new VCR and a new TV/monitor makes for a slow start to the S-VHS/E-Beta video revolution, even when the gear is released.

My thanks to the marketing people at Panasonic and JVC for their help in getting some of the above information on Super VHS. Hopfully when the first PAL gear does arrive, we'll be able to check one out and tell you more. Super VHS may be pricey, but those demo pictures I saw certainly looked good. It would be interesting to see if we're all going to be able to duplicate them!

New Horizons in Television

Advances in technology are greatly expanding the choices when it comes to television reception in Australia. Here's a look at the alternatives that have either become available recently, or will do so shortly.

by THOMAS E. KING

When the first television pictures flickered across the lounge rooms of Australia, audiences were delighted and satisfied. Apart from the cinema there wasn't anything else that could offer such action and entertainment – except perhaps Saturday night at the local pub!

It's 30-odd years later, and the scene in some areas hasn't changed all that much: Saturday night at the local is still lively and the cinema occasionally still draws crowds. Television, however, has changed greatly. Over the past three decades the start of PAL colour transmissions, stereo sound, station networking, the use of satellites, the adoption of video tape and the embrace of other sophisticated products and procedures has helped create a world-class television industry in this country.

The onward progression of technology not only ensures better quality programming and state-of-the-art electronic images, but gives the home viewer an ever expanding horizon of viewing choices. Aussat, for instance, provided many isolated homes with their first watchable signals. As well it put Sky Channel into pubs and clubs across the width and breadth of Australia. Important though they are to their respective audiences these specialised and restrictive services, respectively, will be overshadowed by the possible introduction of subscription or pay television, a complex issue under statutory moratorium until September 1990.

Some amateur TV studios are surprisingly well equipped. Some ATV signals can be picked up using any UHF receiver.

Currently the subject of a Department of Transport and Communications policy review, pay television would add to the existing range of television services by providing additional programs to the general public – for a fee. Typical program offerings could be feature films and sports broadcasts.

National distribution of pay television services might be via the Aussat system or Telecom bearers with earth transmission on UHF or VHF frequencies, Multipoint Distribution Systems (MDS), cable (either optical fibre or coaxial) or any combination of these. It is also possible that in the case of remote or lightly populated areas, home viewers will use signals direct from the satellite (DBS).

The number and range of pay television services, as well as the manner in which the pay television signal will be delivered are but two of some 10 terms of reference to be examined in the review. The report to follow will be published and circulated for public comment and consultation. It will then be used as a basis for recommending to the Government whether or not pay TV should be introduced in Australia.

Public television

While pay TV is still just over the broadcast horizon, public TV could well be the next television star. Also known as community access TV, PTV will enable community groups to televise locally produced programs using low powered transmitters. This concept is similar to that already well established on the FM band in major centres, and will give TV broadcast opportunities to many groups and organisations that have generally been unable to secure air time, i.e., the disabled, ethnic minorities including Aborigines as well as theatre and sport groups.

The main objective of public television is to gain community access to both the production and broadcasting sides of the television industry. PTV is vitally concerned with giving community groups the opportunity to use the medium of television to express their

Aussat's satellite has brought Sky Channel to many remote locations, like this hotel in Queenstown Tasmania. In the future it could bring pay-TV to ordinary viewers as well.

own messages, thoughts and ideas.

And that's exactly what happened in Melbourne during the first full week of June. Authorised to operate from June 5 to 11 under the first-ever PTV test transmission permit, *Unlimited Television* broadcast on Channel 47 from 6 pm to midnight from studios located in the offices of Open Channel in Fitzroy. (Correspondence, however, should be directed to TVU, PO Box 263, East Brunswick, Vic. 3057.)

The low powered UHF signal covered a radius of about 20km and carried both live and prerecorded material, which had been provided by a cross-section of mainly cultural and ethnic groups as well as independent film and video producers. (As TVU's activities were well publicised in the Independent Video Newsletter, GPO Box 1837, Canberra, ACT 2601, program material was also submitted from other centres.)

It is hoped that this highly successful demonstration of PTV will pave the way for more TVU telecasts. Under Australian Broadcasting Tribunal guidelines three managment "test" broadcasts are allowed to an authorised permit holding station each year. While TVU, obviously wants further opportunities to professionally air community views and issues, the Government "has no commitment at this stage to introduce public TV in the long term".

Despite this conservative approach, community awareness of and interest in PTV continues to grow. PTV groups have been established in Sydney, Brisbane, Adelaide, Perth and Alice Springs. (Sydney's community TV access group, Metro Television, is technically ready for test broadcasts although the unavailability of UHF frequency space is proving to be a major stumbling block.)

Closely watching the progress of PTV groups is the Sydney-based Public Broadcasting Authority. Formed in 1974 this organisation has been responsible for the public broadcasting "explosion". In the past 14 years the PBA has been a major stimulus to helping public radio grow from just 1 station with a restricted licence to 81 stations (7 AM and 74 FM). The challenge now is to give the public a similarly greater viewing choice.

Closed circuit TV

Another viewing option came about because of community interest and support in the Sydney suburb of Redfern. Low income tenants as well as single mothers, the disabled and pensioners felt they were not getting information they needed, so they decided to start their own housing estate broadcasting station, CTV1. The first of its kind in Australia, CTV1 is the Redfern Community Cable Television Station. It began operations in late 1986, thanks to a fund raising effort to buy the modulator and permission from the Redfern and Waterloo Housing Commission.

New Horizons in TV

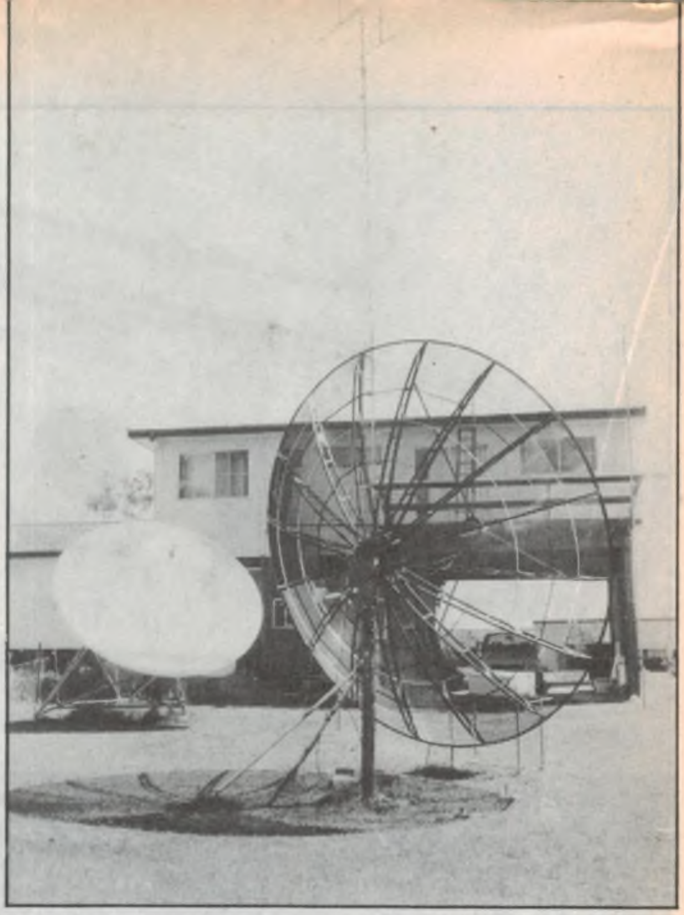
Programming includes local news and mini documentaries plus educational telecasts and music video shows. Additional programs deal with drugs, unemployment, childcare, literacy and other issues which affect the lives of those in this large housing complex. (Anyone considering such a closed circuit cable venture and needing more information may want to contact CTVC1 at PO Box 42, Waterloo, NSW 2017.)

Although amateur radio operators are generally more interested in the technical and experimental side of TV broadcasting than the programming aspect, fast scan amateur transmissions can be seen in many centres around Australia. No special equipment is usually needed beyond a good UHF receiver and antenna, for anyone wanting to watch ATV activities on Channel 35½. (The government authorised ATV allocation for Australian amateurs is between UHF channels 35 and 36.)

Amateur TV activity can be seen in a number of capital cities and provincial centres including Canberra; South Hedland, WA; Brisbane and Townsville; Melbourne; Adelaide and Hobart. In NSW there are ATV groups in Wagga Wagga, Newcastle, the Blue Mountains, Gosford and Sydney where the Gladesville Amateur Radio Club screens live test transmissions for three hours from 7.30 pm every wednesday. There's a repeat test transmission of the Wednesday amateur radio lesson on Fridays, and subsequent non commercial education and informative programs. On Saturday a 2½-hour computer course is transmitted from 7.30 pm while the Sunday transmission, also beginning at 7.30 pm, relates to a technical topic.

One of GARC's greatest successes has been its ongoing series of amateur radio classes offered by Ron Bertrand. These are available to students able to attend weekly lectures in northern Sydney. As well, all instruction is videotaped and made available Australia-wide for a nominal fee. Enquiries should be directed to the Gladesville Amateur Radio Club, PO Box 48, Gladesville, NSW 2111.

GARC's novice and full call lectures are also available to the Sydney population at large as they constitute a major part of the club's regular ATV test transmissions. Ironically since there is no publicity about the Sydney signal on Channel 35½, few viewers outside the amateur radio fraternity know of this most professional of amateur operations.



From his home on the Central Coast of NSW, Vic Barker VK2BTV can transmit amateur TV and also receive signals from a number of satellites, using these antennas.

Satellite reception

Steve Gregory, VK30T, is also a member of Australia's slowly expanding amateur TV fraternity – but instead of exclusively spending time transmitting ATV test transmissions or obtaining QSL cards from little heard countries, this electronics enthusiast devotes many hours to watching programming coming from an orbiting satellite. Not content with monitoring domestic Aussat broadcasts (which anyone with readily available equipment can now do), Steve points his 3.7-metre dish at Intelsat 5/F8 to watch programs beamed across the Pacific.

There are but a handful of people around Australia – Steve estimates the number at perhaps 20 – who are serious enough to have invested a minimum of $2500 for the satellite dish, receiver, low noise converter and necessary hardware needed to watch television signals from space.

And what can be seen after you have assembled an assortment of a equipment available through outlets such as Melbourne's VicSat, Sydney's Orient & Pacific (OPAC), Dick Smith Electronic Centres or Queensland's Sat Pacific? (this latter Gold Coast-based supplier headed by Tom Courtney VK4DDG, and Axel Fager VK4YBE, is currently manufacturing some items for the satellite hobbyist and aims to be the largest outlet of equipment in Australia within a year.) "A lot, " says Steve Gregory.

For starters there is a wide variety of news and special program feeds from the three American TV networks: NBC, ABC and CBS. CNN, America's Cable News Network can be seen on Intelsat 5/F8 as well as AFRTS (Armed Forces Radio & Television Service). Unfortunately AFRTS transmissions were due for encoding in July/ August, which will be a blow to followers of American sports and the "Johnny Carson Show".

Intelsat 5/F8 is also used by RFO as a domestic broadcast link to span the 800 km between the Marquesas Islands and Tahiti. However, this service will only likely appeal to language students as transmissions are in French!

After "language lessons" are over, Steve Gregory either listens to one of several FM subcarriers that come over the satellite from California, or watches as one of the television feeds from Los Angeles. Channel 13 (KCOP) is a favourite, because of "great science fiction movies" and new episodes of "Star Trek". These offerings are beamed to an orbiting television station and received by a minute hobbyist audience in Australia, eagerly tuning the dial in search of still more choices on the television horizon.

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The night they got together for

Fairchild's farewell

For a brief, precious moment, time seemed to stand still as the two ends of a loop in time met –enclosing all of the history that has been made during the past 30 (mostly stormy) years of semiconductor development. For there on the podium of the grand ballroom at the Hyatt Hotel in Palo Alto were the original eight founders, reunited for the first time in 30 years in the same room where they held their first meeting after forming Fairchild Camera & Instruments in 1957.

by PAUL SWART

For the first time that night everyone of the 1,200 Fairchild alumni who had come to pay their last respect to the company that started it all, stopped talking to give a standing ovation to the eight men who "put the silicon into Silicon Valley" and started an industry that today is doing in excess of $US30 billion in sales.

The reunion was the emotional highlight of a day of festivities that started at National Semiconductor's headquarters in Santa Clara, where a 146,000-square-foot, state-of-the-art research centre was dedicated as the "Fairchild Research Center."

Or as master-of-ceremonies Fred Hoar put later that evening in his typical cynical way: "Fairchild worked its way from a laboratory operation in the solid state field...to a laboratory operation in the solid state field..."

At the dedication earlier in the day, National president Charlie Sporck recalled how Fairchild pioneered the planar process, which he called "the genesis of high-tech."

The Fairchild research centre, he told thousands of National and Fairchild workers outside the centre, symbolizes the continued commitment of both National and other Silicon Valley chip makers to R&D. "Silicon Valley didn't grow here by accident. It is still the most fertile area in the world for technology talent. The Fairchild Research Centre will be the place where we continue to sow the seeds for future growth."

Dedicating its R&D centre to Fairchild, Sporck said, was the natural thing to do. It will keep the name and spirit of the company alive and "honours a rich and innovative industry. "I'm not even going to attempt to list the technological breakthroughs of Fairchild, because they are too numerous."

Who was there

For most of the 1,200 "Fairchildren", as the alumni of the company call themselves, the evening's party turned into a massive reunion of old friends, even though many of them are considered archrivals in today's market.

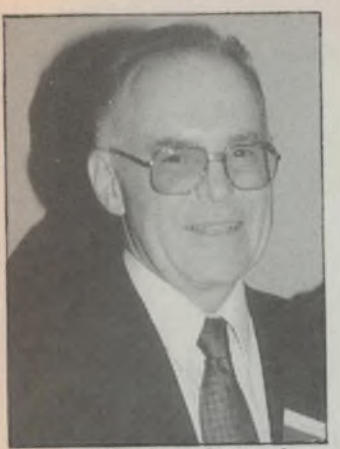
By all accounts a vast majority of the semiconductor companies in Silicon Valley, as well as many other electronics firms in the area, started out as spin-offs from Fairchild. The company was often referred to as "Fairchild University", because of the tendency among talented executives to learn the business at the Mountain View company, only to quit and start up a competing company several years later.

Many of Fairchild's most famous fairchildren were among the crowd, including Intel founders Andy Grove (president) Gordon Moore (chairman) and Robert Noyce (vice chairman), the latter two of whom were also among the 'Fairchild Eight".

National Semiconductor President Charlie Sporck, himself an early general manager of Fairchild, and former Fairchild presidents Wilf Corrigan (now chairman of LSI Logic) and Les Hogan

Above: National's president Charles Sporck dedicates the new Fairchild Research Center.

Left: Fairchild's founders reunited. Clockwise from bottom right are Last, Hoerni, Grimish, Noyce, Roberts, Moore, Kleiner and Blank.



Fairchild cofounder and current Intel chairman Gordon Moore.

Current Intel vice-chairman Robert Noyce (right), also an original Fairchild cofounder.

(now retired) refreshed old memories with scores former colleagues. Some of the fairchildren had come to the reunion from as far away as Australia, Mexico, Europe, and most of the 50 US states.

Noticeably absent, however, was AMD chairman Jerry Sanders, an early marketing vice president of the company. As was Donald Brooks, who unsuccessfully tried to keep Fairchild alive by trying to first sell the company to Fujitsu in 1968, and later couldn't get enough backing for a management buy-out when the Fujitsu deal was blocked by the Reagan Administration. This was the move that opened the way for a mere $120 million from its parent Schlumberger.

For trivia buffs, there was Murray Siegel, the first employee hired by the original eight. And John Giblin, who is in his 32nd year of employment at Fairchild, since he joined the chip maker's parent company, "Fairchild Camera & Instrument," in 1956.

Also present was Arthur Rock, who is credited with getting Sherman Fairchild to provide the eight founders with $US1.5 million of initial start-up money – ironically, after no less than 35 other major sources of venture capital had all turned down the opportunity to invest in Fairchild. "No one had ever bought a package of eight founders," Rock recalled.

Unfortunately for the organizers of the event, the roasting of former Fairchild executives by Fred Hoar, was enjoyed by only a few of the 1,200 partygoers, as the repeated requests for silence fell under – rather was trampled by – the crowd. Even charismatic Charlie Sporck was only moderately successful in quieting the crowd when he banged his fist on the speaker podium and threatened not "to say another damn word" until everyone would stop talking and listen.

"We always were an unruly bunch," quipped Geri Handley, a former Fairchild public relations manager and co-ordinator of the party. "You should try managing all these people. Now you know why there were so many spin-offs from Fairchild".

The "roast"

For the few hundred gathered around the stage, Fred Hoar delighted many with a slide show and his comical jabs at former Fairchild executives ("I saw Charlie Sporch, Bob Noyce, Wilf Corrigan, and Gordon Moore here earlier, names that used to strike fear into the hearts of the Japanese") and at the chip industry in general. ("Working in the semiconductor industry is like making love to a gorilla... You don't get to stop when YOU want to!")

Hoar recalled how many of Silicon Valley's early chip companies used to spy on each other to learn about the latest technological developments. Some companies are known to have sent engineers to popular restaurants located near a competing firm to try to pick up valuable information from conversations at nearby tables. "Some of us remember when Charlie (Sporck) got his research at National from Fairchild. Somehow, the designs from out R&D lab in Palo Alto always seemed to made it to Mountain View by way of Santa Clara.."

Hoar also dished out some questionable honors, including "Most Cars" to Wilf Corrigan and Jerry Sanders, and "Most Wives" to Andy Procassini (now SIA president).

Partygoers were also treated to a slide show that showed a young Charlie Sporck sucking a big cigar, and an even younger Jerry Sanders with closely-cropped dark (!) hair and black beret while lounging in an inner tube during one of Fairchild's traditional sales meeting in Hawaii.

Hoar also noted that "Many of you have brought your wives tonight, which is a big change for this industry..."

Maybe the industry is growing up.

Footnote

Here is where the eight founders of Fairchild are today:

Julius Blank	Director of EEPROM maker Xicor
Victor Grinish	President of Escort Memory Systems
John Hoerni	Consultant in Idaho
Eugene Kleiner	Partner in the Kleiner Perkins, Caufield venture capital firm
Jay Last	Vice president of Teledyne
Gordon Moore	Chairman of Intel
Robert Noyce	Vice chairman of Intel
Sheldon Roberts	Consultant in Oregon

And Employee No. 1:

Murray Siegel	Strategic Accounts Manager at Cirrus Logic

Above: National's president Charles Sporck is explansive mood. Right: Intel president Andy Grove (left) with former Fairchild president Les Hogan.

Shortwave radio review:

Sony's new ICF-SW1S system

Shortwave receivers with microprocessor control and fully synthesised tuning are now fairly common, right? But not this small, folks. Sony's engineers have now managed to compress one down to the size of an audio cassette!

When the man from Sony rang up to ask if I'd like to check out the firm's latest you-beaut fully synthesised all-band shortwave radio, I said "Sure!". Sony gear is nearly always innovative, pushing the frontiers of technology rather further than most of its competitors, so it's always interesting to see the latest offerings. But I wasn't quite prepared for what this one turned out to be.

Even when it arrived, the overall package looked about the size you'd expect for a receiver about the same size as other modern synthesised models – about 310 x 240 x 75mm. But when I opened it up to look at the receiver, there inside was a neat moulded plastic carrying case. None of the usual expanded polystyrene foam packing...

Then when I opened up the case, my first reaction was that I must have received only half the outfit. The case seemed to contain only accessories: a neat little separate telescopic whip antenna with retracting cable, a little gadget labelled "Ant Controller", a little container with a pair of in-the-ear phones, carrying strap, etc. etc. But where was the actual ICF-SW1S receiver itself?

The only item left in the case was a little protective bag about the size of a compact audio cassette, in dark grey and with the solitary word "Sony" on the front. Surely this couldn't be it? But it was.

Presumably not satisfied with cramming cassette recorders and CD players into the smallest possible cases, Sony's engineers have now turned their attention and design expertise to performing the same trick with a general-coverage synthesised tuning shortwave receiver. They've even thrown in scanning, a stereo FM receiver and digital alarm clock as well, just for good measure.

The ICF-SW1S receiver itself measures only 110 x 71 x 23mm, about as small as all but the very tiniest broadcast band personal portables. But inside that tiny case you're getting a sensitive general-coverage receiver of the kind that up until only a few years ago would have taken up a big rack-mounting case.

What does it do? Well for a start, it tunes from 150kHz to 29.995MHz for AM, and 76.00 to 108.00MHz for FM stereo or mono – all with fully synthesised PLL (phase-locked loop) tuning and microprocessor control.

The coverage of the two bands is continuous, although like all receivers with synthesised tuning, this means tuning which increments and decrements in small discrete steps. However from a practical point of view with the ICF-SW1S this is not very significant, as the steps are always smaller than the set's effective bandwidth. So very little is missed.

The actual tuning step size varies automatically with frequency, to give the best results. Between 150 and 531kHz in the long-wave band, the steps are only 3kHz, small enough to cope with resolution of fairly narrow band signals like those from beacons.

Then for the MW broadcast band from 531 to 1611kHz, the tuning changes in 9kHz steps to suit the station channel spacing in Australia and many other countries. For countries like the USA and Canada which use 10kHz channel spacing, the steps can be changed to this figure, using a small switch accessible via the battery compartment at the rear.

For the rest of the ICF-SW1S AM coverage across the shortwave bands, from 1615 to 29995kHz, the tuning step size changes to 5kHz. And finally for the extended FM band coverage, from 76.00 to 108.00MHz, it changes to the appropriate 100kHz steps to suit the international channel spacing in this part of the spectrum.

Tuning itself can be done in a number of ways. The most direct way is simply to key in the frequency you want, using the keypad. This is very straightforward: you simply press the AM or FM band buttons first, then the number keys for the frequency you want, and finally the band key again.

By the way, if you try punching in a frequency outside of the bands provided on the ICF-SW1S, it simply displays a little "Try Again!" message on the LCD display.

Once you're at a frequency, you can move up or down from it using the "+" and "-" manual tuning keys. These take you up or down in frequency, in single steps if you press them briefly, or multiple steps if you hold them down for more than a second or so.

The third way of reaching a new known frequency is to press one of the keypad digit buttons directly. This will call up one of the 10 preset frequency memories, which can each be programmed with any frequency on either the AM or FM bands.

Programming any desired frequency into one of the 10 memories is very easy, too. All you do is tune in the desired signal manually, and then press the appropriate digit button while holding down the Enter key.

Finally there's scanning. Pressing the Scan Tune button sets the ICF-SW1S incrementing upwards from the frequency it's currently tuned to, looking for another signal. It then stops briefly, allowing you to listen to what it has found. If you press the button again within 1.5 seconds, it will stop scanning and remain on the new station; otherwise it will keep going and searching for new signals.

To make scanning more practical, the set divides the 150 – 29995kHz AM band into 17 different sub-bands, each corresponding to a popular part of the spectrum for international or other broadcasting. So in scanning mode, the receiver doesn't attempt to scan the entire LW-MW-SW spectrum, but only the immediate sub-band enclosing the frequency setting at the start of the scan.

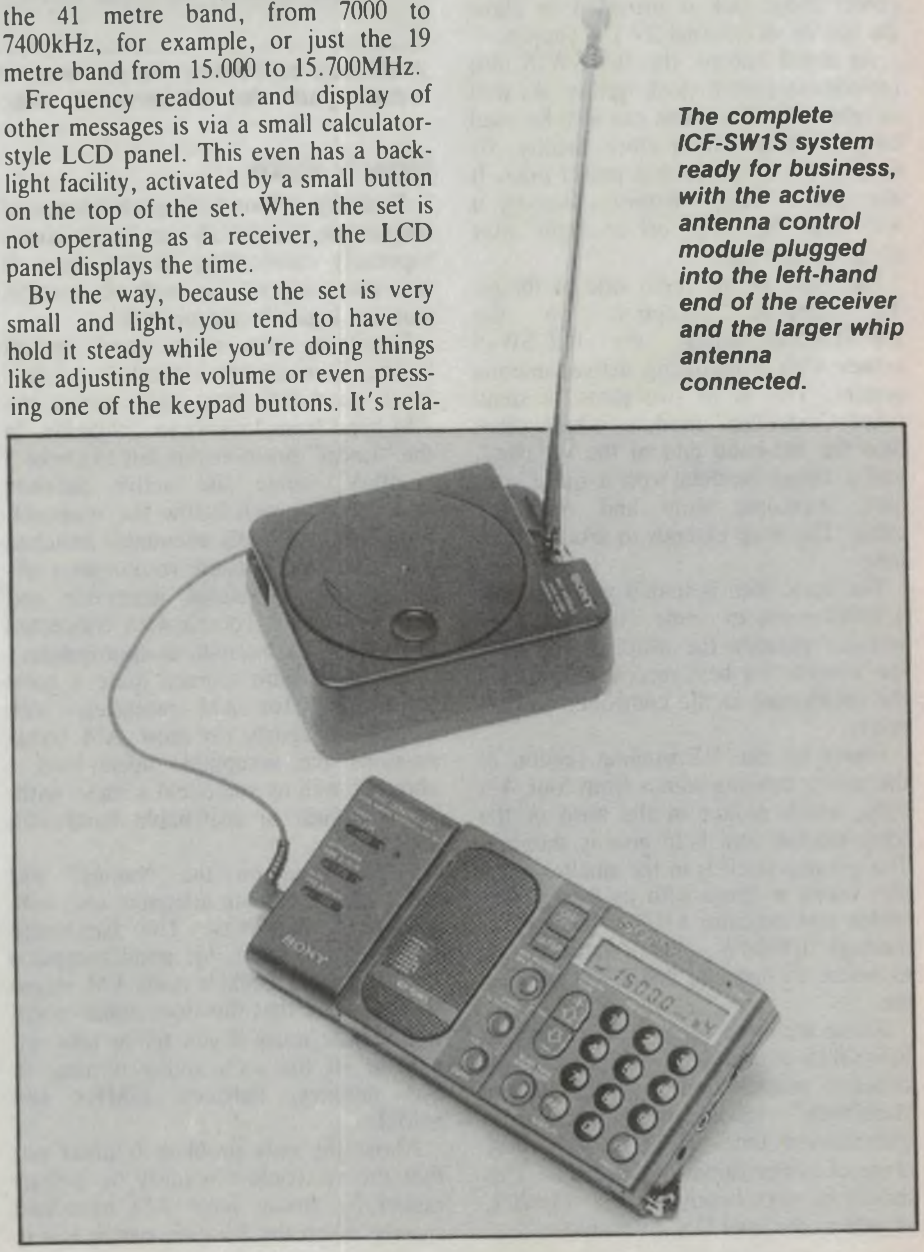
This makes it very easy to scan just the 41 metre band, from 7000 to 7400kHz, for example, or just the 19 metre band from 15.000 to 15.700MHz.

Frequency readout and display of other messages is via a small calculator-style LCD panel. This even has a backlight facility, activated by a small button on the top of the set. When the set is not operating as a receiver, the LCD panel displays the time.

By the way, because the set is very small and light, you tend to have to hold it steady while you're doing things like adjusting the volume or even pressing one of the keypad buttons. It's relatively easy to brush against another button accidentally, when you're doing this. I suspect it's because of this that Sony has provided a "Key Protect" button, which effectively locks out all other keys once you've set them for a wanted signal. They all become inoperative until you press the Key Protect button again.

The ICF-SW1S is effectively a double conversion superhet for the AM bands, with single conversion for the FM band. It has a built-in ferrite rod antenna for the LW and MW bands, and a small telescopic whip antenna for the SW and FM bands. When retracted the whip also becomes the input contact for the matching active antenna module – more about this shortly.

Other facilities of the receiver include a miniature red LED to indicate the



The complete ICF-SW1S system ready for business, with the active antenna control module plugged into the left-hand end of the receiver and the larger whip antenna connected.

presence of a signal; a two-position tone control, marked "News – Music"; a 3.5mm jack for stereo headphones; a similar jack (but mono) for connection to a recorder; and a "DX - Local" RF sensitivity switch, to reduce overloading on very strong local signals.

The speaker built into the receiver is a tiny rectangular type measuring 66 x 38mm, which considering its size has quite respectable tone and clarity.

Power for the receiver comes from two AA-type cells, which fit into a compartment at the bottom rear. The current drain is fairly solid (around 75-80mA), but Sony claims the set will typically operate for about 12 hours from one pair of cells if used for four hours per day. A miniature concentric power input jack is provided to allow the use of an external 3V DC supply.

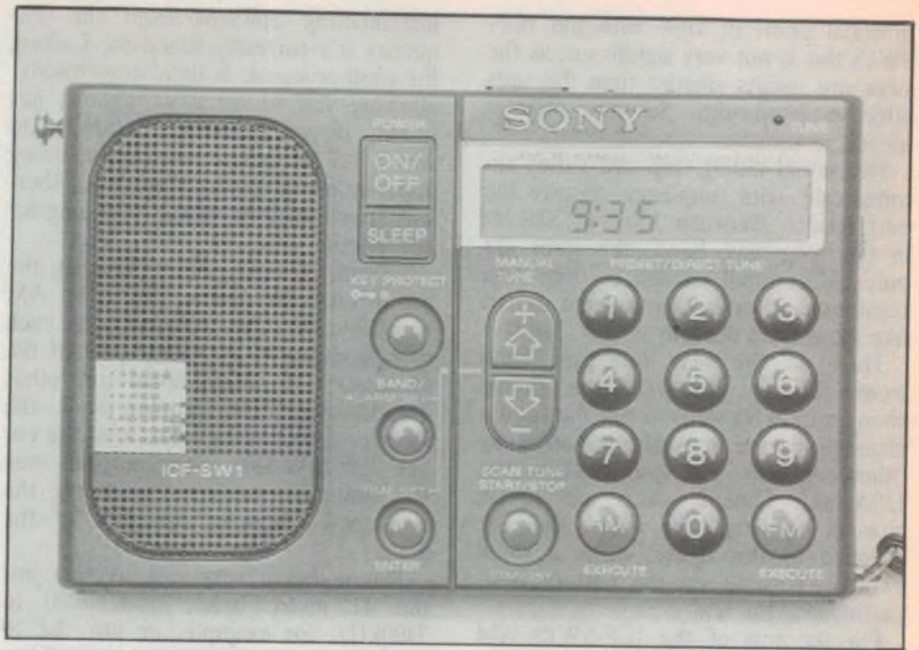
As noted before, the ICF-SW1S also includes an inbuilt clock facility. As well as telling the time, this can also be used to provide an alarm clock facility, by turning on the radio at a preset time. It also has a "Sleep" feature, whereby it will turn the radio off at night after about 65 minutes.

But back to the radio side of things. To improve reception on the LW/MW/SW bands, the ICF-SW1S comes with a matching active antenna system. This is in two parts: a small "Ant Controller" module, which plugs into the left-hand end of the set itself, and a larger module with a quite sizeable telescopic whip and retracting cable. The whip extends to around 1.3m long.

The basic idea is that if you're inside a hotel room or some other building, you can position the whip module near the window for best reception, and run the cable over to the controller and receiver.

Power for the RF preamp section of the active antenna comes from four AA cells, which mount in the base of the whip module and help give it stability. The preamp itself is in the smaller module, which is fitted with its own power switch and indicator LED, a bandswitch marked "LW/MW – SW", and a switch to insert an optional 20dB RF attenuator.

Along with the other accessories the ICF-SW1S comes with an operating instruction manual and a special "Wave Handbook", giving frequencies and transmission times (UTC) for a wide range of international broadcasters. This should be very handy for the traveller, as well as the avid DX enthusiast.



A closeup of the new set, just a whisker smaller than actual size. Not bad for a fully synthesised all-band HF radio, is it?

How it went

Basically, I found the performance of the sample ICF-SW1S very impressive – especially considering its tiny size. It was very easy to use, with all controls working logically and smoothly.

Sensitivity was quite good on all bands. It measured around 1 – 1.5uV for a good S/N ratio, right across the AM band from 150kHz to 29995kHz. In the "Local" position this fell to about 7 – 10uV, while the active antenna boosted it to well below the microvolt level (with the 20dB attenuator switched out, of course!). These results were obtained using a signal generator and dummy antenna combination connected to either whip antenna, as appropriate.

The bandwidth seemed quite a good compromise for AM reception, with reasonable clarity on most AM transmissions and acceptable noise level – about as well as you could achieve without a choice of switchable bandwidth settings.

Performance on the "bonus" FM band was more than adequate too, with plenty of sensitivity. The bandwidth here is fairly wide, for good reception of the normal 200kHz wide FM stereo signals. Note that this does make reception a little noisy if you try to take advantage of the set's ability to tune in FM mobiles, between 76MHz and 88MHz.

About the only problem I found was that the set could obviously be embarrassed by strong local AM broadcast signals, when the RF gain switch was in the "DX" position. This was mainly evidenced by multiple spotting – the stations popping up in various spurious positions on the band (particularly in the LW area).

Switching to the "Local" position avoided the problem, but obviously this would make things difficult if you were trying to log in some distant stations on the bands concerned. A better solution would probably be to use a small tuneable wave trap.

The only other minor niggle was that I found the little switch sliders on the active antenna module a bit loose and flimsy. I had the distinct feeling that if one wasn't careful, they could come off in your hand.

Overall though, the ICF-SW1S is certainly a very impressive little receiver – and all the more so because of its tiny form. It should be excellent for the regular traveller, whether they're a keen shortwave enthusiast or simply want to keep in touch with "home" via Radio Australia. A shirt-pocket marvel!

A final wish: If Sony were to somehow add in facilities like a BFO for single sideband reception, and switchable bandwidth, it really would be a fully functional communications receiver.

Perhaps I've just described the next model...

The quoted retail price for the complete ICF-SW1S package is $799.00, and it should be available from Sony dealers by the time you read this. My thanks to Garry Beauchamp of Sony Australia for the opportunity to try it out on your behalf. (J.R.)

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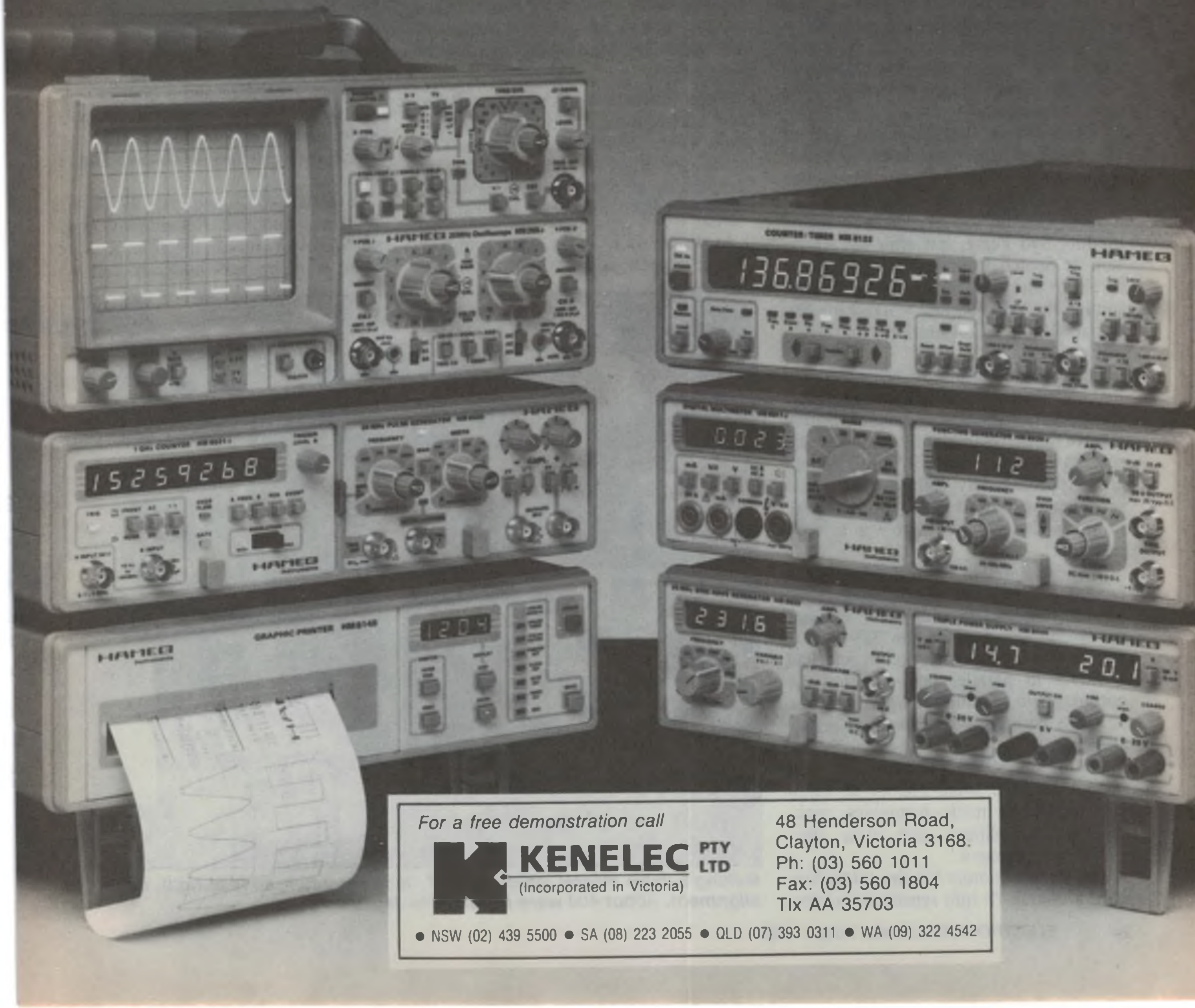

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Australian tape recorder pioneer:

Jack Ferry and his tape recorders

Older readers of our magazine may remember the "Ferry" brand of locally made tape recorders — back in the days of reel-to-reel machines. Here's the story behind Ferry recorders, told by one of the people who worked there.

by NEVILLE ELLISON

Once upon a time, we didn't import our electronic equipment from Japan — we made it right here in Australia. There was even a time when some of the reel-to-reel tape recorders were made in Adelaide.

When World War II ended, one of the soldiers who returned to SA was John (Jack to his friends) Ferry, who had spent the duration in a radar unit.

Jack was the son of Adelaide racing identity Syd Ferry, but after his education at Scotch College his interests lay in electronics rather than racing. Before joining the AIF, he had worked for National Radio Corporation in Grote Street, Adelaide.

After demobilisation, he was soon making good use of his wartime electronics experience manufacturing 5-valve superheterodyne mantel radio sets, in a small factory in lower Mitcham. Approximately 400 of these radio sets were exported to Japan — quite ironic in the light of what was to happen later!

Next he joined the Peerless Radio factory at Prospect, where he designed 32-volt vibratorless radios for country use — his circuit used the 32V as the high tension rail of the circuit, and had 4 valves in parallel push-pull for the output stage. Dunlite marketed these 32V sets with their Freelite wind generating plants.

Before the 1940s were over, he had started his own small factory at Clapham where he made turntables, pickups, hifi amplifiers and even disc recording equipment.

The electric motors for the turntables were a unique 78 rpm synchronous type that had to be started by hand. These and the motors for the wire recorders were made by Mr Gilbert Johnson of Beulah Park.

When magnetic wire recorders made their appearance, Jack immediately made some for the local market. This technology however was quickly superseded by tape recorders, notably the Pyrox and AWA Magictape in 1950.

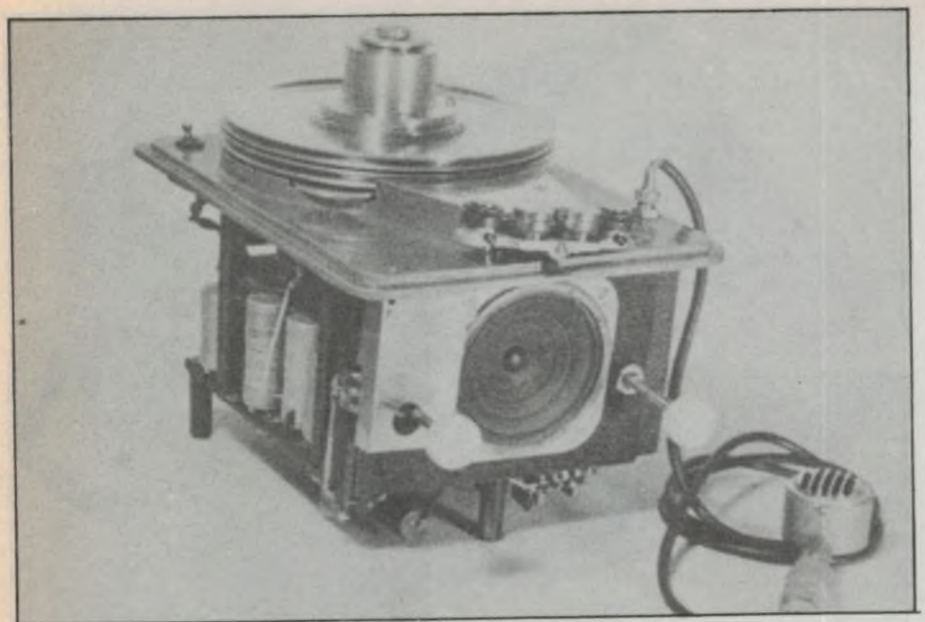
As usual Jack Ferry, his company now registered as Ferry Sound Industries, was quick to embrace the new development. Soon he had made a number of recorders and tape transport decks.

These first tape recorders were single-speed, full track models with no fast forward, and contained in a cast aluminium housing.

Jack's "second wave" of recorders, from 1951 to 1953 were still of cast aluminium construction, but by now with variable speed, fast forward and rewind. Then came models with two speeds, half-track recording and a built-in radio tuner. All of these first machines used a single motor with a figure-eight belt drive to two clutches for take-up and rewind.

In the late 1940s and early 1950s, you could not purchase Record/Play heads off the shelf in an electronics store. There were no text books to tell you

Making 5-valve mantel radios in 1947. Jack Ferry himself is at right, doing the alignment. About 400 were exported to Japan!



The works of a Ferry magnetic wire recorder, made in 1949.

how to make them, either. So we experimented and made our own.

The first tape recorder R/P heads we made consisted of strips of old transformer "Stalloy" metal with sticky tape for insulation, and 40G enamel copper wire windings (high impedance in valve days) with thin slivers of mica to form the gap between the pole pieces. This head assembly was then pressed into an aluminium casting, which was machined with a 1/4" groove to guide the tape past the gap.

Later we punched laminations from "mu" metal for the pole pieces, and used aluminium foil (from cigarette packets) for the material to form the gap. The resulting assembly was then clamped between machined aluminium formers. By 1954 we could purchase "Elemec" brand heads and by 1956 came the "Ultron" brand heads, which we used in all our later professional tape recorders.

When we changed to three drive motors in 1954, we used motors made by BSR in England. These were also used for the semi-professional tape recorders from 1955 on. The motors used for the professional recorders were made by an electric fan manufacturer in the Eastern states.

About this time Jack made tape recorders under the Multivox and Bluebird labels, for McDougalls and Ralph Peterson respectively to sell as office dictation equipment.

In 1954 Jack started advertising in *Radio & Hobbies*, the forerunner to *Electronics Australia*, and in late 1955 his advertisements were to be seen on some Adelaide trams.

For several years his small factory with its staff of four turned out about five tape recorders a week, and at a rough estimate would have made about 1500. These were sold throughout Australia. In 1954 PMG engineers approved the Ferry tape recorder for use in SA schools.

Between 1952 and 1955-6 a lot of Ferry tape transports were sold to hobbyists in Adelaide, to add their own electronics. In fact Jack Ferry offered *Radio & Hobbies* an article on building a complete tape recorder, but for some reason it was not used.

Jack was of the opinion that the frequency response specs published by other manufacturers were only achievable using very expensive factory alignment techniques, and couldn't be duplicated in the home. So he never quoted frequency response specs, if he could avoid it. He always said "If it sounds good to your ears, you are satisfied and you like the sound, then buy it!"

The construction of our tape decks changed to sheet metal in 1955, with three motors and plastic top cover and escutcheon. The following year the construction changed again, with the parts being assembled on vertically arranged anodised aluminium panels.

It was a measure of his standing as a manufacturer that it was to Jack Ferry that the Government turned for advice when seeking information in this field. In the 1950s there were import controls on many manufactured items, including tape recorders, and several times in that period the Government department concerned sought Jack's advice for approval of the importation of tape recorders. One such case I distinctly recall was a request from an airline to import 28-volt recorders for use aboard the aircraft.

In 1955 Jack wrote a manual on tape recording that was never published. However about 50 roneoed copies of the 50-page manual were distributed to

Ferry working on an early tape recorder in his Clapham factory workshop, around 1953-4.

Jack Ferry

ATRA (Australian Tape Recordists' Association) members and customers. It was written in terms that the layman could understand and included a brief history of magnetic recording, from steel band to wire to tape. It then described how a tape recorder worked and how to get the best from your own.

In July 1956 Jack was elected Federal President of the ATRA, a position he held until late 1959.

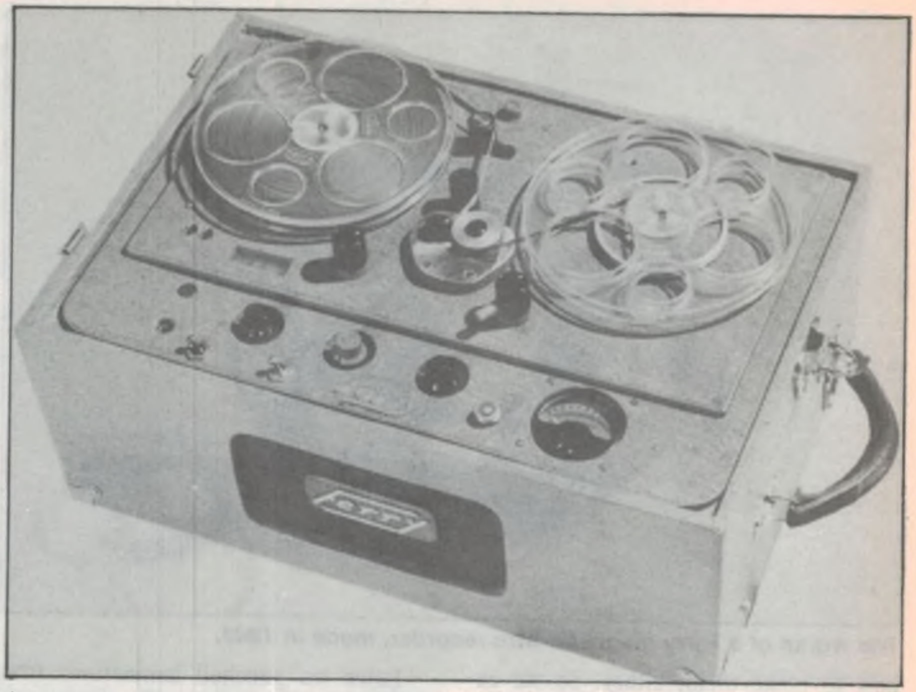
It was 1956, too, that saw the advent of stereo. By July of that year Jack Ferry demonstrated, to the monthly meeting of the SA branch of the Tape Recordists Association, the first stereo recorder to be built in SA. This first stereo machine earned the nickname of Frankenstein the Monster — Jack was never sure whether he controlled it, or it controlled him. It featured three heavy-duty motors, three speeds and had two tracks in one direction only, with the recording heads being staggered by 1-7/32" (not stacked vertically as they are today). It also had twin push/pull valve amplifiers of 7 watts each, and volume-controlled monitor speakers.

All of the Ferry recorders from 1956 to 1959 had mic/phono mixing, variable tone control during recording and PA facilities.

During this time Jack built a number of special recorders for such places as drive-in theatres, the Commonwealth Hearing Aid Laboratory, the Customs Office at Port Adelaide, and others.

In September 1957 Jack and I demonstrated, again to the Tape Recordists Association monthly meeting, a portable AC recorder working off a vibrator power supply from a 12-volt car battery. We were able to play tapes of interviews made "on location". This recorder, a prototype known as the Workshop Special, had an adventurous life — several times it was secretly installed in the boots of cars, to record conversations that were later used as evidence in divorce cases.

Some time in the late 1950s Jack developed a telephone answering tape recorder, for Adelaide business identity Mr Sanderson. Telecom at the time would not allow direct connection to the telephone lines, so any equipment had to work mechanically and acoustically. When the phone bell rang, a signal from a microphone activated the mechanism and an arm raised the telephone handpiece, moving it over to rest on a cradle with the microphone resting on an earpiece, and the earpiece over a microphone. A 3" reel-to-reel tape recorder then played the message to the caller to leave his phone number etc. After 30 seconds it moved the handset back and replaced it on the telephone, resetting itself for the next call.

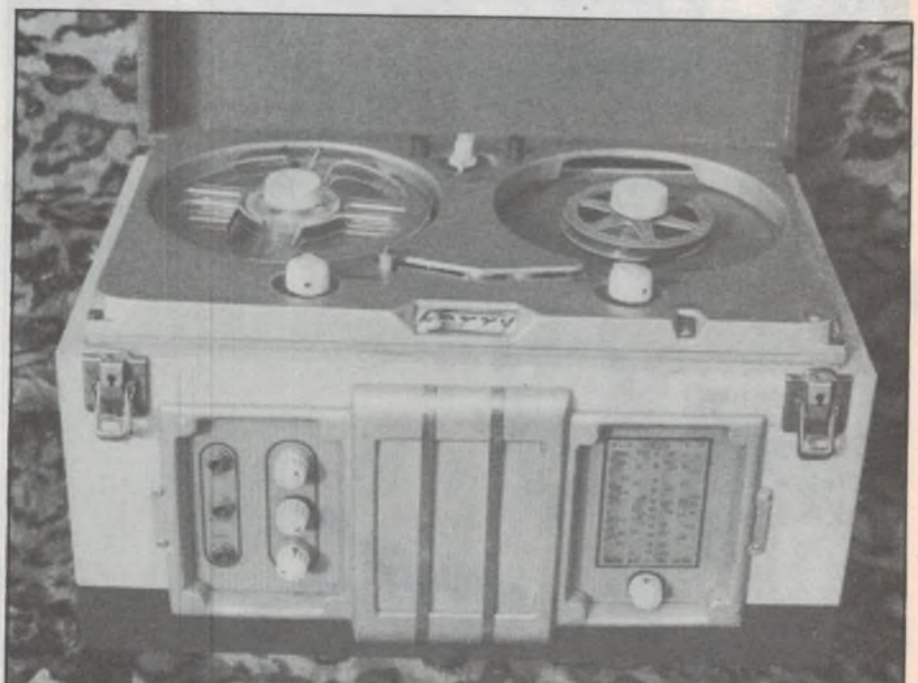


One of the first 12 Ferry magnetic tape recorders, made in 1950. These first machines were full track and ran at 7.5ips. They used DC recording bias, and had no "fast forward" facility.

Mr Sanderson tried in vain to get it manufactured around Australia, so he took it to England, where EMI decided to mass produce it. However, by the time their prototype was finished Telecom had changed its rules and any such device had to have a direct connection — so the project was dropped.

In 1959 and 1960 English "Collaro" tape transport decks were available in Australia, and Jack used these, building the electronics under them and installing them in cases we made in the factory.

By 1961, television had caused a



A later Ferry M5 recorder of 1954, with built-in radio tuner.

slump in the demand for tape recorders. Because of this Jack turned to other things like TV servicing, manufacturing TV aerials, making PA systems and installing them in supermarkets, making electronic systems to measure water purity in water demineralising plants, and doing general electronic repairs.

Jack Ferry died in December 1966, leaving his widow, Maree (whom he had met and married during his Army service while stationed in NSW) and two daughters, Christine and Rosie.

The passing of this bright and energetic sound engineer marked the end of the pioneering period of "home-grown" sound and tape recorder engineering in South Australia. EA

Editor's Note: This article has been adapted from Mr Ellison's booklet "Jack Ferry and his Tape Recorders", by arrangement. Copies of the booklet, complete with many more historic photographs, are available from Mr Ellison direct at 67 Cremorne Street, Malvern SA 5061. The cost of the booklet is $5 per copy.

A former employee of Jack Ferry and an Honorary Life Member of the Australian Tape Recordists Association, Mr Ellison also maintains a collection of early Ferry tape recorders.

Jack Ferry in July 1956 demonstrating the first stereo tape recorder in South Australia, at a meeting of the Australian Tape Recordists' Association.

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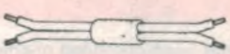

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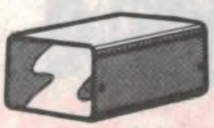

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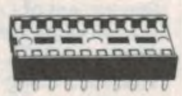
24-28 pin T12191	$9.95
36-40 pin T12193	$9.95



LOW PROFILE IC SOCKETS

Save a small fortune on these "Direct Import" low profile IC sockets! PCB mounting solder tail. Dual wipe. All tin plated phosphor bronze or berryllium and dual wipe for reliability.

Cat.No.	Description	1-9	10+
P10550	8 pin	$0.20	$0.15
P10560	14 pin	$0.25	$0.20
P10565	16 pin	$0.35	$0.20
P10567	18 pin	$0.40	$0.30
P10568	20 pin	$0.40	$0.30
P10569	22 pin	$0.40	$0.30
P10570	24 pin	$0.40	$0.30
P10572	28 pin	$0.50	$0.40
P10575	40 pin	$0.50	$0.40

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

A11510 .... $23.95

IEC MAINS LEAD

3 pin mains plug to 3 pin IEC plug. 1.8 metres long.

P10252 .... $5.95

DB25 SOCKET WALL PLATE

- Fitted with DB25S socket. (RS232)
- Anodised aluminium plate
- Includes mounting hardware.

P10947 .... $11.95

K&W METAL INSTRUMENT CASES

Used in many projects, these cases have hammertone finish and are both versatile and economical.

H10478	125 x 40 x 65mm	$ 5.95
H10479	150 x 55 x 95mm	$ 6.95
H10480	100 x 92 x 130mm	$ 8.95
H10481	150 x 55 x 100mm	$ 7.95
H10482	200 x 80 x 130mm	$ 9.95
H10485	255 x 92 x 155mm	$14.95
H10487	255 x 165 x 155mm	$16.95
H10489	305 x 105 x 200mm	$16.95

UTILITY BOXES

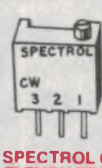
Plastic boxes with aluminium tops, and available in four sizes. Very popular for projects and very economical!

H10101	150x90x50mm	$ 3.25
H10102	195x113x60mm	$ 4.50
H10103	130x68x41mm	$ 2.75
H10105	83x54x28mm	$ 1.95
H10110	120x65x38mm	$ 2.95
H10112	120x65x38mm (Metal top)	$ 2.95

POCKET SIZE BATTERY TESTER

- Tests all 9V to 1.5V batteries including button cells
- Arms extend to various battery sizes
- Easy to read meter
- Requires no power source

M23521 .... $11.95



SPECTROL 64Y MULTI TURN TRIMPOTS

Cat No.	Description	1-9	10+
R14700	10R	$3.50	$3.20
R14710	20R	$3.50	$3.20
R14720	50R	$3.50	$3.20
R14730	100R	$3.50	$3.20
R14740	200R	$3.50	$3.20
R14750	500R	$3.50	$3.20
R14760	1K	$3.50	$3.20
R14770	2K	$3.50	$3.20
R14780	5K	$3.50	$3.20
R14790	10K	$3.50	$3.20
R14800	20K	$3.50	$3.20
R14810	50K	$3.50	$3.20
R14820	100K	$3.50	$3.20
R14830	200K	$3.50	$3.20
R14840	500K	$3.50	$3.20
R14850	1M	$3.50	$3.20

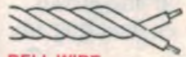
MASTER RACK MOUNTING CABINETS

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
- Removeable top and bottom lid
- Ventilated lid

Horizontal Depth: 254mm
A = External Front Panel Height mm
B = Mounting Hole Centres mm
C = Internal Chassis Height mm

A	B	C	Finish	Cat.No.	Price
44	34	38	Natural	H10401	$59.50
88	57	82	Natural	H10402	$69.50
132	89	126	Natural	H10403	$79.50
44	34	38	Black	H10411	$65.00
88	57	82	Black	H10412	$75.00
132	89	126	Black	H10413	$85.00



BELL WIRE

Red and white twisted
Conductors: 2 x 1 strand 0.17mm
Sheath: O.D. 2 x 1.35mm
Cat. W

1-9 rolls **$19.00/m** — 10+ rolls **$17.50/m**

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

PIEZO DIRECT RADIATING TWEETER

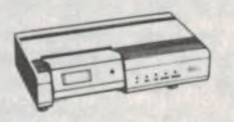
Requires no crossover, handles up to 100 watts
Sensitivity: 98dB
Maximum Imput: 24 volts
Freq. Response: 3.2 - 30kHz
Dimensions: 95mm diameter

Cat. C12104 .... $11.95

10W HORN SPEAKERS

White durable plastic, 8 ohms

Cat. C12010 ...... Normally $11.95
1-9 **$7.95** — 10+ **$6.95**



P.I.R. SENTRY

FEATURES:

- 7 LED indicators
- Passive Infra-red detection radium
- Built-in piezo siren
- Rechargeable 12V battery
- Built-in automatic battery charging system
- External siren connections
- Exit/Entry system
- Terminals for external detection devices
- Separate digital panel and main unit
- 3 Function switch: delay/off/instant
- 3 Adjustable timers
- 24 Hour loop included
- Built-in tamper switch
- Adjustable detection angle
- LED monitor for walk test
- R.F. Protection design

S $175

TELEPHONE INDUCTION COIL

- For recording or amplification
- 3.5mm plug with 1 metre cord
- Peel-off stick-on adhesive back

A12032 .... $5.95

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

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

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RED HOT BARGAINS!

If you like discount prices... try Rod Irving Electronics!

VERBATIM DISK SPECIALS!

All prices 10 disk boxes!

Description	1-9	10+
3½" 1S/2D	$44.95	$42.95
3½" 2S/2D	$46.95	$43.95
3½" 2S/HD	$99.00	$95.00
5¼" 1S/2D	$22.00	$21.00
5¼" 2D/2D	$26.00	$24.00
5¼" 2S/4D	$75.00	$70.00
5¼" 2S/HD	$41.00	$39.00

KEY SWITCHES

Cat. S12500 ... Normally $7.95

1-9	10+	25+
$4.95ea	$4.25ea	$3.95ea

CENTRONICS SOLDER PLUGS SPECIALS!

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

"NO BRAND" DISKS!

Now you can buy absolute top quality disks that are also the cheapest in Australia! They even come with a lifetime warranty! So why pay 2-3 times the price for the same quality?

