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AUSTRALIA'S NUMBER ONE ELECTRONICS MAGAZINE

ELECTRONICS AUSTRALIA

DIRECT CONNECT MODEM

JANUARY 1984
AUST $2.30
NZ $2.60

Telecom's mobile telephone system

Mains energy monitor

Dim your lights by remote control

800W/channel amplifier reviewed

Picture yourself with a Sanyo 'Betamovie'

Feather-weight camera from the video giants.

When you take a look at the Sanyo Betamovie you'll realise that life's never been better.

Because unlike many video cameras, there's no annoying heavy back-pack. No over-the-shoulder cables.

It's light in weight and heavy on features like compact Omega tape loading system, 6x power zoom lens with Macrofocus, in-handle battery pack, through-the-lens optical viewfinder. Just one compact, light-weight unit designed for one-handed operation. So important when you've got a camera that will film for 3 hours, 40 minutes. That's 3 hours longer than any similar VHS camera

And Betamovie comes in its own beautifully designed optional carry case that would make the professionals envious.

Take a good look at the Sanyo Betamovie you won't see yourself without one – but that's life.

SANYO

That's Life!

AUSTRALIA'S LARGEST SELLING ELECTRONICS MAGAZINE

ELECTRONICS AUSTRALIA

Volume 46, No. 1, January 1984

On the cover

Currently installed in Sydney & Melbourne, Telecom's new cellular mobile telephone system has all the facilities of conventional wired systems. Our story on p.12 explains how it works.

Remote control light dimmer

Our compact infrared transmitter and receiver combination adds remote control to the Touch-lamp dimmer described in the April 1983 issue. At the touch of a single button you can turn the room lights on or off or dim them to any desired level, without stirring from your armchair. Construction starts on p.44.

Versatile multi-standard modem

This new direct-connect modem is just the thing to get you going in computer communications. Built around a single dedicated IC, it provides both 300 and 1200bps transmission to both Bell (United States) and CCITT standards, auto-dialling and auto-answer functions. Build it from a kit and save! See p.90.

Features

Hifi, Video and Reviews

Projects and Circuits

Personal Computers

Columns

Departments

Audio/Video: together at last

With the compact disc and stereo sound for VCRs, AM radio and television, 1984 could well herald the advent of the integrated home entertainment centre. For a preview of this exciting new era in entertainment, turn to our story on page 30.

The Digital vs. Analog battle is over.

From $110* buys you the new champion. The new Fluke 70 Series.

They combine digital and analog displays for an unbeatable two-punch combination.

Now, digital users get the extra resolution of a 3200-count LCD display.

While analog users get an analog bar graph for quick visual checks of continuity, peaking, nulling and trends.

Plus unparalleled operating ease, instant autoranging, 2,000+ hour battery life and a 3-year warranty.

All in one meter.

Choose from three new models. The Fluke 73, the ultimate in simplicity. The feature-packed Fluke 75. Or the deluxe Fluke 77, with its own multipurpose protective holster and unique "Touch Hold" function (patent pending) that captures and holds readings, then beeps to alert you.

Each is Fluke-tough to take a beating. American-made, to boot. And priced to be, quite simply, a knockout.

So call or write for more information.

Fluke 73	Fluke 75	Fluke 77
$110 *	$129 *	$165 *
Analog/digital display	Analog/digital display	Analog/digital display
Volts, ohms, 10A, diode test	Volts, ohms, 10A, mA, diode test	Volts, ohms, 10A, mA, diode test
Autorange	Audible continuity	Audible continuity
0.7% basic dc accuracy	Autorange/range hold	"Touch Hold" function
2000+ hour battery life	0.5% basic dc accuracy	Autorange/range hold
3-year warranty	2000+ hour battery life	0.3% basic dc accuracy
	3-year warranty	2000+ hour battery life
		3-year warranty
		Multipurpose holster

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Editorial Viewpoint

Hifi dealers bad-mouthing compact disc players

We all know that the market for turntables is threatened by the advent of compact disc players but I am amazed at the lengths that some dealers will go to bad-mouth the compact disc. Some dealers have even had demos of the compact disc alongside their favoured turntables purporting to show "just how bad the compact disc is".

Someone's got to say it. These people are wrong and in a few cases, downright dishonest. If a dealer starts deprecating compact disc players you must ask yourself if he has given it a fair test or whether he is getting a bigger margin on turntables and cartridges.

In a really fair comparison between the best conventional discs played on a top quality turntable (and cartridge) and the equivalent compact disc played in synchronism, and with levels matched exactly, you would be surprised at just how close the two sound. In fact, depending on just when you switch between the two it can be difficult to tell which is which. Ultimately though, in such a test, the compact disc comes out the winner.

It has no surface noise, better bass (provided the loudspeakers can reproduce it) and cleaner sound on complex orchestral passages. It is just not possible for a fair-minded person to conclude that the compact disc is worse than the conventional vinyl disc. Anybody who says otherwise is either cloth-eared, severely deluded or has a vested interest.

Sure, there are some poor compact discs around and the overall selection of compact discs is still not anywhere near wide enough. There may even be a compact disc player which is a "lemon" but we have yet to come across it. Eventually, we will all have compact disc players in our homes and turntables will become as rare as open-reel tape decks.

New Zealand breaks into the world hifi market

On page 38 of this issue we review a Perreaux stereo amplifier which is unusual in a number of aspects. First, it is the most expensive and most powerful we have ever tested, by a long shot. Second, it is designed and manufactured in New Zealand and third, it is one of the very few hifi products from our region which has broken into overseas markets. It has been acclaimed by overseas magazines. And rightly so. It is a very fine product even though the price tag is far too steep for most of us.

What makes the case of Perreaux amplifiers all the more remarkable is that it is so rare an achievement. Why? On analysis, there is nothing really outstanding about the circuit concepts or engineering of Perreaux products. They are simply designed and very well made but they could just as easily have originated in Australia or anywhere else for that matter.

There are a number of companies in Australia who could have designed and manufactured the same products but they have never come up to the high standards achieved by Perreaux. Nor have any of these companies shown any of the marketing flair of Perreaux.

Perhaps the best that can be said for Australian companies is that Perreaux has shown the way to penetrate overseas markets with well made products. It is a salutary lesson.

Leo Simpson

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STOCK! WE'RE CHOKING IN IT. WE HAVE SO MUCH STOCK AT JAYCAR/ELECTRONIC AGENCIES WE HAVE NO WHERE TO SIT! WE HAVE TO SACRIFICE MANY LINES AT COST OR EVEN BELOW TO MAKE WAY FOR NEW 1984 PRODUCTS. SO IF YOU HAVE GOT ANY MONEY LEFT AFTER CHRISTMAS, GET ON DOWN TO JAYCAR – No.1 FOR SPECIALS!

MOST OF THE ITEMS SHOWN ARE 10 – 50% OFF OUR NORMAL LOW PRICES!!

FANTASTIC Multimeter

- FUSE/DIODE PROTECTED!
- 4mm BANANA SOCKET PROBES!
- BIFURCATED SELECTOR SWITCH CONTACTS!
- ABS IMPACT–RESISTANT CASE!
- LARGE! MEASURES 90(w) x 135(h) x 45(d)mm

SPECIFICATIONS:

DC 0 – 0.25	AC 0 – 10
0 – 10	0 – 50
0 – 50	0 – 250
0 – 250	0 – 1000
0 – 1000	AT 9,000 ohms/volt
AT 20,000 ohms/volt	

RESISTANCE	DC CURRENT
0 – 5K	0 – 0.05
0 – 50K	0 – 25
0 – 500K	0 – 250mA

dB: –20 to +22dB
BATTERY CHECK FACILITY: AA, C & D CELLS
ACCURACY: DC +/–3% F.S AC +/–4% F.S
OHMS +/–3%
BANANA PLUG PROBES AND BATTERY INCLUDED
This is an unbelievable meter bargain. Normally this unit would sell for around $25. Japanese made quality
Cat. QM-1005

NORMALLY (a low price anyway) **$17.95**

THIS MONTH **$15.95** SAVE WELL OVER 10%

BT151-650R

This is the 650 volt version (for extra safety) of the C122E SCR which we use in the popular 'Fluorescent Lamp Starter' Kit as described in October 1982 EA. Normally $1.50 each. This month only $0.95 each! (Minimum 5 pieces). Makes the Fluoro starter kit very cheap!
(PCB's for the kit) Cat. HP8747 ONLY $1.95

Cat. ZX7022
(8 amp 650V SCR)

Quartz Crystal Clock movement

Cat. XC6000

- Very compact and reliable
- Self-starting one-second stepping motor has strong torque
- Powered by 1.5V AA battery that lasts for a year
- Supplied with two sets of hands, one short and one long
- ±15 second/month accuracy
- 56mm square, 15mm deep

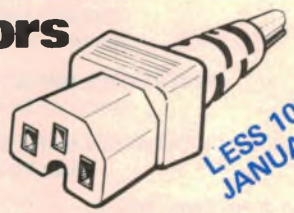
Complete with data sheet, instructions and wall hanger bracket.

$14.95

SAVE $2 JANUARY ONLY **$12.95**

IEC Cable Connectors

Most imported equipment these days now uses IEC 320 style AC power inlet connectors. Indeed, the electronics mags will soon be specifying these connectors on many of their mains-powered projects to simplify (and therefore make safer) mains wiring. Jaycar now stocks a range of ELECTRICITY AUTHORITY APPROVED mains line cords. We have them in straight entry, left and right entry with and without standard 240V mains moulded plug. Each cord is a generous 2 metres long and is rated at 7.5 amp continuous.



LESS 10% FOR JANUARY ONLY

Cat. No	Description	Price
PS4302	LINE CORD STRAIGHT ENTRY 2M	$3.95
PS4304	LINE CORD R/HAND ENTRY - 2M	$3.95
PS4305	LINE CORD L/HAND - 2M	$3.95
PS4306	LINE CORD STRAIGHT ENTRY WITH 240V PLUG - 2M	$4.95
PP2302	IEC 320 CHASSIS PLUG	$2.95
WM4530	2 PIN 240V PLUG MOULDED TO 2M FIG. 8 7.5 AMP CORD - BLACK IN COLOUR	$2.95

(Note: the first 5 items are grey in colour)

low cost IC inserters AND EXTRACTORS

Up until now these have cost a fortune!!
Features:
- **CMOS SAFE conductive plastic**
- **Exclusive bent pin alignment guides in handle. 8 to 40 pins.**
- **Ground strap can be connected.**
- **One hand operation.**

INSERTERS

Cat. No	Model	Description	Normally	NOW
TH1810	CIT820	8 – 20 pin	$5.95	$4.16
TH1812	CIT22	22 pin	$6.50	$4.55
TH1814	CIT2428	24 – 28 pin	$6.95	$4.86
TH1816	CIT3640	36 – 40 pin	$8.95	$6.26

EXTRACTOR TH1818 ET480
Deceptively simple looking device. One piece metal construction. 8-40 pins
$2.95
NOW $2.06

30% OFF JANUARY

MOTOROLA CMOS DATA

Normally $14.50

NOW ONLY $9.95

862 pages crammed with up-to-the minute information on 4000, 4400, 4500 devices. A complete product index is included along with comprehensive data on every device (almost 200 described). As the part numbering system is standard, you can use this reference for other manufacturers products with the same generic numbers. This book normally sells for $14.50
Cat. BM-4210

RIBBON tweeter

SAVE $16.95

Unique regular phase design drives the entire diaphragm, uniformly and completely in phase over the full frequency range. The performance of an electrostatic speaker with the ruggedness and ease of use of a dynamic.
Cat. CE-2042 NORMALLY $38.50 ea

ONLY $19.95

- 91dB sensitivity
- 50W system power
- 5,000-40,000Hz
- No voice coil

SEE PAGE 43 FOR

10-50% OFF SALE!!

SAVE A FORTUNE!

LOW COST DIGITAL MULTIMETER KIT

ONLY $45

Ref: EA March 1983 (This month)
Almost everyday we are asked for a multimeter kit. Up until now we thought that it was just not worth it considering the fine low-cost built-up units available. The DP2010 changed all that.
This kit, fully imported from the UK uses the famous DPM-05 custom LCD/Voltmeter to achieve phenomenal accuracy at very modest cost!
All parts are included to complete the meter including an attractive and colourful front panel.
(a 9V battery is required)

Set of test probes to suit $2.95
Probe to suit Cat. WT5312
ONLY $2.50
Eveready 216 (red)
9V Battery Cat. SB2370
ONLY $1.40

SAVE OVER 15%

DP2010 kit Cat. KJ7010
ONLY $45

SPECIFICATIONS

Function	f.s.d.	Resolution	Accuracy	Protection
Volts (d.c.)	2V	1mV	1%±1 digit	500V for
	20V	10mV	1%±1 digit	one minute
	200V	100mV	1%±1 digit	
	500V	1V	1%±1 digit	
Current (d.c.)	2mA	1uA	1%±1 digit	1A/250V
	20mA	10uA	1%±1 digit	
	200mA	100uA	3%±1 digit	
	2000mA	1mA	5%±1 digit	
Volts (a.c.)	2V	1mV	2%±5 digit	500V for
	20V	10mV	2%±5 digit	one minute
	200V	100mV	2%±5 digit	
	500V	1V	2%±5 digit	
Current (a.c.)	2mA	1uA	2%±5 digit	1A/250V
	20mA	10uA	2%±5 digit	
	200mA	100uA	4%±5 digit	
	2000mA	1mA	7%±5 digit	
Resistance	2K	1	1%±1 digit	260V
	20K	10	1%±1 digit	r.m.s.
	200K	100	1%±1 digit	
	2000K	1K	1%±1 digit	
Diode Test	2V	1mV	1%±1 digit	260V r.m.s.

AC VOLTAGE AND CURRENT RANGES
When S3a selects a.c. functions the output from either the voltage attenuator or current shunts is fed through C1 to remove any d.c. component.

AMAZING VALUE WAS $45 THIS MONTH SAVE. . . **$37.95**

SPRAY ON CONDUCTIVE PLASTIC. . . $6.95

This handy 200 gram spray enables you to do all manner of things. You can spray sheets of Styrene foam and make them suitable for storing your MOS IC's. Far cheaper than other methods!! You can make conducting screens inside plastic boxes to shield RF. You can re-coat the back of CRT's. You can make conductive parts of equipment cabinets to reduce static. The paint dries to a hard varnish like film. Non-inflammable and Non toxic. Grab a can now. You never know when you will need it!
Cat. NA-1010 — $6.95

115 VOLT COMPUTER FANS

$12.95 THIS MONTH

NORMALLY $14.95

We have made a scoop purchase of computer grade Box Fans. They measure a standard 80 x 80 x 40mm. But there's a catch! They are only available in 115V!
Great if you are making equipment for export to the USA — or use 2 in series! No problem!
Cat. YX-2508 ONLY $14.95

SAVE $2.00 OR OVER 10%

Lyrebird Piano Kit

REF: EA 11/81-1/82

GREAT NEW FEATURES!!
- FREE! A stand (like the one illustrated but not exactly the same). Worth around $50 but yours at no extra charge with each 73 or 88 note kit.
- FREE! A soldering iron (worth around $19). Yours to keep to give years of faithful service after you have completed your Lyrebird. (88 note only)
- FREE! A 200g roll of solder. You will need some to build the Lyrebird but there will be plenty left over for other projects. (73 & 88 note versions)
- FREE! Quality IC sockets provided in both kits.

HUNDREDS SOLD!!!

REMEMBER!! THE LYREBIRD OUTPERFORMS READY BUILT PIANOS COSTING UP TO THOUSANDS OF DOLLARS MORE. WHY PAY MORE WHEN YOUR CONSTRUCTION KNOWLEDGE CAN SAVE YOU A FORTUNE?

The stand that we provide for the piano kit is not the same as the one shown in the illustration.

88 NOTE VERSION
NORMALLY $589
THIS MONTH $489
SAVE $100!!

73 NOTE VERSION — NORMALLY $475
THIS MONTH $425 — SAVE $50!!

8 CHANNEL MIXER KIT

SAVE JANUARY ONLY

Ref: EA March/April 1983
This great 8 channel 'live' mixer is perfect for bands, churches, theatre groups, home recording, disco etc.
Each input channel accepts either microphone (balanced) or line (1V) levels. Powerful equalisation foldback effects facilities are provided. The left and right master channels can drive balanced or unbalanced lines with 5 band "graphic" equalisation. Separate foldback and "effects" are provided.
The unit can be rack mounted or housed in a console chassis (which accommodates the power supply). Attractive wooden end-pieces finish the console to form a professional looking unit.

FREE!! Console mount chassis and power supply INCLUDED FOR $495! NORMALLY $98 EXTRA

$495 AMAZING VALUE

TWIN SCREENED AUDIO CABLE

$20.00 PER ROLL

Twin screened round audio cable (Two screened conductors — NOT fig '8')
This cable normally sells for $0.48/metre or $42.00/roll.

Cat. WB-1504 $20.00/roll

SAVE OVER 50%. .

10" ELECTRIC GUITAR SPEAKER

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

Impedance	8 ohm
Voice Coil Dia	1½ (inch)
Power Rating	60 WATT (RMS)
Resonant Frequency	80Hz
Sensitivity	98 (dB/W)
Response	80Hz - 7,000Hz
Total Flux	61,100 Maxwell
Flux Density	8,300 Gauss
Net Weight	1,540 gm

$29.95

ADDRESS DETAILS

News Highlights

Helicopter pilot sees in the dark

Hughes Aircraft Company test pilot Curt Lindt is shown wearing a helmet with a biocular heads-up visor display, which is part of a new helicopter night vision system. The company developed the system to reduce a pilot's work load at night, in adverse weather, or in hazy and smoky conditions. In flight, a forward-looking infrared derived image is projected on the helmet visor so the pilot may see the world outside his cockpit. His head movements are instantly transmitted through a servo linkage to the infrared turret (under the helicopter), which is automatically aimed along his line of sight.

Research leads to high efficiency solar cells

Silicon solar cells produced by the University of NSW have been tested in the United States and rated as among the most efficient in the world.

The Joint Microelectronics Research Centre at UNSW has produced the cells and Associate Professor Martin Green says that the time is ripe for an Australian company to begin making them commercially. The cells have been tested by the Solar Energy Research Institute in Colorado, USA, which carries out the US Department of Energy's to be 18.7% efficient. The previous highest efficiency recorded by the Institute was 17.1%.

Work is continuing to improve the efficiency of the cells, and production processes that can be easily used by commercial operators have already been developed, making large scale production possible.

Most research into solar cells and all commercial production involves the use of silicon. Another semiconductor material, gallium arsenide, is more efficient but is 10 to 100 times more expensive. Gallium arsenide photovoltaic cells are about 21% efficient but Professor Green is confident that his group can match that figure with silicon cells in the near future.

Associate Professor Martin Green (centre) and the UNSW solar cell team.

New ICs from Fairchild Australia

Fairchild Australia has available several new ICs of interest to circuit designers. These include:

- uA8T26A and uA8T28 3-state bus transceivers, featuring MPU or MOS compatibility. Both feature high-impedance PNP inputs and high-speed operation made possible by the use of Schottky transistor technology. They are identical to the NE8T26A/28 or the MC8T26A/28;
- uA759 high performance monolithic operational amplifier. This amplifier provides 325mA output current and features small signal characteristics better than the uA741. It is intended for a wide range of applications including voltage regulators, audio amplifiers, servo amplifiers and power drivers;
- uA78G, uA79G 4-terminal adjustable voltage regulators. These are designed to deliver continuous load currents of up to 1.0A with a maximum input of 40V for the positive regulator 78G and −40V for the negative regulator 79G. The output voltage range is 5V to 30V for the 78G and −30V to −2.2V for the 79G.
- 3708 8-channel multiplex switch with output enable control and 1-of-8 decoder included on-chip. The logic input lines are NPN bipolar compatible and can be used directly with TTL 5V logic levels. The device is intended for use in A/D converters, multiplexing in analog or digital data transmission systems, and other instrumentation signal routing applications.

Further information is available from Fairchild Australia Pty Ltd, PO Box 19, Nunawading, Victoria, 3131, phone (03) 877 5444; or 619 Pacific Highway, St Leonards, NSW, 2065, phone (02) 439 5911.

Sinclair releases pocket television

Sinclair Research is gearing up for millions of sales of its flat screen pocket television set, finally launched after delays due to disputes at the Timex plant which will make the units.

Although Sinclair claims to have produced the first flat-screen TV tube, the company was narrowly beaten to the market by rival sets from Sony. But the Sinclair version, at around $136, is less than one-third the price of its Japanese rivals.

The flat-screen pocket television set

AUSSAT opens the way to national TV

Telecom will be permitted only a minority share-holding in the Australian domestic satellite system under new plans announced by the Government last month. Private companies will also be permitted direct access to the satellite from their own ground stations, allowing them to set up their own networks for "in-house" traffic.

However private companies will not be able to resell their shares of the satellite's capacity, preventing the creation of private communications networks which could compete with Telecom as a public common carrier of communications.

Under the decision, Telecom will be allowed to own no more than 25% of the shares in Aussat Pty Ltd, the company which will own the satellite. Companies and private interests will be able to build and operate their own earth stations to transmit and receive their own traffic from the satellite, rather than go through Aussat ground stations.

According to the announcement, Sydney's three metropolitan television networks – Seven, Nine and Ten – will be allowed to use the high-powered satellite transponders for national networking and program distribution, a decision opposed by proprietors of regional television stations.

The broadcasting policy is as yet not fully decided. The four 30W transponders on board the first satellite were originally designed for direct broadcasting to the outback and were to be directed into four spot beams covering different areas of the continent.

Under a plan formulated last year, four joint ventures would be formed to provide separate programming via satellite for each of the four regions. The three Sydney television networks however, wanted the 30-watt transponders switched into national beams to give each broadcaster an exclusive national signal, and this appears to be the current Government policy.

Aussat will now have to decide on applications to lease the national beams, and the three Sydney networks are the most obvious customers. Regional stations however protest that this could mean the domination of Australian TV by the three eastern networks. To counter this possibility, the Government has apparently decided that the signals sent via the transponders will be coded, with only regional stations and some remote viewers being licensed to receive and unscramble the signals.

The regional stations will thus be able to decide how much of the signal they will re-transmit to their viewers.

The fourth high power transponder is as yet uncommitted. It cannot be switched to provide national coverage and will be fixed in a spot beam covering Western Australia. The WA State Government seems certain to insist that it has the use of this transponder for state emergency services, School of the Air and other needs.

In November, the WA lower house passed a motion expressing concern over the possibility of television programs from the eastern states coming directly into Western Australia.

has a 50mm screen and measures just 14 × 9 × 3cm. Only two controls are provided – an on-off/volume switch and a tuner. Special low profile batteries provide up to 15 hours of viewing, said to be up to six times that of its competitors.

Sir Clive Sinclair, founder and chairman of Sinclair Research Company, says that "the new set, and its successors, can achieve for television what the transistor radio did for wireless, and create a new one-per-person product".

The flat-screen television tube has the electron gun mounted at the side and deflection circuits which bend the beam through 90° to strike the faceplate. Apart from the tube, the new set uses a single integrated circuit which was designed by Sinclair Research in conjunction with the Ferranti electronics company.

The complex chip handles virtually all of the functions of the UHF TV set. It also automatically decides whether it is receiving a 625 or 525 line transmission and adjusts accordingly. A UHF/VHF version is under development.

Sinclair says that the miniature television set has been used successfully in trains and cars, but that he personally has little time to watch TV!

Left: Clive Sinclair with his new flat-screen TV receiver.

News Highlights

Australian University in Space Shuttle experiments

The 17th flight of the US Space Shuttle in August this year will signal the start of a major experiment involving the University of NSW in the search for underground water in arid areas of Australia.

On board the Shuttle will be an advanced radar system which can gather images of the earth's terrain and actually look below the surface in extremely dry regions. Called "Shuttle Imaging Radar – B" the system uses the movement of the orbiting spacecraft to create what is in effect a very long antenna, achieving a resolution of around 25 metres on the ground, from an altitude of about 230km.

The SIR-B experiment is the third spaceborne imaging radar to be orbited, following a Seasat satellite mission in 1978 and a Space Shuttle flight in 1981. The first Shuttle flight of the radar raised the possibility that the system could aid the search for undergound water, returning high resolution images of buried watercourses in the Sahara and the Menindi Lake area of NSW.

The University's Centre for Remote Sensing in association with the Schools of Applied Geology, Electrical Engineering and Computer Science, Geography and Surveying have been selected by NASA to participate in the Space Shuttle radar experiment as one of 44 experiments chosen from almost 200 proposals worldwide.

SIR-B returns data in digital form of images taken from a variety of angles, giving a detailed view of the topography of the area scanned. Dr John Richards, director of the Centre for Remote Sensing, says that the experiments should produce data similar to that obtained for the Sahara. Fowlers Gap, 100km north of Broken Hill, the Macdonnel Ranges and the Mildura/Pooncarrie regions have been selected for the tests.

"The experiment involves interpreting radar imagery from these regions in order to evaluate the potential of using the data to locate underground water courses and to assess its viability in managing the State's arid zone. The latest advances provide images which enhance the contrast of the topography and allow patterns to be seen which are not visible through other imagery. The pulsed radar beam is reflected from water in the earth so that in wet areas there is good reflection while in arid regions the radar penetrates the ground until it is reflected by underground water".

The CSIRO and the Defence Research Centre in Adelaide will also participate in experiments using the radar system. In fact, of the 14 experimental packages from outside the United States aboard the Shuttle, three will be from Australian research teams.

Team leaders for four of the five experiments are (clockwise from left) Dr Geoffrey Taylor, Dr Tony Milne, Dr John Richards and Dr Bruce Forster.

US Solar Energy Show

From August 29 to September 1, for the first time, the US renewable energy industry came together in one trade event called RETSIE '83: Renewable Energy Technologies Symposium and International Exposition.

The event, which was held at the Anaheim Convention Centre, California, near Disneyland, was sponsored by the California Solar Energy Industries Association and the US Department of Commerce.

The renewable energy industry is a comparatively new one, spurred to a great extent by the oil crises of the mid 70's. Of this young industry, the heating sector (domestic hot water, space heating, swimming pool heating) is the most developed due to its relatively low technology.

Of the 231 exhibitors, 45% (103 exhibits) were in this field, including familiar Australian names like Solahart and Solar Edwards. Other exhibitors in this field were manufacturers of special coating materials to enhance the heat capture of the solar collectors, various storage tanks and insulating materials, and electronic controllers.

The most interesting product in the heating field was the Pulstar electronic controller. Unlike Australia, where thermosyphon systems are most popular, the American home owner prefers an active system with the storage tank at ground level and only the solar collector on the roof. This system requires a circulating pump and some sort of controller, hence the term "active system". The simplest method is to use a mains powered circulating pump coupled to a time clock. The use of a photovoltaic module to run a DC pump seems ideal since it eliminates the

Australian modification for the Hornet?

Informed Washington sources state that Pentagon officials may accede to intense lobbying by a group of retired admirals from New York, and order immediate feasility studies into the possible introduction of an Australian designed modification to all USN and USMC Hornets.

Without this device, the admirals insist, the United States will become a second-rate sea power by 1987.

Dubbed the Kinetically Energised Equipment Levitator (KEEL), this revolutionary development is said to provide dramatic improvements in

controller (pump only runs during daylight hours) and gives independence from the mains electricity supply. The drawback up to now has been the cost of the PV module and to a lesser extent, the cost of a DC pump.

Now, Pulstar has come out with a system which uses a much smaller PV module, 7 Watt compared to the more common 20 or 30 Watt module. During low light intensities, the stored energy is converted into a pulse train which drives the stepper motor on the pump. As the light intensity increases, so does the pulse frequency, thereby creating a good match between available solar energy and water flow.

The next biggest group of exhibitors (34) were organisations and societies. These ranged from trade organisations and government bodies to publishers of various journals etc.

Photovoltaics and related equipment was next with 21 exhibitors. The small number in this category relative to the heating group indicates the difference in technology levels. PV is still a high technology product which requires a lot of capital and technical expertise for manufacturing.

Three companies, including the Aerospace Co and Martin Marietta Corp, displayed concentrating PV systems. Typically, sunlight is magnified 100x using plastic fresnel lenses and concentrated on 3 x 3cm solar cells. Some systems have passive cooling while others are water cooled. Microcomputers are used to control the two-axis tracking.

Concentrating systems are economical for large systems like village power stations, independant power utilities or water pumping for irrigation.

Wind generators were shown by 17 exhibitors, mostly showing large 30 to 150kW units.

In 1978, the US government passed the PURPA act. This "Public Utilities Regulatory Policies Act" allows small renewable energy power producers to connect to the mains utility grid and be paid a reasonable rate for their excess electricity. This applies both to residential and business users.

Since PURPA, "wind farms" have become a viable business producing electricity and selling it back to the utility companies. In California alone, some 1200 wind turbines were installed in wind farms last year. The American Wind Energy Association expects the total installed capacity to exceed 120 MW by the end of 1983.

Although PURPA also includes photovoltaic generators, the higher initial cost of PV makes it much less viable at this stage. However, the technology to generate high power levels using PV is already available. This was shown by ARCO Solar with a 1MW power station near Hesperia, Southern California.

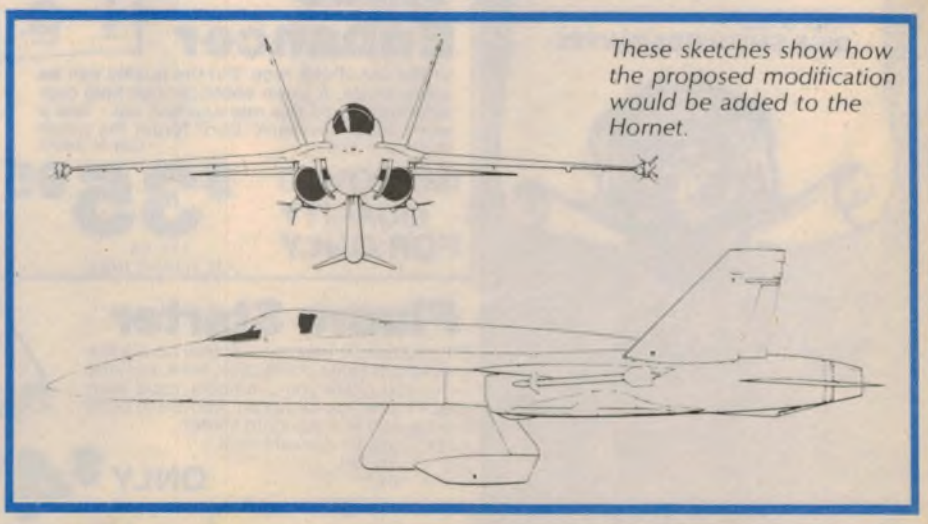
The renewable energy industry is a young but fast growing industry in the USA. It currently supplies more total energy than the 72 nuclear power plants, but this is still only 6.3% of the $US energy supply. In monetary terms, sales of all renewable energy products and equipment in 1983 will surpass $US5 billion.

Australia will also see a growth of this young industry and benefit from the technological advances made in the USA. (Report by Jim Kuswadi, Amtex Electronics).

performance throughout the whole flight envelope. In particular it increases maximum speed down wind and vastly improves turn radius and acceleration in a dog-fight situation.

The inventors of the system, Lexcen Aviation Pty Ltd, are jubilant over this Washington development as it promises enormous earning potential under current AIP offset programs.

McDonnell Douglas engineers are meanwhile working around the clock in order to perfect a complementary modification, the Somewhat Taller and Improved Landing and Take-off System (STILTS), without which the full potential of KEEL might not be achieved. [From "Hornet Report," courtesy McDonnell Douglas (Australia) Pty Ltd].



These sketches show how the proposed modification would be added to the Hornet.

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Superb design uses the latest IC technology. The low component count makes it very reliable and easy to build. It will measure frequency to 500MHz (with optional pre-scaler – see left) and period both with a 7 digit resolution. It rivals the performance of commercial units costing many times the price! **Cat K-3439**

- **Huge, bright high efficiency, 7 segment display.**
- **3 frequency ranges, 0-10MHz, 0-50MHz, 10-500MHz (with optional pre-scaler).**
- **4 gating times, .01, .1, 10 seconds.**
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- **High input sensitivity, 10mV to 30MHz, 10mV to 50MHz @ 1M input impedance.**

QUALITY FOR ONLY **$115**

Pre Scaler FOR ABOVE

Improve the performance and increase the range of your K-3439 Frequency Counter to a more professional range of operation . . . 10 - 500MHz. This kit adapts easily to the existing frequency counter PC board.

Cat K-3432

$31.50

SEE EA DEC. 1981

$79

Function Generator

An essential piece of test and design gear for all hobbyists, amateurs, service technicians, engineers, etc. Produces sine, triangle and square waves from below 20Hz to 170kHz with a very wide range of output levels too. Case shown is included.

Cat K-3520 SEE EA DEC. 1982

SUPER SIREN

A great little screamer!

This siren has got an ear-splitting sound, yet it is compact and draws very little current. It uses a piezo-electric tweeter, which can be soldered directly to the PC board. Ideal as an equipment malfunction alarm, intruder alarm or car alarm (separately powered and not dependent on the car battery).

Cat K-3505
SEE EA NOV. 1982

AMAZING VALUE **$19.95**

Video Enhancer

VCR's are all the rage. But the quality can be pretty crook. A video enhancer can help considerably. Build this one and find out – and it won't break the bank! Don't forget the patch over your eye . . .

Cat K-3463

IMPROVED QUALITY FOR ONLY **$35.95**

See EA OCTOBER 1983

Fluoro Starter

This substitute electronic starter solves the problem of lights going blink, blink, blinkety blink and gives you a smooth rapid start EVERY time you switch on. And all the parts are housed in a standard starter case! Outlasts conventional starters by far!

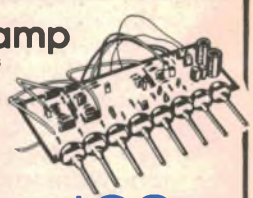
Cat K-3082

ONLY **$4.50**

See EA OCTOBER 1982

HOLIDAY PROJECTS TO SINK YOUR TEETH INTO

Mixer Preamp



This unit has 4 inputs with an impedance of 100K – suitable for most mics, guitars, etc. Ideal for use with power amp modules up to 300W. Provides bass, treble and presence control.

Cat K-3035
SEE ETI JULY 1980

VALUE **$29.50**

50W Amp Module

Ideal for home stereo systems. The compact design makes this module the obvious choice wherever a medium power general purpose amp is required. Input sensitivity is 500mV.

Cat K-3440
SEE ETI DEC. 1976

ONLY **$19.95**

100W Amp Module

100W RMS: 5kHz - 50kHz at 100dB signal to noise ratio. The ultimate in simplicity; even the power transistors mount on the one PCB. Ideal for the home constructor or technician who wants to 'roll his own' amplifier system for the home or professional use.

Cat K-3442 SEE ETI DEC. 1976

$25.00

ETI 480 PS Power Supply

Full PCB and component kit for one K-3442 or two K- 3440 modules (above). Supplied complete with speaker de-thump relay and Zener regulated plus and minus 15V preamp rails.

Cat K-3438
SEE ETI DEC. 1976

VALUE **$19.95**

NEW

TV SERVICEMEN BUILD-IT-YOURSELF BARGAIN!

TV Pattern Generator

A bargain for the serviceman, technician, hobbyist, etc. We had one of these 5 years ago and sold thousands! Now here's a brand new kit giving crosshatch, dot and raster for fast and simple convergence, etc.

SEE EA NOV. 1983 **Cat K-3472**

EXCLUSIVE VIDEO MODULATOR INC. IN THIS KIT

ONLY **$29.95**

YOUR OWN CASINO!

The Dick Smith

Electronic Roulette Wheel

PLAYING MAT EXCLUSIVE TO DICK SMITH

Wow! All the fun and excitment of Las Vagas . . . Wrest Point . . even Forbes Street. Now you can have a completely random roulette wheel – without the bias of some commercial units.

Cat K-3389 SEE EA MAY. 1983

AMAZING VALUE AT **$29.50**

A GAME OF SKILL!

Leds & Ladders

A game of skill which is not only a lot of fun to play, but which also gives you a chance to improve your reflexes. Can you climb out of the well without being dumped back in? Easy to construct, the kit comes with all parts required and full instructions. Also included is a specially printed foil label for the box. **Cat K-3390**

VALUE AT ONLY **$16.50**

SEE EA AUG. 1980

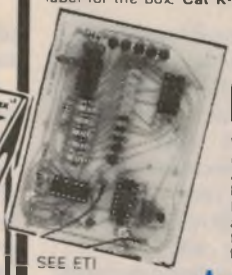
The not so random Breath Tester

Beware boys in blue and booze buses bailing belligerent Brabhams blowing bad breath into bags before banning. Check out our breath tester kit – it could be the answer to your broblems!

Cat K-3391

See EA May 1983

ONLY **$29.95**



SEE ETI AUG. 1983

Alien Invaders

Wow! You could save the earth from those pesky aliens..... and on a kit you built yourself! Multi-level LED display, easy to build and battery operated. Fantastic for Christmas gifts for technically inclined kids.

Cat K-3393

ONLY **$15.95**

MORSE PRACTICE SET

Thinking of becoming an amateur radio operator? If you are, you'll need to be able to send and receive perfect Morse at a speed of 5 words per minute (or 10 words for a 'full' licence) before you can pass the amateur operator's licence examination. This Morse Practice Set will help you learn the code, and achieve the speeds necessary.

PREPARE FOR AOCP EXAMS . . .

Cat K-2623

ONLY **$4.50**

SEE FUNWAY 2 BOOK

IT WILL AMAZE YOUR FRIENDS!

Electronic Door Chime

An exclusive design, this unit plays a different tune every time you press the front door button. Perhaps you like one tune in particular, this is also possible. Everything you need is supplied in this great kit.

Cat K-3502

ONLY **$31**

SEE EA SEPT. 1979

IT'S AMAZING

Stereo Simulator

Wish those old video movies had modern stereo sound? This low-cost gadget turns almost any mono signal into amazingly good synthetic stereo!

Easy to build, too!

Cat K-3421

See EA April 1983

$19.95

SOUNDBENDER

With this great little kit you can sound like a Dalek, a Darth Vader, a Cylon, or any one of a dozen robotic spin offs! Cat K-3509

ONLY **$24.50**

ETI FEB '82 WAS **$29.50**

BUILD YOUR OWN

Phoney Patch

SEE ETI MAY. 1983

Phone patching is legal from November 1st. Build your own phone patch and save a fortune . . . very simple kit, suits most transceivers. Compare our price with built-up units.

Cat K-3054

$59.50 Not Telecom Permitted

THE AMAZING

Musicolour Mk IV

The latest model Musicolour combines all the features of Musicolour III and Light Chaser, plus much more. Chaser plus 4 chase patterns, plus automatic and reverse modes for startling effects.

Cat K-3143 SEE EA AUG. 1981

$99.50

FOR YOUR CAR!

IMPROVED! Car Alarm Mk 2

SeeETI JULY 1981

The Car Alarm Mk 2 uses a different triggering technique – one that makes it less prone to false triggering! It will detect a current flow ANYWHERE in the vehicle's electrical system.

Cat K-3253

WAS **$28.50**

$22.50

Transistor Assisted Ignition

Ideal for use in all conventional ignition systems this revised unit adds to stability and gives higher energy. Housed in a die-cast box with deluxe radial fin heatsink for best possible performance. **Cat K-3301**

SEE EA FEB. 1983

$34

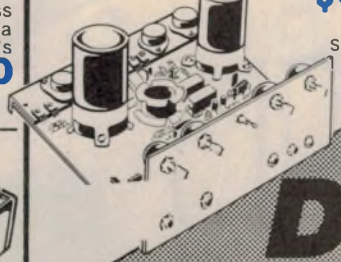
150W Mosfet PA/ Guitar Amplifier

Guitar and public address amplifier utilising ETI's 499 Mosfet 150 watt power amplifier module as published in ETI March, 1982. Comes complete with pre-amp PCB and special Hitachi mosfets 2SJ49 and 2SK134.

Cat K-3525

$119

SEE ETI MARCH/ JUNE. 1982



DICK SMITH Electronics

See Page 98 for full address details

A87B/GT

Telecom's mobile

Telecom's new cellular mobile telephone system has all the facilities of conventional wired telephones. Here's a look at how this advanced system works.

Telephone engineers have long sought to extend their conventional wired telephone network into the mobile field; to cars, boats, aircraft, and even lightweight pedestrian sets. Many approaches have been tried over the last 30 years, but it is only recently that a system giving all the facilities of a wired telephone has become a reality.

In the past, mobile telephone systems have employed one or two VHF channels on a simplex (press-to-talk) basis. Calls originating from a telephone had to be manually connected to the radio base and an appropriate selective calling code initiated to alert the mobile subscriber. The call would then proceed in a more or less normal manner, except that the mobile subscriber had to operate on a press-to-talk basis.

When a call was initiated from a vehicle, it was answered by an operator who noted the wanted number, dialled it, and then patched the circuit through to the radio system. It was, at best, a time consuming arrangement.

But the real snag was congestion. Since all subscribers had to share one or two channels, there were many occasions when a subscriber had to wait for long periods before a channel became available. A further restriction was that, even if several channels were used, any individual vehicle could use only the one channel for which it was programmed. While that channel was occupied, all other vehicles allocated to it could not use the system even though other channels might be clear.

Because of these limitations, it was necessary to severely limit the number of subscribers. As a result, there was always a waiting list and what amounted to almost a black market in mobile telephones.

Then, a few years ago, overseas engineers, mainly in the United States, adopted a completely different approach to the problem. First, they moved from the VHF band, typically around 160MHz, to the UHF band and as high as 900MHz in some cases.

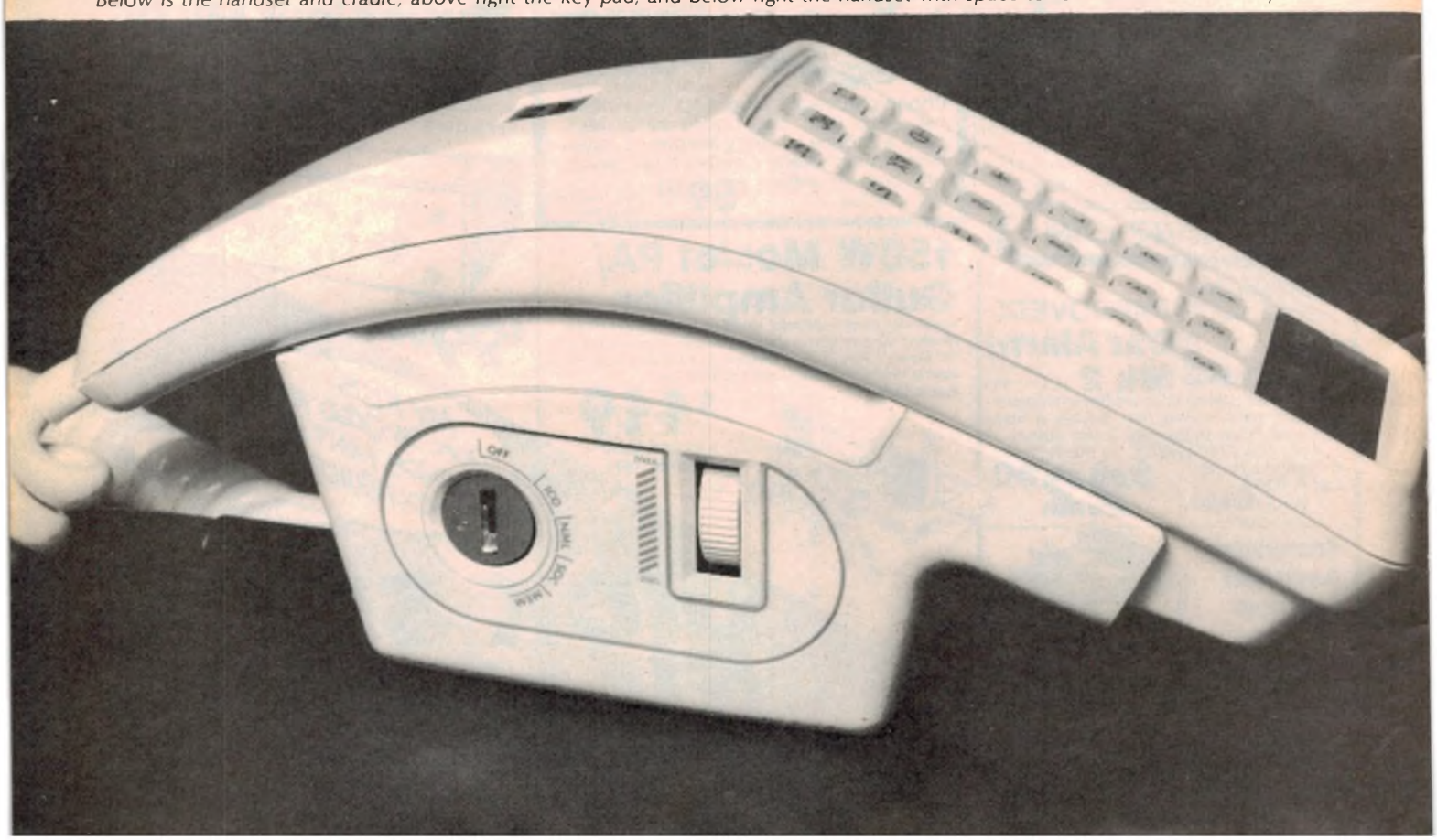
This had the advantage of making many more channels available – typically 100 or more – and of allowing two separate frequencies for each channel, one for the out-going signal (base to mobile) and one for the incoming signal (mobile to base). This permits normal duplex operation and does away with the press-to-talk requirement.