Packs of 10 D/S D/D without boxes, or brand name, just their white paper jacket, and index labels. (5¼" disks includes write protects)

5¼" 2S/2D DISKS

10+DISKS	100+DISKS	1,000+DISKS
$6.95**	$6.75**	$6.50**

(ALL PRICES PER 10 DISKS)

5¼" HIGH DENSITY DISKS

(DOUBLE SIDED)

10+DISKS	100+DISKS	1,000+DISKS
$29.95**	$27.95**	$26.95**

(ALL PRICES PER 10 DISKS)

3½" "NO BRAND" DISKS

DOUBLE SIDED/DOUBLE DENSITY

10+DISKS	100+DISKS	1,000+DISKS
$29	$27	$25

(ALL PRICES PER 10 DISKS)

RECHARGEABLE 12V 1.2AH GELL BATTERY

Leakproof, long service life batteries ideal for security systems, emergency lighting or as a computer backup power supply, etc.

Cat. S15029 ... Normally $19.95

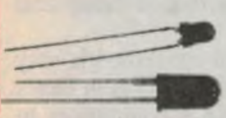
1-9	10+
$13.95	$12.95

DB25 CONNECTOR SPECIALS!

TYPE	1-9	10+	100+
9P	$0.70	$0.60	$0.50
9S	$0.70	$0.60	$0.50
9C	$0.60	$0.50	$0.40
15P	$0.70	$0.65	$0.60
15S	$0.70	$0.65	$0.60
15C	$0.70	$0.60	$0.50
25P	$0.70	$0.60	$0.50
25S	$0.75	$0.65	$0.60
25C	$0.70	$0.60	$0.50

DB 25 CRIMP SPECIALS!

Type	1-9	10+	100+
Female	$2.95	$2.50	$1.95
Male	$2.95	$2.50	$1.95



QUALITY 3mm LEDS

Cat. No.	Col.	1-9	10+	100+
Z10140	Red	$0.15	$0.12	$0.10
Z10141	Grn	$0.20	$0.15	$0.12
Z10143	Ylw	$0.20	$0.15	$0.12
Z10145	Ora	$0.20	$0.15	$0.12

QUALITY 5mm LEDS

Cat. No.	Col.	1-9	10+	100+
Z10150	Red	$0.08	$0.07	$0.06
Z10151	Grn	$0.15	$0.12	$0.10
Z10152	Ylw	$0.15	$0.12	$0.10

UV EPROM ERASER

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

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

WITHOUT TIMER

Cat. X14950 ... Normally $97
Special, $79

WITH BUILT-IN TIMER

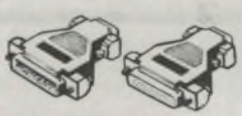
Cat. X14955 ... $139
Special, $99

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



9 PIN TO 25 PIN CONNECTOR ADAPTORS

NEW! The ideal solution! Features gold plated pins.

X15668 DB9 Plug to DB25 Socket
X15669 DB9 Socket to DB25 Plug
... **each $10.95**

PANEL METERS GALORE!

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
Q10560	MU65 0-20V	16.95

CANNON TYPE CONNECTORS

	1-9	10+
P10960 3 PIN LINE MALE	$3.90	$3.50
P10962 3 PIN CHASIS MALE	$3.00	$2.50
P10964 3 PIN LINE FEMALE	$4.50	$3.90
P10966 3 PIN CHASIS FEMALE	$4.95	$3.95

20% OFF THE PRICE OF SPECTROL MULTIDIALS

MODEL 15-1-11

Number of turns: 10
Minor Scale Division: 1/500 turn
Shaft Bore: 6.35mm (¼")
Finish: Satin Chrome
Body Size: 25.4 x 44.45mm (1 x 1¾")
Depth: 25.4mm (1")
Weight: 45.4g (1.6oz.)

Cat R14405 ... $45.95
SPECIAL, $35.95

MODEL 16-1-11

Number of turns: 15
Minor Scale Division: 1/50 turn
Shaft Bore: 6.35mm (¼")
Finish: Clear Anodize
Body Size: 22.2mm diameter (.875")
Depth: 22.2mm (.875")
Weight: 19.8g (0.7oz.)

Cat R14400 ... $26.95
SPECIAL, $21.50

MODEL 21-1-11

Number of turns: 15
Minor Scale Division: 1/100 turn
Shaft Bore: 6.35mm (¼")
Finish: Satin Chrome
Body Size: 46.04mm diameter (1.812")
Depth: 25.4mm (1")
Weight: 85g (3oz.)

Cat.R14410 ... $46.95
SPECIAL, $37.50

10 TURN WIRE WOUND POTENTIOMETER

Spectrol Model 534
¼" shaft.

Equiv (Bourns 3540S, Beckman 7256)
Dials to suit 16-1-11, 18-1-11, 21-1-11.

R14050	50R	R14100	5K
R14055	100R	R14110	10K
R14060	200R	R14120	20K
R14070	500R	R14130	50K
R14080	1K	R14140	100K
R14090	2K		

1-9	10+
$9.95	$9.50

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

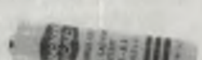
Cat. C92084 ... Normally $29.95
This month only $24.95

Dealers, OEM's, etc., phone (03) 543 2166 for wholesale prices

MINIATURE HOBBY VICE

- Lever operated suction grip base for instant mounting and portability
- Mounts on smooth non-porous surfaces
- Ideal for holding components, and other small/light objects

Cat.T12458 ... **only $6.45**



NICADS!

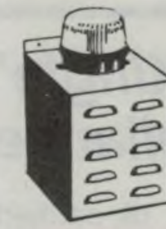
Save a fortune on expensive throw away batteries with these quality Nicads and Rechargers!

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

SUPER DELUXE BATTERY CHARGER

- Charges from 1 to 10 D, C, AA, AAA N, and up to 3 x 9V batteries at the same time
- Dual colour LED in first three compartments to designate 1.5V or 9V
- 240V AC/50Hz
- Approval No. N10637

Cat M23525 ... **$59.95**



EXTERNAL SIREN & FLASHING LIGHT

Housed in a waterproof, metal case, with tamper switch.

SPECIFICATIONS:

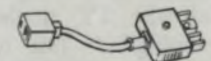
Siren:
DC 12V 450 mA
Impedance 8 ohm
S.P.L. (dB/W) 110
Dimensions: 135 x 150mm

Flashing Light:
DC 12V
100 flashes per minute
Dimensions: 82 x 100mm

... **$89.50**

JOINABLE PCB MOUNTING SCREW TERMINALS (GREY)

	1-9	10+
2 Way Cat. P10520	$0.50	$0.45
3 Way Cat. P10521	$0.75	$0.65



TELEPHONE ADAPTOR

- Australian plug to U.S. socket
- Length 10cm

Cat. Y16026 ... **$6.95**

METEX M-3650 MULTIMETER

20A, 3½ 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.

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
- ½" High contrast LCD
- Full overload protection
- 20 Amp
- Built in tilting bail
- Capacitance meter
- Instruction manual

Q91550 ... Normally $165
Special, only $129

5¼" DISK STORAGE (DD100-L)

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

Features
- 100 x 5¼" disk capacity
- Smoked plastic hinged lid
- Lockable (2 keys supplied)
- High impact ABS plastic base
- Contemporary design

C16020 ... **only $15.95**

ECONOMY TRANSFORMERS

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

rie

Rod Irving Electronics

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Phone (03) 663 6151

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Phone (03) 543 7877

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Electronic Discounters P/L,
305 Morphett St, ADELAIDE
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NOTE: (Prices may vary interstate due to freight costs)

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P.O. Box 620, CLAYTON 3168
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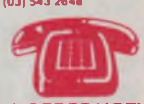

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008 335757
(TOLL FREE)
(STRICTLY ORDERS ONLY)

LOCAL ORDERS & INQUIRIES
(03) 543 7877

POSTAGE RATES:

$1	$9.99	$2.00
$10	$24.99	$3.00
$25	$49.99	$4.00
$50	$99.99	$5.00
$100	$199	$7.50
$200	$499	$10.00
$500 plus		$12.50

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

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RITRONICS WHOLESALE,
56 Renver Rd, Clayton
Ph. (03) 543 2166 (3 lines)

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FORUM

Conducted by Jim Rowe

Does a "tingle" mean your appliance is dangerous?

In the old days of earthed electrical appliances, a "tingle" when you touched them was a warning that something was seriously amiss and the appliance concerned was likely to be dangerous. But nowadays, it isn't necessarily so – and if you're not careful, even measurements with a meter can be quite misleading.

Let's say your wife or mum is doing the washing up in the kitchen, and watching *Days of Our Lives* or whatever on the portable TV nearby. When it ends, she reaches over to change channels – and receives a rather frightening "tingle". Not a shock, so no actual damage is done, but a bit worrying all the same. So very wisely she wipes her hands, turns off the TV at the power point and unplugs it, just to make sure. Then she waits until you get home, and tells you what happened. Is the TV faulty and dangerous?

You're not sure, but a tingle is certainly a bit worrying – and you wouldn't want her to be in any danger, of course. So straight away you get out your nice new digital multimeter and switch it to the highest AC volts range. Then you plug the TV back in, switch it on (first at the set and then at the power point) and gingerly measure between the channel-change buttons and the stainless steel sink.

Good grief – the meter reads over 100 volts! No wonder your good lady received that tingle. It must be faulty and dangerous, after all. It's one of those double-insulated appliances too, with only a two wire cord and 2-pin plug, so there isn't even a protective earth. It's a wonder she wasn't killed...

So you take it halfway across town to the manufacturer's service department, and ask them to examine it carefully for a suspected dangerous leakage. But when you go to collect it again a couple of weeks later (well, say three weeks later), they couldn't find anything wrong with it. Supposedly it's perfectly OK, and quite safe. All you're up for is the $45 minimum service fee.

Hmmm. When you take it home again and try measuring between the TV channel buttons and the kitchen sink, the meter still reads more than 100 volts. Who's kidding whom – didn't those turkeys in the service department do *anything* for that 45 bucks? Is the blanky thing dangerous or not? It's all very disturbing.

Well, have I got your attention? I hope so, because electrical safety is an important subject and something we electronics types are often expected to know about and offer responsible advice on. We of all people should be clear about how to determine if an appliance is safe or not, without any confusion.

By the way, in case you're wondering the above story didn't actually happen – I made it up, just to kick off the discussion. But it's a scenario that certainly *could* happen nowadays, given the prevalence of double-insulated appliances (including TV sets) and digital multimeters. In fact a very similar chain of events did occur recently, as was explained to me by the safety approvals manager of one of the large manufacturers.

What actually happened was that a lady did get a tingle from her portable TV set, in a similar situation. She promptly called the local office of the electricity authority, and a safety inspector was sent out to investigate. When he arrived and used a digital multimeter to measure the voltage between the TV set controls and the kitchen taps, he did indeed get a reading of well over 100 volts – and promptly declared the TV unsafe.

The TV set was almost brand new, as it happened, so the lady's husband not surprisingly took it back to the manufacturer's service department. Here he demanded to see the manager, and asked why the company was selling sets that were unsafe. It was then that my friend the safety approvals manager was brought into the picture, to test the set and see if it was indeed faulty and dangerous.

Now the gentleman concerned is very experienced in this area, and is in fact a member of various SAA committees to do with electrical safety. So he promptly carried out the official tests, to see if there was anything wrong.

The verdict? There was in fact nothing wrong with the set at all. It easily met all of the prescribed tests for electrical safety, and was quite incapable of delivering a dangerous current or shock.

In other words, the county council's safety inspector had actually been quite WRONG in declaring it unsafe. Even though it could indeed deliver an undeniable "tingle" in the right circumstances (as the lady had found), and would also produce a leakage voltage of well over 100V as read by a digital multimeter.

So what's the explanation? Let's look into it a bit deeper.

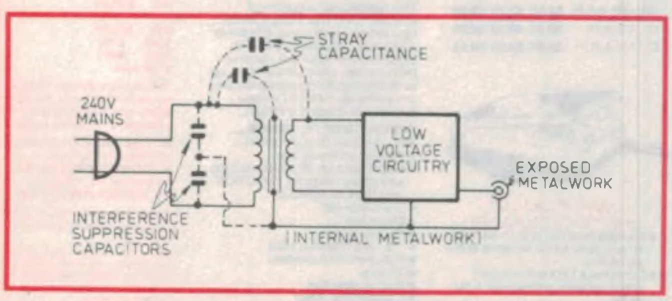

Fig.1: Due to things like stray capacitance, the exposed metalwork of a double insulated appliance can easily produce a "tingle".

Why a tingle?

Inside almost all electronic appliances powered from the mains is some kind of power transformer. This is either connected directly to the 240V power line, or indirectly via a switching power supply circuit. The basic purpose of the transformer is twofold: (a) to change the mains voltage into whatever voltage or voltages are better suited for powering the appliance circuitry, and (b) to isolate the circuitry as a whole from dangerous mains potential.

In general you can visualise the transformer's primary winding side as floating at the full potential of the active mains lead. Certainly in the simplest case this will be true for at least one side of the winding. With a switching supply the situation is rather more complex, but the basic idea isn't too much different.

Now the secondary winding(s) are normally separated from this primary winding by a number of layers and types of insulation, providing a high degree of *conductive* isolation. So the straight ohmic conduction path between the two will have a very high resistance indeed – typically from many tens to hundreds of megohms.

The internal circuitry of the equipment will generally be directly connected to the secondary winding(s), and quite often any exposed metalwork will be also. This means that these too will only be connected to the mains via the extremely high resistance of the insulation layers, as least from the point of view of straightforward ohmic conduction.

If this were the only way that current could flow, there would probably be no chance of getting even a faintly noticeable "tingle" from a normal appliance with undamaged insulation. Ohm's law tells us that with a series resistive path of say 100 megohms, the maximum current that could flow with 240V applied would be only 2.4 microamps. This is well below the level that will produce even a tingle – unless perhaps you have it flowing between electrodes connected to your tongue, or some other highly sensitive part of your anatomy!

But of course ohmic conduction *isn't* the only way that current can flow. Where alternating current and voltage are involved, there's also reactive "conduction" – the AC current that flows through things like capacitors and inductors, as a result of their reactance.

In this case there is often quite a significant capacitive path between the mains wiring entering the appliance and the circuitry/metalwork on the "other side" of the power transformer. As shown in Fig.1, this can often consist of two main items. One of these is the stray capacitance between the mains wiring and transformer primary, on one side, and the transformer core, secondary windings, appliance circuitry and metalwork on the other. This capacitive path is always present in all equipment, but its value varies between a few tens and a couple of hundred picofarads (pF).

The other item is any discrete interference suppression capacitors which may be deliberately connected between the mains wiring and the equipment metalwork. While larger in value than the stray capacitance, these are generally only found on equipment that is designed to be used with a mains safety earth. In fact they mustn't be fitted to double-insulated equipment, because of the safety risk if they should break down.

Let's forget these interference suppression capacitors for the purpose of the present discussion, then, on the basis that they're normally only going to be found on earthed equipment – and you can't get a tingle from such equipment if it *is* properly earthed.

So we're left with the stray capacitance, of around (say) 100pF. At the 50Hz mains frequency this has a capacitive reactance of about 32 megohms – rather less than the resistive leakage

FORUM

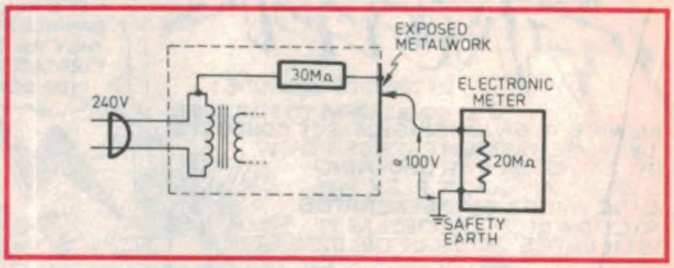

Fig.2: Measuring the leakage with a high impedance electronic meter tends to produce a high voltage reading.

path we've already considered, although still quite high.

The thing is that when both the resistive and capacitive leakages are taken into account, the nett leakage impedance will obviously be lower than either. So with 240V AC applied, there can be the potential to supply rather more current – say a few tens of microamps. And this is where the tingle can come from.

But is it safe?

Now comes the crucial question. A current of this order may be able to give you a noticeable little tingle, but is it dangerous?

Broadly speaking, the answer seems to be no. At least, it isn't if the current is applied to you in the usual external ways. It might be dangerous if passed directly through the wrong part of your heart muscle during an operation, perhaps, but otherwise there's general agreement that it would not cause you any injury.

In fact the Standards Association of Australia specifies that a current of up to 700 microamps (0.7mA) peak is deemed safe for AC, and up to 2mA for DC. However the relevant SAA standard notes that for some conditions – especially where there is a high humidity – it may be necessary to ensure that leakage current levels are kept below 0.3mA peak (300uA), to reduce *discomfort*. In other words, to minimise the "tingle current".

OK then, so getting a tingle doesn't in itself necessarily mean that the equipment concerned is dangerous. It *could* be quite safe – but how can you be sure? After all, an appliance that is faulty will also tend to give you a tingle, and in this case the situation could be potentially lethal. It would obviously be very foolish to become blase about tingles in general.

Testing it

Needless to say, the sensible thing to do is *measure* the leakage, to see if it is safely below the danger level.

But what's wrong with measuring the voltage between the appliance's exposed metalwork and ground, with one of those nice new digital multimeters – like our hapless county council inspector? The problem here is that the test is quite unrealistic.

Modern electronic digital multimeters (or electronic analog multimeters, for that matter) have a very high input impedance – typically 20 megohms. This is fine for making most normal measurements in sensitive electronic circuits, without disturbing them and loading them down. But in this case it doesn't show what happens to the voltage between the appliance and ground when the leakage circuit has to deliver current into the kind of load we're most concerned about: a human body.

If the leakage path has an impedance of say 30-odd megohms, for example, the effect of connecting the digital multimeter's 20MΩ of input impedance between metalwork and earth will be quite modest (Fig.2). The total circuit impedance connected across the 240V will be 50 megohms, which will draw only 4.8 microamps, and the proportion of mains voltage across the meter will be about 2/5 of 240V, or around 100V RMS. And this will be the reading shown on the meter – apparently quite high.

Even if the appliance was faulty and the leakage path had fallen to only 10kΩ, the total circuit impedance would still be over 20MΩ and the current still only 12uA. The meter would then read almost 240V, to be sure, but superficially this is only a bit over double the reading with an appliance that is quite safe.

The situation would be quite different if you or I were connected – particularly if we have wet or sweaty skin, to achieve a relatively "good" contact. Our effective load resistance would be below 50kΩ, bringing the total circuit resistance down much closer to that of the leakage path by itself. And the current that flows would be determined not so much by us, but by the leakage impedance.

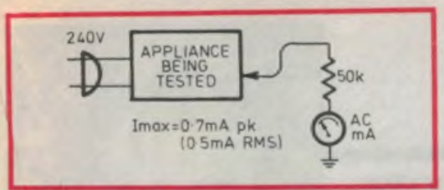

Fig.3: With a 50k load, only 0.7mA peak current should flow.

So if the appliance is safe, with a leakage impedance in the tens of megohms, only a few tens of microamps will flow – and because most of the voltage will be dropped across the leakage impedance, very little will appear across our body: a few volts at the most.

But of course if the appliance is faulty, with a leakage impedance much lower that it should be, a lot more current will be able to flow. And proportionally less voltage will be dropped across the leakage impedance, leaving much more across us...

To find out whether an appliance is dangerous or not, then, it's important to measure the leakage current or voltage in a realistic fashion. In other words, by measuring in a way where the loading at least approximates that of a human body.

The SAA standard suggests that a suitable load impedance is in fact 50kΩ . So the SAA's test of appliance safety involves measuring the leakage *current* when such a load is connected (between the exposed metalwork and a reference or "safety" earth. And as noted earlier, the current in this situation must not exceed 0.7mA peak (0.5mA RMS) for the appliance to be deemed safe.

So the way our county council safety inspector *should* have measured the suspect appliance is shown in Fig.3. And this is the way *we* should make the measurement too, if we want to check out an appliance that has delivered a tingle or is otherwise under suspicion.

What if you don't have a multimeter which can measure small AC current levels? Then you can use the slightly modified technique of Fig.4, which relies on measurement of the AC voltage drop across the 50kΩ load resistor. Ohm's law tells us that this will have a voltage drop of 35V peak or 25V RMS for the prescribed maximum current level – so any voltage readings below this level are OK.

The critical point is that you need to use a 50kΩ load resistor, to provide a realistic testing situation. And ideally the resistor should be non-inductive, to prevent inductive reactance from complicating the situation.

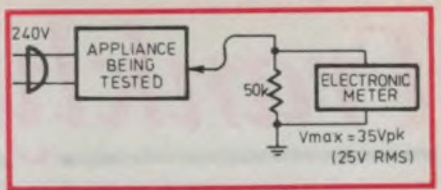

Fig.4: Alternatively, only 35V peak voltage should appear across 50k.

Providing you use this load resistor, it doesn't matter much whether you measure the leakage current as such, or the voltage drop created across the load resistor. Either way, you'll get an unambiguous indication of whether the appliance really is safe or not.

Summarising then, you can indeed get a "tingle" from double insulated appliances – even when they're quite safe. But don't take any chances: if someone does get a tingle, check out the offending appliance carefully. Just make sure you test it correctly though, with that 50kΩ load resistor.

That's about it for this month. Next month I hope to look at the rather weird subject of "oxygen-free" copper, and its use in speaker cables and other audio components. I hope you'll join me.

Frankly Frank

Musings on matters electronic by FRANK LINTON-SIMPKINS

Seductio ad Absurdum

Once again the forces of good, Dobie Gillis and the PTL ministry are being led from the paths of righteousness by the seductive activities of the evil reds. It isn't as if the born-again hordes hadn't been warned – Senator Joseph MacCarthy and his House Un-American Activities committee, Pik Botha, the Festival of Light and even Rudyard Kipling have all warned us about the danger of the Russians.

We Australians built Fort Denison, Port Philip's south channel fort, and commissioned a war ship called Cereberus (which now serves as a nice breakwater) – all to stop Russian invasions. But not so the Americans.

Fooled by Glasnost and believing that the main proposition of the Marxian Communist manifesto is actually part of the US constitution, the Americans are falling for the communist audio line without much of a struggle.

Perhaps it might be better to amplify the above paragraph. Something like 70% of a recent US population sample identified the Marxian motto "From each according to his abilities, to each according to his needs" as being part of the US constitution. Some others thought it was from one of Abe Lincoln's speeches, some from a Billy Graham sermon and only a fraction over five per cent got it right.

We all know (it is written in letters of fire in the entrance lobby of the CIA building in Langley, Virginia) that the only way the Soviets' technology can get within a scientific bull's roar of the west is if somehow the Russians steal, seduce and blackmail someone into giving them secret documents. Or maybe for the Russians to bribe unsuspecting US technologists or scientists to part company with plans etc.

From this the whole US view of Russia has become somewhat distorted. The demographic image of Russia held by most US people is that the population of the USSR consists of wild, undisciplined Asiatic troops, beautiful spies and cold eyed Callan-Meres type KGB killers. One is left with the impression that there is no one in Russia who is left over to drive the garbage trucks or mend the worn boots (no one in Russia can afford shoes).

Now the Russians are getting their own back and selling technology to the west. What the Yanks are buying represents not only trading with the hordes of Muscovy, but also a measure of electronic heresy at worst and regression at best. In short the Americans are in the process of buying thermionic valves, to drive audio systems in recording studios and in the US homes.

When the Three Mile Island atomic reactor ran away in the eastern states of the US it was saved from being a disaster of Chernobyl dimensions not by US high tech, but simply by low tech. The containment building at Three Mile Island was better than the Russian one. Now the Russians are turning the tables on the US by exporting low tech products, to waste more of the US foreign exchange and merely increase its balance of payments problem.

The odd thing is that when the US swapped over from its semi-religious belief in the use of valve driven amplifiers to those driven by the new solid state faith, it ceased production of valves almost totally and thus made the lives of the musically sensitive just that much harder to bear.

So, some 40 years after the transistor was invented (that is if you reject the 1919 patent application that seems to have been a transistor), many of the better sound recording studios are now almost totally Russian driven.

It seems that despite all the theoretical superiority of the solid state sound system (devices I hate, as unlike all owners of these wretched devices I don't have seriously impaired hearing), valve driven systems produce more accurate and better sounding results than solid state ones. Here I quote the more musical among us, as I declare that you have to be somewhat freaky to need all that accurate reproduction. Besides, whatever drives an amplifier, the horrible thing will eventually fall into the malign hands of an audio-visual display exhibitionist. All these people have impaired hearing as well.

Once upon a time in the early 1920's the valve was manufactured in the US at an annual rate of about one megavalve. By the time that the 1939-1945 war had come along to make the fortune of the US, the annual rate of production was over 100 megavalves. The current figure is hard to determine, because first you have to find a maker and then find a pencil and paper.

But why do the Americans so eagerly lay down their very souls, that is their credit cards and cash, so eagerly for the Russian valves? Have the Russians developed some Slavic equivalent to the approach much followed in the land of Sod, which lies to the west of Wee Waa? This involves a Bucolic Buck approaching his target from the stock whip side, and saying the magic words, "Are yuh gunna come down for a swim in the Bore drain after the dance?". (This implies no disrespect for the local males, as the "bore" referred to is an artesian bore that usually runs freely day and night and also very hot. It is a sort of pre-dawn "Hot Tub" of 1970s pre-AIDS lore.)

No, it is simply that solid state amps don't have any compunction about exhibiting an overbearing component of third harmonic distortion when in overload condition. We all know that these things are always operated at extreme overload levels. But the problem of the third harmonic component is that to a musician the music doesn't seem right, in their terms "stopped" or "covered".

So how can this strange technological reversal be handled? It is obvious that somehow the Russians discovered that somewhere in the US, there was a valve research station. It was probably funded by the Electronic Cathedral Organists of America Foundation. Find that research centre, find who was seduced into aiding the Russians, and this treasonous buying of valves can be brought to a halt.

One simply has to speculate how it

continued on page 140

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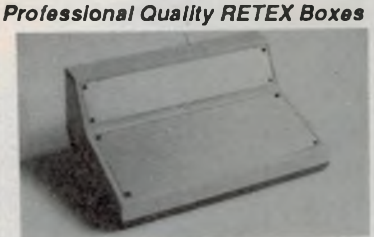

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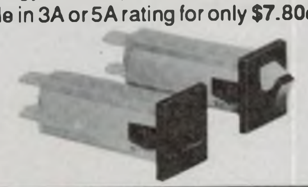

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Silicon Valley NEWSLETTER . . .

Effort going into neural networks

Recognizing a human face or a familiar shape is routine for infants, but such tasks tie computers in knots. This failing has perplexed, even embarrassed, a generation of engineers whose machines have grown ever more adept at solving mathematical problems but still are virtually useless at solving a broad range of recognition problems. Despite intense efforts at solving these problems, conventional computers are basically no closer to recognizing, learning and adapting than they were at the dawn of the computer age more than 40 years ago.

A radically different approach to computing, called "neural networks," could soon shatter this technical impasse. And that prospect has corporate America eager to exploit the technology in a host of products aimed at both military and business uses.

"We're at an embryonic stage, but over the past year developments have been happening at a very impressive rate," said Robert Hecht-Nielsen, chairman of San Diego-based Hecht-Nielsen Neurocomputer, an early leader in the field.

Neural computers are years away, but in the past six months a handful of companies, including Hecht-Nielsen has introduced neural software that enables conventional personal computers to tackle some tough handwriting and vision-recognition problems. Once neural hardware becomes available in the 1990s, these nets will, among other things, enable bank customers to talk to automatic teller machines and automobiles to pilot themselves, Hecht-Nielsen pedicts.

Loosely modeled after the brain, neural nets promise to exhibit human abilities to recognize patterns, make judgements about fuzzy information and learn by doing. Even conventional supercomputers are stumped by such requirements because they process information in a step-by-step way. They also seek a single "right" answer to a question and are programmed to discard answers that are roughly accurate.

Federico Faggin, of Synaptics

The brain, on the other hand, shares data simultaneously among billions of nerve cells, called neurons. Besides answering either/or questions, the brain also solves problems that turn on shades of gray, such as picking a man out of a crowd or discovering a small imperfection in a Coke bottle.

Astonishingly, researchers don't even think this future generation of machines will require programming because they'll rely on massive parallel-processing elements that resemble the brain's collection of neurons. "These computers will teach themselves," said Tom Schwartz, a Mountain View consultant who specializes in the field.

Excitement over the technology is tempered by the realization that it must still prove itself. "There's a lot of promise, but no proof yet," said Federico Faggin, one of the developers of the microprocessor and the head of Synaptics, a San Jose company that is developing neural net semiconductor devices to serve as the building blocks for full-fledged neural computers.

Faggin wants to relive his past – sort of. In the early 1970s, Faggin and other engineers at Intel developed the microprocessor, the so-called "computer on a chip" that changed the course of electronics and made the personal computer possible.

Now Faggin wants to do the same for neural nets: develop the basic processors that will open the way for engineers to build neural computers.

"The analogy with the microprocessor is relevant," said Faggin, who founded Synaptics in San Jose 18 months ago with California Institute of Technology Professor Carver Mead. "But there are important differences. When we developed the microprocessor, we knew what a computer was. The microprocessor was using an old paradigm; it allowed us to build a computer more cheaply. "With neural nets, we are trying to develop a new paradigm for information processing. So we are further behind."

Faggin's model involves thousands of tiny processors, each working in unison. The success of Faggin's effort – and that of others – to build a neural computer is critical to the future of this infant field. Without the hardware designed to fully exploit the uniqueness of neural software, it is unlikely that neural nets will ever attain the processing speed needed to solve many problems.

Faggin hopes to have neural hardware for sale within three years, but some pessimists caution that is could take even longer.

"A full-blown neural computer is way, way down the road – if ever," said Lawrence Jackel, a scientist at AT&T's Bell Labs, at a recent conference on neural nets.

New etcher for sub-micron silicon

Applied Materials has announced a key new dry-etching system which will ensure that semiconductor manufacturers will be able to continue to shrink chip dimensions well into the 1990s. The company's new Precision 5000 Etch system is designed for low-pressure reactive ion etching (RIE) of single-crystal silicon, a process that has proven difficult to control.

Single-crystal silicon is the purest of base materials used in the semiconductor industry. But despite the advantages of its purity, the material has proven difficult to work with in conventional processing systems.

The Precision 5000, however, creates a magnetically enhanced ion plasma which is achieved by applying a magnetic field to increase the plasma's ionization and dissociation efficiency. When combined with Applied's advanced CVD chemical vapor deposition system, it has proven possible to etch sub-micron features into the single-crystal silicon while maintaining smooth sidewalls and round bottoms which are essential in producing advanced circuits.

"The Precision 5000 Etch provides enabling technology to the industry's advanced silicon etching requirements. It incorporates the reliability, flexibility, and contamination control needed to produce advanced semiconductor devices," according to Peter Hanley, general manager of Applied's Etch Products Division.

The system will carry a price tag of $US800,000 to 1.3 million, depending on options.

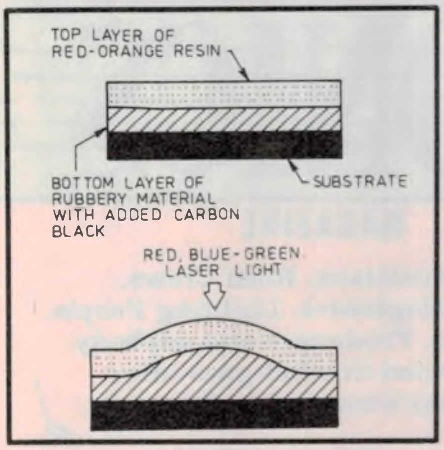
Tandy had outside help with erasable CD

When Tandy announced that it had perfected a new technology to record music and data on compact discs, competitors were stunned. But skeptics were quick to question Tandy's claim that it had developed the leading-edge technology on its own.

The skeptics were partly right. Tandy has confirmed that the basic technology to be used in its erasable, optical CD player was developed by a tiny firm called Optical Data of Beaverton, Oregon.

For the past two years, Tandy had talked with Optical Data about a shared approach to designing an optical-disc device that could write, erase and rewrite data. Several companies worldwide, including Sony of Japan and Maxtor of San Jose, have been working for years on this same problem. But whereas Tandy hopes to produce a recordable CD player, priced under $500, these other firms are concentrating on devices that store data for powerful, office computer networks.

Indeed, Maxtor has already introduced what industry observers believe is the most powerful erasable optical storage device yet, capable of storing one gigabyte of data per 5.25-inch disk. Sony already offers a similar device that stores up to 650 million characters of data and costs $2,000 to $3,000 in large quantities.



How the erasible CD stores data.

Optical storage technology relies on lasers to "read" holes or bumps on a disc, which are converted into "bits" of data. Dye-polymer technology is based on changing the look of a disc's surface using a laser's heat. Optical Data is one of the pioneers in this technique.

"We're acknowledging that Optical Data developed a dye-polmer technique similar to the one we're using," said Mike Grubbs, director of marketing at Tandy Electronics, Tandy's engineering and manufacturing arm, who confirmed that Tandy has agreed to licence Optical Data's technology. "But our work was done independently, in our own lab, and it is critical to achieving an erasable CD device."

Tandy won't elaborate on its CD technology. Grubbs considers the most critical feature to be the internal structure of the CD platters, which he described as the company's "secret sauce."

To record information, he explained, a laser heats up the platter. That causes a special layer on the platter to "bump up." The bumps can be detected by sensors in conventional CD audio and DC-ROM players.

When thermally "erased" – Tandy won't say how this is done – the bumps disappear, Grubbs said. The process of recording and erasing can be repeated over and over again.

VLSI and Hitachi to share ASIC know-how

In a deal some analysts fear once again allows a Japanese chip giant to acquire key US semiconductor technology from an undercapitalized US chipmaker, VLSI Technology in San Jose has entered into a joint ASIC chip venture with Hitachi.

Under the terms of the agreement, VLSI will provide Hitachi with its state-of-the-art cell-based custom chip design technology. (Gate arrays were not included in the deal). In return, Hitachi will provide VLSI with its manufacturing expertise. Both companies will also be producing some of each other's chips sold to customers in the other firm's domestic market.

According to VLSI, the two firms will co-operate in modifying Hitachi's manufacturing technology to make it compatible with VLSI's advanced chip design tools. VLSI will implement the new process in its wafer fab facilities in San Antonio, Texas, while Hitachi will build a new plant in Japan that will use VLSI's design tools in conjunction with the new manufacturing process.

On the surface, the deal would seem like another example of a Japanese firm acquiring US technology, only to turn around and muscle its way into becoming a leading supplier in a key new market through competitive pricing.

But VLSI president Al Stein and Hitachi vice president William Gsand quickly disputed these charges. For one, to make sure it would not be giving away all of its trade secrets, VLSI is only providing Hitachi with the design tools for ASIC chips, not the critical source codes which contain the instructions that enable the design tools to greatly automate the chip design process. Without the source code, Hitachi will not be able to modify the design software.

The VLSI-Hitachi deal is seen by most industry observers as part of the continuing trend in the industry toward the formation of alliances, particularly between US and Japanese firms. "There is a massive restructuring in the semiconductor industry under way, and the general trend is that in order to be a world class supplier in the 1990s, you are going to have to have a global presence," explained analyst Andrew Phophet at Dataquest.

Sematech gets green light

Sematech, the US chip industry's manufacturing research consortium, cleared an important hurdle recently when it signed an agreement with the Pentagon to guarantee it some $100 million in annual subsidies for the next five years.

Sematech chairman Sanford Kane, a top IBM semidonductor executive, said the agreement was signed after clearing several bureaucratic hurdles had having Sematech's plans approved by the Pentagon's science review board.

Under the terms of the agreement, The Pentagon will be allowed to use any of Sematech's technology and give it to defence contractors, even those firms are not Sematech members themselves. However, the defence contractors will be limited to using the Sematech technology for the production of military-type components.

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Processor.

NEC. The Uni-x contains a NEC V20, manufactured by Sony.

Thus a V20 running at 4.77MHz will outrun an 8088 running at the same clock speed.

machines examined provided a standard PC clock rate of 4.77MHz as a minimum, although the Uni-x delivered higher than standard performance even on this clock rate by virtue of the V20. The Atlantis and machines

Performance.

The Uni-x is fastest overall, providing a 50 per cent boost over the Technology Interface due to the V20.

Display.

delivered with a nice INTRA tilt/swivel amber screen.

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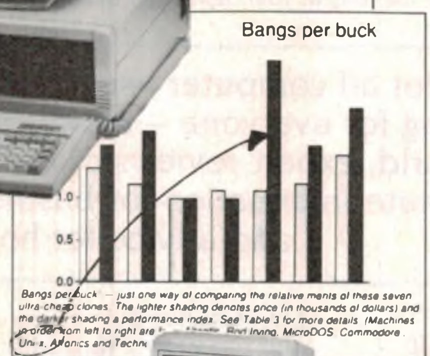

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Compact Disc Reviews

by RON COOPER

MOZART

Transcriptions of operas for wind instruments
The Magic flute
Don Giovanni
Maurice Bourgue wind band
Pierre Verany PV 787033
Playing time: 63 min 47 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 Mozart with a difference – a new sound to operatic selections, played by wind ensemble. This form of playing was quite fashionable during the last quarter of the eighteenth century and first quarter of the nineteenth centuries, as it was a very good way of introducing this kind of music into certain bourgeois salons and kiosks. Otherwise this form of music would never have been heard.

Nearly all the composers of the time wrote music of this type, but not much has been recorded. Many great works have been transcribed for wind band and those represented here are considered to be the best made by transcribers of the time soon after the first performance of the works.

On first hearing, being used to this delightful music played by a large orchestra, you are aware of a rather restricted dynamic range and a lack of orchestral sparkle, but this music is in a different category and should be regarded as such. It just happens that the tunes are all very familiar!

The wind playing here is extremely sensitive and delightful in its own right; to improve the balance the transcribers have added double bass and glockenspiel where necessary.

The sound is well balanced and clean. It does have a slight hole in the middle space-wise, but overall is very pleasant, satisfying and extremely well performed. If you enjoy both Mozart and music for winds, you will be well satisfied with this Disc.

SCHUBERT

Piano Quintet in A, D.667
"The Trout"
Der Hirt Auf Dem Felsen, D.965 (The Shepherd on the Rock)
The Nash ensemble with Felicity Lott (Soprano)
IMP Classics PCD 868
Playing time: 56 min 45 sec

PERFORMANCE
1 2 3 4 5 6 7 8 9 10

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

Schubert wrote the "Trout" during a walking tour in upper Austria with his companion Michael Vogl. The year was 1819 and while staying at Vogl's home town of Steyr, which was set in magnificent countryside, they met Sylvester Paumgartner.

Paumgartner was a wealthy mine manager and amateur cellist, who held regular chamber music concerts at his house. He asked Schubert to write a piece for one of his gatherings and that it should contain a movement based on Schubert's song "Die Forelle" ("The Trout") written 2 years earlier.

The result is this most famous of Piano Quintets, and coincided with one of the happiest times of Schubert's life, representing a climax – his first mature instrumental work.

There are slight differences here from the usual version of this work, as the performers on this recording are using the URTEXT edition of the music.

"The Shepherd On the Rock" was written in 1828 for the Soprano Anna Milder-Hauptmann who was the first Leonore in Beethoven's "Fidelio". The work features a brilliant clarinet obligato and in the hands of the performer here is a real delight.

The recording is extremely good with a fair amount of ambience and will delight the most fastidious Schuber fan.

I certainly enjoyed the double bass in the opening of the "Trout" though at time I felt the balance was slightly hole-in-the-middle. The "Rock" sounded a little further away but the blend of soprano and clarinet left little to be desired. Excellent value at $19.95.

ROSSINI

Operatic Arias
Scottish Chamber Orchestra
Raul Gimenez – Tenor
Conducted by Michelangelo Veltri
Nimbus Records NI 5106
Playing time: 61 min 33 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 magnificent release of rarely heard Rossini operatic arias which should delight all opera baffs. They are as follows:

Tancredi
1. Pensa,pensa, che sei mia figlia
2. Oh Dio! Crudel!... Ah! segnar invano io tento
La Pietra del Paragone
3. Oh, come il fosco impetuoso nembo ci separo... Quell'alme pupille
Otello

continued on page 140

Recording Australia's Oral History – 4

Ready, Set, Go!

Now that you have assembled all the equipment, the time has come to learn how to use it. In this and the next month's article, the author talks about putting the equipment to work.

by JIM LAWLER, MTETIA

Home recording of oral history is an entirely new hobby, and there are as many ways to do it as there are people doing it! Just what kind of material you finish up with will be entirely your own affair. Your imagination will dictate the kind of programme you will make – I can only give you advice about how to make it.

The primary object of recording oral history is to make the stories of the past available to a wide and future audience. This has to be done in a way that makes it easy for the listener to absorb. It's one thing to listen to the stories live and quite another to hearing them played back from tape. Ten to fifteen minutes at a time is about all that most people can take of even the best of speakers.

If you listen to radio you'll notice that most items last no longer than about 5 minutes without a definite break in the flow of material. In a programme like the ABC's *Science Show*, a thirty minute discourse on a single subject will be broken every 4 to 6 minutes with a bit of music, sound effect or a few comments from the presenter.

The overall length of any story you commit to tape will be governed by the content, and the way in which the story-teller presents it. It is good if this fits into about 15 minute segments, with one or two breaks within that time. Otherwise, you can cut the story up into 15 minute episodes, each with front and back titles so that the listener has a clear point at which to break his attention.

Think of it this way. If you want to read a history book, you would find it hard to concentrate on a facsimile copy of an ancient handwritten scroll. A printed copy of the scroll would be easier to read, and a version cut into pages would be easier still. Your tape has to be a modern version of a book, easy to pick up and put down, and as clear to the ear as a printed page is to the eye.

I mentioned in an earlier instalment that I was lucky enough to have been trained in radio production by the ABC. This has given me an appreciation for their professionalism, and a target to aim for in my work. Long experience has taught the ABC how to make "easy listening" programmes, and if we copy their ideas we must finish up with material that will do justice to both our subject matter and our listeners.

In these articles I have used the word *talent* quite often, to describe the person who is delivering the talk or interview. This is a common radio and TV term and is one that is hard to avoid when writing in a general sense about the people who provide the material for radio or television.

It's a generic term for the folk in front of the mike or camera. It doesn't mean they can sing or dance especially well, but only that they can provide the material that we, the producers, can make use of. So your talent is anyone who will talk into your mike, and I'll use the word in that sense for the rest of this article.

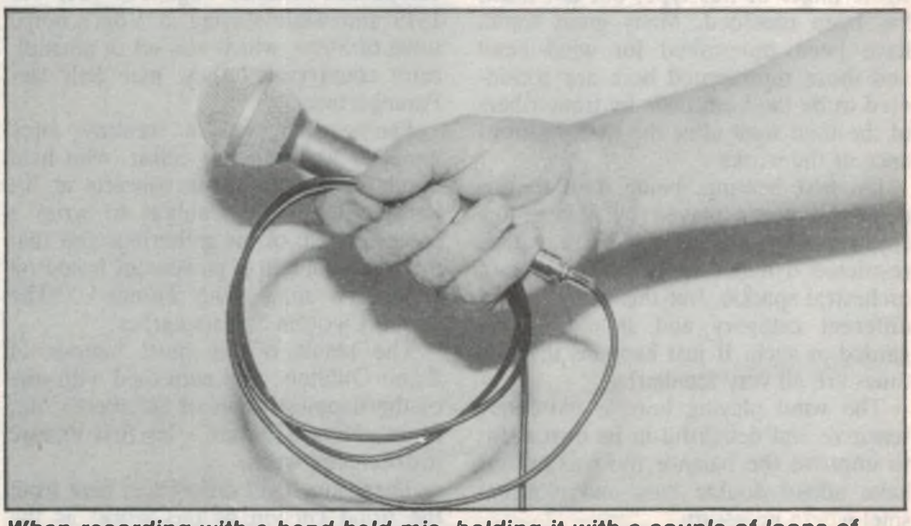
Selecting a format

When you have chosen the speaker for your programme, you must decide about where and how they should be recorded. If the talent has a strong voice you might choose to record outside, in an environment appropriate to the theme of the programme. This has the advantage of authenticity, but leaves you with no control over the background noises on your tape.

Wind noise is particularly hard to avoid when recording out of doors. A wind shield helps, but is never 100% effective.

On the other hand, a subject who is a bit shy or timid is much better handled in the studio, or at least in a private outdoor situation.

In either case the talent must be put at ease before the session starts. This is best done by talking generally about the subject to be covered. Try to set some limits to the range of material, but be



When recording with a hand-held mic, holding it with a couple of loops of cable will generally minimise handling noise.

OARTS trainee Frankie Pettman (left) putting her recent training in oral history recording to good use, by capturing for posterity the reminiscences of her long-time friend Wyn Clayton.

careful not to be too restrictive. If you get too much material this time, file it away and perhaps make another story from the surplus at a later date.

If you are going to interview the speaker, you will already have your questions formulated. You can talk around the subject before you start so that your talent knows the general outline of the programme. But the one thing you should not do is reveal the actual questions beforehand. This leaves the talent wondering about when a particular question will come up, and gives him time to think about the answers. It often results in stiff, stilted replies that lack vitality. The spontaneous reply to an unexpected question is much more natural and pleasant to listen to.

The choice between an interview or a talk can be a difficult one. Many old folk with an interesting story to tell become tongue tied when faced with a microphone. They will talk freely and fluently until the mike appears, then freeze up and can't remember beyond the end of the next sentence. In this event an interview is the way to go. You can prompt the speaker's memory by careful questioning, then later edit out all but the important leading questions.

Another way to put a timid speaker at ease is to use a lapel microphone. Most people soon forget they are "wearing" a mike, and it's out of sight unless they look down. Usually, it's not the idea of making a recording that worries people but the sight of the microphone being held under their nose.

The "Talk" is the way to capture the speaker who likes to tell stories and is not fazed by a microphone. In fact, many of these kind of people love the mike and are often hard to stop once they get going. All you will have to do is to introduce them and their subject, then stand back and let 'em rip!

Even those speakers less enthusiastic about recording their stories will need no prompting once their story starts to roll. The secret is to make them feel comfortable with what they are doing.

One thing to avoid like plague is fumbling with your equipment as you begin your session. If you are untangling a mike cable, or trying to fit new batteries into a difficult space, you won't be relaxed and neither will your talent.

Get all the technical details cleared up before you leave home. Test the mike and recorder with new batteries and a new cassette. Make sure you have a notebook and a pen that writes. Wind the cassette back to the start; carefully coil the mike cord around the recorder; only then put on your hat and coat and go to meet you talent.

A lot of the best stories are told around the bar in the local pub. (Don't laugh – I'm not talking about that kind of story!) It's an unfortuate fact that Fourex tongue oil (or Fosters if you live south of the Gold Coast) is so effective in starting the tales flowing. The trouble is that both the Fourex and the stories are hard to stop once they get going.

If you start recording in the bar, make it a short session. If a drink is necessary to loosen up your talent, I would suggest that you take both the talent and the bottle home with you. That way you can control them both and assure yourself of a more usable tape. Of course, it goes without saying that a bottle is a last recourse. You should never use the promise of a drink as a lure to your talent; only to put them at ease once the session is about to start.

Looking for talent

The answer to the question "Where do you find your talent?" is quite simply "Everywhere!"

I left the Public Service some fifteen years ago, and when I return to the office to visit old friends, the new staff wonder who is the wrinkley that seems to know so much about the old days. And I'm only in my late 50's! If a 70 year old ex-public servant went back how much more interesting his story would be.

You will find a lot of talent among the soon-to-retire staff in your office or factory. The head printer of the local newspaper will talk about the days of linotypes and rooms full of the clattering machines with their waving arms and pots of molten metal. Say EATOIN SHRDLU to an old inky and his eyes will mist up, and out will come a stream of stories that will keep your recorder busy for hours.

If you look around, you might come across an ex-tram driver who remembers the Melbourne cable trams in the thirties. Or more recently, the fabled Bondi Tram. Old train drivers are usually good for a yarn, especially those who drove steam. I remember one train driver who retired from mainline steam to drive a one-car rail motor on a short Victorian branch line. He liked to ride with his passengers and talk to them along the way; he felt too isolated in his big express locomotive. He died before tape recorders were common, but what a story he would have put down.

There is a lot of interesting material to be gathered from retired professional people. The formal history of medicine, architecture, education or banking is fairly well documented, but not so the informal history. My father-in-law was a bank manager in Western Australian country towns in the 30's. I wish now that I had recorded some of his tales of the Depression on the land when I had the opportunity. It's too late now for me and that story, but not for you and yours.

Former *Electronics Australia* Editor Neville Williams has often written about the early days of radio in Australia, when he was employed by one of our fledgling radio manufacturing companies. Neville's writings might be too technical to rate as popular oral history, but I am sure that he could talk about the same period in a way that would be of interest to everybody. Or perhaps the Serviceman could talk about servicing during the thirties. I recall his story of the sausage antenna that is a gem of early radio history. (See *EA*, January 1968, page 60.)

A lot of your material will be dictated by where you live. A country town or a fishing village will surely have a number of old characters with fascinating stories to tell. And in that kind of locale they should not be hard to find. On the other hand, "characters" are scattered thinly in big cities and you might have to look harder for them. But they are there, and most of them are worth finding.

There is simply no end to the stories that make up oral history. You can even start with your own story. I have not yet recorded my tales of childhood, but I will. I can talk about the Melbourne Centenary Celebrations in 1935; Scott and Black winning the MacRobertson Air Race in that year; the 1937 Polio epidemic. I'll have something to say about Public Health and Industrial Safety in the 1930's. I can well remember Black Friday, 13 January 1939. And I even have some home front stories from the war years.

I have never done anything spectacular, but my accumulation of trivia will make quite an interesting tape – when I get around to it. In the meantime, I'm too busy working on other people's oral history.

Next month I will give you some tips about handling the equipment for recording and editing.

Author Jim Lawler snatching some hurried comments from the guard of a Tasmanian Transport Museum rail motor, before it departed on a run. By leaving the tape running, he also secured some atmospheric sound effects.

FOOTNOTE

In this installment of my series "Recording Australia's Oral History", we used a picture of Frankie Pettman and Win Clayton, two longtime friends with an interest in the stories of long ago.

Years ago, Win had developed an Olde Worlde English garden at remote Port Davey, south western Tasmania, and Frankie had spent many happy summer holidays helping her tend the foxgloves and snapdragons.

After finishing her OARTS training, Frankie realised that Win's garden would make a good subject for an oral history story. Our photo was taken as Frankie strolled with Win in her "new" garden at Franklin, south of Hobart and far from the Port Davey garden that started the exercise.

Sadly, Frankie Pettman died on May 25th while her story was still being edited. Her friends will complete the editing and entrust the tape to Radio 7RPH, where Frankie was a volunteer reader and enthusiastic supporter.

Jim Lawler.

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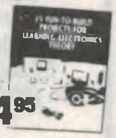

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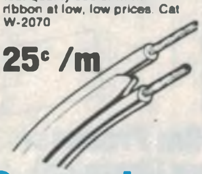
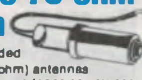
25c /m



300 to 75 ohm Balun



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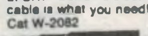

80c/m

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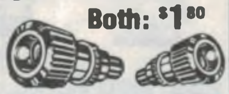

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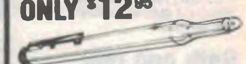

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The Serviceman

Sets that hiccup, or do other weird things

Colour TV sets can be entertaining things – especially when they're broken down. Or at least, some of the older models can be, taking a surprising amount of your time in order to track down a weird fault. In some cases it just isn't possible to be certain about the real fault, either, even though a set is nominally "fixed".

One of the first things we servicemen noticed about colour sets was the funny way they often hiccupped when they broke down. This was something new in our experience – black and white sets usually died and stayed respectably dead.

The next thing we noticed was the variety of hiccup rythms. Some sets made a very rapid tic-tic-tic-tic, while others were much slower – tic...tic...tic. I remember one set that had a very musical hiccup – it went ticka..ticka.. ticka.

But nothing I've ever heard matched a set that came into my workshop recently. It had a multiple-beat hiccup that would not have sounded out of place in the top ten. It went Ka-thump-a-ka...Ka-thump-a-ka...Ka-thump-a-ka. It was a Rock and Roll rhythm that any teenager would have found more entertaining than most regular programmes!

The set was a GEC model C2214, one of the English chassis that were imported in the early days of colour TV. These have been among the more reliable of the early colour sets, most of their faults being of a general nature rather than characteristic.

Despite the double sided circuit boards and the lumpy appearance of some of the solder, there have been no reported dry joints and very few electro failures in these sets. Those that have come into my workshop have been universally praised by their owners who wouldn't change them for "quids".

And so to the present set and the merry chase it led me on before its troubles were cured.

The two most common causes of hiccupping are faulty triplers, or shorted line output transistors. One only needs to unsolder the lead from the output transformer overwind to test the tripler. If the set stops hiccupping, a new tripler is called for.

To test the line output transistor, you simply measure the resistance from the collector to ground. Some sets have a diode in parallel with this measurement, so it may be low ohms in one direction, but the other direction must be infinity for a good transistor. Any leakage will be the reason for the hiccupping.

Needless to say, neither of these basic tests revealed a fault in the subject of this story, so more sophisticated and detailed tests were required. Of course, it was possible that the output transistor was breaking down only under load, so I replaced it with a new one. But that made no difference. The power supply was still hiccupping.

"By this time I was beginning to get a bit desperate."

Although the transistor is not easy to remove from this chassis, it is easy to disconnect it from the circuit. Pulling a two pin plug will open the collector and emitter leads, so I tried this and got an immediate response – no more hiccupping. So, if it wasn't the transistor or the tripler, it had to be some other overload in the line output stage.

A less common cause of overload is a shorted yoke coupling capacitor. Some black and white portables were noted for this fault, but it is fairly rare in colour sets. However, in this one it was a possibility because the particular capacitor was one of those yellow "dog-bones". In high voltage circuits in other brands these caps have been very unreliable, so it was worth changing this one. But it too made no difference.

The next thing I looked at was the two diodes in series, across the line output transistor. These diodes are involved with the pincushion correction and are high voltage, high current types.

I have known these diodes to break down under load, even though they test perfect at more moderate voltages. So to avoid any argument, I replaced both of them. But that still didn't do any good.

By this time I was beginning to get a bit desperate. About the only real "load" left was the vertical stage, but pulling the plug on that one made no difference either.

At this point I had cleared all of the most likely and many of the unlikely sources of trouble. As a last resort I disconnected the set from its power supply and ran the supply into a dummy load. It worked perfectly, supplying 160V to a combination of 150 and 100 watt lamps in parallel. I estimated that the two lamps were just a little less than twice the normal load of the set, so there was nothing wrong with the power supply.

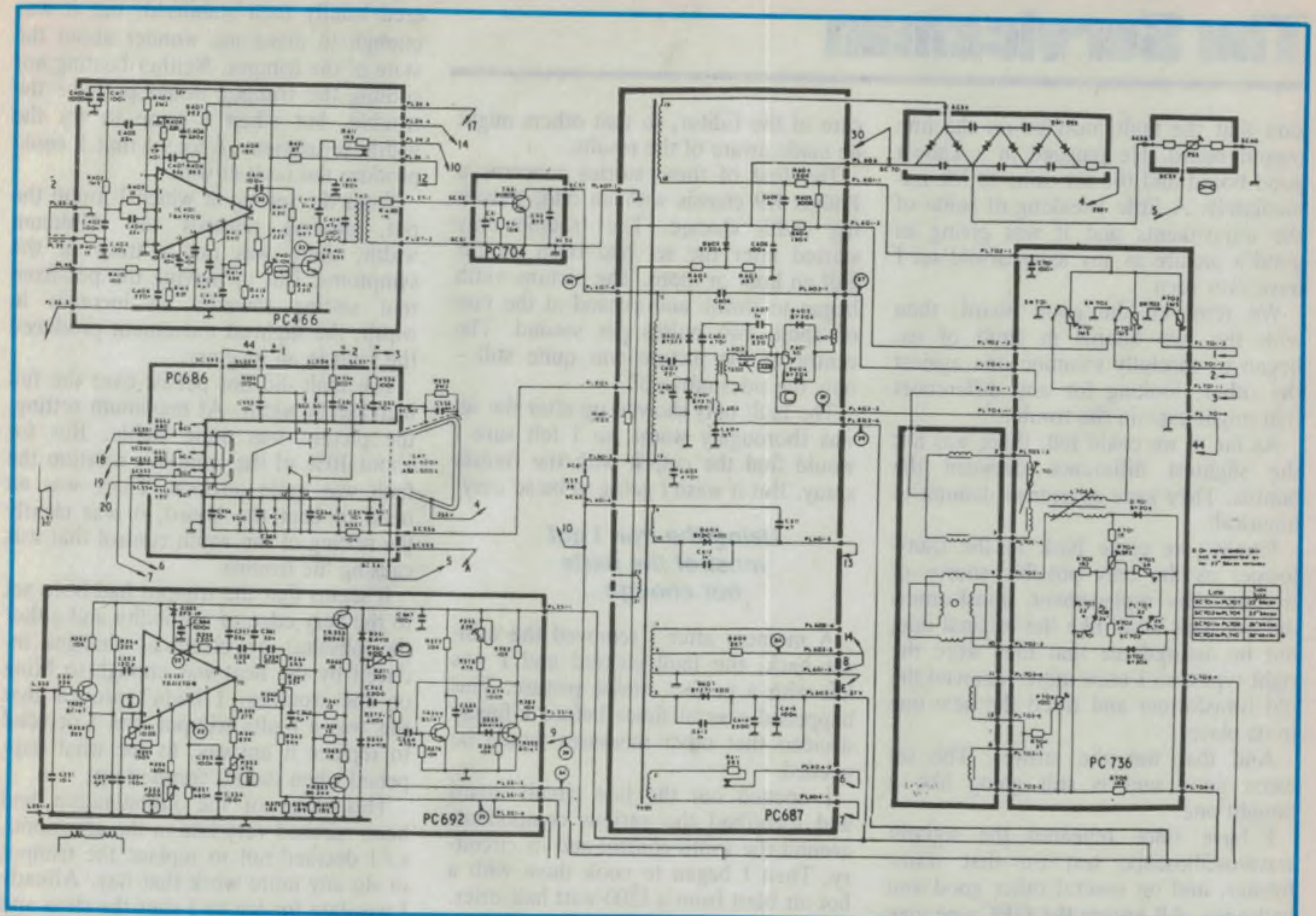
Finally, I came back to the line output transistor, convinced that it must be faulty in some way not apparent to any static tests. It could have been bad drive, but until I tamed the power supply I couldn't run the set for long enough to look at the drive.

Then I had one of my rare brainwaves. I reasoned that if I could feed in an external power supply, I should be able to see what the drive and the output looked like. This must surely give me a clue as to what was going on.

It was easy to slip the main rail lead out of its plug on the power supply board and I soon had an external 160V supply feeding in to the set. It only remained to switch the set on to power up the low voltage rails, and we should get some clues.

Unfortunately, the service manual for this model does not give a line drive waveform, only the oscillator and output waveforms are shown. However, the picture at the base of the output transistor was as near as makes no difference to the drive shown in similar circuits, so I had to abandon faults there as a possible cause of my troubles.

At this point I had to consider a line



The line output section of a GEC model C2214, subject of our first story this month.

output transformer fault as a distinct possibility. I had a dozen faulty transformers in the trash can, all replaced in the previous six months. It seemed that I was going through an epidemic of shorted turns with Philips, AWA and Sanyo sets. I had reached the stage where some of these were no longer available, and I don't like having to tell a customer to junk his set.

I would have to try something else – like call for "Help!!!"

So it was with much apprehension that I removed the transformer from this set, to give it as thorough a test as I could devise.

I once had a very useful little instrument called a "Shorted Turns Tester". It incorporated a small battery powered oscillator and a meter to monitor the oscillator activity. When an inductance was clipped across the oscillator, its frequency would change but not its output level. However, if the inductance should have a shorted turn, the oscillator would stop and the meter would show no output.

This instrument worked well for all inductances of medium to high impedance, which covers most line output transformers in the earlier colour TV's. Unfortunately, I trod on it one day and now it's new flat format doesn't work very well at all. So I have had to devise another means of testing transformers. For this I use a 15kHz square wave generator and my oscilloscope.

This can be done by feeding the square wave in to one of the windings, and viewing the transformer output at another winding. If the transformer is in good order, the output will show high voltage spikes at each transition of the waveform, followed by a number of cycles of ringing current before the trace levels off.

If a single shorted turn is placed around the transformer core, the output spikes and most of the ringing will disappear. This test will reveal a good transformer – a bad one will have no spikes or ringing to begin with. Or so I had thought, until recently.

The transformer from the GEC came through this test with flying colours. I would have staked my fortune on it being a good one. So I replaced it in the set and went on looking for some other kind of fault.

By the time I had spent something like eight hours on this job, I realised that I would have to try something else – like call for "Help!!!"

A colleague who lives in a country town some way from here is the GEC service agent and still has fair stock of GEC parts. I called him up and asked if (1) he had any clues as to the cause of my problem, and (2) did he have a set of good boards that I might borrow, to isolate my fault.

His answer to (1) was "no", and to (2) "yes, but!". Quite reasonably, he wasn't keen to let the boards out of his control, but if I liked to take the set to his workshop, I could do any test I cared to make. So a few days later I loaded the set in the van and took the morning off for a trip to the nearby countryside.

We discussed at some length the work I had already done on the set and eventually my colleague came to the conclu-

The Serviceman

sion that the fault must be on the line output board. He plugged in a known good board and the set came to life immediately. A little tweaking of some of the adjustments and it was giving as good a picture as any ten-year-old set I have ever seen.

We removed the good board, then with the two boards in front of us, began to carefully examine one against the other, looking for any differences that might explain the trouble.

As far as we could tell, there was not the slightest difference between the boards. They were as near as dammit to identical.

Finally, we came back to the transformer as the only possible source of trouble. His replacement transformers did not look at all like the original one, but he assured me that they were the right types, so I once more removed the old transformer and fitted the new one in its place.

And that was the answer. The set came good and is still going like a bought one.

I have since repeated the square-wave/oscilloscope test on that transformer, and on several other good and bad ones. All except the GEC one give unequivocal results. They are either good or bad. The GEC tranny reads good, but I know it's crook. So my test is not as infallible as I had believed. Oh, well! We learn something new every day.

The "odd" ones

While I'm on the subject of unsatisfying stories, my stories here usually begin with a bit of philosophy about the trade of electronic servicing, followed by an exposition of the problem to be discussed. Then comes a column or two about how the investigation proceeded, and finally the resolution – in which the original cause of the trouble is exposed and explained.

There are many occasions, however, when the job concerned cannot be resolved into a tidy Serviceman story – because the problem, although cured, cannot be explained (by me, at least). These stories are interesting from a technical point of view, but do not have the neat finish that we would all hope for and usually expect in these pages.

I'm now going to relate some of these off-beat stories, simply because they are interesting. If you know the answer to any of them, please send details to me care of the Editor, so that others might be made aware of the results.

The first of these stories concerns a Philips K9 chassis with an odd, pulsating width change. The trouble only started after the set had been on for half an hour or more. The picture width began to shrink and expand at the rate of about two pulses per second. The centre of the picture was quite still – only the sides moved.

The fault only showed up after the set was thoroughly warm, so I felt sure I would find the culprit with the freezer spray. But it wasn't going to be so easy.

Using the iron I got most of the parts hot enough...

A moment after I removed the cabinet back, the fault cleared and I was left with a perfect, stable picture. This happened several times before I finally decided that other measures would be needed.

I opened out the line circuit board and identified the various components around the width control and its circuitry. Then I began to cook them with a hot air blast from a 1200-watt hair drier. It didn't take long for the fault to show up, but it disappeared as soon as I switched off the heat.

Several cycles later all that I had proved was that the fault only showed up when the set was very, very hot. Even the cooling induced by removing the cabinet back was enough to cure the fault.

It was obvious that I would never get the faulty part hot enough to maintain the symptoms with the hair drier alone. What I wanted was something very hot that could be applied to each suspect component in turn.

A small soldering iron is an ideal tool for this purpose, although it must be isolated from earth so that it won't short out any rails that it might accidentally touch. I soon had my iron hot and began to check each of the components around the width circuitry.

Using the iron I got most of the parts hot enough to shrivel the paint, but there was no sign of the trouble. Not even using the hair drier on the back of the board and the soldering iron on the front was enough to restore the symptoms.

That is, until I accidently touched the width control itself. The picture flickered briefly then stabilised, but it was enough to make me wonder about the state of the trimpot. Neither heating nor cooling the trimpot would produce the trouble, but when I came to try the width adjustment, I found that I could produce the fault at will.

From the setting at which I found the pot, moving towards the minimum width, there was not a trace of the symptoms. But in moving the pot from that setting towards an increase in width, the slightest movement produced the fault in all its glory.

The fault did not persist over the full increase in width. At maximum setting, the picture was quite stable. But for about 10% of the trimpot's rotation the fault was quite obvious. There was no need to heat the board, it was clearly the setting of the width control that was causing the trouble.

It seems that the trimpot had been set to the very edge of instability and either the physical or electrical changes induced by the heat was enough to bring on the troubles. I hadn't proved that this was a faulty trimpot, but I decided to replace it anyway, to see what happened when the set warmed up.

This stage of the investigation had been reached very late in the afternoon, so I decided not to replace the trimpot or do any more work that day. Already I was late for tea so I shut the shop and left the job until next day.

And that's the end of the story. Next day the fault had disappeared, completely. And to the present time has not been seen again. I am not naive enough to believe that I have repaired the set. But if there are no symptoms, what am I expected to fix?

...None of this had any effect on the symptoms.

A similar problem occurred with a National colour TV, a model TC1807. It was reported to have a habit of not starting up when switched on.

It seems that three or four times a week the set would only give a little squeak when turned on, then nothing. Sometimes it would appear to start up OK, but after 10 to 15 seconds would give out with the squeak and then stop. It would never stay on long enough to show a picture.

Yet at other times the set would perform perfectly, for several days at a time. Needless to say, I only saw it on the days when it chose not to play up. In the course of several visits I had checked most of the likely sources of trouble.

There were no obviously dry joints, but I resoldered all those that could go dry just to be on the safe side. None of this had any effect on the symptoms. The set still played up at totally irregular intervals.

Eventually, the owner became exasperated with the set and asked me to take it in to my workshop so that I could be there when it next played up. He assured me that I would not have to wait more than a couple of days to see the fault.

I set it up in a corner of the workshop and switched it on and off a dozen times a day for a fortnight. You are not wrong if you imagine that I saw no trace of the trouble.

I had to do something to earn my fee

The owner couldn't believe it when I rang to tell him about my lack of success. In fourteen days he would have had at least seven mis-starts. He begged me to find out what was wrong with the thing, even if I had to take it apart to find the fault.

I got the set up onto the bench and removed the back of the cabinet. I sat there looking at the chassis, willing the beast to misbehave. But no such luck. It started up every time, and showed as good a picture as any I've ever seen.

I had already been over all the possible dry joints, and now I tackled some of the likely electros. Those that I removed all tested perfectly, with full capacity and no trace of leakage. I changed them over for no other reason than that I had to do *something* to earn my fee.

Finally, I decided that I could do no more and the set would have to go home. One last test would be a check of the 110 volt rail. I had tested this early in the piece, and had found it to be very close to normal. At that time I had used an analogue meter and by chance, this time, I used my digital meter. Whereas the analog meter had read "about" 110 volts, the digital meter read precisely 111.7 volts.

Now, in any TV I have worked on a variation of less than 2% in a rail voltage could be ignored. But this set had a fault that seemed to be shutting down the power supply. And this tiny overvoltage could be the cause. So I adjusted the voltage down to 110.0 volts, replaced the cabinet back and returned the set to its owner. And I've heard nothing more of it since.

Was it one of those otherwise perfect electros? Or was it the small over-voltage condition? Or was it something else altogether?

Then there was a Fisher video recorder, model FVH-P620 that was reported as refusing to rewind or fast forward. Everything else worked, but not these two functions.

The odd thing about this job is not that it cured itself – it didn't! The odd thing is how the fault came to be there in the first place.

When either REW or FF was selected, the machine made noises as though it was about to work, but then shut down. The tape didn't move in either direction, although the motor seemed to be trying to do something.

The Fisher manual includes a very extensive fault-finding chart covering all imaginable electrical faults. By following these charts, I soon established that the fault wasn't electrical. So, it had to be a mechanical problem, and here the story gets complicated.

The manual does not give very much mechanical detail and I had to spend quite a long time working out how the various idlers, gears, levers and brakes were inter-related.

I put the machine into play mode and switched off..

Eventually, I established that there were two ways of driving the takeup reels. There was a friction roller and a nylon gear, both running off a main idler wheel driven by the capstan motor.

I knew that the reels were being properly driven in the play and record modes, but it was impossible to see which drive system was operating. I assumed that one system drove each function – but with a cassette in position, everything was out of sight.

In the end, I put the machine into play mode and switched off the power so that I could remove the cassette carrier with the drive still engaged. It was then obvious that the nylon gear was doing the work in that mode.

This left the friction drive to do the job in FF and REW, and I again used the power switch to lock the mechanicals in the required mode.

And here it was quite clear that the friction roller was not touching the reel base. In fact, it was nowhere near touching, and there was no sign of any tension that might have pulled it into position.

In common with many other videos, the Fisher uses a toggling idler to shift the drive from one reel base to the other. A light spring is used to pull the toggle to the end of a guide slot, whereupon the direction of rotation ensures that the friction roller wedges between the drive wheel and the reel base.

Well, in this Fisher there was a light spring alright, but somehow it had been stretched to nearly double its original length. The first five coils had been pulled out nearly straight, and the remaining 20 odd turns had no tension on them at all.

It was obvious that this wasn't the normal shape of the spring, so I cut off the distorted end and reshaped the first turn into a new loop. I refitted the spring, which now pulled the toggle firmly up to the end of the slot.

This seemed to be all that was wrong with the machine, which then FF'd and REW'd quite satisfactorily. The only thing unexplained is how the spring came to be so badly distorted, seeing that it was tucked away under the cassette carrier, almost out of sight.

There was just one clue. When I first removed the cassette carrier, I found several pieces of uncooked spaghetti lying among the works! Raw spaghetti can be very hard and brittle. I've seen it cut little fingers so it's not hard to imagine what it could do to little springs in a VCR.

As I mentioned with the other items in this story, this is a quite unsatisfactory conclusion. Was the spaghetti responsible? Or was there some other, equally unlikely cause of the trouble? If the spaghetti was innocent, then I have not cured the trouble and the machine could bounce next week!

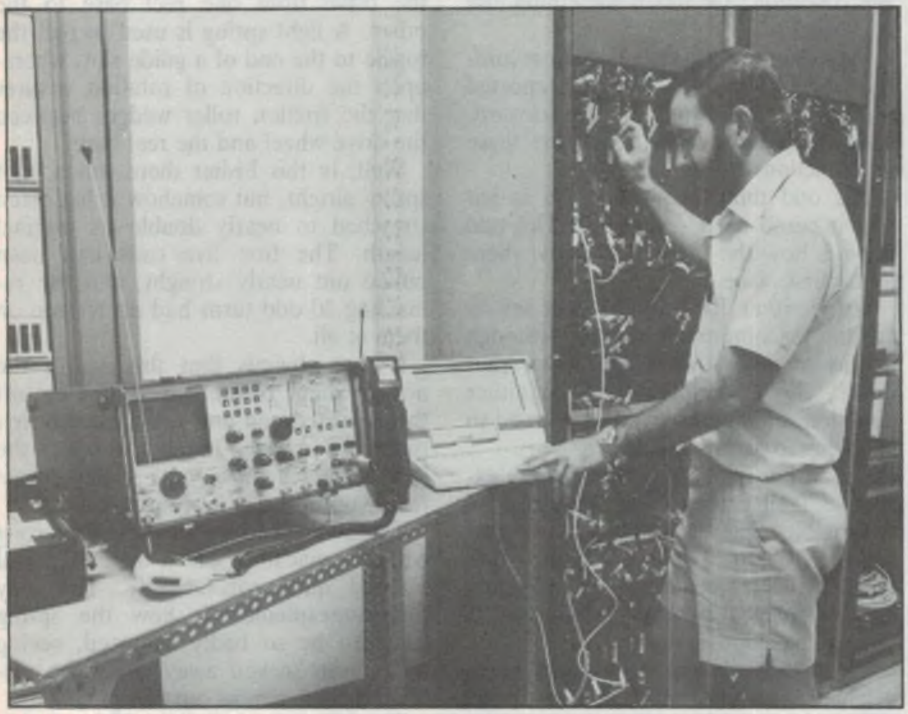
TETIA Fault of the Month

National TC-1802 etc. (M7, M8 chassis)

Symptom: No vertical scan. D406 short circuit, R445 open circuit. New components fail repeatedly, sometimes only minutes after replacement.

Cure: C564, a 10uF 250V electro dry jointed. This capacitor, on the 160V rail, can cause problems in the brightness, video, sound and vertical circuits. Look also for dry joints in the earth return circuit from the line output transformer, at pin 3 of plug CO-6.

News Highlights



Telecom develops computerised radio field-strength meter

The Radiocom Support section of Telecom Australia in Brisbane has developed a computerised radio field strength meter for cellular radio phones, which also looks to have applications in testing paging systems, CB radios and two-way radio networks.

The testing system was developed initially to help in troubleshooting the new cellular phone system. As well as needing a mobile measurement/testing facility to accurately monitor field strengths and communication reliability, Telecom engineers found that it was also necessary to use a computer to access the base station systems properly. From this they developed the system into a complete portable testing terminal, based on a Toshiba T1000/1100 portable PC.

Telecom support engineer Neil Boucher wrote the software which runs on the system. This runs various tests on the base stations and alters frequencies to provide the most reliable communications in difficult areas.

So far Queensland has two cars that are fitted out with the computers, and set up to test signals in the area of south-east Queensland currently served by 13 base stations.

The software developed for the system is available for companies wishing to carry out similar work with other two-way radio systems. Further details are available from Mobiles Section, Radiocom State Support, Telecom Australia, GPO Box 5555 Brisbane 4001 or (07) 837 3683.

Teknis in receivership

Adelaide PC board maker Teknis Limited has been placed in receivership after running into financial difficulties, and is for sale as a going concern.

Teknis, which recently won a lucrative contract potentially worth more than $13 million to supply printed circuit boards to IBM Australia, employs 140 people at its modern Hendon base in South Australia.

As well as its main Adelaide operation, Teknis operates marketing businesses in Sydney and Melbourne and will continue to trade through its three operating divisions – Tekpro Pty Ltd, Teknis Systems Pty Ltd and Tritek Electronics Pty Ltd – which are not in receivership.

Ramtron signs six year agreement with ITT

Ramtron Corporation, the research and development subsidiary of Ramtron Australia Limited (formerly Newtech Development Corporation), has signed a non-exclusive six year multi-million dollar technology joint-development and licensed manufacturing agreement with ITT Semiconductors.

The total value of the technology licence and research and development commitment is expected to exceed $13 million. In addition, ITT will pay royalties to Ramtron for products using the company's ferroelectronic technology.

Effective immediately, the three-phase agreement provides ITT with access to Ramtron's new ferroelectronic semiconductor technology and also commits both companies to the joint development of advanced ferroelectronic manufacturing processes for very large scale integrated circuit (VLSI) product applications.

Under the terms of the agreement Ramtron and ITT will share ownership of the jointly developed technologies. The co-ownership permits each company to design and market its own products using the technology.

Mr Ross Lyndon-James, chief executive officer of Ramtron Corporation and deputy chair man of Ramtron Australia, said that the agreement is the first of a series of long term corporate partnerships and manufacturing agreements currently under negotiation which will generate subgstantial revenues for Ramtron Australia.

"The initial market for the Ferroelectronic Random Access Memory (FRAM) has been forecast by Dun and Bradstreet electronic industry market research company Dataquest Inc, to reach $430 million by 1992. Dataquest has further stated that this technology has the potential to achieve a significant share of the entire memory market which in 1987 was $6.6 billion and is expected to grow by 13% annually to reach $11 billion by 1991."

"Ramtron Australia's 72% interest in Ramtron Corporation will ensure that much of the benefit of this technology will flow back to Australia" Mr Lyndon-James said.

The ferroelectronic technology merges the ferroelectric effect with conventional integrated circuits. The new invention follows almost four years collaborative research between Ramtron and University of Colorado at Colorado Springs (UCCS) and Michigan Technological University (MTU).

This research has produced an important breakthrough technology for the semiconductor industry by solving the considerable problem of volatility for electronic circuits. Information stored in volatile circuits is lost when power is interrupted. Non-volatile circuits permanently retain information without power.

Ramtron has successfully integrated its ferroelectronic process with a conventional 3-micron feature size silicon fabrication process and produced the world's first true read/write non-volatile access memory, the Ferroelectronic Random Access Memory or FRAM – the FMx 801. The FMx 801 can store 256 "bits" of information.

Although ferroelectronic materials have been extensively researched for electronic memory applications, Ramtron is the first to make the combined breakthroughs in material science, electronic circuit design, and process technology required to manufacture practical ferroelectronic devices. The technology is compatible with existing semiconductor processes such as silicon-based bipolar and Complementary Metal Oxide Semiconductor (CMOS), as well as gallium arsenide.

Ramtron's ferroelectronic process uses a thin (less than 0.00004") film of ferroelectric ceramic lead-zirconate-titanate (PZT), sandwiched between two metal electrode films to form a "digital memory capacitor" which is built above existing semiconductor circuitry. The non-volatile operation results from the PZT film's two stable polarisation states, which can store "1s" and "Os" to represent digital information.

The PZT film is very rugged and remains ferroelectric from below −80 to above +350° C, well beyond the operating temperature range of existing silicon circuits. Further, unlike other nonvolatile memory, the RAM is both operated and programmed from a single industry-standard +5 volt power supply.

Vintage radio on Viatel

To cater for the recent explosion of interest in the history and memorabilia of the early days of domestic radio, a "Vintage Radio" database is shortly to be established on Viatel by Stimulus Videotex Services.

A directory of clubs and interest groups, articles on collecting, restoration, and construction of replicas, booklists, and general news about the hobby will be featured – and above all, a "swap shop & flea market" section, aimed at solving the big problem of obtaining those rare bits-and-pieces.

Stimulus offers a one page directory listing FREE to any non-profit organization which is set up to promote interest in Vintage Radio. A response page for such registrations is already on Viatel – simply log on and key *457069# to register your organization now! (Mail address RMB 1561, Benalla 3673).

News Briefs

- Malcolm Williams has been appointed managing director for ***InterTAN Australia (Tandy Electronics)***, the first Australian to be appointed to this position. Mr Williams has been with the company 15 years, the last three as general manager.
- Adelaide-base maker of metal vapour lasers for medical treatment ***Quentron*** has been placed in receivership. The firm's high technology products have met with considerable success overseas, but could not raise additional working capital needed for new product development.
- Revitalised parts distributor ***Promark Electronics***, recently acquired by the Electron House Group, has signed a distributor agreement with SGS-Thomson and renewed agreements with Siemens Components and Telefunken Electronic. The Sydney office has centralised its warehousing and moved to larger premises at 104 Reserve Road, Artarmon. Company operations are now fully computerised.
- Paging and telephone answering equipment suppliers ***Voicecall Communications*** and ***Page Alert*** have merged operations, creating what is claimed to be the largest privately-owned paging network in Australia.
- BWD Industries subsidiary ***Fastron*** has been appointed Australian distributor for Toshiba Semiconductors, including MOS and bipolar power transistors, MOSFETs, diodes, rectifiers, thyristors and fibre optics products.
- Former MD of EAI-Electronic Associates Nat Iyer has been appointed national product support manager with ***AWA Distribution***, with responsibilities for support of HBM, Advantest and Leader instruments, and Thorn EMI data products.
- ***Tecnico Electronics*** has appointed St Lucia Electronics as its Queensland distributor for products including Belling Lee, Potter & Brumfield, EECO and Oxley. The firm is located at 24 Campbell Street, Bowen Hills 4006, phone (07) 252 7466.
- Ian Wade has been appointed Victorian sales manager for ***Component Resources***, a division of Hobart-based Critec Corporation. Mr Wade was formerly with Antenna Engineering Australia (now Radio Frequency Systems).
- The ***Wagga Amateur Radio Club*** is hosting the 1988 Amateur Radio Convention, to be held in Wagga Wagga on the weekend of November 5-6 next. Further details are available from John Knight VK2JGK, via PO Box 294, Wagga Wagga 2650.
- Axel Herde has been promoted to the position of national sales manager for electronic components at ***Siemens***. Mr Herde has held various appointments in the company for the last 20 years.

Laser pulses monitor chemical reaction

Using extremely short, strobe-like pulses of laser light, scientists have observed the progress of the fastest chemical reaction ever studied – the kind of reaction that triggers vision.

The laser bursts provide a "slow-motion" measurement of a chemical bond twisting 90° in 100 femtoseconds.

The findings are reported in the journal *Science* by a research team led by Charles V. Shank, director of the Electronic Research Laboratory at AT&T Bell Laboratories, Holmdel, N.J., and Richard A. Mathies, professor of chemistry at the University of California at Berkeley.

The laser study further reveals that the bond continues to twist another 90° in a further 400 femtosecond, completing a 180° rotation by the endof the reaction.

In the light-sensing rod cells of the eye, the same kind of reaction starts a cascade of chemical changes that allow the eye to detect light — the basis of vision. The first step, reported in the journal, is the only one actually triggered by light.

The laser-aided detection shows for the first time how quickly the first part of this reaction occurs and establishes with certainty that it is indeed the first step in the vital light-sensing process.

In the experiment, the scientists used the laser pulses to measure how light was absorbed by the molecule as the rapid reaction proceeded. Changes in the pattern of the light absorbed provide direct evidence of the shape of the molecule and the progress of the reaction.

News Highlights

Export order for locally designed grid antenna

Large export markets in Asia, the Pacific, and South and North America are expected for a field-assembled grid antenna originally designed for Telecom Australia.

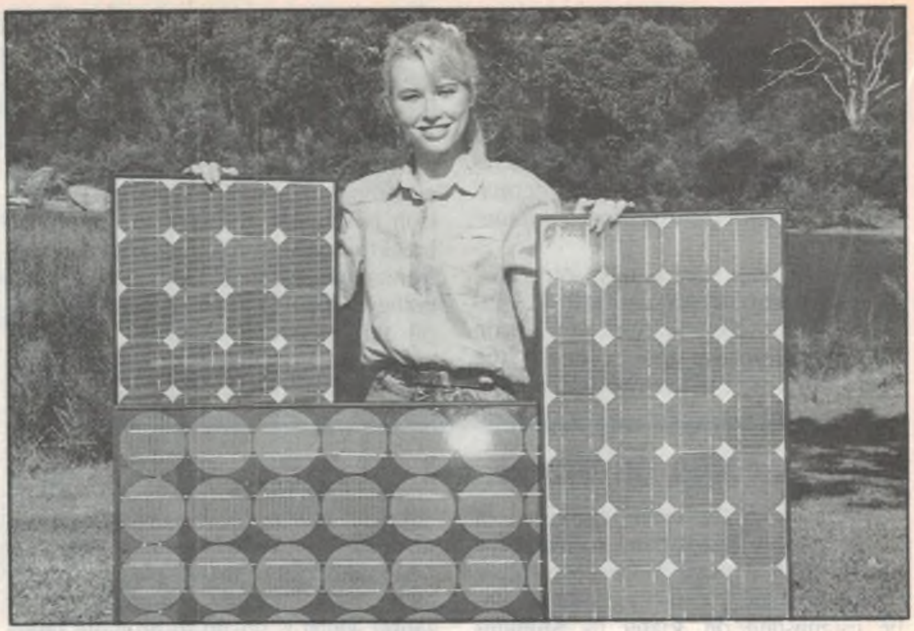
Radio Frequency Systems (RFS), an Australian company with headquarters at Kilsyth near Melbourne, has just received the first large export order to supply approximately 100 of the antennas for South America.

The grid kit antenna has a number of advantages; it is light and economical to transport, can be assembled with a few simple tools, and easily disassembled for relocation.

The RFS design has also resulted in great mechanical stability for the antennas, an important feature in areas such as Northern Australia where cyclones and high winds are common.

Telecom is using the grid kit widely for outback telecommunications, especially for rural telephone point-to-point use.

The grid kit antenna is available in a number of forms, with antenna reflector sizes ranging from 1.8 to 3.8 metres and covering frequency bands from 300 to 2700 MHz.



New lower-cost solar power modules are Australian made

One of Australia's leading solar electric companies has released a new range of solar modules designed to significantly reduce the cost of solar installations. The range provides power outputs up to 30% higher than previously available.

BP Solar's "Suntamer" range features three new modules designed and manufactured in Australia to meet a growing demand for solar electric systems.

Modules with outputs of 44, 52 and 58 watts provide greater flexibility and cost effectiveness for a wide range of solar power applications. The 58 watt module is claimed to provide the highest power output available in solar modules in Australia.

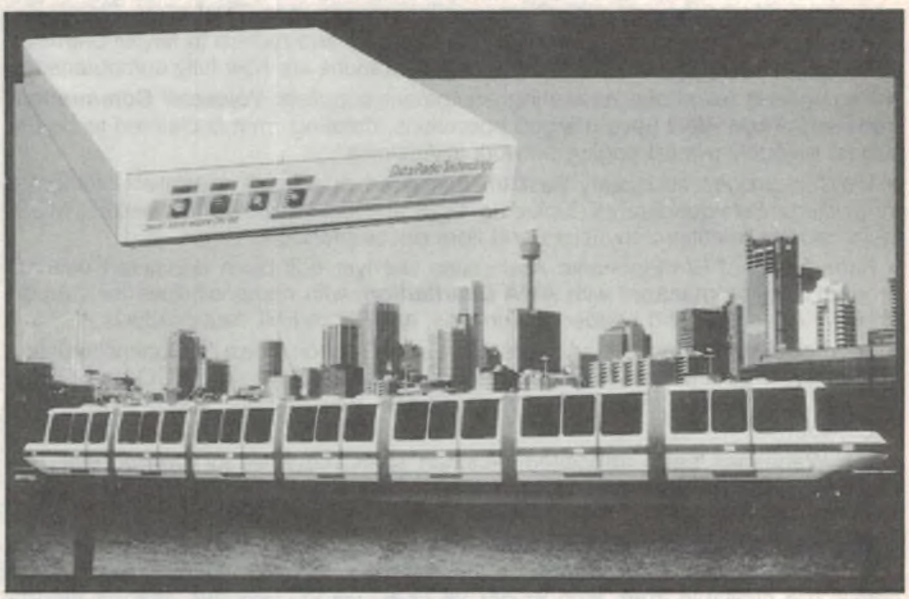
Seven hundred of BP Solar's highest output modules have already been supplied to a major mining operation in outback South Australia.

Monorail to use Australian radio modems

Sydney's recently commissioned Darling Harbour Monorail is outstanding in many respects, not the least being the fact it is Australia's only automated passenger train system. Unlike Brisbane's Expo monorail, which requires the presence of a driver on each train, the Sydney vehicle is capable of complete automation, all control being exercised from a central operations centre.

Two Microvac II computers running GEC developed software monitor and control everything on the trains from door, light and power circuits ensuring collisions do not occur. Redundancy at all levels maintains an extreme safety margin.

Error-free data communication to and from the trains is provided by dual redundant smart radio modems in conjunction with an AWA UHF-FM radio system. The radio modems are standard Data Radio Technology model CPU-100's designed and manufactured by GFS Electronics in Mitcham, Victoria, Australia.



Running specially developed software the CPU-100's provide the system with a 1200-baud error free data transfer capability using the full duplex radio link. The CPU-100's also handle the data path's networking through the use of special internal addressing techniques.

Bell Laboratories demonstrates neural network

AT&T Bell Laboratories researchers have demonstrated a large neural network system, programmed with light, capable of recognising extremely distorted visual patterns.

The unique feature of the system is the simultaneous control of all of its synapses by the image projected on them.

The system was designed and built by computer scientist Cary Kornfeld, electrical engineer Robert Frye and physicist Edward Rietman. Materials scientist Chee Wong developed its new circuit processing methods.

The system is built of 14,400 light-sensitive, electrically connected elements, or "synapses," made of amorphous silicon deposited as a thin film on plain glass. Each is a light-controlled valve for electrical current, making it possible to vary the amount of current passing through each synapse by as much as a factor of 1,000 by changing the level of illumination that falls on it.

Signature verification device

A signature verification device called Sign/On is gaining increasing acceptance in the US over other personal identification systems such as voice analysis, inkless fingerprinting and geometric hand measurement devices.

The Sign/On device, which is being marketed in Australia by Allied Data, a member of the Andrew Sweeney Elecronics Group, is creating its greatest impact on the banking fraternity where one of the most important security challenges is the constant need for positive identification of customers and employees.

Once linked to a computer system, the device can store unlimited signatures. It then measures 13 spatial and timing characteristics of any authorised signature such as pen-in air movements which are unique to any one individual when a signature written on the Sign/On pad, accepting or rejecting it within three seconds.

Solar array for space telescope

The Space and Communications Division of British Aerospace has been awarded work to the value of 9.5 million pounds from the European Space Agency (ESA), the major part of which is to provide the second pair of solar arrays for the NASA/ESA Hubble Space Telescope.

The two "wing-like" solar arrays, each comprising two flexible blankets of solar cells and deployment and orientation mechanisms, will convert solar energy into electricity to power the telescope's scientific instruments and communications payload.

Work on this latest contract will be undertaken at the Division's Bristol site which was responsible for the design, manufacture and test of the first pair of arrays for the Hubble Space Telescope, scheduled for launch by the Space Shuttle "Discovery" in June 1989.

The new and enhanced solar arrays, designed as replacements to the first, will be transported when needed to the Earth orbiting Telescope by a servicing Shuttle. Astronauts will then remove the old and fit the new arrays which have a design life of five years and can provide up to 5.5kW of electric power.

Operating above the atmosphere of the Earth, so avoiding distortion, the Hubble Space Telescope will give astronomers a clearer view of the Universe. The telescope's sensitivity will enable it to view objects at an estimated distance of 14 billion light years.

Nitrogen benefits CD manufacture

Nitrogen supplied by CIG (Commonwealth Industrial Gases) is increasing manufacturing efficiency at Distronics, Australia's major compact disc manufacturer.

Savings in cost and time have resulted from the company's decision to use nitrogen to create an oxygen free environment for the storage of "masters" and "stampers" essential to disc production.

Compact disc production requires the making of a metal "master" from which duplicating "stampers" are taken and utilises a high technology laser lathe. Both masters and stampers are nickel plated and as such are subject to oxidation. Distronics engineers determined that storing them in an oxygen free environment would extend their life.

The provision of a CIG nitrogen environment in a gas cabinet has resulted in a three-fold extension in the working life of both stampers and masters and, as a result considerable savings are being achieved.

Australian turnstiles for sydney monorail

A $600,000 contract for the supply and installation of electronic turnstiles and gates for the eight commuter stations in Sydney's Darling Harbour monorail system has been won by ATL Pty Limited, of Ryde, NSW.

Each station will be fitted with a complete set of two "entry only" turnstiles, two "entry/exit" turnstiles, a gate for disabled persons, wheelchairs and strollers, three exit turnstiles and a control console. A support keyboard for programming and monitoring the equipment will also be supplied.

Capable of handling up to 22 patrons per minute, each unit is designed to minimise delays and queueing for passengers while reducing operating costs and preventing fare evasion, tampering and vandalism.

When coins or tokens are inserted, the turnstile or gate ejects a thermally-printed ticket showing the station name and the date and time of issue. The release mechanism operates to admit one passenger each time a ticket is removed from the printer chute.

New European satellite TV standard

The major representatives of Europe's consumer electronics industry have unanimously agreed on the specification for the "Eurocrypt" Scrambling and Conditional Access System for satellite transmissions using the MAC packet family.

The agreement was reached after many months of intensive negotiations between two major industry associatons – the "Anglo-Nordic" and "Euromac" groups – and took into account the work done by the European Broadcasting Union – EBU.

With the backing of more than 75% of European industry, "Eurocrypt" is assured of success. It demonstrates clearly the TV industry's commitment to 1992 – a single Scrambling and Conditional Access System for a single Europe.

"Eurocrypt" is claimed to bring many advantages to both consumers and suppliers. Consumers will need only a single satellite receiver to view programs from all the new European satellites. Program providers will see both their investments and their critical customer data protected – each program provider can maintain his own, secure customer database.

Althoguh "Eurocrypt" will work with any member of the MAC family, it is still hoped that agreement can be reached on a single transmission standard.

Australian directory on a single CD-ROM

The first of its kind, a new CD-ROM disc provides a directory of virtually all business firms in Australia, plus the residential names, addresses and phone numbers for Sydney, Melbourne and the ACT. Called simply *Australia on Disc*, the new disc is the result of a joint project between United Directory Systems and Philips Telecommunication and Data Systems.

An extremely flexible and easy to use retrieval software system called *Textware* accompanies the disc, and is designed to run on virtually any MS-DOS based personal computer. This allows retrieval of the directory information in a variety of useful ways.

Currently the *Australia on Disc* CD-ROM disc is available from both UDS and Philips together with a half-height Philips CD-ROM drive, as a special introductory offer. Prices are $1785 plus tax (if applicable) for an internal drive, or $2045 plus tax with an external drive. The disc itself costs $852, but will be updated regularly for a nominal cost.

Guy Norman, manager of Philips Australian CD-ROM activities, said the company was very proud of its involvement in the project.

"Our objective was to produce a CD-ROM that every business in Australia would have a use for, and to provide the disc at a market price every business could afford. To do this we had to ensure that the user interface was as friendly and as easy to use as possible."

Jack O'Donnell
M/Director

Why Waste Your time With Other Suppliers Altronics Can Deliver Any Of The Quality Products To You Tomorrow — Just Phone Your Order Toll Free On 008 999 007

Country Clients Please Allow Additional 48-72 Hours

Microprocessor Controlled Detector Clips On To Sunvisor

Invisible from outside your vehicle - this fantastic high spec Radar Detector Detects X and K Band Radar up to an Amazing 13KM

This super compact "Sunvisor clip on" Microeye Detector is virtually invisible from the outside of most vehicles at normal eye height hence its very unlikely yours would attract the attention a thief (or the Gendarmes for that matter) However, please remember that use of Radar Detectors is not permitted in some states.

MICRO EYE VECTOR
The First Detector With GaAs Diodes

Until now, GaAs diodes have only been used in sophisticated military radar equipment. The Microeye Vector is the first consumer electronics product equipped with this new technology.

Why GaAs Diodes Make The Difference.

• Lower threshold allows for a better signal to noise ratio • Lower signal conversion loss • Higher barrier reduces noise. Quite simply GaAs diodes increase the sensitivity of the Microeye Vector.•Using the latest digital processing technology the unit will filter out and ignore emissions from 80% of poorly designed Radar Detectors that emit microwaves. • Simply plugs into your cigarette lighter socket. • Clips onto sunvisor • Detects Mobile Radar Equipment. • Highway/City Modes switch allows monitoring of City or Highway conditions.

A 1530 $499

Accessories Included:- Visor bracket • Velcro • Cigarette lighter plug.

21 Day Money Back Guarantee.

DC Brushless Fan

120MMx120MMx38MM
Brushless, Electronically Commuted DC Motor

Voltage	24V DC
Current	330mA
Speed	3100 RPM
Air Flow	23 C.F.M.
Noise Level	32 dbA

Normally $29.98

This Month

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Ultra High Power Capacity Polypropylene Bass Drivers

Save 25% This Month

12" (300mm) Model

100 Watts continuous input
150 Watts intermittent input
Impedance 8 Ohm
Sensitivity 93db
Weight 3620gm

C 3070 $99

Normally $139

15" (375mm) Model

120 Watts continuous input
200 Watts intermittent input
Impedance 8 Ohm
Sensitivity 92db
Weight 4120 gm

Normally $179

C 3075 $149

Our all new "Black" polyprop cone Bass Drivers exhibit quite astonishing low register reproduction. The power ratings quoted are conservative. While they may not be the cheapest around they definitely represent the best value we know of - **Anywhere. The real exciting news is we have the top selling 12 and 15 inch models at low discount prices this month** - but be quick stocks are limited.

High Performance ALC Wireless Microphone

Our incredible ALC Mic is one of the most exciting products for '88. Wireless Mics suffer from overmodulation distortion with too higher input sound level making them unsuitable for high grade vocal entertainment use of ALC (Automatic Level compressor) fixes all this.

SPECIFICATIONS:

• Cardiod-Uni Directional Pick-up pattern • Freq.Res.: 30Hz-15KHz
• Carrier Frequency Adjust Range: Within +1MHz, 88-108MHz. Built-in Antenna

C 0328

Normally $129.00 Amazing Value $99.00

Super Bargain Save $50

Fantastic Negative Ion Generator

There have been volumes written about the benefits of negative ions combating air pollution, cigarette smoke etc. can be very beneficial to Asthma sufferers. Our great little Rover generates billions of ions per second! Includes tester.

Were $79.00

A 0990

$29

These are the Genuine Grain Oriented Toroid Transformers as used in Electronic Australia Projects

Toroidal Power Transformers

Why a Toroid?

- 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.

Dimensions and Weight

160 VA Models 110 Diam. 45mm H. 1.8Kgs Leads 200mm

300 VA Models 125 Diam. 45mm H. 25Kgs Leads 200mm

160 Watt Models

$65 10 up **$62 ea**

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

300 Watt Models

$79 10 up **$75 ea**

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

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Superb *Redford* 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 **Redford** Dual Diversity 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, 202.5, 203.7MHz (Please specify if you have a preference)

Mic Carrier Power 50mW (Max) **Mic Antenna** built-in **Dynamic Range** over 100db **S/N Ratio** better than 90db **Frequency Response** 20Hz to 16KHz • or - 3db **Mic Battery** 4 x AA cells **Battery Life** over 24 hours continuous operation. **Receiver Sensitivity** 12db/micro volt for 60db S/N ratio **Pre emphasis/De emphasis** 50us **Receiver output** unbalanced 6.3mm phone jack and balanced 3 pin cannon type. **Output Level** (adjustable) Unbalanced 0-2.5V Balanced O to • or - .3V into 600 ohms. **Receiver Power Supply** 200 - 260VAC.

Prices

(A) Dual Diversity Receiver **$729.00**
(B) Entertainment Microphone (hand held type) **$349.00**
(C) Lavalier Type Microphone **$349.00**

Bonus Offer SAVE $78 **Choose Receiver and Either Microphone For Just $999**

Please Note 3 different operating frequencies are available (you will need to specifically nominate desired frequency only if the equipment is being used in proximity with other Systems on the 200MHz band.

Frequencies

C 0111	Dual Diversity Receiver	202.1MHz	$729
C 0113	Dual Diversity Receiver	202.5MHz	$729
C 0115	Dual Diversity Receiver	203.7MHz	$729
C 0121	Entertainment Microphone	202.1MHz	$349
C 0123	Entertainment Microphone	202.5MHz	$349
C 0131	Lavalier Microphone	202.1MHz	$349
C 0133	Lavalier Microphone	202.5MHz	$349
C 0135	Lavalier Microphone	203.7MHz	$349

Stereo Mixers At Low Import Prices

ATTENTION: Social Clubs, Schools, Churchs, Disco Operators, Entertainers, Hotels, Night Clubs and Sporting Bodies. With Altronics low prices - here is your opportunity to install one of these outstanding sound control mixers. Both models iclude microphone "Soundover" facility - making either ideal for live entertainment use.

Stereo Audio Mixer

240V Mains Operated

A 2550 **$199.00**

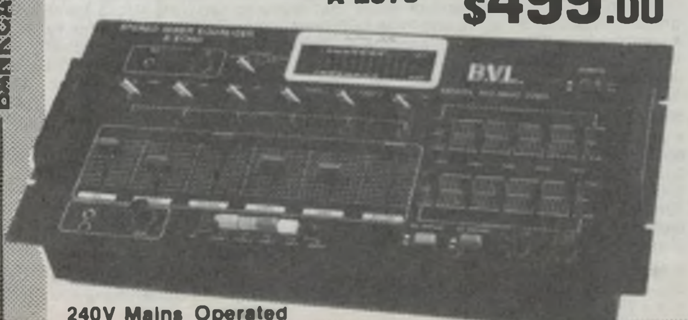
This brilliant little mixing console is absolutely packed with features. Allows blending of Microphone, two Phono inputs and either two Tape or Turner inputs • Right and left VU meters • Separate Bass and Treble controls • 5 slide level controls • Fader control between Phono pickups for professional cueing • Headphone monitor switch • Talkover facility.

SPECIFICATIONS:

• **Input** Mic 0.5mV 600 Ohms Phono 3mV 50K Ohms Tape/Tuner 150mV 100K Ohms • **Output** 250mV • **Frequency Response** 20Hz to 20Hz (plus or minus 1db) • **Tone Control (Treble)** 10KHz (plus or minus 12db) • **Tone Control (Bass)** 100Hz (plus or minus 12db) • **Distortion** Less than 0.07% • **S/N Ratio** More than 60db • **Headphone Impedance** 4—6 Ohms • **Dimensions** 318 (L) x 217 (W) x 85 (H)

Pro-Quality Stereo Console

A 2570 **$499.00**



240V Mains Operated

AMAZING VALUE

Our sophisticated 'NEW' Audio Mixing Console is ideal for 'live' recording • PA mixing • Fantastic Tape recordings • Even Stereo/Mono VCR recording. A truly professional deck that features separate R/L 5 band graphic equalisers • Echo and Peak LED level indicators • Talkover facility • Separate H/Phone level control • Patch switch bank • Individual microphone, Phono 1 Phone 2, Aux/Line 1, Aux/Line 2, and Master slide level controls — Blend up to two magnetic or crystal turntables, two tape decks or tuners and two microphones all at once!!

SPECIFICATIONS:

• **Input** Mic 1—0.5mV 600 Ohms Mic 2—0.5mV 600 Ohms Mic 2—0.5mV 600 Ohms (low imp.) 2.5mV 10K Ohms (low imp.) Phono 1 & 2 (Mag) 3mV 50K Ohms Phone 1 & 2 (Cry) 150mV 100K Ohms Tape/Tuner 1 & 2 150mV 100K Ohms • **Equaliser** 5 frequency bands—60Hz, 250Hz, 1KHz, 4KHz, 12KHz—Boost Cut range-plus or minus 12db @ Centre frequency. • **Output** 1.5V/0.775V (Selectable) • **Frequency Response** 20Hz to 20KHz plus or minus 1db • **Distortion** Less than 0.05% • **S/N Ratio** More than 50db

• **Headphone Impedance** 4—16 Ohms • **Echo** B.B.D. System • **Delay Time** 30—200mS • **Echo Repeat Control** • **Delay Time Control** • **Dimensions** 480 (L) x 240 (W) x 110 (H)

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Amazing Range of Over 200 Metres in typical applications

Superb Microphone Reproduction Compares with Shure, Beyer and AKG

Unique Microphone design completely Eliminates "Dangling" Antenna

Breathtaking performance without signal drop-out or noise interference The Eleco Wireless Microphone System is virtually the ultimate in an Entertainers Microphone system (or for any roving microphone application for that matter!)

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C 0113	Dual Diversity Receiver	202.5MHz	$729
C 0115	Dual Diversity Receiver	203.7MHz	$729
C 0121	Entertainment Microphone	202.1MHz	$349
C 0123	Entertainment Microphone	202.5MHz	$349
C 0131	Lavalier Microphone	202.1MHz	$349
C 0133	Lavalier Microphone	202.5MHz	$349
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240V Mains Operated

A 2550 **$199.00**

This brilliant little mixing console is absolutely packed with features Allows blending of Microphone, two Phono inputs and either two Tape or Turner inputs • Right and left VU meters • Separate Bass and Treble controls • 5 slide level controls • Fader control between Phono pickups for professional cueing • Headphone monitor switch • Talkover facility

SPECIFICATIONS:

• **Input** Mic 0 5mV 600 Ohms Phono 3mV 50K Ohms Tape/Tuner 150mV 100K Ohms • **Output** 250mV •**Frequency Response** 20Hz to 20Hz (plus or minus 1db) • **Tone Control (Treble)** 10KHz (plus or minus 12db) • **Tone Control (Bass)** 100Hz (plus or minus 12db) • **Distortion** Less than 0 07% • **S/N Ratio** More than 60db • **Headphone Impedance** 4—6 Ohms • **Dimensions** 318 (L) x 217 (W) x 85 (H)

Pro-Quality Stereo Console

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240V Mains Operated

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SPECIFICATIONS:

• **Input** Mic 1—0 5mV 600 Ohms Mic 2—0 5mV 600 Ohms Mic 2—0 5mV 600 Ohms (low imp) 2 5mV 10K Ohms (low imp.) Phono 1 & 2 (Mag) 3mV 50K Ohms Phone 1 & 2 (Cry) 150mV 100K Ohms Tape/Tuner 1 & 2 150mV 100K Ohms • **Equaliser** 5 frequency bands—60Hz, 250Hz, 1KHz, 4KHz, 12KHz—Boost Cut range-plus or minus 12db @ Centre frequency. • **Output** 1 5V/0.775V (Selectable) • **Frequency Response** 20Hz to 20KHz plus or minus 1db • **Distortion** Less than 0 05% • **S/N Ratio** More than 50db

• **Headphone Impedance** 4—16 Ohms • **Echo** B B D System • **Delay Time** 30—200mS • **Echo Repeat Control** • **Delay Time Control** • **Dimensions** 480 (L) x 240 (W) x 110 (H)

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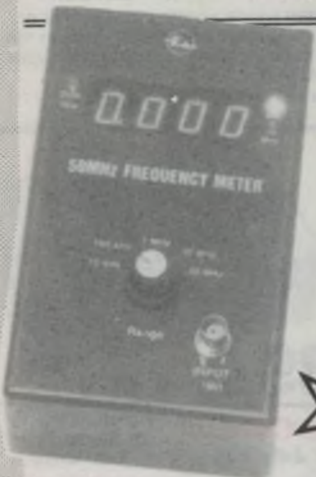

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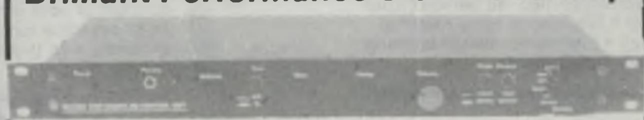

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(Silicon Chip June/July'88)

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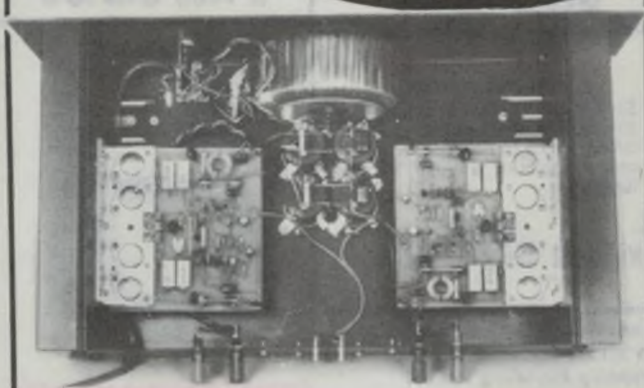
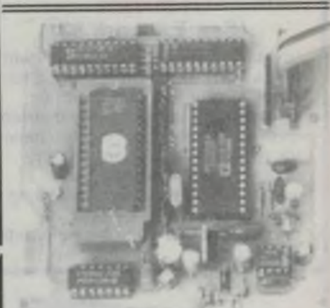
K 5015 $229

Simple PCB Construction Virtually No Wiring





Speech Synthesizer

(ETI March'88)

This incredible "Voice" generator will store 127 messages or statements each an amazing 128 bytes long. (A sentence such as "You've left the lights on" uses only 31 bytes)

Simply programmed with an eprom programmer and PC or you can purchase the pre programmed 56 message Eprom Cat.No. K 9502 for just $20.00. Refer to ETI March '88 or request a message listing from us.

On board amplifier easily drives the 3-1/2 inch speaker supplied with the kit.

Fantastic for installing at home, behind your car dash or for interfacing with alarm systems, control systems etc. Requires external 12V DC supply. Kit includes 27128 eprom.

Simply Fantastic!

K 9500 $85.00

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(ETI Dec'87)

Charge Your Batteries Free From The Sun

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K 5010 $399

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(See EA Dec'86)

K 2570

$21.95

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Measures accurately from -20 deg.C to +120 deg.C.

Congratulations To The Design Team At Sillicon Chip Magazine for this Excellent Design

K 2515 $299.00

1GHz Digital Frequency Meter

(See SC Nov'87 Jan'88)

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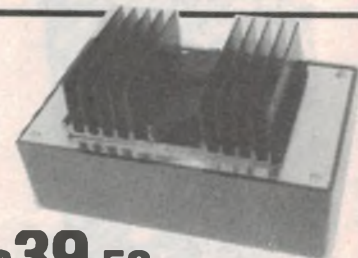
Features: Professional machined and screen printed red perspex front panel • Easy to asemble and construct • No special tools required • Bright Hewlett Packard 8 digit display • Electronic switch latching • High performance IC's • High Quality Components.

Transistor Assisted Ignition With Dwell Extension

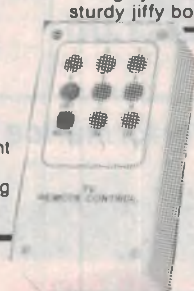
(See EA Feb'83)

Pays For Itself In No Time

Dead easy to build & (even better) there are only 3 electrical connections required to the car wiring system. Now housed in sturdy jiffy box.



$39.50 K 4010



8 Way Remote Control

(See EA June July'86)

Control Your TV Or Stereo From Your Chair

Convert your TV, CD, VCR etc to be operated remotely from the comfort of your armchair. Up to eight separate functions can be switched with this infrared remote control.

K 1830 $125.00

Added Facility

Apart from above - allows for control of On/Off, Mute and volume control.

K 1840

$45.00

Touch Lamp Dimmer

(See EA April'83)

Instantly turn lamps on and off with just a light touch on a wall panel. Alternatively you can dimm or brighten the lamps to any desired level by merely touching the panel for two or three seconds - very classy! The *Altronics* kit is complete in every way, including satin touch plates for that prestigeous look. Please nominate plate colour.

Gold K 6319
Silver K 6320

$35.00 ea

K 1400 $9.95

Telephone Off Hook Indication

(See SC Nov'87)

Use where 2 or 3 phones are connected on the one line. If one extension is in use a LED will flash in each of the other extensions. Requires no external supply. Runs off the telephone line. One module required for each phone.

Regenerative Radio

(See EA Jan'88)

Step back in time and build this simple regenerative radio receiver. Using only 3 transistors, its not only fun to build, but uses Varicap tuning.

K 1150 $55.25

This natty service aid allows you to track down short circuits without continually blowing fuses.

DC Electronic Fuse

(See EA Nov'87)

Replaces Any Size fuse Up To 10A

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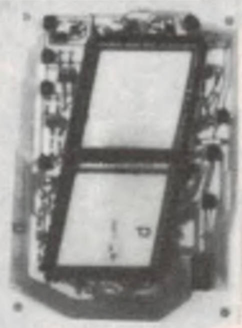
K 2535 $39.50



Large 7 Segment Display

This large 153mm high seven segment display can be configured for use as either common anode or common cathode. Multiplexed on DC driver and arranged to have a decimal point on either the left or right hand side.

It can be used to interface equipment with existing displays for large elapsed times & digital clocks.

K 1225 $59.95

Low Ohms Adaptor For Your DMM

(See SC Feb'88)

Measure Accurately Down To 50 Milli Ohms!

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Megohm Meter

(1985 Successor to the "Megger")

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K 2550 (See EA July '85)

$65.00

The Protector Car Alarm

(Silicon Chip Feb'88)

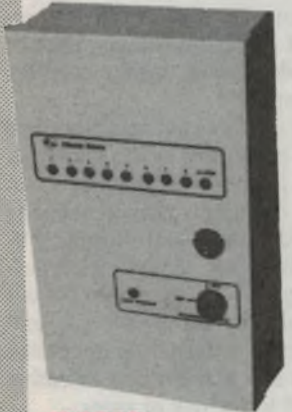
Save Over $100 On An Equivalent Commercial System

Features: Internal & External Sirens • Dash lamp flasher • Battery back up • Delayed & Non delayed inputs • Ignition killer • Easy to build & install.

K 4370 $129.00

Save $$$ on the cost of commercial equivalents

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.**
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K 1900 (without Back Up Battery) **$149.50**
S 5065 (12V 1.2AH Backup Battery) **$24.95**

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Housed in rugged "ABS" instrument case.

K 2700 $179.00

(See EA Oct'87)

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(Silicon Chip Dec'87)

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New 30W stereo amplifier project – 2

Full circuit details

Here it is, our latest Playmaster amplifier. This compact unit is low in cost and very easy to build, yet provides all the essential features and excellent performance.

by ROB EVANS

In the June issue we discussed the design considerations for a new low cost, high performance stereo amplifier. This article considered the power, features and overall performance required for today's signal sources. We also looked at the requirements of the home constructor, in terms of ease of construction and reliability.

In fact, we set ourselves quite a challenge, since the actual design of such an amplifier has a few conflicting requirements. High performance for example, does not necessarily lend itself to low cost and reliability, while a construction technique with little interwiring means a more complicated printed circuit board (PCB) design.

However, since we at EA are not adverse to challenges, the time and effort was put in to overcome these hurdles. The end result is the Playmaster 30-30; an easy to build, moderately powered amplifier, with excellent noise and distortion specifications to satisfy the most fastidious listener.

It's neat as well. With the exception of the power transformer and output terminals, all components mount directly onto one square PCB – resulting in simple, trouble-free assembly. In fact, by connecting the power transformer to the assembled PCB, the amplifier may be tested as a free standing unit, without the cabinet. This is made possible by the use of a very careful PCB design, direct mounting potentiometers and input sockets, and small high efficiency heat sinks. As a bonus, all of this fits into a small, moderately priced box.

To simplify our design even further, we have elected to use integrated power amplifier chips for the main power amp stage. At moderate powers, this slightly unusual method has some distinct advantages over an equivalent discrete design.

Power from an IC

Integrated circuit power amplifiers have been viewed with some suspicion in the past, due to their reputation for questionable reliability, and poor noise and distortion performance. However, the newest generation of power ICs settles any doubts about their ability in these areas. Manufacturers have developed these devices to a performance level where they challenge the best discrete designs, while offering a host of self protection facilities and an attractive price.

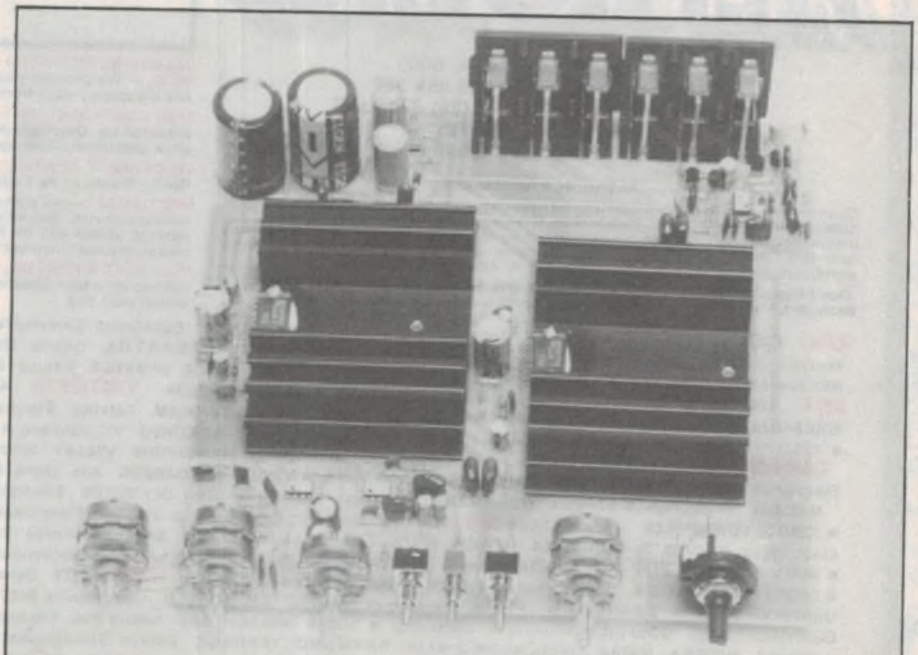
Just as we use the common op-amp instead of a handful of transistors, we may now also use these new power ICs as an effective replacement for discrete power designs. In the present case, the power IC is a neat physical and electronic solution to the conflicting requirements of our output stage. That is, it is small and self contained, yet offers high performance.