Limited coverage

On the negative side UHF has the disadvantage of limited coverage, particularly in rugged terrain or heavily built-up areas where tall buildings cast sharp RF shadows. To overcome this, the system uses multiple base stations, each one designed to cover a part of the total service area. These are called "cells" and the common term for this approach is "cellular system".

This system no longer restricts the vehicle to a single channel. It is capable of using any one of (say) 100 channels, the first vacant channel being selected

Below is the handset and cradle, above right the key pad, and below right the handset with space to list numbers in memory.

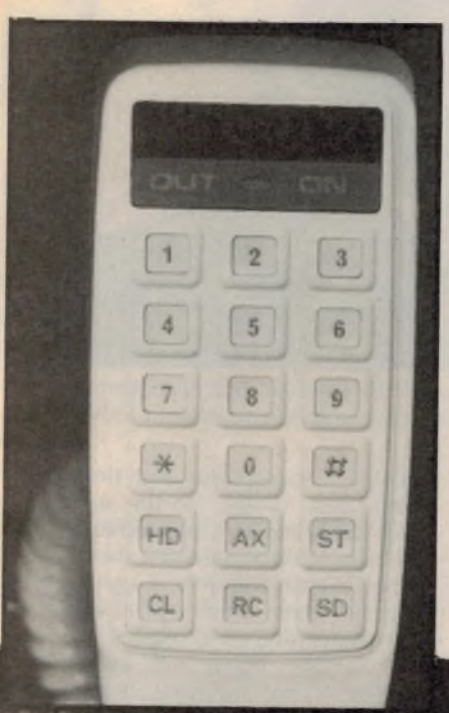


telephone system

by PHILIP WATSON

automatically. Thus, a subscriber might be allocated channel 10 in a slack period, or channel 90 in a busy period.

Finally, they added a dialling system which allows the mobile phone to work directly into the telephone network and call any number, including those requiring trunk or overseas circuits, with no more effort or delay than using a normal phone.



That, in very general terms, is how these systems work. But the various firms who have pioneered them differ in their approach to various problems, so that individual systems vary considerably in detail. The system used by Telecom Australia was designed by the Nippon Electric Company of Japan (NEC) but is made in Australia by NEC Australia Pty Ltd.

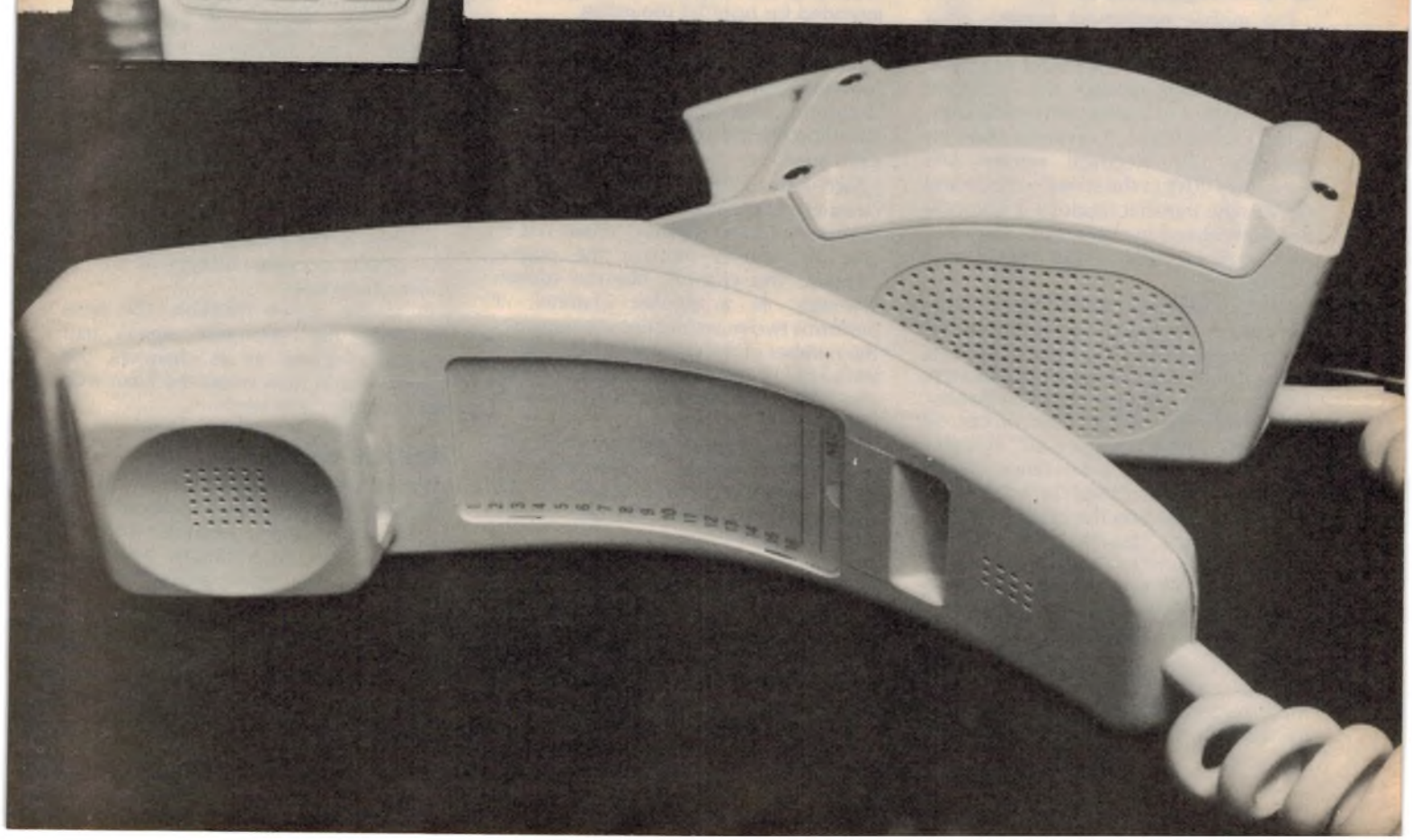
The Telecom system as currently installed in Sydney and Melbourne operates in the 500MHz UHF band. Each channel uses two frequencies, 10MHz apart, to provide full duplex operation. These systems initially employed 47 channels and were designed to accommodate 2000 subscribers, with the capability of upgrading to 120 channels and 4000 plus subscribers. They are currently being upgraded to 96 channels.

In the Sydney area there are currently five base stations: at Telecom House in the city, Waverley, Dural, Bilgola Plateau, and Cecil Park. Unfortunately, due to Sydney's rugged terrain, there are still some spots which present difficulties

and Telecom is planning to install two more bases, one on the Channel 7/10 tower in the Artarmon area and one at the telephone exchange at Hurstville.

Melbourne is more fortunate in this regard in that it is flatter and has a nearby mountain range. It has three bases: one at the Lonsdale exchange, one at Dunns Hill, and one on Mt St Leonard.

The system is also available for boats and, in Sydney, the coverage is from



Telecom's mobile telephone system

Shauna Wilson uses the mobile telephone to book a customer for her Hansom cab in Sydney's Rocks area.

Another satisfied customer. Stephen Hatcher, plumber, of Casula is the 1000th mobile telephone customer in NSW.

Terrigal in the north to Bundeena in the south, and approximately 70km out to sea. In Melbourne, it can be operated from anywhere in Port Phillip Bay.

Mobile equipment

The mobile equipment consists of a transceiver, a handset assembly, and an antenna. The transceiver features a 10W transmitter and includes the necessary logic circuitry to identify incoming calls, select channels, etc. It operates from the vehicle's 12V electrical system and consumes 20W in the standby mode and 88W in the transmit mode. It is normally accommodated in the vehicle boot but can be fitted behind the front seat if necessary.

The handset and cradle is fitted within easy reach of the driver. The handset carries a pushbutton keyboard consisting of the usual 10 numerical keys, plus eight function keys. There is a readout display, with which the dialled number can be checked, a green "power on" indicator lamp, and a red "out-of-range" lamp. Numbers may be dialled "on-hook" – ie, with the handset on the cradle.

An optional auxiliary call facility enables the vehicle headlights, horn, or other signal to be activated when the driver is absent from the vehicle.

The handset stores the last number dialled and, if a call is unsuccessful, the number can be re-dialled by pressing the recall button. It can also store up to 16 frequently used numbers which may be recalled by keying the appropriate address number (one to 16) and pressing the recall key.

Two antenna types are available, one having 2.5dB gain and intended for roof mounting, and one with 4.5dB gain and intended for boot lid mounting.

In operation the system works like this. From the total number of channels (96 at present) each base is allocated a certain proportion, the exact distribution being based on the projected traffic density for each area.

Each base station also has a paging channel and this is the same (say channel one) for all base stations. When not in use, all mobiles monitor the paging channel. This channel, like the speech channels, is a duplex channel. It performs two main functions: it transmits the number of the wanted vehicle, and it transmits a list of available access channels (more about access channels later).

In addition, it provides the mobile with a continuous check to show that it is within range of a base station. If the paging channel is lost the red "out-of-range" lamp will glow.

Let us assume that a call has been initiated from a telephone to a vehicle. The dialled number will appear on the paging channel and the mobile equipment, if it is switched on and within range, will hear it and respond on the duplex channel.

Any, or all, of the base stations could receive this response and the control centre then "votes" on the strength of each signal and allocates a channel from the base which is receiving the strongest signal. It then transmits a signal on the paging channel which says, in effect, "Go to channel (say) 25 to receive your call." The mobile equipment switches to channel 25 and transmits its number to permit base confirmation.

The base acknowledges that it recognises the number (a so-called "handshake" condition), instructs the mobile equipment to generate ringing tones in the handset, and completes the connection to the telephone line. The presence of the ringing tone is the first the vehicle occupant knows of any of these procedures!

If, in the above situation, the base receiving the strongest signal had already allocated all its channels, the system would then select the base with the next strongest signal.

Vehicle calls

When a call is initiated from a vehicle the sequence is somewhat different. As well as the paging channel which is common to all base stations, each base station has a duplex access channel which is exclusive to it. That base can be accessed via that channel while ever it has any vacant speech channels. When all speech channels are occupied, and there is no role for the access channel as such, it becomes a speech channel.

Making it harder for the eavesdroppers

One problem with any telephone circuit that uses a radio link is that of privacy. Anyone with a suitable receiver or, more particularly, a scanner, can eavesdrop on such a circuit. In this regard Telecom warns all subscribers to the mobile system that the circuit is not private and that they should exercise discretion in what they discuss.

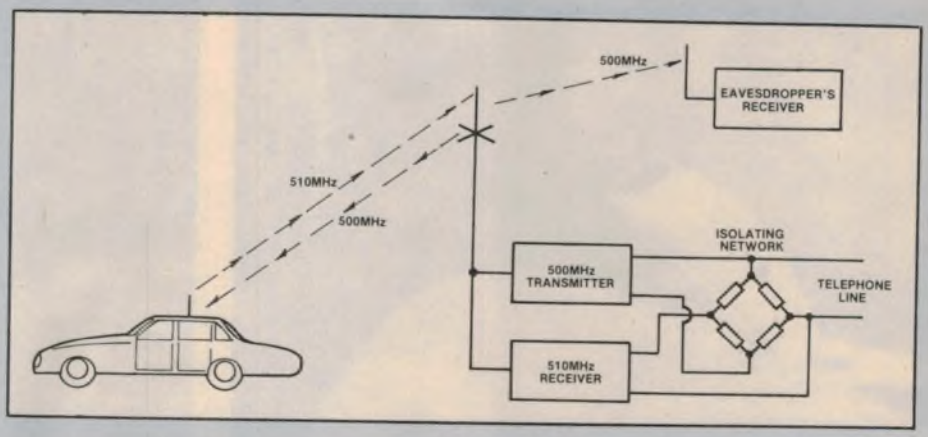
While some eavesdropping may be malicious, ie, undertaken with intent to defraud or embarrass, most is likely to be based simply on curiosity. But, either way, it is undesirable.

As far as the malicious eavesdropper is concerned, the random selection of channels tends to be a deterrent; any one subscriber is likely to appear on any channel and, even with the aid of a scanner, it would be a full time job to monitor the band and check each call until the wanted party is recognised.

The curious eavesdropper, on the other hand, is likely to listen to the first conversation he picks up. In this regard, until now, he has been encouraged by the fact that, even though he intercepts only one channel of the duplex pair, he can still hear both sides of the conversation.

To understand how this comes about it is necessary to consider an important difference between the radio link and the telephone line. The telephone line conveys the voice signals in both directions on a single pair of wires; a "two-wire" circuit in telephone parlance.

The radio link, on the other hand, conveys the two voice signals on separate channels; a "four-wire" circuit in telephone parlance. It is at the base station, where the "two-wire"/"four-wire" conversion takes place that a degree of undesirable coupling occurs.



The telephone pair has to be connected to both the output of the base receiver, to receive the incoming signal from the mobile, and to the input of the base transmitter, to transmit a signal to the mobile. Which means that the output of the receiver is effectively connected to the input to the transmitter.

This means that a voice signal from the mobile will travel to the base on one frequency and, as well as going down the telephone line to the telephone party, will also go back to the mobile via the other frequency channel. Thus the caller in the car will hear his own voice come back to him. This effect is known as sidetone.

All telephones produce some sidetone, and most telephone engineers regard it as psychologically desirable, to a limited degree, to give the impression that the phone is alive. In the case of the mobile base station there is an isolating network (sometimes called a "hybrid" circuit) designed to allow the telephone line to be connected to both the transmitter and the receiver, without the output from the receiver being able to reach the transmitter.

The only snag is that it is not completely effective; some signal still finds its way back to the mobile, though at a much reduced level. This state of affairs was more or less deliberate; designed to provide an effective level of sidetone. Unfortunately, it also helps the eavesdropper to hear the other side of the conversation if he listens carefully.

To overcome this and, hopefully, to discourage the curious listener from listening at all if he can hear only one side of the conversation, Telecome engineers have recently modified the base station set-up to provide virtually complete isolation between receiver and transmitter, using echo suppression techniques developed for long distance trunk and overseas circuits.

The only minor complication which results is that the mobile user no longer hears any sidetone, and some people find this disconcerting. To overcome this Telecom engineers are modifying the mobile units to provide an artificial sidetone from within the unit itself.

Thus there will be times when not all access channels are available and, as mentioned earlier, the paging channel continuously transmits a list of those access channels that are available.

So let us assume that the vehicle occupant has dialled a number. The number appears in the display window, is checked, and the occupant then presses the "SD" (send) button. In fact the number is not sent immediately, but is held until a circuit has been set up.

When the send button is pressed the equipment refers to the list of available access channels, interrogates each one in turn, and notes the respective signal strengths. Selecting the base with the strongest signal, it uses the access channel to transmit a request for a speech channel, together with its mobile number. The control centre allocates a vacant speech channel and instructs the mobile equipment to switch to that channel.

When it does, there is a further confirmation sequence (handshake) and the stored telephone number is then transmitted directly into the telephone network. The occupant hears the ringing tone from the called phone and the called party's voice when they answer.

But the system does not abandon the circuit at this stage. It continues to monitor the signal strength from the mobile in case the vehicle should move out of range of the assigned base station. The system sets a level of 10dBμ (10dB above 1μV, or 3μV approx) below which signals become suspect.

If an incoming signal should drop below 10dBμ for eight seconds or more, the system initiates a "hand-off" sequence. In general terms this means that it looks for a base which can receive a stronger signal, sets up a new speech

Telecom's mobile telephone system

A typical handset and cradle installation in a modern car. The slightly angled mounting favours the driver's viewpoint.

This shot, of the same installation, emphasises the compact nature of the handset and its ease of operation.

channel from that base, then "hands off" the call to the new channel.

In greater detail, the sequence is as follows. The control centre, having sensed a suspect signal, transmits a signal to the vehicle which says, in effect, "Go to the paging channel for possible hand-off instructions". At the same time it disconnects the speech channel, but holds the telephone circuit.

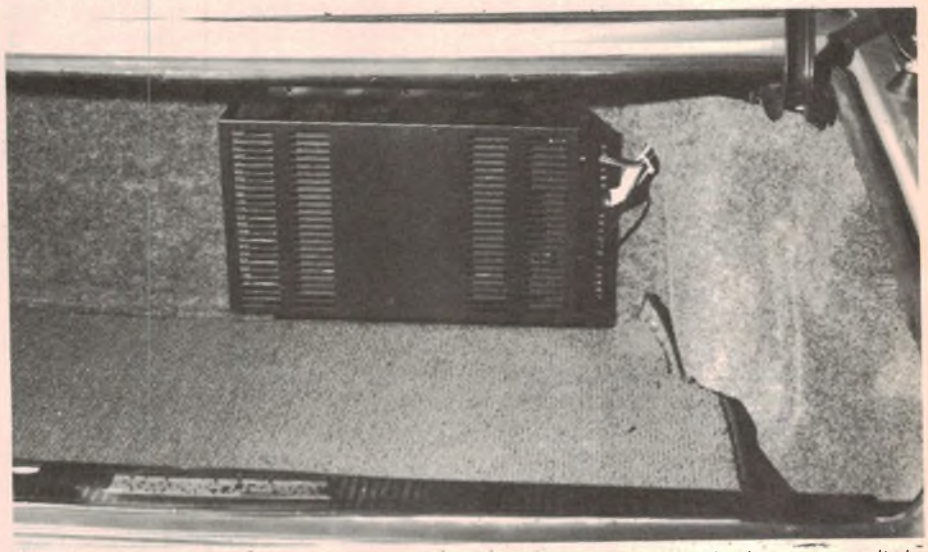
The mobile takes note of the channel currently in use and memorises it, then switches to the paging channel. At the same time the mobile user hears a warning tone, indicating what is happening. There is no tone for the telephone user, but Telecom engineers are planning to provide this.

When the mobile switches to the paging channel it announces its presence and transmits its number. All bases within range receive the signal and report the signal strength to the control centre. If one of these bases reports a signal which is 5dB better than the previous signal the control centre will set up a new channel on that base, instruct the mobile accordingly, check that the mobile identifies itself on that channel (handshake) then restore the telephone circuit.

The whole process takes about two seconds.

In the event that no better circuit is available, or that the circuit is lost in the hand-off process, the system automatically reverts to the original channel.

The mobile system has now been in operation for over 18 months and has proved to be highly reliable. Users range from business executives to small businesses, and includes a Hansom cab operating in Sydney's Rocks area. All are enthusiastic about the service and the money it saves. At the time of writing both Sydney and Melbourne have about 1300 subscribers.



The complete transceiver, installed in the boot. It is compact and takes up very little space. In commercial vehicles it can be installed behind the front seat.

As well as the current upgrading of the Sydney and Melbourne systems, plans are under way for systems in Brisbane, Adelaide and Perth. Brisbane and Perth should have a limited service before the end of 1983, and all should have a full service before the end of 1984.

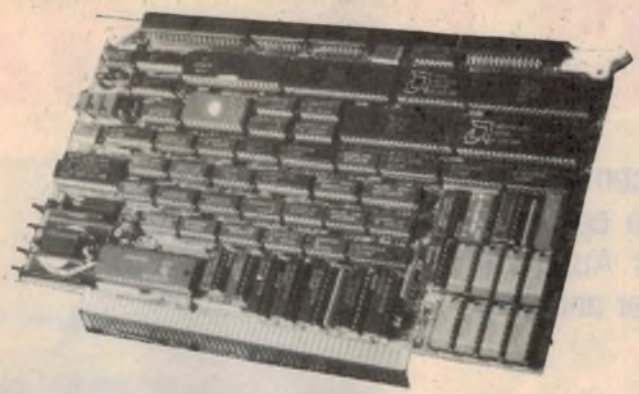
What it costs

The cost structure for the mobile systems is as follows. The mobile equipment may be either rented or purchased outright. Rental costs $1000 per annum, and the purchase price is $3990. There is an installation charge of $150. Regardless of which option is chosen there is an annual network subscription of $800 and this includes maintenance on the mobile equipment. Call charges are based on the minimum STD rate for three minutes, varying with the time of day, ie, day rate, intermediate rate, or night rate.

And what of the future? Technologically, the next step appears to be the development of a personal unit, similar to and not much larger than a typical amateur hand-held two-metre unit, which could also work into the system.

Australia's Telecom engineers are watching these developments closely in the hope that it may not be too long before they can be introduced into the present system.

In conclusion we would like to acknowledge the very considerable assistance we received from Telecom's Sydney Public Relations office, and Sydney and Melbourne engineering staff, in preparing this story.



MORE THAN JUST A CPU

The CPZ-48000 From Intercontinental Micro Systems

A HOST OF USES

The CPZ-48000 will act as more than a CPU. Use it as a multi-user-tasking host, a multi-processing host or a CPU with high speed serial data link capability for network architectures. It will also act as a highly sophisticated single board system.

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- ☐ IEEE 696.1/D2 S100 compliance. The CPZ-48000 will interface with most IEEE S100 bus products on the market.
- ☐ Z-80A,™ 4Mhz Operation.
- ☐ Floppy disk controller (FDC) with onboard data separator. Single or double sided. Single or double density. 8" or 5¼". The choice is yours.
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- ☐ Four channel DMA controller.
- ☐ 64K on board RAM. Bank selection puts 4K-64K under software control.
- ☐ Memory management unit (MMU). Addresses up to 16 megabytes of system memory.
- ☐ Eight vectored priority interrupts are chained with serial and parallel I/O interrupts for use with Z-80A mode 2 interrupts.
- ☐ Provisions for 2K or 4K onboard EPROM. A boot up function and monitor in a 2K EPROM is supplied.
- ☐ Software selectable baud rates.
- ☐ IBM Bisync, HDLC, SDLC and other protocols. All are handled through a Z-80A SIO chip.
- ☐ CP/M,™ MP/M™ and Turbo-DOS™ operating systems available.
- ☐ Turbo-Disk® implementation included.

Leading Edge S100 Slaves

From Intercontinental Micro Systems

LEADING EDGE? EVERYONE SAYS THAT. PROVE IT.

When you read the features, the specs and the description, we're betting you'll be impressed by the capabilities of our CPS-MX slaves. Compare them to any of the competition. And when you discover our prices, we hope you'll allow us to help you with your distributed processing needs.

FEATURES

- ☐ IEEE 696.1/D2 S100 bus compliance.
- ☐ Compatible with CPZ-48000 SBCP, any Z-80A based CPU with extended address capability or 16 bit based CPUs complying with IEEE 696.1/D2 bus specification.
- ☐ Z-80B™ 6 Mhz (CPS-6X) or Z80A 4Mhz (CPS-4X) operation.
- ☐ Two synchronous (CPS-MS) or asynchronous (CPS-MA) serial I/O ports.
- ☐ TURBOdos™ & CP/NET™ compatible.
- ☐ Master confiscation of slave memory for diagnostic purposes.
- ☐ Two parallel I/O ports; eight data bits + 2 handshake lines per port.
- ☐ 64 Kbytes of onboard dynamic RAM.
- ☐ Master/slave memory-to-memory transfers under DMA control @ 571 Kbyte/sec transfer rate when used with CPZ-48000 SBCP.
- ☐ Software selectable baud rates.
- ☐ Usable as an intelligent I/O processor in single user systems.

FEATURES ARE FINE BUT IT'S PERFORMANCE THAT COUNTS.

The model CPS-MX slave processors are Z-80A (4Mhz) or Z-80B (6Mhz) based single board computers compatible with TURBOdos and CP/NET distributed processing operating systems.

CPS-MX slave processors together with an S100 bus master (host) like Intercontinental's CPZ-48000 SBCP, constitute a high performance, high throughput network which can be integrated into most S100 bus mainframes. Master/slave communications take place over the S100 Bus via slave/host bidirectional memory transfers under control of the host processor. In an architecture where the host is the CPZ-48000 SBCP, those memory transfers may take place under direct memory access (DMA) control. The data transfer rate under DMA is 571 Kbytes/sec which is a 300% increase in speed over Z-80A block move rates. Data transfer rates in non-DMA mode are one-half of the maximum transfer rates for I/O mapped slave processors. Data transfer rates in DMA mode are up to one-sixth of the maximum transfer rates of I/O mapped slave processors.

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MONITOR DYNAMICS designed the HDC-1010 series Easy Disk Controllers to interface a maximum variety of Winchester Disk Drives to any S-100 system with a minimum of complexity. The HDC-1010 interfaces to many types and sizes of drives — 5¼ inch (Seagate ST-506), 8 inch (Shugart SA-1000) and 14 inch (SA-4000) compatible, including 8 inch Memorex/Fujitsu drives. The New World Computer Mikro Disk** (5¼" and 8") Drives are supported by the HDC-1110 Controller. Only four switch selectable I/O ports are used, fully compatible with the IEEE-696 standard and all known variants.**

A single chip microprocessor, coupled with a simple, high-speed PROM based micro-controller provides bit-slice performance at a fraction of the cost and power consumption. Several innovative features reduce operation system overhead and drive size, including automatic seeking, soft error recovery, write verify and bad sector remapping.

A typical disk operation requires only the new ID parameters (if any) and a read or write command to be sent to the controller, which returns an error code upon completion. What could be easier?

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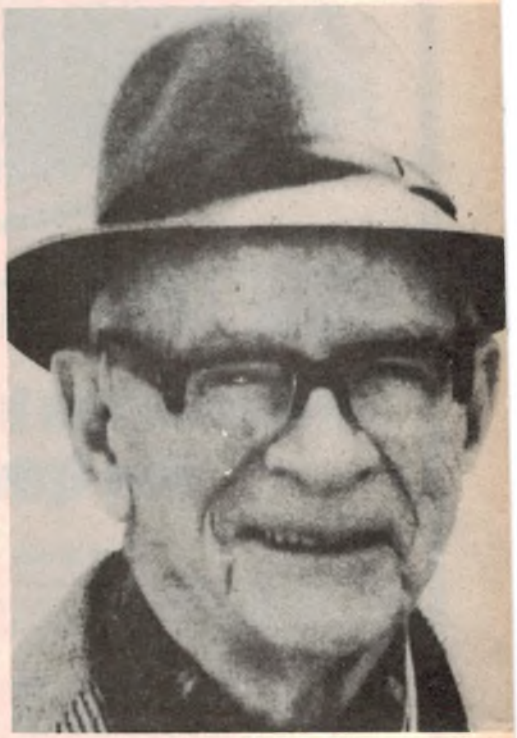
Arthur McClay – NZ

Arthur McClay of Auckland, New Zealand, commenced radio listening in 1911 when it was illegal to operate a receiver. Recently he related to "Electronics Australia" the story of his activities both as a radio listener and later, as a pioneer broadcaster.



Arthur McClay began his career in radio in 1911 – when listening to radio was illegal.

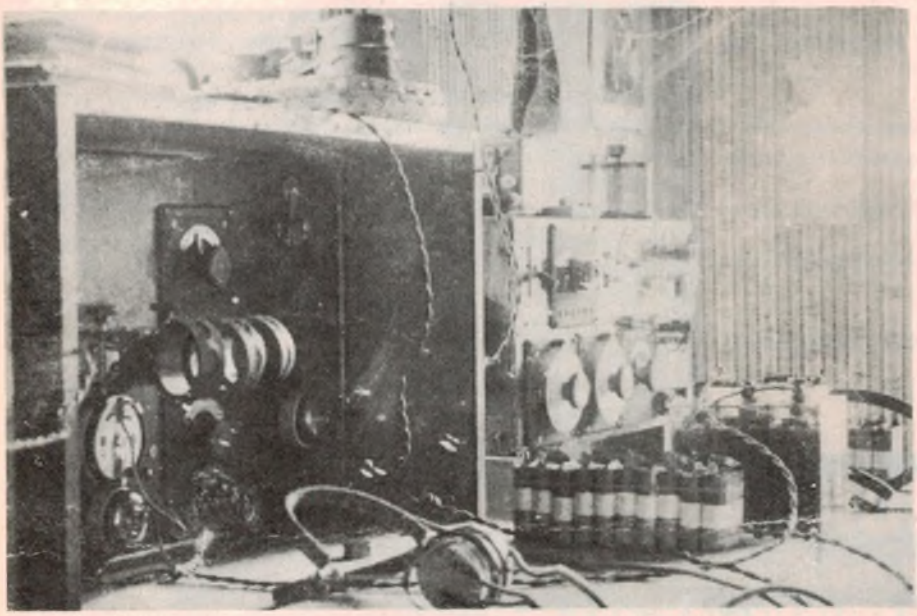
Today we take it for granted that our participation in many radio hobbies may be carried on without any restrictions, but in 1911 there was a fine of £500 for any New Zealander found operating a radio receiver. At that time, only an officer of the New Zealand Post & Telegraph Department was allowed to use receiving and/or receiving-transmitting equipment. In 1903 the NZPO had established a complete monopoly on both radio transmitting and receiving and there was no encouragement for any person in New Zealand to engage in the radio listening hobby.

New Zealand hobbyists were disappointed when, in 1911, citizens in other parts of the world were able to get a permit from their Post Office and take up radio listening experiments. The courage, vision, and determination of three young Wellington residents finally accomplished this listening facility for all New Zealanders.

At 85, Arthur McClay still vividly recalls his listening days in 1911, when he lived in the suburb of Newtown, Wellington. He had always had an interest in electricity and then learned of the possibility of transmitting and receiving. He had a two-roomed cottage attached to their home at 13 Gordon Place, Wellington where he began his hobby and this was used up to 1914 when radio operations were suspended during the war. Then, in 1922 through to 1925, the same site was the home of broadcasting station 2YK Wellington.

As a student of Wellington Boys' College in 1911, Arthur McClay was interested in press reports on advancements being made in Marconi telegraphic equipment and radio communications. He made up his mind he would learn all he could about this new marvel of science.

Pursuing the hobby in 1911 presented major difficulties, as it was not possible to legally purchase equipment or obtain books on the fascinating subject of wireless communication. Although wireless telegraphy was in its infancy, there were sufficient ships coming to New Zealand to encourage radio listening, but this was an offence at that time.



Honeycomb coil receiver at 2YK, New Zealand's first radio station.

The Post Office operated low powered transmitters in Auckland and Wellington and receiving and transmitting sites at Aranui in the North Island and at Awarua in the South Island. These two stations had remarkably good coverage, world wide. The ships coming to New Zealand used either Marconi or Telefunken radio-telegraphy systems.

Early in June 1911, while walking down a Wellington street at dusk, Arthur McClay saw a young man pulling up an aerial between two trees, with the lead-in wire running into the basement of a house. He was overcome with amazement, for here was a fellow enthusiast like himself. This resulted in his meeting with Brian Robinson who turned out to be a qualified electrician employed by Turnbull & Jones, electrical engineers of Wellington. He had built a receiver which was a perfect replica of the Telefunken shipboard receiving unit.

In the course of his work, Brian Robinson visited many of the overseas ships which were in port, where he met many ship's officers who, over the months, had supplied a great deal of equipment to him. One friend was Harry Tuson, who was a wireless operator on the "SS Ulimaroa", a Huddart Parker vessel sail-

radio pioneer

by ARTHUR CUSHEN

Bob Apperley (left) and Hugh Simpson, co-founders of 2YK Wellington.

Arthur McClay's home in Wellington, New Zealand, was the site of many early experiments, and in 1922 the location of the first broadcast station.

Brian Robinson was one of the first radio enthusiasts in New Zealand.

ing between Wellington and Sydney, and he procured anything the two enthusiasts required for their hobby.

Arthur McClay soon acquired a similar receiver and transmitter and became proficient in Morse sending and receiving but, aware of the severe penalties facing them, they never transmitted on the ship-to-shore frequencies. Utmost care was taken to keep the aerials out of sight in daylight hours and nightly transmissions in Morse were conducted between the two enthusiasts.

Early in 1912, another potential listener made himself known to Arthur McClay; Guy Tinney, employed by the Post Office as a landline telegraphist. The three enthusiasts began meeting on a weekly basis, chatting over what they had heard and comparing entries in their log books.

One severe stormy night in July 1912 Arthur McClay was awakened at midnight by his friend Guy Tinney, who was very agitated. He had been listening and had heard a vessel in distress, drifting towards the reef in Wellington Harbour. It was obvious that the gale had put out the Wellington Post Office receiving station and the distress messages had not been heard.

A decision had to be made, knowing that radio enthusiasts faced prosecution for possessing and using a radio receiving set. They decided that the vessel in distress was more important than any subsequent charges of illegal operation of radio equipment, and so the Post Office was informed. The ship and crew were safely brought into Wellington Harbour, following the action of the radio listeners.

The Minister of Justice was made aware of the fact that the law had been broken and a fine of £500 and confiscation of their equipment was possible, but he was convinced that such drastic measures were not justified and the listeners were exonerated. The three listeners were then issued with official radio receiving licences which had to be renewed each year and this brought about the introduction of radio listening on a recognised legal basis in New Zealand. In 1914 when World War I broke out, the Post Office requested that the equipment be dismantled and aerials taken down. Transmissions were silenced during those four years.

Plans for a post-war broadcasting network

After the war, Arthur McClay returned to Wellington and renewed his interest in radio. While on war service, Arthur became involved in radio transmission and when he returned to civilian life, was well prepared to continue his dream of operating a broadcasting station. He quickly visualised what radio broadcasting could do for New Zealand and its people as a means of communication and entertainment.

The New Zealand Post Office had drawn up plans for a national network and were looking for promoters to operate a monopoly type of broadcasting service with a 10 year contract. It was also envisaged that commercial broadcasting would be allowed as a secondary means of obtaining extra operational revenue.

Arthur McClay then applied for a broadcasting licence for three years so that experimental broadcasts could be undertaken. With a power of 15W, on 1090kHz, he felt he should reach the greater part of New Zealand during night time. The first broadcasts were to be four nights per week from 7.00-11.00pm and, in addition, the station could be used to transmit any special announcements as required.

At the same time, Professor Jack in Dunedin was experimenting with radio broadcasting and the signals from that station were also heard in Wellington. The Dunedin station subsequently became the responsibility of the Otago Radio Association, which still broadcasts a non-commercial program in Dunedin on 1431kHz, and recently celebrated 60 years of broadcasting with its slogan "Pioneer Radio".

Soon a band of enthusiasts gathered around Arthur McClay in preparation to launch 2YK Wellington. The station was given its licence and a United States company, the Federal Telephone and Electric Company, provided some of the vital equipment which was unable to be made in New Zealand. 2YK took the air in mid-July, 1922 as promised and the nightly transmissions were heard all over New Zealand. During the three years from 1922-25 a trio of enthusiasts, Bob Apperley, Hugh Simpson and Arthur McClay, gave up all their spare time and much of their finance to keep the station operating.

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SERIES 5000

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PREAMPLIFIER

$259

SPECIFICATIONS

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

POWER AMPLIFIER

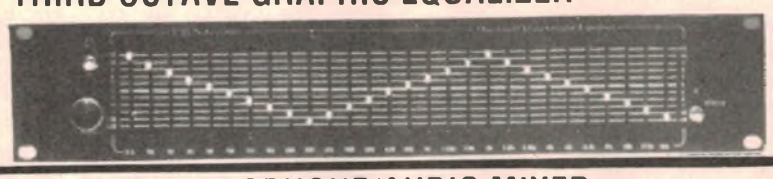
Please note that the "Superb Quality" Heatsink for the power amp was designed and developed by Rod Irving Electronics and is being supplied to other kit suppliers. This product cost $1 200 to develop so that your amplifier kit would have a professional finish as well as sound. We also have a new range of rack mounting boxes which will be released soon.

SPECIFICATIONS

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

$299

THIRD OCTAVE GRAPHIC EQUALIZER

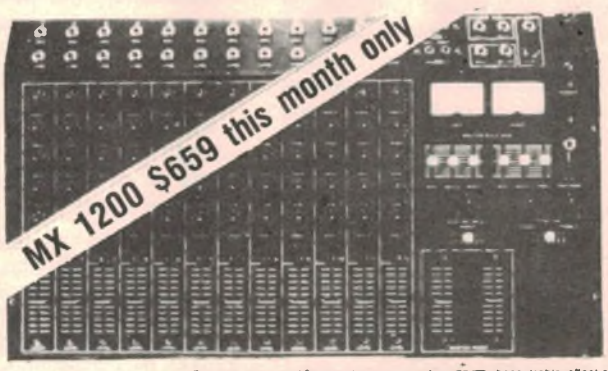


SPECIFICATIONS

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

1 unit $189
2 units $359

MX-1200 MICROPHONE/AUDIO MIXER



This unit features: 12 microphone line inputs with pan, bass, treble, effect and fold back controls for each channel ● LED peak indicators for each channel ● 2 turntable inputs with cross-fade and individual output controls ● master equaliser for bass, midrange and treble ● variable headphone output etc. etc ● complete with carrying case.

Rec. Ret. $759

SPECIFICATIONS
INPUTS
Level/impedance Mic 45 db 1K
Line 22 db 15K x 12
Phono 52 db 50K STEREO x 2 (2mv) at 1KHz
Effect Return/Aux 20 db 50K x 1
OUTPUTS
Level/impedance L & R 0 db 2K
Effect Send 0 db 2K F.B Out 0 db 2K
Head phone Stereo +10 db 600/100 1K
EQUALISATION
Channel
Bass ±15db
Treble ±15db
Master
Bass ±12db
Treble ±10db
Middle ±12db

FADER & CONTROLLERS
12 channel fader Side 60mm LOG 25%
2 Master fader Side 60mm LOG 15%
12 F.B Volume 300 LIN
1 F.B Master level 300 LIN
12 Effect Send 300 LIN
1 Effect Return 300 LOG 15%
2 Phono 300 LOG 15%
1 Head Phone 300 LOG 15%
S/N 58DB
FREQUENCY RESPONSE 20-20 KHz
TOTAL HARMONIC DISTORTION Less than 0.1%
METER 2 illuminated VU Meters 0db = 0.775V
PEAK INDICATOR 12 LED Peak indicators
VOLTAGE 240 VAC 50Hz
POWER CONSUMPTION 72 watts
DIMENSIONS 820(W) x 386(D) x 108(H)mm (supplied complete with carrying case)

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- All components are top quality
- Over 200 Kits now sold
- We have built this unit and so know what needs to go into every kit
- SUPER FINISH Front panel supplied with every kit at no extra cost to you
- We are so confident of this kit that we can now offer it assembled and tested so that people who do not have the time can appreciate the sound that this amplifier puts out. This is done on a per order basis delivery approx two weeks after placement.

only $425

*All parts available separately for both kits

PREAMPLIFER

KIT PRICE $259 P&P $8.00

- 1% Metal Film Resistors are supplied
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- We have built and tested this unit and so know what needs to go into every kit
- Specially imported black anodised aluminium knobs
- Again as with the power amp we are offering this kit A & T at a price which we do not believe there is a commercial unit available that sounds as good. Same delivery as the P.A.

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Errors and omissions excepted.

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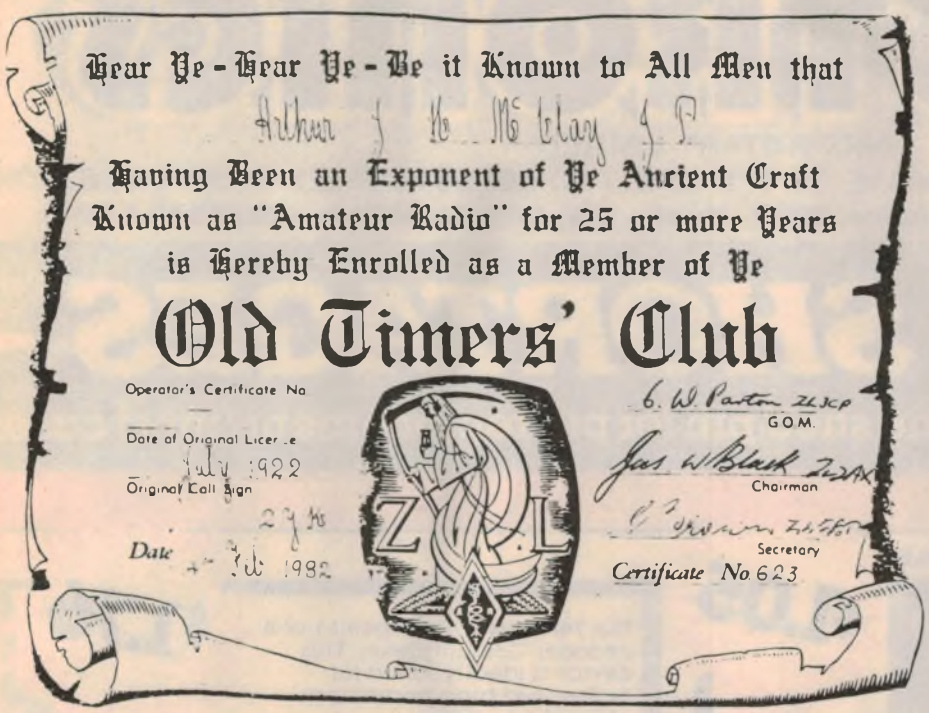
Arthur McClay — NZ radio pioneer



Arthur McClay's certificate of service to amateur radio.

Over the three years of 2YK's broadcasting, many deserving causes were given help over radio. There were even requests from Government House in Wellington for records to be played, while the station took part in many firsts for New Zealand, including the first broadcasts of general elections in 1922.

The first outside broadcast also took place in Wellington when a concert was held in a city department store on a Friday evening. Loudspeakers outside the store attracted a huge crowd, and this led to traffic being disrupted. The store had to pay a fine for this disruption. Due to 2YK Wellington, interest in broadcasting was created throughout the country, and between 1922 and 1925 the NZPO issued ten short-term radio broadcast licences.

As the end of the three year term drew near, a plan to encourage participation in establishing a national radio service was announced. A dinner was held in Wellington with selected guests interested in providing a national service for New Zealand.

Regretfully one of the guests ridiculed the future of broadcasting. The three years of tremendous effort by the three broadcasting pioneers had come to an untimely end, due to the lack of knowledge of those people who had the financial ability to make radio broadcasting in New Zealand a financial success. Like all pioneers, the operators of 2YK were ahead of their time. It was not until 11 years later, in 1936, that commercial radio came to New Zealand.

Due to lack of financial support 2YK closed, but the pioneer spirit in Wellington was still evident and soon after the Dominion Radio Company was formed to carry on where 2YK left off. As the Dominion Radio Company could only get a short-term licence, the operators of 2YK agreed to transfer their licence.

2YK continued to operate and, later, 2YK along with 1YA Auckland, 3AC Christchurch and 4YA Dunedin were taken over by the Radio Broadcasting Company of New Zealand on August 30, 1925. 2YK became 2YA, which is still operating today under the control of Radio New Zealand.

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The 74F109 consists of two high-speed completely independent transition clocked JK flip-flops. The clocking operation is independent of rise and fall times of the clock wave form. The JK design allows operation as a D flip-flop by connecting the J and K inputs together.

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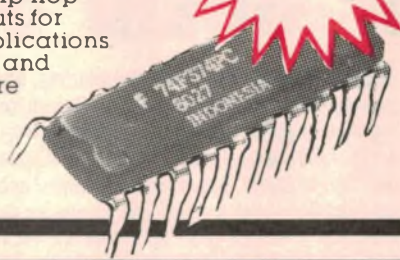
The 74F138 is a high speed 1-of-8 decoder/demultiplexer. This device is ideally suited for high-speed bipolar memory chip select address decoding. The multiple input enables allow parallel expansion to a 1-of-24 decoder using just three 74F138 devices or a 1-of-32 decoder by using four 74F138 devices and one inverter.

$3.26

The 74F374 is a high speed, low power octal D-type flip-flop featuring separate D-type inputs for each flip-flop and 3-state outputs for bus-oriented applications. A buffered Clock and Output Enable are common to all flip-flops.



$1.76

The 74F153 is a high-speed dual 4-input multiplexer with common select inputs and individual enable inputs for each section. It can select two lines of data from four sources. The two buffered outputs present the data in the true (non-inverted) form. In addition to multiplexer operation, the 74F153 can generate any two functions of three variables.

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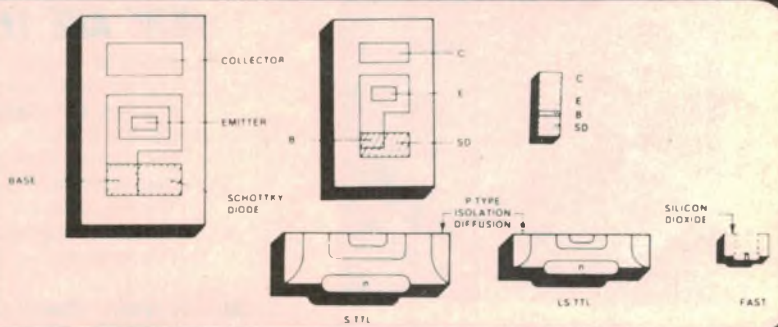

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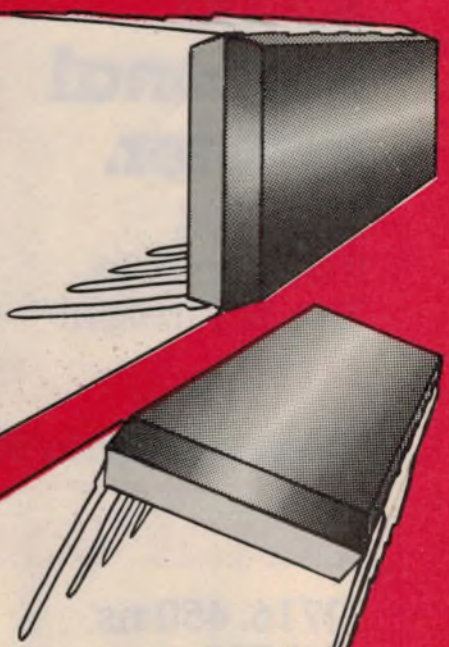

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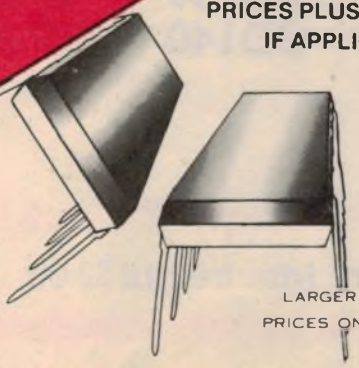

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Audio Dynamic Range: you can have

Telarc describe their recording of Tchaikovsky's "1812 Overture" as an "audio tour-de-force". It has certainly proved to be a most interesting technical exercise; an example of how you can make a recording if you want to. But it's an even better example of how you really shouldn't; of how not to make a recording when you're making one.

FORUM

Conducted by Neville Williams

This instalment of Forum really started out as a routine review of Telarc's compact disc version of the original "1812". However, I found myself deleting so much of what I felt could be said, and should be said, that I tore it up, changed the typesetter's catch from "Records" to "Forum" and started again.

To give it its full title, the disc in question is a recording by Erich Kunzel and the Cincinnati Symphony Orchestra of three works by Tchaikovsky: the "1812 Overture", Op 49; "Capriccio Italien", Op 45; and "Cossack Dance from Mazeppa". It was recorded in 1979 in the historic Cincinnati Music Hall, which has been "home" to the Orchestra since 1896.

I first laid hands on the record in November '79 as a digitally sourced analog pressing. This was before it had received any significant publicity in overseas technical magazines and it was accompanied by a handwritten note from the Australian distributor to the effect: "Please be careful on first playing, as per the warnings on the wrappers, &c. We wouldn't want you to blow up a speaker or two!"

While the recording climaxes in the massive sound of the full orchestra and brass band, augmented by the bells of a large carillon, the real reason for the above apprehension is a succession of sixteen ponderous cannon shots, which punctuate the music during the last couple of minutes of the performances. Produced by authentic 19th century cannon, the sound was digitally recorded and subsequently computer mixed into the master tape.

According to Telarc's jacket notes, the cannon-shot transients concentrate in the region of 2kHz to 3kHz, with the follow-up boom ranging down to 6Hz. To commit the final mix to analog disc posed a major challenge to the JVC Cutting Centre but they coped with it and, even to the naked eye, the pitch and deviation of the resulting groove is probably the most spectacular that you'll ever see.

When I reviewed this first disc in the February '80 issue, I did so on the basis of "good news and bad news":

On the one hand, it appealed as an intriguing exercise in digital/analog recording, with the reassurance, at a personal level, that my equipment could trace the tortuous track without apparent distress. On the matter of quality, I said:

"What tends to degenerate into noise-on-noise in other versions emerges here as a series of incredibly clean and gutsy transients, that literally shake the house" – all this, of course, by the standards of the late '70s.

But I also expressed a reservation that, by the time one had matched the cannon shots to the capabilities of the amplifier and the welfare of the loudspeakers, the soft passages could well drop into the noise ambient of an average on-street suburban dwelling . . . "such is the dynamic range". Certainly a judicious setting of the volume control would be necessary to preserve the vitality of the softer passages.

Overseas reviewers were no less intrigued by the technical implications of the disc and, in due course, Telarc's "1812" became something of an industry benchmark – possibly the most analysed and written about disc in LP-stereo history.

Responding to the publicity, Telarc later issued a UHQR (ultra high quality recording) version prepared by the Victor Company of Japan (JVC) under the title "Super-Cut 1812". They also included the climactic section as a test track in their "Omnidisc" (reviewed in January '83). In both cases, the level of the cannon was lifted by 6dB – thereby rendering it untrackable by all but a few cartridges!

Compact disc version

Now we have the compact disc version, with its ponderous cannon shots untroubled by any potential tracking problems or by acoustic feedback from the loudspeakers. And, at the other extreme, there is no trace of noise from the disc or the player to mask the whisper-soft sounds that lead into or out of the pianissimo passages. What is on the digital tape master is there to be heard on the compact disc. That is how it should be.

Aware of this background, my first step in preparing to review the compact disc was to "fast-forward" it to the 12-minute mark and to set the volume control so that the cannon shots which followed would register around 100 watts per channel, as indicated on the amplifier's LED output meters. This done, I pressed the Repeat/Skip pad to get back to the start and commence play – leaving the volume control untouched.

However, I did switch the level indicators to the 1-watt position but the record had been playing for more than two minutes before the peak hold function reached even that modest level. For the most part, the opening stanzas ranged only up to about 100mW, with much of the sound in the 1-10mW range, and some of the lingering die-away tones not even registering 1mW. Perhaps I should add that this last observation was possible only because it was made when the house was very quiet and with virtually no traffic noise from the street outside.

I had a strong urge to turn up the volume so I could hear the music to better advantage, but I knew what would happen at the other end. Besides that, the unwritten hifi code suggests that, when presented with an example of wide dynamic range, it should be cherished and respected and preserved, even if you don't like it!

While not wanting to set too much store on the LED power output readings, they would certainly be a lot more accurate than subjective "guesstimation". It may come as a surprise to realise that the range from 1mW to 100W (per channel) – from faintly audible to house-rumbling in this case – represents a power ratio of 100,000:1 or 10^5 or a mere 50dB. Allowing for some latitude in the readings and the observations, a figure of 60dB would be generous.

In the face of such remarks, how casually do some audiophiles aspire to a dynamic range of 70, 80 or 90dB, as if it

too much of a good thing!

was so essential for realistic reproduction, so natural to accommodate in the home and so easy to achieve technically. If you feel that way, I suggest you get hold of Telarc's "1812" in CD and work through all its implications.

In my case, any extra noise at all, in what would have passed as a quiet suburban house, would have masked the lingering fragments of sound, being reproduced at milliwatt levels. I was listening very close to the bottom of my particular domestic "dynamic window". And yet, 13 minutes later, with the volume control untouched, the system was running to 100 watts per channel, which I regarded as being a prudent limit.

But you have a 200W per channel system? Fine; that gives you an extra 3dB of dynamic range!

If you want an extra 10dB, over what I've been talking about, you had better go shopping for a 1000W per channel amplifier, or for hifi loudspeakers that will help make up the extra decibels by way of added sensitivity. Neither are easy to come by.

The fact is that high dynamic range is easy to dream about and drool about, not too difficult to achieve with modern signal sources, but very demanding as a house guest!

Using the medium

In saying this, I am not belittling, in any sense, the achievement of wider dynamic range for signal processing generally. The wider the dynamic window available, the more certain the consumer can be that the signal which ultimately reaches the listening room will be clear of the noise floor and clear of overload – qualities that certainly could not be taken for granted with traditional analog systems.

However, it does not follow that, because a record/playback system is credited with a dynamic range of 80 or 90dB, it should carry a signal that appears, subjectively, to fill that window. It would be unbearable if it did! What we can rightly expect is that the recording be subjectively silent during breaks of signal, and that it handle, without crushing, those fast rise-time transients that defy analog tape to capture – that add a glass-hard edge and immediacy to the notes of a piano or acoustic guitar.

In general, the subjective dynamic range should never need to exceed that likely to be experienced at the actual performance. These days, companies like Telarc take pride in not modifying the microphone mix or level settings once the recording has commenced, so that the dynamic signal range on the disc should approximate that up-front in the audience.

While this may appeal to the purist as an entirely logical approach, there is a substantial body of opinion to the contrary. The thinking is that, in an auditorium, listeners are able to concentrate with ears and eyes on the source of the tiniest sound; in a domestic listening room, the visual stimulus is not available and the whole of the lower and medium levels of sound should therefore be made more prominent to compensate for the loss of communication.

In the fortissimo passages, so the reasoning goes, some restraint may be desirable, out of consideration for members of the household who may not want to be involuntary participants in the supposed festivities on the outskirts of Moscow!

In an article elsewhere in this issue, I mentioned Bill Andriessen, Chief Applications Engineer for Video and Audio for BASF in Germany. Chatting about orchestral recordings, during a recent visit to this country, he maintained that the dynamic range of many digitally sourced analog recordings was too high for comfortable listening in the home, and that this would be an undesirable feature of many compact discs. While realising that constraints had to be applied of necessity to the older all-analog discs he felt that, in terms of dynamic range, they were nearer the mark for agreeable home listening.

Telarc's "1812"

This brings me back to my earlier comments about Telarc's "1812", which goes well beyond even a direct transfer from concert hall to disc. For sure, the

There's something that needs to be said!

In the September '83 issue, I indulged in a few reminiscences about "Forum" or "Let's Buy an Argument" and where it all started. I rounded it off with a reference to a then-current argument about the shape of the groove which would be produced in a lateral disc recording by a square-wave input signal. The problem was neatly resolved by a final year engineering student ANT who we came to know later as A. N. (Neville) Thiele, the Australian engineer primarily responsible for sorting out the mathematics of vented loudspeaker enclosures.

At the end of the article, I made a throw-away remark to the effect: "There's just one thing: if a square-wave signal produces a triangular-shaped groove, what kind of a groove would you get from a triangular signal? A number of readers could not resist the challenge and their reaction might be summed up thus:

"I realise that it was a rhetorical question; that you really weren't looking for an answer but I worked it out anyway. Thanks for the stimulation!"

One reader, C.M. from Moonee Ponds, Victoria, came up with about three foolscap pages of closely-spaced text, plus another couple of pages of diagrams that would have taken quite a lot of effort, time and space to turn into an article. Not only that but C.M. concluded with the remark "Don't ask for the groove shape of a sine-wave!"

At this late stage in the history of analog disc recording, I do not propose to pursue the matter but simply to assume that, within the frequency limits of the system, geometric waveshapes can be recorded and reproduced, and that the groove inscribed in the vinyl is well able to look after itself.

Right now, any surplus lecturing or writing genius could be used to better advantage, unravelling for the non-specialist the mysteries of digital encoding, error correction, data insertion, bit manipulation, and decoding, on which the compact disc depends. The specialists obviously understand what it's all about and can talk freely to one another in the digitalese dialect. The need is for someone to translate it into plain English that ordinary mortals can understand and use to create the mental images that most of us rely upon.

It would be humiliating indeed if we technical writers had to be content in future with a block diagram and lines marked "signal in" and "signal out", with no way of explaining what goes on in between! That's about where we stand at the moment.

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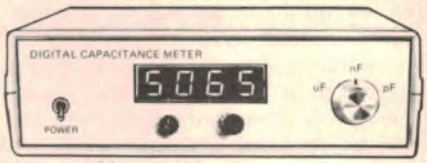

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jacket carries the usual note about the level being unchanged during the course of the recording but that could have applied only to the orchestral performance.

To the orchestra, at full blast, Telarc engineers subsequently added the sound of a large carillon from elsewhere in Ohio, plus that of the cannon – the level of the latter determined as much by technical considerations as anything else. Evidence of this is the issue of subsequent versions with the level of the cannon raised by a further 6dB.

The result is a recording quite different from what I referred to earlier: one that can accommodate high-speed transients that add "bite" to the sound without seeming to be loud, and without endangering the system because of their very brief duration.

By contrast, the combination of orchestra and bells which climax the "1812" is very loud to start with, but the cannon blast through it all as sustained, very high energy, very low frequency pulses, well able to wreck loudspeakers, as it did, I believe, for some exhibitors at a recent Consumer Electronics Show in the USA. They turned up the quiet section too far and weren't prepared for the big boom that followed.

As I remarked earlier, Telarc's "1812" is an interesting and intriguing exercise in recording, first on LP-stereo, now on compact disc. But it is one that perches on the very edge of practicality as a consumer recording:

- Some phono cartridges will track the LP version; others will not. CD players should handle the new recording without difficulty but how the rest of the system will cope with the signal could be anybody's guess.
- Unless the house is quiet enough to allow the softest passages to be heard at milliwatt levels, the cannon shots may overload the system, almost irrespective of its power rating.
- A low powered amplifier system would have great difficulty in playing the recording through, unless the volume control is readjusted as necessary, or self-limiting in the signal chain crushes the signal peaks in a not-too-objectionable manner.
- The fact that I could describe the Talarc "1812" as "on the edge of practicality" explains why I could also apply to it the misquoted slogan: "How not to make a recording when you're making one".

As a technical exercise, as something to argue about, as a challenge to replay systems, as a demonstration of bass-end power, the last two minutes of the Overture containing the cannon are brilliant. But as a recording, in any of its forms, to pass across the counter to a hifi novice, it really is on the edge of practicality.

As such, it's the type of recording that record producers should tend to back away from rather than emulate. There's room on the shelves for the odd "1812" with real cannon; for the organ recording with everything from the tiniest pipe to the 64' thunderer; for the steam train that emerges from behind the song of a distant magpie to clank past two metres away!

Recordings like that have their place for special occasions but please: not all the time.

What we need for everyday listening are recordings which are free of noise, distortion and overload, and which offer a dynamic range which provides a wise compromise between what is appropriate for the performance and practical for in-home listening.

If it transpires that the ideal dynamic range is about the same as the last generation of analog discs, we should not feel cheated. Let's just enjoy it and be thankful that the combination of digital and laser technology has obviated many of the attendant problems of the analog system.

Compact discs in cars

A matter which arises out of this, and one which I mentioned on a previous occasion, has to do with the proposed use of compact disc players in cars. For the ordinary family sedan the definition of what is "practical" by way of dynamic range may be quite different from what can be accepted in the home.

Quite apart from possible driver distraction, the ambient noise level in a family car can vary widely and abruptly with traffic conditions and road speed and it is difficult to set the radio or player at a suitable median level, if the program itself varies too much – or has too wide a dynamic range. It is partly for this reason that AM broadcast stations frequently monitor and/or limit their programs to achieve a more constant level of loudness for in-car or casual listening.

A commonly quoted dynamic range figure for convenient home listening is 45dB – perhaps a little more for an attentive audience. For in-car listening, the figure could be as little as one-third of this. If such be the case, how could motorists possibly enjoy compact discs, which frequently feature wide dynamic range, through a dynamic "window" only 15dB wide?

With this in mind, I recently raised the question of compact disc players in cars with an executive of a potential supplier of such equipment.

He admitted that movement and vibration in a vehicle could conceivably have upset disc tracking but, he said, that problem had now been overcome.

He admitted also that high temperatures in a car might once have caused compact discs to warp but that was no longer a problem, either.

What about a possible problem with excessive dynamic range? He was sorry but he hadn't heard about that one, although he could see what I meant. Good grief!

Unless the manufacturers can come up with a practical, switchable volume compressor that does not do dreadful things to the quality, compact discs may well be identified individually as recordings that are or are not suitable for use in the family car.

But, frankly, it sounds like a fad to me, – a knee-jerk market reaction. As a source of pre-recorded music in a car, the compact tape cassette meets the need so well that I cannot, for the life of me, see why it needs to be discarded.

Welcome to 1984 and . . .

A whole new era in Audio/Video

by NEVILLE WILLIAMS

To date, domestic video and domestic hifi have remained substantially independent, linked only by predictions that they must one day get together. It should all begin to happen in 1984, with VCRs, broadcast television and AM radio all acquiring stereo sound, and moving in to share the hifi system with tape and compact discs.

(National Panasonic)

Back in 1982, the announcement of hifi-stereo sound for Beta format video seemed to be little more than the latest manoeuvre in the long-running battle between Beta and VHS – another talk-up feature to win a few more sales. There was little to suggest, at the time, that the development would help to breathe new life into both formats and, indeed, have an important bearing on the whole audio/video scene. But that's the way it's looking now.

Hifi-stereo sound for Beta & VHS home video

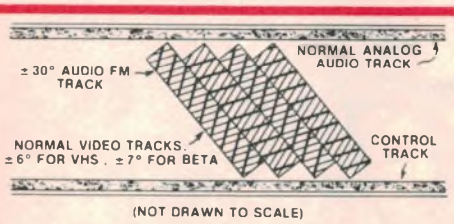
Back in 1982, Sony were concerned that the Beta group held only about one-third of the world VCR market, with the prospect that they could slip even further behind. Sony needed some inducement for consumers to switch formats and they appeared to have found it when their engineers came up with a method of recording a stereo pair of FM sound carriers on the tape, without disturbing the existing video and audio signals. It offered the potential for true, hifi-stereo sound while preserving compatibility with existing Beta format equipment.

Sony engineers had realised that a substantially unused frequency segment existed in their NTSC Beta system between the chrominance signals (predominantly below 1MHz on the tape) and the luminance signals (predominantly above 1MHz). Into this space it would be possible to drop a pair of sound carriers, frequency modulated respectively with the left and right stereo audio signals. The extra carriers would simply be fed to the video heads, along with the video signals, and simultaneously imposed on the tape – to be recovered and decoded during subsequent replay.

Sound quality would be in line with accepted hifi standards, with a substantially flat response from 20-20,000Hz, compared with a rather unreliable 50-12,000Hz for a conventional VCR analog soundtrack. Signal/noise ratio, in stereo mode with NR (noise reduction) would jump from the mid '40s to at least 80dB. There would be a 10-times reduction in harmonic distortion (typically from 3.0% to 0.3%) and a huge reduction in wow and flutter (from about 0.3% to .005%). Overall, the quality would fall marginally short of compact disc standards but would compare more than favourably with the best analog "black" discs.

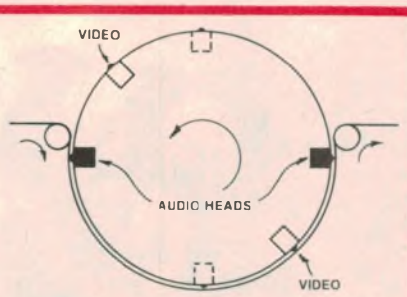
Keen to press home their advantage, Sony said – or let it be said – that the method would be exclusive to the Beta format because no equivalent accommodation existed in the VHS configuration for extra carriers – at least, not without significantly compromising picture quality.

It was the wrong kind of challenge to direct to Matsushita, and to their 50% owned subsidiary JVC, which holds the key patents in the VHS system. In short order, both companies had announced the development of a practical VHS hifi-stereo sound system and both had demonstrated prototype equipment to selected technical writers. That served to spread the message: VHS owners would



(NOT DRAWN TO SCALE)

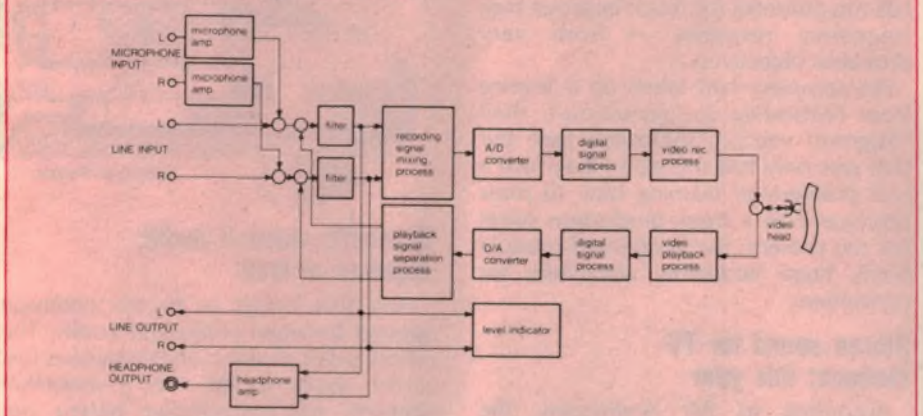
In the D-MPX (depth multiplex) system, the FM soundtrack is recorded deeply into the magnetic layer, then overlaid by the normal video track, which penetrates only about the top one-third of the layer. The radically different azimuth angles minimise mutual interference during playback.



In the D-MPX system, used in both VHS and Beta/PAL hifi VCRs, special heads to record the FM audio signal track just ahead of the normal video heads.

The National SV-P100 is a digital audio recorder using a VHS cassette and tape mechanism and internal analog/digital conversion. With performance figures which surpass even the new hifi VCRs, if makes available to the home recordist audio quality which rivals that of a compact disc.

Main Signal Flow Chart of the SV-P100



Reproduced from a National brochure, this diagram shows the signal path through the SV-P100 digital audio recorder. PCM adapters offered by National and Sony can be used with normal domestic VCRs to produce much the same end result.

not need to switch formats to gain the advantage of hifi-stereo sound.

Sony officially launched Beta hifi in the NTSC format in April '83, along with a hundred or so cassette features carrying both normal and hifi stereo sound. Other Beta equipment manufacturers were reportedly preparing to follow suit.

Matsushita announced their VHS hifi model NV-800 about one month later (May '83) although, overall, the VHS group were about six months behind. But an inventory of VHS hifi software is now building up and the hardware should become available in quantity from now on – for the NTSC market, at least.

The release date for PAL format hifi VCRs in Australia is as yet uncertain but "around mid year" is as good a prediction as any, with both formats running about neck and neck!

The VHS hifi system uses a somewhat different approach from the original NTSC Beta concept to achieve what, at this stage, appears to be an identical end result. It uses a pair of FM sound carriers in the 1 to 2MHz region but they are imposed on the tape in a quite different manner.

Two extra heads are fitted to the video drum with azimuth angles of ±30°, which track just ahead of the video heads (the latter with the normal VHS azimuth of ±6°). The extra heads impose the twin sound carriers on the tape, the configuration and drive being so arranged that the FM signal is recorded deeply into the magnetic layer. JVC, the major licence holders for the VHS system, describe the method as D-MPX (depth multiplex) sound recording.

As is normal in a VCR, the video signal, which is recorded an instant later, penetrates only about the top one-third of the magnetic layer, so that it has very little effect on the sound carrier recording.

During replay, because of the radical difference in azimuth angle, the video and audio signals can be recovered by the respective heads, with very little mutual interference.

The major performance specifications quoted by JVC for VHS hifi are identical to the Beta hifi figures listed earlier: frequency response 20-20,000Hz; dynamic range with noise suppression 80dB; wow and flutter less than .005%; total harmonic distortion less than 0.3%. In addition, they quote audio channel separation as greater than 60dB and

Colour viewfinder for home cameras

Hitachi, Japan, has announced the development of a practical 38mm (diag) colour picture tube suitable for use in home video camera electronic viewfinders. To date, only monochrome tubes have been practical in consumer equipment.

It would appear that Hitachi have been able to apply a principle that has hitherto been considered too critical for mass production. A single beam sweeps across the tube face, which carries a very fine pattern of red, blue and green lines. The beam is modulated so it causes only the required phosphors to fluoresce. Internal light sensors and a feedback system ensure accurate registration.

The tube uses a beam deflection angle of 36° and has a claimed resolution of 160 lines. It operates from the normal 12V camera supply line and consumes 2.7W. In making the announcement, Hitachi said that the tube should be ready for the market in early '84 but that its price level would confine its use initially to new top-of-the-line cameras.

A whole new era in Audio/Video

audio/video crosstalk under the most extreme conditions as not more than 20%.

It was naturally assumed, when Beta and VHS hifi were translated from NTSC to the PAL format, that each would retain its original and distinct technology – but such was not to be. When PAL format Beta hifi was jointly demonstrated in Sydney by Sony, Sanyo and Toshiba, it was revealed that Beta hifi had been switched to essentially the same technology as VHS hifi: separate audio heads with 30° (approx) azimuth and depth multiplex recording.

While the choice of the D-MPX came as a surprise to the Sydney audience, it carried a welcome implication: consumers would be spared the speculation as to which was the better of the two systems. In the PAL format, at least, they were virtually identical.

It now appears that the provision of hifi stereo sound and a continuing reduction in the size and weight of portable equipment has imparted a whole new image to the established formats. VCR production in Japan is again on the increase and speculation about an impending format change has diminished sharply.

Released to the Japanese market in May '83, the National NV-800 offered hifi-stereo audio to the same performance specifications as had previously been claimed exclusive to the Beta format. 1984 should see hifi sound selling freely in both formats.

No less to the point, Matsushita is reported to have reached agreement with Grundig and others to establish a joint facility in Europe to manufacture video equipment. This is being interpreted as a move to phase out the European V-2000 system in favour of VHS.

The 8mm video format: five years away?

The tip is that the proposed new 8mm video standard will now be pushed back by five years or so, while the industry and consumers alike gain more mileage from the systems they already have. During that five years, the 8mm format may well be refined and re-developed from one that was essentially camera-based to a truly universal system with a significantly upgraded performance.

Moves to delay a possible format change have the strong support of Wilhelmus (Bill) Andriessen, Chief Audio/Video Applications Engineer of BASF in Germany, who was in Australia recently on a fact finding and lecture tour.

He maintains strongly that a new 8mm – or similar – system should be based on a tape from which the binder has been eliminated and the magnetic layer applied by direct deposition in vacuum. It effectively reduces tape thickness and has the potential for much improve high frequency response – both very desirable objectives.

His company had taken up a licence from Matsushita to manufacture their "Angrom" vacuum deposited tape but that was only half the story; they face a real problem of learning how to mass produce it at a mass production price! For the present, the established product holds huge economic advantage for consumers.

Stereo sound for TV stations: this year

According to Bill Andriessen, the emergence of VHS and Beta hifi coincides with a trend which his Company has observed: a rising interest in musically based video programming had increased awareness of video sound quality. While medium quality mono may suffice for ordinary movies, it is far from adequate for musical features or, for that matter, for space-age themes and sound effects.

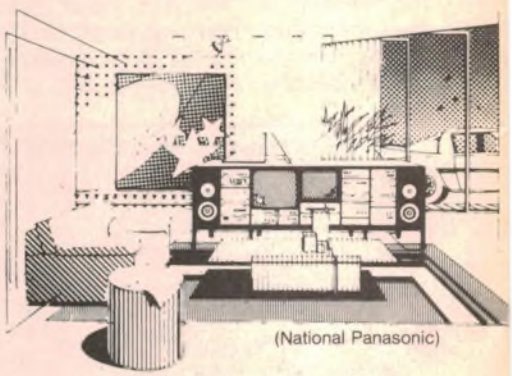
VHS and Beta hifi can now meet that need and, for many, the humble video cassette will take on a whole new sound during the course of 1984.

Viewer expectation of high quality stereo sound must pose an urgent challenge to television stations to "get with it". From the outset, TV stations and, indeed, the TV industry as a whole, has been preoccupied with the visual side of programming, with sound relegated to a secondary role – for the most part medium quality mono.

Some TV broadcast stations in Germany and Japan have indeed been transmitting dual-channel sound (stereo and/or bilingual) on a regular basis and others elsewhere (including Australia) have been doing so on an experimental basis during the past year; this against a background of tedious debate about systems and standards.

As we write, however, the Australian authorities and the TV industry appear to have reached agreement on the German system and an official announcement to that effect can be expected at any time. So, if and when you shop around for your new VHS or Beta hifi VCR, make sure that it is fitted with a tuner able to receive and resolve two-channel sound, using the German system.

Alternatively, if you're considering the purchase of a new TV receiver, this year, give some thought to whether it should be equipped for stereo sound, with further provision to connect it to an external hifi audio system.



(National Panasonic)

Domestic video & audio: together at last!

And that brings us to the common ground between video and audio. The whole point of video or TV stereo is lost if the signal it fed into a makeshift amplifer and loudspeaker system. So, unless you can afford and accommodate two separate quality systems, the logical course is to bring the equipment together so that video and TV sound, AM and FM radio, tape and discs can all be fed through the main hifi system, as required.

To date, with only medium quality sound available from video and broadcast TV, the incentive to do this has not been very strong but that position will change, this year, with high quality stereo sound becoming available from both sources.

Stereo for AM radio: also planned for 1984

Nor should we overlook AM radio,

While the compact audio cassette cannot match the sound quality from the newest sound sources, it is unrivalled in terms of versatility. It will be around for quite a while yet, providing both home and car entertainment.

mentioned above. It, too, has offered only medium quality mono sound, to date, partly because the system developed that way, and partly because of the cost-cutting design of virtually all AM radio tuners. During the past year, however, AM radio stations in Australia have been quietly experimenting with compatible mono/stereo transmission systems, and AM stereo is another almost certain innovation during 1984.

There is one complication in that, in Australia, as in the USA, failure to settle on a single standard will result in radio stations having to choose between four possible technical methods – all producing much the same result but all differing in detail. Fortunately, receiver designers have been able to come up with ICs (integrated circuits) capable of decoding all four systems, although with some penalty in terms both of complication and cost.

However, the challenge facing the designers of new up-market AM tuners and receivers will not just be a provision for decoding AM stereo transmissions. They should logically provide wide band tuning circuits as well, to let through the higher modulation frequencies which are currently lopped off by conventional AM tuning systems. It will be interesting to observe the response of the Japanese suppliers to this new challenge during the year ahead.

In terms of overall sound quality, AM stereo will probably not match up to its FM counterpart but, for the many who find pleasure in AM programming, the availability of stereo sound, and hopefully better sound, can only be a bonus. It's certainly something to keep in mind if you're planning to invest in a new, up-market receiver or tuner.

"Time shifting" for sound broadcasting

Getting back to high quality, video-style sound recording, BASF's Bill Andriessen made another rather intriguing observation at a symposium for technical writers held in Launceston, Tasmania. There seemed to be a growing interest, he said, in time-shift radio listening – the sonic equivalent of time-shift television viewing. Candidates included people interested in classical and pop concerts, operas, recorded music sessions and so on.

Some of the material, he said, might even find its way on to compact cassette for further replay in the family car – an observation that might be less heinous in West Germany than elsewhere, because of their surcharge on tape.

An obvious technical barrier to long-duration time-shift radio listening has been the lack of a convenient, long-running, high quality recording system, preferably with timer facilities. At best, a compact cassette deck can record continuously for two hours, but only provided that it has auto reverse facilities, and will operate reliably with a C-120 cassette. A large, open-reel tape recorder is a possibility but scarcely one that would meet the criteria: "convenient, high quality".

Now, with the arrival of VHS and Beta hifi VCRs, consumers have access to a unit with accurate self-timing facilities and the ability to make a very high quality stereo sound recording with a running time of up to four hours – at present. One can confidently predict that the second generation of hifi VCRs – in the VHS format at least – will combine hifi audio with half-speed tape travel to provide eight hours of hifi stereo on a single cassette!

While hifi video recorders would normally be fed with an external video signal (to which they lock), this is not a prerequisite. They can operate in free-running mode and, in fact, an impressive recording of Bach's "Toccata and Fugue" played at the Sony/Sanyo/Toshiba presentation in Sydney, was a sound-only dubbing on a Sony Beta hifi VCR, with its own in-built audio level control and metering.

With just such a VCR, grouped and interconnected with other video and audio components, it becomes technically possible to make a long-duration sound-only recording, in high quality stereo, from any available source; this by merely pushing the appropriate buttons! And, just as easily, the entire program can be played back into the system, with hardly any loss of quality, and subject to all the program search facilities which characterise a top-range VCR.

As if to emphasise that there is more to these observations than mere speculation, a report that has just reached me from Japan confirms that the trend has emerged there already. It suggests that hifi VCRs, sold in that country, are being used for between 30% and 40% of the time recording hifi-stereo audio!

State-of-the-art home recording

While Beta and VHS hifi will offer to the enthusiast a means of recording video or other sound to a very high standard, it is not the end of the line for the home recordist in terms of ultimate quality. Already listed in the catalogues are "consumer" products which aliow audio signals to be recorded on video style equipment but in digital form – marginally better again than the FM-based video hifi systems.

Sony have an adaptor, type PCM-701ES (reviewed last month), which can accept a stereo audio signal and transpose it into a pulse code modulated signal, able to be recorded by most Beta format VCRs. In playback mode, the adaptor converts the recording back into analog stereo, at a quality level which approaches that of compact discs.

National have a similar unit, the SV-100 Digital Audio Processor, for use with VHS format VCRs. National also list the SV-P100, which incorporates a VHS recording mechanism becoming, in effect, a self-contained digital audio recorder.

When we first encountered these units, we tended to question their relevance to anything but a professional recording

A whole new era in Audio/Video

situation, because no ordinary enthusiast would have had access to program material calling for that order of technical specification. But, in the context of 1984, with the emphasis on audio/video systems and on quality, they may well attract the attention of at least the big-budget enthusiasts.

The Compact Cassette — good for a while yet!

FM and digital recording may seem to be rather elevated company for an analog tape system that started out in the '60s as a means of recording speech or, at best, music of (very) medium quality. Since then, with a lot of help from Dolby NR, and improvements in performance, won a decibel at a time, it has gained acceptance as a "respectable" system: handy for everyday use, excellent for in-car sound, and sufficiently close to full-scale hifi to pose a continuing challenge to engineer and enthusiast alike.

Looking ahead, the compact cassette system would appear to be in no danger of being eclipsed during 1984 although, equally, there is little chance of it being further upgraded, beyond the odd marginal refinement. We say this, despite talk about halving tape speed and doubling the playing time; of evolving new tape formulations to gain an all-round improvement in performance; of resorting to digital recording and/or other methods of scanning the tape.

Most such speculation commonly leads to one conclusion: a significantly upgraded system, with higher information packing density (probably digital) should really be designed around a new generation of tape (eg vacuum deposited) of selected width (not necessarily 3.8mm) and housed in a cassette that will afford better protection (eg like a video cassette). One school of thought favours something about the size of the present compact cassette; another, strongly supported in Japan, favours the smallest possible format, more like the present minicassette.

All of these options rule out any thought of compatibility with the present compact cassette and would commit the world audio industry to the same kind of negotiations which ultimately produced the compact disc. We understand that a study group has already been set up to consider the whole matter but how protracted and how successful their effort may be remains to be seen.

In the meantime, the compact cassette is unlikely to be abandoned or to fall into disuse. It's much too handy a facility to invite that fate!

The Sony compact disc player. Production figures of compact discs and players alike are climbing steeply and will undoubtedly provide the standard source of top quality pre-recorded music for many years to come.

The Compact Disc — it's here to stay!

Despite initial production problems and a barrage of criticism from those who distrusted the digital system in any form, the compact disc system is rapidly winning acceptance – and is doing so in the audiophile area from which most of the criticism originated.

The trend has been evident over the past year to anyone who has watched the reviews in the English "Gramophone" magazine and noted the rising proportion of compact discs. What's more, most of the reviews have ranged from favourable to enthusiastic, compared with the older technology – this in a journal which has a rather staid and studious image.

According to the latest figures from Japan, more than 80% of all "classics" type albums pressed in that country to the end of last year were in the CD format, with conventional "black" audiophile albums falling to less than 20%. The figures relate to total Japanese production, both for the domestic market and on an OEM basis for other major labels around the world.

In the jazz field, again with a significant audiophile following, the proportion of CD releases has reached about 40%. In the "pops" area, CD albums represent only about one-third of that percentage, with the cheaper conventional albums still dominating the pop market.

Japan now has the potential to produce about 70% of the world's supply of compact discs, with a monthly production capacity of about one-and-a-quarter million discs. CBS/Sony heads the list, followed by Nippon-Columbia and Matsushita. The figure for Europe is about one-half million per month, headed up by Polygram in West Germany. Domestic production in the USA is still in its very early stages.

CD player production has also tended to concentrate in Japan, with about 30 base models currently in production by the major manufacturers. Most of these are sold in Japan and elsewhere under their own names and model numbers, but quite a few others are for the OEM market and end up with cosmetic changes and the nameplates of other established hardware suppliers.

Significantly, the production of CD players in Japan has overtaken that of quality phono decks, indicating that the majority of quality-aware buyers are deciding to equip or re-equip for compact, rather than conventional discs.

It is also noteworthy that most manufacturers have one or even two models selling for Y150,000 or less in Japan, which translates roughly to $1000 or less RRP in Australia. For a player which, technically, can outperform any phono deck ever contrived, or any tape player for that matter, $800 is not excessive – and that will not be the lower limit for long.

No, we're not suggesting that you should dump your phono deck and your collection of black discs into the garbage bin. We'll probably be playing stereo LPs for the next five or 10 years, if only for the treasure house of sound they contain. But, as of 1984, they'll begin to take on the aura of a vintage car: something to polish, and admire and remember, but a little too primitive for everyday use!

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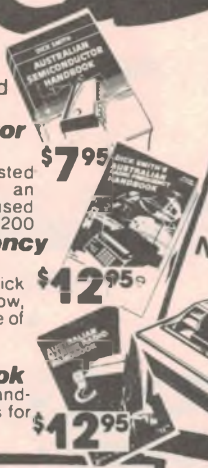

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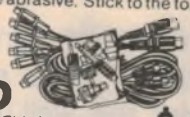

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Having trouble with video leads? No more! This incredible video lead pack will match ANY video to ANY video with its unique system!
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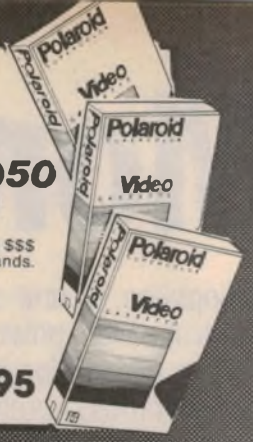

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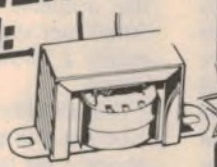
NEW DICK SMITH PA AMP

Fantastic value for youth groups, fetes, churches, etc – quality PA Amp has microphone & line inputs, operates from 12V DC or 240V AC (so it will go anywhere). Huge 20W output./
Cat F-2035

$110.00

HOBBYIST TRANSFORMER BARGAIN:



12V and 4 amps output – think of the huge range of uses! Battery chargers, power supplies, paper weights . . . and look at the ridiculous price!

NORMALLY $15.00 or more

WHILE STOCKS LAST

$7.50

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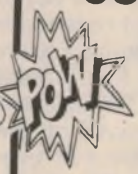

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Now from Arlec, The Fantastic supertool makes a super hobbyist!
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WHY PAY MORE! COMPUTER CONNECTORS

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Standard 100 pin socket for S-100. High contact life for maximum efficiency.
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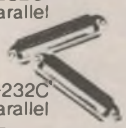
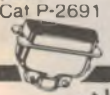
$10.95

'D' TYPE PLUG
25 pin plug for RS-232C port and Sorcerer parallel port.
Cat P-2690
$3.95



'D' TYPE SOCKET
25 pin socket for RS-232C port and Sorcerer parallel port.
Cat P-2691
$4.75



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57N-36 type, suits most printers. With cover.
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C size	Cat S-3302	$12.40
D size	Cat S-3304	$13.20
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Our new 1% metal film types in a computer selected pack. Now there's no excuse not to use 1% resistors in all your projects: especially at this price! Cat R-7015

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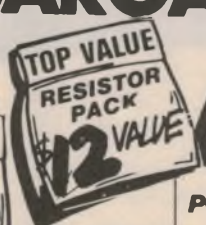

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300 ¼ watt types worth $12.00! 60 values, quality 5% types. Cat R-7010

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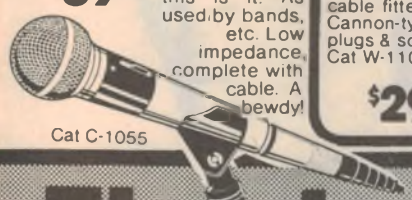

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Huge 20m length of quality mic-cable fitted with Cannon-type plugs & sockets.
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Electronics

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Monster Amplifier

Most audiophiles at one stage or another probably dream about owning a truly high power amplifier. While price alone probably keeps this a dream for most, for the well-heeled Perreaux has produced what must surely rank as one of the best amplifiers ever. Boasting a power output of 800W per channel coupled with extremely low distortion, the Perreaux 5150B should suit the most discerning (or hard of hearing!) audiophile.

This review was prompted by a visit to IREECON, a trade show and conference held at the Royal Agricultural Society showground in Sydney a few months ago. As we wandered through the stands, we came across one of the largest power amplifiers we had ever seen. What's more, the lid of the amplifier was off and we were able to poke and pry to our heart's content.

Inside the case was a huge power transformer, eight very large filter capacitors (10,000μF 160VW), 24 output devices, and virtually nothing else! It took a second look to find the rest of the amplifier circuitry, which seemed ridiculously simple for such a large amplifier.

A talk with the sales representatives at the stand confirmed that the amplifier used MOSFET output devices and that the amplifier is capable of delivering 500W per channel into eight ohms and nearly a kilowatt per channel into four ohms!

This amplifier we just had to review!

To cut a long story short, after several phone calls to Melbourne a loan of the amplifier was arranged and we sat back to await its arrival. We were told by Melbourne that the amplifier was actually a preproduction prototype and was the only one in Australia, having been completed just in time for the IREECON show. Consequently, the amplifier was very much in demand for demonstrations to interested people and so our loan period would have to be kept short.

The amplifier is a Perreaux 5150B, designed by Peter Perreaux and produced by his New Zealand based company "Perreaux Sound". The company now exports to the American and European markets as well as Australia and is currently establishing an excellent reputation as a producer of high quality audio amplifiers.

One afternoon, a week or two after the phone calls, a representative from Perreaux called around and left almost 30 kilos of 5150B amplifier in our care. The sheer size of the amplifier created much comment from our normally blase staff, as did the internal construction when the lid was removed.

Internally, the 5150B probably has the best mechanical construction we have ever seen in an amplifier. It is literally "built like a tank". The front panel is a custom designed aluminium extrusion 6mm thick, which fits a standard 19-inch rack. Below the aluminium extrusion, and recessed slightly from it, is an open mesh grille which allows the circulation of cooling air into the lower section of the amplifier.

from Perreaux

MONSTER AMPLIFIER – Perreaux 5150B is huge, features heavily-finned heatsinks to dissipate heat generated by massive output power.

The front panel has a silver-satin finish set off by a small panel which carries the amplifier name and Perreaux logo, a pushbutton on-off power switch and an on-off indicating LED. Two large aluminium carrying handles are attached to the front panel in standard rack-mount style.

Each side of the amplifier is constructed from three large sections of heavily finned heatsink. The heatsink is held together by a "T" shaped bracket which is also used to mount the output transistors. Total surface area of the heatsinks is a massive 21,000 sq cm.

The upper portion of the rear panel is constructed from an open mesh while the lower portion is constructed from 2mm thick aluminium sheet. Mounted on the aluminium section are five fuses: four of these are 10A fuses used in the amplifier supply rails while the fifth fuse is a 240V, 10A line fuse. Also mounted on the back panel is a gold plated RCA socket and two huge 110A (yes 110A!) gold plated speaker terminals. The speaker terminals are a binding post type which accepts spade terminals and can be screwed up very tightly, giving an excellent electrical connection.

The power transformer, which is the heaviest single component in the 5150B, is mounted via special channelling on the rear of the front panel. This shifts the centre of gravity towards the front of the amplifier and allows it to be rack mounted without danger of the case distorting or the rack screws being subjected to excessive pressure. The printed circuit board assembly runs nearly the full width of the case and is supported on all sides by brackets.

In addition, the eight large filter capacitors are supported by a wide aluminium bar which runs down the centre of the printed circuit board.

The two large circular objects seen attached to the heatsinks in the photographs are actually inductors used in the load stabilising networks. Physically, these are the largest output inductors we have ever seen, and consist of 13 turns of heavy gauge insulated wire wound on a 32mm diameter perspex tube.

Most amplifier wiring is run on the underside of the printed circuit board and is bundled into one large wiring loom running down the centre of the printed circuit board.

Overall dimensions of the 5150B are 606 x 483 x 257mm (D x W x H) with an approximate weight of 30kg.

The 5150B is not only the largest amplifier we have ever tested, but was also one of the hardest to test. The immense power output which the amplifier is capable of required the setting up of new dummy load resistors since our usual dummy load resistors just could not handle the power. We were able to produce suitable 4 and 8Ω dummy loads using a length of spiral wound resistance wire on a ceramic former. Since each load had to be able to dissipate at least 1kW, water cooling, in the form of a ten litre bucket of water, was needed.

Using this set-up, we found that if the amplifier was run at maximum power output for about 15 minutes, it was possible to actually boil the bucket of water!

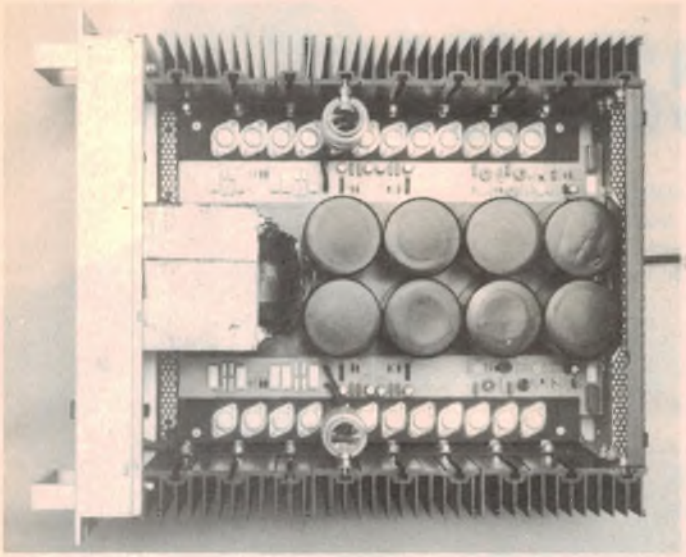
Referring to the distortion versus frequency graph, it can be seen that for the 8Ω case, distortion was below the residual of the analyser for all frequencies under 3kHz. Above 3kHz, the distortion rose gradually to a maximum of .018% at 20kHz. At frequencies of 10kHz and greater, distortion components were mainly second harmonic, while third harmonic components dominated below 10kHz.