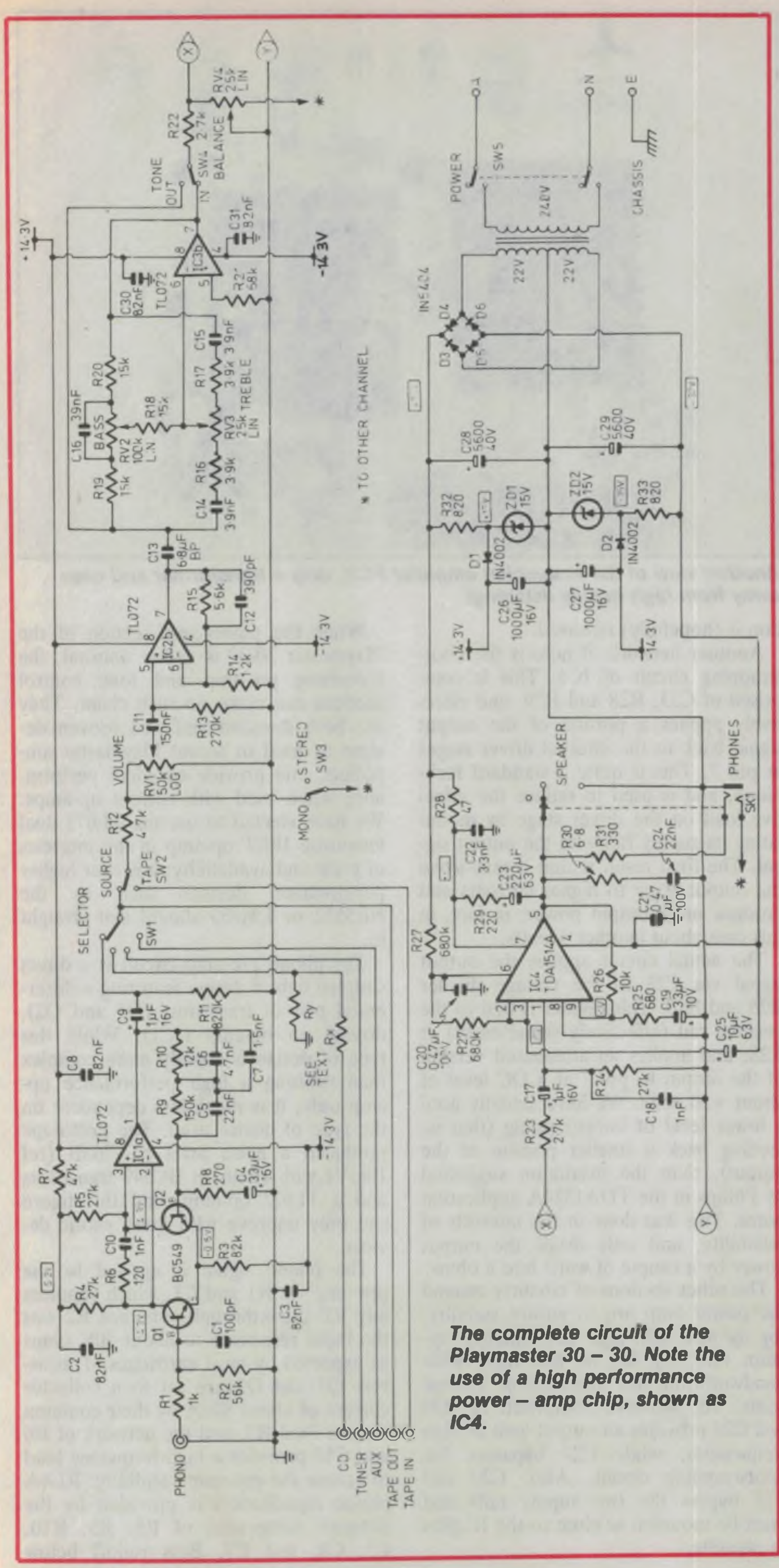
The reason for this high reliability and performance is the power IC's internal construction. In the same manner as an op-amp, the intimate thermal coupling and optimised component layout produces a highly stable device. As a further advantage, an IC is simple to implement thanks to the small physical size and minimal external components. This means a less complicated assembly procedure and lower risk of error.

So, with this high production technology and long periods of research and development, how can manufacturers charge so little for such a sophisticated device? The answer is simply large production runs and high volume sales, which is due to the wide range of applications and predictable results.

The Philips TDA1514A

An excellent example of these new high performance power chips is the





The complete circuit of the Playmaster 30 – 30. Note the use of a high performance power – amp chip, shown as IC4.

Philips TDA1514A integrated power amp. This remarkable little beastie has a nominal output power of 40 watts, a 10V/us slew rate, very low noise and distortion levels, and is contained in a 9-lead package (type SOT-131A) measuring only 24 x 12 x 4mm. It also has a number of very useful protection features that are ideal for our application.

The first of these features is an internal muting circuit, which may be activated by applying a low voltage level to its control pin. This condition may be induced by internal chip conditions, or an externally applied level. As the name implies, the muting circuit simply mutes the audio signal path to the IC's output stage.

The muting circuit's control pin may be wired to an RC network so that muting is activated for a pre-set time, during power-up conditions. This is effectively a "de-thump" circuit, for it blocks the DC offsets produced by charging capacitors in the earlier amplifier stages, until they have settled.

The second feature is primarily designed to protect the output transistors and is called SOAR protection. SOAR is an acronym for "safe operating area", and refers to the range of voltage and current combinations the output devices may safely handle. Since dissipated power is the product of the applied current and voltage (P=IV), a given device will pass a much higher current at a low terminal voltage and a low current at the maximum applied voltage. In practice, these two conditions are at the opposite ends of a SOAR curve.

The clever thing about the TDA1514A chip is that when the SOAR limit is exceeded, the internal muting circuit is activated automatically – which in turn shuts down the signal, thereby removing the overload. Clearly, a direct short circuit across the output will rapidly exceed the SOAR limit, so we may consider this chip as protected against short circuits.

A thermal overload is treated in a similarly clever manner, with the muting circuit activated when the chip temperature exceeds a predetermined level. This third feature is very handy in a stereo amplifier, which has to cope with a wide range of ambient temperatures and load conditions.

As previously mentioned, a current generation power amplifier chip is not unlike a high powered op-amp, and shares its versatility. This is typified in the TDA1514A, which has inverting and non-inverting inputs, an input impedance of 1M ohm, an open-loop voltage gain of 85dB, a supply ripple rejection of 72dB, and an input bias current of 1uA. In short, it is an extremely practical IC which easily slots in almost any high quality power-amp application.

Performance plus

So it's a great chip, but how does the final amplifier perform? In a word: great. As the accompanying table shows, the specifications for the Playmaster 30-30 exceed those of a commercial unit costing many times the price. It delivers a continuous 28 watts into 8 ohms (both channels driven), and up to 60 watts under the IHF tone burst technique. So in the practical sense, this little amplifier is capable of cleanly driving loudspeakers to *loud* levels.

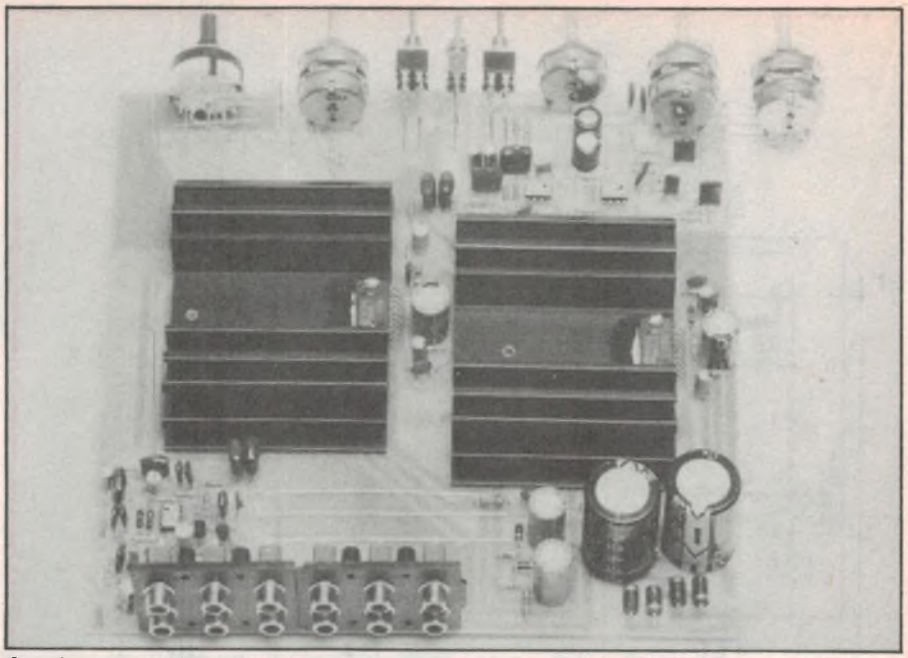
Naturally, the performance can be a little more civilized than attempts at speaker destruction. Using the Compact Disc input and the tone controls bypassed for example, the noise and distortion levels virtually drop to that of the CD player itself. In this "straight through" mode the performance of the amplifier is almost set entirely by the TDA1514A power amp chip; happily its conduct is first class.

The circuit

Turning our attention to the actual circuit diagram, we can see the TDA1514A as IC4. It is arranged with an input impedance of 27K as set by R24, and a gain of about 15 as set by R25 and R26. The signal is coupled to the "non-inverting" input via R23 and C17, with R23 and C18 acting as a low-pass filter to remove any frequencies above the audio bandwidth.

Both the inverting and non-inverting inputs (pins 9 and 1) are AC-coupled by C19 and C17 respectively, since these inputs are at a slight negative bias voltage. Also, to prevent unwanted subsonic frequencies reaching the output, these capacitors form high-pass filters with R25 and R24 respectively.

The muting control network (R27 and C25) is connected at pin 3 of IC4, which is linked to pin 2, the control output from internal protection circuitry. Initially, when power is first applied the discharged state of C25 will hold pin 3 low, forcing IC4 into its muted state. The muting is maintained as C25 charges towards the positive supply rail via R27. When pin 3 rises to about +6 volts, the muting function is released allowing audio signals to pass. In a similar fashion, an internal overload condition of the TDA1514A will drive pin 2 and consequently pin 3 low, until the condition is (hopefully) removed.



Another view of the assembled amplifier PCB, only a transformer and case away from high quality listening!

Another network of note is the bootstrapping circuit of IC4. This is comprised of C23, R28 and R29, and effectively applies a portion of the output signal back to the internal driver stages at pin 7. This is quite a standard technique, and is used to reduce the effective load on the driver stage by modulating its supply rail with the output signal. The final result is that it may drive the output stage to higher currents and produce more output power: in fact, in this case about another 4 watts.

The actual circuit applies the output signal via C23 to the voltage divider R28 and R29. This divider is tied to the positive rail (effectively signal earth) at R28, and applies an attenuated version of the output to pin 7 at a DC level of about +30 volts. We have actually used a lower level of bootstrapping (that is, feeding back a smaller portion of the output), than the maximum suggested by Philips in the TDA1514A application notes. This was done in the interests of reliability, and only drops the output power by a couple of watts into 8 ohms.

The other sections of circuitry around the power amp are to ensure stability, for as with any high performance op-amp, this chip has an extremely wide bandwidth at low closed-loop voltage gains. The network comprised of R30 and C24 provides an output load at high frequencies, while C22 bypasses the bootstrapping circuit. Also, C20 and C21 bypass the two supply rails and *must* be mounted as close to the IC pins as possible.

While the power-amp section of the Playmaster 30-30 is rather unusual, the remaining pre-amp and tone control sections can make no such claim. They are both standard and well proven designs as used in recent Playmaster amplifiers, and provide excellent performance when used with current op-amps. We have elected to use the TL072 dual low-noise JFET op-amp in the interests of price and availability; however higher performance devices such as the NE5532 or LM833 should slot straight in.

The phono pre-amp circuit is a direct coupled hybrid design featuring a differential pair of transistors (Q1 and Q2), driving an op-amp (IC1). While this type of design is slightly more complex than utilising a high performance op-amp only, it is much less dependent on the type of device used. The prototype produced a noise level of -76dB (ref 10mV) with common BC549 transistors and a TL072 op-amp, and this figure can only improve with more exotic devices.

The phono signal is applied to the pre-amp via R1 and C1, which suppress any RF breakthrough, whereas R2 sets the input resistance to about 50K ohms as expected by most cartridges. Transistors Q1 and Q2 are set to a collector current of about 80uA by their common emitter load R3, and the network of R6 and C10 provides a high frequency load to ensure the pre-amp's stability. RIAA phono equalisation is provided by the network comprising of R8, R9, R10, C5, C6, and C7. Bass rolloff below

SPECIFICATIONS

Performance of prototype		
Power output	One channel	Both channels
4 ohms	44W	32W
8 ohms	33W	28W
Dynamic power (IHF-A-202)		
4 ohms	60W	50W
8 ohms	40W	40W
Harmonic distortion		
8 ohms	0.025% at 30W	
4 ohms	0.065% at 30W	
Typically less than 0.015% at normal listening levels		
Frequency response		
Phono input	RIAA/IEC equalisation within ±0.5dB (30Hz to 20kHz)	
Line inputs	+0/−1dB from 20Hz to 20kHz	
Hum and noise		
Phono input	−76dB unweighted	
(ref: 10mV/1kHz, terminated in typical MM cartridge)		
Line inputs	−91dB unweighted	
(ref: 250mV/1kHz)		
Damping factor		
Approximately 80 (8 ohm load)		
Channel separation		
100Hz	−83dB	
1kHz	−72dB	
10kHz	−54dB	
(ref: 30W output)		
Input sensitivity		
Phono input	4mV (overload at 1kHz: 150mV)	
Line inputs	250mV	
CD input	2V (as set by optional pad resistors)	
(ref: 30W output)		
Tone controls		
Bass	±12dB at 60Hz	
Treble	±12dB at 16kHz	

about 20Hz is provided by C4 to prevent sub-sonic signals from warped records and other turntable anomalies. This is in line with the latest IEC recommendations.

The output from the phono pre-amp is coupled to the input selector switch via C9, and R11 holds the output at 0 volts to prevent any switching transients. A reasonably high value has been chosen for C9; this prevents an excessive bass rolloff from the phono stage when a load is connected to the "tape out" connections.

Two optional resistors, Rx and Ry are shown in the path between the CD input socket and the selector switch SW1. When included, these resistors attenuate the high output of a CD player to match the amplifier's nominal input sensitivity of 250mV. For example, if we choose 47K ohms and 6.8K ohms for Rx and Ry respectively, a CD player with an output of 2 volts will deliver our nominal input level at the selector switch.

The signal is then applied to the volume control via the input switching networks, and the isolating resistor R12. This resistor prevents loading between the channels of the signal source when "mono" mode is selected.

From this point, the signal is applied to a buffer amplifier stage (IC2) by another high pass filter, comprised of R13 and C11. Incidentally, the various high pass filters throughout the Playmaster 30-30 are generally set to about 6 or 7Hz. This has the total effect of a sharp rolloff filter below about 10Hz, which is a very efficient sub-sonic filter for the whole system.

The buffer amplifier stage (IC2) is set to a gain of about 6 by R14 and R15, and high frequency bypassed by C12. This in turn drives the following stages via C13. The load may be the tone control stage, or both the tone and balance control sections, depending upon the position of the tone defeat switch SW4. Since the load presented by these sections may vary greatly, for example the balance control at one extreme, C13 is chosen as a high value to prevent significant bass rolloff.

A standard "Baxandall" style feedback network is arranged around op-amp IC3 to produce the tone control stage, which has a maximum boost and cut of about +/-12dB. The network is comprised of R16 to R20, C14 to C16, with RV2 and RV3 controlling the bass and treble frequencies respectively. This stage (or the previous amplifier stage) then drives the power-amp via the balance control, which is arranged as a simple variable voltage divider.

That's about it for the signal path. The remaining circuitry generates the unregulated supply voltages for the power-amp, and the low voltage, regulated power supply rails for the earlier stages.

The power supply is quite a standard circuit with the transformer's centre-tapped secondary feeding a pair of full wave rectifiers (D3 to D6). The rectifiers' positive and negative outputs are filtered by C28 and C29 respectively, and applied directly to the power amplifier chip IC4 (and the equivalent chip for the other channel).

The supply is reduced for the rest of the circuitry by simple zener diode shunt regulators, comprised of R32, R33, ZD1 and ZD2. These regulators produce about +/-15 volts, which is applied to the filtering capacitors C26 and C27 via diodes D1 and D2, producing a final supply of about +/-14 volts. The diodes will prevent the low voltage supply at C26 and C27 from being discharged by the falling main supply (via R32 and R33), when the amplifier is turned off. This keeps the pre-amp and tone control circuitry "alive" until the power-amp has completely shut down, thus preventing any spurious signals which would be generated if all stages "died" at the same time.

That about wraps it up for the circuit description. As you can see from the pictures, it all mounts neatly on a single PCB. The TDA1514A power chips attach directly to the heatsinks which lie in the centre of the board, while the remaining circuitry is arranged around the edges of the PCB.

The metal backing plate of the TDA1514A chip is internally cconnected to the negative supply rail, but may be bolted directly to the heatsinks without the need for insulating washers. This is possible since the heatsinks are not attached to the case (or earth) and are effectively "floating".

The pots and switches are also mounted in a simple manner; either directly to the board or on short wire stalks, allowing the unit to be assembled and fully tested out of its case.

Next month we will show the amplifier in its final form and provide full construction details. EA

Construction project:

Field strength meter for TV

Here's the design for an instrument which should be a great help to anyone who does a lot of TV/FM antenna installations or adjustments – especially antenna installers and service technicians. It's also a basic TV receiver front end, as well.

One of the perennial problems associated with getting the best performance from a TV receiving system is positioning the antenna correctly. It is rarely a matter of simply erecting an antenna in some convenient position, and pointing it in the general direction of the transmitter.

In a primary signal zone right near a transmitter, you can sometimes get away with the proverbial "piece of wet string" for an antenna. But even in these situations, there's generally a need to receive more than one station – and at least some of these are likely to call for more careful treatment, if they are to be received properly. Out in a fringe receiving area, the antenna system needs to be not only more elaborate, but much more carefully adjusted.

The height, orientation and relative position with respect to surrounding objects has a great bearing on the performance of most VHF and UHF antennas. Also important is the choice of antenna type – some will be more suitable than others, for any given situation and its particular combination of receiving conditions.

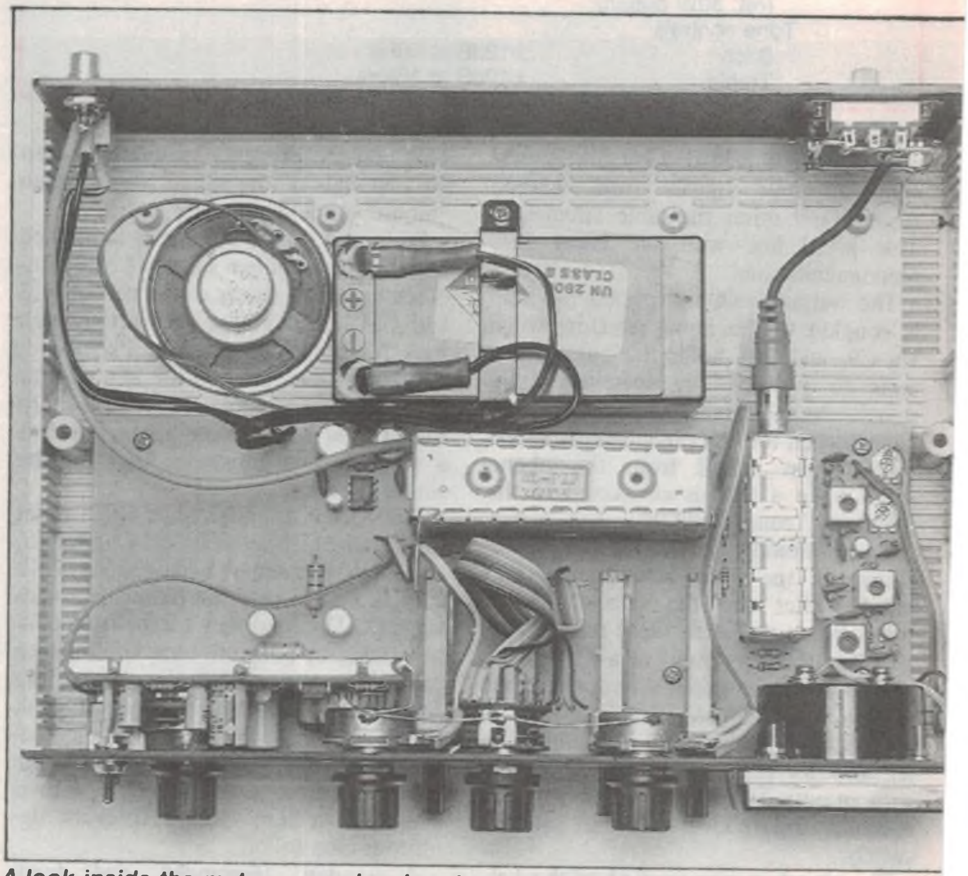
All of these aspects can have a drastic influence on the economics of an installation, particularly in the case of systems needing a telescopic, guyed mast. As well as being quite expensive, the latter will generally also involve a building permit from the Local Council.

A relative field strength meter or RFSM can help greatly in this kind of situation, by allowing you to check on signal field strengths around the area. You may well discover that a complex and costly installation is not really necessary.

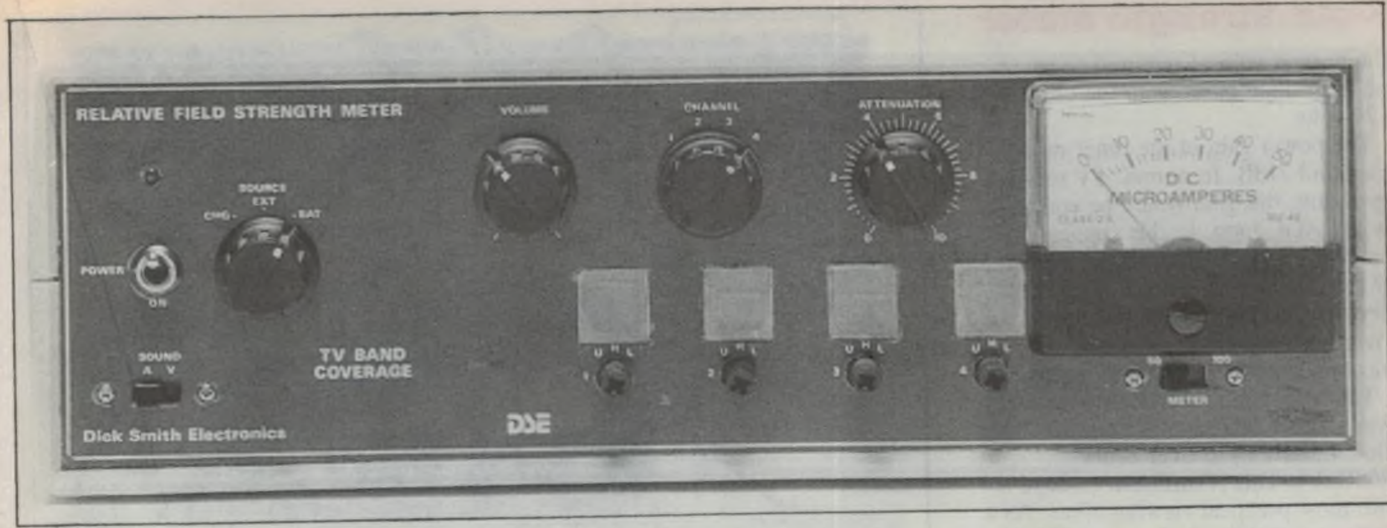
Then when you've been able to determine the kind the rig needed, the RFSM can be a great help in installing and setting it up for the best results. By allowing you to do this "on the spot" right at the antenna itself, it obviates all of the usual climbing up and down ladders, and/or calling between yourself and an assistant at the receiver.

The selection of different types and lengths of feeder cable is also an important factor in any installation. The insertion of splitters, diplexers, baluns and in-line masthead or distribution amplifiers can have a marked effect on signal levels. The RFSM can give comparative measurements of these types of components, before and after insertion.

Even with simple installations, the instrument can get quick fixes on the best height, position and orientation. Because it can be battery powered and portable, you can take it up on the roof, into the ceiling space, out in the backyard, a mile down the paddock or up the nearest hill. Or if you're really lazy, you can simply measure the signal coming out of the local TV wall socket.



A look inside the meter case, showing the main PCB just behind the front panel. This supports the RF and IF modules and the vertically mounted power supply/battery charger board.



What it does

As the title suggests, the RFSM is a *relative* field strength indicating device, not an absolute level measuring instrument. It is designed for making comparative judgements of one condition over another.

At the heart of the instrument is the front end of a TV set. It has a tuner, IF strip and sound output stage, to which have been added a measuring circuit to give a meter readout. A channel switch along with four pre-set tuning controls have been provided, to make selection of signals more convenient. Each of the four channel positions may be set for channels in the low VHF band (Band 1/2), high VHF band (Band 3) or UHF band (Band 4/5).

The built-in sound output stage and speaker is designed to aid in tuning when video information cannot be seen – when you are on the roof for instance.

Control over the RFSM's overall signal sensitivity is provided by a manual RF attenuator. This caters for varying levels of signal likely to be encountered in normal viewing areas. This control could be calibrated to give reference values, but more on this later.

To ensure that the unit can be made portable, it has been designed to operate from either an external 9 -14V DC supply or an optional internal battery. Because a rechargeable battery will make the unit much more economical, a suitable charging circuit has also been built into the design. This is suitable for a sealed gel-type 12V lead-acid battery, with a capacity between 1.2 and 2 ampere-hours (Ah). The actual current drain of the RFSM is around 500mA.

A switch is incorporated into the antenna system input so that the signal can be routed to either the instrument or a local TV set for comparative purposes. Video information is available at an RCA socket on the rear panel. This can be fed to a composite monitor for comparative viewing, or it can be used to convert a video monitor into a TV set when the RFSM is not being used for antenna evaluation or testing. The video output provides a full PAL composite colour video signal.

The design of this project has been carried out by the R&D Department of Dick Smith Electronics, and as a result the PCB patterns are protected by copyright. Needless to say, complete kits for the project will be available shortly at all DSE stores and selected dealers.

How it works

To avoid the need for complex and tricky alignment of RF and IF circuitry, the system has been built around pre-assembled and aligned modules. This also avoids the need for costly signal generators and other associated test equipment, which would otherwise be required for alignment.

The pre-aligned RF tuner module (MOD1) covers the full frequency range used by Australian TV channels, in three bands:

Low Ch 0 – 5 (46.25 – 102.25MHz)
High: Ch 5A,6 – 11 (138.25 – 216.25MHz)
UHF: Ch 21 – 69 (471.25 – 855MHz)

The tuning of these bands is performed by a DC control voltage, derived from a regulated 30V output provided by the power supply. For operator covenience, four pre-set multi turn potentiometers VR1 – VR4 are provided, selectable by the channel change switch, SW1. Each tuning control has an associated three position switch to select the band required.

Each pot acts as an adjustable voltage divider across the 30V regulated supply.

SPECIFICATIONS

Bands:	3 (HI, LO, UHF)	
Frequency Coverage:	LO Ch's 0-5	46.25-102.25MHz
	HI Ch's 5A, 6-11	138.25-216.25MHz
	UHF Ch's 21-69	471.25-855.25MHz
Channel Presets:	4	
Input Signal Level Range:	$<10\mu V$ ($20dB\mu V$) — $>100mV$ ($100dB\mu V$)	
Gain Control:	Manual Attenuator (uncalibrated)	
Attenuation Range:	>80dB	
Metering:	52mm panel meter, 0-50μA scale	
Antenna Input Impedance:	75 ohm, Belling Lee type connector	
Video Output:	PAL composite, 2.5V p-p	
Sound Output:	>200mW, 57mm speaker	
Input Power:	9-14V DC @ <500mA (typ 380mA @ 12V)	
Optional Internal Battery:	12V Lead-acid gel cell, 1.4-2Ah	
Charge Facility:	Constant voltage, current limited	
Charge Time:	8-48hrs (depends on residual charge)	
Max Charge Time:	No limit; can be left on permanently	

Note: Lead/acid batteries should not be left in a discharged state for long periods. Even if not in use, they should be charged on occasions to preserve life.

The normal voltage required to cover the Australian bands is in the order of 0 – 24 volts.

The power gain of the tuner module is around 27dB. In normal TV receiver operation, this gain would be controlled by the AGC loop. In this application, manual RF gain adjustment is provided by the attenuation control, VR5. This allows adjustment of the RFSM to cover the normal signal levels encountered by TV receiver inputs.

The complete instrument is useable over a signal level range from less than 10uV (20dBuV) to over 20mV (86dBuV). This is sufficient to cope with most practical viewing areas. As a guide, a signal level of around 200uV is required for reasonable colour TV viewing.

If you need the unit to operate under *higher* signal level conditions than 20mV, external discrete attenuators at the antenna input would have to be used.

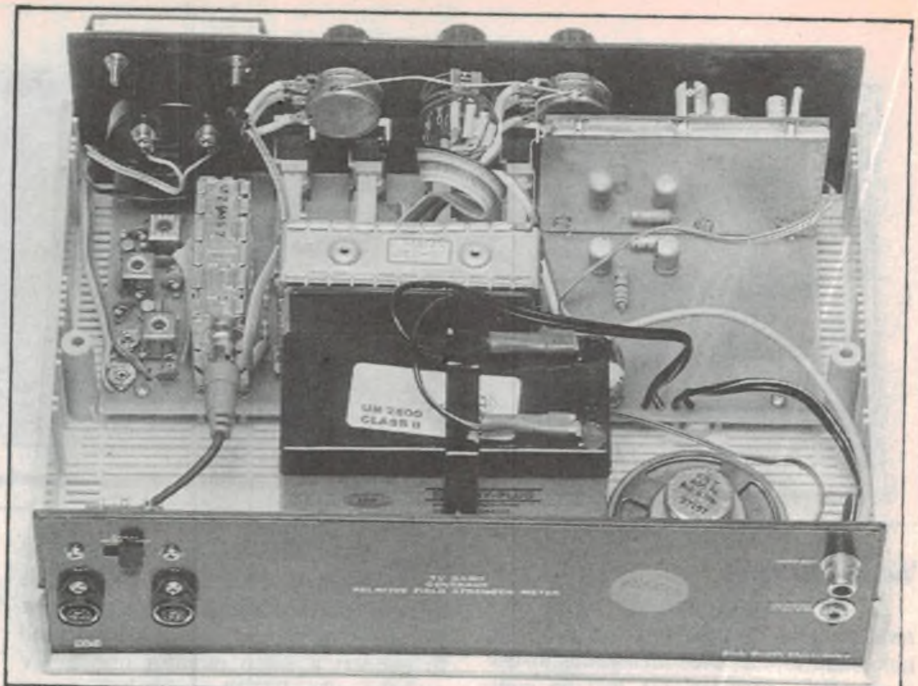
The output intermediate frequency (IF) from the RF tuner module is 36.875MHz for the picture and 31.375MHz for the sound signals. To amplify and further process these signals, the second pre-assembled and aligned module is used (MOD2). This provides IF amplification and detection for both the video and sound, delivering these to output pins 4 and 2 respectively.

Video is fed straight to a back panel socket (SK3), for external use. The sound is amplified by the on-board LM386 integrated circuit, and then fed to a small internal speaker.

The automatic gain control (AGC) output from MOD2, which would normally be coupled back to the tuner in a TV receiver is not used is this application. However the automatic frequency control (AFC) output is taken back to the tuner, to provide tuning lock despite variations in signal and component changes. In TV sets, this function can usually be disabled by a front panel switch but in this case, it is permanently connected for ease of operation.

A separate narrow-band IF strip is used to drive the metering circuitry, taking its signal from the output of MOD1 in parallel with the input of MOD2 – or more accurately, via a splitter consisting of two 10 ohm resistors.

This IF strip is located close to the tuner module on the mother board. It is tuned to 36.875MHz, the picture IF.



Another view inside the case, showing the wiring to the front panel controls. Note also the sealed lead-acid battery, next to the speaker, and the shield for the power supply board.

Transistors Q1 and Q2 provide two stages of gain, resulting in an overall figure of around 45dB. This provides sufficient signal level to drive the 50uA meter movement from the detector.

The meter detector itself is very simple, using an OA90 germanium diode forward biased by the 100k resistor R14 for maximum sensitivity. In order to overcome the small offset voltage that would appear as a reading on the meter due to this forward bias, a balancing voltage is developed by the voltage divider R15 and trimpot VR8. This provides a meter zeroing adjustment to compensate for variations in detector diode current. The second trimpot VR7 and switch SW3 enable the meter sensitivity to be reduced by 50%, for a second less sensitive 0-100 measuring range.

The audio amplifier stage has deliberately been kept simple and low in power capability. It is only used as a secondary indicator, to aid in tuning and allow rough checking of signal sound quality. The output is limited to a couple of hundred milliwatts, but this is sufficient to drive a small speaker. Power for the amplifier is derived from the 11V output of the regulated supply via the 15 ohm resistor R19.

Power supply

At first glance, the power supply itself may look something of an "overkill". But to cope with the supply requirements of the instrument's circuitry and operational features, it was necessary to meet certain minimum performance parameters.

Firstly, the RF and IF modules are rather power hungry. This is one of the penalties of high frequency circuits of this nature.

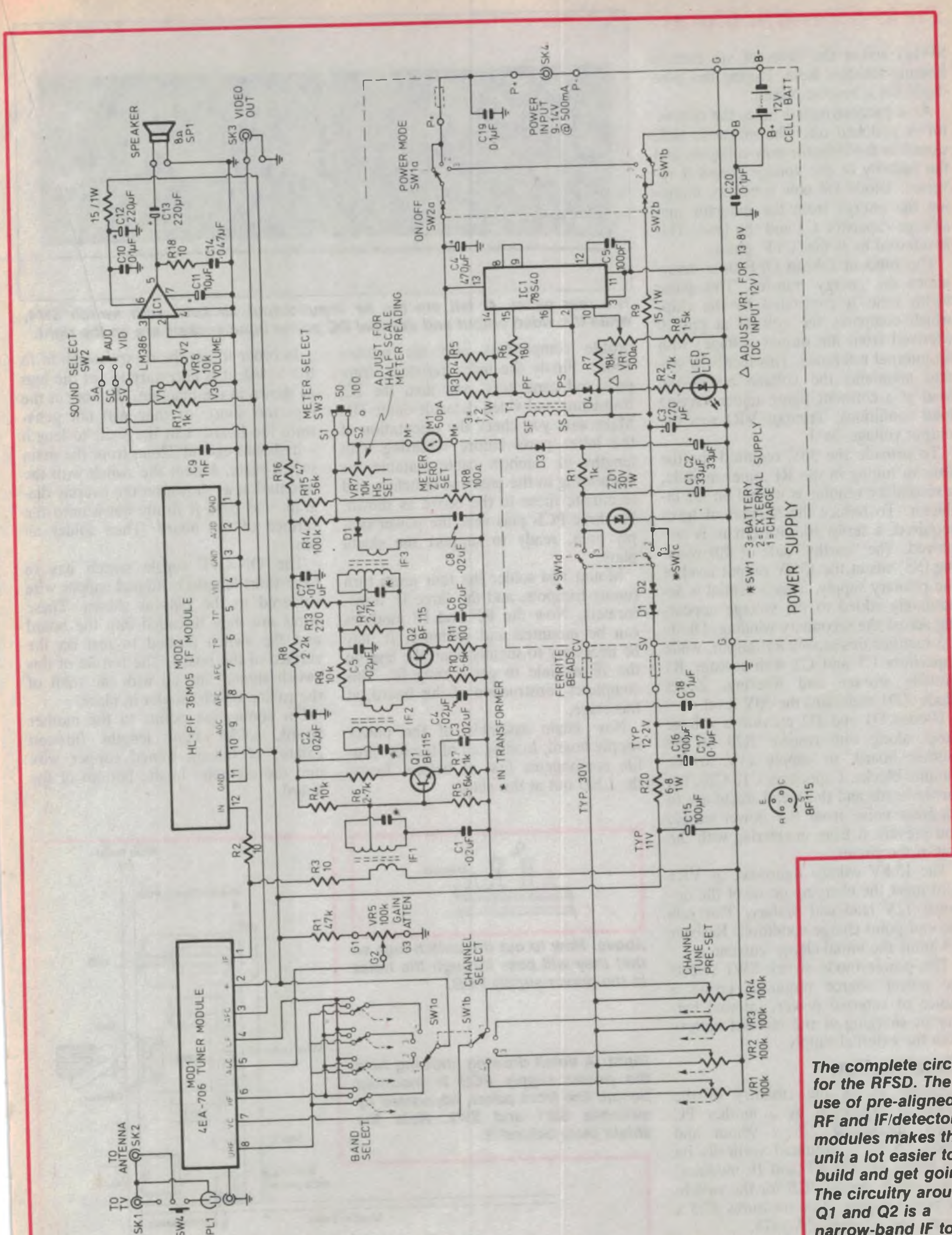
Secondly, to get consistent measurements, the supply voltage should remain reasonably constant. However when operating from batteries the raw supply voltage may vary from around 9 to over 12 volts, rather beyond the tolerance allowed by the modules.

In the interests of economics, a rechargeable battery is required, and since this should be built in for maximum portability and convenience, there arises the problem of providing a suitable charging circuit.

With the circuit shown, all of these requirements are met. Incidentally, please note that in the following discussion, power supply components have separate numbering from those in the rest of the project.

The circuit is based around a 78S40 switching regulator chip. This device uses an energy storage inductor (the primary winding of T1) as part of the switching circuit.

During the regulator's ON phase, a power transistor inside the 78S40 switches the PS side of this inductor winding to ground, thereby applying the incoming raw power source (from



The complete circuit for the RFSD. The use of pre-aligned RF and IF/detector modules makes the unit a lot easier to build and get going. The circuitry around Q1 and Q2 is a narrow-band IF to drive the meter.

SW1a) across the inductor via current limiting resistors R3-5. During this time diode D4 is reverse biased.

At a predetermined time, the transistor is switched off. The magnetic field stored in the inductor now collapses and the polarity of the voltage across it reverses. Diode D4 now conducts, dumping the energy from the inductor into storage capacitor C3 and the load. This is referred to as the 'OFF' phase.

The ratio of ON to OFF time determines the energy transfer. This pulse width ratio is controlled by the chip, which compares the voltage at pin 10 (derived from the output voltage) with an internal reference. This feedback system maintains the voltage across the load at a constant figure under varying load conditions. Trimpot VR1 sets the output voltage level.

To provide the 30V required for the varicap tuning in the RF tuner module, a secondary winding is wound on the inductor. To reduce the number of turns required, a series additive circuit is employed. The "earthy" side of this winding (SS) sits at the 13.8V output level of the primary supply. This potential is accordingly added to the voltage appearing across the secondary winding. Diode D3 rectifies this secondary output, while capacitors C1 and C2 with resistor R1 provide storage and filtering. Zener diode ZD1 maintains the 30V level.

Diodes D1 and D2 provide a voltage drop, along with resistor R20 on the mother board, to supply 11V to the module blocks. Capacitors C17-C20, the ferrite beads and the metal shield are to suppress noise from the power supply and prevent it from interfering with the rest of the circuit.

The 13.8V voltage figure set by VR1 is to meet the charging needs of the optional 12V lead-acid battery. This sets the end point charge condition. Resistor R9 limits the initial charge current.

The power mode switch SW1 selects the power source required, giving a choice of external power, internal battery or charging of the internal battery from the external supply.

Construction

Almost all of the circuitry of the RFSM is supported by a mother PC board, measuring 225 x 95mm and coded ZA-1477. Mounted vertically on this board are the RF and IF modules, plus a small second PCB for the switching power supply. This measures 87.5 x 56mm, and is coded ZA-1478.

Start assembly by loading all the low profile components into the mother board. Firstly the links, resistors, trimpots and capacitors, and then the IC, transistors and video detector diode D1. Make sure you check the orientation of the latter parts before soldering. Cut lengths of rainbow cable suitable for connecting to the pots and switches, and terminate these to the board as shown. Fit three PCB pins near the power supply area, ready to support the shield plate.

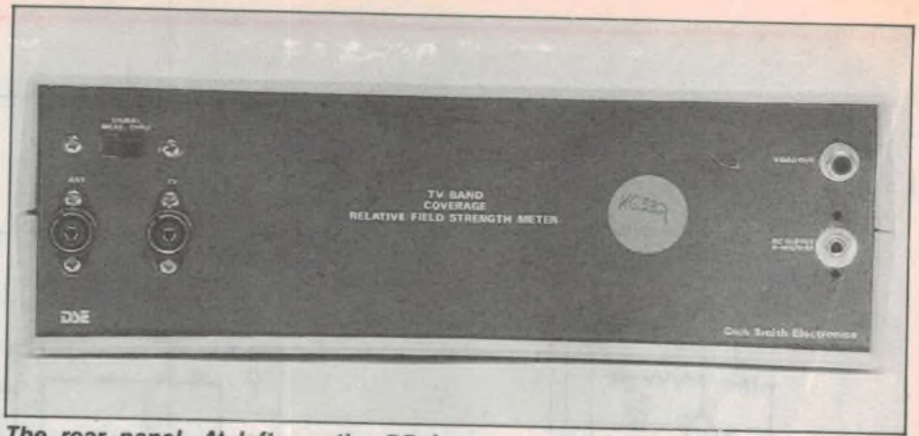
Mount and solder the four multi turn tuning trimpots, and the three IF transformers. Now the RF and IF modules can be mounted and soldered. It may be necessary to slightly bend the legs on the IF module to get a snug fit. This completes construction of this board, at this stage.

Now begin assembly of the power supply board, loading all of the low profile components first as before. Leave the LED out at this stage.

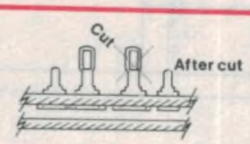
In order to get the rotary switch to fit the board, it is necessary to cut the lugs as shown in the diagram. Do not cut the lugs too short, or they will not penetrate the board. Cut the shaft to length – it should extend 22mm from the main switch plate. Mount the switch with the orientation as shown on the overlay diagram and push it firmly down onto the surface of the board. Then solder all pins.

The ON-OFF toggle switch has to have short lengths of tinned copper wire soldered to the pins as shown. These wires are then threaded into the board and the switch pushed to rest on the surface of the board. The ferrule of this switch should line up with the shaft of the rotary switch. Solder in place.

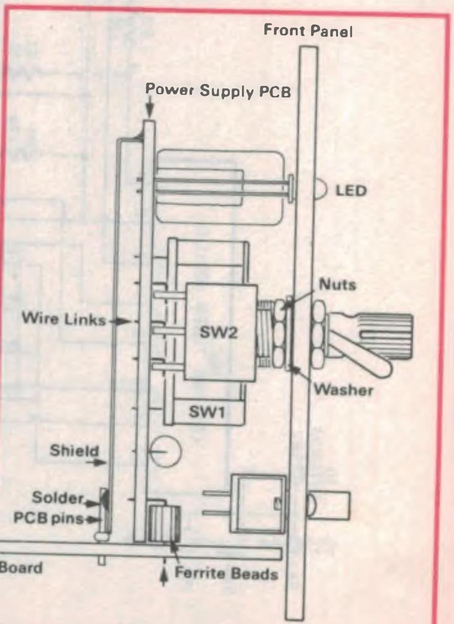
For connection points to the mother board, solder short lengths (around 25mm) of 0.8mm tinned copper wire into the six holes in the bottom of the board.



The rear panel. At left are the RF input/output sockets, with switch SW4, while the video output and external DC power input sockets are on the right.



Above: How to cut the switch lugs so that they will pass through the holes in the power supply PCB.



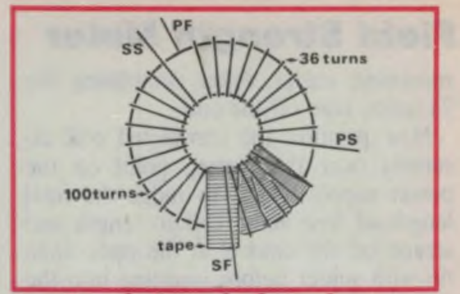
Right: A detail drawing showing how the power supply PCB is mounted behind the front panel, supported by switches SW1 and SW2. Note the shield plate behind it.

Coil Winding

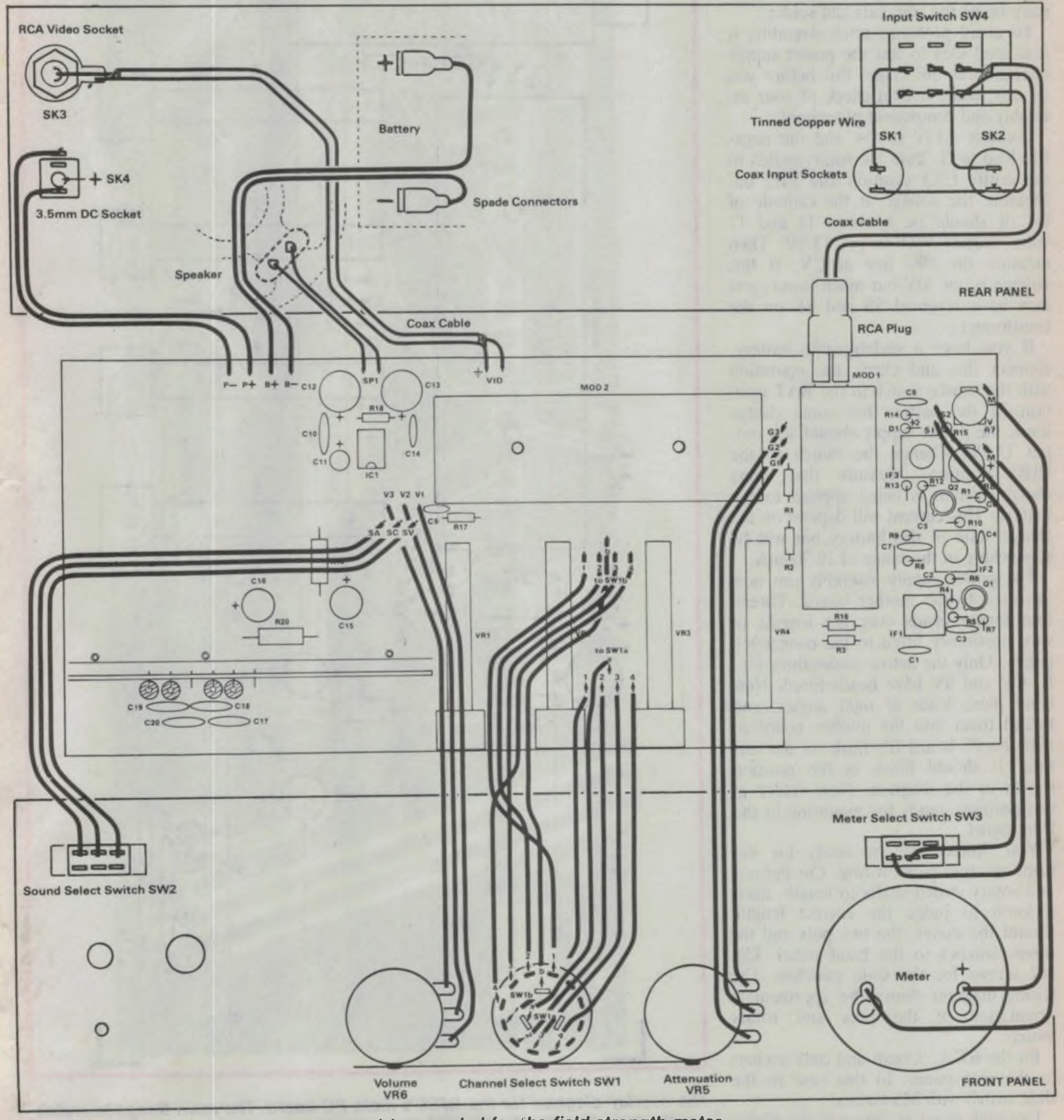
Winding the power supply transformer T1 is the hardest operation in the construction of the project, and requires a little patience.

To wind the primary, cut off approximately 1.25m of 0.4mm enamelled copper wire for the first winding. Referring to the coil winding diagram, wind on 30 turns. The turns should be as closely wound as possible, and touching on the inside of the toroid. Make sure the winding direction is as shown. A little self adhesive tape at the start and end of the winding will hold it in place.

The secondary winding is more difficult, because of the extra turns. Wind on a single layer around the remainder of the toroid, then hold the long end with a small piece of tape. Now wind on a layer of thin tape as shown. Although not essential, this makes winding of the



Details of the windings for power supply transformer T1.



Details of the small amount of discrete wiring needed for the field strength meter.

remainder easier. After completing the 74 turns, tape off the end.

Now position the completed coil assembly over the seating point on the power supply board, to judge the final length of free ends. Cut to length and scrape off the enamel at the ends, then tin with solder before inserting into the board. Mount the coil and strap it to the board with two nylon cable ties. Finally insert the coil ends and solder.

To avoid problems after assembly, it is a good idea to test the power supply operation at this stage. But before you do this, make a final check of your assembly and component placement.

Connect +12V to P+ and the negative lead to G. Turn the rotary switch to the centre EXT position and SW2 on. Measure the voltage at the cathode of D4; it should be between 12 and 17 volts. Adjust VR1 to get 13.8V. Then measure the 30V line at CV. If this voltage is not 30V but much lower, you may have reversed SS and SF on the transformer.

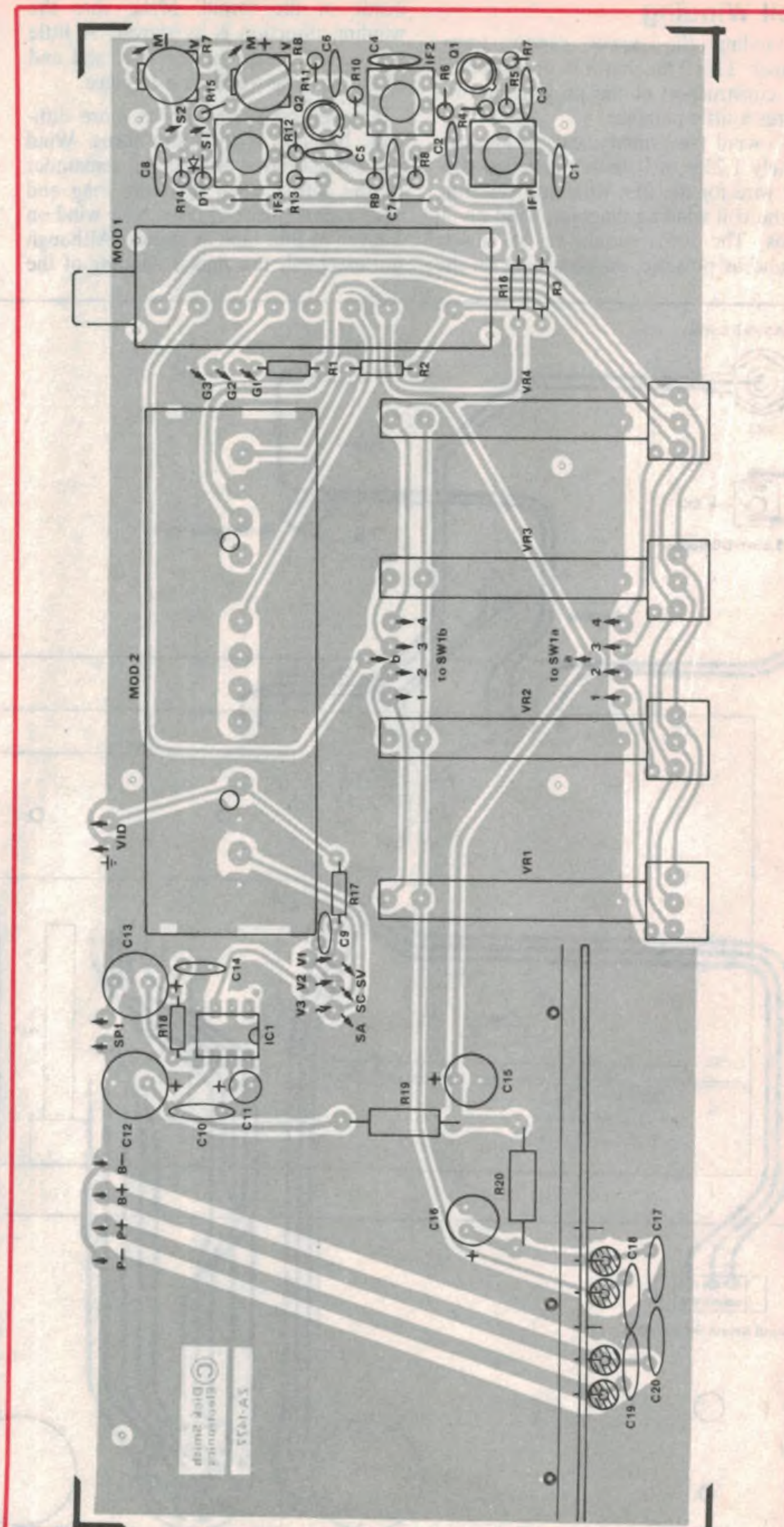
If you have a rechargeable battery, connect this and check the operation with the source switch in the BAT position. If the battery has some charge level, the power supply should still output 13.8V. Change the switch to the CHG position. Measure that some charge current is being applied to the battery. This current will depend on the charge state of this battery but will be somewhere in the range of 10-200mA.

The power supply assembly can now be fitted to the mother board. Thread four ferrite beads over the lengths of wire previously fitted to the connection points. Only the active connections P+, B, CV and SV have beads fitted. Now bend these leads at right angles, and thread them into the mother board so that the PS board fits flush on the surface. It should finish in the position shown in the diagram. Now solder in this position, ready for mounting to the front panel.

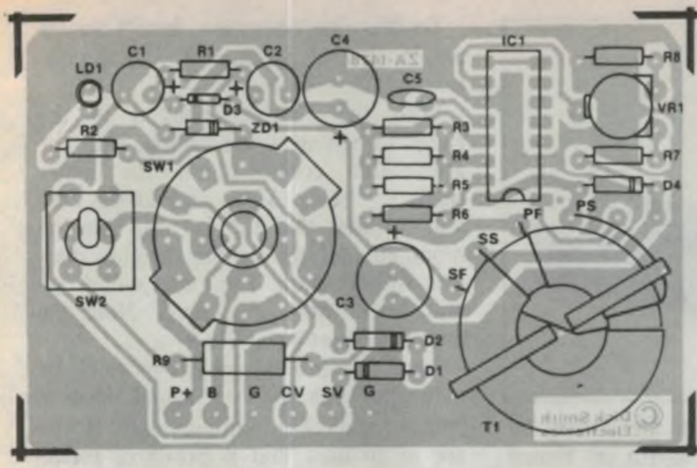
You should now be ready for the front and rear panel wiring. Cut the pot and rotary switch shafts to length, using a knob to judge the correct length. Mount the meter, the two pots and the three switches to the front panel. Use M2 screws for the slide switches. The wiring diagram shows the approximate orientation of the pots and rotary switch.

Fit the RCA, 3.5mm and coax sockets to the rear panel. In this case fit the slide switch with M3 screws.

Lay each panel as shown in the wiring



The overlay diagram for the RFSD's main PC board. The main things to watch are the polarities for the electrolytic capacitors, transistors and diodes.



The overlay diagram for the power supply/charger PC board. Be careful with the connections for T1!

diagram and terminate all wires. Note how the sound switch wiring runs around the back of the power supply. Two spade connectors can be crimped and/or soldered onto the battery lead. It would be a good idea to mark the positive wire with some identification, such as a red PVC sleeve.

Use heavy 0.8mm tinned copper wire to connect the coax sockets and switch. Fit an RCA plug to a short length of coax and solder to the switch as shown, to connect to the input of the RF module. Wire the speaker. You should now be ready for the setup procedure.

Setting it up

After a complete check of your assembly and wiring, the following procedures are necessary.

First the power supply. Apply 12V to the power input, with the power mode switch in the EXT position. Check the voltage at the points shown on the circuit diagram on each side of the 6.8 ohm resistor R20 on the mother board. Much lower values than those shown would tend to indicate something wrong in one of the circuit blocks on the mother board.

Recheck the original 13.8V point. Readjust VR1 if necessary. Measure the 30V line. It still should be close to the original figure.

Note: When fitted, the LED will be on when any power source is connected and the power switch on. The CHG position is purely for charging the internal battery from the external source. In the EXT position, both the charging and measuring circuits are operational. If the external power is disconnected, the internal battery will partly power the system back through the 15 ohm resistor R9. This is a non-valid state and the RF circuits will fail to operate properly.

At this stage, noise should be coming from the speaker. If you have access to a video monitor, connect this to the RCA socket on the rear panel. Connect an antenna, select a channel, turn the attenuation control to 0 and tune a local TV station for best sound and picture. Now turn the attenuation control up. At some point, the signal should drop out. This shows the manual gain control over the tuner is working.

This is all that can be done with the IF and tuner modules. All alignment and adjustments for these are factory set. However we do have to set up and align the measuring circuitry.

Without signal input, detune the tuner to a dead spot. Set the meter switch to the 50 position and adjust VR8, the meter balancing pot, to get a zero reading on the meter.

Now turn the attenuation control back to zero. Select a strong, constant TV signal source and precisely tune this channel. You may already get a reading on the meter. With a suitable non-conductive, non metallic alignment tool suitable to fit the IF transformer cores, turn the core of IF1 to get some increase in reading. You should find some peak somewhere near the centre of the coil. Then move to IF2 and do the same. Finally turn to the core of IF3 and peak it too. If you find that the meter has already gone beyond full scale, adjust the attenuation control for

PARTS LIST

Mother Board

- 1 Plastic instrument box, 255 × 190 × 82mm
- 1 PCB 226 × 95mm, code ZA-1477
- 1 3-pole 4 pos rotary switch
- 2 DPDT slide switch
- 1 3PDT slide switch
- 4 100k multiturn tuner pots c/w switch
- 1 10k lin pot
- 1 100k log pot
- 1 50uA 58 × 52mm panel meter
- 1 tuner module, TUMUF 4EA 706
- 1 IF module, HL-PIF 36MO5
- 3 miniature 36.875MHz IF transformers
- 1 8-ohm 57mm speaker
- 2 75-ohm chassis coax sockets
- 1 3.5mm chassis socket
- 1 RCA chassis socket
- 1 RCA plug
- 4 medium plastic knobs
- 1 prepunched & screened front panel
- 1 prepunched & screened rear panel

Semiconductors

- 2 BF115 transistors
- 1 OA90 germanium diode
- 1 LM386 audio amp IC

Resistors

1/2W: 2×10ohm, 1×47ohm, 1×180ohm, 1×220ohm, 2×1k, 1×2.2k, 2×2.7k, 3×5.6k, 2×10k, 1×47k, 1×100k
1W: 1×6.8ohm, 1×15ohm

Capacitors

Ceramic 1×1nF, 7×22uF, 1×47nF, 6×0.1uF
RB electros 1×10uF/25VW, 2×100uF/16VW, 2×220uF/16VW

Miscellaneous

0.8mm T/C wire, 1.2mm T/C wire, 12 core rainbow hookup wire, fig8 cable, Teflon coax cable, PCB pins, spade connectors, screws, tinplate shield, bracket, rubber feet

Power Supply

- 1 PCB 87.5 × 56mm, code ZA-1478
- 1 4-pole 3 pos rotary switch
- 1 DPDT toggle switch

Semiconductors

- 1 78S40 swtiching IC
- 2 1N4002 diodes
- 1 1N4148 diode
- 1 3mm red LED
- 1 30V 1W zener

Resistors

1/4W: 3×1.2ohms, 1×180ohms, 1×1k, 1×1.5k, 1×4.7k, 1×18k
1W: 1×15ohm,
1×500ohm horizontal 10mm trimpot

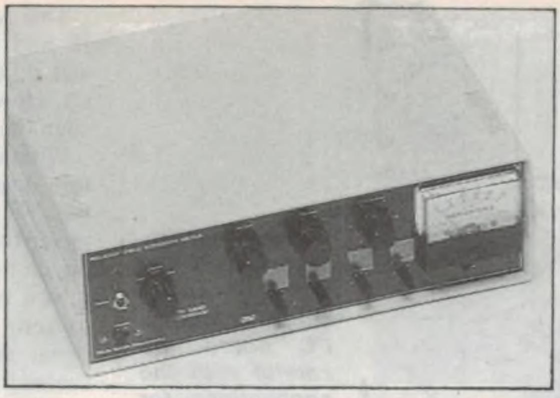
Capacitors

1×100pF ceramic, RB electros; 2×33uF/35VW, 2×470uF/16VW

Miscellaneous

cable ties, 0.4mm enamelled wire, ferrite beads, iron powder ring core

Field Strength Meter for TV



Another view of the completed meter. The overall size is 260 X 210 X 83mm.

half scale reading.