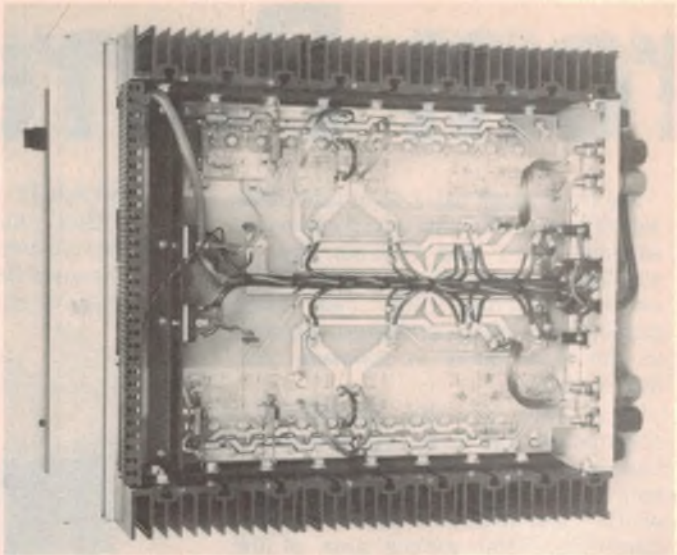
The distortion versus power output graph is typical of a normal power amplifier and shows the usual gradual rise in distortion at lower power levels as hum and noise forms a greater portion of the output content.

Output power at the onset of clipping was measured as 640W with one channel driven and 570W with both channels driven into 8Ω. Into 4Ω the output powers were measured as 1080W and 920W respectively.

We measured the dynamic headroom of the amplifier as per the IHF-A-202 standard which calls for 20 cycles of high level tone to be applied to the amplifier, every 0.5s. The dynamic headroom of the amplifier is then the ratio (in decibels) of the maximum tone burst power output before clipping to the nominal maximum power output of the amplifier.

Using the tone burst test signal, the 5150B was able to produce a 228V p-p sine wave across both 4 and 8Ω loads before visible clipping of the waveform occurred. This corresponds to dynamic headrooms of 2.1dB into 8Ω (ref 500W) and 3.1dB into 4Ω (ref 800W). The lower headroom figure for 8Ω is due to the





Interior construction is simple and rugged. Design features 12 output transistors per channel.

Monster Amplifier from Perreaux

amplifier being voltage limited rather than current limited. Perreaux quote a headroom figure of 2.5dB for the 5150B which is slightly larger than our figure but they used a music source rather than a tone burst source and this probably accounts for the difference.

The frequency response of the 5150B was virtually ruler flat being only −0.2dB at 20Hz and −0.1dB at 20kHz for 500W RMS output. Between these limits deviations from 0dB were much less and the 5150B easily met its specification of ±0.25dB from 20Hz to 20kHz. Wider frequency response limits of ±0.5dB from 10Hz to 50kHz are given in the specifications and we were able to verify the amplifier response at 10Hz as being −0.5dB but we did not wish to overheat the resistor in the load stabilising network so we did not check the response at 50kHz.

Crosstalk was found to be below the noise floor at 100Hz while at 1kHz it was −98.5dB and at 10kHz −79.5bB. Input sensitivity, or the input signal required to produce rated output power from the amplifier, was measured as 1.5VRMS for both the left and right channels, in line with the Perreaux specification.

The unweighted signal-to-noise ratio was found to be 102.5dB for the left channel and 104.5dB for the right channel, both of these measurements being referred to rated output of 500W. These figures comfortably meet Perreaux's specification of 100dB below rated output, 20Hz to 20kHz unweighted.

Damping factor was measured as 95 at 1kHz, giving an output impedance of around 84mΩ. The damping factor at 50Hz was 92 which is good but a long way from the "greater than 500" specification given by Perreaux.

There were one or two points about the amplifier which we feel deserve some criticism. However, readers should bear in mind that the amplifier we are testing is a preproduction model and these criticisms may not apply to the production model.

Our first criticism is the lack of output power indication. We would prefer to see some form of power meters fitted to the amplifier so there is no chance of accidently overdriving loudspeakers. While we realise many loudspeakers can be safely overdriven to several times their nominal rating on program peaks, some cannot, and "winding the wick up" on an amplifier of this size when using under-rated speakers carried with it the possibility of loudpseaker destruction.

We would also like to see some form of warning included on the back panel to advise people of the electric shock hazard presented by the speaker terminals. Although 80VRMS may not sound like much, it is potentially dangerous.

Our last critical comments have to do with the power supply. This uses two 10,000μF capacitors with a fuse between

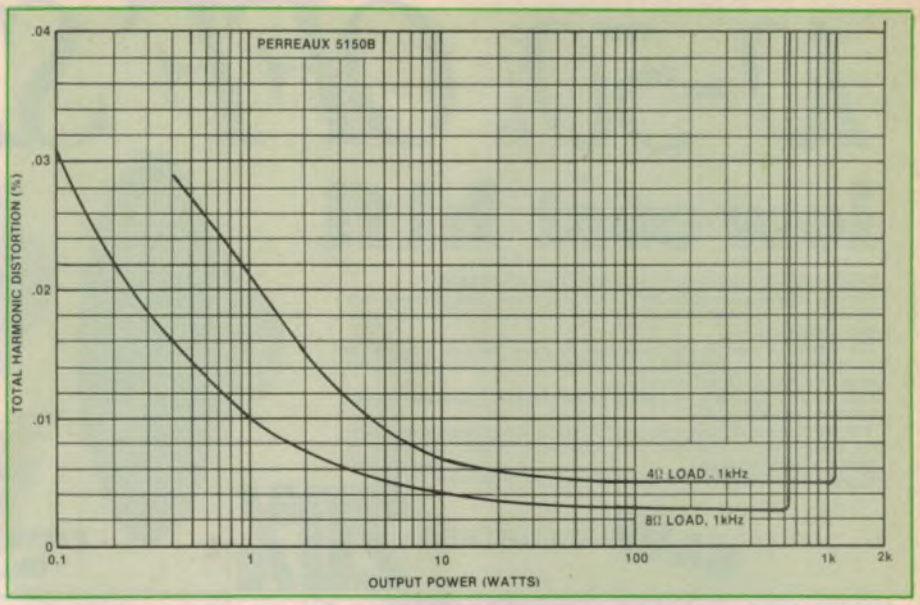
	Manufacturer's specs	Test results
Output power (8Ω load)	500W RMS per channel	570W RMS per channel
(4Ω load)	800W RMS per channel	920W RMS per channel
Dynamic headroom	2.5dB using a music source	2.1dB using a tone burst source
Output voltage swing	220V peak to peak	228V peak to peak
Distortion	Less than 0.035% from 0.25 to 500W RMS into 8Ω load	See graphs
Frequency response	20Hz to 20kHz ±0.25dB	20Hz to 20kHz +0, −0.2dB
	10Hz to 50kHz ±0.5dB	10Hz −0.5dB, 50kHz not checked (see text)
Channel separation	60dB minimum, 20Hz to 20kHz	100Hz Below amplifier noise floor 1kHz 98.5dB 10kHz 79.5dB
Hum and Noise	100db below rated output, 20Hz to 20kHz unweighted	104.5dB below rated output, DC to 80kHz unweighted
Damping factory	Over 500 from 10Hz to 1kHz	50Hz 91.9 1kHz 94.7
Input sensitivity	1.5V RMS for rated output at 1kHz	1.5V RMS for rated output at 1kHZ

them in each supply rail. If the fuse blows for some reason during amplifier operation, the first capacitor is left charged (at around 130V) while the second capacitor is discharged by the amplifier circuitry. When the new fuse is screwed into place, the discharged capacitor is suddenly connected across the charged capacitor via the fuse and the result is a flash and bang like a small firecracker, and a second blown fuse.

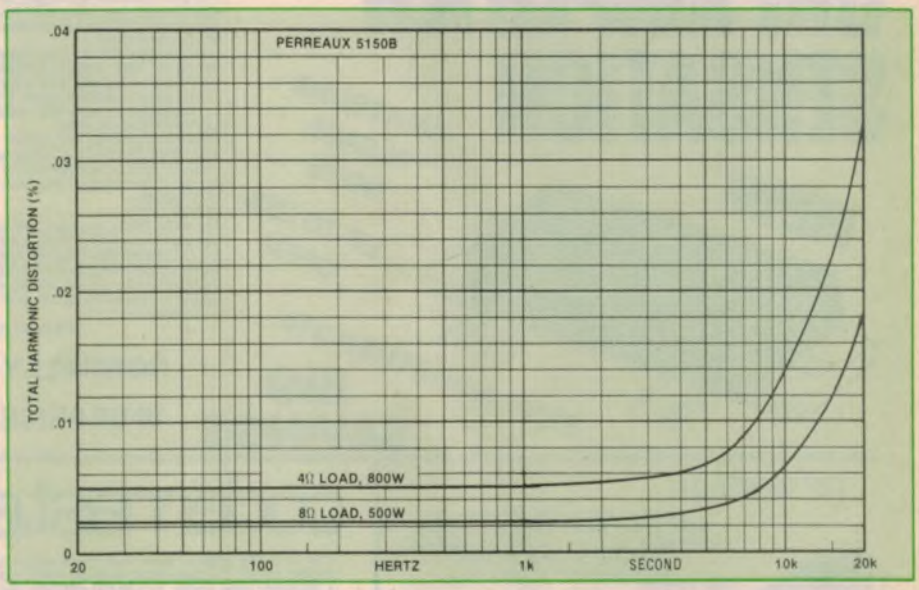
We believe that Perreaux has included a bleed resistor across the first 10,000μF capacitor to discharge it after the amplifier is turned off, however no information has been placed on the rear panel to indicate how long you have to wait before it is safe to insert the new fuse. This problem has obviously caught a number of people (including us) since all four amplifier supply rail fuses showed signs of damage and subsequent repair on the metal ends.

Our overall impressions of the Perreaux 5150B amplifier are very favourable. The simplicity of the circuit together with the superb mechanical construction, extremely low distortion and huge output power, combine to make this amplifier one of the best we have ever tested. The few criticisms we have of the 5150B are quite minor and will probably be remedied on the production versions anyway. If you are intending to purchase an amplifier in the top end of the market, we highly recommend you give the Perreaux 5150B an audition.

The amplifier has a five year warranty and carries a recommended retail price of $3875. Further information on the Perreaux 5150B amplifier is available from Perreaux Australia, 6 University Place, North Clayton, Vic. 3168, or from hi-fi dealers stocking Perreaux equipment. (JS)



These graphs plot the total harmonic distortion (THD) as a function of output power (above) and as a function of frequency (below). THD is generally less than .01%.



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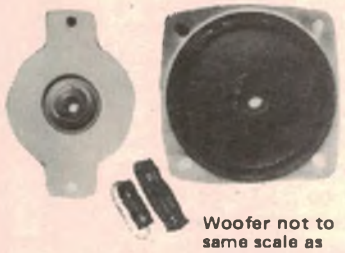

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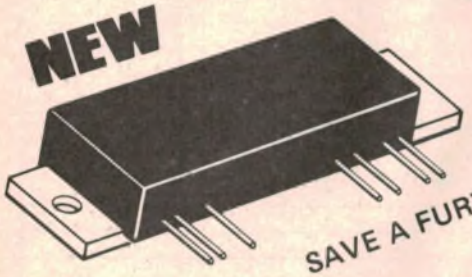

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– 19.4 dB (Min) POWER GAIN. TYPICAL DRIVE LEVEL TO FULL POWER 80 - 150mW
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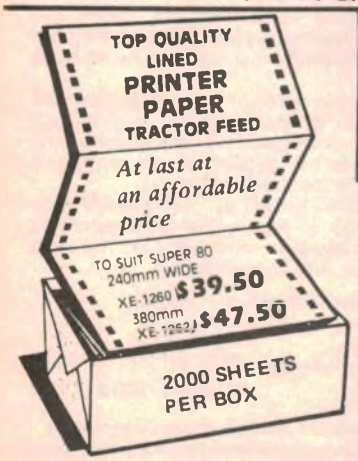

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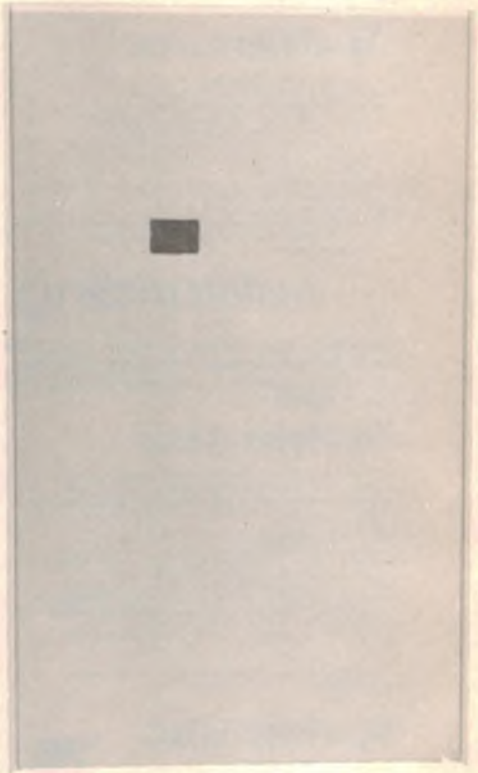
Infrared Remote Control for the Touch-lamp Dimmer

by JOHN CLARKE & GREG SWAIN

Fancy infrared remote control for your Touch-lamp Dimmer? This circuit can turn the lights on and off or dim them to any desired level, all at the touch of a single button.



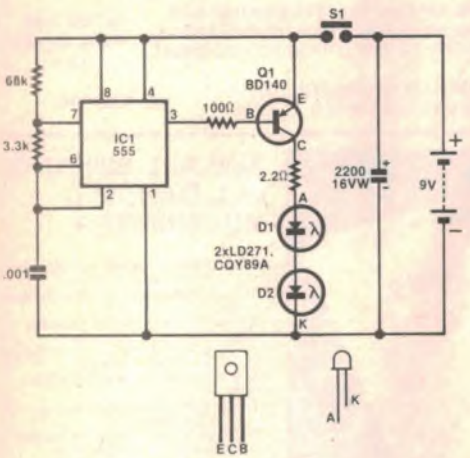
In many instances, the location of light switches is far from practical. In most rooms, for example, switches are located near the doorway. This is the obvious position for switching the light on and off upon entry or exit, but if you are seated in the room the doorway location is usually not convenient. With this infrared control, the lights can be switched on and off or dimmed to suit the mood without moving from your chair.

In the bedroom, the same advantages apply. You can now turn the light on and off or dim from the convenience of your bed. You will not need to walk around in the dark again. Just press the single button on the hand-held transmitter and the light will turn on or off. Or by holding the button down, you can dim (or brighten) the light to any desired level from full brightness to completely off.

You don't even have to point the transmitter directly at the wall-mounted receiver/dimmer unit. The circuit is so effective that wall reflections of the transmitted infrared light are quite sufficient to activate the receiver. Naturally, the user still has full control over the Touch-lamp Dimmer in the usual way – that is, by touching it.

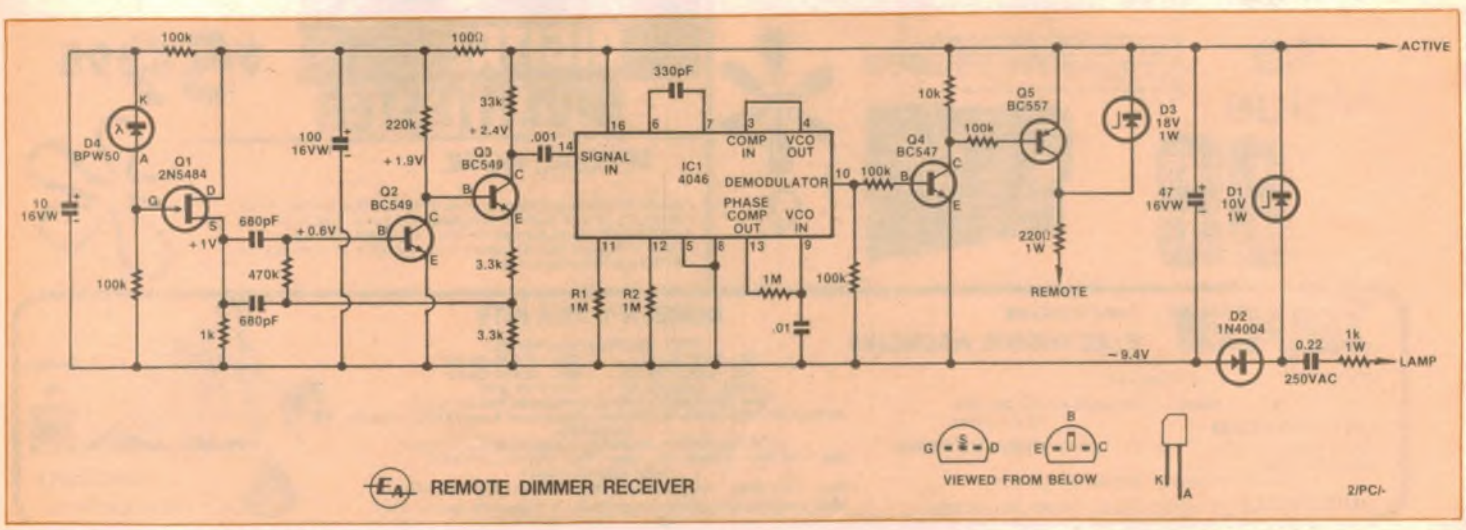
The Touch-lamp Dimmer was originally described in April 1983 and consists of an HPM blank grid with a metallic cover plate. Mounted on the back of the grid plate is a small printed circuit board (PCB) which contains the dimmer circuitry. By lightly touching the front plate for between 50 and 400ms, the unit will switch lights on and off. Alternatively, touching the plate for longer periods initiates up/down dimming.

All these features are duplicated by the Remote Dimmer, although you actually have to go to the trouble of pressing the



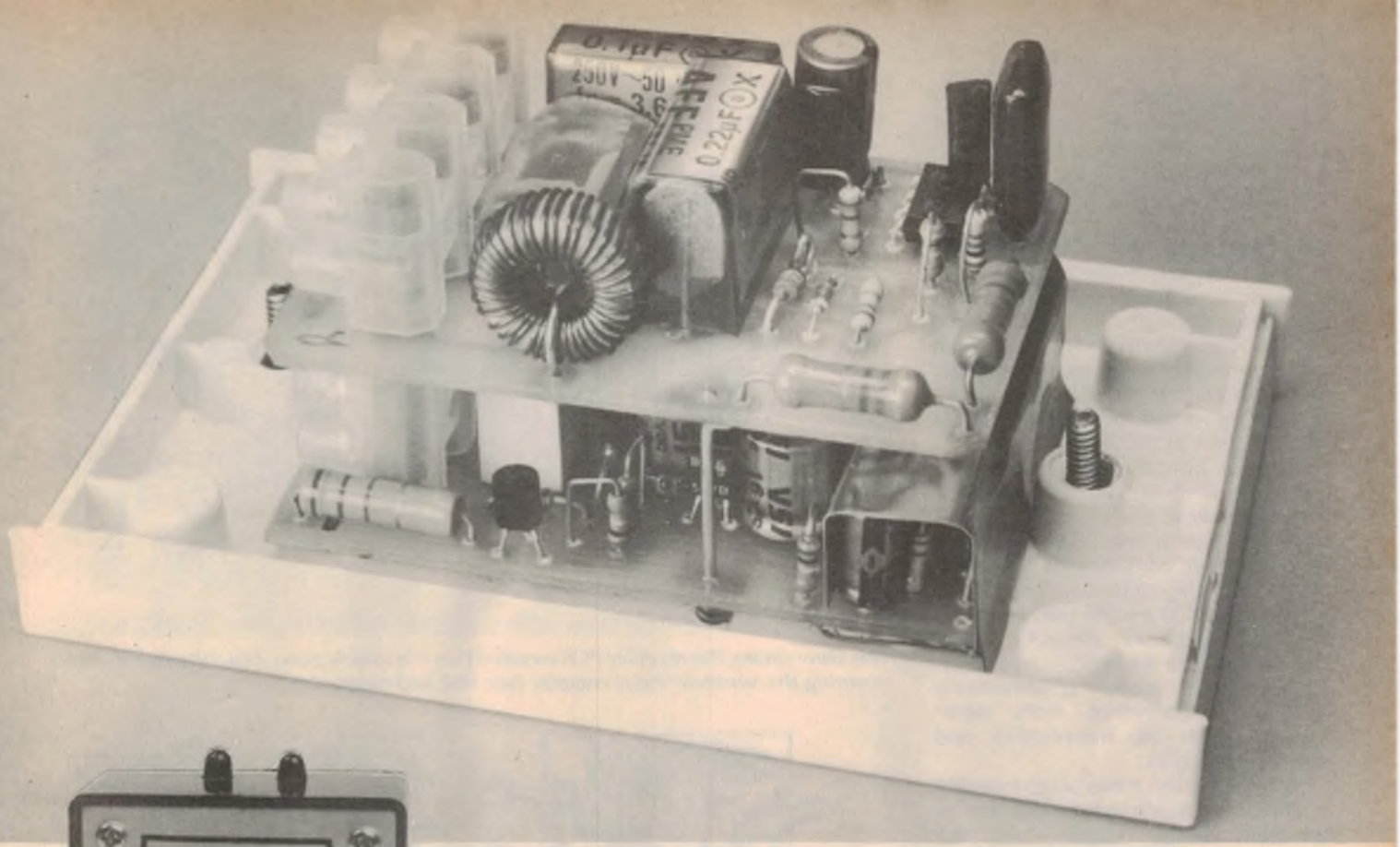
REMOTE DIMMER TRANSMITTER

2/PCI-



REMOTE DIMMER RECEIVER

2/PCI-



The remote control receiver PCB and the dimmer PCB are both mounted on the back of the switch plate. At left is the hand-held infrared transmitter.

switch on the hand-held transmitter unit. Even so, the burden should not be too great!

Externally, the appearance of the Touch-lamp dimmer with remote control is identical to the original except for a small hole in the touch plate (see photo). This is to admit infrared light pulses generated by the transmitter to an infrared photodiode in the receiver circuit. The receiver PCB and the existing Touch-lamp Dimmer PCB are stacked together, with the receiver PCB mounted directly on the grid plate.

The transmitter consists of a small box containing the necessary circuitry and a 9V battery. Two infrared LEDs protrude through the end of the box and a small momentary contact switch on the lid switches power to the transmitter when lamp control is required.

When the switch button is pressed, the transmitter emits pulses of infrared light and these are detected by the infrared detector diode in the receiver. The signal is then amplified and fed to a phase lock loop (PLL) IC which immediately locks onto the incoming frequency. The PLL drives a transistor output stage which, in turn, activates the dimmer circuit via the existing "Remote" input on the dimmer PCB terminal strip.

Since the receiver PCB carries its own power supply components, only two further connections are required between the receiver and dimmer PCBs. These are "Active" and "Lamp". As before, these connections are made directly to the terminal strip on the dimmer PCB.

How it works

The remote dimmer transmitter consists of a 555 timer IC, several resistors, two capacitors, a 9V battery, two infrared LEDs and a BD140 driver transistor. The 555 IC is connected in the astable mode, operates at 20kHz, and provides a 2.3μs negative going pulse at its pin 3 output. This signal switches on the BD140 transistor which supplies 1A current pulses to the two infrared LEDs. The 2.2Ω resistor limits the current to prevent damage to the LEDs.

Even so, the peak current is more than the battery could supply on its own. For this reason, a large storage capacitor (2200μF electrolytic) has been included to supply the peak current. The battery keeps the capacitor topped up with charge while the capacitor supplies the LED current pulses.

The average current drawn by the circuit is around 60mA giving a battery life of several months under normal use.

Note that two infrared LEDs have been used in the transmitter to double the infrared light output. These LEDs are either Philips CQY89A or Siemens LD271 types. They are similar in appearance to the more usual red LEDs except that they are encased in a very dark blue encapsulation which is transparent to infrared light.

Let's now turn to the receiver circuit. It can be broken down into four sections: an amplifier, a phase lock loop (PLL), an output driver stage, and a power supply.

The infrared light generated by the transmitter LEDs is received by an infrared photodiode (D4). This is a Philips BPW50 type which incorporates an integral infrared filter and which is specially designed to match the infrared LEDs.

The photodiode has its cathode connected to the positive supply rail via an RC decoupling network consisting of a 100kΩ resistor and a 10μF capacitor.

Remote Dimmer

This ensures that the supply line does not modulate the anode voltage of the diode, with subsequent amplification in the following stages. In operation, the photodiode acts as a current source such that it generates a current proportional to the incident infrared light. This current signal is converted to a voltage by the 100kΩ resistor at the anode.

The signal from the photodiode is fed to the input of Q1, an N-channel FET connected as a source follower. This stage has a gain of about 0.5 and drives a bandpass filter consisting of transistors Q2 and Q3. The centre frequency of the filter is about 20kHz while the bandwidth is wide enough to allow for some mistuning of the transmitter frequency. At the same time, it effectively eliminates interference from other sources such as fluorescent and incandescant lights.

Q2 and Q3 form a two stage inverting amplifier. Both transistors operate as common emitter stages, with the second stage providing two separate outputs: one from the junction of the two 3.3kΩ resistors and the second from Q3's collector. The first output has a relatively low impedance and is used to drive the filter and to provide DC feedback via the 470kΩ resistor to bias Q2.

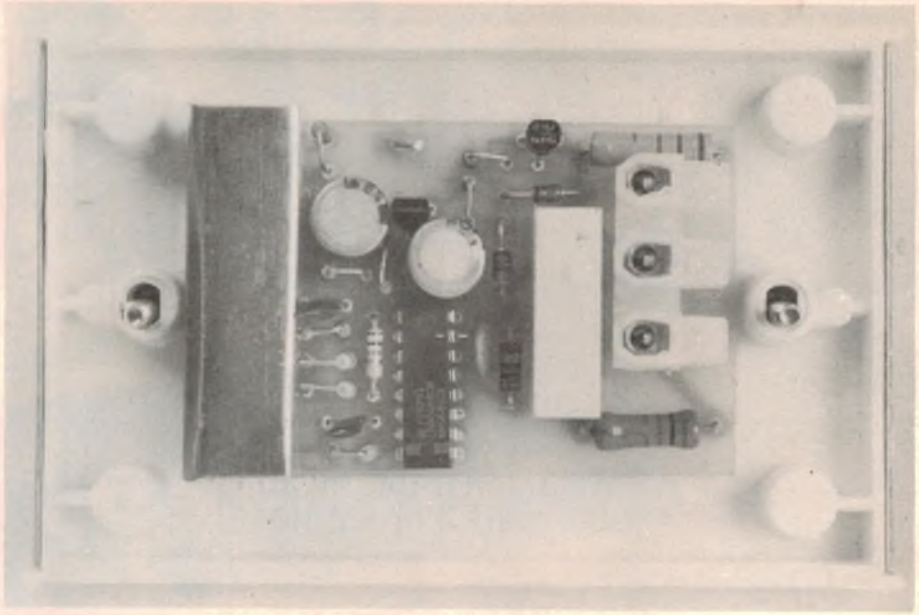
The filter components are the two 680pF capacitors and the 470kΩ bias resistor which, together with the output impedance of the previous FET stage, determine the centre frequency and Q of the filter.

Phase lock loop

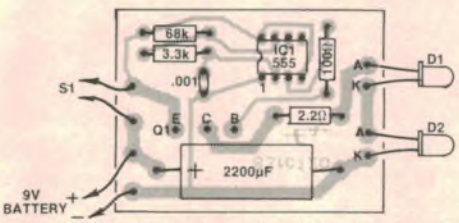
The amplified signal at the collector of Q3 is AC-coupled to the signal input of the 4046 PLL (IC1). This input has a sensitivity of about 200mV when AC-coupled which means that it can lock on to signals at or above this level.

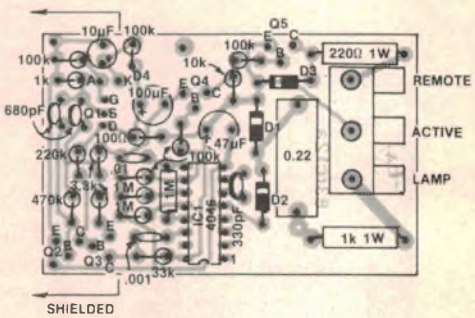
Inside the PLL is a voltage controlled oscillator (VCO), a phase comparator, a filter and a demodulator. The frequency of the VCO can be varied over a certain range by applying a DC control voltage to the VCO input (pin 9). R1 and R2, together with the 330pF capacitor (pins 6 and 7), set the range of the VCO from 10kHz to 20kHz.

What happens is that the phase comparator compares the signal frequency with the VCO and produces a control voltage to bring the VCO into lock (ie, to the same frequency). If there is no signal input, the VCO simply free runs at its minimum frequency (10kHz) and the filtered output from the phase

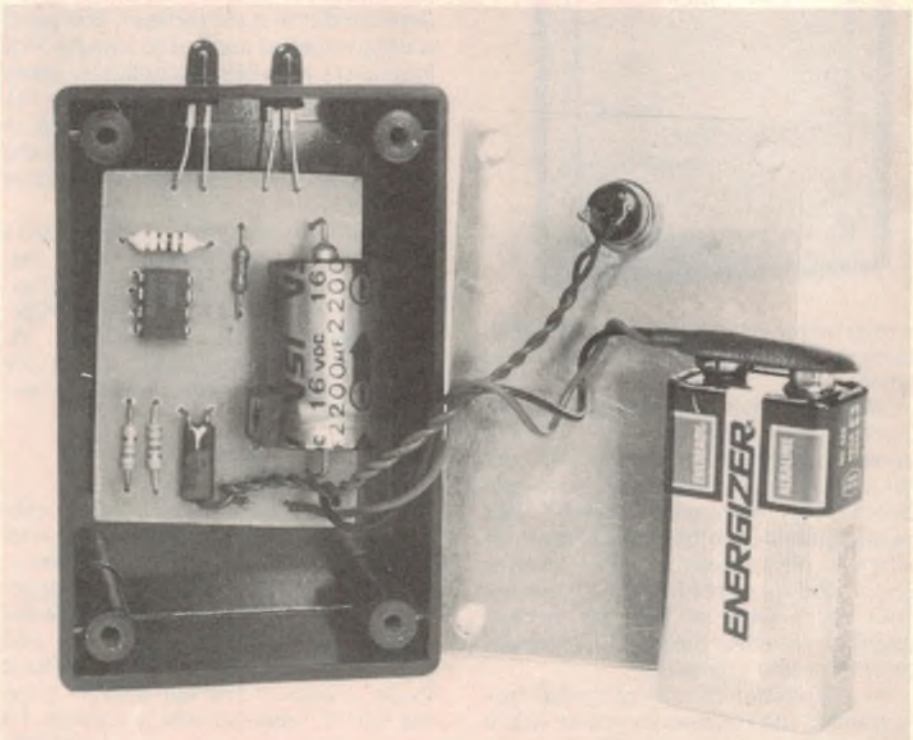


This view shows the receiver PCB mounted on the switch plate. Note the metal shield covering the sensitive input circuitry (see text and diagrams).





Install all parts exactly as shown on these overlay diagrams. Figs. 1 & 2 show the details for the metal shield.



View inside the hand-held transmitter. Use a small piece of foam insulation to prevent shorts between the battery and the PCB.

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Remote Dimmer

comparator is low. This means that the demodulator output (pin 10) will also be low, since it follows the voltage on the VCO input, and that transistor Q4 will be off.

When the signal frequency is higher than the VCO, the phase comparator increases the duty cycle of its pulsed output with pin 13 remaining high for a greater proportion of time. This output is filtered by a 1MΩ resistor and a .01μF capacitor to produce a smooth control voltage on pin 9. Thus, when a 20kHz signal is received, pin 9 and the demodulator output (pin 10) both go high, turning on transistor Q4.

Q4, in turn, drives transistor Q5 which turns on and pulls the Remote input of the dimmer circuit high via a 220Ω resistor. Zener diode D3 protects Q5 from excessive collector-emitter voltages.

Note that for incoming frequencies much below 20kHz, the demodulator output will not go high enough to trigger Q4. IC1 thus provides an additional measure of filtering against frequencies below 20kHz.

Power for the circuit is derived from the mains via a 0.22μF current limiting capacitor and a 1kΩ resistor. By using the capacitor reactance to limit the current rather than a large value resistor, heat dissipation is kept to a minimum. Diodes D1 and D2 operate in conjunction with the 0.22μF capacitor as a "charge pump" for the 47μF capacitor, while D1 performs the additional function of limiting the supply voltage to about 9.4V (ie, 10V minus the voltage across D2).

The 0.22μF capacitor acts as an impedance of 15kΩ at 50Hz and thus limits the current to an average of 16mA when the full mains voltage is applied across the Lamp and Active terminals (ie, at minimum brightness). When the lamp is at full brightness, the first 35 degrees (or 2ms) of each mains cycle is still available for the power supply (see EA, April 1983). The lower average voltage thus developed is still sufficient for zener regulation and filtering.

PARTS LIST

1 PCB, 83rc12a, 47x72mm
1 PCB, 83rc12b, 52×39mm
1 plastic utility case, 83x54x29mm
1 Scotchcal front panel, 50x79mm
1 momentary contact pushbutton switch
1 9V battery, Eveready 216 or equivalent
1 battery clip
1 3-way mains terminal strip
1 100mm length of 1mm-diameter tinned copper wire

SEMICONDUCTORS
1 555 timer IC
1 4046 phase lock loop IC
1 BD140 PNP transistor
2 BC549 NPN transistors
1 BC547 NPN transistor
1 BC557 PNP transistor
1 2N5484 N-channel FET
1 18V 1W zener diode
1 10V 1W zener diode
1 1N4004 diode
2 CQY89A or LD271 infrared diodes
1 BPW50 infrared photodiode

CAPACITORS
1 2200μF/16VW pigtail electrolytic
1 100μF/16VW PC electrolytic
1 47μF/16VW PC electrolytic
1 10μF/16VW PC electrolytic
1 0.22μF 250VAC
1 .01μF metallised polyester
2 .001μF metallised polyester
2 680pF ceramic
1 330pF ceramic

RESISTORS (¼W, 5% unless noted)
3×1MΩ, 1×470kΩ, 1×220kΩ, 5×100kΩ, 1×68kΩ, 1×33kΩ, 1×10kΩ, 3x3.3kΩ, 1x1kΩ, 1x1kΩ 1W, 1x220Ω 1W, 2x100Ω, 1x2.2Ω

MISCELLANEOUS
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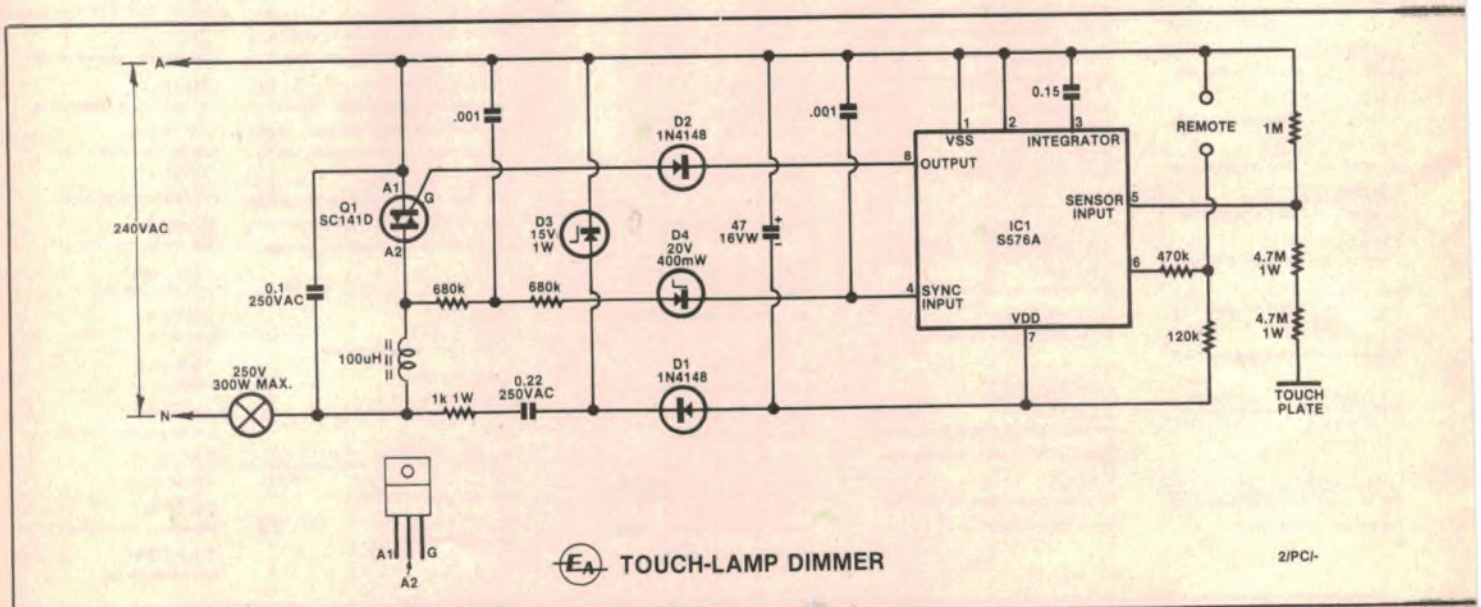
PLUS
All the parts required to build the Touch-lamp Dimmer (see April 1983)

Construction

The Remote Dimmer receiver circuitry is constructed on a PCB coded 83rc12a and measuring 47x72mm. This PCB mounts directly onto the rear of the HPM grid plate. The transmitter circuitry is constructed on a PCB coded 83rc12b and measuring 52x39mm. This PCB, along with the 9V battery, is housed in a small plastic utility case measuring 54x29x83mm (WxDxH).

Begin construction by assembling the transmitter PCB according to the parts overlay diagram. The main point to watch here is that all polarised parts are correctly oriented. These include the 2200μF capacitor, the LEDs, the transistor and the IC. The two infrared



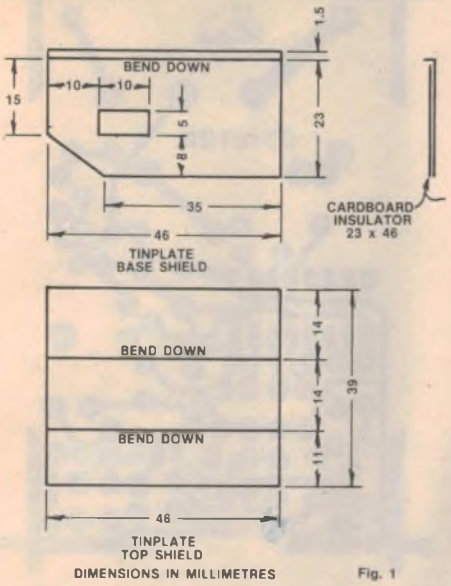


Fig. 1

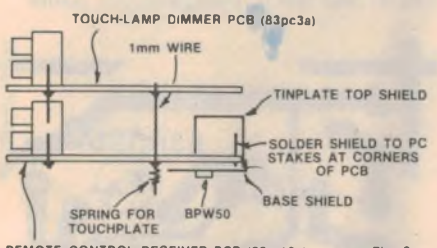


Fig. 2

LEDs are mounted at the extremities of their leads and bent at right angles after soldering.

Note that the body of the .001μF capacitor must be mounted flat against the PCB. This is to allow the battery to fit between the PCB and the lid of the case during final assembly.

With the PCB assembled, attach the Scotchcal label to the lid of the case and drill the switch mounting hole. You will also have to drill two 5mm holes at one end of the case to accept the infrared LEDs. These holes should be positioned so that the PCB will sit comfortably on the bottom of the case. The two infrared LEDs should protrude by about 5mm to ensure that their active areas are exposed.

The wiring to the switch and battery can now be completed according to the wiring diagram and the case assembled. We used foam insulation to isolate the battery from the PCB and to hold these items in place when the lid is screwed down.

Attention can now be turned to the remote dimmer receiver. As before, take care to ensure that all polarised components are inserted correctly and note that most of the resistors are mounted end on. Note also that alternative pad spacings have been provided for the 0.22μF capacitor. These are to suit the two different types of capacitor commonly available.

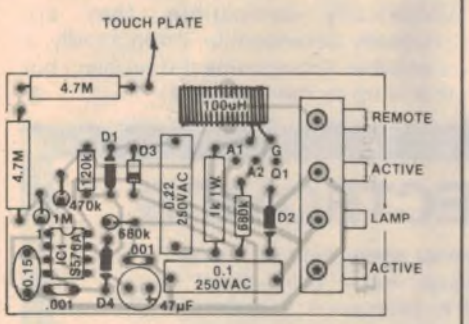
The three-way insulated terminal block is secured to the PCB using short lengths of 1mm diameter wire soldered to the copper pads allocated for the terminals.

The photodiode (D4) is mounted on the copper side of the PCB. Bend the leads at right angles adjacent to the diode body, then insert the diode so that it lies flat on the PCB with the act. e area facing outwards. In practice, this means that the diode body should lie under transistor Q1.

Shielding is required for the amplifier portion of the circuit and Fig.1 shows the dimensions required. Tinplate is the ideal material and this can be obtained cheaply by cutting up a tin can that previously contained Fido's dinner. The 5x10mm cutout in the base shield provides clearance for the photodiode.

A cardboard insulator is required between the base shield and the PCB, and this can be attached to the metal using double-sided tape or epoxy adhesive. This done, the two shield pieces can be attached to the receiver PCB by soldering them to earthed PC stakes (see Fig. 2). Note that the shield could touch the leads of some resistors — this is acceptable provided the leads are connected to earth. You will have no problem if you solder in the resistors exactly as shown in the parts overlay diagram.

Check the assembly carefully to ensure adequate clearance between the shield and the photodiode leads.



Left and above: reprinted from the April 1983 issue, these two diagrams depict the circuit and PCB parts overlay for the Touch-lamp Dimmer. As shown in the photos and Fig. 2, the dimmer PCB is stacked on top of the remote receiver PCB. Refer to April 1983 for a full circuit description.

Final assembly

You are now ready for the final assembly. First, remove the dimmer PCB from the grid plate by prising it gently with a screwdriver blade (be careful though, otherwise the PCB could

Remote Dimmer

shatter). This done, remove the contact spring and the three short lengths of tinned copper wire from the Remote, Active and Lamp terminals (but not from the Active terminal adjacent to the 0.1μF 250VAC (capacitor).

Fig. 2 shows the stacking arrangement for the two PCBs. As shown, the touchplate contact spring is soldered to a pad on the receiver PCB and a 23mm length of 1mm tinned copper wire run to the contact (or touch) pad on the dimmer PCB. Connections between the two terminal blocks are made using three 20mm lengths of 1mm tinned copper wire – one each soldered to the Remote, Active and Lamp terminals of the dimmer PCB.

Solder in each 20mm length of wire so that it extends 8mm above the surface of the dimmer PCB, then insert the wires into the terminal blocks and tighten the screws. Provided that you use 1mm tinned copper wire for all connections, no further support will be required between the two boards.

The PCB assembly is centrally located on the rear of the plastic grid plate. You will have to mark out and cut a hole in the grid plate for the photodiode, together with a matching hole in the metal faceplate. Make sure that these holes are large enough to admit light to the full active area of the photodiode. It will not be necessary to drill a new hole in the grid plate for the contact spring, since the existing hole can be re-used.

Because the photodiode leads are at mains potential, a rectangular sheet of stiff, clear plastic should be fitted over the cutout for the photodiode (the plastic used for shirt box lids is ideal). This should be glued directly to the plastic grid plate using a suitable adhesive (eg, "Airfix") so that, when the metallic cover plate is clipped into position, the plastic window is sandwiched between the two.

The PCB assembly can now be affixed with epoxy resin to the rear of the grid plate and the touchplate checked for correct isolation. Set your multimeter to the highest range and check that the resistance between the touch plate and the active terminal on the dimmer PCB is about 10MΩ. If the circuit fails this test, check carefully for faults and rectify any problem before proceeding.

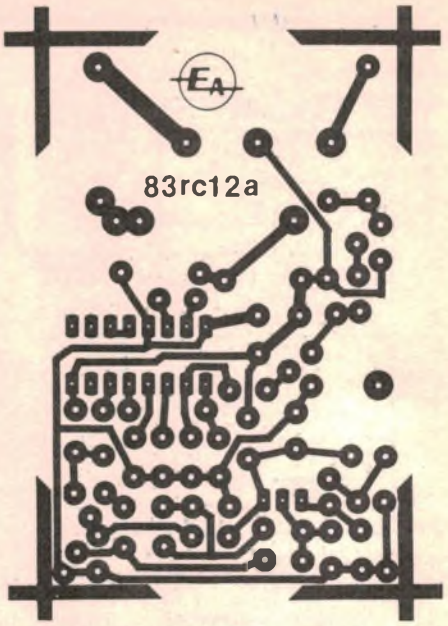
Installation of the completed unit is exactly the same as for the original Touch-lamp Dimmer circuit in the April 1983 issue. The new unit is designed to fit a standard wall box and, just in case you're wondering, the remote switching option can be added as before.

Finally, some readers may be wondering if the remote control option can be fitted to the Touch-lamp Timer described in August 1983. The simple answer is that while the two circuits are electrically compatible, they are physically incompatible. Undoubtedly, it is possible to overcome this problem but that is up to the individual.