Repeat the alignment of the three IF transformers until you can no longer get any further increase in level. This is the end of the simple measuring IF alignment procedure.

Note: You will notice a fluctuation in the meter reading with changes in video information. This has to be accounted for in the alignment peaking adjustment.

All that remains in the setting-up procedure is calibration of the "100" range for the meter. Adjust the attenuator control for a full scale reading on the "50" range. Now switch to the 100 range and adjust trimpot VR7 to obtain a half scale reading. That's it!

Final assembly

Fit a nut and washer to the ON-OFF toggle switch, to go behind the front panel. Then locate the front panel over the four tuning control shafts and the two switches on the power supply, and slide the assembly into the case. Fit the five No.4 PK screws to secure the mother board to the case.

The ON-OFF power switch should penetrate the front panel enough to accommodate the full thickness of the outer nut. Tighten the rear nut to secure. Note that a nut is not used to secure the rotary switch; only the shaft fully penetrates the front panel. Fit all knobs, so that the indicators line up with the marks on the panel. It may be necessary to slightly turn the pots and switch to get correct alignment.

Thread the LED into the power supply PCB and then the body flush up to the front panel. Check the polarity before soldering. Now fit the tinplate shield to the back of the power supply. You will have to bend over the top edge approximately 4mm, as shown. Solder at three points along the top edge to the earth track of the board. At the bottom, solder to the three PCB pins previously mounted on the mother board.

Check that this shield plate does not foul the connections on the bottom of the board. Solder a length of tinned copper wire between the bodies of the pots, channel switch, shield and the IF module.

Fit the speaker into the location provided in the case, and glue it in place with a small amount of contact adhesive or similar material around the perimeter.

If you have a battery to be fitted, the bracket is screwed to the centre rear case pillar and under the centre-rear mounting screw for the mother board, on its top surface. Note that the bracket supplied is shorter at the PCB end than at the other. The screw at this point has to be longer than the others. Use a thin layer of plastic foam under the battery as a shock absorbing medium.

Finally fit four rubber feet to the bottom of the case. This completes the assembly.

Using it

The input impedance of the RFSM tuner module is 75 ohms. If the instrument is to be used with 300 ohm systems, an external balun will need to be used. The insertion loss of this device may have to be considered in measurements.

To tune the RFSM, connect the input signal lead, turn the attenuation control to zero and select a channel. Precisely tune to a station. If a video monitor is connected, tuning will be easy. If you are at a remote location without the aid of a visual picture reference, the video can be monitored via the sound V switch position. This actually samples the video and makes it audible as frame buzz. In this way you can switch between V and A (audio) to give correct tuning. The meter peak reading is also part of the tuning state.

A little practice will soon show you how the system works. To make use easier, the four switched tuning controls can be pre-set to the main stations in your area, before tests in the field are carried out.

To illustrate operation, here's an example. We will assume we want to position an antenna on a roof.

With the antenna pointed in the rough direction of the station, turn the attenuation control until the meter reads half scale. Move around the area you consider that the antenna may be mounted and try varying height, position and direction. The meter will go up and down with signal level. Note the area of highest signal level.

Some compromise might have to be made between the best signal position and a practical mounting point. If you are in an area that is prone to reflections which cause ghosting, it may be wise to temporarily connect a TV set to check out that aspect. It could be that the strongest signal area is not necessarily the best for elimination of ghosting.

To give some guide to the actual signal strength level with the attenuation control at zero (maximum tuner gain), the prototype instrument gave a full scale reading (50 range) for a signal input level of around 60uV at 70MHz. It would be reasonable to expect that other units would give similar figures, at least in the order of 50uV to 100uV FSD.

If you have access to some form of reference signal, a graph could be plotted, showing signal level versus the attenuator control scale figure. As an example, on the prototype unit we were able to plot:

Scale	Input Level (approx)
0	60uV
3	200uV
4	900uV
5	3.25mV
6	9.5mV
7	160mV

It can be seen that the top end of this control soon reaches the maximum capability of the tuner to handle very high signal levels. To allow the tuner to operate within the normal AGC control range at these higher levels, an external attenuator would have to be placed before the tuner.

The 100 range on the meter switch is only meant as an indicator when using the instrument as with a video monitor. If the signal level is strong enough, turn the attenuator control until a half scale reading is obtained. This represents a good signal level for colour viewing. This scale cannot be used for measuring relative signal strength, as the levels are not in the most linear operational area of the measuring IF strip.

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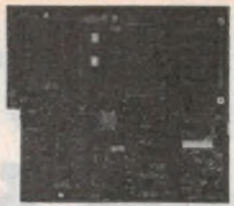

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- Games port
- Clock/Calendar with battery back-up
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- NS16450 Asynchronous communication elements (ACE)
- COM1/COM2 COMPATIBLE
- DTE/DCE Selectable
- Drive support for PC*/AT*, XENIX*
- Interactive installation procedure available.

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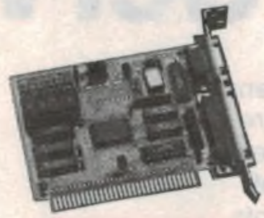

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- Hercules compatible
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- One Centronics parallel printer port
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- Display Mode: 720 dots x 348 lines

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This combination card features printer and monitor interface. It has 1 parallel printer port, RGB CTTC outputs.

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Text Mode: 40 columns x 25 rows
Graphics: 320 x 200
Monochrome:
Text Mode: 80 columns x 25 rows
Graphics: 640 x 200

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PRINTER CARD

This card features a parallel interface for Centronics printers such as the Epson RX-80, 100, and other similar printers. Included is printer data port, printer control port, and printer status port.

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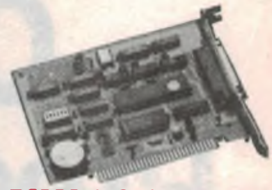

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This RS232 card supports 2 asynchronous communication ports. Programmable baud rate generator allows operation from 50 baud to 9600 baud. Fully buffered. Second serial port is optional.

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Construction project:

Universal "Real World" interface for PCs – 1

Here is a design for a unit which provides eight digital outputs, eight opto-isolated digital inputs, and eight 8-bit analog inputs. It can be connected up to virtually any computer system via a standard RS-232C serial or "Centronics" parallel port. This article discusses the basic design objectives and how they have been met.

by MARK CHEESEMAN

When the initial novelty wears off, people often want to do something more tangible with their marvellous all-purpose "thinking machine" than the usual word-processing, database or shoot-em-dead games that most personal computers seem to spend most of their time doing.

All your computer needs is some form of interface to the real world, and suddenly a whole range of possibilities opens up.

However, making an interface/-controller for use with a wide range of PCs is not as easy as it may sound. As everybody knows these days, there is no such animal as a standard computer. From small ROM-based machines using cassette storage, to 16 or 32 bit hot-rods, the range of PCs in use is enormous. The number of different expansion busses and I/O interfaces and the inherent incompatibility of one system with another means that any design based on a specific bus tends to be restricted for use with only one type of computer.

Use of such an interface also makes the assumption that there is a spare expansion slot available, which may not be the case, especially on computers which only have one expansion bus connector.

A universal design for connection to various expansion busses is not really easy to achieve either, as a large amount of work would be required to adapt the circuit to any given computer. This requires the constructor to have a rather extensive knowledge of the bus timing and memory map of the system to which the controller is to be connected, and to invest a considerable amount of time in getting the system operational.

Bearing all of this in mind, we set out to design the most universal controller board possible. To achieve this, we have made it connect to the computer using only the standard serial or parallel I/O ports.

The board may be connected to the controlling computer either by means of a parallel "Centronics printer" interface, provided that it meets certain criteria in relation to the number of input and output pins available, or virtually any RS-232 serial interface. Only the circuitry for one of the interfaces needs to be installed on the board.

The parallel interface was designed primarily with IBM PC compatibles in mind, although other computers may be able to utilise the parallel interface if their port has enough input and output lines.

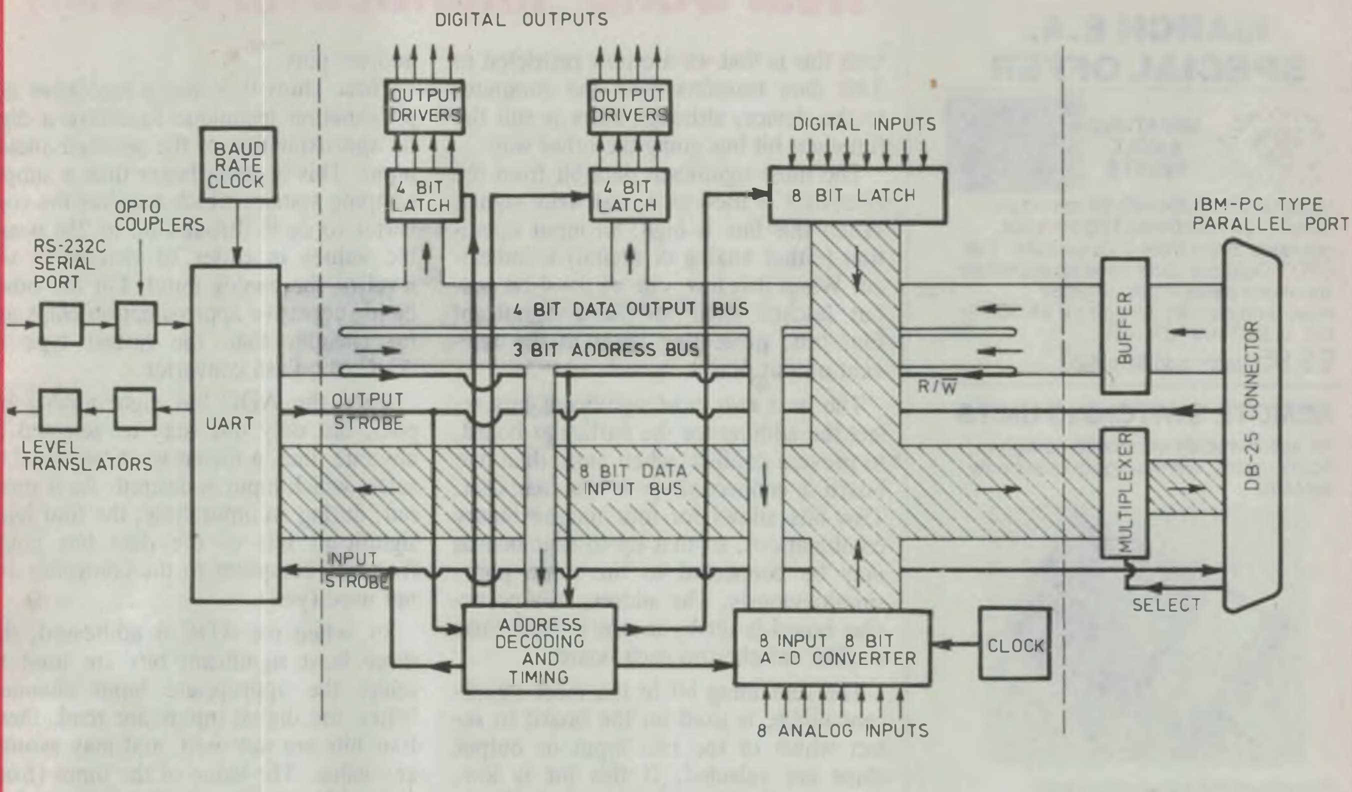
The main advantage of the parallel interface is one of cost. For owners of PC clones, the support in MS-DOS for up to three parallel ports means that it is possible to have a device such as this controller connected up to one port, while still having a printer (or two) hanging off the others. If you don't have a spare parallel port, you can obtain a printer interface card for 30 or 40 dollars. Just make sure that the card can have its address set so that it won't conflict with existing ports in the system.

The serial interface, on the other hand, costs a little more than the parallel version due to the added cost of the UART device (which converts serial data to parallel and back again). However all the advantages that apply to serial interfaces in other applications are also relevant here.

The most obvious advantage concerns the cable requirement. The serial version only needs a four core cable to run between the computer and the controller board. On a (not too) long run the difference in cost between this cable and the multi-way cable required for a parallel interface will easily outweigh the added cost of the UART on the controller board.

Cost considerations aside, the maximum cable length allowable for a serial link is much greater than for the parallel variety as found on most computers. The reason for this is primarily related to the use of special line drivers on serial outputs rather than the TTL gates used on parallel ports. Also, as the baud rate of a serial link is reduced the maximum distance that the cable can cover increases even further. In this application 300 baud will be adequate for all but the most critical tasks, allowing quite a long cable to be used.

In addition to this, the serial port on this board is opto-isolated, which allows the computer to be used, say, to monitor mains voltages or currents, without the computer (and its operator!) being subjected to potentially dangerous voltages.



This is the block diagram for the complete interface. The central section is the main part of the circuit, with the serial interface on the left, and the parallel interface on the right. Only one interface needs to be present, depending on available ports on the computer

I/O provisions

As mentioned in the introduction to this article, this controller board provides eight latched digital outputs, eight latched digital inputs and eight analog inputs. The outputs are straight TTL levels, and can be either used directly (if you're careful), or connected to an external driver board to drive higher current or high voltage devices.

There are two different external driver boards, which each accommodate four outputs. One is basically a DC controller, with high current transistor outputs. The other is an opto-isolated triac board, to control AC devices. This allows you to have up to four of each type of output, or up to eight of one type. The DC board can also be used to control relays, but as relays are rather expensive these days, it is usually preferable to use electronic means where possible.

The digital inputs are opto-isolated, so that they may be connected to various parts of a circuit (within reason) without having to be concerned with different reference voltages and the like. If opto-coupling is not required, this may be omitted to save on cost.

The eight analog inputs are not isolated at all, as it is difficult to get opto-couplers to behave linearly over a large voltage range. Therefore the eight analog inputs must all have the same ground reference, although this may be achieved with extra circuitry if desired. It is still possible to isolate all of the analog inputs from the computer, by using the opto-isolated serial interface to the computer rather than the parallel interface.

Expansion

If eight of everything is not enough for you, then you can "daisy-chain" further boards from the first one, up to a total of four boards. These boards may be fully populated, or you may leave some components off if you do not require all the facilities on all of the boards.

There are two possible ways in which boards may be daisy-chained. The first is to omit both the serial and parallel interfaces from all but the first board, and connect their busses together with ribbon cable. This method is useful if all of the devices to be controlled or monitored are located in close proximity to one another.

The other way only applies to the serial version of the controller. In this case the serial interfacing circuitry is provided on all boards, and the serial cable is daisy-chained between the controller boards. This option allows the various controller boards to be located some distance apart from each other. As a bonus, not only are the controllers electrically isolated from the computer, but also from each other.

You can even use a combination of both methods. For example you may have two boards close together, connected by their busses, and a third board located some distance away, with a serial daisy-chain between it, the other two boards and the computer.

Addressing

Since there are several input and output ports on each controller board, and potentially up to four boards attached to the computer port, there is a need for some means to address the various ports in the system. This function is performed by four of the data bits from the computer, with the other four bits forming the data bus itself. The problem

"Real World" interface for PCs – 1

with this is that we are now restricted to 4-bit data transfers from the computer to the device, although there is still the full eight bit bus going the other way.

The most significant data bit from the computer is used as a read/write signal. When this line is high, an input operation (either analog or digital) is indicated. When it is low, one of the 4-bit output latches latch the least significant four bits, presenting them to the relevant output pins.

The next two most significant bits select the address for the particular board, to prevent conflicts when more than one board is connected up to the computer. Two bits allows for four unique binary combinations, so that up to four boards may be connected to the same port simultaneously. The address of a particular board is set by means of wire links or DIP switches on each board.

The remaining bit in the most significant nibble is used on the board to select which of the two input or output chips are selected. If this bit is low, then the first four bit output latch, or the digital input latch is selected (depending on the state of the R/W line). If this bit is high, then the second output latch is addressed (for an output cycle), or the analog inputs are read (if an input is indicated by the R/W line).

Data going from the controller back to the computer consists merely of eight data bits, as there is no need for address information travelling in this direction. In the case of the serial interface, these bytes are sent as-is. However for the parallel interface, the two nibbles which make up the byte are multiplexed down to four bits, and need to be read into the computer separately.

This is because the parallel port on PC compatibles only has 5 bits for input, and we need one of these for handshaking. The most - or least-significant nibble is selected using a spare output line, and the two nibbles are read into the computer via the four remaining inputs, one at a time, and combined internally. The serial interface does not have the same problem, so the multiplexer is not used in this case.

The analog-to-digital converter used in this project can be an ADC0808 or ADC0809. These two devices are identical, except that the former is slightly more accurate (and costs a few dollars more). Both contain an eight input analog multiplexer on the chip, and the input to be sampled is selected by three address pins.

These chips then use a successive approximation technique to derive a digital approximation to the selected analog input. This is much faster than a simple ramping system, which requires the converter to cycle through up to 256 possible values in order to determine the level of the analog input. On the other hand successive approximation chips are far cheaper than the fastest type of ADC: the flash converter.

Since the ADC has eight analog inputs, but only one may be selected at any one time, a means must be found to select which input is desired. As it turns out, during an input cycle, the four least significant bits of the data bus going from the computer to the controller are not used (yet!).

So, when the ADC is addressed, the three least significant bits are used to select the appropriate input channel. When the digital inputs are read, these four bits are not used, and may assume any value. The value of the input (from either the analog or digital source) is then applied to the data output bus, and the computer is signalled to indicate the presence of valid data.

A byte is sent back to the computer on both input and output operations, but the actual value returned during an output operation is not relevant to anything in particular. It merely serves as an acknowledgment that the command has been received by the controller, since there is no "acknowledge" line due to the shortage of spare input lines mentioned above.

The only other input line to the computer is used as a strobe to indicate that valid data is waiting to be read into the computer. If this strobe is returned in response to an output command, there is no need to actually read in the data, as it is irrelevant.

With the serial interface, the arrival of a byte from the controller indicates that the last command was received, since the controller does not send information to the computer without being polled (it speaks only when spoken to). If the last command was an output, the value of this byte is irrelevant, and may be discarded. If the command was an input, the value of the byte is important, being the value returned from the selected input.

Next month we will present full circuit and constructional details for the controller board.

Construction project:

Low cost capacitor meter

Here's a nifty little unit which turns your digital or analog multimeter into a direct-reading capacitance meter. It uses a handful of parts, and is very easy to get going.

by BARRY KAULER

The basic circuit for this project was originally described by me in the January 1985 issue of *Electronics Australia*, in the "Circuit & Design Ideas" section. Since then there has been a steady stream of letters from interested readers, asking about things like the availability of a PCB pattern, and where to get some of the components.

As a result of this interest, I thought it might be worthwhile to provide some additional information – including a PCB pattern and wiring details.

Since the circuit was first described over three years ago, there may be many readers who won't be able to refer easily to the original article. So the best idea seems to be to start all over again.

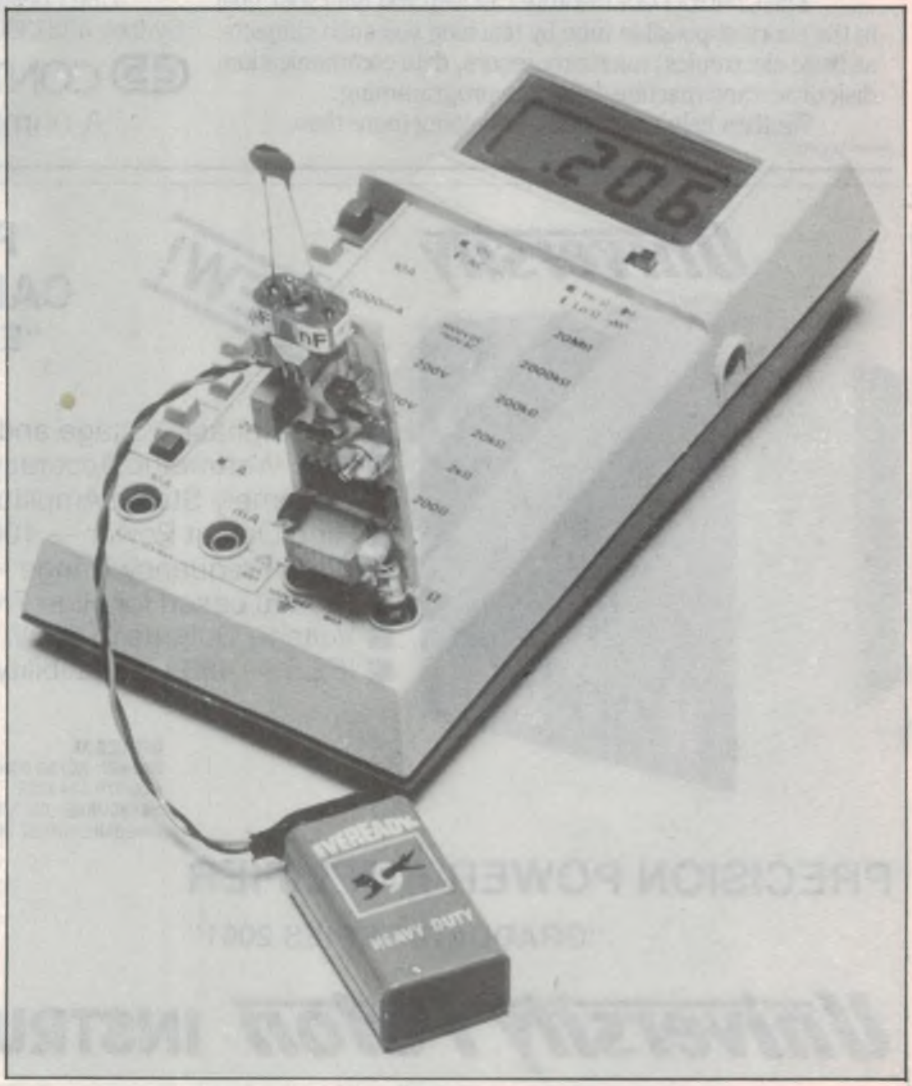
The basic idea is that the circuit is an adaptor, which plugs into any normal digital or analog multimeter to convert it into a capacitance meter. It will read any unknown capacitance in the range from 3.3pF to 2000uF, in two ranges. One range reads in picofarads, and the other in nanofarads. It can measure polarised capacitors such as aluminium and tantalum electrolytics, as well as normal non-polarised types.

The unit is very small and is made to plug directly into banana sockets which are spaced 19mm apart, as now found on the majority of multimeters.

There is only one control switch, a three-position DPDT centre-off type. There is nothing to adjust – you simply plug the pigtails of the unknown capacitor into the adaptor's socket (a modified crystal socket), switch to either the pF or nF ranges and read the capacitance value on the meter.

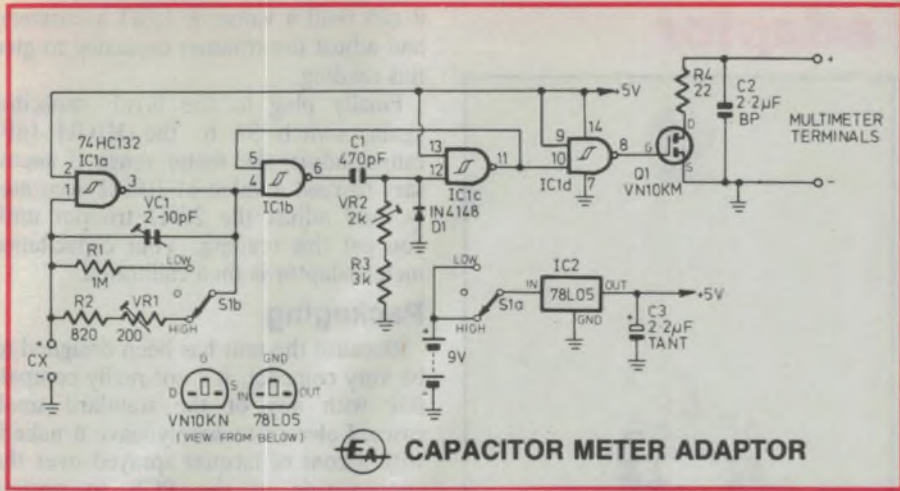
The multimeter itself is set to a standard resistance range, to measure ohms. The only minor complication is that for correct reading, the indication on the meter in ohms must be divided by 10 to give the capacitance value in pF or nF (depending on the rane selected).

So a reading of 1MΩ on the LOW range corresponds to 100,000pF, or 0.1uF. Similarly a reading of 1kΩ on the same range corresponds to 100pF, while on the HIGH range it would correspond to 100nF or 0.1uF.



The circuit

At the heart of the circuit is a 74HC132 quad Schmitt trigger chip with



The circuit for the adaptor, which uses only one IC, a small power MOSFET and a three-terminal regulator. It's very compact.

2-input NAND gates. The first of these, IC1a, is connected as a relaxation oscillator whose frequency depends on the unknown capacitor Cx connected between input pin 1 and ground.

The oscillator output is fed to IC1b, which together with IC1c forms a one-shot or monostable. This converts the oscillator output into a stream of narrow pulses, of constant width but with a duty cycle (mark/space ratio) proportional to the capacitance of Cx. These pulses are squared up and inverted by buffer IC1d, and used to switch Q1, a VN10KM enhancement-mode power MOSFET.

The multimeter, set to measure resistance, is connected between the drain and source of Q1 via a small protective resistor. Also connected across the multimeter input is a 2.2uF bipolar capacitor, which effectively forms an integrating circuit in conjunction with the meter's current source. As a result, the integrated or "average" resistance measured by the meter becomes proportional to Q1's switching duty cycle, and in turn to the value of Cx.

The effective resistance across the meter terminals varies from very close to the 22 ohms of the protective resistance, up to almost infinity – certainly many megohms, when Cx has a large value.

Although this way of measuring capacitance may seem a bit unorthodox and indirect, it has been carefully designed and is capable of very accurate results. Part of the secret is the use of a small power MOSFET for Q1, to get really fast switching and very low on-resistance.

Note that because of the way the circuit works, there is a DC voltage component across the capacitor being measured – the average value of the oscillation waveform at the input of IC1a. This has a value of around 2.5 volts, with polarity as marked. As a result polarised capacitors such as electrolytics can be measured quite accurately, providing they are connected with their negative side to the earthy terminal.

The only kind of capacitors which can cause significant reading errors are leaky high-value electrolytics, because the leakage will tend to slow down the oscillator and give false higher readings. In an extreme case, leakage can even prevent IC1a from oscillating altogether. But then very leaky capacitors are difficult to measure on any simple equipment, and are in any case best confined to the dustbin.

Switch S1b provides the two measurement ranges, by switching in two different feedback resistor values for the oscillator. The 2-10pF trimmer capacitor is to compensate for stray capacitance, which otherwise upsets accuracy at very low values of Cx.

The 2k trimpot adjusting the shunt resistance across the input of IC1c is used to calibrate the LOW capacitance range, by fine tuning the one-shot pulse width. Secondary calibration of the HIGH range is performed by the 200Ω trimpot forming part of the oscillator feedback resistance on this range.

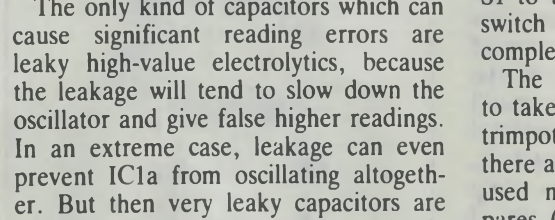
Power for the adaptor comes from a 216-type 9V battery, with a 78L05 low-power three terminal regulator (IC2) to produce the 5V rail required by IC1. On-off switching is performed by S1a, the second pole of the range switch. This not only saves a second switch, but also conserves power by reminding you to turn off the power when you're not actually making a measurement.

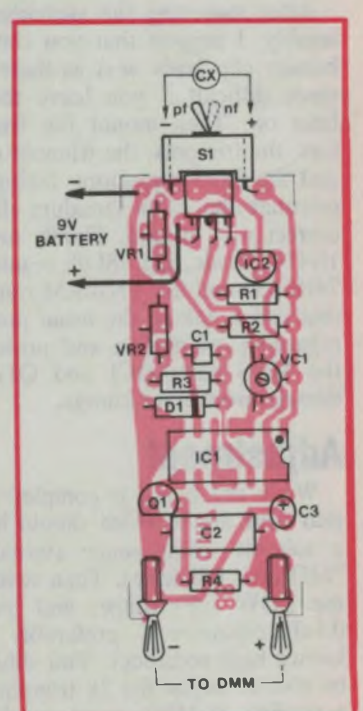
Construction

The complete circuit, apart from the 9V battery, mounts on a very compact PC board measuring only 25 x 66mm and coded 88cm7. A pair of banana plugs mount on one end, spaced 19mm apart, to plug directly into the multimeter's input jacks.

At the other end is mounted S1, a miniature toggle switch of the type which has 90° tails, for horizontal PCB mounting. Mounted concentrically with the switch is a slightly modified miniature crystal socket, to accept the leads of the capacitor to be measured. It's quite neat, and the close proximity of S1 to the socket again prompts you to switch off when the measurement is completed.

The PCB pattern has been designed to take a variety of components for the trimpots and trimmer capacitor, because there are a few different types around. I used miniature trimpots from Radiospares (Cat. No.'s 186-609 and 185-858 for the pots, 125-648 for the trimmer), but the board will also take the some-





Above is the PCB pattern, actual size, while at right is the overlay/wiring diagram. Use this in conjunction with the picture overleaf, as a guide to wiring up the project.

Capacitor meter adaptor

what larger types available from other suppliers.

Radiospares also carries the VN10KM power MOSFET (Cat. No. 295-107), which is made by Siliconix, and the 2.2uF bipolar capacitor (Cat. No. 114-446). The latter is a very compact unit – most other bipolar types of this value are rather larger physically, and won't fit on this board. But note that a 2.2uF capacitor must be used, to ensure correct operation.

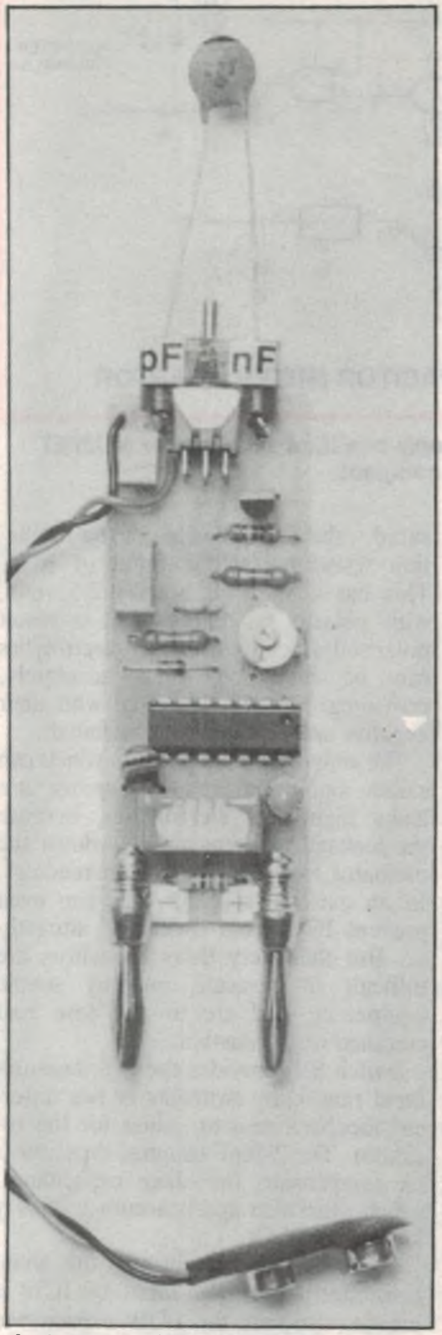
The correct positions of all of the components on the PCB should be clear from the overlay diagram. Note that the two banana plugs are "naked" (the plastic sleeves are not used), and mounted to the board via either small split pins or loops of 18G tinned copper wire.

Before mounting toggle switch S1 to the board, it is best to modify the crystal socket so that the two can be mounted together as an assembly. The socket is modified by first enlarging its centre hole carefully (using drills) until this just fits snugly over the switch sleeve. Then file flats on the inner sides of the two protrusions on the rear of the socket, to clear the sides of the switch body itself. And finally, you'll need to cut off most of the external length of the socket's two wiring tails, leaving them just long enough to crimp and solder short lengths of 18G tinned copper wire at right angles, to connect to the PCB.

After mounting the switch/socket assembly, I suggest that you connect the battery clip leads next as these become more difficult if you leave them until later on. Then mount the fixed resistors, the trimpots, the trimmer capacitor and the fixed capacitors, taking care to orientate the 2.2uF tantalum electro the correct way around. Finally mount the 1N4148 diode, the 78L05 regulator, the 74HC132 and the VN10KM transistor in that order, taking the usual precautions regarding orientation and protection of the MOS parts (IC1 and Q1) against damage from static charge.

Adjustment

When the board is complete, plug it into your meter which should be set to a suitable ohms range (initially with 1MΩ near full scale). Then switch S1 to the LOW (pF) range, and plug in a 0.1uF capacitor – preferably one of known high accuracy). You should then be able to adjust the 2k trimpot to give a reading of 1MΩ, corresponding to a correct reading of 100,000pF.



A close-up of the assembled unit, slightly larger than actual size. The overlay diagram can be used to identify all of the components.

If you have any difficulty in achieving the correct reading, you may have to reduce the value of the fixed resistor in series with the 2k trimpot, from its value of 3k. Note that 1% high tolerance resistors are recommended for this circuit, for all four fixed resistors.

Next remove the 0.1uF capacitor, and plug in a 10pF NPO ceramic or styroseal (again of known accuracy, if possible). Then turn your meter down until it can read a value of 100Ω accurately, and adjust the trimmer capacitor to give this reading.

Finally plug in the 0.1uF capacitor again, switch S1 to the HIGH (nF) range, adjust the meter range if necessary to read a value of 1000Ω accurately, and adjust the 200Ω trimpot until you get this reading. Your capacitance meter adaptor is then calibrated.

Packaging

Because the unit has been designed to be very compact, it's not really compatible with any of the standard small cases. I elected to simply leave it naked, with a coat of lacquer sprayed over the copper side of the PCB to protect against finger grease, etc.

An alternative approach would be to enclose the whole thing in a sleeve of heat-shrink tubing, once it's all calibrated. Radiospares has suitable tubing available, as may other suppliers.

Don't forget to mark the banana plugs and the crystal socket carefully in terms of polarity, to avoid confusion and possible false measurements later on.

That's about it. I hope you find this little adaptor as useful as I have.

PARTS LIST

- 1 PC board, 88cm7, 25 x 66mm
- 1 Small crystal socket (see text)
- 1 DPDT centre off miniature toggle switch, horizontal PCB mounting type
- 2 Banana plugs, without plastic sleeves
- 1 9V battery (216 type)
- 1 Matching clip connector and lead
- 4 Small split pins

Semiconductors

- 1 74HC132 quad Schmitt NAND gate
- 1 78L05 three-terminal regulator
- 1 VN10KM low power MOSFET
- 1 1N4148 silicon signal diode

Resistors & trimpots

- 1 22Ω 1/4W 1%
- 1 820Ω 1/4W 1%
- 1 3k 1/4W 1%
- 1 1M 1/4W 1%
- 1 200Ω min. vertical trimpot
- 1 2k min. vertical trimpot

Capacitors

- 1 2-10pF horizontal trimmer
- 1 470pF ceramic or polystyrene
- 1 2.2uF bipolar (see text)
- 1 2.2uF tantalum electrolytic

Books & Literature

Auto electronics

UNDERSTANDING AUTOMOTIVE ELECTRONICS, by William B.Ribbens and Norman P. Mansour. Published by Howard W. Sams/Texas Instruments, 1984. Soft covers, 227 x 178mm, 284 pages. ISBN 0 672 27017 X. Recommended retail price $34.95.

This is one of the "Understanding" series of books, produced by Texas Instruments in conjunction with Howard Sams. The stated aim of the series is to form a library to help people learn easily and quickly about modern electronics technology – especially that related to computers and microprocessors. Nowadays that seems to cover almost all of electronics.

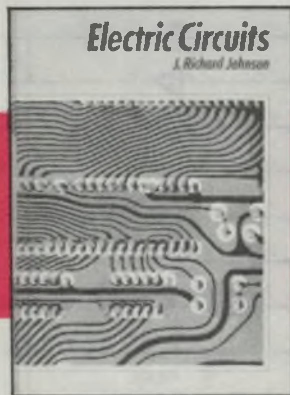
The idea of this particular volume in the series is to give a good idea of the various functional systems in a modern car, and the ways that electronics is being used to upgrade those systems. The authors are both heavily involved in this subject, being director and research associate respectively at the Vehicular Electronics Laboratory of the University of Michigan.

After introductory chapters on automotive system fundamentals, electronics, control/instrumentation and basic microcomputer operation, the book then moves into the ways these disciplines intermesh in a modern car. There are chapters on sensors and actuators, electronic engine control, vehicle motion control and instrumentation. Finally there's a chapter looking into the future, and the ways that electronics can be expected to play an even greater role in the operation and control of our cars.

The approach taken throughout is very satisfying. The concepts are explained simply and without a lot of deep theory or maths, but still in enough detail to give a sound understanding of the equipment and its principles of operation.

In short, an excellent book for anyone wanting to gain a much better understanding of the role of electronics and microprocessors in modern cars.

The review copy came from McGill's Newsagency in Melbourne. (J.R.)



Circuit theory

ELECTRIC CIRCUITS, by J. Richard Johnson. Published by Hayden Books, 1984. Hard covers, 260 x 190mm, 888 pages. ISBN 0 8104 0655 1. Recommended retail price $69.50.

Although written primarily to serve as a circuit theory textbook for first-year students in electrical/electronics engineering, this book would in fact make an excellent introduction for almost anyone with a basic grounding in high school maths. It starts right at the beginning with atoms and energy, and works its way through resistance, basic DC circuits, networks, capacitance, inductance, EMF, measurements, AC, vector analysis, resonance, transformers, AC circuit measurements and so on.

The treatment is very thorough, but highly readable. Everything is carefully explained, not just in terms of maths but qualitatively as well. There's a generous quota of graphs too, again to help in the understanding of concepts. Plus plenty of worked examples, and tutorial problems at the end of each chapter (with the answers to odd-numbered problems given at the back).

All in all, I think it's one of the best texts on circuit theory that I've ever come across. So if you need a good basic text, I can recommend it.

The review copy came from Jaycar Electronics, which stocks it under the catalog number BH 0904. (J.R.)

Using the scope

TROUBLESHOOTING WITH THE OSCILLOSCOPE, by Robert G. Middleton. Fourth edition, published by Howard W. Sams, 1984. Soft covers, 215 x 135mm, 256 pages. ISBN 0 672 21738 4. Recommended retail price $28.95.

The first edition of this book was published way back in 1962 – over 26 years ago. And over those years it has gone through not only four editions, but a very large number of reprints (this is in fact the fourth printing of the fourth edition). Countless people have used it to gain a basic familiarity with the 'scope, that most useful of test instruments, and there's no doubt now that Bob Middleton has produced a true classic in electronics book publishing.

As with the earlier editions, this one still gives a fair amount of emphasis to servicing TV receivers – in fact one way and another this occupies 6 of the book's 10 chapters. However the first part of the book still gives an excellent and easy to understand introduction to the 'scope and how you use it for basic measurements. And of course the measurement techniques discussed in the chapters on TV servicing are in most cases just as applicable to analysis of other kinds of analog circuitry.

A new final chapter supplements this basic material with a discussion of using the 'scope for troubleshooting in digital circuitry, giving at least a basic grounding in this area of application. I guess I'd like to have seen a little more along these lines, to bring the book even further up to date, but perhaps we'll see that in the fifth edition!

All in all, though, it's still an excellent introduction to the 'scope and how it's used.

The review copy came from McGill's Newsagency, in Melbourne. (J.R.)

Circuit & Design Ideas

TTL-RGB to composite video converter

The average composite video display on an IBM PC or clone is amazingly poor. This can have a number of causes. Some monitors are incompatible with the NTSC colour burst put out by some adapter cards. Many monitors require a video signal of 2V peak to peak, while others work properly on the more standard 1V peak to peak signal. Of course the video output of CGA cards varies with manufactures from one to two volts peak to peak.

The intensity levels of various colours is also hit and miss (what can you expect from crash mixing into the base of the output transistor) and does not always work well with every colour combination.

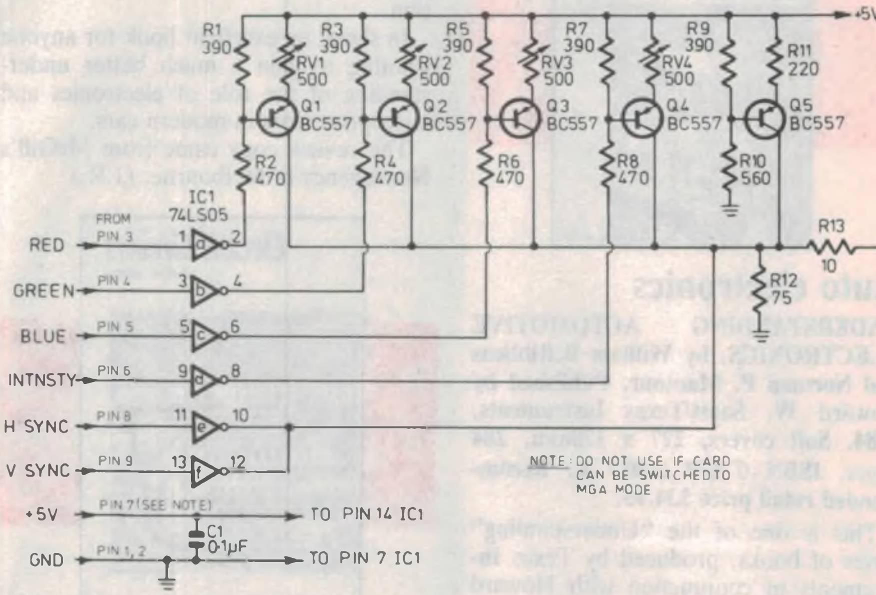
It is possible to get a much improved display for just a few dollars.

This circuit uses the TTL output of the CGA card and converts the signals into a high quality composite video signal suitable for monochrome monitors. Q1-5 work as constant current sources and when on, develop a voltage across R12. Q5 is permanently on; the current supplied provides the 0.5V black level.

Q1-4 are on when the appropriate open collector outputs are low. Presets RV1-4 control the level of brightness produced. With careful adjustment it is possible to produce sixteen different shades on a monitor. Inverters E and F provide the sync pulses by pulling the output down to O.2V.

The five volt supply for the circuit was supplied in my case by modifying the CGA card. I linked pin 7 on the 9 pin D socket to the nearest 5V rail on the CGA card, and ran this 5V supply to my converter.

This will not work if you have an adapter card that allows you to switch between CGTA mode and MGA mode. If so you will have to provide a separate 5V supply and leave pin seven alone (it is the video data output in MGA mode).



VIDEO CONVERTER

David Eather,
Brisbane, Qld

$40

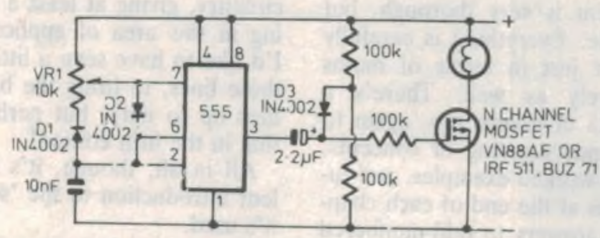
Dimmer for torches

This circuit was designed to conserve the expensive 6 volt lantern batteries used in "Dolphin" torches. It was fitted into the narrow space between the battery and the lamp reflector inside the torch, with only the control knob visible from the outside of the case.

The design is essentially a modified 555 timer oscillator with variable duty cycle, driving a MOSFET via a charge pump. The charge pump was necessary as most MOSFETs require more than 6 volts to turn them on fully, but can tolerate up to about 3 volts before turning on at all.

The 555 oscillator is modified so it charges the capacitor through one side of VR1 and discharges it through the other. This allows the duty cycle to be variable from 0% to 100% and keeps the scale linear.

The charge pump works by the 2.2uF capacitor charging to 2.4 volts while the 555's output is low, and applying 8.4V (6V + 2.4V) to turn the MOSFET on via the 100k resistor when its output is high. This then turns on the MOSFET and lamp during the time when the output of the 555 is high.



TORCH DIMMER

Jeffrey Harrison,
Mt.Waverley, Vic.

$40

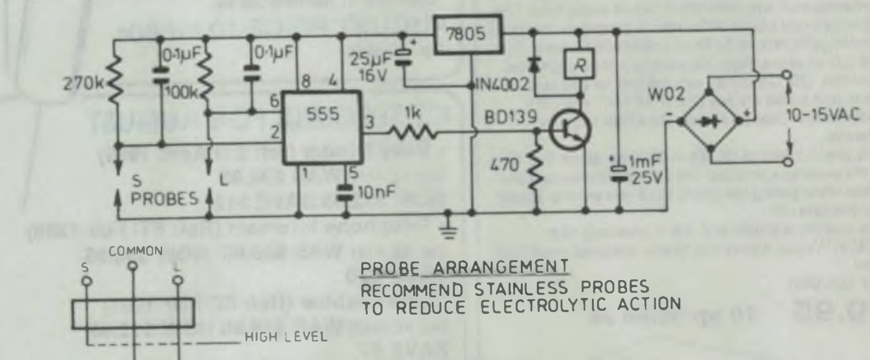
Interesting circuit ideas from readers and technical literature. While this material has been checked as far as possible, the circuits have not been built and tested by us. As a consequence, we cannot accept responsibility, enter into correspondence or provide constructional details.

Sump/bilge pump controller

Here is a straightforward and easy to build design for a sump or bilge pump controller which uses only common components. It is also a rather unusual application for a common 555 timer chip, as a dual sensing comparator with hysteresis.

As water reaches the "high" level, it establishes a conduction path from contact probe S to the common earth line. This pulls pin 2 of the 555 low and below its internally set trigger level of 1.7V (1/3 of Vcc), causing the IC to switch to its ON state. Output pin 3 thus goes high, and turns on the BD139 transistor to activate the relay and turn on the pump.

As the water is pumped out and its level falls, eventually it falls below the bottom of the contact probe L, removing the conduction path between this probe and the common earth line. This allows pin 6 of the 555 to rise above the upper internal threshold of 3.3V (2/3 of Vcc), causing the 555 to reset again – turning off the relay and the pump.



BILGE PUMP

Operation of the pump is thus fully automatic, turning on only when the water reaches the "high" level set by probe S, and turning off only when it falls below the "low" level set by probe L and the common probe.

As you can see there are no moving parts. I would recommend that the probes are made from stainless steel rod, to reduce electrolytic action.

I powered the circuit from a small 2155-type power transformer.

Ron Coleman,
Rivett, ACT **$50**

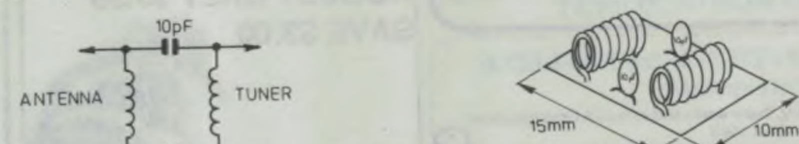
High pass filter for TV

I was faced recently with a TV installation where the Channel 2 signal was so strong that it overwhelmed the set's AGC and caused severe herringbone patterning on the picture. At the same time, the commercial channel was only just adequate, and any attempt to reduce the overall level to accommodate the Channel 2 signal took the other one down into snow.

Commercially made wave traps are available but not to me at the particular time in question. I hunted around in the bottom of my toolbox, to see if there was anything that might help me out of the predicament.

I found two 10pF ceramic capacitors, some stiff copper wire, and a scrap of Veroboard about 10 by 15mm. In no time I had cobbled up the little trap shown here. It was fitted inside the TV between the antenna and the tuner and easily reduced the Channel 2 signal to manageable proportions.

The reduction in strength was about 10dB relative to Channel 6. A similar unit was later made for use with Channel 8 and the reduction there was about 12dB.



TV FILTER

The coils are wound from short lengths of 0.7 or 0.8mm copper wire and consist of five or six turns using a small screwdriver, about 3mm in diameter, as a former.

This trap is not tuned to any particular frequency. It is simply a broad, high pass filter. It has a small but measureable insertion loss at the higher VHF channels but very much higher losses at lower frequencies. The trap is not recommended for use on UHF.

This handy little trap was an emergency lash-up which worked so well that several others have been made, all with equal success.

Jim Lawler,
Geilston Bay, Tas. **$30**

Dreamed up a great idea?

If YOU have developed an interesting circuit or design idea, like those we publish in this column, why not send us in the details? As you can see, we pay for those we publish — not a fortune, perhaps, but surely enough to pay for the effort of drawing out your circuit, jotting down some brief notes and popping the lot in the post (together with your name and address, or course!). Send them to Jim Rowe, Electronics Australia, PO Box 227, Waterloo 2017.

AND MORE BARGAINS

SENSATIONAL SCOOP PURCHASE!

ONLY $99.95

Enjoy a "SOUNDTRACKER 1" Video Processing centre for less than 1/3 the cost of recent retail.

The Soundtracker 1 is a U.S. made video graphic equaliser, mono to stereo digital synthesiser and noise reduction unit. It goes between your VCR and audio amp to enable you to apporach that cinema sound of the movie theatre!
If you have, for example, a mono (fixed head) VCR - the most common type by far - you probably only play the audio back thru the TV set speaker. If you were to play the one channel sound thru a Hi Fi you would notice 3 things, tape hiss similar to cassette hiss, poor frequency response and poor dynamic range apart from the fact that its still MONO!
The Soundtracker 1 can help most of these things, but only to a degree. It has a 5 band graphic to improve Bass, treble, muddy mids, etc. It has a noise gate to help reduce annoying tape hiss and it will synthesise a STEREO signal as well! It also works with stereo VCR's.
They were on the market for around $379 and at that price were a FLOP. For that money, plus a little more you could trade in the old VCR and buy a 6 head Hi Fi stereo VCR.
But not everyone has $1500 odd to spend on a fancy VCR, nor $379 for a gadget no matter how useful!
So Jaycar bought the importers stock at a way below cost end-of-financial year price. The result is that you (once again) get a fantastic BELOW COST bargain.
But hurry, stocks are genuinely limited on this quality made U.S. product.
You can grab one of these at a never-to-be-repeated prcie of $99.95, that's right! - less than 1/3 of the price that sold thousands.
Sorry, no room for specs - just buy one!
Cat. AV-6500

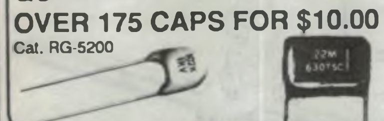
DIRT CHEAP!!

HIGH VOLTAGE CAPACITOR PACK

This is rare. Attention servicemen. We can offer you a bag of over 175 pcs of both high quality Polycarbonates and ceramic capacitors. Many of these are from current colour TV manufacturers surplus. Limited quantity, and probably will never be repeated. (We rarely see high quality high voltage caps anymore).
Here's what you get:
Polycarbonate
We have many different values in small quantities so most bags will be different. Higher quantities include: 0.0056, 0.047, 0.068, 0.056, 0.1, 0.18, 0.22, 0.27, 0.33, 0.56, in voltages 200V, 400V, 630V, 1.5kV, 1.6kV, 2kV
Ceramic:
Include a good range of values. 100pF, 220, 270, 330, 470, 500, 680, 1000, 2200, 4700pF in voltages 400V, 500V, 1kV, 2kV and 3kV.

DON'T MISS OUT!! LIMITED QUANTITY!! WON'T LAST
OVER 175 CAPS FOR $10.00

Cat. RG-5200



Clock Movement Accessory SELLOUT

See our 1988 catalogue for full specifications
- MD-01 Melody Module - 12 songs Cat. XC-0115

WAS $12.95 NOW $4.95 SAVE $8
- MD-02 Westminster Chimes Cat. XC-0120

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WAS $14.95 NOW $6.95 SAVE $8
- Pendulum Driver Cat. XC-0110

WAS $14.95 NOW $4.95 SAVE $10
- Quartz Movement with Switch Contacts - to suit all the above Cat. XC-0105

WAS $16.95 NOW $14.95 SAVE $2
- "Twinkle, Twinkle little star" module Cat. XC-0130

WAS $3.95 NOW $1.95 SAVE $2

1/2 PRICE TV COAX

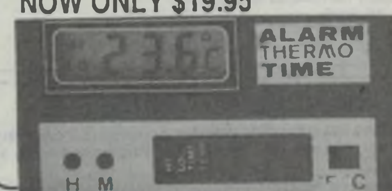
Another Jaycar scoop purchase!! Installers please note!! Quality AIR SPACED coax at 1/2 our usual price. Available in 4 different roll lengths. Normally sells for $1.20 per metre. Special price only applies to purchases of full rolls as listed below.

50 metre roll	Cat. WB-2020
ONLY $30	**SAVE $30**
60 metre roll	Cat. WB-2021
ONLY $36	**SAVE $36**
65 metre roll	Cat. WB-2022
ONLY $39	**SAVE $39**
70 metre roll	Cat. WB-2023
ONLY $42	**SAVE $42**

Digital Alarm Thermometer/Clock

This great new product has a built-in temperature sensor, so displays the temperature in both Celcius and Farenheit. It also tells the time. An alarm will sound when the temperature falls below or above a preset temperature. Handy pocket size, measures 53 x 82 x 22mm. Temperature measuring range -20°C to 70°C - 0°F to 160°F. Use one AAA battery.
Cat. XW-0390

WAS $27.95 SAVE $8
NOW ONLY $19.95



Tantalum Capacitor Pack

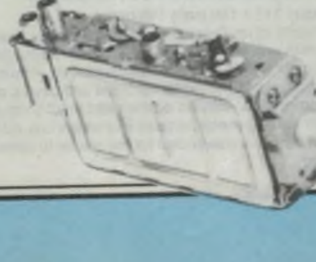
Tantalums are getting more expensive all the time. Due to a very large bulk purchase, we can offer you a mixed pack of over 50 Tantalums. Over 40 of these are tag type, and the rest high quality military spec RT style which are worth up to $5 each.
A typical pack will include: TAG STYLE 2 x 0.33/35V, 10 x 2.2/16V, 5 x 6.8/6.3V, 1 x 0.15/50V, 20 x 4.7/16V, 1 x 4.7/25V, 3 x 68/10V, 1 x 100/16V. RT STYLE 1 x 0.1/35V, 1 x 0.22/35V, 1 x 0.33/35V, 1 x 0.68/35V, 6 x 15/20V, 1 x 32/35V, 1 x 47/20V. We reserve the right to make changes if stock shortages occur. This is a once only offer. Don't miss out.
OVER 50 TANTALUMS FOR ONLY $12.50
Over $35 worth of Tag Tantalums alone, without taking into account the expensive Milspec style also supplied.

Cat. RZ-6695

UHF TV TUNER Sanyo Model T1087RA

Yet another fabulous scoop purchase.
A compact high quality tuner that operates from 526-814MHz (corresponding to channels 28 thru 63). This tuner is designed for Australian standard reception (AS1053 1973), and is offered at a very low price.
You can grab one now for the silly price of $29.95! This price includes circuit diagrams and connection drawing. You can have a photocopy of the complete manual for $4 but a lot of the info is in Japanese!
This is a very cheap way to convert a VHF only TV to UHF! (Some skill may be required).
Specs:
Power +12V DC nominal @ 14mA. Case neg. Bandwidth 526-814MHz (28-63 ch). AFT +6.5V. Dimensions 150 x 65 x 28mm. Tuning multirotation of 1/4" shaft. Knob not supplied.

Cat. DM-1000 **$29.95**



LCD Thermometer Travel Alarm Clock

Credit card size 85 x 55 x 8mm thick and is supplied in handy wallet. Loud alarm and snooze function. Easy to use. Degress in C or F. Uses one LR-44 battery. Has quartz accuracy.

Cat. XW-0392 **$29.95 NORMALLY**

SAVE $8 ONLY $21.95

BARGAIN RF CHOKE PACK

Over 50 pieces supplied!
A pack of 30 brand new RF chokes with at least 14 different values! Popular values include: 1.5, 4.7, 12, 15, 18, 22, 68, 100 & 1000uH. Each choke is resin dipped and colour coded (they look like bead tantalums). A colour coding chart is supplied so that you can decipher the value.
BONUS! Not only do you get 30 useful chokes we will give you at no extra charge at least another 30 more RF chokes! These are genuine chokes but are commonly called 'peaking coils'! They look like a 1/2 watt resistor. (Read the choke value in uH as you would a resistor value).

Cat. RC-5600 **ONLY $10.00**

AND MORE BARGAINS

HALF PRICE POT PACKS

Mixed Pots

A pack of at least 35 potentiometers which includes slider pots - single and dual, an assortment of pots and lab style pots with assorted shafts and a slection of quality 5mm vertical sealed trimpots and open 5mm horizontal styles. This represents excellent value at $10

Cat. RP-3902

NORMALLY $10

SAVE 50%

$5 per pack

Slider Pots

You don't see this very often. A pack of 20 sliders in assorted values between 5k and 500k. 20 for $10. That's only 50¢ each! The majority in the pack are dual gang which have been selling for $5.50 each. A typical pack includes values such as 5k, 50k, 100k, 250k, and 500k in 45 and 60mm lengths in single and dual styles

GET A PACK WHILST THEY LAST

Cat. RP-3903

NORMALLY $10

SAVE 50%

$5 per pack

TELEPHONE PLUG BARGAIN

SAVE 50%

without the cable grommet.

NORMALLY $3.95

Limited quantity

Cat. PP-1400

ONLY $1.95 ea

10 up $1.75 each

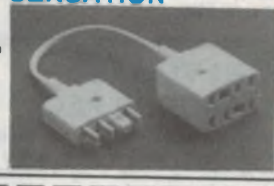
TELEPHONE DOUBLE ADAPTOR SENSATION

WAS $7.95

SAVE 47%

Cat. XT-6020

$3.95 ea



Utility Box

Ideal system for the serviceman, or mobile workshop, or just to keep all those resistors and capacitors tidy. Also ideal for fishing tackle boxes and many other uses. Six of these utility boxes will fit snugly into the carry case pictured. Size of utility box 188 x 115 x 36mm. Colour opaque white.

Cat. HB-6310

$2.29 **10 up $2.10 ea**

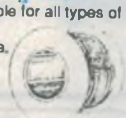
Solder Reel - lower price

200 gram reel. 1mm universal gauge. Suitable for all types of electronic soldering.

Resin cored and including bit saving additive.

Cat. NB-3010NEW LOWER PRICE

$6.95 **10 up $6.50**



Utility Carry Case

Specifically designed to hold 6 utility boxes snugly to give a 30 compartment totally portable parts storage system. Size 365 x 210 x 80mm. Colour white.

Cat. HB-6312

$17.95

SPECIAL INTRODUCTORY OFFER 6 - UTILITY BOXES AND A CARRY CASE FOR ONLY $28.95 - SAVE $2.74.

"BICENTENNIAL" LIGHTS IN YOUR OWN HOME!

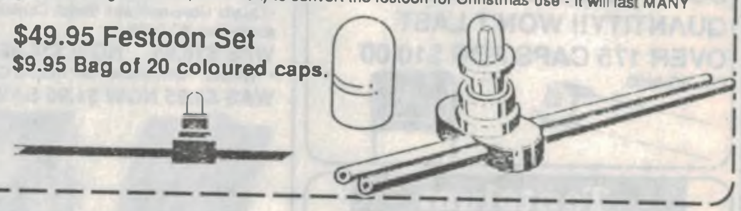
Illuminate your garden, trees or windows with this low volatge lighting system!

Now you can have the same beautiful 'firefly' lighting that is all over the civic squares around Australia.

Until now weatherproof outdoor low wattage festoon lighting simply has not been available. That is behind us, because Jaycar has an exclusive outdoor/indoor lighting kit to enable you to beautify your home or garden. Each festoon set comprises a 6 metre cord with 20 lamp bases moulded in parallel onto the cord at 300mm intervals. (At the end of the festoon is a clear 700mm of cord.) Each lamp base is fitted with a 12V 50mA globe and clear polycarbonate weather-proof cap. The entire festoon draws, of course, 1 amp AC or DC, only. THE RATED LAMP LIFE IS 20,000 HOURS! Each lamp is in parallel and in the likely event of an individual bulb failure THE REST STAY ON (unlike cheap series type festoons). The 'Pixielite' festoon is moulded in water clear plastic. At one amp per festoon a cheap 2155 type transformer (Cat. MM-2002 $10.95) is all you need for power. The festoon, however, is NOT CHEAP. It is a quality made in Australia product designed to last a lifetime. A 6.7 metre 20 lamp festoon will cost you $49.95. You can buy a mixed bag of coloured caps (red, amber, green, blue, 5 of each) to convert the festoon for Christmas use - It will last MANY Christmases!

Cat. SL-2802 **$49.95 Festoon Set**

Cat. SL-2805 **$9.95 Bag of 20 coloured caps.**



6" x 2" SPEAKER!!!!

Yes, a 6" x 2" speaker, that's 157 x 57mm. The size may be strange, but the quality certainly isn't. They are Japanese made, with a large magnet. It even has a foam roll surround. These were used in colour TV's, so the quality is excellent. Sanyo brand 8 ohm 5 watt. Limited quantity. These would probably cost $30 as a spare part!!

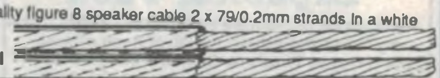
Cat. AS-3030

$4.95 ea **10+ $4.50 ea**

NEW HEAVY DUTY SPEAKER FLEX

Don't pay through the nose for heavy duty speaker flex. High quality figure 8 speaker cable 2 x 79/0.2mm strands in a white covering with black trace.

Cat. WB-1712 **$1.50 metre** **$120 per 100m roll**



BREADBOARD JUMPER KIT??

We supply a pack with 5 metres of both red and white solid core hook-up wire. This is the ideal size for breadboards. All you need to do is cut it up into whatever lengths you require and strip the ends. Cat. WH-3030 **ONLY $1.95**

2-Wire AC Mains 7.5 Amp Flex

This cord has a moulded 2-pin (i.e. no earth) approved plug with a very generous 3 metres of flex stripped and tinned at the end.

Ideal as a replacement lamp cord or any long cord that need not have an earth.

Worth $3.95

THIS MONTH $2.00 Cat. PS-4112

Low Cost Direct Imports for the U.K.

'Practical MIDI Handbook'

R.A Penfold. 215 x 140 (soft) 150 pages

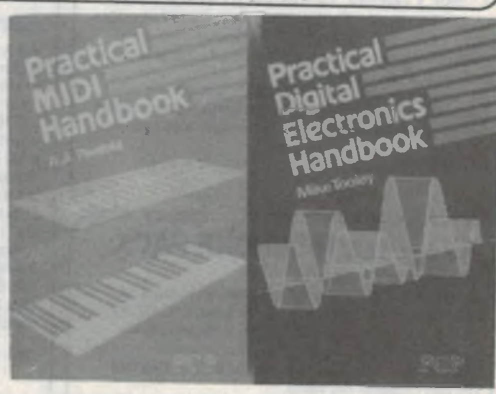
The Musical Instrument Digital Interface (MIDI) is a subject that many people have heard of but know little about. Many electronics magazines produce MIDI type electronic projects and these are proving to be reasonably popular - especially in the U.K.

This book is primarily aimed at the musician who has some technical knowledge of electronics. It explains what MIDI is, what MIDI's vast capabilities are, how to interconnect, etc.

Special emphasis is placed on MIDI and computers and operating a MIDI connected system.

An excellent book.

Cat. BP-1202 **$17.95**



ATTENTION PA INSTALLERS

Jaycar can offer GREAT prices on 8" twin cone speakers and plastic grills.

8 Ohm 10 watt Speaker

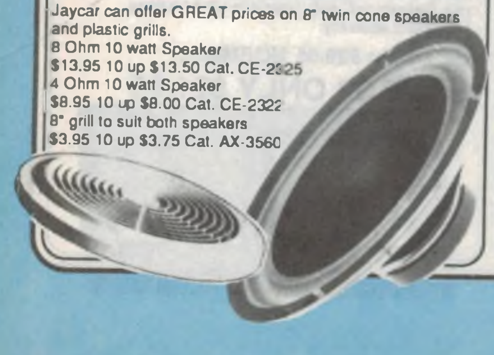
$13.95 10 up $13.50 Cat. CE-2325

4 Ohm 10 watt Speaker

$8.95 10 up $8.00 Cat. CE-2322

8" grill to suit both speakers

$3.95 10 up $3.75 Cat. AX-3560



'Practical Digital Electronics Handbook'

By Mike Tooley 215 x 140 (soft) 198 pages

The vast majority of modern electronic systems rely heavily on the application of digital electronics. This book aims to provide readers with a practical introduction to the subject. Anyone involved with the design, manufacture or servicing of digital equipment should find the book invaluable. Anyone just interested in the subject will find it rewarding.

The book introduces basic digital concepts and covers such areas as Logic gates, bistables, timers, etc. It quickly moves on to microprocessors, support devices and Input/Output (I/O) devices. The popular RS232C Interface is discussed in detail as well as the general purpose instrument bus IEEE-488 and finally the IEEE-1000 based microprocessor bus. Test gear projects are also shown for the reader to contruct. An excellent book on this subject. Cat. BP-1204

$19.95

Don't forget the Electronics Australia –

GRAND AUSSIE HOBBY

How good are YOU at designing a really novel and exciting hobby electronics project? Now's your chance to prove what you can do –

The Grand Aussie Hobby Electronics Contest is sponsored by *Electronics Australia*, the country's leading electronics magazine, and leading electronics retailer Dick Smith Electronics. The contest is open to all Australian electronics hobbyists, although entries must be accompanied by the entry form below (or a photocopy if you don't want to cut the magazine).

The idea of the contest is to encourage more Australians to take up electronics as an exciting and rewarding hobby. We're doing this by asking you to design the most novel, exciting, useful and easy to build project you can dream up – provided that the total current retail cost of the parts required to build it is less than $100.

It can be an electronic game, a test instrument, a radio set, a piece of amateur radio gear, an amplifier, an audio accessory, a useful gadget for use around the home or office or whatever, as long as it meets the above requirements. Now that shouldn't be too hard, should it?

Needless to say, you'll be expected to build up a neat prototype of the project, to make sure that it works properly. And to produce the usual things needed in a good project design to make sure that others can build it up easily: things like a printed circuit board pattern, and so on.

Each project entered in the competition should also be accompanied by a description of what it is, how it works and how to build it and get it going. In short, the manuscript of an article which could be used to describe it in *Electronics Australia* – complete with neatly drawn circuit and any other diagrams as necessary.

Not surprisingly we'll be awarding points not just for your project design itself, but for the way you've built up the prototype and your description of it as well. In short, for your overall presentation.

Along with the main prizes, there are two runner-up prizes in each category as well. In each case these are Open Vouchers, to purchase components or other products of your choice to the value of $100, at Dick Smith Electronics.

Rome wasn't designed and built in a day, and neither are good electronics projects. That's why we're giving you three months to prepare your entry. The closing date is September 30, so entries sent to us but postmarked after that date won't be eligible for the competition. The winners will be advised by mail before the end of October, and will be announced in the December issue. If possible we'll also be presenting the winning projects in that issue, as well.

What encouragement is there for you to enter this exciting new competition? Well, for a start there are some great prizes. All up, the total value of prizes being offered is over $3500!

To be fair to both newcomers and more experienced hobbyists, we've decided to award not one but TWO main prizes – one for people in each category. The two prizes are of roughly equal value (both more than $1500), but structured to suit people at different stages of hobby involvement. In each case they provide a mouth-watering collection of the things you've probably always wanted, but couldn't really afford. At the same time they'll provide a tremendous boost to your home workshop, and help you move on to even bigger and better things – what could be more appropriate for a contest designed to encourage hobbyists!

Along with the main prizes, there are two runner-up prizes in each category as well. In each case these are Open Vouchers, to purchase components or other products of your choice to the value of $100, at Dick Smith Electronics.

In addition to these prizes from Dick Smith Electronics, the winning and runner-up project entries are likely to be published in *Electronics Australia* – the largest selling and most respected electronics magazine in Australasia. How's that for being seen by the largest number of your fellow hobbyists – and having them build YOUR design! When your design is published, you will of course receive the usual contribution

---

EA

OFFICIAL ENTRY FORM:

Here's my entry to the contest. I affirm that this is an original design by me, and that I have built and tested a prototype unit to make sure that it works as claimed. The accompanying description is also all my own work. If my entry is judged one of the winners, I am happy to supply the prototype unit to EA and DSE for testing, photography and preparation of a kit.

NAME: .... PHONE NUMBER: ....

ADDRESS: ....

.... POSTCODE: ....

CATEGORY OF ENTRY: (Tick which one) Newcomer ☐ Advanced ☐

OCCUPATION: ....

MAIN INTEREST IN ELECTRONICS AS A HOBBY: ....

ESTIMATED COST OF PARTS IN YOUR ENTRY: $ ....

I understand that a condition of entering this contest is that Electronics Australia magazine shall have first option on publishing details of my design/project, and that Dick Smith Electronics shall have first option on marketing any kits based on the design/project. I also agree to abide by the decision of the contest judging panel.

SIGNATURE:

....

Dick Smith Electronics

ELECTRONICS CONTEST!

whether you're an enthusiastic newcomer, a seasoned old timer or anyone in between. There are great prizes to be won!

fee, as well.

Needless to say Dick Smith Electronics is also going to be interested in producing kits for the winning projects, to make it easy for other readers to build them up. So you'll receive not only fortune but fame as well – what more could you possibly want?

So don't delay – start working on your entry today. Whether you're a keen beginner or an experienced old-timer, you have an equal chance. Put on your thinking cap, and see if you can come up with a winning design!

A final point. To make it even easier for you to work on your entry, Dick Smith Electronics has decided to offer a special 10% discount on the components you may need to build up your prototype. So if you cut out the voucher on the bottom of this page and take it to your nearest DSE store, it will get you that very handy discount. How's that for being helpful!

Please note, however, that you must use the original voucher from the magazine – photocopies can't be used. The voucher can also be used only to purchase electronic components and associated hardware such as a case, knobs, connectors and PCB materials – not for other products. So write out a list of all the bits you'll need for your project entry, and make sure you get them all at once to take advantage of the 10% discount.

HERE ARE THE GREAT PRIZES TO BE WON:

NEW HOBBYISTS' SECTION

A. First prize:

Q-1280 6.5MHz Oscilloscope	$399.00
Q-1600 Digital Multimeter	$199.00
T-2000 Solder Station	$129.00
Q-1220 RC Audio Oscillator	$119.00
Q-1335 Transistor Dip Meter	$129.00
N-5700 PCB Etching Kit	$ 99.95
P-4616 Prototyping Breadboard	$ 39.95
PLUS — A DSE Components Voucher for	$400.00

A TOTAL PRIZE VALUE OF OVER $1500!

B. Two runner-up prizes of DSE Components Vouchers, each for the value of $100.00

ADVANCED HOBBYISTS' SECTION

A. First prize:

Q-1260 20MHz Dual Trace Oscilloscope	$899.00
Q-1666 Precision Digital Multimeter	$249.00
T-2050 Royel "Pro" Soldering Station	$199.00
PLUS — A DSE Components Voucher for	$250.00

A TOTAL PRIZE VALUE OF ALMOST $1600!

B. Two runner-up prizes of DSE Components Vouchers, each for the value of $100.00

TOTAL VALUE OF ALL CONTEST PRIZES OVER $3500!

(All prizes listed above are being donated by Dick Smith Electronics, and further details of each product can be found in the company's latest catalog.)

Prize winning entries and other selected entries may also be published in Electronics Australia, and all entries so published will of course earn an appropriate publication fee, in addition to any prizes awarded.

SPECIAL DISCOUNT VOUCHER: ▶

To make it especially easy for you to enter the Grand Aussie Hobby Electronics Contest, Dick Smith Electronics is offering this special discount voucher. By presenting the voucher at any Dick Smith Electronics store when you're buying the parts to build your project entry, you'll get a very welcome 10% discount!

(Discount only applies to components, etc., and voucher can only be used ONCE)

DICK SMITH ELECTRONICS

COMPONENTS DISCOUNT VOUCHER

I'm building a project for entry in the Electronics Australia – Dick Smith Electronics Grand Aussie Hobby Electronics Contest, and I hereby apply for my 10% discount on the parts I'm buying.

NAME: ....

ADDRESS: ....

....

P/CODE: ....

PHONE NUMBER: (....).

CATEGORY (Tick): Newcomer ☐

Advanced ☐

MY MAIN HOBBY INTEREST IS: ....

Tuning Receivers and Transmitters

This month we consider how radio receivers are able to select just one of the hundreds of radio transmitters on the air, rejecting all others. The simplest method for this purpose uses a "tuned circuit", consisting of inductance and capacitance.

by BRYAN MAHER

An "inductor" is a component designed to exploit the electrical property *inductance*. For radio use an inductor usually takes the form of a coil of wire, possibly with an iron ferrite core. If our interest is in low frequencies we would use a coil of perhaps hundreds of turns (see Fig.1), but for very high frequency use a tuning coil may have only a few turns.

Inductance

The property of inductance is a natural effect possessed by every piece of wire, and the effect is enhanced when a wire is wound into a coil. Any current flowing in the coil creates a magnetic field in and about the coil. Whenever the current in the coil changes, in value or direction, the associated changing magnetic field generates a voltage in the coil. During that time the coil is acting as a generator.

The amount of voltage so generated by the coil is proportional to the *rate* at which the current changes, while its polarity depends on the direction of change of current.

When we attempt to change the value or direction of current in the coil, the inductive effect will cause the generation of a voltage in such a direction as to try to *prevent* such a change. Because of this, any voltage suddenly applied to a coil will produce a current which rises at a comparatively low rate.

Constant steady currents, no matter how large, produce no inductive effects of this type.

The basic unit of inductance is the "Henry", so named to honour Joseph Henry (USA 1797-1878) whose inventive work was not recognised during his lifetime. The abbreviation for the unit is "H".

As the Henry is a fairly large unit, for tuned circuit work we usually use millihenries (mH) or microhenries (uH). (Remember that the prefix *milli-* means one thousandth of the basic unit, while *micro-* means one millionth.)

Capacitance

A "capacitor" is a component in which we exploit the electrical property of *capacitance*. Such a component consists of two or more parallel plates or surfaces of conducting material, separated by air, vacuum or a solid insulating material.

The space or material between the conductive plates or surfaces is known as the "dielectric". Connection wires or terminals connect the conductive plates or surfaces to the other components of your circuit. Fig.2 shows a small variable capacitor, using air as the dielectric.

Capacitance is a natural effect exhibited between every pair of separated conductors. If a changing voltage exists between the two, this change in voltage causes a current to flow. The amount of current which flows is proportional to the *rate* at which the voltage changes, while its direction depends on the direction of change of the voltage. A steady voltage produces no capacitance current.

Fig.1: The tuning coil shown in the centre of this picture is wound on a ferrite rod, which significantly enhances its inductance.

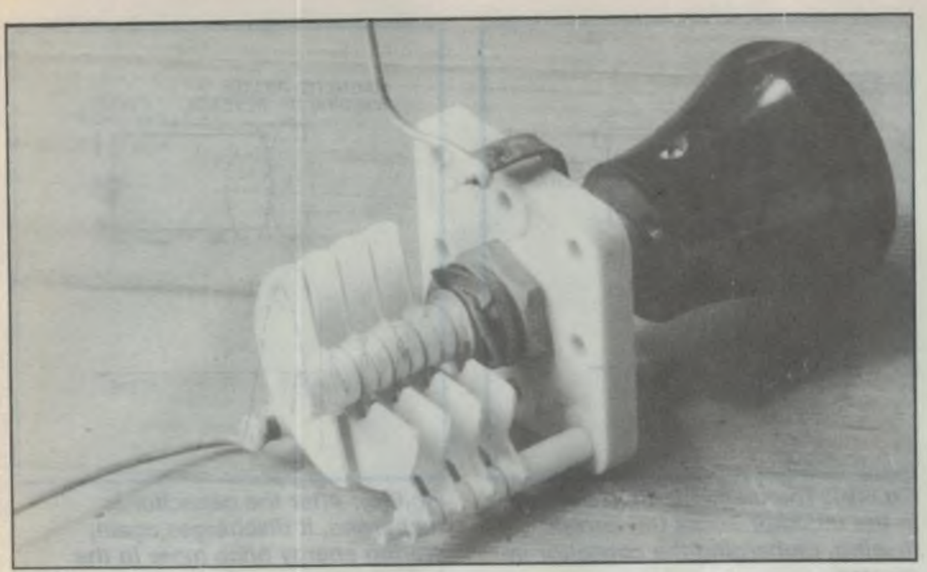


Fig.2: This small variable capacitor is adjustable between 3 and 13pF, and is intended for tuning in the range 10 – 50MHz.

The basic unit of capacitance is the "Farad", to honour Michael Faraday (England, 1791-1867) who invented the electric generator and motor. The abbreviation for the basic unit is "F". But because one farad is a very big quantity of capacitance, we commonly use the million-times smaller *microfarad* (uF), or the thousand-times smaller again *nanofarad* (nF). For capacitors used in tuned circuits we go even smaller and use the *picofarad* (pF), representing one million-millionth of a farad.

As the frequencies used by radio and TV are quite high, all radio frequency *voltages* are continually changing at quite a fast rate, so the capacitance currents flowing are important. Similarly as the radio frequency *currents* are always changing quite quickly, inductive effects also play a big part in circuit operation.

Unwanted resistance

Unfortunately *resistance* is another electrical property which pervades almost everything. Certainly all ordinary coils of wire designed to be used as inductors also have some resistance. Even the plates and connections of capacitors have some resistance. Part of the tuned-circuit maker's art is to produce components having the minimum possible value of resistance.

Techniques that can be used for this include winding the coil from relatively thick wire, and plating the surface of both the coil and the capacitor plates with a particularly good conductor such as silver or gold.

L-C interaction

A capacitor can be "charged" with electric charge by connecting it across any voltage source, for example a battery, as in Fig.3. Here C represents the capacitance of the capacitor, connected to a battery which will quickly charge it.

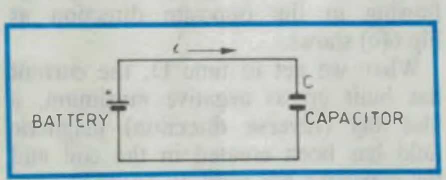


Fig.3: Connecting a battery across a capacitor C causes a current i to flow, to "charge" the capacitor.

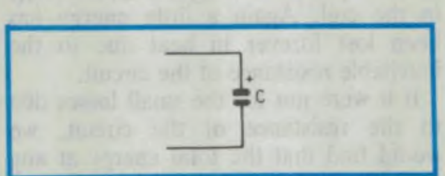


Fig.4: If the battery is then disconnected, the capacitor will hold the charge for some time until it leaks away.

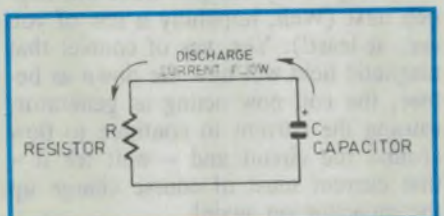


Fig.5: But a resistor will discharge the capacitor much faster, wasting the stored energy as heat dissipated in the resistor.

Once charged, we could remove the battery, leaving the capacitor in the fully charged state (Fig.4). The charge would stay on the capacitor for some time if we left it like this, slowly leaking away. If we connect a resistor across the capacitor as Fig.5 a current will flow, discharging the capacitor and dissipating all the charge by turning the energy into heat in the resistor.

"That's not very clever", you probably are objecting "What's the good of that?". Quite right you are, of course, it's no use at all! But let's now throw that resistor away and do something else rather startling.

If while the capacitor is well charged, we were to connect an inductance across it as in Fig.6(a), things are very, very different. A chain of events would follow that would please the most expectant soul. We depict what happens in the next few microseconds in the sequence of little "snapshots" represented by Figs.6(a)-(e).

In Fig.6(a) charge begins flowing out of the capacitor at time A, passing a current through the inductance – which sets up a magnetic field in the inductance. In the figure we show a little diagram showing how the current starts from zero at time A, rising to a maximum at time B, perhaps in a microsecond or less.

By time B the current has built up to a maximum. The capacitor has lost all its charge, and all of its electric-field energy has been transferred into magnetic energy stored in the magnetic field of the inductor. We now have the condition in Fig.6(b).

The completely discharged capacitor C is just sitting there, connected in parallel with the inductor L, which has a nice big current flowing in it. This produces a strong magnetic field entwining its turns.

But life never stands still. That magnetic field is proportional to the current flowing, and now with the capacitor discharged there is nothing to keep that current flowing. So the current decreases down to zero, at time C. But that's not all that happens!

The falling current means a change in magnetic field in a downward direction, so this decreasing current must induce a voltage in the turns of the inductor, with opposite polarity as shown in Fig.6(b). The inductor during this time has become a generator of voltage.

The voltage generated by the inductor keeps the current going around the circuit in the same direction as previously, as in Fig.6(b). But the current's value decreases all the while, from time B to time C.

There's still more to come, though. At time B there was no charge left in the capacitor, yet the inductor forced the current to continue flowing. Whence did this current flow?? It must be that from time B to time C the current is re-

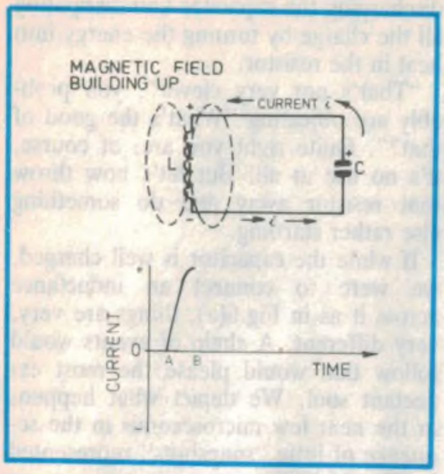


Fig.6(a): If an inductor L is connected across a charged capacitor, the discharge current first rises relatively slowly.

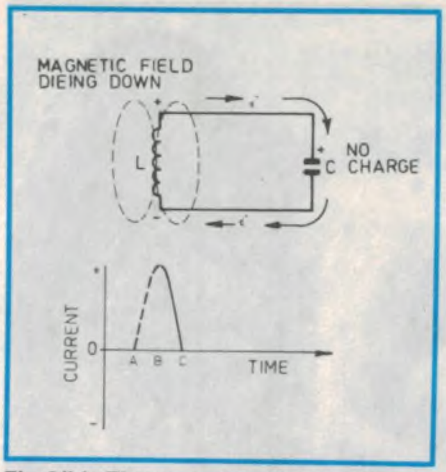


Fig.6(b): The magnetic field built up in the inductor keeps the current flowing, recharging the capacitor in reverse.

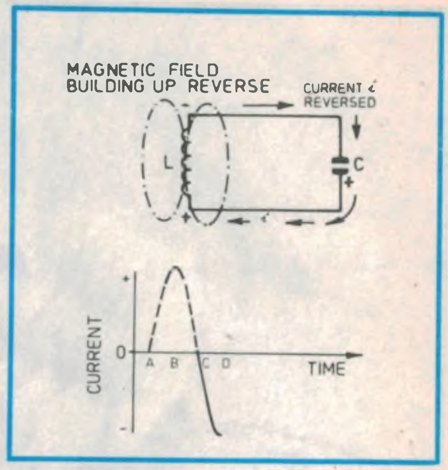


Fig.6(c): After the capacitor is recharged, it discharges again, storing energy once more in the inductor's magnetic field.

charging the capacitor. And because our diagram shows the current flowing "into the bottom" of the capacitor, that current must be charging the capacitor in the opposite direction to the original – i.e., negative at the bottom, as in Fig.6(b).

During this time B to C the current is decreasing and the energy in the magnetic field is decreasing, but the charge on the capacitor is building up (in the opposite direction) and the energy stored in the capacitor is increasing. So the energy is transferring from the inductor back into the capacitor.

Sadly some energy is also being lost (turned to heat) in the inevitable resistance of the circuit.

By the time the current finally decreases to zero at time C, no energy is left in the inductor. But the capacitor now has all the remaining electrical energy, because it is now well charged, up to a voltage a little less that the original full charge. (A little less because of those resistive losses). The only other difference from when we started is that the capacitor voltage is now opposite in polarity.

Now, gentle reader, what do you expect will happen next? The situation is as Fig.6(c). At time C we again have a coil with no current and no magnetic field, in parallel with a well charged capacitor.

First prize to the reader who said that the whole process recommences again, i.e., the capacitor drives a current into the coil, such current building up from zero value until some maximum is reached at time D. Because of the reversed polarity of the charge on the capacitor this new current is negative, flowing in the opposite direction as Fig.6(c) shows.

When we get to time D, the current has built up to negative maximum, a nice big (reverse direction) magnetic field has been created in the coil and the capacitor has used up all its charge, as depicted in Fig.6(d). The energy has swapped again from electric field energy in the capacitor to magnetic field energy in the coil. Again a little energy has been lost forever in heat due to the inevitable resistance of the circuit.

If it were not for the small losses due to the resistance of the circuit, we would find that the total energy at any moment, i.e., the sum of the inductive energy plus the capacitive energy, is a constant.

All over the country readers are clamoring to cry out just what will happen next (Well, hopefully a few of you are, at least!). Yes, yes of course: that magnetic field will now die down as before, the coil now acting as generator, causing the current to continue to flow around the circuit and – wait for it – that current must of course charge up the capacitor yet again!

Notice the direction of charge building up on the capacitor. By the time the magnetic field completely dies down the current has decreased to zero, and we are at time E as in Fig.6(e). All the energy we have left is back in the form of an electric field in the capacitor, with no energy in the coil and the capacitor voltage as shown, positive at the top. Clearly the capacitor is anxious to go again.

Do you have a feeling of *deja vu*? Yes, we have been here before. The whole description that you, most gallant reader, have just ploughed through is about to repeat all over again, with current rising from zero value at time E to start the second cycle, reaching the second (slightly reduced) positive peak at time F. From there it will continue on as before, so let's not say any more. Like an old movie, the rerun will be the same again only a bit less dramatic.

Subsequent maximum charge, voltage and current values encountered will be less again, as the small amount of resistance in the circuit inexorably gnaws away at the energy stored in this tuned circuit.

And just what have we achieved? Basically we have generated an *alternating current*, using a coil and an initially charged capacitor. Admittedly the alternating current is slowly running down, like a pendulum clock that needs winding up, but it's certainly there.

Could we find a way to continually "wind it up" by injecting small charges of electricity to make up for the losses incurred by the circuit resistance? If so, our alternating voltage and current would repeatedly return to the same maximum values every cycle, time after time.

Readers overcome by enthusiasm will immediately see the above description of the generation of an alternating current in a coil/charged capacitor circuit as a parallel to last month's description of the generation of alternating current in a power station alternator. Indeed they are both the same kind of alternating current, and both have a sine waveform. But this month, because we have no moving parts to limit speed, our frequency may be thousands, millions or billions of Hertz.

Now let's pose some questions, as yet unanswered:

(1) Why do we keep calling this coil-

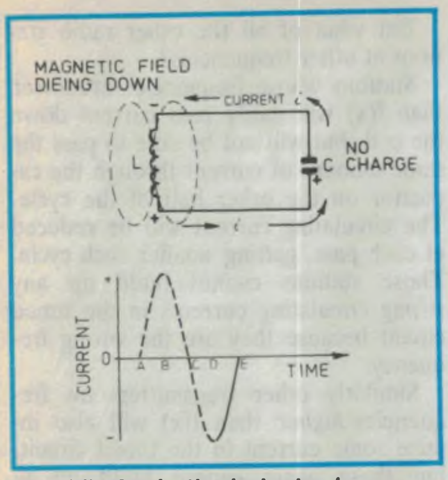


Fig.6(d): Again the inductor keeps the discharge current flowing, recharging the capacitor with the original polarity.

and-capacitor combination a *tuned circuit*?

(2) At what rate do all these goings-on go on?

(3) How long does it all *keep* going on?

As any good politician would, we answer the last question first. The process repeats many times over, but decreasing in voltage and current amplitude all the time because of the resistance (unfortunately) present in the circuit.

In answer to question (2), the time taken for each of these complete cycles of events, "from one deja vu to the next", is constant for any one pair of coil-and-capacitor. This time does not "stretch out" as the system runs down.

We call the time for each complete cycle of current (or voltage) values one *period*, defined as the time taken from one positive peak to the next.

More exactly, one period is the time taken, measured from any convenient point on the current waveform diagrams (Fig.6) to the next occurrence of that same current value, where the graph is going the same direction. The period may be measured in seconds or less, for example:

1.0 millisecond $= 10^{-3}$ second
1.0 microsecond $= 10^{-6}$ second
1.0 nanosecond $= 10^{-9}$ second
1.0 picosecond $= 10^{-12}$ second

Frequency in Hertz

We could also answer question (2) by saying that the rate or *frequency* of these happenings is simply the number of times the whole process repeats in one second.

The unit of frequency was once upon a time simply called "cycles per second" but nowadays the unit is called the

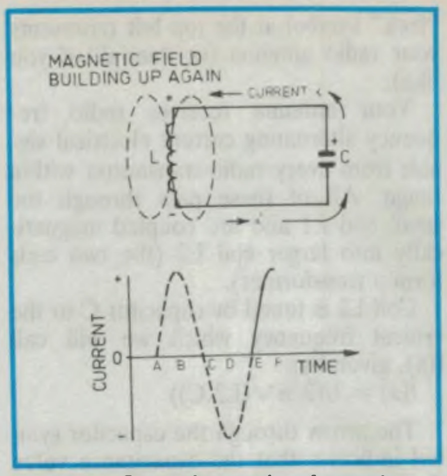


Fig.6(e): Then the cycle of events tends to repeat all over again, with energy oscillating between the capacitor and inductor.

Hertz (abbreviation Hz), to honour Heinrich Rudolph Hertz (Germany, 1857-1894) – the first man to experiment with electromagnetic radiation. If one complete cycle of current values, say from point B in Fig.6 (where the current is at maximum positive value) to the next occurrence of maximum positive current value, occurs *n* times per second then the frequency of that tuned circuit is *n* Hz.

In radio and TV we often measure frequencies in kilohertz, megahertz, gigahertz, etc. These multiples were defined in the first of these articles, you may remember.

Now let's see if we can find the answer to question (1): Why is a coil-and-capacitor combination called a *tuned circuit*?

The answer to this will emerge if we consider what determines the frequency of the alternating current that we've been generating. It turns out that this is set by the coil and capacitor values themselves. But how?

In the following we make a simplifying assumption. This is that the resistance in our circuit is so small (compared to the inductance and capacitance) that we can forget about the degrading effects of resistance.

If we make this assumption, this means that the total energy in the circuit will truly be always a constant.

Finding the frequency

It has been found by experiment that if a sine waveform alternating current of frequency f is passed through an inductor of inductance L Henries, as in Fig.7, then an alternating voltage drop occurs across the inductor. The value of this alternating voltage drop is found to be:

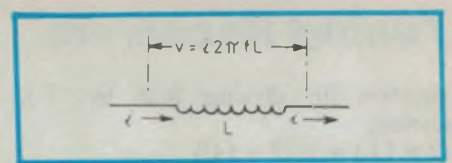


Fig.7: The voltage drop across an inductor is proportional to frequency and inductance.

Voltage across inductor = $(i.2.\pi.f.L)$

Where i = the current flowing
π = 3.1416 (ie the number of radians in a circle)
f = the frequency in Hz, and
L = the inductance in Henries

Furthermore it is also found by experiment that if an alternating current is passing thru a capacitor, an AC voltage drop occurs across the capacitor as in

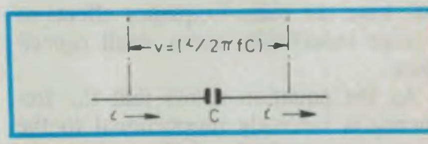


Fig.8: Conversely, a capacitor's voltage drop is inversely proportional to frequency and capacitance.

Fig.8, and the value of this voltage drop is given by:

Voltage across capacitor = $(i/(2.\pi.f.C))$

where i = the current flowing
π = 3.1416
f = the frequency in Hertz,
the capacitance in
and C = Farads

But as Fig.9 insists, in our tuned circuit the same alternating voltage exists

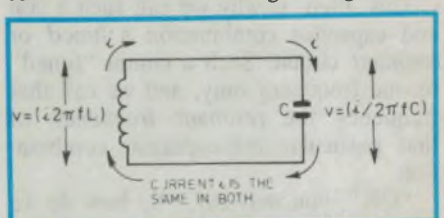


Fig.9: When a capacitor and inductor are connected together, their currents and voltage drops must be the same. This fact allows us to find an equation for their natural oscillation frequency.

across both coil and capacitor because they are both in parallel. So:

Voltage across inductor = Voltage across capacitor.

i.e.,

$(i.2.\pi.f.L) = (i/(2.\pi.f.C))$

And as Fig.9 also shows, the current i is the same in both coil and capacitor, since they're also in series. Therefore we can cancel "i" from both sides of the equation (by dividing both by "i"), leaving:

$(2.\pi.f.L) = 1/.(2.\pi.f.C)$

By cross multiplying this we get:

$$f = 1/(4.\pi^2.f.L.C)$$

then cross multiplying again:

$$f^2 = 1(4.\pi^2.L.C)$$

Finally, taking the square root of both sides: $f = 1/(2.\pi\sqrt{(L.C)})$

So we see that it is the value of inductance L of the coil, and the value of capacitance C which together decide the frequency.

More exactly the frequency is a function of the *LC product*. A small inductance and large capacitance can therefore have the same frequency effects as a large inductance and a small capacitance.

As the equation shows that the frequency is inversely proportional to the square root of the LC product, so broadly speaking small component values work at high frequencies, and large components operate at low frequencies.

But for any one value of inductance and capacitance there can be only one frequency at which the actions described above can take place. The energy-swapping and constant total energy features of the circuit will only hold for that one critical frequency, f as given above.

A tuned circuit

This, then, is why we call such a coil and capacitor combination a *tuned* or *resonant* circuit. Such a circuit "tuned" to one frequency only, and we call that frequency the *resonant frequency* of that particular coil-capacitor combination.

"OK", you may say, "So how do we use that magic little circuit to tune our radio receiver so that it receives just the one radio transmitter? We know there are thousands of stations out there!"

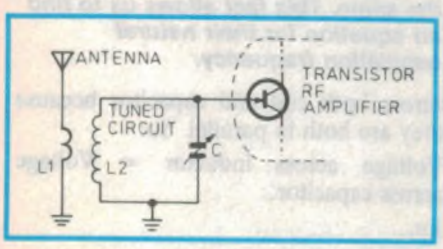


Fig.10: In a radio set the L-C tuned circuit selects just one RF signal, rejecting all others.

Fig.10 shows in abbreviated form the first part of a radio receiver. The little "fork" symbol at the top left represents your radio antenna (or "aerial" if you like).

Your antenna receives radio frequency alternating current electrical signals from every radio transmitter within range. All of these pass through the small coil L1 and are coupled magnetically into larger coil L2 (the two coils form a transformer).

Coil L2 is tuned by capacitor C to the critical frequency which we will call f(x), given by:

$f(x) = 1/(2.\pi\sqrt{(L2.C)})$

The arrow through the capacitor symbol indicates that the capacitance value C can be varied, perhaps by rotation of one set of blades, as in the capacitor of Fig.2. But for the moment we will consider the capacitor fixed at the one value C.

To the right of the tuned circuit in Fig.10 is a connection to the first amplifying transistor of the radio receiver. At the moment we are only interested in the tuned circuit part of the business, L2 and C.

Down the antenna line comes a great mixture of received radio frequency (RF) currents, at different frequencies and at various levels of power. All are coupled into L2 and C, and will "attempt" to produce the energy-swapping routine we've looked at above – involving the exchange of energy between magnetic field and capacitor charge. But we now know that this energy-swapping can only be done at the one critical frequency f(x), the resonant frequency set by the value of L and C.

Should one of the received radio transmitters happen to be transmitting at frequency f(x), then we are in luck.

Yes, the radio station signals at that frequency will supply the power which the tuned circuit loses by its circuit resistance. The current induced by that radio station in the antenna and coupled into the tuned circuit, will be rising and falling in its sinewave pattern at exactly the correct rate to excite the circulating RF currents in the tuned circuit. Backwards and forwards in the tuned circuit those currents will go, energy first in the inductance, then in the capacitance. And this will repeat as long as the circuit is excited by that radio station at the resonant frequency f(x).

Such nice large circulating RF currents have a comparatively large voltage drop across the circuit – RF voltage which is passed on to the receiver amplifier stages, to be further amplified (and processed) until large enough to operate your loudspeaker.

But what of all the other radio stations at other frequencies?

Stations whose frequencies are *lower* than f(x) will easily pass current down the coil, but will not be able to pass the same amount of current through the capacitor on the other half of the cycle. The circulating current will be reduced at each pass, getting smaller each cycle. Those stations cannot build up any strong circulating currents in the tuned circuit because they are the wrong frequency.

Similarly other transmitters on frequencies *higher* than f(x) will also induce some current in the tuned circuit, but these again cannot build up to strong circulating currents, for while they easily pass current down the capacitor branch, they cannot pass enough current through the coil. They cannot effectively swap energy between coil and capacitor, therefore the tuned circuit does not respond well to them either.

In other words, our tuned circuit of resonant frequency f(x) responds well only to the one station which is transmitting on the same frequency f(x). All other stations are received at much reduced response, as depicted in Fig.11.

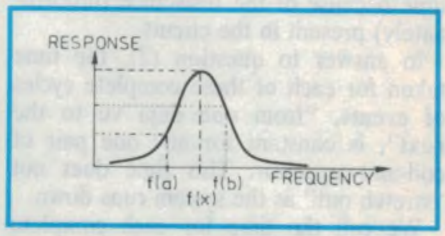


Fig.11: Response of a tuned circuit to three different frequencies, including its resonant frequency f(x).

Our radio thus plays music and other program material from that one station, rejecting all others.

Changing stations

Should we want to listen to a different station, we could mechanically change the setting of our variable tuning capacitor C to a different capacitance value. Then our tuned circuit would have a different resonant frequency, so it would respond preferentially to some other transmitter.

Alternatively by varying the position of a ferrite iron core inside our coil L2, it can be made to have different values of inductance, again changing the tuned circuit resonant frequency.

There are also other methods used for tuning, so our story of radio transmission and reception will continue next time. 'Til then, bye.

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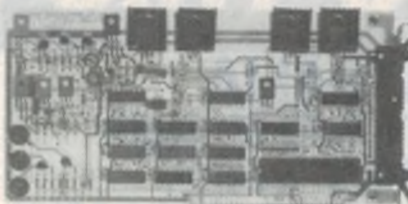

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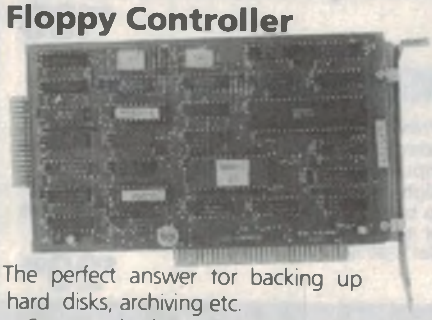

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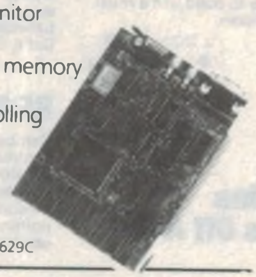

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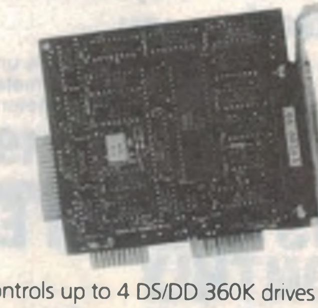

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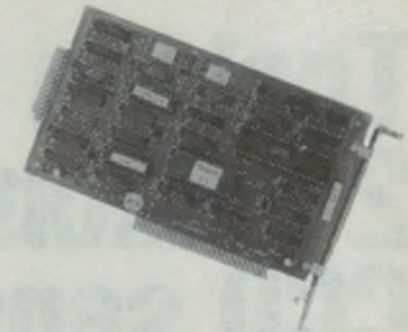

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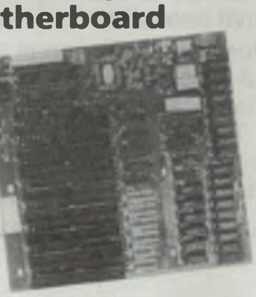

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Toshiba develops 2 million-pixel CCD sensor for HDTV

Video cameras for the next generation of high-definition television (HDTV) will need CCD image sensors with much higher resolution than the current devices offering up to 400,000 pixels. Researchers at Toshiba in Japan have recently announced the development of a device with a resolution of 2 million pixels, achieved by overlaying the light sensing and CCD scanning elements.

Nowadays CCD (charge-coupled device) image sensors are widely used in video cameras and camcorders. They have replaced conventional image pickup tubes such as the vidicon, because they are much smaller, lighter in weight, consume considerably less power and are also more rugged.

The CCD image sensors used in most current video cameras have a resolution of between 300,000 and 400,000 pixels (picture elements). Those with 400,000 pixels have excellent resolution by modern standards, being quite suitable for use with the enhanced Super-VHS video system – the highest quality home video system currently available.

However the next generation planned for television and video technology is high definition television (HDTV), planned to start in Japan in 1990. This will call for CCD image sensors with much higher resolution again – around 2 million pixels, or five times the resolution of the best current devices.

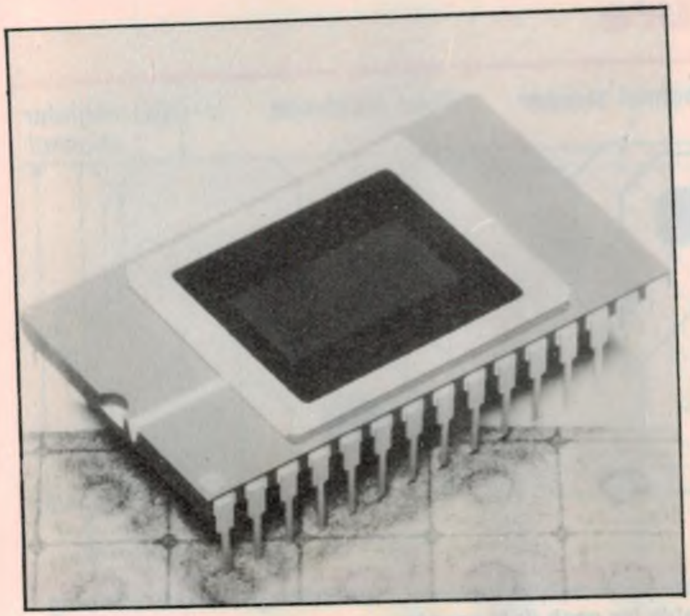
Until recently the prospect of achieving this kind of resolution from CCD sensors seemed rather remote. Prototype HDTV cameras developed in Japan by companies such as Toshiba therefore used thermionic pickup tubes, as the only known way to achieve the desired resolution.

However at the recent International Solid-State Circuit Conference (ISSCC) in San Francisco, researchers working for Toshiba in Japan announced that they had succeeded in developing a 2-million pixel CVCD sensor.

Progress in LCD, plasma displays...

Left: The new Toshiba LZ-400D portable colour TV with 4" diagonal LCD screen, just released on the market in Japan.

Right: Panasonic's new Minivision colour portable, with 3" diagonal LCD screen and 276 x 372 pixel resolution.



Left: The new 2 million pixel CCD image sensor in its package, sitting on an enlarged picture of the chip surface.

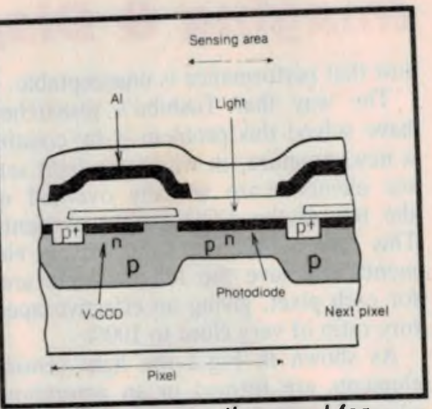


Fig.1: The construction used for current CCD image sensors.

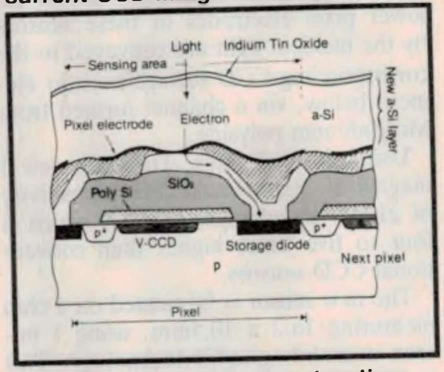


Fig.2: Toshiba's new construction, with pixel sensors overlaid above the actual CCD structure.

The problem in producing CCD image sensors with such a large number of picture elements is the maintenance of characteristics like sensitivity and dynamic range – the range of luminous intensity that can create images with acceptable contrast. As the image is divided into a larger number of pixels, there is inevitably a reduction in the light sensing area available for each pixel.

Each picture detection element in a CCD image sensor actually consists of two parts: the diode used to convert incident light into electrical charge, and the storage/transfer element which forms part of the CCD matrix used to shift out the charge packets from the sensor array, to form the output video signal.

With conventional CCD image sensors, these two parts are essentially fabricated side by side in the same silicon layer – see Fig.1. This means that the two together must share the available pixel area. And as the charge storage/-transfer elements of the CCD matrix must have a certain size, in order to achieve acceptable performance, this means that as the available pixel area is reduced, the proportion of this area available for the actual light sensing element gets smaller and smaller. This proportion is called the *aperture ratio*.

For a device with a resolution of 2 million pixels the aperture ratio which can be achieved with this conventional method of fabricating CCD sensors is so

---

The last year has seen significant progress in the area of flat-panel display technologies. At the recent conference of the Society of Information Display (SID) in Anaheim, California, some 11 papers dealt with developments in full-colour LCD displays, while a further 5 papers dealt with similar developments in plasma displays. It became clear that both technologies are now entering the era of full colour display capability, with ever-increasing resolution.

Most colour LCD panels to date use active-matrix technology, where the transistors used to control each display pixel are fabricated using thin-film technology right on the display itself. A number of Japanese firms are working on multicolour STN (supertwisted nematic) displays, while another is developing a colour ferroelectric display.

Sharp Corporation demonstrated a prototype of a 384 x 200 pixel colour LCD display which uses a double layered STN process, while Asahi Glass showed a 9" diagonal colour display which combines a basic double-layered STN panel with transparent electrodes on micro colour filters. Sharp also described an active-matrix 5" colour LCD panel with a resolution of 309,000 pixels.

Engineers from Toshiba described a 12" diagonal display they have developed, which achieves a resolution of 400 lines and can be driven at video rates. It uses a black matrix technique with RGB colour filters, for enhanced contrast.

Mitsubishi Electric is apparently working on a 10" diagonal colour LCD display offering 640 x 450 pixel resolution.

General Electric researchers demonstrated a 6.25" square full-colour LCD display using TFTs (thin film transistors) in an active matrix, and achieving a resolution of 1 million pixels (1024 x 1025). GE engineers also described a pilot fabrication line to produce both the latter display and a smaller 4" unit offering 400 x 400 pixel resolution. The TFT fabrication involves only four masking steps.

A further GE development described is the use of triple phosphor fluorescent lamps to provide improved backlighting for full-colour LCD displays.

In the area of gas-plasma displays, workers from the Science and Technical Laboratories of NHK in Japan reported the development of a 20" diagonal colour display with a resolution of 640 x 448 pixels. Other progress in developing this technology was reported by Hiroshima University, Bell Communications in New Jersey and Thomson-CSF in France.

Colour LCD technology in particular really looks set to burgeon in 1988-89. Perhaps the end of the line may finally be in sight for our old faithful cathode-ray tube, with its need for very high voltages, high power consumption and considerable bulk.

low that performance is unacceptable.

The way that Toshiba's researchers have solved this problem is by creating a new structure, in which the light sensor elements are actually overlaid on the top of the CCD matrix elements. This means that the light sensing elements can have the full available area for each pixel, giving an effective aperture ratio of very close to 100%.

As shown in Fig.2 the light sensing elements are formed in an amorphous silicon layer, formed above the basic CCD array. The charges formed on the lower pixel electrodes of these sensors by the incident light are conveyed to the corresponding CCD storage/transfer element below, via a channel formed from Molybdenum polyside.

Using this technique, Toshiba's new 2 megapixel sensor achieves a sensitivity of 210nA (nanoamps) per lux, which is four to five times higher than conventional CCD sensors.

The new sensor is fabricated on a chip measuring 16.2 x 10.5mm, using 1 micron microlithographic technology. This is finer than the design rules used for current 1 megabit dynamic RAM chips.

Fig.3 shows the basic pixel layout of the new sensor, in plan view. As may be seen the pixel sensor electrode occupies virtually the full area (cross-hatched squares), with the charge produced fed into the rather smaller storage diodes (dark octagons). From there they are transferred into the CCD register channels (shaded zig-zags), for shifting out of the chip.

The overall schematic arrangement used in the new sensor is shown in Fig.4, while the pictures show the dramatically improved resolution which is achieved by comparison with a conventional CCD sensor of 300,000 pixels. (J.R.)

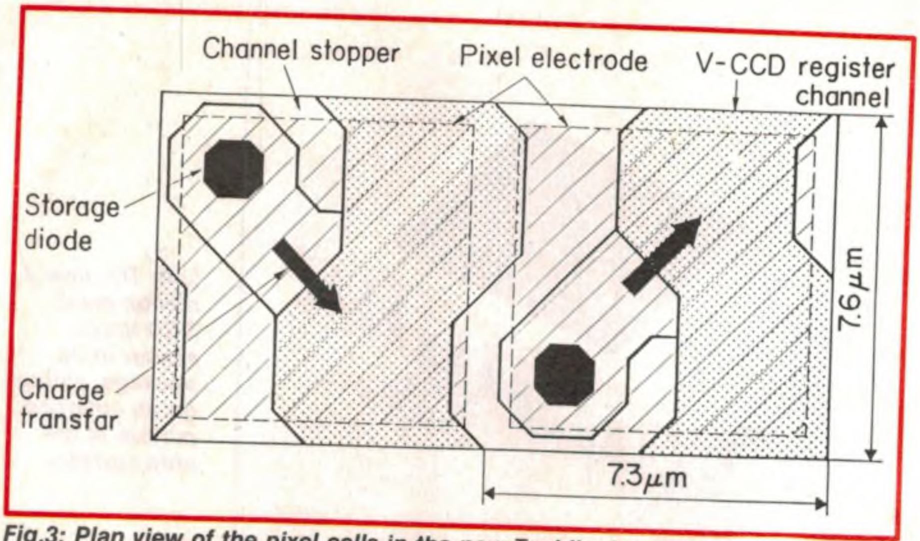


Fig.3: Plan view of the pixel cells in the new Toshiba image sensor, showing the large area available for each light sensor.

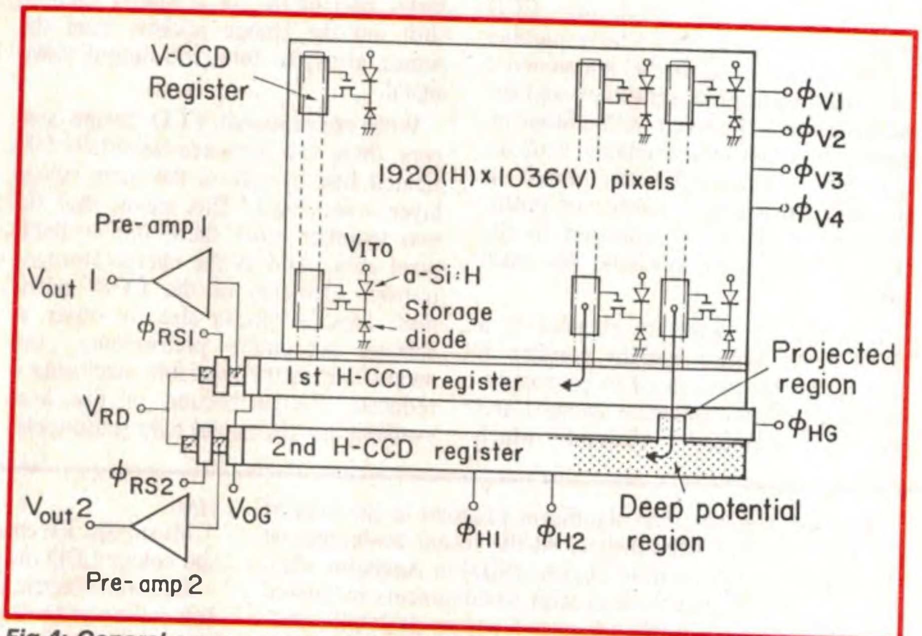
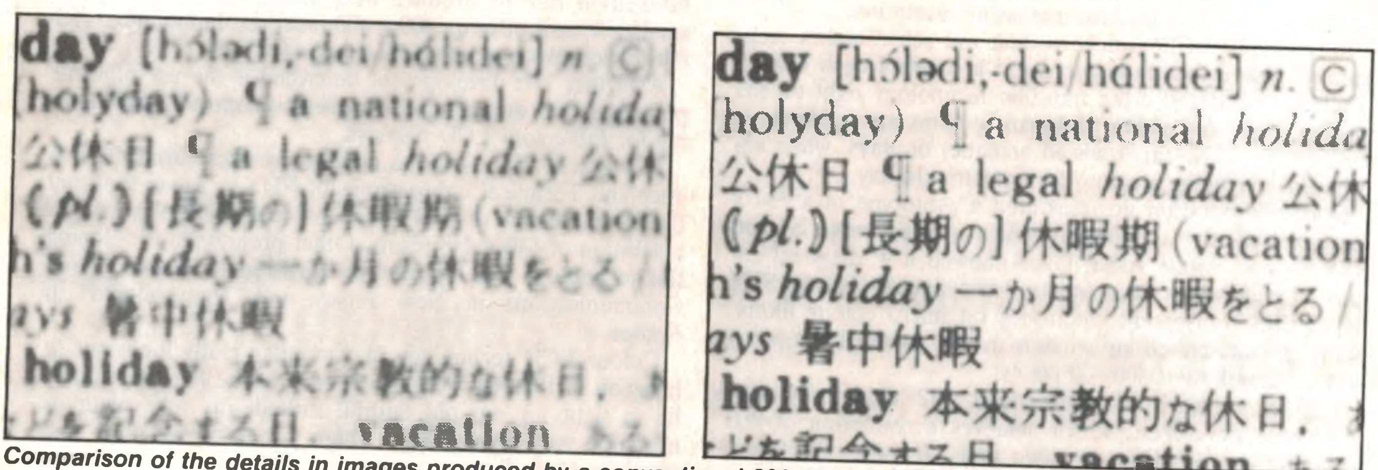


Fig.4: General arrangement of the 2 million pixel sensor. Two horizontal CCD registers give an effective readout at 74.25MHz.



Comparison of the details in images produced by a conventional 300,000-pixel CCD image sensor (left) and the new Toshiba 2 million pixel sensor (right).

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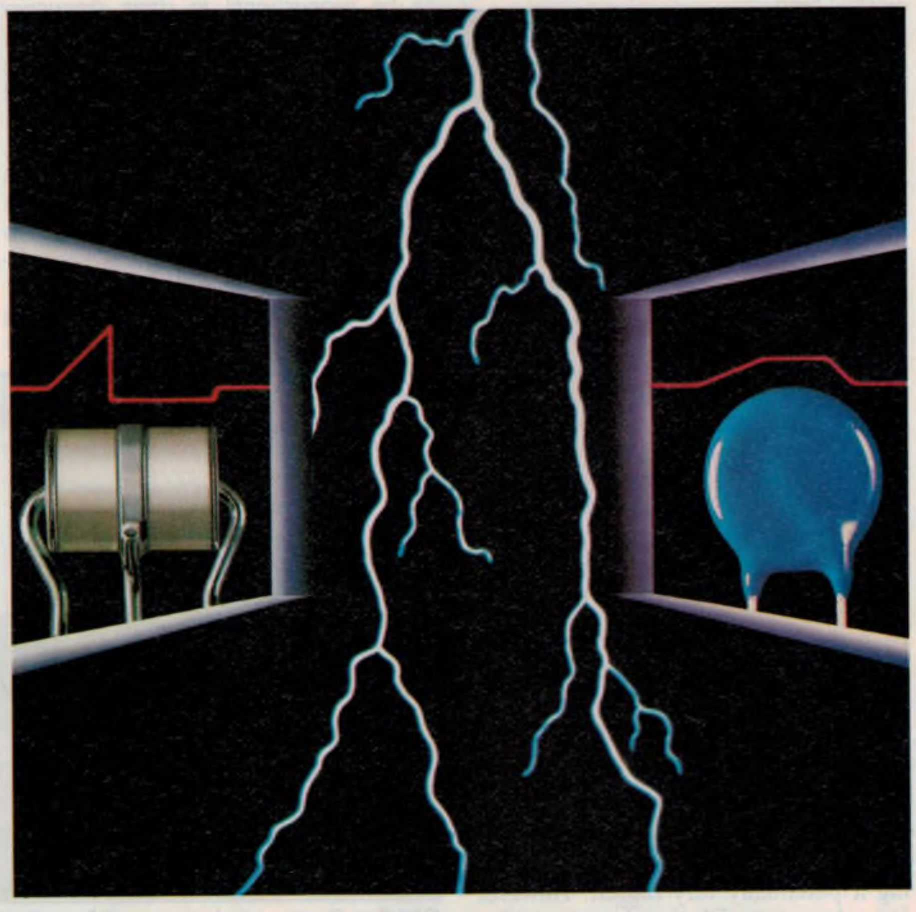

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CSA 3295 SL

Australian firm develops new EL technology

Electroluminescent display technology finally looks set to surge ahead this year, and Melbourne firm E'Lite has made an important contribution to the art with its development of a new ultra-thin and flexible EL display material with the potential to achieve a dramatic reduction in cost.

by JIM ROWE

Electroluminescence or "EL" for short has been around for quite a while – since it was first discovered by French physicist Destriau in 1936, in fact. Often called "cold light", it takes advantage of the fact that some materials emit light when subjected to a sufficiently strong electric field.