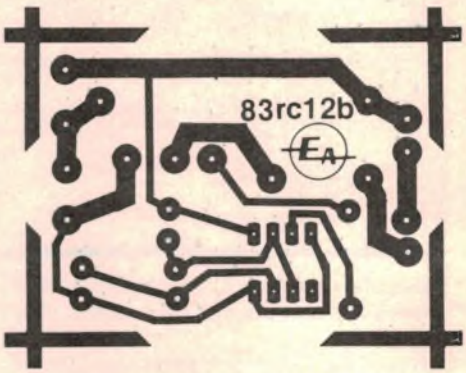
We estimate that the current cost of parts for this project is approximately

$26

This includes sales tax but does not include the cost of the Touch-lamp Dimmer.



Here are actual size artworks for the PCBs and the transmitter front panel.



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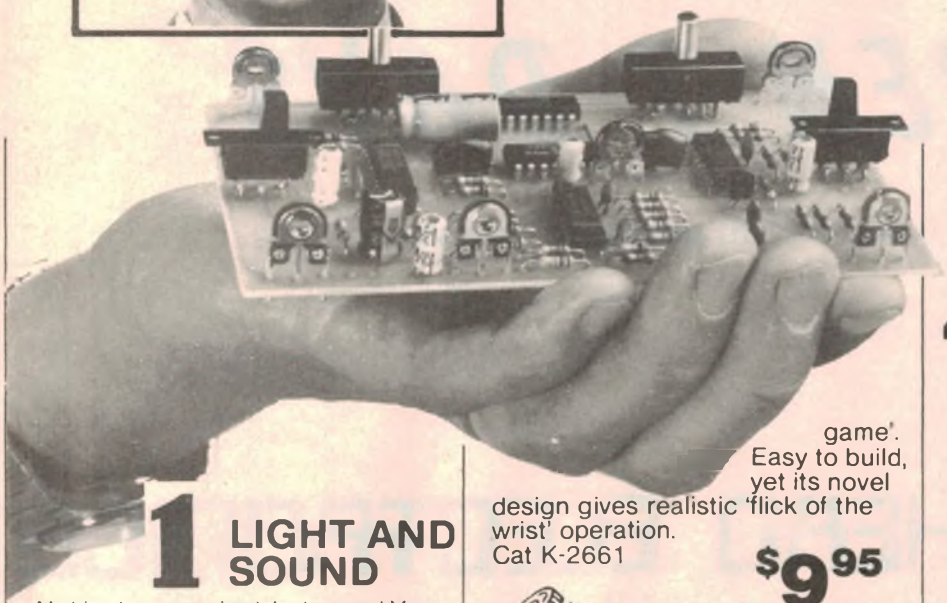

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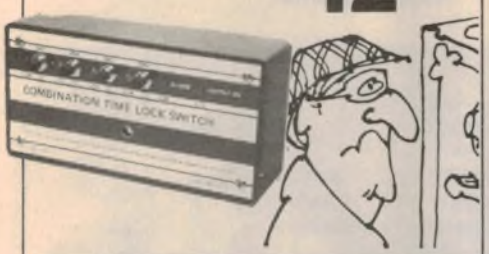

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A682/

Sprinkler controller

Watering large areas of market gardens can be a tedious business where limited water pressure restricts the number of sprinklers to one or two at the time. The automatic switching system described here enables a large number of sprinklers to be switched on in succession. It could also be used for watering lawns.

This project came about due to my interest and work in electronics, and through working on my father's potato farm. Several paddocks are out of reach of water pumped from our dam. Therefore, we must resort to using water from the street main which, at the best of times, will drive only one sprinkler. For years these paddocks have been watered in this fashion, which meant that, every two or three hours, someone had to go and shift the sprinkler. That is, until I came up with the idea of a portable sprinkler controller.

After some looking around, I found an electric solenoid valve ideal for the job and, after a lot of head scratching, came up with a circuit for controlling the taps. I built my project on a moveable platform, which I will describe later. The biggest benefit is that I am now able to water during the night, when there is maximum pressure and minimum evaporation.

The circuit is built on two printed circuit boards. One is a timer board which gives an output pulse every 1, 2, 2.5 or 3 hours, depending where S1 is set. The second board consists of 10 output transistors (500mA output current) which are sequentially switched each time a pulse is received from the timer board.

Each board is designed to take a 16-way edge connector with 0.1in spacing, such as is available from Dick Smith under catalogue number P2816. These are used to provide interconnection between the two boards, and also from each board to various external components. In the case of the timer board these include switches S1 and S2, and, for the control board, the solenoid valves, the two batteries, S3 etc.

How it works

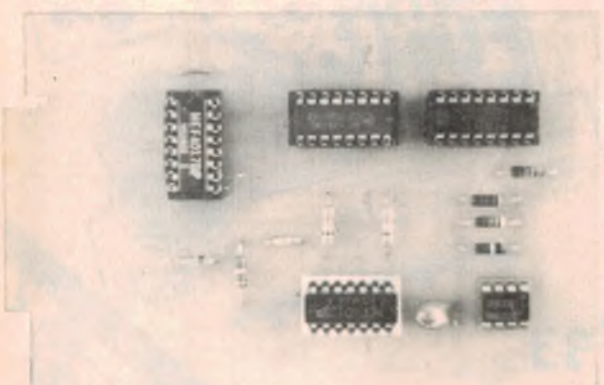
The timebase for the timer is an LM555 timer (IC1) operating at 5.5Hz. The 12kΩ timing resistor shown should give this time approximately, but may need to be modified to cope with any spread of the 10μF capacitor. Provision is made on the printed circuit board to add or substitute a trimpot if the timing is critical.

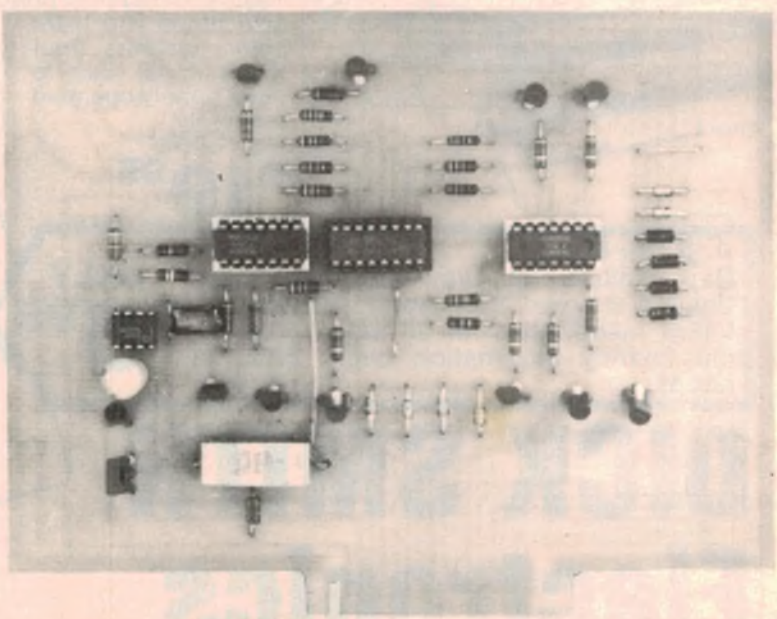
Following this are two 4518 dual decade counters (IC2-IC3) which divide the 5.5Hz 10,000 times, giving a negative going pulse at pin 14 (IC3) once every half hour. IC4 is a Johnson counter and is wired to divide the half hour pulses at its pin 13 by 2, 4, 5 or 6 to give a negative going pulse every 1, 2, 2.5 or 3 hours at pins 2, 7, 10, and 1 respectively.

Switch S1b selects whichever one of these pins is required for a particular time, while S1a is connected so each switch position is one stage of the Johnson counter ahead of S1b. For example, in position 1HR, a negative going pulse is delivered to pin 13 of IC6 after one hour. Simultaneously, position 1HR of S1a receives a positive going pulse which is fed to the reset pins of IC2, IC3 and IC4, and this resets all the counters to zero. Therefore, pin 13 (IC6) will receive another negative going pulse only after a further one hour. The 12kΩ resistor is used to keep the reset line down to the zero line during counting.

Switch S2, a pushbutton type, is used to reset all counting to zero when a new watering cycle is commenced.

When S2 is depressed, S2a sends a positive pulse to the reset lines of IC2, IC3 and IC4. Section S2b functions in conjunction with IC5, a 4011 quad 2-input NAND gate. Two of these are used as a flipflop, as shown, to send a pulse to pin 13 (IC6) when S2 is depressed. The flipflop is used to avoid contact bounce.





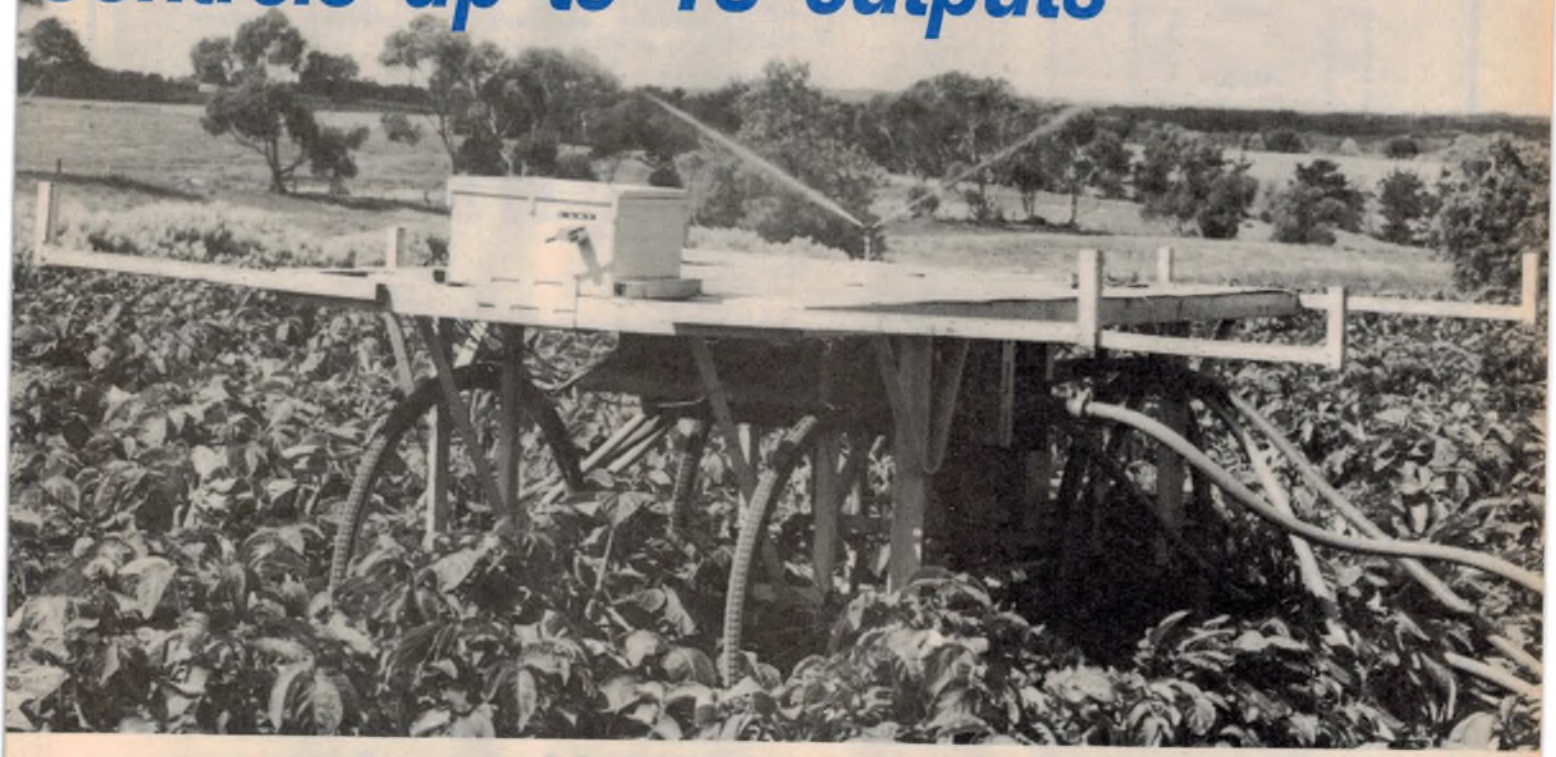
THE TIMER board (above) delivers an output pulse every 1, 2, 2.5 or 3 hours, depending on the setting of S1. Note that the final version differs slightly from the prototype.

THE SPRINKLER CONTROLLER board (right) controls the 10 water sprinkler solenoids. Both PCBs plug into 16-way edge connectors and are easily removed from the case for servicing.

for vegetable gardens

Controls up to 10 outputs

by L. J. VELLA



The author's unit was mounted on a mobile platform which also carries the solenoids, the hoses and the 12V car battery.

When S2 is depressed the flipflop output changes to 1. When it is released the output goes to zero. This negative pulse will move the output along one stage, and activate the first solenoid.

The output board is made up of several sections. Basically, it switches the 10 output solenoids sequentially each time pin 13 (IC6) receives a negative going pulse from the timer board. The heart of this board is another 4017 Johnson counter (IC6). This counter can be pulsed by either a positive or negative going pulse. In this case, pin 14 is held at the positive rail which enables pin 13 to be triggered by the negative pulses from the timer board. Pin 15 is held at zero to disable the reset function.

From IC6 the 10 outputs are connected to 10 two-stage amplifiers. The first stage consists of two LM3086 integrated circuits, each of which contains five low power NPN transistors. The second stage consists of 10 2N4356 transistors which are capable of 500mA collector current. Diodes D3-D12 are used to suppress any back EMF when the coils of the valves are turned off.

A useful optional addition to the circuit is a LED indicator connected across each solenoid to indicate which one is energised at any time. These can be fitted by connecting the commoned cathodes of the LEDs to the common solenoid rail via a 680Ω resistor. The anode of each LED is then connected to its respective active solenoid line.

Richdel solenoid

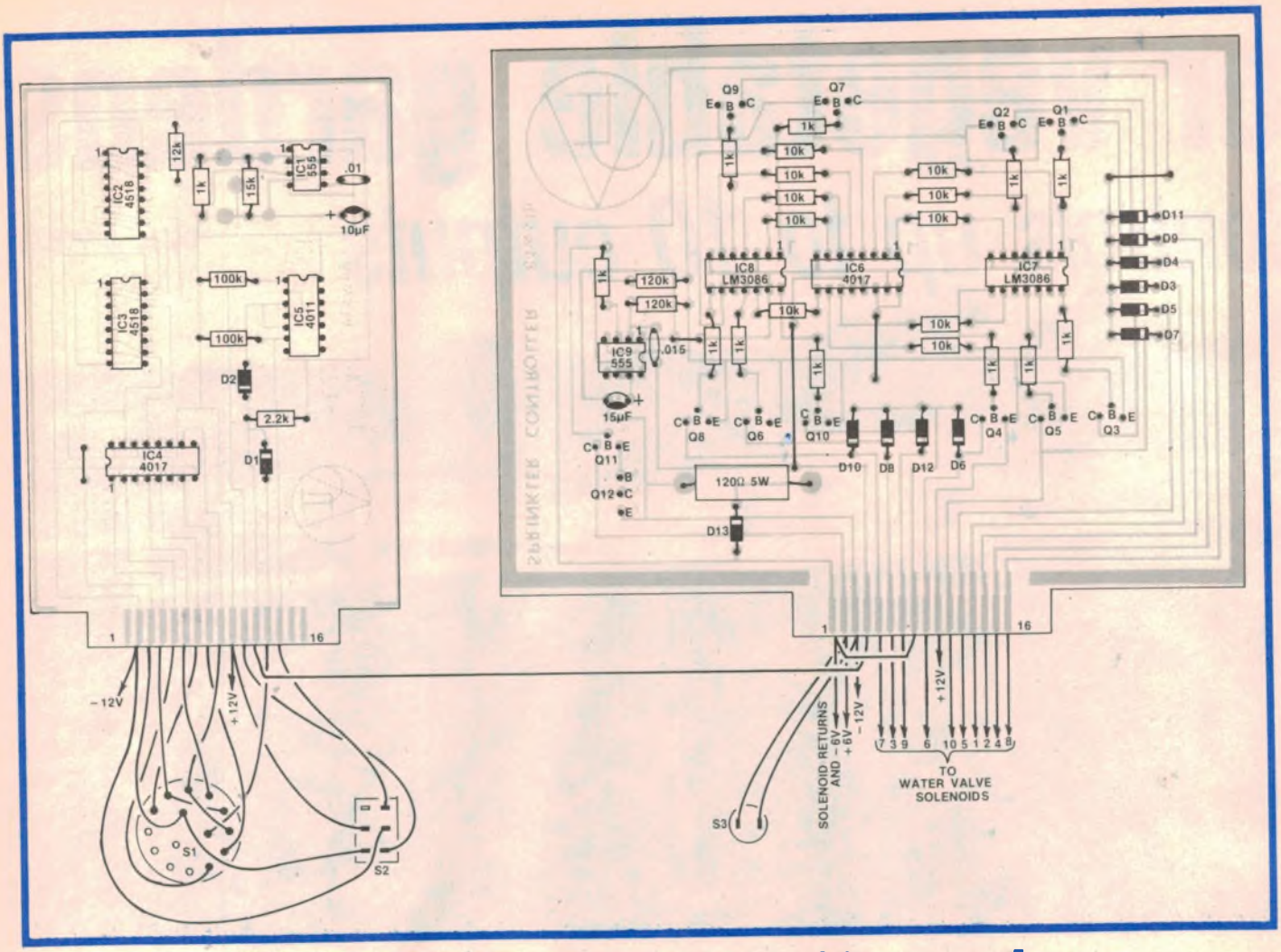
The Richdel 204LG solenoid is made by Richdel Inc, Carson City, Nevada, USA. The units used by the author were purchased from Donald Dons and Son Pty Ltd, Baxter Rd, North Geelong, Victoria 3215. Phone (052) 78 8100. The price paid was $29.50 each. It should also be possible to purchase the solenoids from other large plumbing supply houses, so check suppliers in your town or city first.

A problem that I encountered in my prototype was the pull-in current of the water solenoid coils. The water solenoids I used were Richdel R204LG which use a coil designed for 24V AC. In spite of the coil problem, I wanted to use these, as they were ideal mechanically for my project. They can be plumbed into 25mm piping, can control pressures up to 1000 pascals, with a flow rate of 160 litres per minute, and are relatively cheap. Another attraction was the low power requirements (5.7VA at 24V AC), thus avoiding the use of relays to switch heavy currents.

At 24V AC the pull-in current is 480mA, which then drops to about 200mA due to inductive reactance. But when used on DC (I used a 12V car battery for my supply) the resistance is 30 ohms which, at 12V DC, should draw 400mA. In practice (due to some losses) it draws only 320mA, which, in some circumstances, will not operate the armature.

To overcome this problem, I designed a circuit which connects a 6V Big Jim battery in series with the coils and 12V supply for two seconds. This gives, after losses, 15V across the coil, at a current of 500mA, which is more than enough to pull in the armature.

The circuit is quite simple. As each output turns on, a negative going pulse is fed to the trigger input of 555 timer IC9 via a .015μF capacitor. IC9 is configured



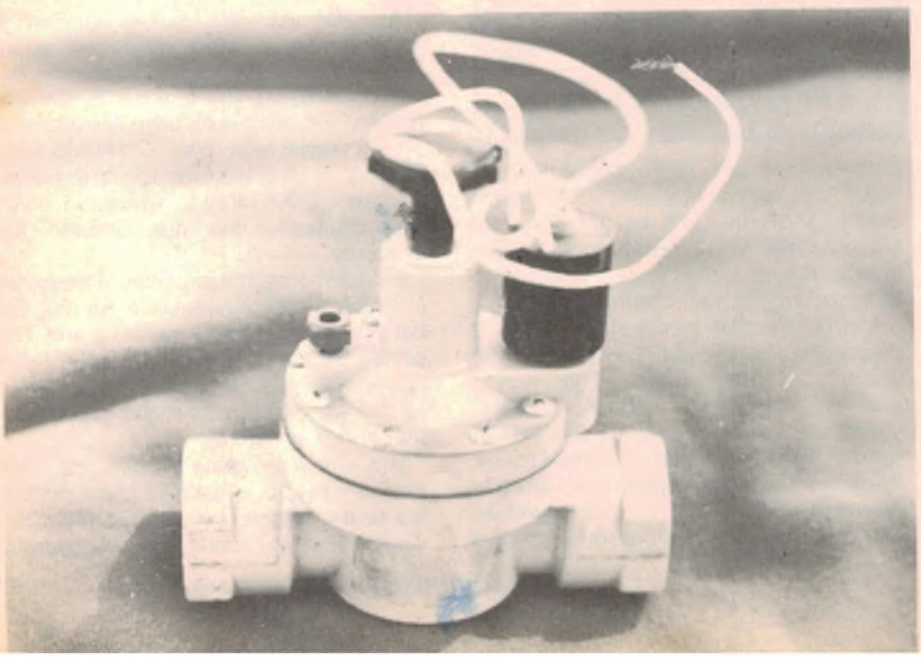
Sprinkler controller for vegetable gardens

here as a monostable with a period of about two seconds. When its pin 3 output goes high, Q11 and Q12 turn on and connect the 6V supply in series with the output transistor selected, its associated solenoid and the 12V supply.

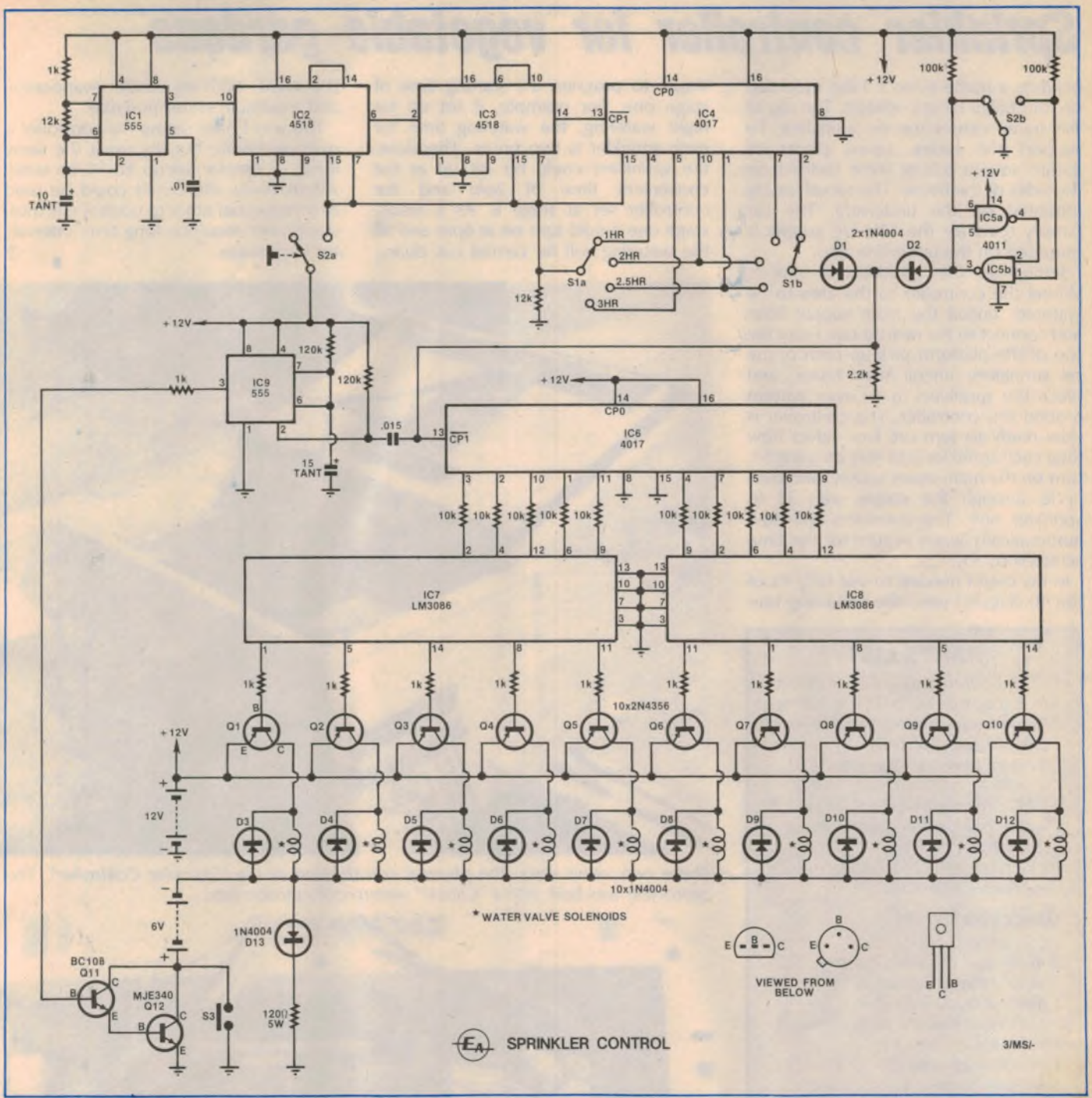
At the end of the two second delay period, Q12 turns off and disconnects the 6V supply. The current through the solenoid coil now drops to around 70mA due to the 120Ω 5W resistor in series with diode D13. This scheme significantly increases the discharge cycle time of the 12V car battery while providing sufficient holding current to keep the solenoid on.

One problem with the above circuit concerns the optional LED indicators. When Q12 is off, only about 2V is developed across the energised solenoid, insufficient to illuminate the LED effectively. To overcome this problem, I connected a N/O spring loaded switch (S3) between the emitter and collector of Q12. This switches the 6V supply in to give adequate LED brightness. Delete S3 if the LEDs are not used.

As a point of interest, if the circuit is not required to cycle through all the 10 outputs, connect the reset function (pin 15) of IC6 to the stage following the one you require. For example, if only six stages are required, stage 7 (pin 5, IC6) should be connected to the reset pin. Now, after the last stage required turns off (stage 6), stage 7 goes positive and resets the 4017 back to stage 1.



Left: the Richdel 204LG water sprinkler solenoid. Other solenoids with similar specifications may also be suitable.



(Note: besides using this controller for controlling water valves, it could also be used to control relays, which in turn may control anything you desire.)

The four time periods I used were 1, 2, 2.5 and 3 hours, but by changing the point along the two dual decade counters at which pin 13 (IC4) picks up the signal, or by changing the number of times IC4 multiplies the signal at pin 13 (IC4), a time period of up to five hours can be achieved.

Construction

Because of the exposure to water from the sprinklers, the electronic hardware was built into a "Clipsal" electrical waterproof junction box No. 265/7. S1 is mounted inside the box. For adjustment, a screwdriver slot was cut in the shaft and access is provided through a 20mm electrical plain-to-screwed conduit fitting mounted in the side of the box.

This opening is sealed with a plug made from a short piece of 20mm conduit, filled with silastic. To make an adjustment, the plug is unscrewed, the shaft rotated with a screwdriver, and the plug re-inserted to prevent the entry of water. Switches S2 and S3 are mounted on a small piece of aluminium. This is then secured to the underside of the lid. A large hole was cut in the lid above each switch and these holes sealed from the bottom with a thin piece of rubber. The holes above the rubber are filled with liquid silastic. Therefore, by pushing the silastic layer, S2 and S3 can be operated with no entry of water.

The LEDs are mounted in appropriate size holes drilled in the lid, the LEDs being sealed into the holes with silastic. The terminal strip used is a Belling Lee unit which has terminal screws at the top and solder posts at the back. Holes were drilled to pass these solder posts through the side of the box. Silastic is used from the inside as a seal against moisture.

In my case the sprinkler controller had to be portable. I achieved this by

Sprinkler controller for vegetable gardens

building a frame 0.9m x 1.8m mounted on four 68cm bicycle wheels. The top of this frame carries the six sprinklers. To support the hoses, seven pieces of 25mm square tubing were welded on the sides of the frame. The six valves are mounted on the underside. The car battery used for the 12V DC supply is mounted on the underside also.

Setting up the sprinklers is simple. Wheel the controller to the area to be watered, uncoil the main supply hose and connect to the nearest tap. From the top of the platform pick-up each of the six sprinklers, uncoil their hoses, and place the sprinklers in an even pattern around the controller. The controller is now ready to turn on. First select how long each sprinkler is to stay on using S1, turn on the main water supply, and then cycle through the stages with S2 to sprinkler one. The sprinklers will now automatically water in turn for the time selected by S1.

In my case I needed to use only six of the 10 stages. I used the remaining four stages to program the starting time of stage one. For example, if set up for night watering, the watering time for each sprinkler is two hours. Therefore, the sprinklers could be set up at the convenient time of 2pm and the controller set at stage 8. As a result, stage one would turn on at 6pm and all the watering will be carried out during the night, with minimum evaporation and maximum water pressure.

The way I have set up my controller is quite elaborate but, by using the same ideas, a simpler set-up could be used. Alternatively, the circuit could be used as a sequential timer to control electrical equipment requiring long time intervals for each stage.

PARTS LIST

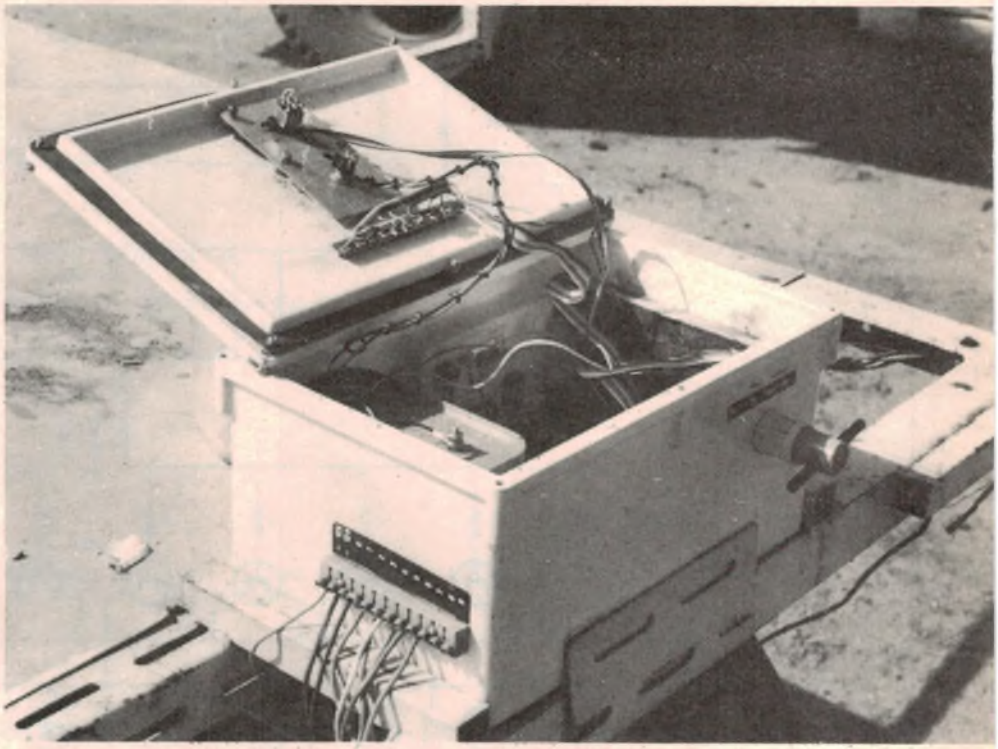
1 PCB, code 84ws1a, 123 × 80mm
1 PCB, code 84ws1b, 161 × 128mm
2 16-way edge connectors (0.1-inch)
1 case to suit (see text)
1 12-way terminal strip (see text)
1 2-pole 4-position rotary switch
1 DPDT momentary contact switch
1 single pole momentary contact switch
10 Richdel 204LG (or similar) water sprinkler solenoids

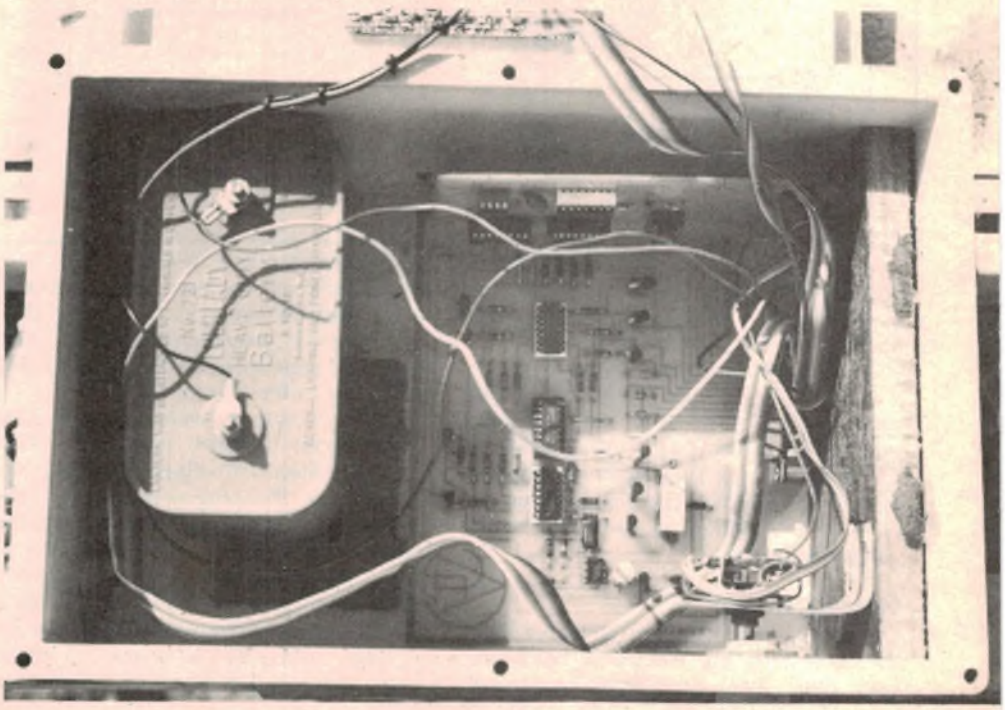
SEMICONDUCTORS
2 555 timers
2 4518 dual decade counters
2 4017 Johnson counters
1 4011 quad NAND gate
2 LM3086 transistor arrays
10 2N4356 transistors
1 BC108 transistor
1 MJE340 transistor
13 1N4004 diodes
10 LEDs (optional, see text.)

CAPACITORS
1 15µF/16VW tantalum
1 10µF/25VW tantalum
1 .015µF metallised polyester
1 .01µF metallised polyester

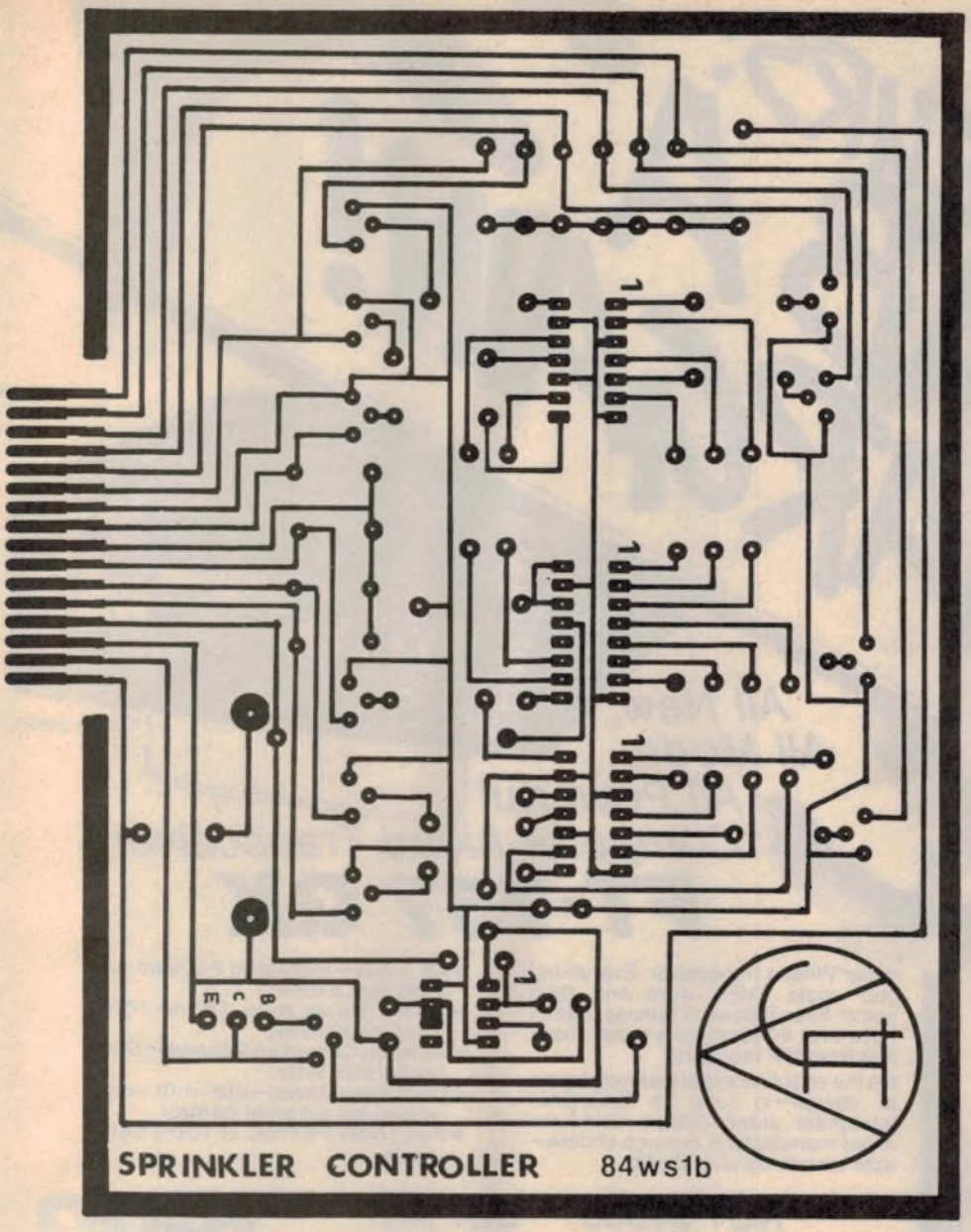
RESISTORS (½W, 5% unless stated)
1 × 120kΩ, 2 × 100kΩ, 1 × 22kΩ, 2 × 12kΩ, 10 × 10kΩ, 1 × 2.2kΩ, 12 × 1kΩ, 10 × 680Ω (optional for LEDs), 1 × 120Ω 5W

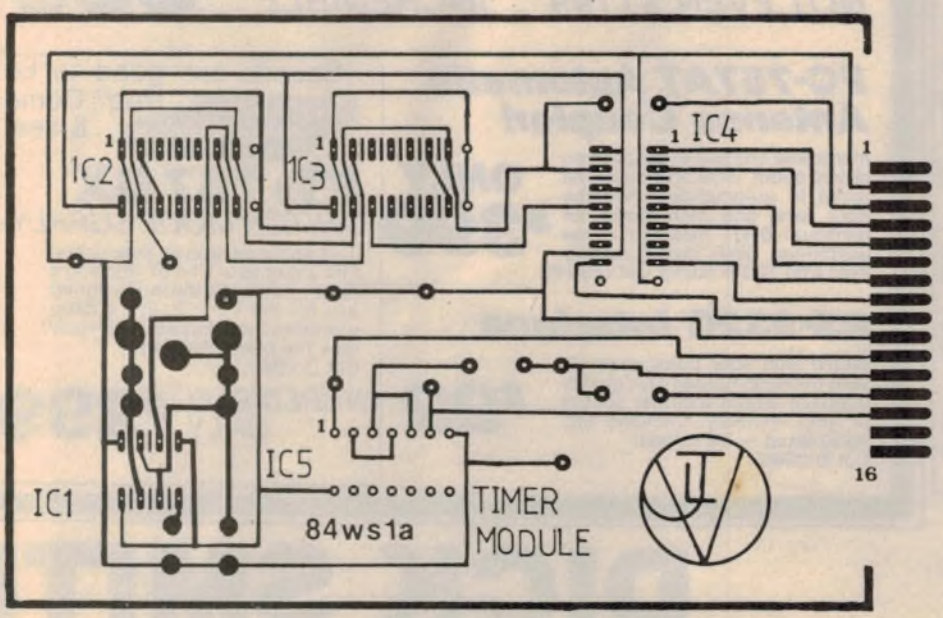
MISCELLANEOUS
Hook-up wire, machine screws and nuts, spacers, solder etc.





These two views show the physical construction of the "Sprinkler Controller". The prototype was built into a "Clipsal" waterproof junction box.





Software for the Super-80 Computer

The programs are:

POKER MACHINE SIMULATION:
This simulated poker machine keeps a record of your winnings and unlike the real ones, you can set a limit on your losses.

CALENDAR CALCULATOR:
This program displays or prints out a calendar for any year of the 20th century — and keeps track of paydays!

OTHELLO GAME:
The game of Othello, or Reversi, is played on an 8 × 8 grid with counters of two colours. This one has a "help" option.

INVESTMENT ANALYSIS:
How much money can you make investing for a fixed term of years at current interest rates? Find out with this program.

GUESSING GAME:
Is it animal, vegetable or mineral, a place, name or a car? Play against your friends, trying to guess the object.

LIST AND SORT:
This program lets you compile lists of up to 500 items, arrange them in alphabetical order and save them on cassette tape.

FRED THE SHRINK:
Got a problem? Perhaps Fred can help. Talk things over with your computer — it may give you a new perspective on life!

SIMPLE MATHS DRILL:
A great one for the kids — or to test your own arithmetic skills. It tells you the right answer, with comments if you goof.

LOTTO NUMBER SELECTOR:
We don't guarantee you'll win your fortune, but this program makes picking Lotto numbers easy. It's fun to use, too.

TRIANGLE SOLUTIONS:
Computerised trigonometry at your service. If you think you know all the angles, try this program for size.

MORTAR ATTACK GAME:
Match wits with the computer! See how long you can hold out in this challenging game of mortar bombardment.

CAVES & MONSTERS:
Go adventuring in the maze. You must fight monsters and find the treasure, but be careful — the monsters get tougher as you go.

AMATEUR Q CODE TUTORIAL:
If you're thinking of going for your amateur radio licence, or just want to find out what all those "Q" codes mean, try this.

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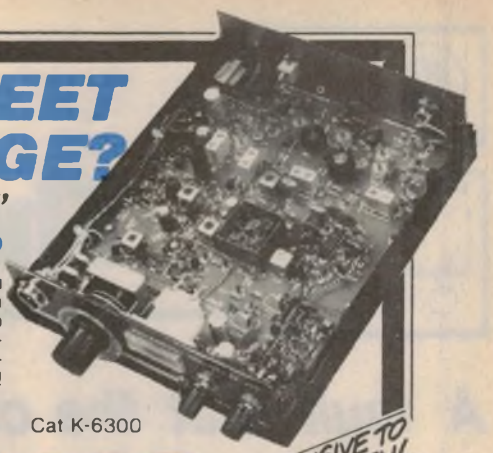

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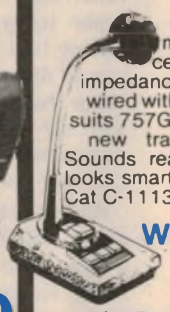

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The Serviceman

A fault that the customer didn't know about

It seems that never a month goes by without encountering at least one frustrating job; either an intermittent or a fault so obscure that there is no profit in the job by the time it's finished. Perhaps this is just as well, for the sake of these notes, but that is small consolation at the time. This month was no exception.

The set in question was a National 36cm portable, model TC-1404. This is a quite recent model and the particular set was only about 18 months old, a point of some importance as it transpired. The customer explained that it was used as a second set, mainly by his wife in the kitchen and, in answer to my question, described the trouble as ". . . having stopped dead in its tracks."

In view of subsequent events, there were times when I wished that the lady herself had brought the set in. After all, she was the one using it and she might have been more inclined to mention any other, more subtle, faults she had observed. But at the time I simply took the customer's word for it and assumed that, like most total failures, it would probably turn out to be a fairly routine exercise.

NO SERVICE MANUAL

But almost immediately I realised that I did have one problem; I had never encountered this model before and I had no service manual for it. I immediately contacted the distributors and placed an order for a manual, but decided to have a look around the set in the meantime, just in case there was something obvious to be seen.

In fact, I progressed as far as locating the main HT rail and measuring it. I expected a figure somewhere between 110 and 120V and when I measured it at around 115V I reckoned it probably wasn't far out. In fact, the circuit subsequently showed 114V.

But with the HT rail seemingly intact I hesitated to waste more time floundering around in unfamiliar territory without knowing exactly what I was looking for. I put the set to one side until the manual arrived.

When it did arrive I checked the main supply rail figure already mentioned, then looked for other supply rails. As usual, there was low voltage rail – 12V in this case – derived from an overwind on the line output transformer via a half wave rectifier and a regulator transistor, the latter controlled by a zener diode.

The only snag was that the supposedly 12V rail was down to about 4V. The first thing I checked was the zener network, D552 and a conventional diode D551 in series, but this seemed to be functioning correctly. And, since I could find no evidence of a short or heavy load across this supply rail, I was eventually forced to suspect the regulator transistor itself, Q552, a 2SC1846.

In fact, this hunch proved correct. The transistor had developed some rather obscure fault and replacing it proved the point conclusively; the 12V supply was restored and the set promptly sprang into life. "You beauty", I thought, "Another redskin bites the dust."

Unfortunately, my joy was short lived. Taking a more critical look at the picture I realised that it was exhibiting a degree of horizontal ringing; a series of vertical lines starting at the left hand side of the picture and extending about one third of the way across the screen, becoming gradually less intense. It wasn't all that obvious, except on some light video content, but I was surprised that it was there at all.