An EL display element is therefore essentially a capacitor, with two conducting plates separated by a dielectric. Also coated on the dielectric and between the two plates is the electroluminescent phosphor material, so that when a voltage is applied between the plates, the resulting electric field causes the phosphor to glow. Normally one of the plates is made transparent, to allow the glow to be seen.

EL produces a "soft" and relatively low intensity light, best suited for low ambient lighting conditions. Most EL panels have used zinc sulphide as the basic phosphor material, doped with materials called *activators* which enhance its light-emitting properties. Earlier monochrome EL displays used manganese as the activator, producing an amber light, while more recently rare-earth fluorides have been used to produce displays of various other colours. The doping levels used for these activators are around 1%, very much higher than those used in semiconductor devices.

Unlike other kinds of display technology, EL doesn't need a vacuum or even a gas or liquid at low pressure. It's virtually a solid state technology, making it potentially very rugged. However for a long time EL panels were manufactured on solid metal backing plates and with solid glass dielectrics. This made them fairly expensive and difficult to manufacture.

EL displays also tend to require AC voltage drive for best results, unlike the DC drive needed for most other kinds of display. And display intensity tends to be proportional to drive *frequency* rather than voltage, making it necessary to vary frequency if brightness is to be modulated. This tends to complicate the drive circuitry.

As a result of these complications, EL displays have until quite recently been used mainly for use in military aircraft and in other applications where cost is of secondary concern to things like reliability in harsh environments.

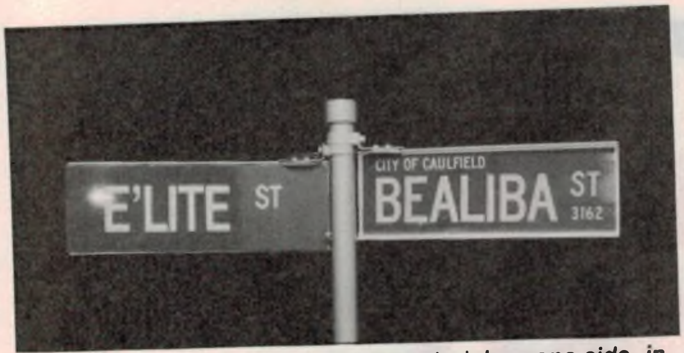
However EL displays have quite a few other advantages, apart from ruggedness. These include very wide viewing angle and contrast ratio, plus low power consumption. As a result, researchers around the world have been putting a great deal of effort into developing ways of making EL both cheaper to manufacture and more flexible in its applications.

All this effort now seems to be beginning to pay off, with the costs of monochrome EL displays falling at the rate of about 20% per year.

At the recent Society for Information Display (SID) show in Anaheim California, US researchers gave what was claimed to be the first demonstration of a prototype full-colour EL flat panel display, with a resolution of 320 x 240 pixels and an active display area of 122 x 92mm. It also produces a luminance level of 5 foot-lamberts, with a contrast ratio of 6:1 in a typical environment with 500 lux illumination, and 160° viewing angle.

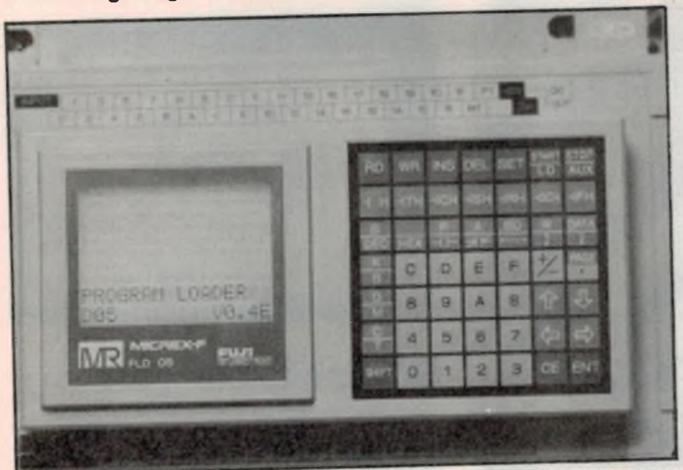
The panel concerned is manufactured using techniques similar to those used for other solid state devices. A reactive-ion etching technique is used to lay

Charles Rener, chairman and founder of ELI, with a sample of his new ultra-thin and flexible electroluminescent material.



A double street sign using E'Lite material on one side, in normal lighting.

The same sign without external lighting, showing the E'Lite self illumination.



View of an instrument with a CRT screen and touch-pad keyboard, in normal lighting.

The instrument at left in the dark, showing the keypad's E'Lite illumination.

down the patterns of red, green and blue thin film EL phosphor dots, and their electrode system. The red and green phosphors use zinc sulphide doped with different rare earth fluorides, while that for blue uses strontium sulphide doped with cerium fluoride. The individual colour dots for each pixel measure 76 x 280 microns.

Along with colour LCD technology, then, EL displays seem finally set to blossom.

Local breakthrough

Only about 10 companies around the world are actively working on the commercial development of EL display technology, but a small Melbourne-based Australian company looks set to play an important role in this new phase of EL display technology, having just announced a breakthrough in the areas of manufacturing, application and cost reduction.

E'Lite Luminescent International (ELI) has come up with a way to produce ultra-thin and flexible EL panels, in low-cost plastic encapsulation. This has the potential to open the door for the use of EL displays in a much broader range of applications than ever before, not just because of the likely cost reduction, but also by virtue of the freedom to make them in flexible form. This allows them to be applied to a wide variety of surfaces.

The driving force behind this exciting new development is ELI chairman Charles Rener, a self-trained electronics engineer with long experience who has spent over 3-1/2 years working on EL technology. His new E'Lite material is still in the early phase of its development, but is already attracting a lot of interest. It has been featured on the national ABC-TV program *Quantum*, and has also been acclaimed by the Australian Inventors' Association – as well as being the subject of many commercial enquiries.

Mr Rener's company has so far spent over $200,000 in proving the basic technology, and is now engaged in developing new automatic manufacturing machinery. This will be housed in a factory which is currently under construction. It is expected that the combination of ELI's new technology and the matching automatic machinery could reduce the cost of EL display panels by a factor of 10:1, within 12 months – hence the excitement.

As development of full scale high-resolution computer graphics display panels would involve both major capital investment and solution of many different manufacturing problems, ELI has chosen instead to develop its technology initially via simpler broad-area panels. Presumably these will be used both as a vehicle to refine the new manufacturing processes, and to generate a healthy cash-flow to fund development of more complex products.

So far ELI has demonstrated a number of applications for its new flexible panels, including building security signs, self-illuminated street signs (using a silicon solar cell and NiCad battery for energy collection/storage), and illuminated keypads on electronic instruments.

Tests carried out on early sample panels suggest that the working life of the new panels is greater than 10,000 hours before light output falls to 50%.

In short, things look good for this new approach to EL display technology, hopefully destined to be another success story for Australian innovation in high technology.

Further information on the new E'-Lite material and its applications is available from ELI at 564 Glenhuntly Road, Elsternwick 3185 or phone (03) 523 5535. EA

Imaging & Display Feature:

New I & D Products

New LCD in portable PC

Epson's latest PC Portable features the latest STN (supertwisted nematic) LCD display, which is said to provide very high contrast and wide viewing angle. In addition the display features EL (electroluminescent) backlighting, for clear display in poor ambient light conditions.

To conserve battery power, the EL backlighting automatically switches off if no keystrokes have been registered after a certain period. The time-out circuitry is also arranged to turn off the internal hard disk drive, in the version of the machine which features a 20Mb drive.

The LCD display provides a resolution of 640 x 200 pixels, sufficient for 25 lines of 80 characters in text mode.

Other features of the PC Portable include a V30 processor; 640Kb of main memory; 4.77MHz and 10MHz "no wait state" operation; ergonomic "AT" type keyboard; inbuilt parallel and serial ports; and a NiCad battery giving 5-7 hours of operation with a dual 720k floppy system or 3-4 hours with a hard disk/720K floppy system. An external CGA-compatible colour monitor can be connected to the rear RGB connector.

Further details are available from Epson sales offices, or by phoning (02) 436 0333.

LCD modules

Seiko Instruments has available a wide range of liquid crystal display modules, suitable for both alphanumeric and graphics display applications.

Alphanumeric displays are available in formats ranging from 1 line of 16 characters to 4 lines of 40 characters, with viewing areas up to 147 x 29.5mm. Graphics displays are available with resolutions of 100 x 64 pixels to 640 x 400 pixels and with viewing areas up to 236 x 153.6mm.

Features of the modules include light weight, slim construction and low power consumption. Standard modules have twisted nematic LCD panels and are designed for positive reflective viewing at "6-o'clock". Options include transreflective viewing with EL backlighting, and a "12-o'clock" viewing angle.

Seiko also makes available a range of multiple 7-segment LCD displays for use in clocks, timers and other instruments.

Further information is available from Soanar, 30 Lexton Road, Box Hill 3128 or phone (03) 895 0222.

Hand-held scanner

The Diamond Handy Scanner HS-2000 desktop publishing scanner scans photographs, logos, signatures and books. The scanned image can then be merged with text and graphics to compose a well-presented document.

Scanning width is 105mm and resolution is 8 dots/mm (200dpi) in both direc-

tions, or 840 dots per line. There are two encoding methods, black and white and half-tone encoding. It has push button scan control and a viewing window on the scanner to ease scanning adjustment. An easy to use software utility is provided for scanning the image and cutting the desired portion of the scanned image. With a mouse an image editor allows the user to edit the scanned image bit by bit. The software can save the scanned image in various standard graphics file formats for other applications or further editing.

The HS-2000 is designed for the PC/XT/AT and compatibles and can be used on Hercules, CGA and EGA cards. The minimum system required is 384 KB, DOS 2.0 or higher, double sided disk drive and one DMA channel.

The scanner is available for $899 as part of a package which includes a free Halo DPE desktop publishing editor.

Further information is available from Kookaburra Computers, 8 Curlewis Street, Bondi 2026 or phone (02) 365 0706.

Colour video copy processor

The Mitsubishi CP100U Colour Video Copy Processor is a Sublimation-type thermal transfer process in which the three colour (yellow, magenta, and cyan) coatings are vapourized and transferred to the print paper. Fine colour modulation is performed with 64 gradations for each colour (640x641) dots, approximately 260,000 colours per dot ensuring faithful reproduction of the subtlest intermediate colours. The system shows its power best in applications demanding precise, high-quality colour expression such as colour graphics and CAD/CAM.

Image signals for displays such as CRTs are stored in the frame memory, and printed directly from memory enabling printing of single frames of motion pictures. The job time required for printing with personal computer that used to occupy the system exclusively is no longer necessary. The ability to check the images on the monitor when deciding what to print means that the user can always select the best image for the print out.

PAL composite signals, Y/C separate signals such as S-VHS signals, RGB analog, and RGB-TTL signals can all be handled. Autoscanning enables automatic tracking of input sync signals and a dot clock of up 30MHz can be handled, so all types of video equipment can be used including colour doppler system and high-resolution personal computers.

Price of the CP100U is $4975 including tax.

Further information is available from Mitsubishi Electric Australia, 73-75 Epping Road, North Ryde 2113 or phone (02) 888 5777

New I & D products

"Super bright" LEDs

Stanley Electric has produced a range of discrete LED devices with exceptionally high light output, based on pioneering work done by Professor Junichi Nishizawa at Tohoku University in Japan. This is said to make them very suitable for information displays in indoor/outdoor and automotive applications, safety indicators and for optical data transmission.

The LEDs are available in four colours – red, green, yellow and amber – and typically produce between 150 and 300 millicandelas for a forward current of 20mA. Peak forward current ratings are 300mA for the red devices and 100mA for the other colours. The devices come in standard 5mm diameter moulded packages, with paraboloidal lenses.

Further information from Soanar, 30 Lexton Road, Box Hill 3128 or phone (03) 895 0222.

Optoelectronic devices

Crusader Electronics has available a wide range of optoelectronic devices including thick film hybrid IC's.

Silicon photodiodes in ceramic, black resin and hermetic packages in seven packages styles form part of the range, complimented by PIN photo diodes, phototransistors, silicon planar photo transistors, high speed photo couplers, photo interrupters, supercompact photo interruptors, CDS photo conductors and light-detecting element arrays.

For further information contact Crusader Electronic Components, 73-81 Princes Highway, St Peters 2044 or phone (02) 516 3855.

LCD displays with LED backlighting

Optrex Corporation of Japan has extended its range of LCD dot matrix character and graphic displays to incorporate a series of LCD character displays with built-in LED backlight.

The series is available in a choice of 16 character x 1 line, 16 character x 2 line and 40 characters x 2 lines. The LCD incorporates a single +5V supply (no external power supply for backlight required). ROM and RAM are built into the range of Optrex LCDs, although they remain very slim with a maximum thickness of 15 mm.

Amtex Electronics stocks an extensive range of Optrex LCD displays including the LED backlit units, a range of high contrast character displays with electroluminescence backlight available in a basic model or extended temperature range of −20°C to +70°C, and semi-custom displays with 12 o'clock viewing with or without EL backlight.

For large scale display, Amtex stocks the Optrex DME Series which feature high contrast and wide viewing angle. They incorporate the new super twisted type LCD with or without EL and a 640x200 dot display using a cold cathode backlight, one of the most visible (in both full sun and low light condition) LCD displays ever developed.

For further information contact Amtex Electronics, 13 Avon Road North Ryde 2133 or phone (02) 805 0844.

Larger 2 × 16 LCD

The Handoks HDM 16216H-4 is a 2 line × 16 Character LCD with a character height larger than normal, a very viewable 8.09mm. This makes it suitable for those applications where the normal 4 or 5mm character height is not sufficient. The option of electroluminescent backlighting adds further versatility to this new display. Driving the display is via an 8-bit parallel interface, and power supply is via a single +5V rail.

For further information contact M.B. & K.J. Davidson, of 17 Roberna St, Moorabbin or phone (03) 555 7277.

Vacuum fluorescent displays

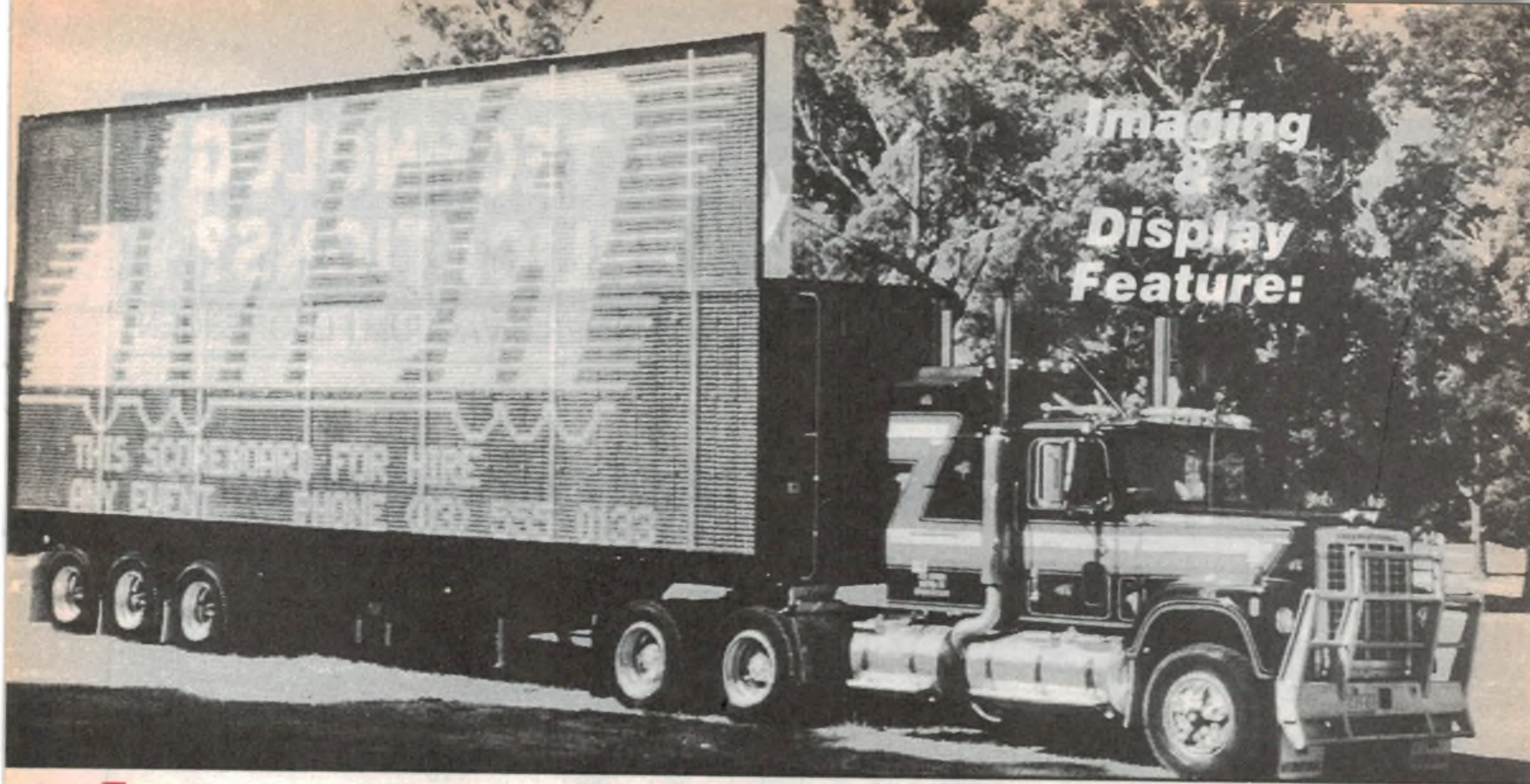
IEE has introduced a comprehensive line of low-cost, 5x7 dot matrix, intelligent vacuum fluorescent display modules.

Designated the "No-Frills" FLIP product line, these displays are ideal for high-volume OEM applications, such as pay telephones, test equipment, point-of-sale terminals and security systems. Eight models are available, in a variety of formats ranging from 1 line of 16 characters to 2 lines of 40 characters. The displays are very compact, with the smallest module measuring only 1.9″H x 4.3″W x 1.4″D. Character heights range from 0.18″ (4.7mm) to 0.27″ (6.8mm).

An on-board microprocessor controller handles all scan, refresh and data I/O tasks, permitting easy interface to an eight-bit ASCII parallel data bus. For RS-232 level serial operation, an optional "No-Frills" serial data converter module is available. Only a single +5V DC power supply is required for operation.

Furthermore, these low-cost modules display 96 upper and lower-case letters, numbers and symbols. Display characters are a bright, pleasant, blue-green colour, that provides for comfortable short or long-term viewing. A wide spectrum of colour filters is available to fit almost any application.

For additional information contact M.B. & K.J. Davidson, 17 Roberna St, Moorabbin 3189 or phone (03) 555 7277.



Largest mobile scoreboard uses magnetised discs

A Melbourne firm has used magnetised-disc display technology to build what it claims is the largest mobile scoreboard and computer-controlled graphics display screen in the world.

The company responsible for developing the very large display screen pictured is Mach Systems, of Moorabbin in Melbourne, and the semitrailer-mounted screen is hired out by its subsidiary Mobile Scoreboards Australia (MSA). As well as providing sporting bodies and venues with a mobile scoreboard, it can also be used for innovative advertising and promotional work.

The screen was given its first public demonstration at the recent Australian Masters golf championship. Designed and built by Mach Systems, it cost $600,000 to produce.

The screen itself measures 12.2 metres by 4.4 metres, and as may be seen it is built onto one side of a semitrailer. It consists of a matrix of 611 separate display modules, arranged in 13 rows of 47 columns. Each module has 35 individual pixel elements in a 7 x 5 format – giving a total of 21,385 pixels (235 x 91).

In addition to the main screen two further "subsidiary" screens are available, each measuring 4.7 x 1.9 metres and with a resolution of 3150 pixels.

At the heart of each pixel display element is a ferromagnetic metal disc 38mm in diameter, mounted in a small frame on a central axle parallel to the plane of the display. One side of each disc is black, while the other is coated with a fluorescent colour – in this case yellow, although other options available in the basic display system are white, orange, red and green.

Near the disc and at right angles to the axle are located the poles of a small electromagnet, through which current can be passed in either one direction or the other. This has the effect of causing the disc to "flip" one way or the other, displaying either its black side (for an "off" pixel) or its coloured side (for an "on" pixel).

The actual display modules are manufactured by Ferranti-Packard Electronics of Canada, and have been used in a wide range of fixed and mobile large-format displays. These include airport arrival/departure indicators, bus and train destination signs and roadside message boards.

Display visibility of the screens is very high, as the discs of the display elements reflect ambient light in a diffused fashion and have a high contrast ratio between the black and coloured sides. Good visibility is achieved within an angle of +/-45° from the normal, at distances of between 10 and 270 metres.

Because of the passive, reflective nature of the display elements, power consumption of the overall screen is surprisingly low. In fact power is only consumed when the displayed material is changed. Once the discs have "flipped" to their new positions, remanent magnetism gives them inherent storage with zero power consumption. As a result there is virtually no heating of either the screen modules or the driving electronics.

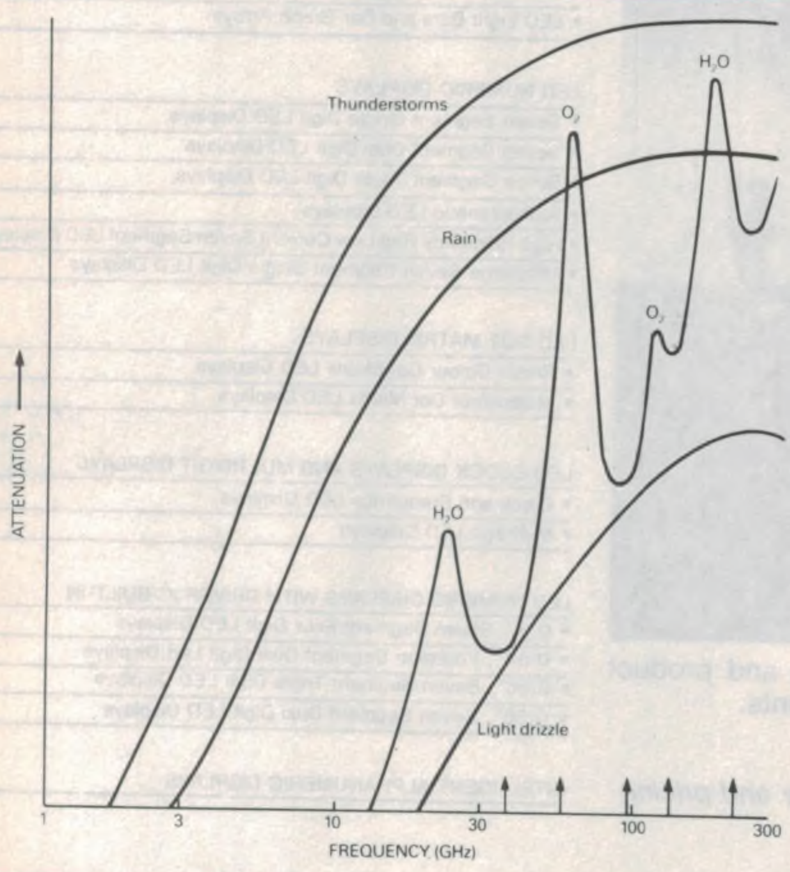
Reliability of the display modules is also very high, with a rated life of over 400 million operations.

Further information on the Ferranti-Packard display modules used in the mobile scoreboard/screen is available from Mach Systems, which is the Australian distributor. The firm's address is 70 Keys Road, Moorabbin, 3189 or phone (03) 555 0133.

UK research towards

Radio communications for the future

Overcrowding of the radio spectrum is severely restricting the reliability and information-carrying capacity of existing communications systems. But moving to even higher frequencies, where there is more room, brings a different set of problems to do with the atmosphere and weather. Research at the UK Science and Engineering Research Council's Rutherford Appleton Laboratory is compiling valuable data for the design of systems for the future, exploiting frequency bands that are so far little used but for which the necessary technology is already available.



Attenuation of microwave and millimetre-wave radio signals by the Earth's atmosphere at sea level. Molecular attenuation is present all the time, and is produced by water vapour H_2O at 22 and 183GHz and by oxygen (O_2) at 60 and 199GHz; there are many more of these 'absorption lines', mainly from water vapour, at even high frequencies. The arrows at the bottom indicate the Rutherford Appleton Laboratory's measurement frequencies.

by DR. CHRIS GIBBINS

Rutherford Appleton Laboratory, near Oxford.

A massive expansion in radio communications over recent years has generated an ever-increasing demand for more channels, and those channels are having to carry more and more information, be it voice, television or other kinds of data. The net result is that the radio spectrum, a restricted resource, is fast becoming overcrowded. This creates problems of interference between adjacent channels (as anyone who listens to short-wave radio, especially at night, will know well) with reduced reliability. There is an additional side-effect of such overcrowding: the bandwidth available to each channel, which determines the amount of information that can be transmitted, is severely limited. That in itself restricts both the capacity and the reliability of communications systems.

Millimetre waves

A remedy for these problems is to be found in exploiting higher and higher frequencies, made possible through the development and availability of new technologies. Communications now extend well into the microwave region of the electromagnetic spectrum (frequencies up to 30GHz) and even beyond into the millimetre-wavelength region (frequencies from 30 to 300GHz).

These regions of the spectrum are still relatively uncrowded, particularly at the higher frequencies, and the bandwidths available are so large that they open up the possibility of new communications channels with a capacity for carrying huge amounts of information.

But use of the microwave and millimetre wave regions of the spectrum for communications brings an additional set of problems not met with at lower frequencies. The Earth's atmosphere starts to interact with the radio waves, resulting in attenuation of the signals which must be taken into account in the

The transmitter cabin at Chilbolton. Hoods keep rain off the windows through which the signals are transmitted. The transmitters are mounted on benches supported independently from ground, inside the four concrete pillars. This prevents vibrations in the cabin affecting the equipment. The anemometer and vane mounted on top of the cabin measure wind velocity.

design of systems.

There are two distinct and quite different effects, which are shown in the first diagram. First, the molecules of oxygen and water vapour in the atmosphere absorb radio waves at certain characteristic frequencies. This is known as resonant absorption. They re-radiate them isotropically, that is, equally in all directions, a fraction of a second later; this means that the signal is attenuated through the loss of directivity and coherency.

The second effect is that raindrops, hail and snow scatter the signals, thereby attenuating it still more. This effect is non-resonant and increases with increasing frequency, as the wavelength decreases and becomes comparable with the sizes of raindrops; at that point the scattering process is most efficient and signal attenuation is greatest.

The first effect, molecular absorption, is present all the time, and changes only slowly with varying temperature, pressure and humidity. A great deal of research has been undertaken into this phenomenon and the effects of molecular absorption can now be predicted fairly accurately. So the designer of communications systems can take a reasonably accurate account of attenuation by oxygen and water vapour when assessing the overall performance of microwave and millimetre-wave links.

Fade margin

Signal attenuation by rain and other forms of precipitation, however, presents quite a different problem. Precipitation is a highly variable phenomenon, changing both in time, space (that is, geographic location) and intensity. This makes it much more difficult to take account of rain attenuation in designing systems.

The problem is generally treated statistically, instead of by the sort of exact calculation that can be used for molecular attenuation. The systems designer specifies a level of reliability for a particular communications link: for example, the link might be required to provide acceptable voice communication for 99.9% of the time, or acceptable television transmission for 95% of the time. That means the users can tolerate the service being unavailable, for 0.1% or 5% of the time, respectively.

The designer then needs to know what level of signal attenuation will be exceeded on the link for these small percentages of time. This is known as the "fade margin" which the link must be able to overcome when providing an acceptable signal-to-noise ratio, to achieve the specified level of reliability. This, in turn, has an impact on the transmitter power, receiver sensitivity and the size of the antennas, which in the end affects the overall cost of the system.

It is therefore of paramount importance that the systems designer should have available the most accurate information from which to derive the necessary fade margins, to achieve the most reliable and cost-effective design.

Fade margins are not easily calculable, and in general tend to be empirically derived from transmission measurements carried out over long periods. A great deal of work has already been done at frequencies up to about 40GHz, and there are extensive data banks from which the necessary statistical information and service predictions can be derived.

For example, the International Radio Consultative Committee (CCIR) at Geneva collates, distils and publishes information of this kind. At higher frequencies than 40GHz, however, there is a marked paucity of data.

Foundation for systems

To provide the necessary information on terrestrial radiowave propagation, the Rutherford Appleton Laboratory has set up an experimental transmission range at its Chilbolton Observatory near Andover in southern England. This facility, represented schematically in the second diagram, works on a number of links transmitting over a distance of 0.5km at frequencies of 37, 57, 97, 137 and 210GHz in the millimetre-wavelength region of the electromagnetic spectrum, and at wavelengths of 10.6um in the infrared and 0.63um in the visible light region.

Frequencies of 37, 97, 137 and 210GHz were chosen as representative of those parts of the spectrum where atmospheric attenuations due to oxygen and water vapour are low; such parts are known as atmospheric "windows" and hold out the opportunity for cost-effective, wide-bandwidth communications. The 37GHz channel can also provide the means for comparing the results from the 500m range with extensive measurements made at this and lower frequencies at other places and by other workers.

The 57GHz frequency, on the other hand, is near the 60GHz oxygen absorption band where very high attenuations of up to 15dB (decibels) per kilometre occur. This means 97% of the signal is attenuated at a distance of one kilometre from the transmitter, and only 3% remains to be received. Such regions of the spectrum could be used for secure communications, for example where transmission range should be restricted, or for multiple repeated use of a frequency in a dense urban environment, because the atmosphere produces extra isolation between links operating at the same frequency.

In addition to the transmission links, the Chilbolton Observatory compiles a comprehensive set of meteorological data, including measurements of temperature and humidity at a number of places and heights above the ground. There are three rapid-response rain gauges, which measure the rainfall rate at different points along the range at 10-second intervals, while a fourth rain gauge is equipped with heaters to assist the measurement of snow during the winter and hail in the summer.

A distrometer measures the distribution of the sizes of raindrops, important in the development of theoretical models to describe rain attenuation; a microwave refractometer measures the refractive index of the atmosphere, which affects the level of scintillation, the name given to small, very rapid fluctuations in the received signal power. The meteorological observations are completed with surface pressure and wind speed and direction.

Outputs from all the links and sensors are coupled via an interconnecting computer bus to the main data-collection computer, which records all the measurements on magnetic tape every 10 seconds. Additionally, when attenuation due to precipitation is detected on the range, the outputs from the transmission links are recorded separately at a rate of 100 measurements per second.

The data-collection computer also initiates automatic calibrations of the links every 6 hours. All magnetic tapes are subsequently calibrated and verified on a mainframe computer, and the data files put into an archive for analysis.

The 500m range then, is a well instrumented open-air laboratory designed to study in detail the interaction between radio waves and the prevailing weather conditions, by providing comprehensive propagation data for a distance over which meteorological conditions are essentially constant.

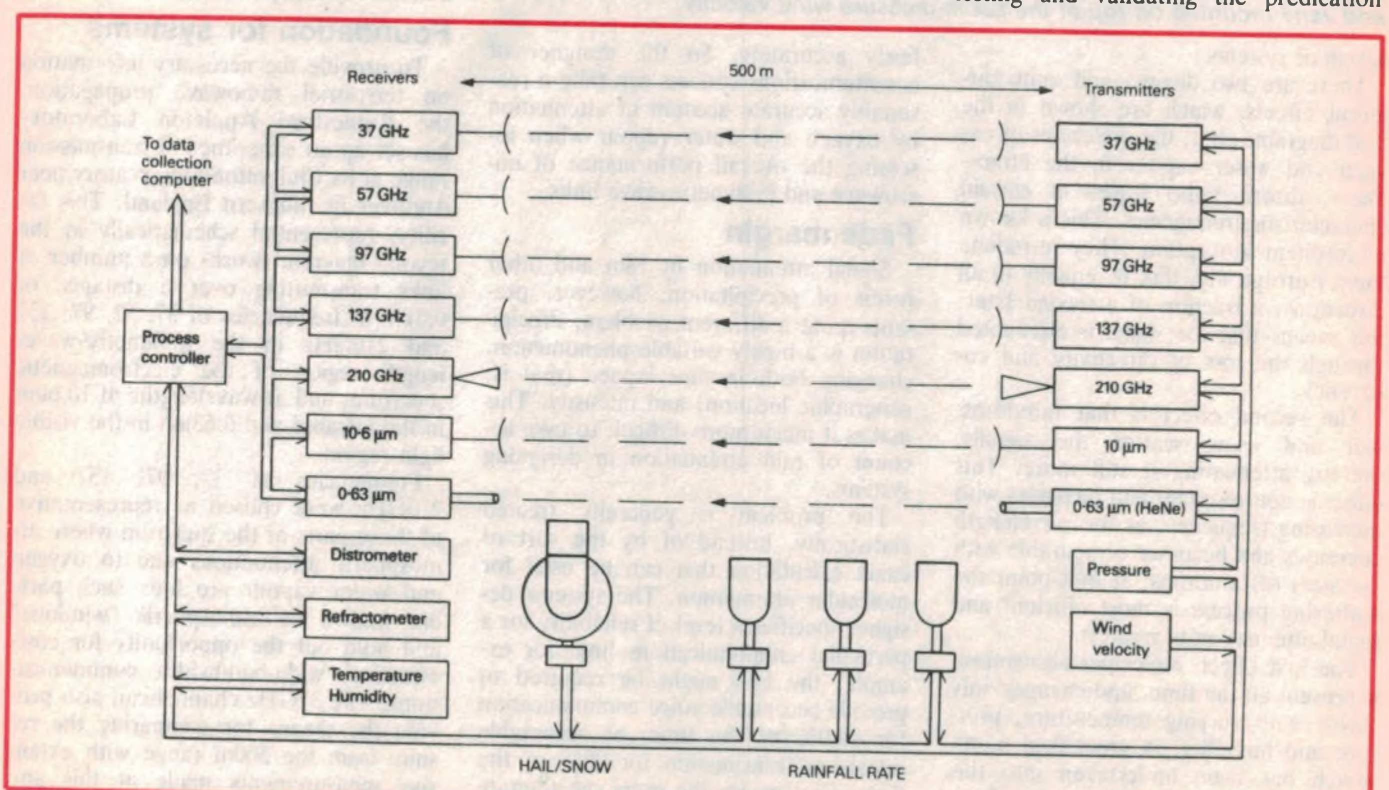
The range has been in operation for about three years and a substantial data base of propagation data has now been accumulated. It is being used for a variety of studies aimed at a more detailed understanding of the various phenomena which may affect the reliability of communications systems, and providing the statistical information required by systems designers.

Two main analyses

The data base is being extensively analysed in two different ways. Detailed studies are being made of individual events, such as particular rains storms, snow storms, fogs and so on, to learn more about the way radio waves propagate through such phenomena. From such studies it will be possible to develop more detailed and accurate theoretical descriptions than so far exist for the way various kinds of precipitation and so forth interact with radio waves.

These theoretical *models*, as they are generally known, can then be used to predict what may happen on proposed new communications links in areas where little, if any, propagation or meteorological data exist.

The second mode of analysis is aimed at providing the kind of statistical data necessary for the most cost-effective design of new communications systems, and to provide a statistical data base for testing and validating the predication



Schematic diagram of the 500m experimental transmission range at Chilbolton.

techniques being developed.

Analyses based on individual events are classified according to the type of event, for example rain, snow, hail, fog or scintillation.

Extensive studies on rain already indicate a general overall agreement both with similar studies conducted elsewhere and the theoretical models which so far exist, such as those recommended by the CCIR. Nevertheless, certain significant differences have been found, which may possibly be attributed to the differences in climate between southern England and the places where other studies have been made.

Understanding such climatological differences is very important in being able to develop production models if they are to be applied to any place on Earth. We feel that our work will help considerably in achieving this.

Attenuations produced by rain vary considerably, of course, because they depend on the features of the rain. Light drizzle may attenuate the signals by only a few per cent over the 500m range, whereas intense thunderstorms can attenuate by more than 30dB/km at 97GHz, for example; in other words, only 0.1% of the signal remains after a distance of one kilometre. Fortunately, such events are very confined.

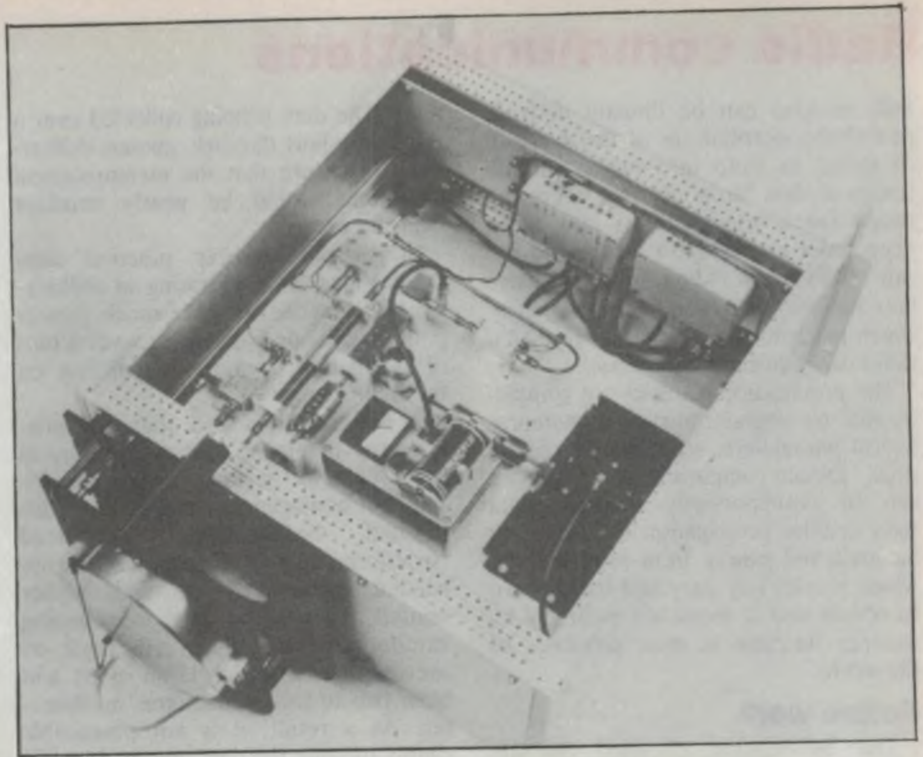
Snow and fog

Of great interest is the effect that snow storms have on millimetre communications. There is a shortage of such data and the few results available show wide variations. Snow is generally difficult to characterise quantitatively with regard to shape, size and wetness of the flakes. These characteristics vary widely, and when snow is carried by the wind it becomes difficult even to measure effective deposit rates.

However, we have developed a rapid-response snow gauge which is producing very encouraging results. The effects of wind are kept as low as possible by surrounding the gauge with a fence, which reduces wind speeds close to the gauge and so improves the efficiency of capture. Using this technique, we find good correlations between attenuation and snowfall deposit rates.

Results so far indicate that when snow is very dry the attenuations are low, compared with rain, for the same amount of liquid water deposited; but for wet snow, attenuations can be considerably higher. The attenuation clearly depends not only on the amount of liquid water falling, but also on the degree of wetness of the snow flakes.

Considerable effort is being devoted to trying to characterise this in terms of other meteorological parameters such as air temperature, so that empirical relationships can be developed to help the prediction of attenuation.



The 97GHz receiver with its 15cm diameter antenna and swan-neck waveguide feed. Its solid-state local oscillator is mounted on a heat sink on the right hand side. A battery-operated power supply biases the receiver's Schottky-barrier mixer to its most sensitive operating region.

Fogs, on the other hand, affect the millimetre links very little; the wavelengths are much greater than the size of the water droplets and the scattering process, which causes the attenuation, is not significant. In general, the attenuations found at millimetre wavelengths are only a few per cent at the 500m range.

At infrared and optical wavelengths, however, very severe attenuations, of more than 80dB/km often occur in the visible range in fog, representing a visibility of only about 200m; only one millionth of one per cent of the signal remains at a distance of one kilometre from the transmitter.

Gas flares

The Chilbolton 500m range can easily accommodate a variety of different measurements or experiments from other interested groups, especially as all the instrumentation and the data collection system are based on a universal interface standard.

As an example of this, an interesting and novel investigation was carried out into millimetre-wave propagation through flames, in collaboration with one of the oil companies operating in the North Sea. The problem was what effect gas flares on the drilling platforms might have on the communications systems.

A large flame was generated, about three metres wide, three metres high and half a metre deep and the signals were transmitted through it. Little effect was observed at the lowest frequencies, though large attenuations occurred in the visible range. There was, however, a general increase in the level of scintillation of the signals, which might possibly be of concern at the very high frequencies but of little significance at the frequencies at present in use for communications systems.

The other type of analysis of results is aimed at obtaining the kind of statistical information needed for direct application to communications systems design, for example finding out what fade margins should be allowed for given levels of operational reliability.

This is necessarily a long-term project, because it is important to find an average over extremes of the prevailing meteorology - something that can be done reliably only over a number of years.

Statistical data now being accumulated include such information as the percentages of time that various levels of attenuation are exceeded, from which

Radio communications

fade margins can be directly derived; probability distributions of the duration of fades, to yield information on the length of data "dropouts"; the times between fades, which tell us how often deep fades are likely to occur; and the rate of change of fading, which indicates how rapidly signals are likely to change, which is particularly important in digital radio communications systems.

The propagation statistics are complemented by similar statistics of meteorological parameters, especially of rainfall rates. Direct comparison of these two sets of simultaneously obtained data then enables propagation conditions to be predicted simply from rainfall data, which is relatively easy and inexpensive to obtain and is measured routinely by weather bureaux in most countries of the world.

Future work

The information obtained on the Chilbolton 500m range will be of immense value in providing propagation statistics and in developing propagation models and prediction techniques for planning future communications systems. The data is being collected over a relatively short distance, chosen deliberately to ensure that the meteorological conditions would be nearly constant over the range.

In general, however, practical communications links operating at millimetre wavelengths will have much greater path lengths, perhaps up to several tens of kilometres or more, depending on the frequency.

It is generally found that precipitation, the dominant source of fading in the millimetre region, is characteristically not homogeneous or uniformly distributed horizontally. Widespread (stratiform) rain is found to contain imbedded connective cells with higher rainfall rates than the surrounding stratiform regions. Such cells tend, on average, to be about 12km apart and from two to three kilometres in diameter. As a result, it is not practicable simply to scale the data obtained on the 500m range to path lengths of more than about two kilometres.

To obtain data over the longer paths which would be used in operational millimetre-wavelength communications systems, an additional link is being developed to operate in conjunction with the 500m range over a path of about seven kilometres. This will provide data on path-length scaling, in which the 500m data are applied to longer, more practical link lengths; at the same time it will produce a data base for validating practical predication techniques.

The 7km link will operate at frequencies at 55GHz, near the peak of the oxygen absorption band, and 95GHz, in an atmospheric "window". These represent two regions of the radio spectrum in which there is considerable interest, for reasons already mentioned, to do with their application to specific types of future communications systems.

These two sets of multi-frequency transmission links, operated simultaneously, will enable us to build up one of the most comprehensive propagation data bases for future millimetre-wave terrestrial communications systems design.

The detailed and extensive programme of data analysis now going on and being proposed will yield essential information for expanding terrestrial radio communications into the millimetre-wavelength regions of the radio spectrum for the foreseeable future.

Product review:

Comtest V.24 breakout box

A breakout box is almost essential when you're trying to solve stubborn problems in RS-232C serial data communications links. The Comtest V.24 communications tester is designed for this very purpose.

A very neat and compact little unit, the Comtest V.24 is also quite rugged. It will fit easily into any toolkit, but provides all normal 'breakout box' facilities.

In theory, the RS-232C serial data communications standard is quite straightforward. It's also very widely used to interface between computers, modems, printers, plotters and all sorts of other devices able to communicate digitally in serial fashion. So superficially you'd expect that hooking any of these things together would be child's play: take a standard cable, plug it in at each end, and away you go...

Only it doesn't work out that way in practice. Somehow, there's almost always a problem. The sending end refuses to send because it thinks the receiving end isn't ready; or it only sends one character and then stops, because the receiving end doesn't acknowledge that it's been received; or the characters get sent, but the receiving end doesn't seem to receive them; or it garbles them because it isn't ready; or they get garbled because of a parity mismatch; or the two ends are set to different baud rates, or different numbers of data bits, or different stop bit lengths, or whatever.

The list of problems, both potential and actually encountered is almost endless, and you can spend *hours* trying to track down the reasons. It's all very frustrating.

In most cases you can at least sort out most of the basic physical interconnections with a so-called *breakout box*. This is a gadget which effectively 'breaks into' the RS-232C signal lines, and shows you what's going on – by displaying the signal levels on say a row of LEDs. It generally also lets you change any of the key connections, if you suspect that this is necessary before things will start working correctly.

But although they're very handy, breakout boxes are not all that thick on the ground – particularly at a reasonable price. There are a few very cheap ones around, but in most cases these leave a lot to be desired. If you want one that really *will* help to sort out those stubborn problems, the price rises quite dramatically and there really aren't that many to choose from.

The new Comtest V.24 tester should therefore attract considerable interest. It's neat and compact, housed in a rugged ABS plastic case measuring only 90 x 80 x 18mm (not counting the connectors). And it comes in a tidy little black vinyl wallet, complete with a set of 10 small jumper leads to mate with its pin jacks.

For each of the 25 connections possible in RS-232C cables, it provides a pair of LEDs to indicate signal presence and polarity. In addition it provides a pair of pin jacks, either side of a subminiature slider switch which can be used to break that particular signal line. So you have the ability to break any line, and connect either end to any of the other lines as desired.

To make things easier, all of the lines are numbered according to the appropriate DB-25 connector pins. They are also identified according to the RS-232C standard signals which should be found on them. By the way it has a DB-25 plug on one side and a matching socket on the other, which should suit most situations.

In addition to these basic breakout box facilities, the Comtest also allows you to test the 'open circuit voltage' between two pieces of data equipment. It also gives a 4-level indication of loop current (bidirectional), where you suspect connector contact resistance, or loop current is important as for short-haul modems. This would also make it handy for testing old-type current loop interfaces, quite apart from RS-232C links.

Operation is very straightforward, as the front panel is clearly marked and the rear panel gives concise driving instructions. There's also a concise table of both CCITT and EIA signal designations for the 25 signal lines, with descriptions and arrows showing whether they go from DTE to DCE or vice-versa.

The unit itself gives every indication of being made for reliable service, too. The main DB-25 connectors have gold-plated contacts, and the pins of the patch leads are also gold plated. The miniature slider switches are all part of a single 25-way 'DIP switch' unit, possibly custom made and very neat indeed. The individual sliders even have the signal line ID numbers printed on the top, to avoid any possible ambiguity.

All power for the unit comes from the RS-232C signal lines, so no batteries or other separate power source is required.

In short, the Comtest V.24 seems a very businesslike little unit, and one that should be invaluable for anyone working with or servicing equipment using RS-232C communications links.

Quoted price of the unit is $315 including tax - more than the real cheapies, but you're getting a quality troubleshooting tool rather than a toy, and it's still quite a bit cheaper than comparable testers.

The unit sent for review came from Geoff Wood Electronics, of 229 Burns Bay Road, Lane Cove West NSW. (J.R.)

Vintage Radio

by PETER LANKSHEAR

The Methuselah of valves

Many vintage radio enthusiasts find valve collecting and historic research a rewarding aspect of their hobby. Valves were a key component of early electronics and their evolution was closely tied to major advances in receiver design. Improvements and marketing demands meant that the great majority of valves were preferred types for only a few years. Despite the evolution of more efficient successors, one rectifier outlived many later developments and became a sort of "working fossil" amongst valves.

Few if any valves can match the longevity of this popular rectifier, introduced in 1927 and an octal version of which, 60 years later was still being produced in Eastern Europe. I am referring of course, to the UX based 80 and its octal based derivatives, the 5Y3G and 5Y3GT.

When broadcasting began in the early 1920's, receivers were battery powered, with expensive blocks of dry cells providing the high tension and generally, a lead-acid battery supplying filaments. A typical medium duty HT or "B" battery was made up of three 45 volt blocks, each consisting of 30 cells about the size of a modern type D. The heavy duty "superdynes" used even bigger cells.

Little wonder then that mains fed HT power supplies, called "B eliminators", soon appeared. These needed rectifiers, and electrolytic, cold cathode gaseous, and high vacuum types were all used. The latter included the progenitor of the 80, the UX213 – which was the first rectifier to include two anodes in one envelope..

The UX280 arrives

Full AC mains operation of receivers had by 1927 become a reality. No longer was it necessary to restrict output valves to a few milliamperes of anode current. A respectable audio output was possible, which enabled the newly developed moving coil loudspeaker to replace the horn and moving iron types. Intended for the modest current requirements of battery eliminators, the existing rectifiers were unable to meet the increased demands, and Westinghouse engineers had been at work developing for RCA an improved version capable of handling much more current.

Released in May 1927, it had an anode rating of 300 volts and 125mA. In 1929 this was raised, the new maximum anode voltage for a capacitor input filter being 350V. Despite even this voltage being regularly exceeded, this new rectifier proved in operation to be a winner.

Originally, the full name was UX280, and the UX prefix is of interest.

The original receiving valves developed for RCA had a tall base with 4 stubby pins, that fitted into a bayonet socket. These valves were given the UV prefix.

Late in 1925 the familiar 4-pin base with the longer pins became standard, and valves, including the 80, fitted with this base had the prefix UX. Some UX bases from this era have a little peg on the side, enabling them to be used if necessary, in the earlier UV socket.

Other manufacturers and distributors soon started marketing the 80 using type numbers such as 180, 380, 480, G80 and T80. The significant portion was "80" and by 1930, magazines were referring to it as the '80. 1932 saw the introduction of the familiar domed bulb. This construction enabled mica spacers to be used, eliminating the filament tensioning springs, and creating a more rigid assembly as well as a less expensive valve to manufacture. Early in 1933 the Radio Manufacturers Association (RMA) rationalised the US valve numbering system and confirmed the new title of "80".

Unsuccessful rival

A new rectifier, which could well have superseded the 80, appeared in 1934. This was the indirectly heated cathode 83V.

Cathode type rectifiers, essential for vibrator powered and transformerless mains radios, had recently been developed and were more efficient than the widespaced electrode 80. The compact cathode construction permitted close spacing of the anode, resulting in superior voltage regulation. A logical move was to make a similar rectifier for standard receivers. The outcome was the 83V, which was more efficient and had improved ratings compared with those of the sometimes overloaded 80.

It made a lot of sense to use indirectly heated rectifiers. The internal voltage drop of an 83V was typically about 50 volts lower than that of the 80. Consequently, the power transformer could have a smaller HT winding and because the 83V heated up slowly, there was less strain on filter capacitors during warmup.

Why the 83V did not displace the 80 is not clear. Maybe manufacturers were plain conservative and certainly the 80 was cheaper.

Whatever the reason, the 80 remained pre-eminent. Although the 80 underwent little modification during its long life, around this time National Union attempted to increase the power handling ability of the 80 by corrugating the anodes. NU did not perpetuate this idea, but British STC marketed similar rectifiers under the BRIMAR label some time later.

An eventful year

1935 was the year of a major development in the American valve market. This was the introduction of the first of the octal-based metal valves. These

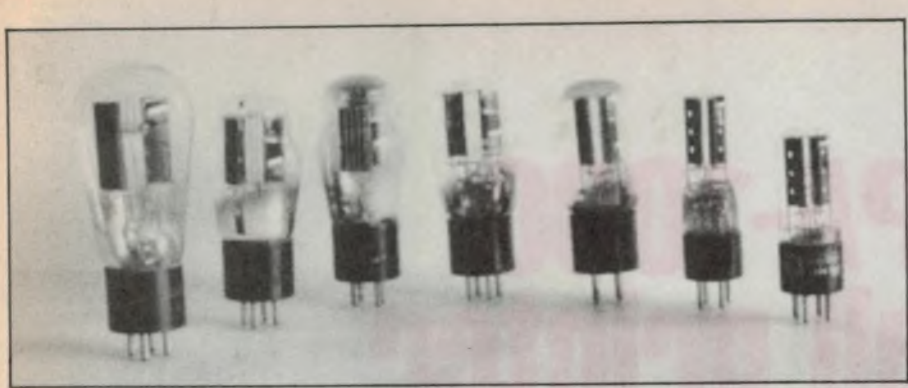


Fig.1: Various versions of the original type 80 (from left) – original S17 bulb; 1933 ST14 bulb; corrugated anode; English Philips; Chinese 1957; Eastern European T9 bulb; English T9 bulb.

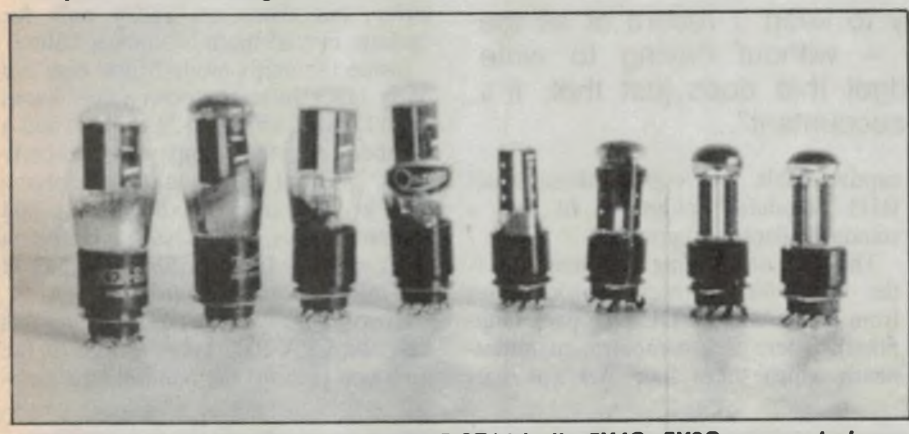


Fig.2: 5Y3 variations (from left) – 1935 ST14 bulb; 5Y4G; 5Y3G corrugated anode; English U50; Brazilian T9 bulb; Japanese 5Y3GT; East European "5Y3GT"; East European 5Z4GT.

were intended to boost General Electric back into the receiver market and along with the octal glass valves, dominated receiver design through the war years until the 1950's.

Their story is worth telling sometime, but it is sufficient to say that, in reality, many of the "first edition" were existing types in metal shells. However, one type, the 5Z4 mains rectifier, was a new design. It had similar maximum ratings to the trusty 80, but with the benefits of indirect heating. In its original form, the 5Z4 had an unusual appearance, with a tall perforated shell surrounding a pair of vacuum tight anodes.

This should have been the end of the 80 in new equipment. In valve terms, it was already old, its contemporaries long obsolete. An odd turn of events however, was to give it immortality.

The new 5Z4 rectifier seems to have been troublesome. When the "bugs" were cured, it became a conventional metal valve in the same envelope as the 6F6, but it was too late. The damage was done, and the reliable old 80 with its glass envelope was brought back into use, given an octal base and called the 5Y3G.

Although the 5Z4 problems were promptly cured, it never in the USA became as popular as the 5Y3G. Oddly though, the 5Z4G glass version of the 5Z4 was quite often used in Britain.

In Australia, AWA stayed with the 5Y3G for general purposes and for an indirectly heated 5-volt rectifier standardised on the 5V4G – which was none other than the 83V with an octal base.

One odd type was made by BRIMAR. This was the 80s, in reality a 5Z4G with a UX 4 pin base. There are times when valve genealogy is as complicated as that of a TV soap opera, but there is more yet!

4 Pin UX Base		8 Pin Octal Base		8 Pin Loktal Base
80	=	5Y3G(GT) 5Y4G U50	=	5AZ4
80s	=	5Z4(G) (GT)		
83V	=	5V4G(GA)		

Table 1: The relationship between the various 80 "family members".

Soon after the introduction of the 5Y3G, Philco, who were at loggerheads with RCA, changed the base connections around and called it the 5Y4G. This was not very clever, and if any reader has a replacement problem, I suggest that the rectifier socket is jumpered to take both a 5Y3G and 5Y4G.

1938 saw a Philco/Sylvania development, the Loktal series of valves. Whilst the preferred rectifier in this group was the isolated cathode 7Y4, a 5 volt directly heated version, the 5AZ4, was eventually included. Any surprise that it was an 80 in a Loktal envelope?

To help clarify the situation, the family tree of the 80 and its associates is shown in Table 1.

It must be emphasised that the 5Y3G was an 80 with an octal base and as such, continues our story. Strictly speaking, there never was a 5Y3, as in the octal numbering system the lack of a suffix would indicate a metal valve. The domed ST14 bulb version was correctly a 5Y3G, whereas the smaller T9 bulb type introduced after 1946 was the 5Y3GT.

During the 1950's, the 5Y3G was used less in new designs, but with so much existing equipment using it, demand has continued until quite recently. The 80 also received a T9 bulb about this time, but as it was not an octal valve, was not given any suffix. The progress of the three different shapes can be seen in the picture of the selection of 80 valves.

Although the 80 must have been made in practically every country that has manufactured valves, to the writer's knowledge, it has never been given an alternative civilian name. This is unusual and can be attributed to its being in common use from such an early date. Even the 5Y3G seems to have had only one redesignation. This was by British General Electric when they introduced their international range, and was called by them the U50.

The rationalisation of replacement valve types has lead recently to a strange twist in the story. At the right of the photograph of the 5Y3 group of valves is a pair of rectifiers of East European manufacture. Although one is labelled 5Y3GT, the other, identical in every way, is labelled 5Z4GT. As the cathodes are indirectly heated they are both correctly type 5Z4GT.

I guess that in a funny way, the wheel has gone full circle with the 5Y3 ending up being substituted by the valve type it was recalled half a century ago to stand in for!

Product review:

Tandy CPA-1000 phone call printer

Ever wished you had some way to keep a record of all the calls made using your phone – without having to write everything down? Here's a gadget that does just that. It's called the "computerised phone accountant"...