It also put me in something of a quandary. Was it a genuine fault, or was it an unfortunate characteristic of this model? If it was a genuine fault I didn't mind looking for it, but there wasn't much point in bashing my brains out trying to cure a condition which was normal.

The trouble was I didn't know how to find out. I didn't want to ask the customer because, if it was a set characteristic, I would only be drawing their attention to something which, until now, they had not noticed and were quite happy to live with. And once having had it pointed out to them, they would never again ignore it. It was at this stage that I wished the lady had brought the set in; at least she may have volunteered some comment about it if she had noticed it.

While I was musing thus, another much more serious fault appeared; one about which I had no doubt that it had to be fixed. The picture suddenly went quite dark and, even though I instinctively tried to correct this with the brightness control, the effect was only partially successful. Then, a few moments later, the brightness shot up again and everything was overbright.

Not only was this something of a shock to the system, but I was again puzzled as to why the customer had not mentioned the problem. I found it hard to believe that they wouldn't have noticed it, so I was inclined to put it down to a breakdown in communications at the domestic level. I could imagine the housewife detailing all the things she wanted her husband to tell me about the set, and him dutifully saying "Yes Dear," while thinking about his golf game and promptly forgetting everything else.

But that wasn't going to help me much now; I had the fault in front of me and I had to find it. As for the ringing, that

would have to wait. My first check was on the 114V and the 12V rails, to see whether they varied significantly with the brightness changes which, fortunately, occurred fairly frequently. But there seemed to be nothing significant happening here.

Next, I began checking out the brightness control circuit. The brightness control function is via pin 4 of the video IC; IC301, AN5612. On the one hand it is fed with a varying voltage from the brightness control pot, R309, 10kΩ which is connected across the 12V rail but with a 56kΩ resistor, R320, between the bottom of the pot and chassis.

Also connected to pin 4 is a sub-brightness control, R559, a 100kΩ pot. The moving arm connects to pin 4 while one end of the pot connects to a rather complex network fed from the line output transformer and the other end via an equally complex network from pin 5 of IC501, AN5435, referred to simply as the "jungle". In fact it contains the noise detector, the sync separator, vertical and horizontal oscillators, etc, and something called the protector which feeds pin 5 and, I assume, is a form of beam limiting circuit.

VOLTAGE CHECKS

All this seemed frightfully complicated and I decided as a first step to monitor the voltage fed to pin 4 of the video IC and, at the same time, monitor the video into the same IC, which comes in on pin 1. So I stoked up the CRO and connected it to pin 1 and connected the voltmeter to pin 4. And finally, I set up a second meter with which I could monitor the collectors of the R, G, B, output transistors.

Then I waited for the first sign of brightness change. This could have been a long wait because the effect was quite erratic, not only in time but also in degree; sometimes it was only slight, sometimes the screen was almost blacked out. Fortunately I didn't have long to wait this time and when it happened the results seemed quite positive; neither the brightness control voltage on pin 4 or the video signal on pin 1 varied in the slightest degree.

But there was quite a significant change in the collector voltage of all three output transistors, quite enough I felt to account for the brightness change. The next thing was to check the input to these transistors or, more correctly, the three outputs of the video IC which drive these transistors, pins 7, 8, and 9.

And here, too, I encountered change. It was only about 0.1 to 0.2V, depending on the degree of brightness change, but I reasoned that it would not need to be much at this point to be significant. All of which seemed to suggest that it was the IC itself which was the culprit; the video input was constant, the brightness voltage was constant, yet the output was varying.

I didn't have a spare IC so I had to order one and, while I was waiting, I pulled the old one out and fitted a socket in its place. That way I could save time when the new one arrived, and also refit the old one should any such test be necessary.

When the new IC did arrive I lost no time in fitting it, then switched on and waited. The picture came up normally and, after making a minor brightness adjustment, I put it to one side where I could watch it while I went on with other jobs. It ran all that day without so much as a flicker, and all the next day as well, a far longer time than it had run since I had started on it.

And when it ran the third day without trouble I considered the point proved; at least as far as the brightness problem was concerned, the set was OK. But what about the ringing which was still evident? Looking over the circuit again I latched onto the horizontal linearity circuit which consists, in part, of an inductor, L553, shunted by a 220Ω 1W resistor, R553.

This is a fairly common arrangement and I have known some degree of ringing to be caused by the shunt resistor going open circuit. Unfortunately, this resistor, and others in the same part of the circuit, all checked out OK. Which, for the moment, just about exhausted my stock of ideas. Finally, after some thought, I decided to return the set to the customer and see what happened. Hopefully, if it was a new fault, they would complain.

In fact, when delivering the set, I made quite a point about them contacting me if they were not happy with the set's performance, for any reason. I even

File these notes

The serviceman's notes are intended to be both entertaining and, for fellow servicemen, informative. But when you encounter a fault which you remember appeared in these notes, can you find the appropriate issue easily? Probably not, if it occurred more than 12 months ago.

So why not make a brief summary of each fault as it is described, together with the month and year, and file it along with that set's service manual and other data. It could well save a lot of hassle next time you encounter a fault which you're sure was dealt with ". . . a couple of months ago".

The Serviceman

went so far as to explain that there had been an intermittent condition (which was true) and that one could never be 100% sure that these things had been fixed (which is all too true!). But I deliberately avoided describing the intermittent fault, thus leaving myself some degree of "out".

I heard nothing for a few days and was hoping that that was end of the story. But then the lady was on the phone and her first comment was that ". . . there are lines down one side of the screen". Oh well, I thought, mentally shrugging my shoulders, I half expected this. But it was her next comment that really rocked me. "But that's not the real problem. The picture keeps going dark and then coming bright again. It's very annoying."

Well that was something I hadn't expected. After all my effort, and having felt so confident, it was a nasty blow to realise that I was back to square one. But there was little I could do except make suitable apologies and non-committal excuses and arrange to get the set back into the workshop. But just how I was going to tackle the problem eluded me for the moment.

After I had recovered my composure somewhat I made a decision. As I have said before, I am not too proud to ask help when I find myself out of my depth, and this was one such occasion. I had already spent more time on the set than I could fairly charge for and more time consuming trial-and-error activities could be even more costly.

So I rang the distributors and asked to speak to their service department. The technician I contacted was most obliging but, at first, it seemed that he was as puzzled as I was. He certainly could offer no ideas regarding the brightness problem, and seemed confused by my term "horizontal ringing".

It was only when I described this symptom in detail that he cottoned on; not only did he know what I meant, but he was quite confident that knew the cause. "Replace C555. It's a 10μF electro. That will fix that problem for sure. But I'm sorry, I can't help with the brightness problem."

So all I could do was thank him, and console myself that, apparently, I had at least solved one problem. But where was C555 and what did it do? I hadn't been able to find it while I was on the phone, and the technician took it for granted that I knew the circuit as well as he did.

When I finally tracked it down it turned out to be a filter capacitor for yet another voltage rail derived from the EHT transformer; the 190V rail supplying, of all things, the collectors of the R,G,B output transistors. Suddenly all became clear. Any ripple in this supply would modulate the brightness at the ripple, or "ringing", frequency.

Then I had another thought. Could the electrolytic also be responsible for the brightness problem, assuming it was intermittent? I hardly dared hope that I might cure both faults at the same time.

Finding C555 on the chassis wasn't easy as it was tucked away in a bunch of other components near the EHT transformer. Nor was it easy to get out and I had to get the solder sucker to work to do the job. And this revealed something else. As I cleared the solder away from one lug it became obvious that it was quite loose and any connection it had been making with the capacitor itself was purely accidental.

I fitted a new electrolytic, switched on, and crossed my fingers. The picture came up normally, and completely free from all signs of ringing. Well, at least I had cured that one. As for the brightness problem, that would require another observation period. Once again I ran it for several days, and once again it never flickered. And, while one can never be certain, I felt a good deal more confident when I returned it this time.

In fact, that was many weeks ago and a check with the customer at the time of writing confirms that it has given no trouble since. So I think I really can rest easy this time. But one other interesting point emerged. When I returned the set the second time I questioned both parties quite closely about both the brightness and the ringing problem before the first failure.

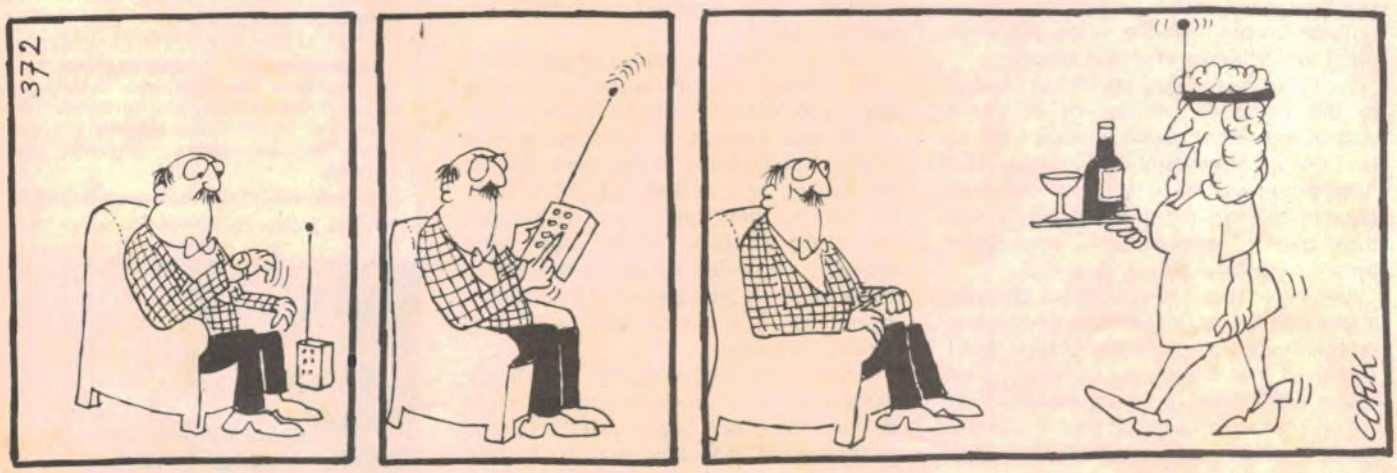
Both were quite adamant – and I have no reason to doubt them – that neither fault had been evident before they brought the set to me. So what had happened? I can only assume that the electrolytic fault, being a mechanical one, had lain dormant until the set had been moved around and manhandled, even with reasonable care.

And so it wouldn't have mattered which of the customers I had dealt with, or how carefully I might have questioned them, they wouldn't have been able to help.

However, I'm aware that the story still leaves some questions unanswered. Was the broken lead – which was probably making intermittent contact – the only fault, or had the electrolytic dried out as well? In view of the set's recent origin I hesitated to accept this idea, eccept that the technician to whom I spoke was obviously familiar with this fault in this chassis; there was no doubt that he had seen it more than once before.

The other point concerns the observed variation in voltage at the R,G,B, output pins of the video IC. With the benefit of hindsight, this was obviously a red herring, yet it was real enough. Was it a normal condition to which I attached too much importance, or was it some secondary effect caused by both supply rails being derived from the EHT transformer?

I'm afraid I don't have all those answers and, while it might have been possible to find them by re-creating the fault, the practical limits on one's time, and the need to get the set back to the customer, don't always allow for such luxuries.



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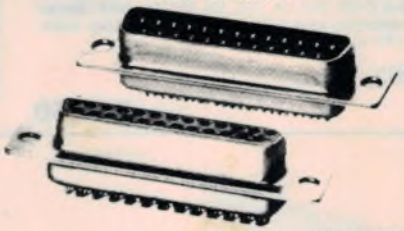

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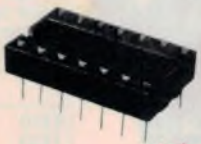

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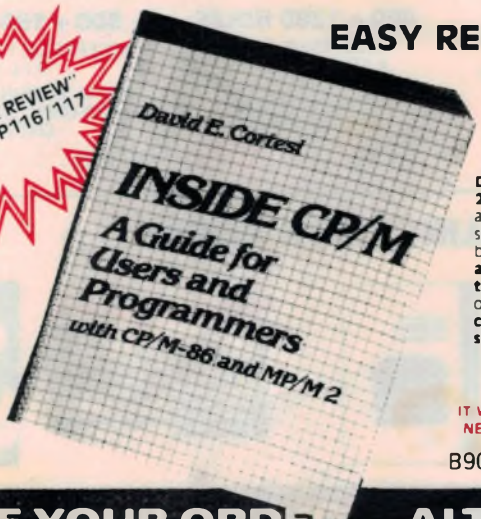

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- SINGLE HANDED OPERATION
- SELF CLEANING PLUNGER
- LONG LIFE TEFLON TIP
- DOUBLE DIAPHRAGM, DUAL O-RING SEAL
- 225mm x 20mm(d) 50mm STROKE
- POWERFUL SUCTION

T1240.. only **$11.95**

T1241. Replac tip. **$1.95**

LOW LOSS

TV SPLITTERS

SUITABLE FOR VHF/UHF TV AND FM

Without doubt our new JEBSEE TV Splitters are the best engineered products we've seen.

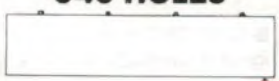
- ★ Spring loaded cable clamps enable super quick termination.
- ★ P.C.B. facilities good screening.
- ★ High isolation leg to leg. (40 db min).
- ★ Silk screened circuit on P.C.B.
- ★ Insertion loss L1310 3.5 db.
  L1320 6.5 db.

	IN	OUT	EA	10 +
L1310	75 OHM	2 x 75	**$3.95**	$3.65
L1320	75 OHM	4 x 75	**$5.95**	$5.50

MINI STRIP 100 HOLES

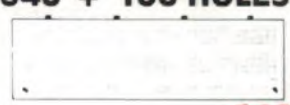
P 1000..... **$1.95**

640 HOLES



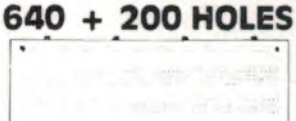
P 1005..... **$8.50**

640 + 100 HOLES



P 1007..... **$10.00**

640 + 200 HOLES



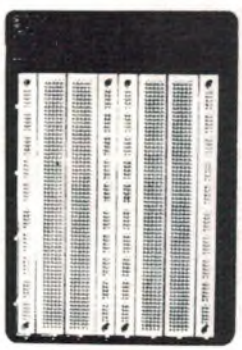
P 1009..... **$12.00**

PROTOTYPE SOLDERLESS BREAD BOARDS

NON-CORROSIVE NICKEL ALLOY CONTACTS RELIABLE FOR 50,000 INSERTIONS

There's a limit to just how many times you can resolder components while prototyping before you either destroy the component or lift a track from the vero.
These solderless breadboards enable circuits to be literally thrown together in an instant, yet all components remain reusable.
A necessity in all research laboratories to save on expensive development costs.

- ☆ Standard 0.1 inch spacings.
- ☆ Accepts all LSI'S, semis, transistors, diodes, leds and passives.
- ☆ 22-30 gauge solid hook up wire for interconnections.
- ☆ Boards are "keyed" to enable easy expansion.

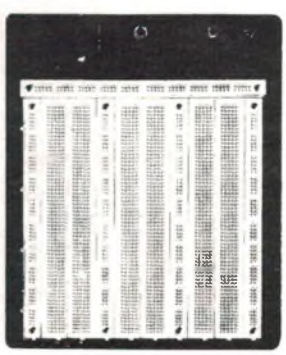


400 + 1280 HOLES

ACCEPTS UP TO 16 x 16 pin D.I.L. IC'S

SCREW TERMINALS FOR PS CONNECTIONS

P1012..... **$26**



500 + 1920 HOLES

ACCEPTS UP TO 24 x 16 pin D.I.L. IC'S

METAL BACKING PLATE FOR SHIELDING OF SENSITIVE CIRCUITRY

P 1015..... **$38**

SUPER BUY ON TOP SELLING DATA BOOKS

MOTOROLA MASTER SELECTION GUIDE

B 1104..... **$5.00**

The most useful book ever printed. Covers MOS IC'S listed by function. LINEAR IC'S listed by function. INTERFACE IC'S listed by function. LSI, memory. TTL ECL power products. SCR'S, diodes transistors listed by application and ratings. RF small signal and opto devices listed by application and ratings. Essential Data given for all devices.
TERRIFIC VALUE

MOTOROLA MEMORY DATA

B 1105..... **$7.50**

An absolute must for the microprocessor Buff. This is the latest reprint of Motorola's famous Memory Data Manual and includes all the latest specifications and design application data on TTL RAM, TTL PROM, MECL MEMORY, MECL RAM, MECL PROM, MOS dynamic RAM, MOS static RAM, MOS EPROM, MOS EE PROM and MOS ROM.
Worth many dollars more!

MOTOROLA CMOS DATA

B 1113..... **$6.50**

A comprehensive reference covering 40XX, 45XX CMOS family's along with specialty devices such as LCD drivers, telephone and general communication functions and industrial control.
862 pages essential in all spheres of electronics.

MICRON SUPER 80

80 CPS : 80 COLS
BIT IMAGE GRAPHICS
FRICTION FEED AND
ADJUSTABLE SPROCKET FEED

MADE IN JAPAN QUALITY

BONUS OFFER 1000 SHEETS OF PAPER FREE WITH EVERY PRINTER (JAN. ONLY) *$10 DELIVERY ANYWHERE IN AUST.

A FEATURE PACKED DOT MATRIX PRINTER FOR UNDER $500

Your "Super 80" printer will enable you to print **letters, reports, graphics generated pictures,** etc and importantly for the programmer, Hard Copy of **program listings.**
Operating under software control from any general purpose micro-computer the Super 80 features **13 different print types** including emphasizd (LETTER QUALITY). **Bidirectional print action** ensures **smooth, quiet operation.**

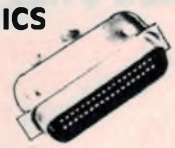
228 ASCII Characters, Handles **4"** to **10"** Paper
STANDARD CENTRONICS INTERFACE

VALUE PACKED AT D1174 ..... **$499.50**
INTERFACE CABLE TO SUIT MICROBEE D1190 ..... **$45.00**
SPARE RIBBON D1175 ..... **$12.50**

FREE FREIGHT IF PURCHASED WITH PRINTER

CENTRONICS PLUG

36 WAY
D1192
$14.95



When you buy one of our printers you'll need a centronics plug. If you are **MICROBEE USER**, have a look at our **INTERFACE KITS** on the opposing page.

DIRECT IMPORT PRICE ON QUALITY JOYSTICKS

SELF CENTERING TYPE ★ HEAVY DUTY SUCTION CUPS — STAYS IN PLACE ★ SILVER PLATED SWITCH CONTACTS ★ PISTOL GRIP ★ VERY RESPONSIVE.

TO SUIT COMMODORE VIC-20, ATARI, etc.
D1410 ..... **$19.50**

TO SUIT MICROBEE
D1420 ..... **$29.50**

NEW MODEL DATA CASSETTE

UNCONDITIONALLY GUARANTEED TO SAVE/LOAD THE RAWEST OF DATA EVERYTIME!

D1122 ..... **$49.50**

A recorder designed solely for the purposes of data storage now at an unbelievable price

- ★ SLIDE VOLUME CONTROL **a must** for quick checking of levels.
- ★ TAPE COUNTER **a must** for easy location of programmes.
- ★ INBUILT PIEZO TRANSDUCER **enables** you to listen audibly to tape level.
- ★ 6v DC operation - USE WITH M9000 PLUG PACK **ensures** low hum levels.
- ★ ROBUST CONSTRUCTION OF BOTH INTERNAL MECHANISM'S AND EXTERNAL CASE.
- ★ LONG LIFE ALKALINE BATTERY SUPPLIED (4 x AA CELLS)

C20 DATA CASSETTES

Quality MICRON brand

D1141 ..... **$1.50** (10 UP) **$1.25**

Unit shown has extra key

DC PLUG PACKS

AT LAST . . . DIRECT IMPORT PRICES ON FULLY APPROVED PLUG PACKS

INSULATED TO ASC 126

Great for powering small Micro's, TV Games, Slot Car Sets, etc.

Eliminate the need for batteries, when testing or operating new projects.

Both Plug packs come with instructions and a 4 way multiplug 1.6m lead.

M9000
240v AC — 3, 4.5, 6, 7.5, 9, 12v DC @ 300mA
ONLY **$12.50**
4 OR MORE **$11.00**

M9005
240v AC — 6, 9, 12v DC @ 500mA
ONLY **$14.95**
4 OR MORE **$13.50**

MULTI-TURN TRIMMERS

INDUSTRY PREFERRED TYPE

ALL ONE PRICE
$1.95
10 up $1.80

Resistance	Cat	Resistance	Cat	Resistance	Cat
100 R	R 2410	SK	R 2423	200 K	R 2433
200 R	R 2415	10 K	R 2425	500 K	R 2435
500 R	R 2417	20 K	R 2427	1 M	R 2437
1 K	R 2419	50 K	R 2429	2 M	R 2439
2 K	R 2421	100 K	R 2431		

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BNC & PL 259 CONNECTORS

		ea.	10 +
P 0514	Plug	1.95	1.80
P 0515	Socket	1.95	1.80

UHF CONNECTORS

REDUCER FOR P 0503

		ea.	10 +
P 0502	(PL259 for RG58 Coax)	1.40	1.25
P 0503	(PL259 for RG8 Coax)	1.40	1.25
P 0504	Reducer	.25	.20

UHF SOCKETS

		ea.	10 +
P 0509	Soc. SQ MNT	1.20	1.00
P 0510	Soc. RND MNT	1.40	1.25
P 0508	F/F Coupler	1.95	1.65

MICRON 30 WATT

This brilliant little 30 watt iron is just the "bee's knees" for the electronics hobbyist, electrician or home handyman. We searched the world for a low cost yet quality iron which met the criteria of • light-weight • screw in interchangeable tips • efficient thermal transfer from element to tip • tip temperature maintains within the limits suitable for electronic work and also small household jobs • and of course, fully S.E.C. tested and approved.

Comes fitted with T 2435 Tip

WAS **$12.95**

REPLACEMENT TIPS

T 2430 **$9.50**

T 2434 Flat Tip	.95
T 2345 Conical Tip	.95
T 2436 Instrument Tip	.95

SOLDER

200 gram reel. 1mm universal gauge. Suitable for all types of electronic soldering. Resin cored and includes bit saving additive.

T 1200 $4.95

5 up $4.50 ea.

ETI CIRCUITS No. 1, 2 and 3.
~~$2.50~~ ea.. **$2.00**
PROJECT ELECTRONICS
~~$4.50~~ ea.. **$3.00**

REDUCED ONLY $7 SET OF 4

Contains hundreds of cirucit and application notes.

VELOSTAT

Non static sheeting for storing CMOS IC's, LSI's etc. 1000 times better than aluminium foil. will store up to 150 IC's on one 225 x 150mm sheet.

H 0500..... **$2.50 per sheet**

MINI SPEAKER 57mm

Large Ferrite Magnet. Ideal replacement speaker. Great for hobby projects.

C 0610... ~~$1.95~~

Now $1.25 ea.

SOLDERING IRON STAND UNIVERSAL TYPE

T 1302 NOW ~~$9.50~~ **$5.00**

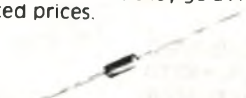
MINI BUZZER 5-15V DC

Handy little solid-state audio "Buzzer" or signalling device. Just the shot for communicator panels, or for timer alarms or in the car. Polarity conscious.

S.5062 . . . **$1.00**

OOPS WE MADE A BOO BOO!

Right now we have around ½ million Premium Quality Genuine Philips IN914/IN4148 Signal Diodes — Out they go at never to be repeated prices.



	1's	100's	1000's
Z0101.....	4c	3c	2c

SAVE ON BULK QUANTITIES

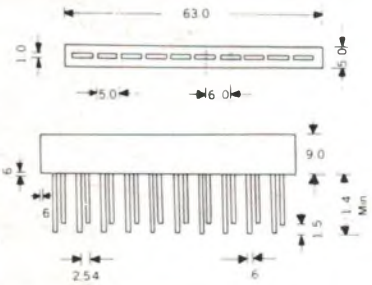
HALF PRICE Z80 A

FULL SPEC FAMOUS SGS BRAND

Z9001 CPU WAS $8.95 NOW **$4.50**
Z9005 PIO WAS $8.95 NOW **$4.50**

NEW PRODUCT

10 SEG. RED BAR GRAPH MODULE



Z 0180 **$2.50** 10 up $2.20 ea.
100 UP $1.80

MINI TOGGLE SWITCHES

OEM QUALITY 250V 2 AMP RATED
6mm mounting hole
12mm x 12.7mm x 20mm (D)

	ea.	10 +	25 +
S1010 SPDT	$1.25	$1.10	.95
S1025 SPDT C/OFF	$1.50	$1.25	$1.10
S1020 DPDT	$1.50	$1.25	$1.10
S1030 DPDT C/OFF	$1.95	$1.75	$1.50

MU 45 PANEL METERS QUALITY CLASS 2.5

Overall dimensions 58W x 52H. Bolt Mounting Centres 38 x 38. Hole required 44mm. Nuts & Washers provided.

SAVE ON BULK QUANTITIES

	FSD	DC Resistance	Price	10 Up
Q 0500	1MA	200	8.25	7.25
Q 0505	50UA	3500	8.25	7.25
Q 0510	5A	.02	8.25	7.25
Q 0520	20V	2000	8.25	7.25
Q 0525	30V	3000	8.25	7.25
Q 0535	VU	-	8.50	7.50

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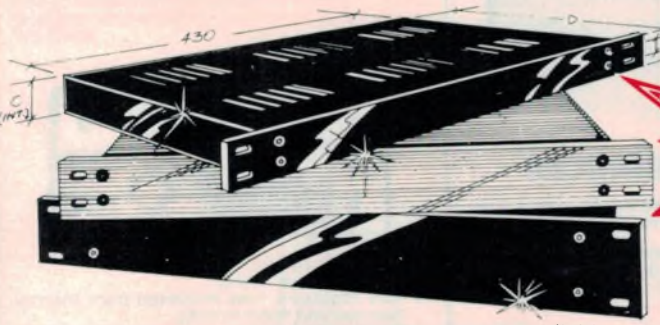
BANKCARD HOLDERS — PHONE ALTRONICS TOLL FREE 008-999-007 FOR NEXT DAY JETSERVICE DELIVERY

YOUR BUDGET PROBABLY ~~WON'T~~ WILL STRETCH TO AFFORD OUR PROFESSIONAL SERIES ALL ALUMINIUM RACK CABINETS

NOW YOUR PREAMPS, AMPS, CONTROL MODULES MONITOR PANELS ETC. CAN LOOK EVERY BIT AS GOOD AS TECHNICS, NAKAMICHI AND OTHER TOP MANUFACTURERS



HUGE SAVINGS THIS MONTH

* These beautifully crafted rack cabinet boxes will give your equipment a real 1st class appearance. * All aluminium construction. * REMOVABLE TOP AND BOTTOM PANELS. * All dimensioning conforms to the International Standard. * Natural or Black finish. * Ventilated lid. * Deluxe brushed finish anodised front panel. * Individually cartoned. * Supplied in Flat Pack Form — Easily assembled in minutes.

Side Elevation:
D = 254mm C (Internal Chassis Height)
B (Mounting Bolt Centres)

Cat. No.	Finish	A	B	C	Was	NOW
H 0401	Natural	44	34	38	$45.00	$39.00
H 0402	Natural	88	57	82	55.00	49.00
H 0403	Natural	132	89	126	59.95	54.00
H 0411	Black	44	34	38	45.00	39.00
H 0412	Black	88	57	82	55.00	49.00
H 0413	Black	132	89	126	59.95	54.00

Beware of other rack boxes that do not conform to International Rack Sizing.

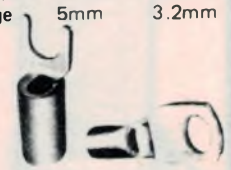
INTERNATIONAL STD SIZING BLANK RACK PLANELS

(Elongated mounting holes provided only)

	Height	Finish	ea.	10+
H0421	44mm	Nat. Anod.	6.50	5.90
H0422	88mm	Nat. Anod.	11.50	10.50
H0423	132mm	Nat. Anod.	14.95	13.95
H0426	44mm	Blk. Anod.	7.50	6.90
H0427	88mm	Blk. Anod.	12.95	12.15
H0428	132mm	Blk. Anod.	16.95	15.95

LUGS

	Max. Bolt Size	Max. Cable Size
Small	3.5mm	1.7mm
Med.	4.5mm	2.2mm
Large	5mm	3.2mm



H 1500	Solderlugs Pack 50	1.00
H 1501	Solderlugs Pack 1000	9.50
H 1510	Crimplug Small Pack 25	1.60
H 1511	Crimplug Small Pack 500	19.50
H 1512	Spadelug Small Pack 25	1.60
H 1513	Spadelug Small Pack 500	19.50
H 1520	Crimplug Med. Pack 20	1.60
H 1521	Crimplug Med. Pack 500	22.50
H 1522	Spadelug Med. Pack 20	1.60
H 1523	Spadelug Med. Pack 500	22.50
H 1528	Crimplug Large Pack 20	2.40
H 1529	Crimplug Large Pack 500	32.50

SAVE A FORTUNE ON ALTRONICS DIRECT IMPORT HARDWARE — JUST CHECK OUR BULK PACK PRICES — THEY ARE A FRACTION ON WHAT YOU'RE PAYING NOW!

1/8th inch WHITWORTH

STEEL NUTS AND BOLTS ROUND HEAD ZINC PLATED

	Length	Pack Qty.	Price
H 1000	9mm	25	$ .85
H 1002	9mm	500	4.50
H 1005	12mm	25	.85
H 1007	12mm	500	4.95
H 1009	25mm	25	.95
H 1011	25mm	500	6.95
H 1020	Hex Nut	30	.75
H 1022	Hex Nut	500	5.95
H 1030	S/Proof Washer	50	.95
H 1032	S/Proof Washer	500	6.95
H 1040	Flat Washer	50	.95
H 1042	Flat Washer	500	6.95

Huge Savings with Trade Packs (Contents: 500)

BA NUTS AND BOLTS

Bolts Cheesehead Steel, Nuts Brass

		Pack	Price
H 1045	4BA x 6mm	25	$ .95
H 1047	4BA x 6mm	500	5.95
H 1050	4BA x 12mm	25	.95
H 1052	4BA x 12mm	500	6.95
H 1060	6BA x 12mm	25	.95
H 1062	6BA x 12mm	500	7.50
H 1070	Nut Hex 4BA	25	1.00
H 1072	Nut Hex 4BA	500	12.50
H 1080	Nut Hex 6BA	25	1.00
H 1082	Nut Hex 6BA	500	12.50
H 1090	4BA S/Proof Washer	50	.95
H 1092	4BA S/Proof Washer	500	5.95
H 1095	4BA Flat Washer	50	.95
H 1097	4BA Flat Washer	500	6.95

SELF TAPPING SCREWS

Nickel Plated Steel

		Pack	Price
H 1100	No. 4 x 6mm	25	$ .75
H 1102	No. 4 x 6mm	500	4.50
H 1110	No. 4 x 12mm	25	.95
H 1112	No. 4 x 12mm	500	5.50
H 1120	No. 8 x 12mm	25	.95
H 1122	No. 8 x 12mm	500	6.95

From less than 1c each.

NYLON NUTS & BOLTS

Super Handy for Mounting Semis, PCB's or anywhere an Insulated mounting is required

4BA	Cheesehead	Pack	Price
H 1200	4BA x 12mm Bolt	10	.85
H 1202	4BA x 25mm Bolt	10	.95
H 1210	4BA Nuts	10	1.65
H 1215	4BA Washer	10	.65
6BA	**Cheesehead**		
H 1220	6BA x 12mm Bolt	10	.75
H 1222	6BA x 25mm Bolt	10	.90
H 1226	6BA Nuts	10	1.45
H 1228	6BA Washer	10	.65

RUBBER FEET

With 3mm Mounting Hole

Standard

Stickon Type

	Size (diam.)	Pack Qty.	Price
H 0914	13mm	8	$ .85
H 0913	13mm	100	7.50
H 0917	16mm	8	.95
H 0916	16mm	100	8.00
H 0940	12mm Stickon	4	.80
H 0942	12mm Stickon	100	9.60
H 0950	20mm Stickon	4	.95
H 0952	20mm Stickon	100	11.50

SPACERS (STANDOFFS) SUPERB NICKEL PLATED BRASS

UNTAPPED 4 BA or 1/8" CLEARANCE

Cat.	Length	Pack Qty.	Price
H 1305	6mm	8	$ .95
H 1359	6mm	100	8.50
H 1362	9mm	8	.95
H 1365	9mm	100	9.50
H 1372	12mm	6	.95
H 1373	12mm	100	11.00
H 1375	25mm	4	.95
H 1376	25mm	100	15.00

TAPPED 4 BA

Cat.	Length	Pack Qty.	Price
H 1379	9mm	8	$1.00
H 1380	9mm	100	9.50
H 1383	12mm	8	1.20
H 1384	12mm	100	12.50
H 1387	25mm	4	1.00
H 1388	25mm	100	17.50

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QUALITY VIDEO KITS

Video has been booming for quite a while, finally a range of video accessories in kit form.
Two **video amplifiers** for both VCR and Computer use, a brand new **Video Enhancer** and our popular **VCR Stereo Synthesizer**. All four represent outstanding value for money and all are assembled with **Altronic's Extra Care.**

VIDEO AMPLIFIERS

DISTRIBUTION TYPE
Simple, low-cost project will allow you to drive five video monitors from one source, such as a video cassette recorder or a computer. Great for piping video around the house, or for clubs meetings when screening lectures etd, or for computer demonstrations.

★ **THE ALTRONICS KIT** includes all components as specified by ETI **plus all** power supply components.

K5830..... Only..... **$45.00**

SINGLE OUTPUT

INVERSE AND NORMAL OUTPUT
Brilliant new kit from EA, **Super cheap** and **Super Effective.** Whilst our K5830 is suitable primarily for VCR use this video amplifier is best suited to use with computers. The EA documentation supplied is extremely well written and provides details for installation into television sets.

NO MORE SMEARY COLOURS, SIGNAL BEATS OR RF INTERFERENCE

NOTE ★ NOT SUITABLE FOR USE WITH LIVE CHASSIS TV SETS.

K5850..... **$14.95**

VIDEO ENHANCER

Here's a **simple** but **effective** Video Enhancer that is super **easy to build** at a fraction of the cost of commercial models.
Unit sharpens picture detail, and can actually improve the quality of a copy by amplifying the top end of the video signal.

AT LAST A VIDEO ENHANCER KIT

K5825..... **$35.00**

ENJOY THE PLEASURES OF STEREO SOUND
(See EA Sept. 1982)

STEREO SYNTHESIZER FOR VCR'S AND TUNERS

Synthesize realistic stereo from virtually any monophonic source by simply connecting this unit between the source and your stereo amplifier.

★ Quality Phillips MN3001 (not second source dropout).
★ Provision for 2 different signal sources.
★ Selection of either source via front panel switch.
★ Normal or stereo sound selection.
★ Complete kit includes all hardwear, cables etc., even solar.

Important ★ beware of Kitset suppliers who sell this kit for **less ★** you get **less!**

K5810..... **$55.00**

FUNCTION GENERATOR

The most essential piece of test gear (second only to a good multimeter) on any hobbyist's bench is some kind of audio signal generator. This design utilizes the latest circuit techniques to produce stable, low distortion waveforms.

A truly versatile unit at a bargain price

6 digit frequency readout (eliminates tiresome dial calibration) — typical accuracy ± 2% — 3 overlapping ranges x1, x10, x100 — 600 OHM Nominal Output — continuously variable 3MV — 2.5V P-P — Distortion — sinewave: less than 0.7% @ 1KHz — Linearity — triangle wave: better than 1% @ 1KHz — Squarewave rise time — 6V/uz maximum output — Amplitude stability — better than 0.1dB on all ranges.

With the exception of the display all components mount on a single PCB making this kit suitable for all constructors.

K2505..... **$85.00**

DIGITAL CAPACITANCE METER

with Deluxe Instrument Case

NEW DELUXE FINISH

We are pleased to announce the release of the Digital Capacitance Kit housed in our Deluxe HQ480 ABS Instrument Case.
This superb Test Instrument kit now compliments our top selling Digital Frequency Counter and Function Generator Project kit. Electronics Australia Project. Measures capacitance of both polarized and non-polarized capacitors from 1 picofarad to 99.99 microfarads in 5 ranges.
Check values of unmarked capacitors, especially those little trimmers that are never coded.
Select precise values for filters and timing networks within ease.

EXCLUSIVE TO ALTRONICS

Each kit includes precision measured capacitors for accurate calibration of each range.

K2521..... **$55.00**

7 DIGIT FREQUENCY COUNTER

UNBELIEVABLE 0.005% ACCURACY

Frequency and Period measurement to 500 MHz (with optional prescaler) — High input sensitivity. Professional unit at a fraction of the cost of built up units.
— IC sockets provided throughout — Low age rate 10.000 MHz XTAL — Quality ABS plastic case with deluxe Front panel — Specified LSI.

K2500..... **$119.50**

PRESCALER
K2501..... **$26.00**

DECIMAL POINT
K2502..... **$7.50**

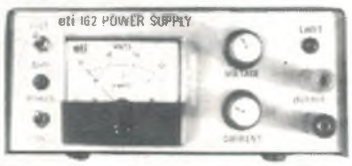
THE EVER POPULAR MUSICOLOUR IV EA PROJECT

K5800..... **$89.50**

Combination Colour Organ and Light Chaser. Four channel colour organ. Internal microphone or connect to speakers for colour organ operation. (The lights connected to each channel pulse in beat to the music proportional to portion of frequency spectrum concerned.) Four chaser modes forward and reverse. Output lamp load capacity a massive 2400 watts — that's 100 party globes. Full instructions and every last nut and bolt included. Great for parties, shop signs, display windows etc.

POWER SUPPLIES

If you're thinking of buying a power supply then buy from us, we are the experts on power supply kits and carry a supply to suit most enthusiast and professional requirements..... READ ON.



BENCH STANDARD
★ 3-30v Output @ 1 Amp.
★ Fully Regulated, Fully Protected from Thermal Overload and Short Circuits.
★ Based on EA Design.

K3200..... **$42.50**

★ All the features of above PLUS Current Limit.
★ ETI Design.

K3205..... (PICTURED)..... **$49.50**

DUAL TRACKING
★ ± 1.3 to ± 22v Output @ 2 Amps.: + 5v @ 0.9 Amps.
★ Fully protected.
★ 10 turn pot enables Voltage adj. to within 10mV.
★ EA Design (March '82).

K3220..... **$89.50**

HIGH CURRENT

MICROCOMPUTER PS
★ + 5 Volts @ 3 Amps ★ + 12 Volts @ 2 Amps. – 12 Volts @ 200 milliamps.
This universal design has enough grunt to power most disk drives.

K3350..... **$59.50**

13.8 VOLTS @ 10 AMPS HAM'S & CBER'S
Save the expense of a Mains Powered Rig.

K3250..... **$8950**

HIGH CURRENT — DUAL METERING

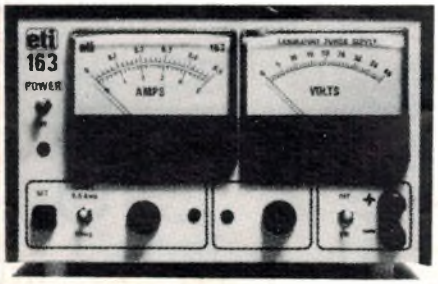
EA SWITCH MODE DESIGN
★ 2-50 Volts at massive 175 Watts.
★ CLEVER DESIGN — a fully mains isolated supply with a "Switchmode" low voltage circuit.
★ Easy to build.

K3300.. (EA MAY, JUNE '83).. **$139.00**
K3301... (10 TURN VOLTAGE CONTROL OPTION)... **$10.00**
K3302..... (± 12V OPTION) EA JULY '83..... **$12.50**

ETI SERIES REGULATOR DESIGN
★ 0-40 Volts @ 5 Amps — **thats 200 Watts.**
★ Current limiting 0-5 Amps variable.
★ Specifications Second to None.
★ Free from the hum and noise sometimes associated with other techniques.

A PROFESSIONAL SUPPLY

K3325.... (PICTURED).... **$175.00**



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GO ANYWHERE 12-240V POWER

MASSIVE 300 WATTS

These great inverter kits enable you to power 240V appliances from a 12V DC power source. Tremendous for camping, fishing etc. Install into your Car, Boat or Caravan.

A fully regulated and overload protected design, featuring XTAL locked frequency. Use to power hi-fi, TV sets, even electric drills for short time periods.

MANY OF THESE KITS ARE NOW IN USE FOR EMERGENCY LIGHTING PURPOSES.

ALTRONICS' KIT features ☆ Gold plated edge connector and PCB fuss ☆ Low age rate XTAL ☆ Sockets for all IC's ☆ High Efficiency Transformer.

K6750..... (EA JUNE '82) ... **$199.50**

($10 DELIVERY AUSTRALIA WIDE)

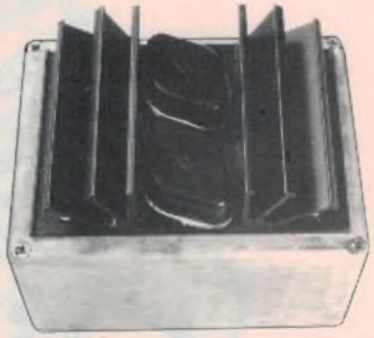
40 WATT MODELS

Suits small appliances, ie. Turntables, Tape Decks, Shavers etc. Variable frequency adjustment enables speed control of turntables. Works as a trickle charger when mains power is available.

EASY CONSTRUCTION ★ VALUE PLUS

K6700..... **$55.00**

TRANSISTOR ASSISTED IGNITION WITH DWELL EXTENSION



The Altronics Kit includes all components for the modifications, detailed by Electronics Australia Feb. 1983.

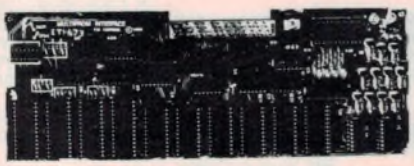
Yes, it's bad enough paying $2.00 a gallon for petrol without wasting a fortune on an out of tune engine. Fit this transistor assisted ignition kit in minutes and start saving money from the very next petrol stop. Easy to build!

K4010..... **$35.00**

★ KIT SUPPORT FOR THE MICROBEE ★

MULTIPROM INTERFACE

44K OF PROGRAM STORAGE



A sensational new kit for the MICROBEE, requires no modification to the computer except for the fitting of a 50 pin expansion socket. This project is easy to build and will allow you to store and software select up to 44K of eprom storage — acts like a mini disk drive system with the speed of RAM. Extra units may be added to further increase storage.

The Altronics Kit comes complete in every way
- ★ Full set of IC sockets.
- ★ Double sided, plated through board.
- ★ Assembled connection lead to Microbee.
- ★ Fully documented.
- ★ Cassette monitor included (plus sourcefile).

THE MICROBEE KIT OF 1983

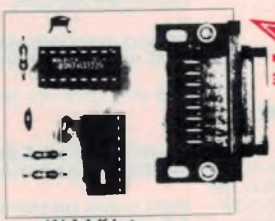
K9673..... **$99.50**

PARALLEL INTERFACE

BUILD YOUR OWN INTERFACE AND SAVE $$$

A simple kit to build — takes about 20 minutes, save on the cost of a built interface and save the cost of a serial printer.

K9671..... **$29.95**



INCLUDES CENTRONICS PLUG AND CABLE

PRICE BREAK-THROUGH

50 PIN EXPANSION SOCKETS

Right angle type to suit Microbee, floppy disk controllers etc.
Mounts on PCB and mates with IDC sockets.

D1196.. **$8.50** EA...10 + ... **$7.50**

PROPORTIONAL JOYSTICK

K9674 **$32.50** (ETI DEC '83)

AT LAST AN ANALOGUE JOYSTICK

Plot X-Y co-ordinates on the screen, sign your name. A great graphics aid. Complete kit **including case**, software example.

EPROM PROGRAMMER

(ETI JAN '83)

K9668..... **$55.00**

Versatile, low cost and easy to build. Plugs straight into the microbee I/O port. Suitable for 2716, 2732, 2532, 2732A and 2764 Eproms. Burn your games programmes and eliminate cassette loading time.

KIT FEATURES Sockets for all other IC's. 1 x 2716 supplied — get started straight away. Front Panel and Mains (SEC approved) transformer. 28 pin and 16 pin wire wrap sockets to flush mount personality plugs (2 included) and ZIF socket (included). DB15 Plug. Complete to last nut and bolt.

(See Review ETI AUGUST 1983)

RADIOTELETYPE DECODER

(ETI APRIL '83)

K9733..... **$19.50**

Display RTTY encoded messages on your Video Monitor. Receive up to date weather information, international News before the Papers, all sorts of coded military info. Simple circuit uses PLL techniques. Single PCB Construction. Kit includes DB15 Plug and backshell for connection to microbee. Shielded pretinned PCB.

NEW

MICROBEE LIGHT PEN

(ETI AUGUST '83)

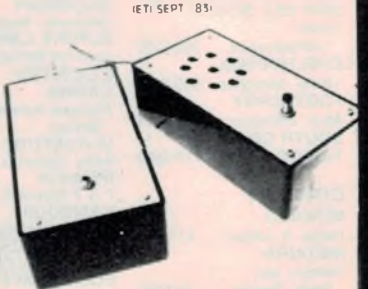
PROVIDES DIRECT PERSONAL CONTACT WITH YOUR BEE!

K9649 **$19.95**

AT LAST — a light pen for the Bee. This pen works in the low-resolution graphics mode and connects directly to the I/O port. • Complete kit including DB15 2m CORD. • Fully documented with software example.

FAX-DECODER

(ETI SEPT '83)



K9733..... **$24.50**

This project allows you to decode the signals of shortwave stations transmitting radio facsimile weather maps, satellite pictures, etc. and then reproduce them on your dot-matrix printer.

• Complete kit of parts includes DB15 Ribbon Cable.

• SOFTWARE LISTING

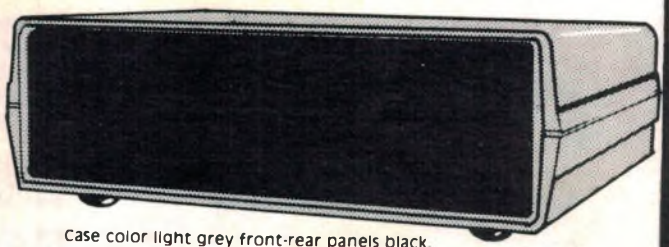
KAISE DIGITAL MULTIMETER SK 6100

WAS $89.95

Now $59.95
Cat Q1100

Check the specifications/features of this superb Digital Multimeter. **Autoranging** with manual override **Auto Polarity** displays — sign when probes reversed **overange indication** "Blink" and Buzzer warning **Low Battery Warning** BATT Sign shows. **Sampling Rate** 2 times SEC **Power Supply** 2 x A penlight batteries (300 hour continuous operation). **Fuse Protected**, spare fuse provided. **Zero Adjustment**, zero adjust button — a must if you change test probes. **LCD Display**, magnificent clear readout. **Inbuilt Buzzer**, available for continuity test, overload warning and switch warning. **Ranges** +/− 1000 V DC/600 V AC, AC and DC current, resistance 200 (Resolution .1 OHM) to 2000K OHM (resolution 1K OHM) in 5 ranges autoranging. **ACCURACY** .5% DC, .8% AC.

DELUXE ABS INSTRUMENT CASE



Case color light grey front-rear panels black.

Our superb new instrument case will give your projects the professional appearance they deserve.

* Internal mounting posts enable a wide combination of PCB's, Transformers, etc. to be accommodated (screws supplied).
* PCB guide rails provided internally allow vertical PCB positioning to several locations.
* Removable front and rear panels. Attractive textured finish one side and plain the reverse side. (Enables direct engraving, silk screen printing etc. to plain side.)
* Great for test instruments and other high grade projects.

Overall Size: 200W x 160D x 70mmH

	WAS	NOW	10 +	50 +
H0480 ..	$13.50 ..	$10.00	$9.00	$8.50

MOLEX PIN SOCKETS

For use with single pins up to .5mm diam.

Make your own sockets for IC's displays, LSI's etc

Supplied on "Break off" header pre-spaced .1 inch.

P0700 Pack of 100 **$ 1.00**
P0701 Pack of 1000 **$12.50**

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Phone toll free 6am - 8pm (EST) for personal service, or take advantage of our **24 Hour 7 day p/week Bankcard phone order service.** Give your name address with postcode, phone number, bankcard number and expiry date then your order — and presto your order will be processed and back to you in a flash. — Please nominate Jetservice if you want overnight delivery.

$2.50 DELIVERY AUSTRALIA WIDE We process your order the day received and despatch via Australia Post. Allow approx. 7 days from day you post order to when you receive goods. Weight limited 10kgs.

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$10.00 HEAVY HEAVY SERVICE — AUSTRALIA WIDE All orders over 10kgs must travel on the heavy service, that is — road express. Delivery time 7 days average.

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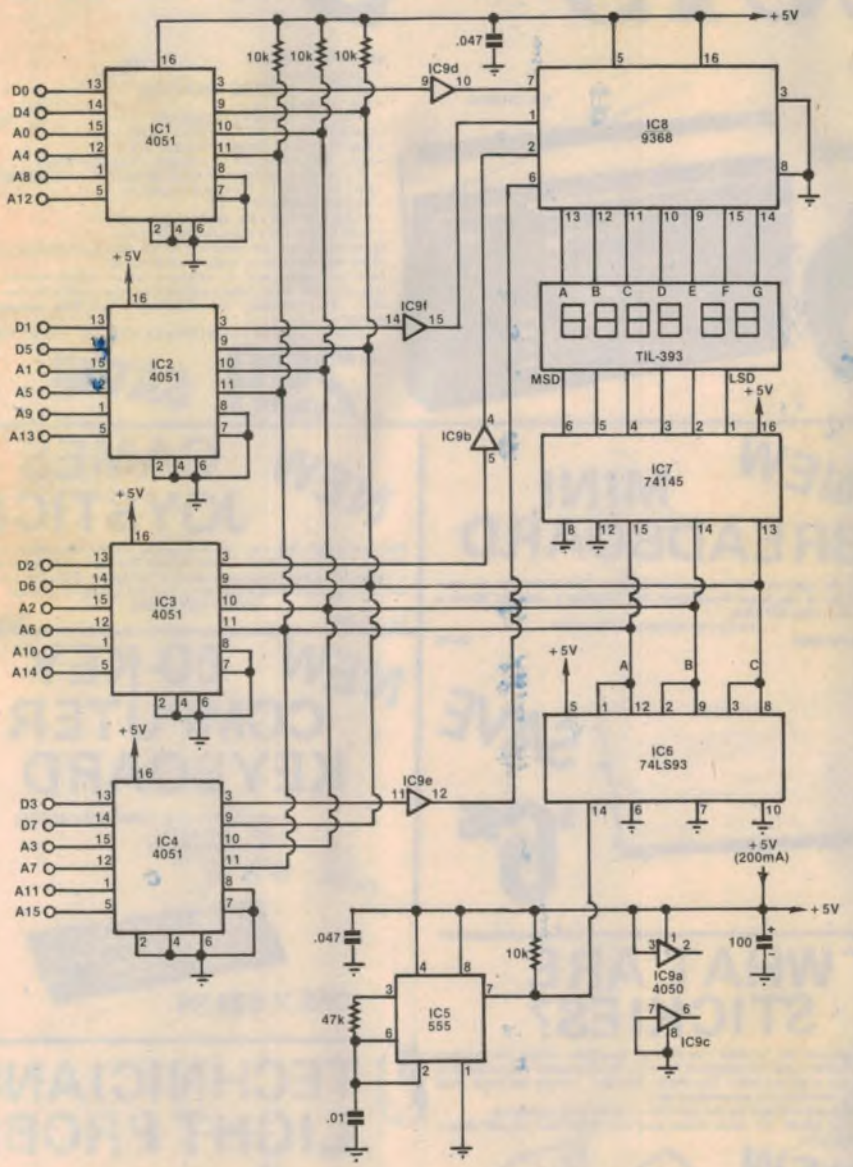
Circuit & Design Ideas

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



Hex display

When experimenting on such projects as EPROM programmers and microcomputers, it is convenient to display the address and data buses in hexadecimal format. This circuit was designed to provide such a display.

The circuit is based on the Fairchild 9368 binary (hex) to 7-segment decoder/driver. The 555 oscillator clocks the 74LS93 which is wired to count to 6 in BCD, thereby selecting one digit at a time to be displayed on the multiplexed display. The 74145 decodes the outputs of the 74LS93 and drives the appropriate display cathode while the 4051 multiplexers select which four bits are sent to the 9368 via the 4050 buffers. The display can be any calculator-style 7-segment LED display (multiplexed, common-cathode).

An input voltage of about 0 to 2.5V represents a logic 0 while 2.5 to 5V represents a logic 1. The circuit uses a regulated supply of 5V at about 175mA.

For a somewhat larger display, try a 9369 in place of the 9368 and insert 68Ω current limiting resistors in series with pins 9-15. Any unused address lines should be tied to 0V.

J. de Silva
Croydon, NSW

$20 for this item

Multiple flash trigger

A simple but effective multiple triggering device for camera flash guns is the dialling mechanism on conventional telephones. These can usually be purchased (complete with the rest of the telephone) from post office surplus stores for a few dollars, and are thus cheaper than a fully electronic circuit.

Opening the telephone will reveal a host of connections on the dialling mechanism. Locate the wires connected to contacts that open and close when the dial is released after it is turned. This can be done by visual inspection or by trial and error with a multimeter. Connect these wires to a flash gun lead socket and plug in your flash unit.

Note that some contacts inside telephone diallers are normally open and others are normally closed. Which ones to use depends in part on how your flash gun operates – once again resort to trial and error. The flash gun I used for multiple triggering was a Sunpak Autozoom 3600, and worked best with normally closed contacts.

Furthermore, if all the energy stored in the flash gun's capacitor were discharged with the first firing, it would not charge in time for the second firing. Therefore it will be necessary to use a "computer flash" (one that senses the amount of light reflected off the subject and turns the flash off when it has been sufficiently illuminated).

The time between the firings of the flash will be determined by the governor inside the telephone dialler. Suitable adjustment of this device can lengthen or shorten this time.

Finally, to take a multiple flash exposure, set the camera's shutter on "B" or "T" (for a time-exposure), open the shutter and dial the number of flashes you want on the telephone dialler. Readers in New Zealand should note, however, that they will have to deduct the number of flashes they want from 10 to get the number they have to dial: the numbers on the telephone dial run the wrong way.

D. de Roos,
Christchurch, NZ.

$10 for this item

GREAT NEW PRODUCTS FOR '84

NEW uniden® WORLDBAND RADIO MODEL CR-2021

Cat. DR-6010

SPECIAL INTHODUCTORY PRICE

SPECIFICATIONS:
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- 150KHz – 29.999MHz (AM/SSB/CW)
- FM – 108MHz
- TRIPLE SUPERHET (AM/SSB/CW)
- 3-WAY POWER AC/BATTS/DC (CAR)
- BACKUP BATTERIES FOR MEMORY
- WILL MEMORISE UP TO 6 PRESET FREQUENCIES
- IT'S ALSO A SCANNER! WILL SCAN THE HF BAND BETWEEN PRE-SET LIMITS. FM SCAN AS WELL!
- NARROW BAND FILTER
- FACILITY FOR EXT. ANT. AND EARTH
- SIZE: 320 x 155 x 65mm WEIGHT 2.1kg

Quite frankly we are astounded at the quality of this unit. It is one of the smartest looking modern radios around!
Each unit comes with an extensive manual which includes detailed info on Short Wave Listening as well as a comprehensive list of major Short Wave stations, their frequencies and their correspondence address.

HURRY STOCKS ARE STRICKLY LIMITED – SO ACT NOW!

$299 SAVE!

'TRADE' PACKS OF SCREWS & NUTS etc. NEW

By popular demand. Now you can get commonly used hardware in bulk and save a fortune!!

Cat. No.	DESCRIPTION	Price
HE-0736	Rubber feet stick-on 12mm Pkt 100	$9.60
HE-0738	Rubber feet stick-on 20mm Pkt 100	$11.50
HE-0913	TO-3 Mica insulator kit Pkt. 100	$12.50
HE-0922	TO-220 Mica insulator kit Pkt 100	$9.80
HP-2742	6BA Flat washer Pkt. 500	$6.95
HP-2752	4BA Flat washer Pkt. 500	$6.95
HS-1521	6BA x ⅜" Cheesehead screw Pkt 500	$7.50
HS-1522	4BA x ¼" Cheesehead screw Pkt 500	$5.95
HS-1527	4BA x ⅜" Cheesehead screw Pkt 500	$6.95
HP-2712	6BA Hex nut brass Pkt 500	$12.50
HP-2722	4BA Hex nut brass Pkt 500	$12.50
HS-1607	No 4 x ¼" Self tapper Pkt 500	$4.50
HS-1609	No 4 x ½" Self tapper Pkt 500	$5.50

NEW SEALED PCB MOUNT ROTARY SWITCHES

We have decided to discontinue our range of open "skeleton" wafer switches for these. The new switches have contacts enclosed in a fully moulded plastic housing – reminiscent of European design rotaries. The silver-plated contacts are terminated with PCB pins instead of the usual eyelet. You can solder to the pin of course, but the pin also inserts straight into a PCB. Another feature of the switch is its programability. A removable ring with tab can be inserted into the switch several ways to your particular requirements. For example, if you purchase a 1 x pole 12 way (max) switch you could convert it to, say, 1 pole 7 way between stops. Versatile! Naturally the switches feature 3/8 x 32 TPI bush mount and a ¼" shaft with standard flat. The shaft is hard nylon moulded to help reduce signal capacitance problems.
They are almost the same price as the inferior wafer units.

Cat. No.	Description
SR-1210	1 Pole x 12 way
SR-1212	2 Pole x 6 way
SR-1214	3 Pole x 4 way
SR-1216	4 Pole x 3 way
SR-1218	6 Pole x 2 way

1-9 ONLY $1.95 ea
10+ ONLY $1.75 ea

NEW MINI BREADBOARD

Just the right size for many small projects. This board has the same features as our larger breadboards but measures a compact 80mm x 60mm. It has 420 holes.
Perfect for the occasional project

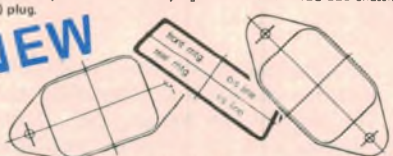
Cat. PB-8808 $6.95

SAVE $6.95

WHAT ARE STICKIES?

As you can see, "stickies" are stick on templates. Attach the template to a panel (note the crosshairs for accurate alignment) and proceed to cut out a perfect hole! The plastic film also protects the panel from scratches while you are working on it.
Stickies are available for the common irregular hole cutouts i.e.
Cannon DB-25, XL series chassis plug and socket and IEC 320 chassis (mains) plug.

NEW



Cat. No.	DESCRIPTION	Price
NL-4010	25 way 'D' template Pack of 6 templates	$1.95
NL-4014	XLR-31 Series template Pack of 6 templates	$1.95
NL-4018	XLR-32 Series template Pack of 6 templates	$1.95
NL-4020	IEC 320 Chassis plug Pack of 6 templates	$1.95
NL-4024	DIN Chassis socket template Pack of 6 templates	$1.95

NEW GAMES JOYSTICK

New low price! This unit, which is similiar to our competitors units offers a huge saving. Why? Direct Import! The unit is not fitted with a connector either because a specific connector limits its use to specific computers. Fit the connector yourself and save a fortune!
DON'T PAY $49.95

Cat. XE-7032 $19.95

NEW 60-KEY COMPUTER KEYBOARD

- AS USED IN THE FAMOUS MICROBEE!
- SPST CONTACTS
- FRAME MOUNTED
- QUALITY UNIT

Cat. XE-3522

ONLY $29.95

TECHNICIANS LIGHT PROBE

NEW $12.95

This NZ made unit enables you to place a spot of bright light in the most awkward places. Ideal for servicemen or kit assemblers. A flash-light or lamp always seems to cast a shadow where you need to see!! The exclusive design allows you to "poke light" around corners!!
The unit is solidly made (Aluminium) and takes 2 penlight cells. A two function switch (lock-on and press on) is also a feature.

Cat. TH-1838 $12.95

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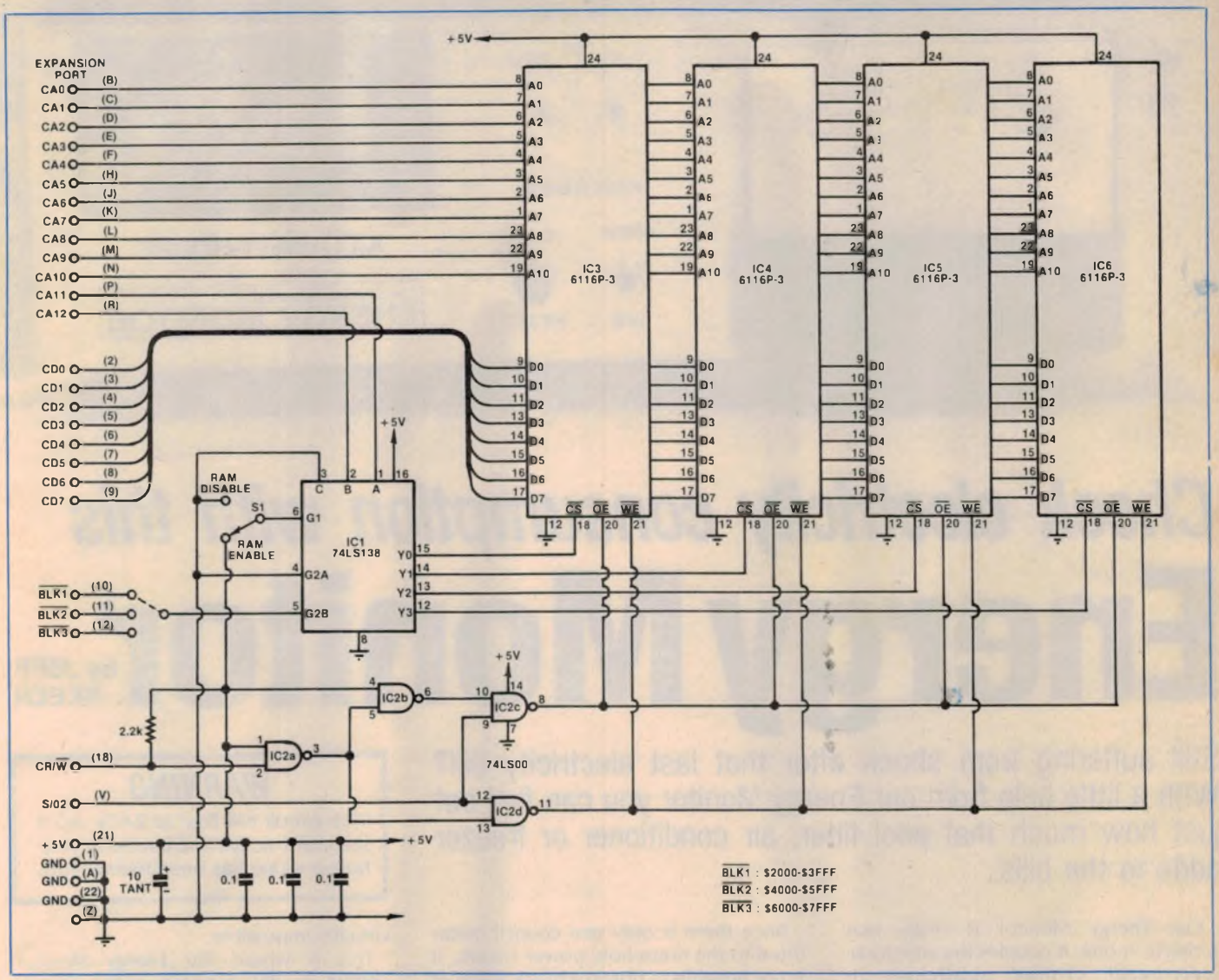
Circuit & Design Ideas



Extra RAM for the VIC-20

The availability of expansion boards for the VIC-20 enables users to experiment with various additions to the basic system. One such addition, described here, is for an 8K memory board. Readers should be advised, however, that adding custom memory is not really cost effective, unless one already has some of the more expensive components.

The circuit consists of four 2K × 8-bit RAMs (6116P-3), an address decoder (74LS138), and control signal logic (74LS00). The address decoder is enabled by the relevant BLK signal (link selectable), and uses the address lines CA11 and CA12 to produce four 2K memory block selects. It should be noted that BLK is strobed by S/02 (the system clock phase 2) within the VIC, so that BLK can only be active when S/02 is in the high portion of its cycle. The purpose of this is to prevent data bus contention. For a similar reason, the signals OE and WE (produced by the control signal logic) are only active when S/02 is high.

Switch S1 is provided so that the memory board can be disabled, without removing it from the expander board. This is necessary when other devices are added that occupy the same memory locations.

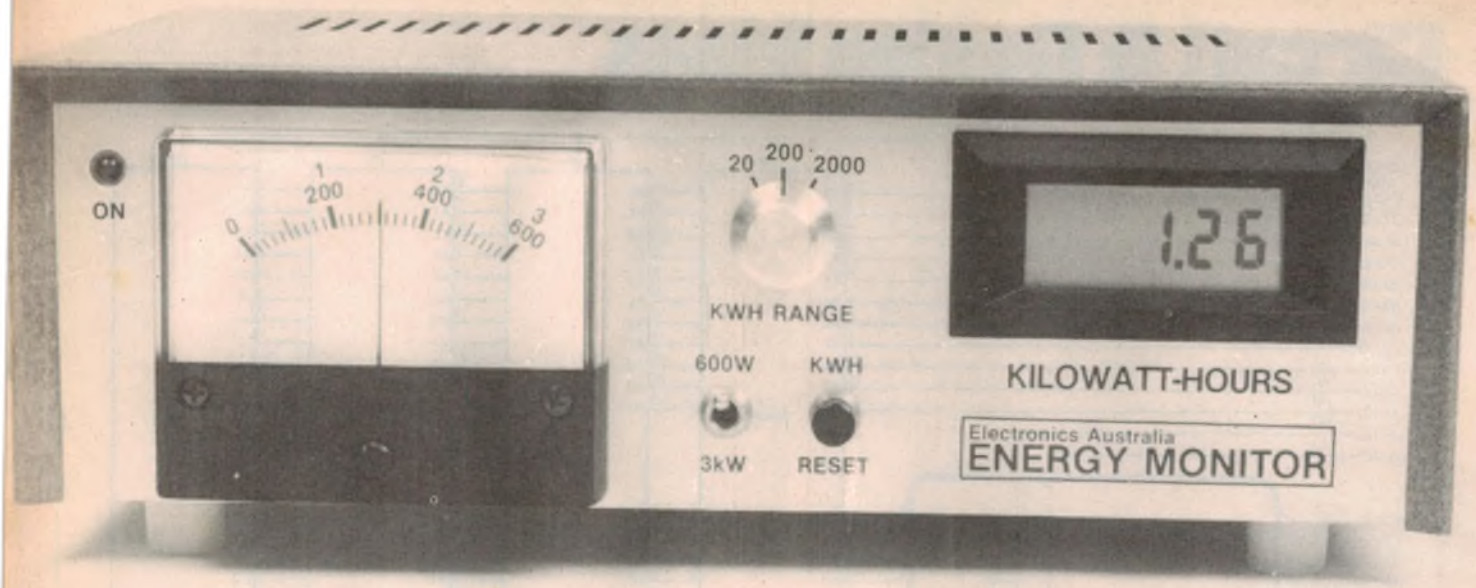
The circuit can be constructed on a 22 + 22 edge connector board using the wire wrap technique (these are available from Tandy Electronics). The constructor should be aware of the non-standard pin numbering system used on the VIC Expansion Port – the numbered row and lettered row are transposed with respect to a normal connector.

For further information regarding the VIC Expansion Port the reader is referred to the VIC-20 Programmer's Reference Guide.

L. Murakami,
West Beach, SA. **$25 for this item.**

Money for old rope

WANTED: *Your circuit and design ideas. We pay between $5 and $40 per item published, depending on the merit and how much work we have to do to publish it. The payment for each of the items on these two pages is given as a guide. If you have an original idea, why not send it in to us? Every item received will be acknowledged by mail.*



Check electricity consumption with this Energy Monitor

by JEFF SKEEN

Still suffering from shock after that last electricity bill? With a little help from our Energy Monitor you can find out just how much that pool filter, air conditioner or freezer adds to the bills.

WARNING

This circuit will float at 240V AC if the mains active and neutral in your house wiring has been transposed.

Our Energy Monitor is really two projects in one. It couples the electronic wattmeter circuit published in September, 1983 with a kilowatt-hour meter, thus allowing both the power demand and the energy usage of an appliance to be measured.

Energy usage is of prime importance to most people because, as consumers, this is what they pay for when the electricity bill comes around. The council electricity meter fitted to your house is actually an energy meter which measures energy consumption in kilowatt-hours. One kilowatt-hour (kWh) is the energy drawn from the mains by a 1000W appliance running for one hour, or a 2400W appliance running for 25 minutes, or a 5W appliance running for 200 hours, etc.

The council meter has a series of dials which total up the kilowatt-hours used. There is no reset provided – the reading at the end of the previous quarter is simply subtracted from the reading for the last quarter, the result being the energy usage during the quarter.

Since there is only one council meter fitted to the household power circuits, it is not possible to obtain a break down of the cost of operating individual appliances.

Further, because most appliances are not run continuously, working out the cost of running them over, say a week, becomes fairly difficult. The times during which the appliance is operated must be noted, then these have to be added together and multiplied by the power rating of the appliance. Finally, the number of kilowatt-hours must be multiplied by the cost per kilowatt-hour.

If the appliance is like many these days and fitted with a thermostat, the on and off times may not even be known to the consumer.

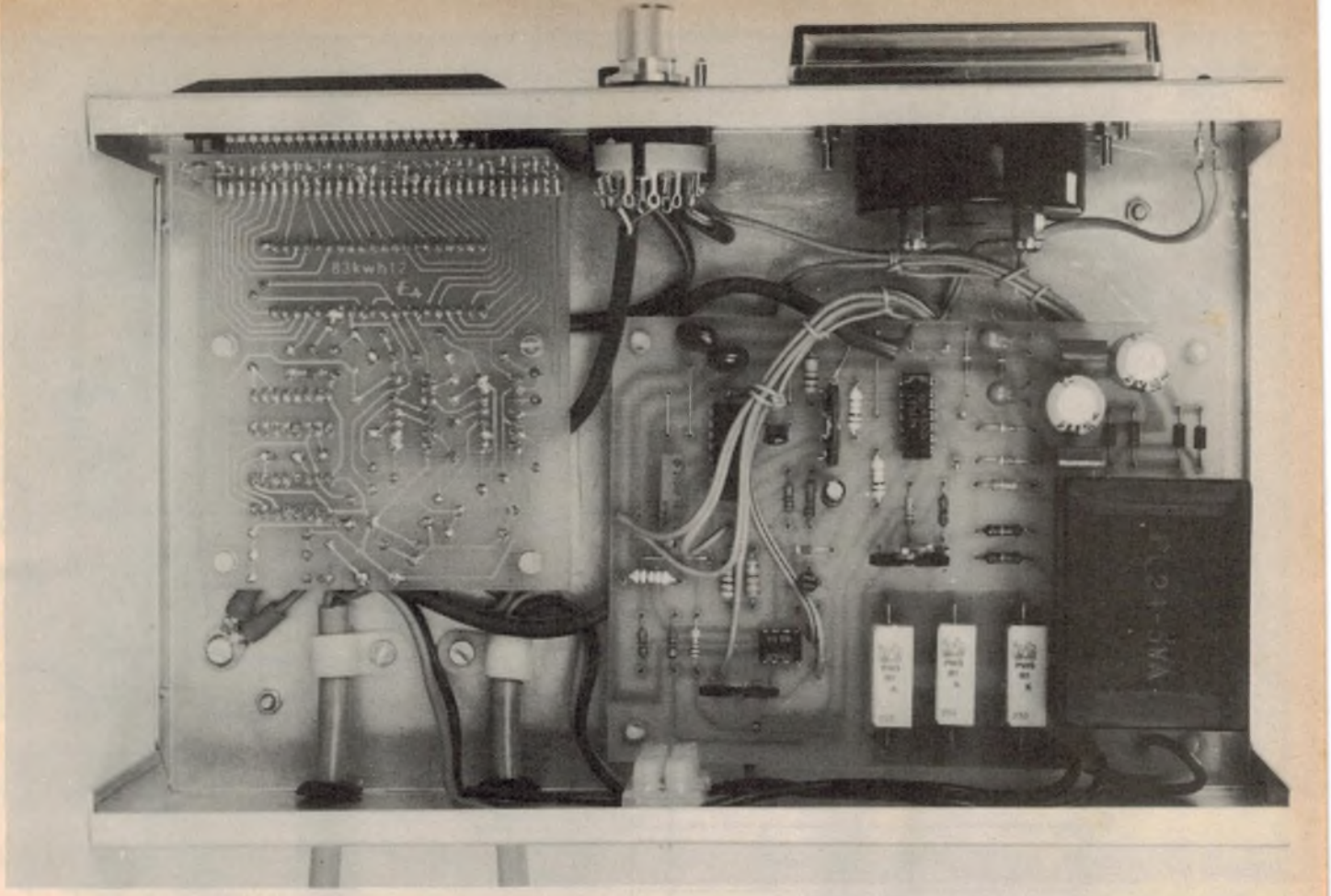
As a further complication, some appliances, such as washing machines, have different power demands at different points in their operating cycle. So, before any cost calculations can be done, the average power demand must be calculated. As far as the average consumer is concerned, this task is virtually impossible.

This is where our Energy Monitor comes in. By connecting the Energy Monitor between an appliance and the mains, both the instantaneous power demand of the appliance and its energy usage over a period of time is automatically measured. The cost of operating the appliance is then determined by obtaining the charge per kilowatt-hour from an electricity bill and multiplying by the number of kilowatt-hours shown on the Energy Monitor.

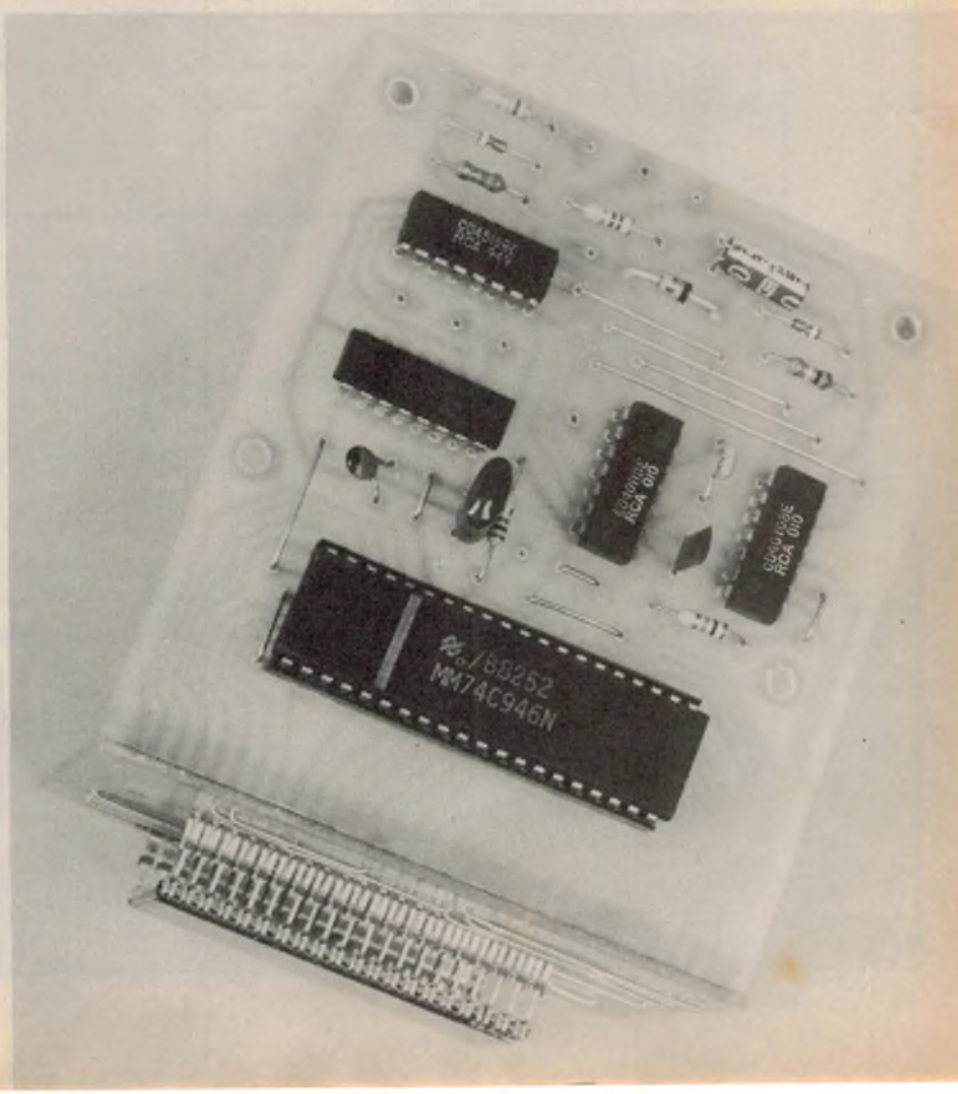
The appliance power demand is displayed on a large moving coil meter which has switchable full-scale readings of 600W and 3kW. The number of kilowatt-hours of energy used is read out on a 4½-digit liquid crystal display (LCD) which has switchable full-scale readings of 20, 200 and 2000 kilowatt-hours. A reset button has been provided to allow the kilowatt-hour meter to be reset to zero at the beginning of each measurement period.

How it works

For the sake of clarity, the complete



Above is a view inside the completed unit while at right is the PCB assembly for the add-on kWh meter.

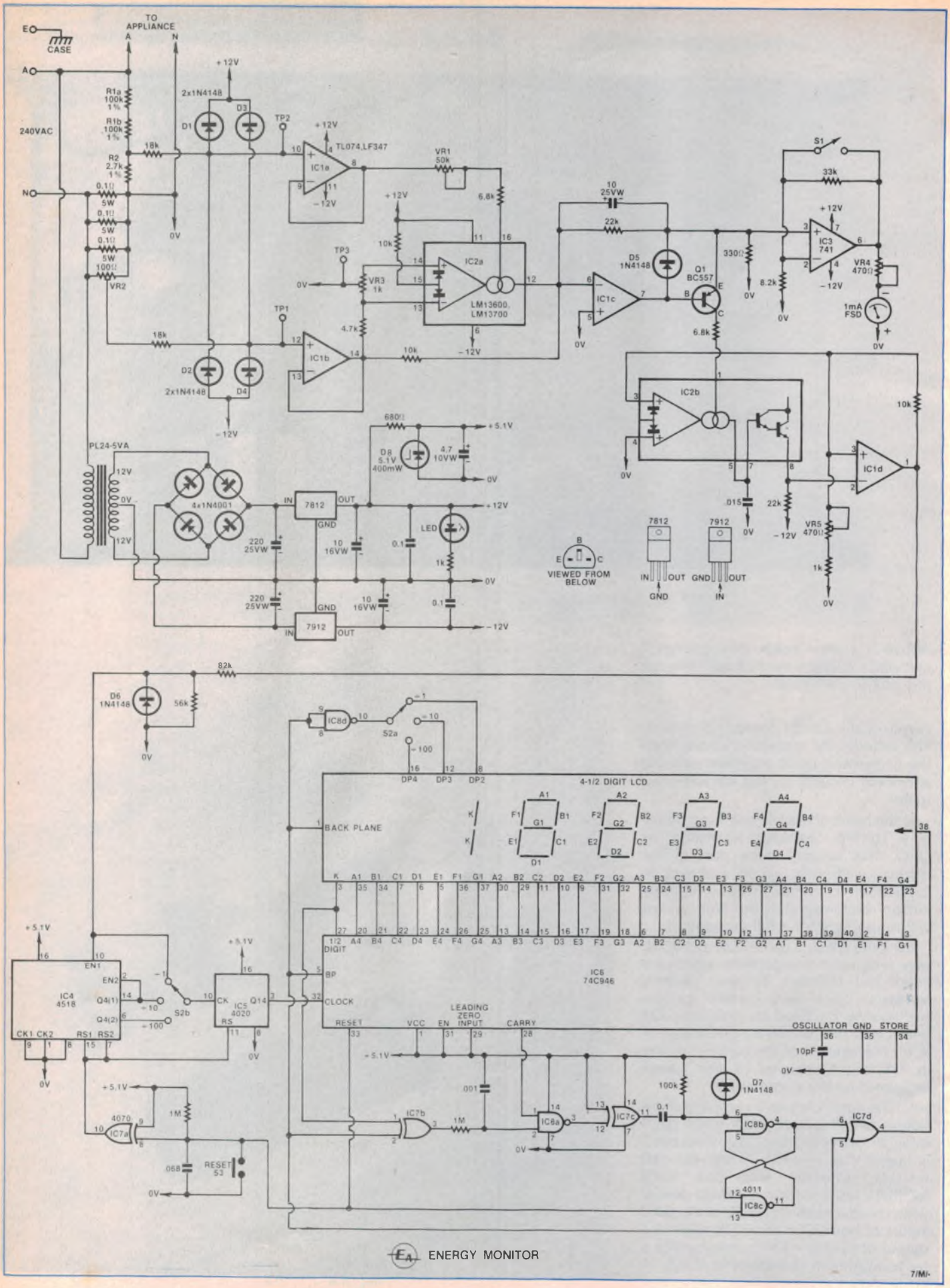


circuit of the Energy Monitor is shown. This includes the wattmeter circuit from the September issue, together with the additional circuitry for the kilowatt-hour meter.

At the heart of the kilowatt-hour meter is a current controlled oscillator, or CCO. This actually forms part of the original wattmeter circuit featured in September. Its operation was given only cursory examination at the time, so we will return here for a full description.

The CCO is made up of IC2b and IC1d, plus associated components which are connected together to give positive feedback. Controlling current for the oscillator is provided by transistor Q1 which is in turn driven by the output of IC1c. The amount of the current flowing in Q1 is proportional to the power registered on the meter scale.

IC1d is connected as a comparator, its output swinging from +12V when pin 3 is higher than pin 2 to −12V when pin 2 is higher than pin 3. VR5 and the 1kΩ resistor, together with the 10kΩ feedback resistor, form a voltage divider which produces about +1.5V at the pin 3 inputs of both IC1d and IC2b when the output of IC1d is +12V (assuming VR5 is set to maximum resistance, ie 470Ω).



EA ENERGY MONITOR

7/MI-

Energy Monitor

Let's assume initially that the output of IC1d has just gone to +12V. A voltage of +1.5V will thus appear on pin 3 of IC2b and this produces a current flow from pin 5 of IC2b equal in magnitude to the control current from Q1. This charges a .015μF capacitor, thereby raising the base potential of the internal Darlington output transistor. The emitter of the Darlington transistor (pin 8) follows this rise in base voltage, although two emitter-base drops (about 1.5V) will always separate the two voltages.

Since the inverting input of IC1d is tied to the Darlington emitter, it too will rise in voltage along with the .015μF capacitor. When the voltage at the inverting input of IC1d exceeds the voltage at the non-inverting input – ie, becomes greater than about 1.5V – the comparator action of IC1d causes its output to swing from +12V to −12V.

This changes the voltage at the non-inverting inputs of IC1d and IC2b from 1.5V to −10.5V. It also reverses the direction of the current flow and so a discharge current equal to the control current through Q1 flows from the .015μF capacitor back into pin 5 of IC2b.

As current flows from the .015μF capacitor, the voltage across it drops and hence the voltage at the emitter of the Darlington output transistor also drops. The capacitor continues to discharge until the voltage at the inverting input of IC1d drops below −10.5V. At this point the output of IC1d will suddenly switch to +12V and the cycle is repeated.

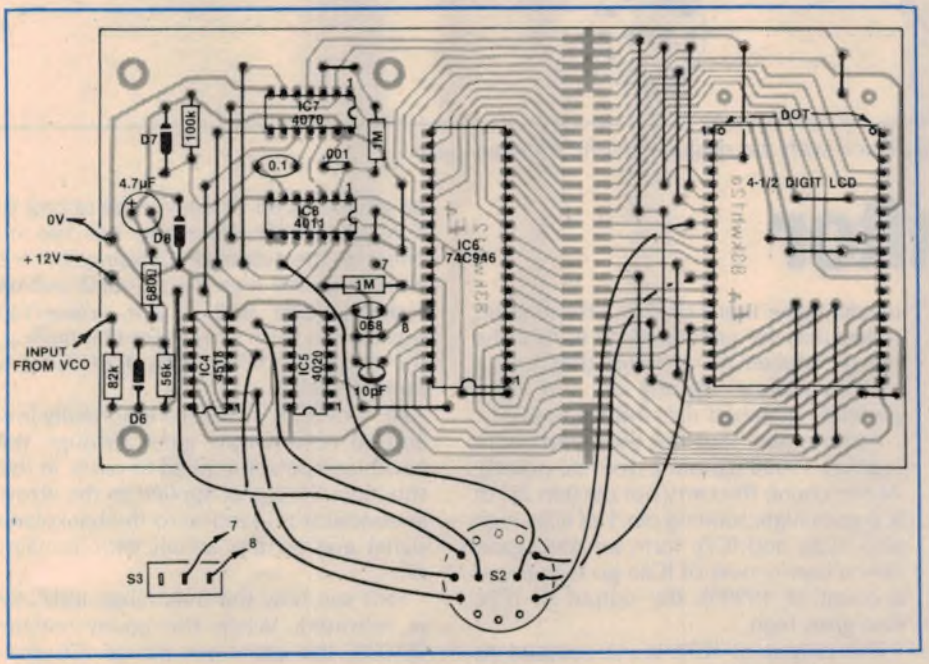
The frequency at which the CCO oscillates for a given control current may be varied by adjusting the voltage divider and hence the two reference voltages. The further apart the two voltages, the longer it will take for the capacitor to charge from one voltage to the other and hence the longer the period of the oscillator waveform. Trimpot VR5 thus allows calibration of the kilowatt-hour meter.

The output of the CCO is passed from the wattmeter circuit board to the kilowatt-hour meter circuit board. At the input of the kilowatt-hour meter is an attenuation network consisting of two resistors and a diode. These make the CCO square wave output compatible with the circuitry of the kilowatt-hour meter by reducing the positive peaks of the CCO output to about +4.9V and clipping off the negative peaks.

The input applied to pin 10 of the 4518 IC and the first position of S1a thus consists of a nominal 0V to +5V square wave at the CCO frequency.

The 4518 (IC4) contains two binary coded decimal (BCD) counters and these have been connected so that each performs a divide by 10 function.

The output of the first counter (pin 14) is applied to the second position of switch S1a and also forms the input to the second divide-by-10 stage. The output of the second stage (pin 6) is thus the CCO frequency divided by 100 and this is applied to the third S1a switch position.



Parts overlay for the kilowatt hour meter. Note that the display board must be separated from the main board and the two soldered together at right angles.

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

$55

This includes sales tax.

Switch S1a selects the divided CCO signal and feeds it directly to the clock input (pin 10) of IC5, a 4020 14-stage binary counter. This counter serves to divide the incoming clock pulses by 16,384 (ie, 2^{14}). The result of all this is that each output pulse from pin 3 of IC5 is equivalent to either .001, .01 or 0.1kWh, depending upon the setting of range switch S1.

Thus, the reading on the LCD will be an indication of the energy used in kilowatt hours.

To count and display the kilowatt-hours of energy used, we have used the event counter circuit described in the July issue of "Electronics Australia". Since we have already described this circuit thoroughly we will simply recap the basic details.

Briefly, IC3 is a 74C946 4½-digit counter/decoder/driver for use with LCDs. The internal circuitry is fairly complex but essentially the input clock pulses are applied to four cascaded decade counters and a half-digit counter (flipflop). The outputs of the counters are passed to latches which are controlled by the store pin (pin 34).

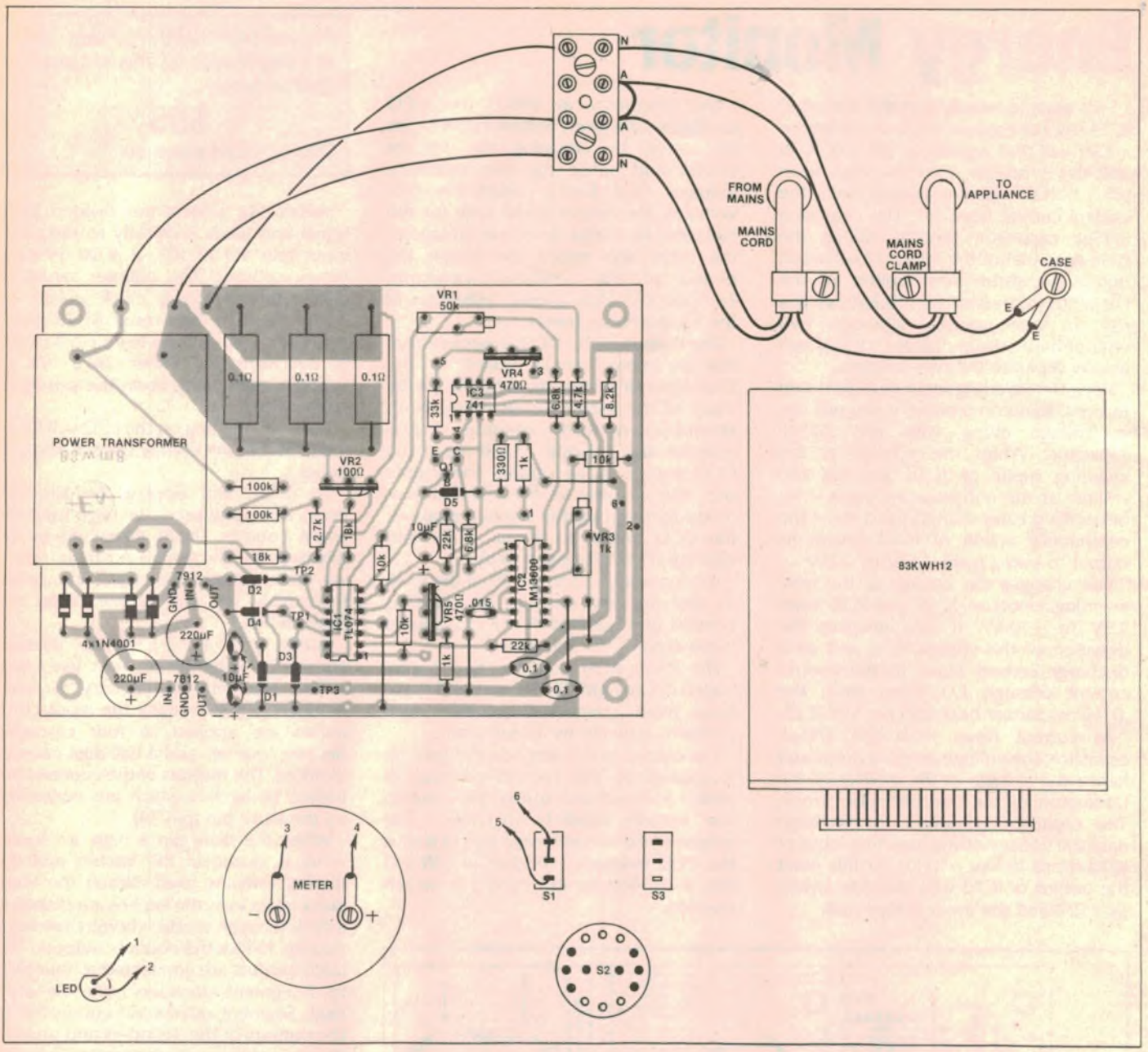
When the store pin is high, a counter value is stored in the latches and the display remains fixed. When the store pin is taken low, the latches are placed in a flow through mode whereby the latch outputs follow the counter outputs. The latch outputs are connected to four BCD to 7-segment decoders, one for each digit. Segment drivers are connected to the outputs of the decoders and provide the special drive characteristics required by the LCD.