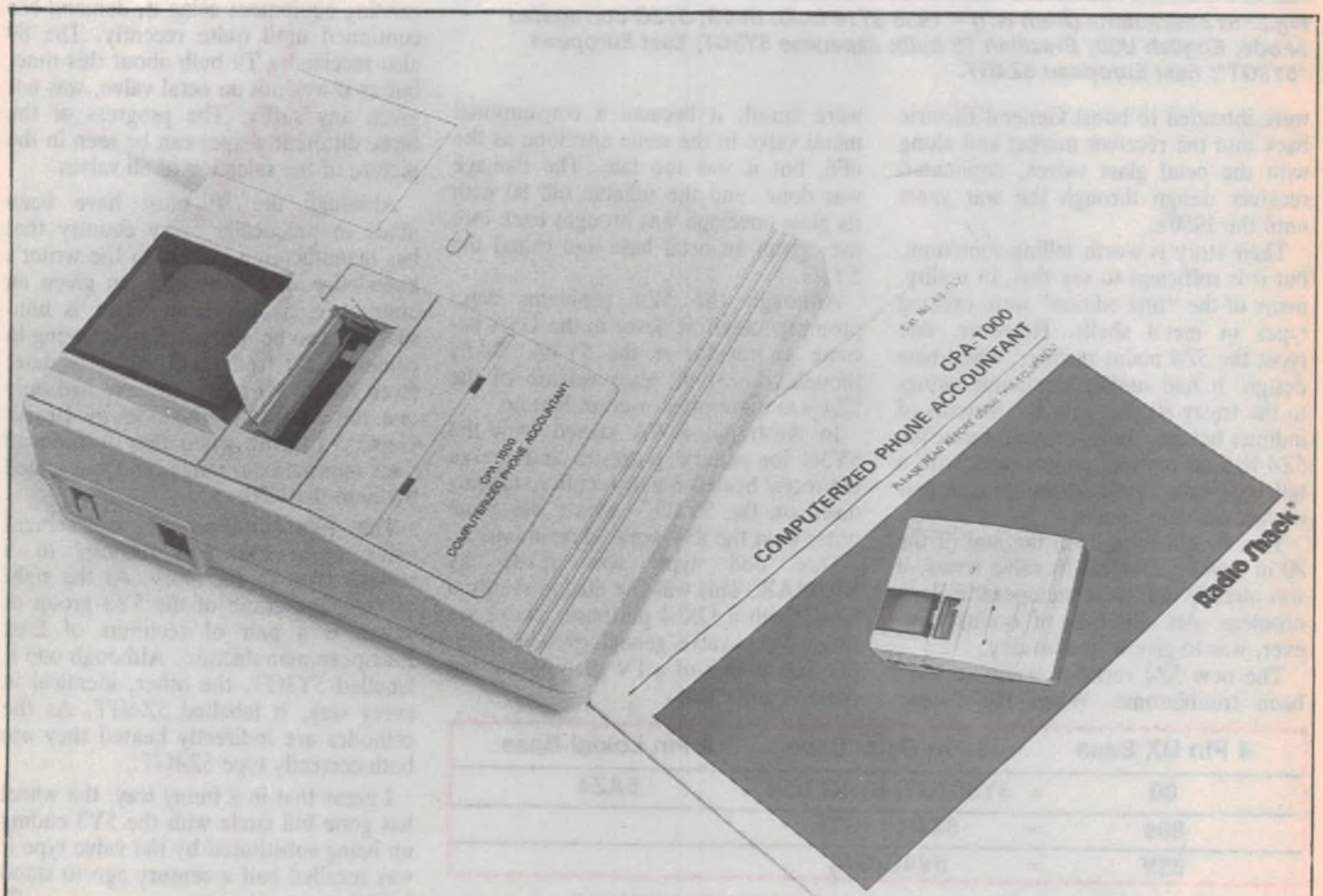
The Tandy CPA-1000 looks a little like a printing desk calculator, without the keyboard. Or at least, without an obvious keyboard; it does actually have a small one, hidden away behind a little sliding panel.

In use, it connects in parallel with your phone. To make this easier it has a captive cable and one of those small RJ11 "modular" plugs, to fit into a standard adaptor plug/socket.

The only other thing to connect up is the CPA-1000's power, which comes from a standard 9V DC plug pack (supplied). There is a compartment underneath which takes four AA-type batteries, but these are really only for backup, in case there is a power failure.

Inside the unit's modest little case is a fairly fancy little microcomputer, based on a TMS70C45/70C20-28 chip set and a number of other chips and discrete parts. This not only monitors the phone line, keeping track of all outgoing and incoming calls, but also maintains a clock/calendar function for logging all of this information on the printer.

Every time you make an outgoing call, the CPA-1000 takes a note of the time you pick up the handset, the num-



ber you dial, and how long the call lasts. Then when you hang up, it bursts into action and prints out a little summary.

Much the same happens for incoming calls, except that it obviously hasn't any way to determine the number calling. So instead it notes when the call came, how many times you let it ring before answering, and then how long the call lasts as before.

If you don't answer at all, presumably because you're out, it basically just notes and prints out the time together with the number of times the calling party let your phone ring, before hanging up.

There's other little tricks the CPA-1000 can do as well. At the end of every day, it prints out a summary of the day's telephone usage statistics. First the date and time (23:59), then the number of incoming calls, the number of calls you answered, the number of outgoing calls with less than 10 digits and the number of outgoing calls with more than 10 digits.

You can also get a similar summary at any time, simply by pressing a button.

If that isn't enough, the internal microcomputer also checks the backup batteries automatically at midnight on the 10th, 20th and 30th of every month, and/or after any power interruption. When it finds the batteries are getting low, it starts flashing a "LOW BATT" indicator LED to remind you to replace them.

By the way, the CPA-1000 is compatible with most PABX systems as well as private phone lines. In fact it has three different modes of operation, to cope with various kinds of PABX call transfer mechanism (i.e., "hookflash") and ways of feeding in "account" numbers to identify the extensions being used for the call.

The ability to enter in account numbers also works with a private line, making the CPA-1000 very suitable for professional people like solicitors and accountants, who need to be able to charge clients for calls made on their behalf. All that is necessary to enter the account number is to key it in at the end of the call using the phone's dial or buttons, just before you replace the receiver. That number will then be printed out with the rest of the data for that call.

The unit will accept account numbers of up to four digits, giving a range of up to 9999 different accounts — more than enough for most purposes, surely. One code can even be reserved to flag outgoing calls that weren't answered, and

```
      ++
05-07-88 17•19
           ÷04
         *0001
      /0•00•01
      =0•01•32

      ++
05-07-88 18•07
           ÷04
      =0•04•02

      XX
05-07-88 19•08
     ¤ 5881354
      =0•03•04

05-07-88 23•59
      =¤+    002
      =¤+%   000
      =¤X    002
      =¤X*   000
```

A sample of the printout, actual size. At bottom is the automatic end-of-day summary.

therefore won't attract a charge (the CPA-1000 otherwise registers these as very short outgoing calls).

Incidentally the Tandy people tell me that when it is to be used with a Telecom "Commander" system, the CPA-1000 must be connected on the exchange side of the Commander's "black box".

When you first hook up the CPA-1000, you first have to fit the paper roll into the printer – simple in theory, but fiddly in practice. Then you have to feed in the correct time and date, which is done using the little keyboard. Although this sounds more complicated, it's actually very simple and strightforward. Then you just press the START button, and away it goes.

Actually when it starts up, it first checks your phone line, to make sure that there's enough line current for correct operation. If there isn't, it warns of a problem by slowly flashing the POWER indicator LED. This happens if you haven't plugged it into the phone socket, for example.

In addition to automatically checking the line current, it even adjusts itself for the most reliable operation with that current level. Pretty nifty!

Incidentally if someone tries to fool it by unplugging it from the phone line while they make some calls, this won't go unnoticed. As soon as it's plugged back into the line, it prints a row of zeroes plus the time when it was disconnected, and for how long.

The nett result of all this is that the CPA-1000 is very flexible, and really does make a thorough job of monitoring events on the phone line to which it's connected.

I gather that business users are finding all sorts of uses for the unit. Some organisations are even ordering them in bulk, so it might not be a good idea in future to make those long distance calls from your office phone!

The only minor drawback I found from testing out the unit pictured is that if you have it right near the phone, the burst of activity from the printer following every call can be a bit disconcerting.

In fact the ladies in my family soon took an instant dislike to it, and after a day or two insisted that I disconnect it. However this may just have been because of the record it was keeping, rather than "that awful whirring noise" they actually used as the basis for their complaint!

The CPA-1000 Computerised Telephone Accountant is available from all Tandy stores, for $299.95 including plug pack adaptor and rolls of printer paper. (J.R)

PRIMER ON

Semiconductor Devices

by JIM ROWE

3 — The Bipolar Transistor

Along with the junction diode, the bipolar transistor began the semiconductor revolution. Not only this, but bipolar transistors still form the most common "building blocks" in modern circuits — whether they're built using discrete parts, or crammed inside integrated circuits. Here's how they work.

A bipolar transistor is basically two P-N junctions "back to back" — that is, in the same piece of semiconductor crystal and sharing a common P-type or N-type region. So there are two different kinds of bipolar transistor: the NPN type, where the two junctions share a common P-type region, and the PNP type, where they share a common N-type region.

In each case the shared centre region is called the *base*, while the other two regions are known as the *emitter* and the *collector*. We'll discuss the difference between these two shortly.

An important point is that the two junctions are arranged to be very close together, by making the shared base region very thin. The effect of this is to cause the two junctions to interact with one another. In particular, the conduction in the collector-base junction is made to depend largely on what happens in the emitter-base junction. Let's see how this occurs.

As well as being made quite thin, the base region is also quite lightly doped. In other words, it contains a relatively small amount of its appropriate impurity — acceptor impurity in the case of an NPN transistor's P-type base, and donor impurity for the N-type base of a PNP transistor. And because the base is only lightly doped, it has a relatively small number of free *carriers* (electrons in an N-type base, holes in a P-type base) available to conduct a current.

On the other hand, the *emitter* region is quite heavily doped. In the case of an NPN transistor it contains a much larger amount of donor impurity, with a similar amount of acceptor impurity in the emitter of a PNP transistor. So in both cases, there are many more free carriers available to conduct a current, than in the adjacent base region.

Because of this, what happens when the emitter-base junction conducts (in response to a forward bias, just like a normal P-N diode) is that the current which flows consists mainly of carriers flowing from the emitter to the base, rather than vice-versa. With an NPN transistor it's mainly electrons, and with a PNP transistor mainly holes.

This is in fact why the emitter is given that name — because it basically "emits", or injects, current carriers into the rest of the device.

Now the third region of the transistor, the collector, is made lightly doped like the base region (only with the opposite type of doping impurity). So it too has relatively few free carriers available to conduct a current in the normal way.

In any case, the collector-base junction is normally *reverse biased*, so that if left to its own devices a depletion layer forms and spreads out either side of the junction, just as in the case of a normal P-N diode. The depletion layer effectively removes the carriers which would otherwise balance out the charges on the fixed impurity atoms in the crystal, setting up a potential barrier to match the applied reverse voltage.

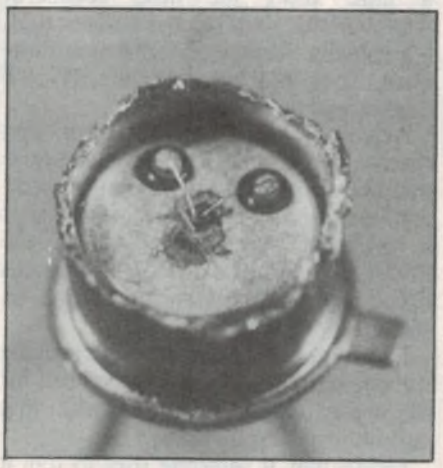
To the normal majority carriers in the base and emitter, this potential barrier is just that: a big wall that they'd need to surmount, before they could pass to the other side. So just as in the case of a normal diode, virtually no current tends to flow across the collector-base junction — again, when it's left to its own devices.

The difference here is that the junction *isn't* left to its devices. Remember that the base region is deliberately made very thin, and the emitter is made much more heavily doped than the base.

Because of these things, the effect of a *forward* bias applied to the emitter-base junction is to inject majority carriers from the emitter into the base, and straight into the depletion layer of the reverse-biased collector-base junction.

Now these carriers are actually *minority* carriers in the base region, because this region is of the opposite type to the emitter. And to these now-turned-minority carriers, the collector-base junction depletion layer's potential gradient is not a *barrier* at all, but an "inviting" downward slope (i.e., an accelerating field). So as soon as they reach the depletion layer, almost all of them are immediately swept over into the collector region.

The nett result of all this is that ap-



Inside two typical bipolar transistor packages, showing the actual chips and the small bonding wires used to connect to them. The TO-18 device at left is about 10 times actual size.

plying a forward bias to the emitter-base junction causes two things to happen, both of which you may find a little surprising at first glance:

1. Only a relatively small current actually flows between the emitter and the external base lead, very much smaller than would flow in a normal P-N diode, despite the forward bias applied to the junction between them.

2. A much larger current flows instead directly between the emitter and collector regions, in this case despite the fact that the collector-base junction is reverse biased.

These effects are illustrated in Fig.1, which will hopefully help you understand what is going on. The diagram shows an NPN transistor, but the situation in a PNP transistor is very similar except for the opposite polarity regions and conduction mainly by holes rather than conduction band electrons.

From a practical point of view, this behaviour of the bipolar transistor means that unlike the simple P-N junction diode, it is capable of *amplification*. In effect, a small input current made to flow between the external base and emitter leads results in a much larger output current flowing between emitter and collector. And the voltage needed to produce the small input current is also quite small: around 0.6V for a typical modern silicon transistor.

In contrast, the reverse bias voltage applied across the collector-base junction can be much larger — typically anything from 6V to 90V or more. So in producing and being able to control a larger current in this much higher voltage output circuit, the transistor's small input current and voltage can achieve considerable voltage and power gain, as well as current gain.

Bipolar transistors thus work very well as both amplifiers and electronic switches. That's why they've become the workhorses of electronics, largely replacing the thermionic valve or "vacuum tube".

By the way, the diagram of Fig.1 is meant to show the way a bipolar transistor works, rather than its physical construction. The actual form of a modern "planar" double-diffused epitaxial junction transistor is shown in Fig.2.

The collector region is formed from a lightly-doped layer grown epitaxially on the main chip substrate, which is made from material of the same type but more heavily doped (to provide a low resistance connection). Here, both are N-type material; for a PNP device they'd be P-type.

The base region is formed by lightly diffusing the opposite kind of impurity into a medium-sized area of the chip surface, to "reverse" the type of this area and create the base-collector junction. Then the emitter region is formed within the base region, by making a second and heavier diffusion over a smaller area inside the first, but this time with the same kind of impurity as used for the epitaxial collector region.

The second diffusion is very carefully controlled, so that the emitter region produced extends almost to the bottom of the base — but not quite. So this leaves the area of the base region immediately below the emitter quite thin — to ensure that as many as possible of the carriers injected from the emitter will be swept through to the collector. The thinner this active base region, the higher tends to be the gain of the transistor.

Note that although the collector and emitter regions are of the same semiconductor type, the two are physically quite different. The emitter is heavily doped (for good carrier injection), and can be relatively small as the emitter-base junction doesn't need to dissipate much power. In contrast the collector is lightly doped (for a wide depletion layer), and its junction is much larger as being reverse biased, it tends to dissipate much more power.

Connections to the emitter and base regions are made via aluminium metal electrodes deposited on the surface. Small wires are bonded to these electrodes, to connect them to the main device leads. The low resistance chip substrate itself is used to connect to the collector region.

This is the basic construction used for most modern bipolar transistors, whether they're single "discrete" units in their own package, or part of an IC (integrated circuit) containing thousands of them. The main difference is size, although in an IC the collector regions of the transistors will generally be in an epitaxial layer grown on the opposite kind of substrate, and separated by diffused "walls" — again of the opposite kind of material — to separate the transistors from each other. In this case the collector connections are made via top electrodes, as well as the base and emitter connections.

Inside an IC, the active part of an individual transistor might be only a couple of micrometres square, while a very large transistor used to switch hundreds of amps might have a single-wafer "chip" 100mm or more in diameter.

Typical small to medium power discrete transistors used in consumer electronics gear and hobby projects have chips measuring from 1mm square to about 3mm square. The rest of the "transistor" you hold in your hand is its protective package.

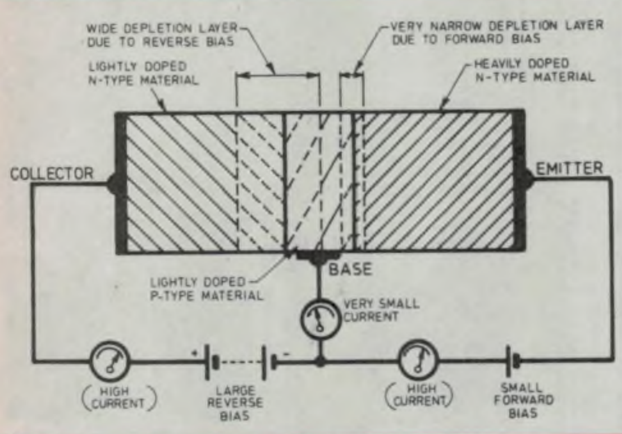


Fig.1: Basic operation of an NPN bipolar transistor. Most carriers entering the base front of the emitter are swept through into the collector.

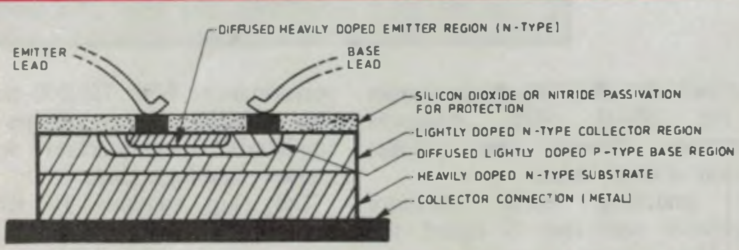


Fig.2 (above): The actual form of a typical NPN bipolar transistor.

Solid State Update

KEEPING YOU INFORMED ON THE LATEST DEVELOPMENTS IN SEMICONDUCTOR TECHNOLOGY

Motorola unveils 88000 microprocessor family

Motorola has unveiled its new microprocessor family, the 88000. The product line incorporates reduced instruction set computer (RISC) features and heralds an era of increasingly powerful systems.

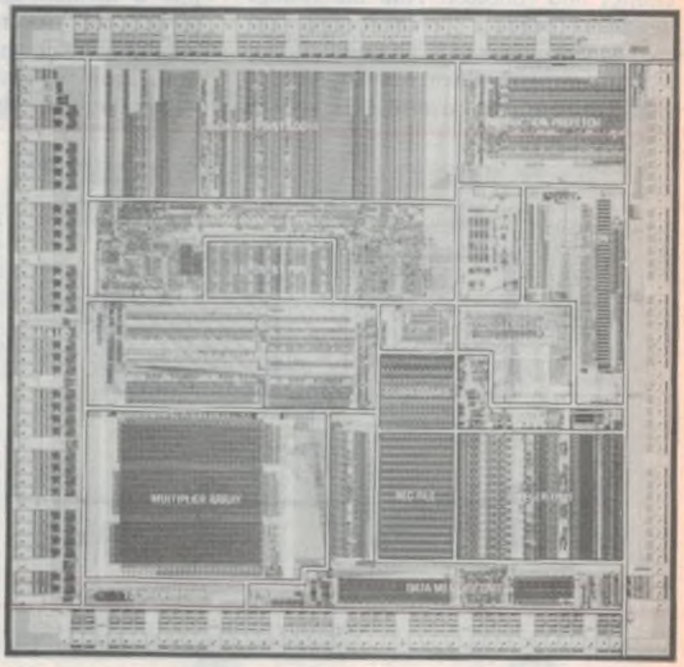
According to Motorola, the 88000 family provides a standard microprocessor platform that will penetrate high performance markets currently supplied with non-standard, proprietary microprocessor technology. The 88000 architecture includes many features of the so-called "Supermini-computer" market, including multi processing and multitasking capability, fault tolerance and high performance graphics.

Motorola also introduced a series of multiprocessing boards called Hypermodule that provide up to 50 MIPS of performance on a circuit board of 30 square inches. In addition Motorola, in partnership with Data General, announced that it is creating an ECL version of the 88000 that will allow over 100MIPS of performance by 1991.

The central processing unit chip in the 88000 family is called the 88100. It contains 165,000 transistors and couples integer and floating-point functions together on a single chip. The initial version of the processor operates at 20MHz and delivers 14 to 17 MIPS. Used in multiprocessing applications, it generates 50MIPS.

Other RISC chips have placed functions on as many as four separate chips, dramatically decreasing overall system performance. By integrating these functions on a single chip, the 88100 sustains 7-12 million floating point instructions per second (MFLOPS). Motorola claims this rating is the highest for any RISC processor on the market today.

Scoreboarding is another unique feature of the 88100. This mainframe technique controls the number of operations the processor can manage concurrently. The 88100 can have up to 11 different instructions in process during any clock cycle. The scoreboard enables processes to happen concurrently by allocating the resources on the 88100. This enhances performance through the parallel execution of instructions.



Above, the three main chips in the new Motorola 88000 family. At right is an enlarged view of the 88100 CPU chip, which contains 165,000 transistors and delivers 17 MIPS (millions of instructions per second).

The matching cache memory management unit chip is called the 88200. This delivers information to the central processing unit at high rates of speed to substantially increase performance. With 750,000 transistors, the 88200 accomplishes what comparable systems achieve with 50-70 memory and logic chips.

The chip contains 16 KBytes of memory as well as a memory management unit (MMU). Multiple 88200's can be used for applications that require more cache. The 88100 can support eight 88200's for a total 128 KBytes of cache and 6 million transistors.

The Hypermodule circuit board is designed to provide customers with a very high performance multiprocessing RISC solution. Packed onto a single board measuring 3.4 x 8.5 inches, the module offers performance equal to that of superminicomputers. The board uses up to four of Motorola's new RISC 88100 CPUs and up to eight 88200 (CMMUS). It can deliver more than 50MIPS sustainable performance for computing in business, scientific and defense environments, and is especially useful for CAD/CAM/CAE, fault tolerant transaction processing and advanced graphics applications.

1M-bit DRAM

The Samsung KM41C1000 is a CMOS high speed (100ns) 1,048,576 x 1 dynamic Random Access Memory. Its design is optimized for high performance applications such as mainframes and mini computers, graphics and high performance microprocessor systems.

The KM41C1000 features fast page-mode operation, which allows high speed random access of memory cells within the same row. CAS-before-RAS refresh capability provides on-chip auto refresh as an alternative to RAS-only refresh. All inputs and output are fully TTL compatible.

The KM41C1000 is fabricated using Samsung's advanced CMOS process.

For further information contact George Brown Group offices or the George Brown Group Marketing Division, 456 Spencer Street, West Melbourne 3003 or (03) 329 7500.

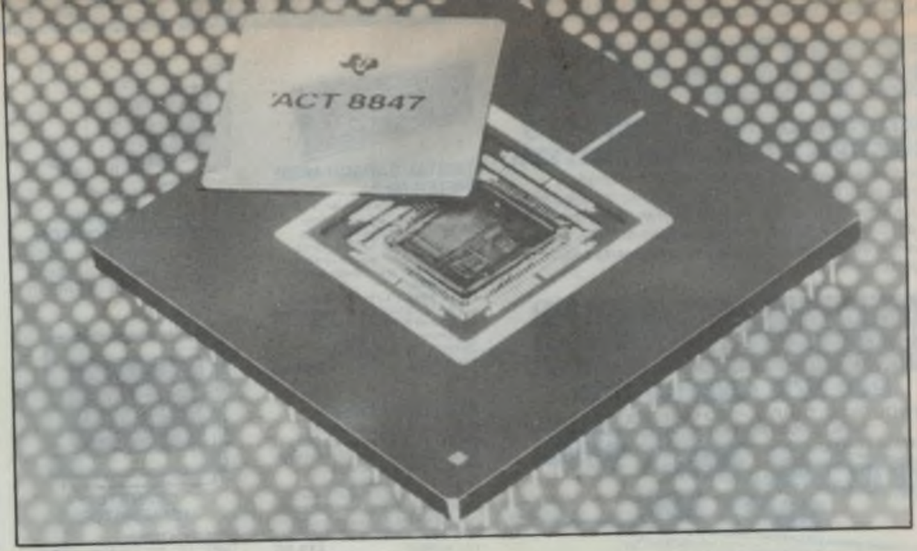
Opto isolators

TRW Optoelectronics division has released the 4N47, 4N48 and 4N49 range of optically coupled isolators.

Each consists of a gallium aluminum arsenide IR LED and a silicon phototransistor mounted side by side and coupled on a ceramic substrate inside a hermetic TO-5 package. All electrical parameters are identical to the JEDEC registered 4N47, 4N48 and 4N49. TO-5 packages offer high power dissipation, ease of heat sinking, superior operation in hostile environments and high reliability in accordance with MIL-S-19500.

The 4N47, 4N48 and 4N49 have 1000 VDC isolation voltage.

For further information, contact Total Electronics, 9 Harker Street, Burwood 3125 or (03) 288 4044.



TI announces fastest floating point processor

Texas Instruments claims to have developed the industry's highest performance, single-chip, floating-point processor. Combining floating point and integer capabilities in one chip, the high-speed, double-precision, floating-point processor can perform 33 million floating-point operations per second (MFLOPS) in single and double-precision operations. This higher performance level is critical to the future designs of high-end computer systems, such as workstations, minicomputers and 32-bit personal computers.

The chip, designated SN74ACT8847, performs a complete spectrum of high-accuracy, scientific computations as part of a customised host processor. Its advanced math co-producing capabilities allow the chip to accelerate the performance of both reduced-instruction-set-computer (RISC)-based processors and complex-instruction-set-computer (CISC)-based processors. Because of its high-speed and advanced architecture, the device will be used as a floating-point processor for the industry-standard, 32-bit scalable processor architecture (SPARCTM), an open-architecture RISC design.

The one-micro EPICTM CMOS device combines two 64-bit functions, a floating-point multiplier and a floating-point arithmetic logic unit (ALU). Its combined functions and advanced computational ability allow the ACT8847 to perform not only as a high-speed, 64-bit, floating-point processor, but also as a single-chip, numeric processor. It has the designed-in capability to perform division and square root operations, and also performs complete integer ALU functions and logical operations, including logical shifts.

The chip's flexible, "building block" design allows it to be used as an element of a customised host processor in either CISC or RISC-based systems. It can accelerate a microprocessor such as the Motorola 68030 and the Intel 80386 or perform high-speed computations in an open-architecture or proprietary RISC design. When fully pipelined, the ACT8847 can perform a double-precision floating-point or 32-bit integer operation in 30 nanoseconds. In flow-through mode, the 8847 takes less than 100ns to perform an operation.

This performance translates to 33 MFLOPS for both single-precision and double-precision operation. With its multiplier and ALU operating in parallel, the 8847 has a performance of over 50 MFLOPS. A double IEEE divide can be executed in only eleven quick 30ns cycles.

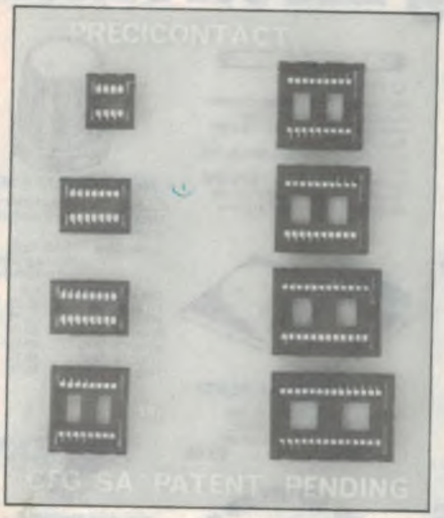
Speech network chip

Rohm Company has released the BA6566, which contains all the required functions for a telephone speech network. The receiving circuit can supply sufficient current for a low-impedance receiver and supplies sufficient voltage for a ceramic receiver. Parallel operation with a standard magnetic type telephone is possible because operation begins at a DC voltage as low as 1.8V.

The line voltage-current characteristics are easily adjusted by adding an external resistor to the CL terminal. The Pd terminal can sink excess line current, while the AGC terminal allows gain to be controlled by the line voltage.

For further information contact Fairmont Marketing at Suite 3, 208 Whitehorse Road, Blackburn 3130 or phone (03) 877 5444.

New Products



Socket for surface mount ICs

Utilux is introducing onto the Australian market the first truly surface mount socket for all "SO" type surface mount integrated circuits.

Manufactured by Precicontact of Switzerland, the new SMD socket (patent pending) is available with surface mount contacts and is compatible with all SMD integrated circuits in SO packaging, following the IEC standards.

These sockets are available on automatic insertion compatible reels for all pin configurations from 8 through to 28 pins.

Advantages include zero insertion force, a contact force of 60 grams and the use of high temperature plastic compatible with vapour phase soldering techniques.

For further information contact the nearest office of Utilux, or the company's Electronics Division at 14 Commercial Road, Kingsgrove 2208, phone (02) 50 0155.

Improved PC compatible

When Dick Smith Electronics began marketing the Acer (formerly Multitech) 500 series of personal computers just over two years ago, they chose it for its reliability and value. Computer users were soon to agree. It was also the first complete system, including monitor, to break the $1000 price point.

The new 500+ "Series II" sells for the same low price, but comes with real time clock, MGA & CGA card, games port, serial & parallel ports and a fully expanded (640K) memory on both dual floppy and hard drive

Utilizing an enhanced version of the NEC V20 microprocessor, the Acer 500+ is functionally compatible with machines using the 8086 and 8088 microprocessors but offers significant advantages including speed. With keyboard selectable 4.77MHz and fast 8MHz clock speeds, tasks can be completed 60 to 70% faster than PC's using 8088 microprocessors.

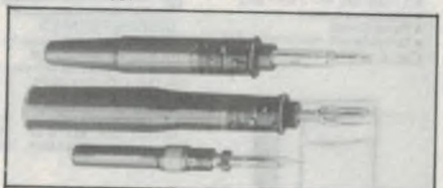
Three systems are available:

System 1 – with 256K memory (expandable to 640K), single floppy disk drive and monochrome monitor (cat X-8060), priced at $995.

System 2 – includes fully expanded 640K memory, dual 360K floppy disk drives and monochrome monitor (Cat X-8061), priced at $1395.

System 3 – hard disk version with 20Mb hard drive, single 360K floppy disk drive, 640K memory and monitor (Cat X-8062), priced at $1995.

All prices include 12 months warranty. Further details are available from all DSE stores.



Butane-powered heat tools

Bowthorpe Australia has released a range of compact and versatile heat tools with a wide range of applications.

The Master Ultratorch uses inexpensive butane lighter refill fuel flowing through a catalyst to generate high temperatures, enabling the unit to be used as a soldering iron, flameless heat tool and butane torch.

There are six models and three sizes, each of which performs the three functions simply by changing tips.

As the Master Ultratorch requires no electrical lead, gas hosepipe or battery, it is ideal for on-site installation and repair work. Two models have simple push button self-ignition.

The three-in-one Ultratorch range is the latest edition to the Master heat gun range available through GEC Electrical Wholesale outlets and other Bowthorpe stockists.

PLCC extraction tool

The Emulation Technology PULL-A-PLCC is a handy tool to easily extract Plastic Leaded Chip Carriers (PLCC) from their tight sockets. Utilising the only two corners available for extraction of a PLCC, PULL-A-PLCC is designed to prevent bending or breaking of adjacent leads.

The one tool covers all 20, 28, 32, 44, 52, 69 and 84 pin PLCC packages.

For further information contact Current Solutions, 12A Church Street, Bayswater, 3153 or phone (03) 720 3298.

Catalog update

Stewart Electronics of Melbourne now has available update No. 3 to its catalog. This update covers the complete range of Amidon ferromagnetic materials and J.W. Miller inductors, for power and EMI suppression applications as well as for RF and IF use.

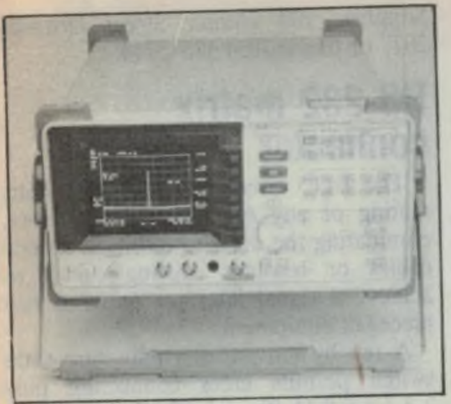
Copies of Update 3 are available on request from Stewart Electronics, PO Box 281 Oakleigh 3166; phone (03) 543 3733 or fax (03) 543 7238.

Photoplotter service

DCI Cadam Services is pleased to announce the installation of its new Photoplotter, enabling the company to offer high accuracy plote at a cost that is comparable and in some cases, cheaper than the conventional "ink on film" and photographer method. DCI believes that it is the only company operating in Australia that can offer such a low cost service.

Overall accuracy of the new system is said to be better than one and a half thousandths of an inch. As well as the above service DCI, continues to offer a complete PCB design and documentation service, supporting PCAD and PROTEL databases.

For more details contact DCI at Suite 10 Alexander Chambers, 9 Alexander Street, Mt Waverley 3149 or phone (03) 807 8483.



RF spectrum analyser

Tech-Rentals now has available the Hewlett-Packard model 8590A RF Spectrum Analyser, a portable, general purpose unit covering a frequency range of 10kHz to 1.5GHz. Resolution bandwidth is 1kHz to 3MHz.

Operation is simplified by automatic adjustment of internal parameters such as bandwidth and attenuation. A digital display is used with a number of convenience features including a peak search. Percentage AM, 3dB and 6dB bandwidth are calculated automatically.

An inbuilt unit Fast Fourier Transformation function permits high resolution measurement of demodulated sidebands such as AC hum.

Further information is available from Tech Rentals offices in Melbourne on (03) 879 2266, Sydney on (02) 736 2066 and other states.

Line scan camera, combined video camera

EG&G Reticon's new solid state camera, the LC1901, features combined video data. This means less preprocessing for the user. Data and controls are differential to provide highnoise immunity.

The LC1901 includes a user invokable line reset feature to reset all elements to zero integration. Each camera is factory adjusted for maximum anti-blooming performance.

Modular features include optical fixturing, precision registered mounting, and consistency of the video gain slope from camera to camera. Other features include dynamic range in excess of 1000:1 and high shock and vibration durability.

The LC1901 is offered with 256, 512, 1024 and 2048 element sensors having centre-to-centre spacing of 13 microns. 13 and 26 micron aperture widths are standard. LC1901 optional accessories include mounting brackets, a through-the-lens viewer and optical adapters.

For further information contact Total Electronics, 9 Harker Street Burwood 3125 or phone (03) 288 4044.

Power conditioners

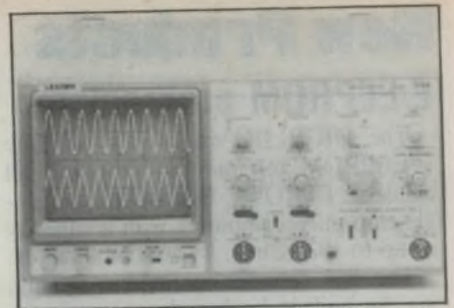
The latest additions to the Topaz range of Line 2 power conditioners are 5kVA, 10kVA and 15kVA models. As with the smaller 500VA, 1,2 and 3kVA models these units are specifically designed for use with today's computers and other power sensitive equipment.

The new Line 2 power conditioners provide voltage regulation via an internal microcomputer and high speed tap changer. Fluctuations as large as +15% to −25% of nominal line voltages (240V) can be regulated to within +4 to −8% and full correction is completed in less that 1.5 cycles.

The Line 2 range also provides excellent dynamic load regulation, maintaining the output voltage despite sudden changes from full load to no load and vice versa.

Extremely high noise attenuation and lightning protection is achieved by the use of ultra isolator noise suppression transformers providing common mode noise attenuation 20 million to 1 (120dB).

Further details from Online Control, Unit 2, 7 Waltham Street, Artarmon 2064 or phone (02) 436 1313.



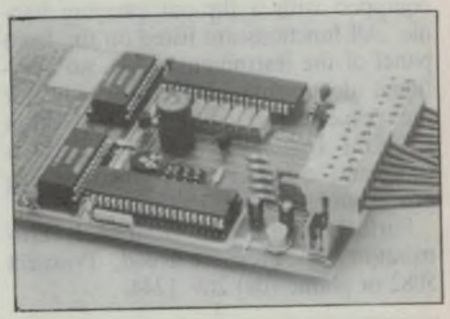
20MHz oscilloscope

The Leader LB0-1020 is a 5mV/div, 20MHz portable oscilloscope that has a maximum sweep speed of 50ns/div (MAG x 10) and a 150mm CRT with internal graticule.

Major features include regulated accelerating voltage to enable accurate, error-free reading; switching to a high sensitivity 500uV/div (5MHz) mode; and variable hold-off time to allow observation of video signals and pulse trains under stable synchronization.

A one-touch operation converts the LBO-1020 into an X-Y oscilloscope with CH-1 serving as the X-axis and CH-2 as the Y-axis.

Further information from AWA Distribution, Unit C, 2-8 Lyon Park Road, North Ryde, 2113.



Linear plug screw connector

The Combicon family of pluggable connectors from Phoenix can be interconnected in many ways. The ease of connector pluggability is combined with well proven screw clamping technology.

Combicon connectors will accept solid or stranded wires up to 1.5 square mm (No.14 AWG), with or without ferrules, the self opening moving cage principle providing reliable wire connection.

To guard against mismating in situations of identical pole numbers, a keying pin is available which fits into a plug contact opening. This corresponds to a pin being removed in the header prior to insertion and soldering to the PCB.

Further details are available from Anitech, 1-5 Carter Street, Lidcombe 2141 or phone (02) 648 1711.

New Products

E/EEPROM programmer

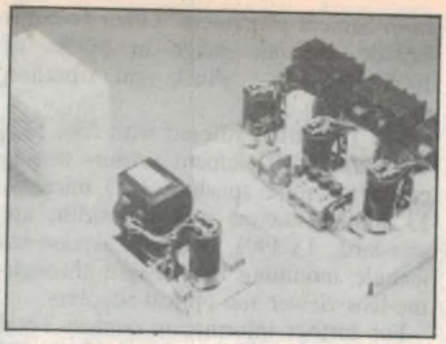
The DIGELEC model 834 portable E/EEPROM programmer programs all available EPROMs, EEPROMs and single-chip microcomputers with a capacity of up to 1024K bits, without an adaptor.

The 834 can be operated manually, via the built-in keyboard, or from a remote terminal connected at the RS-232C port. A wide range of communication formats is available for interfacing with various computers. The 834 can be operated from the IBM PC or the INTEL MDS using the DIGELEC SOFTLINK program.

The system design of the 834 offers several features to increase throughput and save time. The SPEEDY mode allows you to operate device functions relying on default parameters set according to the device type. The SET mode enables you to download a complete file from the computer and to program complete sets of multiple EPROMs with one keystroke per device.

The 834 also affords the portability necessary for the field service engineer. It is housed in an impact-resistant case to endure rugged conditions, and comes equipped with a flip-out carrying handle. All functions are listed on the front panel of the instrument. Thus, no additional documentation is necessary for the experienced user. The built-in EPROM UV eraser makes the 834 a complete, compact and self-supporting programming station.

Further information from A.J. Distributors, 44 Prospect Road, Prospect 5082 or phone (08) 269 1244.



Ferro-resonant power supplies

Sydney-based power supply manufacturer Statronics has released eight new ferro-resonant regulated DC power supplies, bringing the FE range to 15 models. The FE series supplies are ideally suited to powering PLCs, industrial interfaces, security systems and float-charging lead-acid batteries for uninterruptible power.

There are three new single power supplies with output voltages of 48, 24, and 28 volts and nominal loads of 4 amps, 7 amps and 6 amps. Triple models consist essentially of three of these supplies mounted on a single chasis, with outputs trimmed to match and connected in parallel or series as desired. Inputs can be connected to either single phase or three phase power. They are naturally more versatile than the single models and provide improved ripple performance.

There are five triple models with a range of output voltages from 24 to 48 volts and nominal loads from 12 to 21 amps. The triple models can be rack mounted on a standard 19" rack. Further information from Statronics Power Supplies, 103 Hunter Street Hornsby 2077 or phone (02) 476 5714.

RS-232 matrix connector

The BIT3 Connector Matrix permits mating of any two RS232 connectors, eliminating the need to fabricate special cables or resolder existing cables to achieve a signal interface between two pieces of equipment.

A ten by ten position miniature slide switch permits cross connecting pins 2,3,4,5,6,8,11,19 and 20 of the RS232 connectors.

Nine LEDs permit monitoring of RxD,TxD,RTS,CTS,DTR,DSR,DCD as well as pins 11 and 19. Four RS232 connectors provide access to the matrix switch for cables of either gender.

For further information contact Mostyn Enterprises, PO Box 134 Rydalmere 2116 or phone (02) 871 6311.

RF chokes

Siemens MCC (mini cylinder core) and BC (bobbin core) chokes are wound on the approved SIFERRIT cylinder cores or on SIFERRIT drum cores. The mechanically rigid plastic encapsulation is unaffected by the usual cleaning agents (e.g. Freon) and is flame-retardant in accordance with the UL94 V-0 regulation. Colour coding is done by rings in accordance with IEC publication 62-1974. The stand-off version can be supplied with the bent lead insulated down to PC board level.

Further information from Reserve Electronics, Suite 1, 2nd Floor 370 Victoria Avenue, Chatswood 2067 or phone (02) 413 1266.

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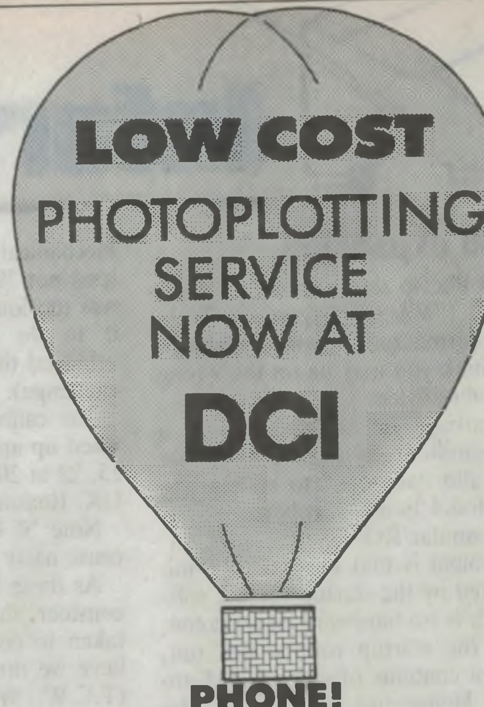
Playmaster Series 200 Stereo Amplifier Kits

sold in component form between January and March this year may have been supplied with a power transformer having a wiring colour code which is not in agreement with the supplied construction manual. Customers who believe that they may have purchased this product during the stated period are invited to contact William DeRose, Kits Division on (02) 888 3200 to arrange for supply of corrected instructions. Dick Smith Electronics wishes to apologise to its customers for any inconvenience caused.

DICK SMITH ELECTRONICS



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Information centre

VZ 300 expansion

I would like to respond to your reply to W.E.P. ("VZ-300 Expansion Problem", Information Centre, January 1988). I think you may be on the wrong track in your advice.

The "garbage on the display" is a familiar symptom to anyone who has tried to build "add-ons" to system-80s, TRS-80 Model Is etc. I believe the VZ series has similar ROMS.

The problem is that the screen is initially cleared by the startup routine software: there is no hardware clear-screen, and until the startup routine has run, the random contents of video RAM are displayed. Hence the "garbage on the screen".

I have not seen the original circuit, so I don't know exactly what has happened. Things to check are:

(1) Are the ROMS still properly seated in their sockets?

(2) Is there a possibility that there is an address conflict between the new RAM and either the video RAM or the ROM. Perhaps try starting the computer with all RAM removed?

(3) An easy thing to do is to short an address or data line to ground or 5V, or to one of the other bus lines.

In all these cases (and in all cases I have seen) there is usually no "damage" done, no blown chips or anything. You just have to find out why the CPU is not communicating correctly with the ROM & video RAM, remove the faulty connection, and everything works again. (R.L., Downer, ACT)

• ***Thanks for the helpful advice, R.L.***

Low Distortion Oscillator

Referring to comments by N.V. of Kirawee NSW and DE Graham of WA in September and November 1987 issues, I had the same trouble. It was obviously caused by the dual pot so I changed it for one of different manufacture but without success.

I purchased three different ones, they were all the same. The mechanical span was OK but excessive resistance is lost by the connections, easily checked with multimeter.

After considerable scouting round I had a wire wound one assembled. I paid $60 + tax for same, knowing it had a mechanical span of 270° (electrically less) not 293° electrically as needed and was too long. But hoped I could rework it to do the job, and I eventually achieved this (I do not recommend this challenge).

The calibration of my instrument finished up approximately. 9.8 at 10, 16 at 15, 22 at 20, 29 at 25, 58 at 50, and 100 OK. Reasonable, but not lab standard.

Note: if Q2 (BC547) is noisy, it will cause nasty spikes on the waveforms.

As these kits are still on the market I consider that some action should be taken to correct this oversight as I believe we three are not the only victims. (T.C.W., West Brunswick, Vic).

• ***Thanks for the information, T.C.W. It does look as if some of the problems are due to the pots supplied with some kits.***

Replacement transformer

I have a problem concerning where to buy a replacement transformer for an old amplifier. The amplifier is in perfect condition and works very well except for its blown transformer.

The amplifier is a *PHODIS CE-6000* and the transformer has "T-16" marked on it. I was wondering if you, or any of your readers would be able to help me out by suggesting where I would be able to buy a replacement, or how to substitute something else. Failing this, I would like to buy another of these amplifiers, or just the transformer, from one of your readers, and would be thankful if you could publish my name, address and number.

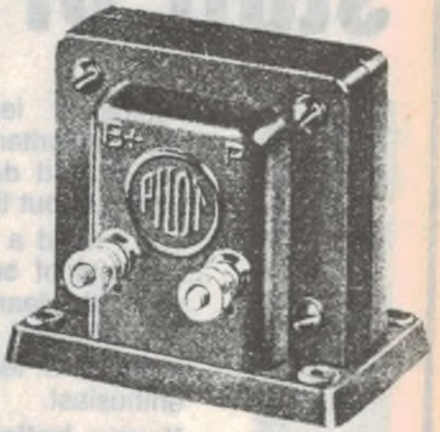
The transformer's input is 240V AC and its outputs are as follows:

(Left Side)	(Right Side)
117 V	32.0 V
100 V	0 V
0 V	32.0 V
117 V	6.3 V
100 V	0 V
0 V	

I would also like to buy or borrow a manual for this amplifier, or to photocopy parts of it. (Trevor Harrison, 37 Patterson Road, Lalor Park 2147. Phone (02) 622 5725

• ***We can't advise where to locate a replacement, Trevor, but perhaps a reader may be able to help.***

What was it?



This month's mystery item was a component used in many of the older radio sets and amplifiers using valves. The unit pictured was contained in a sturdy bakelite case, and had a pair of screw terminals on each side. It cost 15 shillings in 1927.

Later valve sets generally didn't use these components, but they returned in a modified form with the first transistor radios and amplifiers.

Answer for July

July's mystery item was a Jewell model 115 Tube Checker, one of the first valve testers marketed in Australia. It had a single 4-pin socket for the valves to be tested, as most of the valves used in 1928 were of the "UV" 4-pin type. Other types could be tested using an adaptor. Later valve testers grew quite large, with a great many sockets to cope with a wide variety of base configurations and pin connections.

Timer module

Many years ago, in April 1980 to be exact, EA published a project for a Control Timer, built around an LCD clock module listed then in the Dick Smith Electronics catalogues as Y.1050. It was also listed in the Radio Spares catalogues as 304-841, but has now been dropped from their range. EA used board H.8374 to mount all the ancillary bits on, since all the timing functions & display were already on the Y-1050 module.

No-one, at least in Perth, seems to stock the modules anymore, so I'm asking whether you know of anyone who might be able to sell me 3 or 4 of them (although I'll settle for smaller quantities). I hope you can help. (Peter Roga, VK6PV, 6 Havenvale Crescent, Dianella WA 6062).

• Sorry Peter, but we don't know of any current source of those modules. Hopefully a reader may be able to help.

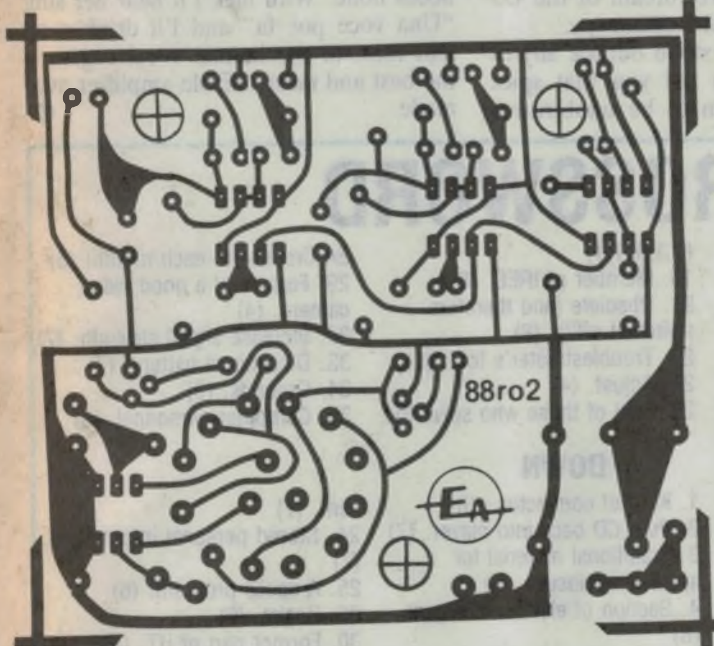
Book enquiry

I am writing because I would like to know if a book by David Heiserman called "How to Build your own self-programming Robot" is still available. If it is, I would like to purchase it. But as yet, I don't know the the price or who to buy it from. Can you be of any assistance? (G.A., Tauranga, NZ)

• We're not really in a position to offer help, G.A., particularly as your information is rather sketchy. Your best plan would be to enquire from one of the larger city bookstores.

NOTES & ERRATA

BRAITENBERG VEHICLE (March 1988): The printed circuit board pattern shown in the article has a track missing, which should connect pin 8 of IC1 to the positive supply rail. The corrected PCB pattern is shown here. (File: 3/MS/134).



STROBOSCOPIC TUNER (July 1988): C1 is listed incorrectly in the parts list as 39nF. It should be 47nF, as shown in the circuit diagram. (File 1/EM/60).

TV COLOUR BAR GENERATOR (October 1987): A1O, which is listed as a 7404 in the circuit diagram and parts list, should be a 74LSO4. The former component tends to cause unreliable operation of the 5MHz crystal oscillator. (File: 6/MS/21).

CD Reviews

continued from page 43

4. Che ascolto, ahime..
Ah, come mai non senti
Il Barbiere di Siviglia
5. Ecco ridente in cielo
6. Se il mio nome
Il Signor Bruschino
7. Deh! tu m'assisti, amore
L'Occasione fa il Ladro
8. D'ogni piu sacro impegno
L'Italiana in Algeri
9. Languir per una bella
10. Concedi, concedi, amor pietoso
La Cenerentola
11. Principe piu non sei...
Si, ritrovarie io giuro

It has been said that of all the great operatic composers. Rossini is the least appreciated. Yet, it could have been that it is difficult to find singers capable of doing full justice to this music. There is even an indication that singing standards were declining in Rossini's own time as he retired from operatic writing in 1829 when only 37 and in the height of his career.

Raul Gimenez is certainly very capable of doing justic to this music, as evidenced on this disc. Born in Argentina in 1951 and studying in Beunos Aires, he made Europe his base in 1985 after singing in many Rossini operas in South America.

All the arias here are sung in Italian and the generous cover notes show both the Italian and English words.

The sound of the singer is very clear and concise, achieving a well rounded balance with the orchestra – though possibly a little low in level. There is considerable reverberration in the acoustics, making it quite a bright recording – which can add atmosphere to certain tracks at the expense of possibly sounding a little light in the lower bass. Overall though, a very fine recording.

Frankly Frank

continued from page 34

was that the Russians got onto that valve research plant "somewhere in the US" in the first place. Bribes expressed in roubles lose much of their savour, straight out theft is good and cost effective, but mildly dangerous, and thus one is left with the secret dream of the US citizen, the beautiful Russian spy.

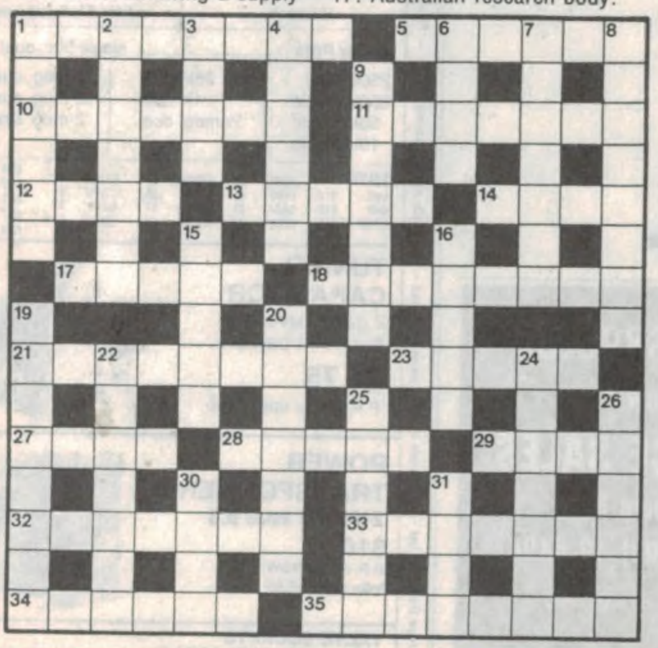
Anyone who has stood outside any of ASIO's offices can tell you that spies are specially chosen to be unobtrusive and to be able to merge into the background. Thus the terms beautiful and spy would seem to be mutually exclusive. Speak to me not of Mata Hari, she wasn't picked so much for her beauty but her dancing. Anyone who has seen any of Peter Ustinov's documentaries will know that beautiful spies, etc, are not thick on the ground in Russia.

Perhaps we are looking in the wrong direction? Are the Americans who seek out these Russian valves doing so not because the valves give a better result, but simply because they are different? The old idea that my imported car is better than your local one.

Maybe those beautiful spies stealing US valve secrets are as imaginary as the Russian threat was to Melbourne late last century? Frankly I can't tell which is which, a valve driven or a solid state system; I detest them with equal vehemence.

I am going out now to my front room and listen to the opera singer who lives across the road from me. She has no amplifiers and being properly trained, needs none. With luck I'll hear her sing "Una voce poc fa" and I'll drink a silent toast to the human vocal organs – the best and most reliable amplifier ever made.

AUGUST CROSSWORD



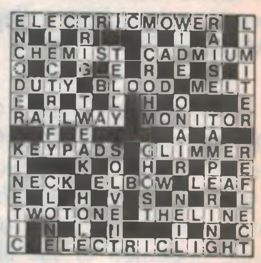
ACROSS

1. Built-in programs. (8)
5. Circuit control. (6)
10. Brand of battery. (7)
11. This could bring a supply down the line! (7)
12. Element in solder. (4)
13. An electronically generated background, ---- noise. (5)
14. Watch the screen. (4)
17. Australian research body. (1,1,1,1,1)
18. Member of IREE. (8)
21. Obsolete (and therefore switched off?). (8)
23. Troubleshooter's tool. (5)
27. Adjust. (4)
28. Said of those who solve the EA Crossword each month! (5)
29. Feature of a good video camera. (4)
32. Increase signal strength. (7)
33. Disconnect battery. (7)
34. Grounds. (6)
35. Computer personnel. (8)

DOWN

1. Kind of connector. (6)
2. Puts CD back into player. (7)
3. Traditional material for speaker enclosure. (4)
4. Section of electronic organ. (6)
6. Siren's sound. (4)
7. Having sense of touch. (7)
8. Computing apparatus. (8)
9. Spectrum-inducing structure, the diffraction ----. (7)
15. Inert gas used in some lamps. (5)
16. Prefix indicating negative power of six. (5)
19. Programs for computers. (8)
20. Again operates phone-recorder's cassette. (7)
22. Device causing signal to be sent. (7)
24. Stored personal information. (7)
25. A space program. (6)
26. Resist. (6)
30. Former part of HT. (4)
31. Data in symbolic form. (4)

SOLUTION FOR JULY



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Wireless Weekly 3d

March 1938

The "Palec" Valve and Circuit Tester: The manufacturers take great pleasure in announcing to country dealers that the popular Model V.C.T. Valve and Circuit Tester has now been developed to operate from EITHER the A.C. supply or from a 6 volt accumulator as desired.

Movie making for the multitude: International Radio Introduces Univex 8 m.m. Equipment. The making of home movies is no longer a rich man's hobby. The Univex 8 m.m. Camera and Projector make it possible for anybody of moderate means to capture scenes of home life and social activities with a vitality and movement which only motion pictures can give. And incidentally as the International Radio Company points out, they provide a most profitable sideline for live radio dealers.

Breville model 120 brings all-electric features to country listeners: In the form of a five-valve, triple-wave receiver, specially built for use with home lighting plants, Breville's newly-released Model 120 brings the advantages of all-electric radio to every country dweller who has even the lowest powered generating plant.

In addition to its simplicity of operation, the Breville Model 120 comes right up to "big set" standard on all points of appearance and performance.

RADIO, TELEVISION and HOBBIES

March 1963

Superconducting magnet A major goal of the world-wide effort in superconductor research was achieved recently when scientists at the General Electric Research Laboratory demonstrated a magnetic coil with a field of more than 100,000 gauss.

A superconducting solenoid wound from 600 feet of special 1-40th inch diameter niobium-tin conductor was used to create fields up to 101,000 gauss in experiments during which currents of up to 266 amperes were applied. The coil, approximately two inches long and two inches in diameter, was wound on a 1-3rd inch diameter tube. It was maintained at a temperature of 1.8 degrees Kelvin (approximately 456 degrees Fahrenheit below zero).

Microwave "Watchmen" Radio microwaves flooding an empty conference room can protect secret documents left out while delegates are absent, claims the Pinkerton Electro-Security Corporation of 100 Church Street, New York 7.

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1000th VTR: From the first production videotape recorder in late 1957, Ampex chalked up their 1000th with this unit, delivered to a Texas (U.S.A). University in February last. Videotape is now being used successfully for the recording and reproduction of colour television.

Traffic Signs: Traffic signs can be made much clearer and give drivers more warning even on wet murky nights, claims Dr Vogt and Co., Chemische Fabrik, Eupenerstr. 113, Koln-Braunsfeld, Germany. This is achieved by what is described as a pearlescent paint which is available in red, white and blue.

The paint is stated to be composed of p.v.c., toluol, methylethylketone, methylisobutyl-ketone and lead oxycarbonate.

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