In our circuit the store pin is connected to ground and this allows the display to update instantly whenever a pulse is received from IC5. The enable and leading zero inputs (pins 31 and 29) have been connected to the supply rail so that the counters and leading zero blanking circuitry are permanently enabled.

Over-range indication

The portion of circuit centred around IC7b, c and d, and IC8a, b and c is an over-range sensor designed to activate an arrow shaped annunciator located in the top left-hand corner of the LCD if the counter exceeds its maximum reading.

To do this, the over-range circuit must sense when both the ½-digit (pin 27) and carry out (pin 28) outputs are active and then signal the over-range annunciator



This wiring diagram should be used in conjunction with the diagram on the previous page.

Energy Monitor

to turn on at the next clock pulse.

The ½-digit output will be active (ie, out of phase with the backplane signal) whenever the four least significant digits change from 9999 to 0000. It then remains active until the counter is reset. The carry out goes high when the counter reaches 9999 then returns to the low state when the display changes to 0000.

When the ½-digit output goes active, the output of IC7b goes high, sending pin 2 of IC8a high also. The 1MΩ resistor and .001µF capacitor on the output of IC7b form a low pass filter which prevents short output spikes from IC7b reaching the input of IC8a. These short spikes may be generated by IC7b if the signals applied to its inputs (the ½-digit and backplane signals) do not have perfectly matched rise and fall times.

Assume now that the displayed count reaches 19999 (ignoring decimal points). At this count, the carry out pin (pin 28) of IC6 goes high, sending pin 1 of IC8a high also. IC8a and IC7c form an AND gate. When both inputs of IC8a go high (ie, at a count of 19999), the output of IC7c also goes high.

The output of IC7c is AC-coupled to pin 6 of NAND gate IC8b via a 0.1µF capacitor. A positive pulse thus appears on pin 6 of IC8b whenever the output of IC7c goes high. However, this has no effect on the output of IC8b since pin 6 is already pulled high by a 100kΩ pull-up resistor. IC8b and c are connected together to form a reset-set (RS) flipflop, the output of which (pin 4 of IC8b) is normally low.

Pin 6 of IC7d is therefore normally low and so IC7d simply gates through the backplane pulses applied to pin 5. In this situation, the signal applied to the arrow annunciator is identical to the backplane signal and so the annunciator remains off.

Let's see how the over-range indicator is activated. When the count reaches 20,000, the carry out pin of IC6 goes low. This causes the output of IC7c to also go low, resulting in a brief negative

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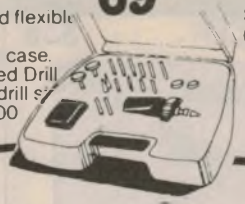

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Stand for Ref 20,000 drill (above). Ideal for PCBs Ref 20,400

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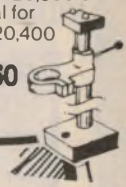

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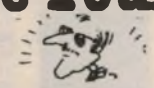

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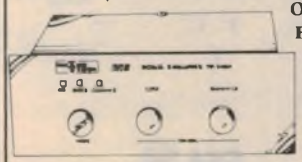

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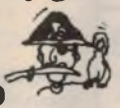

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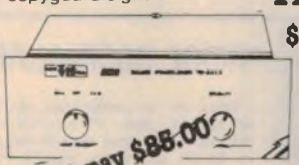

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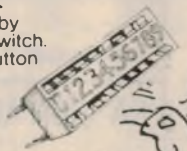

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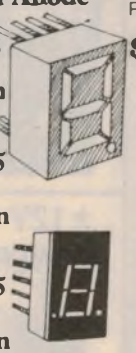

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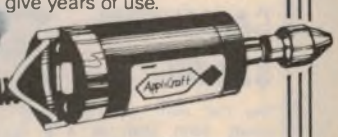

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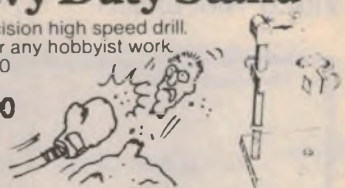

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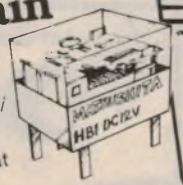

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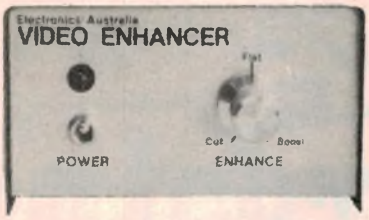

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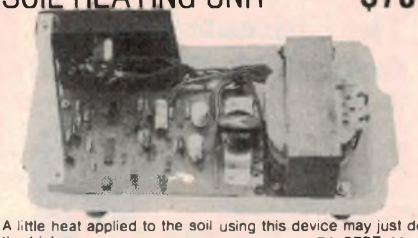
EA SEPTEMBER 83

SOIL HEATING UNIT $70



A little heat applied to the soil using this device may just do the trick. EA SEPT 83

WATTMETER $65

The unit described here will measure the power consumption of any mains appliance with a rating up to three kilowatts. It makes use of a special op amp called an "output transconductance amplifier" or OTA, for short.

EA SEPTEMBER 83

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ETI 159 December 81

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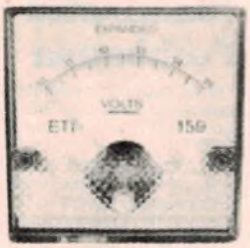
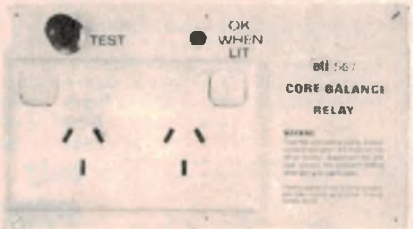


CORE BALANCE RELAY ETI 567



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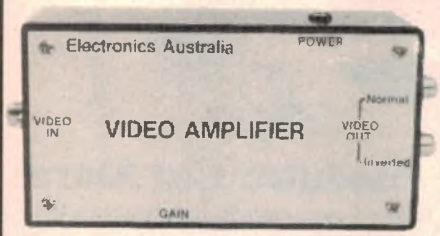

EA AUG 83

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

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

WHEATSTONE BRIDGE $45

Mains-operated equipment that goes faulty is potentially lethal. Electro-mechanical "core-balance relays" which sense earth-fault currents and trip a circuit breaker have been available for house-mains installation for some years. Portable core-balance relay units have obvious advantages. Protect yourself — and your equipment — with this simple, inexpensive project.

±12V RAILS FOR LAB POWER SUPPLY

EA July 1983

$13

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

FRIDGE DOOR ALARM

When the refrigerator door has been left open for about 20 seconds — or, more correctly, when the light has been on for 20 seconds — this EA Fridge Alarm will emit a series of reminder beeps until the culprit closes the door.

$9

FOR PCB VERSION

EA July 1983

Portable 3½ Digit Heart Rate Monitor

$79.00

Here is a new heart rate monitor designed specifically for use by the dedicated fitness seeker. Small enough to carry when jogging or exercising, it features an optical sensor, no electrical connections to the body, an in-built calibration circuit, and direct readout on a large liquid crystal display (LCD).

Driveway Sentry

$32

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

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Energy Monitor

going pulse to pin 6 of IC8b. Pin 6, in fact, forms the set input of the RS flipflop.

The reset input of the flipflop (pin 13 of IC8c) is normally tied high via a 1MΩ resistor to the positive rail. When the negative pulse is applied to the set input, the combination of inputs causes the flipflop to toggle. Pin 6 of IC7d will therefore go high and so IC7d will invert the backplane signal applied to its pin 5 input.

The signal applied to the arrow annunciator is now 180° out of phase with the backplane signal and hence the arrow annunciator will turn on to indicate the over-range condition.

Note that, when the display over-ranges, the ½-digit (ie, the "1") remains on with the arrow annunciator. The four least significant digits reset from 9999 to 0000 and continue counting.

Switch S2 provides the reset function. When S2 is pressed, the reset inputs of the flipflop and IC6, together with pin 8 of IC7a, are taken low by connecting them to the 0V rail. IC7a inverts this low level reset signal to produce the high level reset signal required by IC4 and IC5.

A reset pulse is also generated automatically on switch on to ensure that all counters begin counting from zero. This is generated by connecting a .068μF capacitor in parallel with S2. Initially, the capacitor is discharged so that, when power is first applied, it appears as a short circuit. The capacitor then charges via the 1MΩ resistor to remove the reset pulse after a 50ms delay.

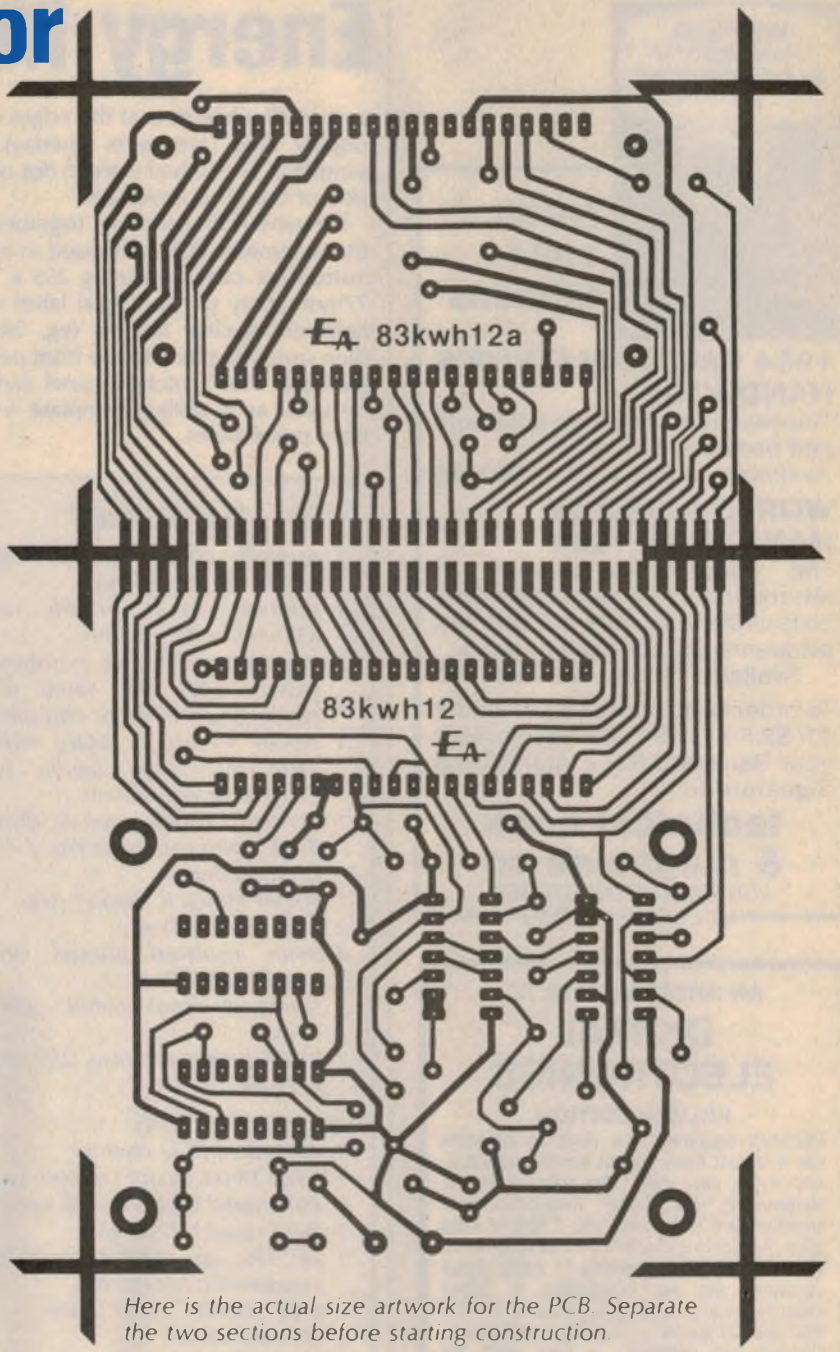
NAND gate IC8d forms part of the decimal point circuitry. Its job is to produce an inverted version of the backplane signal which is then used to drive the decimal point annunciators in the LCD. Switch S1b switches the output of IC8d to the required decimal point position (either DP2, DP3 or DP4).

Finally, power for the kilowatt-hour meter circuitry is derived from the +12V rail used to power the wattmeter circuit. This is regulated to +5.1V using a zener diode, with decoupling provided by a 680Ω resistor and a 4.7μF capacitor.

Construction

Construction of the additional circuitry is straightforward with most of the parts mounted on two small printed circuit boards (PCBs). These are coded 83kwh12 and 83kwh12a, and measure 86 x 93mm and 86 x 60mm respectively.

The larger of the two boards (83kwh12) holds all the ICs and various minor parts, while the smaller board accommodates the LCD. As shown in the photograph, the two boards are soldered together at right angles, an arrangement which keeps internal wiring to a minimum.



Here is the actual size artwork for the PCB. Separate the two sections before starting construction.

Begin construction by mounting the components on the larger board. The best procedure is to install the 10 wire links first, followed by the resistors, capacitors, diodes and ICs in that order.

Note that all ICs used in this project are CMOS and are easily damaged by static electricty. The ICs should be left in their protective foam packaging until ready for installation on the PCB and then the power supply pins should be soldered first to enable the internal static protection circuitry. The 74C946 IC is mounted using a 40-pin DIL socket.

Next, assemble the display PCB according to the parts overlay diagram, commencing with the 17 wire links. The LCD is mounted using two 20-pin Molex IC socket strips. Solder each socket strip to the PCB, then snap off the carrier strips so that each pin connector is separated from its neighbour. The two PCBs may now be butted together at right angles and the edge connectors soldered.

Now go back over your work and check that all ICs and the LCD are correctly oriented. The LCD used in the prototype is a 4½-digit type sold by Dick Smith Electronics (catalog No. Z-4175). Pins 1 and 40 of the LCD are identified by

Energy Monitor

two small white dots at the edges of the display area (see parts overlay). Our sample LCD also had a green dot on one side of the glass envelope.

The new PCB assembly, together with the wattmeter PCB, is housed in a K&W instrument case measuring 255 x 157 x 77mm. Spray the Scotchcal label with a hard-setting clear lacquer (eg, Estapol), then carefully affix it to the front panel of the case. The Scotchcal panel can now be used as a drilling template for the front panel holes.

PARTS LIST

1 printed circuit board, code 83kwh12, 86 x 93mm
1 printed circuit board, code 83kwh12a, 86 x 60mm
1 momentary contact pushbutton switch, 240V AC rated (C&K model 8121, 8168 or equivalent)
1 2-pole 3-position rotary switch, 240V AC rated (Lorlin type CK1030 or equivalent)
1 4½-digit liquid crystal display (Dick Smith catalogue No. Z-4175 or equivalent)
1 40-pin Molex IC socket strip
1 40-pin DIL socket
4 8mm insulated printed circuit board standoffs
1 Scotchcal front panel, 254 x 77mm
1 K&W instrument case, 255 x 157 x77mm

SEMICONDUCTORS
1 4518 dual BCD counter
1 4020 14-bit binary counter
1 4070 quad exclusive OR gate
1 4011 quad NAND gate
1 74C946 or ICM7224 4½-digit counter/display driver
1 5.1V 400mW zener diode
2 1N4148 diodes

CAPACITORS
1 4.7µF 10VW PC mount electrolytic
1 0.1µF greencap
1 0.068µF greencap
1 0.001µF greencap
1 10pF ceramic

RESISTORS
2 x 1MΩ, 1 x 100kΩ, 1 x 82kΩ, 1 x 56kΩ 1 x 680Ω

MISCELLANEOUS
Machine screws and nuts, 240VAC hookup wire, solder etc.

PLUS: All the parts listed for the wattmeter in the September issue, except for the case and the Scotchcal front panel.

The larger cutouts for the meter and LCD are made by drilling a series of small holes around the inner perimeter of the cutout, and then filing the cutout to a smooth finish.

Although our prototype used a bezel surround for the LCD, readers are advised that these are in short supply. At least two kitset suppliers are looking into this situation, but our advice is "don't hold your breath". Fig. 1 shows the locations of the bezel mounting holes for those readers who do manage to obtain a bezel.

The PCB assemblies can now be positioned in the case according to the wiring diagram and the necessary mounting holes drilled. You will also have to drill holes for the mains cord clamps and earth solder lugs, the two cord entry grommets, and the 4-way insulated terminal block. Those readers who previously built the wattmeter project can transfer the PCB mounting hardware, mains cords and clamps, and the insulated terminal block straight into this project.

All wiring within the Energy Monitor should be run using 240V AC rated cable. If 240V AC cable is not available, then a cable with a lower rated insulation can be used and the insulation bought up to par by fitting insulating sleeving over the entire length of the cable. This includes the wiring to the switches, LED and the PCBs.

As a further precaution, a rectangular window of stiff, clear plastic should be fitted to the front panel cutout for the LCD (the plastic used for shirt box lids is ideal). This should be glued to the inside of the front panel using epoxy adhesive and will prevent the LCD pins (which could be at 240V AC) from shorting to the case. As a bonus, the plastic window will also protect the LCD from scratches.

Construction can now be completed by securing the two PCB assemblies. The wattmeter PCB is mounted using four 12mm insulated standoffs, while the kilowatt-hour meter PCB assembly is mounted using 8mm insulated standoffs.

Calibration

The kilowatt-hour meter is calibrated using a high power resistive load such as a 1000W bar radiator. Since the average 1000W radiator will not draw exactly 1000W, the power consumption of the radiator must be calculated before calibrating the kilowatt-hour meter.

This may be done in two ways. The first method involves measuring the voltage across the radiator and the current it is drawing from the mains while at operating temperature, then multiplying

the two figures together to get the power consumption (P= I.V.).

For example, if the voltage is 238V AC and the current is 4.3A, the power consumption will be 1023W.

The second method involves measuring the voltage across the radiator then unplugging the radiator and quickly measuring the resistance of the hot radiator element. The power consumption of the radiator is then calculated by squaring the voltage reading and dividing this by the resistance reading ($P = V^2/R$).

Of the two methods, we prefer the latter since it is easier to measure resistance than current consumption. But whichever method you use, it is essential that all measurements be carried out with the radiator element at normal operating temperature. This is because the resistance of the element increases by about 5% as the element goes from room temperature to operating temperature. In particular, the resistance reading should be taken quickly once the radiator has been unplugged so that the element does not have time to cool.

Once the radiator power consumption has been calculated, it should be used to check the accuracy of the wattmeter circuit which may have lost calibration during the transfer to the new case. If the wattmeter has lost calibration, it should be recalibrated using the procedure outlined in the September issue.

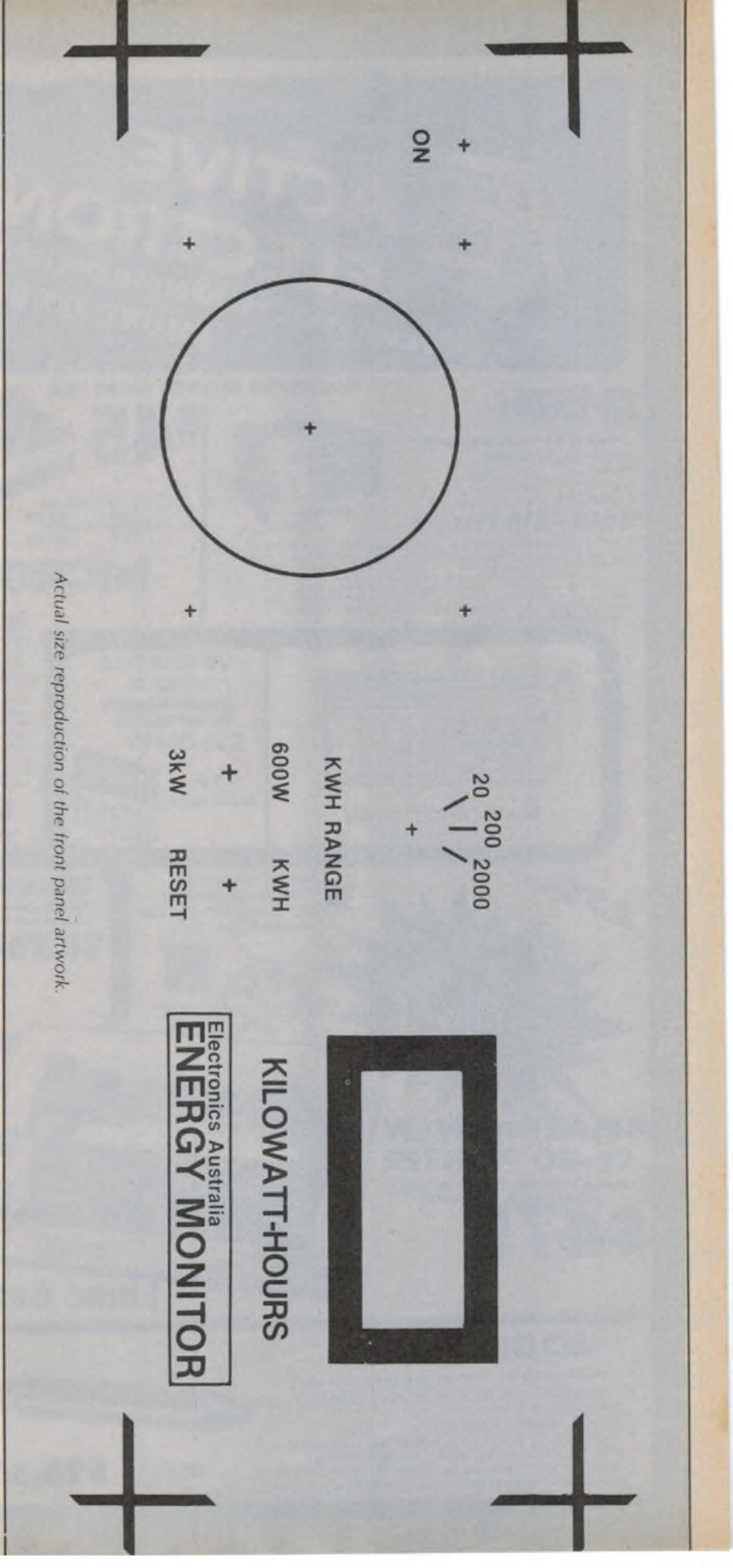
The kilowatt-hour meter is now calibrated by adjusting VR5 on the wattmeter PCB. As before, this adjustment must be made using a screwdriver with a fully insulated blade. Adjust VR5 so that the LCD reads 1/10th the calculated radiator power consumption after a period of six minutes.

An example

By way of example, if the calculated radiator power consumption is 1023W, then the display should read .102 after six minutes. Once this initial adjustment has been made, more accurate adjustments can be made over longer periods of time (eg, for the above example, the display should read 1.023 after 60 minutes. Don't forget to press the "reset" button at the start of each measurement period.

If, due to circuit tolerances, VR5 does not have enough range to allow calibration of the kilowatt-hour meter, it should be replaced with a 1kΩ trimpot.

When using the kilowatt-hour meter, it is important not to alter the setting of the range switch (S1) during the measurement period. If you do, the different counting rate will invalidate the reading. However the wattmeter range may be altered since this does not affect the output frequency of the CCO.



Actual size reproduction of the front panel artwork.

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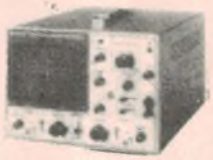

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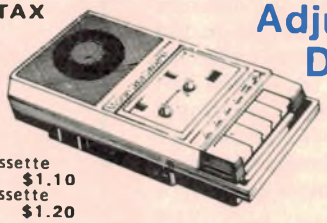

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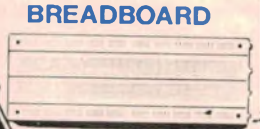

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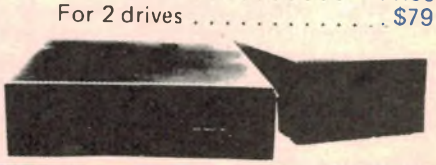

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74LS00

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4000

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4558	1 30
4560	2 40
4569	2 00
4572	58
4583	98
4584	68
4585	80
4599	4 20

9000

9300	58
9302	1 05
9304	60
9307	1 40
9308	1 80
9309	60
9310	85
9311	1 60
9312	50
9314	58
9316	78
9318	1 40
9320	4 80
9321	87
9322	54
9324	76
9328	98
9334	1 10
9338	1 20
9340	2 80
9368	1 15
9370	92

LINEAR ETC

AD570	14 00
AD7524	12 00
ADC0800	14 90
ADC0804	5 50
ADC0808	12 60
ADC0809	8 00
ADC0817	13 60
ADC1210	58 00
AY 3 1015	6 50
AY 3 8910	10 00
BR1941	11 50
BR1943	12 00
CA3028	1 90
CA3036	4 40
CA3039	1 50
CA3059	5 80
CA3081	98
CA3130	1 30
CA3130T	1 70
CA3140	78
CA3140T	1 92
CA3146	2 20
CA3401	99
DAC0800	3 20
DAC0808	2 50
DAC1220	12 50
DM8121	2 50
DM8130	5 20
DM8131	2 95
DM8309	64
DM8310	81
DM8311	52
DM8116	76
DS8820	2 40
DS8830	2 40
DS8833	2 80
DS8836	2 40
DS8859	2 05
DS8869	1 80
DS75107	78
DS75108	1 10
DS75110	1 20
DS75150	1 20
DS75154	90
DS75451	90
DS75452	45
DS75453	78
DS75454	66
FD1771	19 00
FD1791	36 00
FD1793	30 00
FD1795	35 00
ICL7106	13 50
ICL7107	17 00
ICL7660	4 80
ICM7217A	17 50
ICM7218A	18 00
ICM7555	1 85
ICM7556	2 70
L120	2 82
L121	2 76
LF347	1 90
LF351	58
LF353	88
LF356	1 20
LF357	1 20
LF398	3 90
LF398H	6 50
LF13741	70
LH0002	10 90
LH00042CH	9 40
LH0070 1H	15 90
LH0071 1H	17 10
LM10CH	6 50
LM304H	2 90
LM307	48
LM310	1 80
LM311 14	1 10
LM318	1 70
LM319	1 90
LM322	1 90
LM325	4 50
LM329	78
LM334	1 60
LM335Z	1 45
LM336Z	1 45
LM349	1 60
LM358	78
LM358AN	1 38
LM374	4 80
LM377	2 10
LM380 8	1 20
LM380 14	1 30
LM381	1 75
LM382	1 45
LM383	1 90
LM386	70
LM387	78
LM394CH	5 60
LM565	88
LM566	1 90
LM567	89
LM1830	3 20
LM1886	6 00
LM1889	2 30
LM2917 14	2 05
LM3080	1 15
LM3089	2 90
LM3524	2 95
LM3900	95
LM3905	1 40
LM3909	1 40
LM3911	2 00
LM3914	4 50
LM3915	4 50
LM3916	4 50
LM4250	2 90
MC1350	1 30
MC1406	8 90
MC1445	3 80
MC1456	1 50
MC1466	13 00
MC1494	7 10
MC1495	7 10
MC1496	3 60
MC3340	1 30
MC3370	3 70
MC3470	8 90
MC3486	3 20
MC10116	1 40
MCM66740	16 00
MM5303	6 50
MM5837	2 40
MM58167	11 50
MN3001	13 90
MSM58372	11 00
NE530	2 30
NE558	1 85
NE571	2 80
NE5534	1 70
NE5534AN	2 40
OM321	9 80
OM335	16 80
OM350	9 30
SAB0600	6 40
SAK140	1 50
SN76477	5 60
SN76488	7 20
TA7205	2 60
TCA220	8 10
TL061	1 05
TL062	1 50
TL071	78
TL072	1 45
TL074	2 80
TL075	3 10
TL081	58
TL082	1 10
TL084	2 30
TR1602	7 10
TR1863	6 70
TR1983	8 90
UA301	45
UA301H	1 30
UA305H	1 20
UA308	56
UA311	67
UA311H	1 25
UA324	84
UA339	44
UA348	1 40
UA393	51
UA555	55
UA556	88
UA709	56
UA710	75
UA711	58
UA723	48
UA723H	1 20
UA725	2 40
UA739	98
UA741	55
UA741H	1 15
UA747	98
UA1458	48
UA1488	70
UA1489	70
UA2901	58
UA3086	48
UA4136	1 15
UAA170	4 60
UAA180	4 20
ULN2003	1 20
WD1393	64 00
WD1691	17 50
XR2206	5 95
XR2207	4 90
XR2208	3 10
XR2211	6 80
XR2216	2 80
XR2240	3 00
XR2243	2 90
8126	1 70
8128	2 30
8195	1 60
8196	1 80
8197	1 90
11C90	12 00
95H90	7 00

MICRO

2102	1 40
2112	2 20
2114	2 80
2532	10 20
2564	16 50
2708	5 90
2716	4 20
27128	38 00
2732	5 20
2764	9 50
2816	12 00
2911	32 00
2912	22 00
2920	108 00
4116 150NS	2 90
4164 150NS	7 20
6116P3	6 80
6502	9 20
6502A	9 50
6505	11 90
6507	8 50
6520	2 90
6522	7 20
6522A	10 50
6532	10 50
6545	19 80
6551	12 50
6800	4 80
6802	6 40
6808	4 20
6809	13 90
6810	3 10
6820	2 85
6821	2 60
6840	5 60
6844	11 00
6845	11 00
6847	7 20
6850	2 40
6852	2 60
6854	8 60
6875	17 00
68B00	6 50
68B21	3 80
68B40	17 00
68B45	16 00
68B50	3 20
68B54	11 90
8080	6 90
8085A	5 80
8086	52 00
8088	41 00
8155	5 10
8156	5 40
8185	34 00
8202A	56 00
8203	56 00
8206	115 00
8212	1 55
8214	1 80
8216	1 60
8224	4 40
8226	1 75
8228	3 40
8231	285 00
8237	41 00
8238	10 50
8243	2 90
8251A	4 80
8253	5 50
8255A	3 40
8257	6 40
8259	4 60
8271	95 00
8272	29 00
8273	58 00
8274	43 00
8275	44 00
8276	23 00
8282	8 20
8283	8 20
8284	10 00
8286	8 20
8287	8 20
8288	24 00
8289	31 00
8291A	42 00
8292	34 00
8293	25 00
Z80CPU	4 80
Z80ACPU	5 80
Z80BCPU	10 50
Z80P10	4 20
Z80AP10	5 60
Z80S10	12 10
Z80AS10	15 00
Z80CTC	4 90
Z80ACTC	6 40
Z80DMA	14 00
Z80ADMA	16 00
8741A	35 00
8748 8	25 00
8749	54 00
8755A	34 00

VOLT REGS

LM309H	3 90
LM317HVK	7 50
LM337T	1 40
LM337HVK	12 00
LM337K	6 40
LM338K	7 90
LM350K	6 30
LM350T	4 50
LM396K	18 90
LM79L05	70
LM79L12	58
LM79L15	58
SH1605	14 00
UA317T	1 40
UA317K	2 50
UA309K	1 60
UA494	3 10
UA7805	64
UA7805K	1 60
UA7906	70
UA7808	60
UA7808K	1 60
UA7812	64
UA7812K	1 60
UA7815	64
UA7815K	1 60
UA7818	64
UA7818K	1 60
UA7824	64
UA7824K	1 70
UA78H05K	1 40
UA78H12K	9 10
UA78HGKC	9 70
UA78L05	39
UA78L12	39
UA78L15	39
UA78M05	58
UA78M12	58
UA78P05K	15 70
UA78S40	2 70
UA7905	70
UA7905K	1 80
UA7908	70
UA7908K	1 80
UA7912	70
UA7912K	1 80
UA7915	90
UA7915K	1 80
UA79HGKC	15 00
UA79M05	60
UA79M12	60

OPTO

4N25	97
4N26	97
4N28	97
4N32	97
4N33	1 20
4N35	97
MC16	1 30
MC12	90
FND357	1 50
FND500	1 30
FND507	1 50
FND800	1 40
TIL31A	2 50
TIL81	2 00
BPW50	2 00
CQY89	85
MOC3020	2 10
MOC3021	2 40
MAN72A	1 20
MAN74A	1 20
FCD820C	90
FCD825C	90
FCD850C	1 10
FPT100B	1 20
MSM3914	8 50
MSM3916	8 50

LEDS

TLG123 SGS	
3mm GREEN	15
TLR123 SGS	
3mm RED	09
TLO123 SGS	
3mm YELLOW	15
TLG113 SGS	
5mm GREEN	15
TLR113 SGS	
5mm RED	09
TLO113 SGS	
5mm YELLOW	15
20160	
RECT RED	25
20162	
RECT GREEN	25
20164	
RECT YELLOW	25
FLS010	
5mm LED CLIP	06

DIODES

1N4148	03
1N914	03
1N4001	05
1N4002	05
1N4004	05
1N4007	05
1N5404	15
1N5408	17
OA47	43
OA90	17
OA202	87
OA636	89
P600G	35
6A400V	59
BAW62	30
BA102	70
OA91	27
OA95	26
1N3492	
25A100V	1 50
1N3492R	
25A100V	1 50
1N5060	30

BRIDGES

VJ448	
10A400V	1 70
BR154	
15A400V	3 00
BR254	
25A400V	3 05
BR354	
35A400V	3 90
P04	
6A400V	1 50
RS204	
2A400V INLINE	96
SB204	
2A400V	75
W04	
1 5A400V	39

ZENERS

1N4733A	
5 1V 1 WATT	17
1N4734A	
5 6V 1 WATT	17
1N4736A	
6 8V 1 WATT	17
1N4740A	
10V 1 WATT	17
1N4742A	
12V 1 WATT	17
1N5349B	
12V 5 WATT	69
BZX61 C75	
75V 1 3 WATT	78

TRANSISTORS

AC126	70
AC127	60
AC128	85
AC187	56
AC188	1 10
AD149	1 85
AD161	1 70
AD162	1 70
AF127	95
BC107	29
BC107B	34
BC108	29
BC108C	34
BC109	29
BC109C	34
BC177	34
BC178	34
BC179	34
BC212	19
BC318	14
BC327	18
BC328	18
BC546	14
BC547	14
BC547C	15
BC548	17
BC548C	18
BC549	12
BC549C	16
BC550	14
BC556	14
BC557	12
BC557B	16
BC558	12
BC558B	18
BC559	12
BC559B	18
BC637	34
BC639	29
BC640	29
BCY70	55
BCY71	59
BD135	55
BD136	55
BD137	39
BD138	39
BD139	39
BD140	39
BD233	39
BD235	40
BD236	40
BD237	42
BD238	42
BD262	70
BD263	70
BD437	45
BD647	1 90
BD677	60
BD681	71
BD682	71
BDV64B	2 80
BDV65B	2 80
BDY96	3 50
BDY97	3 50
BF115	55
BF167	58
BF173	58
BF180	78
BF184	68
BF198	22
BF199	22
BF337	48
BF458	50
BF459	50
BF469	78
BF470	78
BF494	26
BFY50	52
BFY90	71
BU126	1 85
BU208	1 45
BU326A	1 90
BUX80	2 40
MFE121	1 40
MFE131	1 40
MJ413	3 20
MJ802	3 90
MJ1001	2 40
MJ15003	3 90
MJ15004	3 90
MJ2955	1 65
MJ4032	7 90
MJ4035	7 40
MJ4502	4 00
MJE340	70
MJE350	80
MJE521	1 20
MJE700	50
MJE800	50
MJE2955	1 90
MJE3055	1 70
MPSA05	19
MPSA06	19
MPSA12	19
MPSA14	19
MPSA42	19
MPSA56	19
MPSA92	19
MPF102	36
MPF103	79
MPF105	79
MRF237	3 60
MRF454	28 00
MRF475	4 40
MRF901	2 70
TIP31	38
TIP31A	39
TIP31B	50
TIP31C	55
TIP32	38
TIP32A	54
TIP32B	57
TIP32C	61
TIP41	65
TIP41A	68
TIP41B	70
TIP41C	75
TIP42	58
TIP42A	74
TIP42B	78
TIP42C	80
TIP111	66
TIP112	70
TIP116	70
TIP117	80
TIP120	65
TIP122	70
TIP125	75
TIP127	95
TIP2955	1 40
TIP3055	1 40
2N301	3 80
2N697	40
2N918	40
2N2219	42
2N2219A	45
2N2222	40
2N2222A	45
2N2369	41
2N2484	41
2N2646	96
2N2647	3 60
2N2894	35
2N2904	40
2N2905	40
2N2905A	45
2N2906	39
2N2907	40
2N2907A	45
2N3019	45
2N3053	45
2N3054	1 70
2N3055	75
2N3302	35
2N3440	75
2N3441	2 40
2N3442	2 30
2N3563	18
2N3564	18
2N3565	18
2N3566	18
2N3567	18
2N3568	18
2N3569	18
2N3638	18
2N3640	18
2N3641	18
2N3642	18
2N3643	18
2N3644	18
2N3646	18
2N3702	27
2N3704	25
2N3771	3 10
2N3772	3 50
2N3773	4 20
2N3819	60
2N3866	85
2N3904	20
2N3906	20
2N4032	45
2N4033	69
2N4036	45
2N4121	20
2N4236	1 20
2N4237	1 10
2N4250	19
2N4258	21
2N4355	19
2N4356	19
2N4360	48
2N4401	18
2N4402	18
2N4403	18
2N4416	1 40
2N4427	79
2N5088	18
2N5089	20
2N5179	1 15
2N5190	70
2N5191	70
2N5192	60
2N5193	60
2N5195	64
2N5210	19
2N5245	70
2N5303	3 60
2N5401	20
2N5457	54
2N5458	54
2N5459	59
2N5461	65
2N5485	54
2N5486	54
2N5590	14 00
2N5591	15 00
2N5770	19
2N5777	95
2N5873	1 30
2N5944	13 00
2N5946	18 00
2N5961	19
2N6027	54
2N6084	22 00
2N6121	55
2N6122	55
2N6123	50
2N6124	55
2N6125	60
2N6126	55
2N6129	1 10
2N6130	1 30
2N6131	1 40
2N6133	1 50
2N696	85
2N918	40
2SA683	70
2SC1013	2 50
2SC1061	69
2SC1096	70
2SC1106	4 80
2SC1226	95
2SC1306	1 50
2SC945A	24
2SD350A	2 20
2SJ49	5 90
2SK134	5 90
3N201	1 70

SCR & TRIACS

C103D	64
C106D	79
C122D	1 55
C122E	1 90
C230D	5 80
Q4010L4	1 90
Q4015L5	2 70
Q6010L5	3 20
Q6015L5	3 50
Q6025H	9 80
S4015L5	2 20
S4025H	8 20
SC141D	1 25
SC146D	1 60
SC151D	2 10
ST2	50
ST4	60

TANTALUM

1UF 35V	18
22UF 35V	19
33UF 35V	19
47UF 35V	19
1UF 35V	19
1 5UF 35V	20
2 2UF 35V	21
3 3UF 35V	24
4 7UF 35V	40
10UF 35V	50

ELECTRO PCB

1UF 50V	15
2 2UF 25V	15
4 7UF 25V	15
10UF 25V	15
33UF 25V	15
47UF 25V	15
100UF 25V	16
220UF 25V	20
330UF 25V	25
470UF 25V	34
1000UF 16V	39
1000UF 25V	49
2200UF 25V	80

ELECTRO AXIAL

47UF 63V	18
1UF 63V	18
2 2UF 63V	18
3 3UF 25V	18
4 7UF 25V	18
10UF 160V	24
10UF 16V	18
10UF 25V	18
10UF 63V	19
22UF 25V	19
22UF 63V	19
47UF 16V	18
47UF 25V	18
47UF 63V	19
100UF 25V	19
100UF 63V	34
220UF 16V	19
220UF 25V	24
220UF 63V	49
470UF 16V	37
470UF 25V	40
470UF 63V	60
1000UF 16V	40
1000UF 25V	50
1000UF 35V	74
2500UF 16V	87
2500UF 25V	98
2500UF 35V	1 60
2500UF 50V	1 80
4700UF 35V	2 40

ELECTRO METAL CAN

2500UF 80V	3 50
4000UF 75V	5 40
5600UF 40V	3 40
8000UF 75V	8 40

ELECTRO BIPOLAR

2 2UF 50V	35
4 7UF 50V	38
6 8UF 50V	39
10UF 50V	40
22UF 50V	46

GREENCAPS

001UF 100V	09
0015UF 100V	09
0022UF 100V	09
0033UF 100V	09
0039UF 100V	09
0047UF 100V	09
0056UF 100V	09
0068UF 100V	09
0082UF 100V	09
01UF 100V	09
015UF 100V	09
022UF 100V	09
033UF 100V	09
039UF 100V	09
047UF 100V	14
056UF 100V	14
068UF 100V	18
082UF 100V	18
1UF 100V	18
15UF 100V	18
22UF 100V	18
27UF 100V	22
33UF 100V	30
47UF 100V	34
1UF 250V	85
2 2UF 250V	1 25
3 3UF 250V	2 30
4 7UF 250V	2 80
6 8UF 250V	4 40
10UF 250V	5 90

GREENCAPS HIGH VOLTAGE

01UF 630V	22
022UF 630V	24
033UF 630V	26
047UF 630V	30
1UF 630V	38
22UF 630V	45
33UF 630V	46
47UF 630V	50

CERAMIC

1 PF	08
1 5PF	08
2 2PF	08
2 7PF	08
3 3PF	08
3 9PF	08
4 7PF	08
5 6PF	08
6 8PF	08
8 2PF	08
10PF	08
12PF	08

STYROSEAL

56PF 630V	25
68PF 630V	25
82PF 630V	25
100PF 630V	25
120PF 630V	25
150PF 630V	25
180PF 630V	25
220PF 630V	25

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Letters to the editor

Design standards and television fires

I read your October article on fires in TV sets with some alarm and immediately checked on my Blaupunkt. The switch is exactly as described in your "Serviceman" article. However, on close inspection I was much relieved to find it in very good condition. That set has been in service since December 1975, and it has been switched on at least daily during that period. The contacts are still set very firmly in the plastic insulating strip.

This leads me to suggest that your serviceman's first diagnosis is correct, and that the failures he has observed are fundamentally of electrical origin. Electrical engineers familiar with electrostatic field patterns and stress distribution in insulation materials are aware of the problems of stress concentration at the interface of a sharp cornered conductor and the surrounding insulating material. Normally stress concentration is significant only at high voltages, but with the small insulation spacings used by electronic designers, 240 volts should be regarded as high.

This switch is a typical example of just that. Leakage due to dust pollution, moisture etc will cause greatest deterioration of the plastic insulation in the immediate vicinity of the contact electrode, with consequent loosening of the contact in the plastic and the later symptoms which resulted in burn-out.

This is a 2-pole switch, and it is interesting to note from the illustrations in your article that only one pole had burnt out. (The same current has to flow through both pole contacts.) I suggest that this would have been the pole connected to the mains active. The other pole connected to mains neutral appears to be intact.

I agree that the electrical design of this switch is not good, but I attribute the long life of the switch in my TV set to the fact that when the set is not in use it has always been switched off at the power point and the plug removed. The active pole of the switch in the TV set has not been subjected to continuous electrostatic stress with every voltage spike on the mains adding its contribution to the ultimate breakdown of the insulation.

Last year I wrote a letter to you advocating total disconnection of electronic equipment from the mains when not in use, and you published it under the heading "super pessimist". My pessimism is based on sound engineering knowledge and experience.

I wonder how many more badly designed mains switches there are in electronic equipment, because the electronic designers do not have the necessary knowledge of dielectric phenomena, to design for a suitable safety factor.

H. L. Harvey,
Cairns, Qld.

VCR fire — information wanted

I am prompted to write by your article on TV fires. In July of this year my video recorder caught fire and claimed the life of my wife.

The inquest has not been held yet and all I know is that it was caused by a faulty component. It is highly unlikely that it was being used at the time and was in the standby mode only. I was in Melbourne at the time.

I am anxious to find out if there have been other occurrences or faults likely to cause fire in VCRs. Do you know of any design shortfalls or "cheap" components? I would deeply appreciate any help you could offer. Not only would it help in my, and baby daughter's, claim for damages, but if it turns out to be a dangerous unit perhaps another tragedy could be averted.

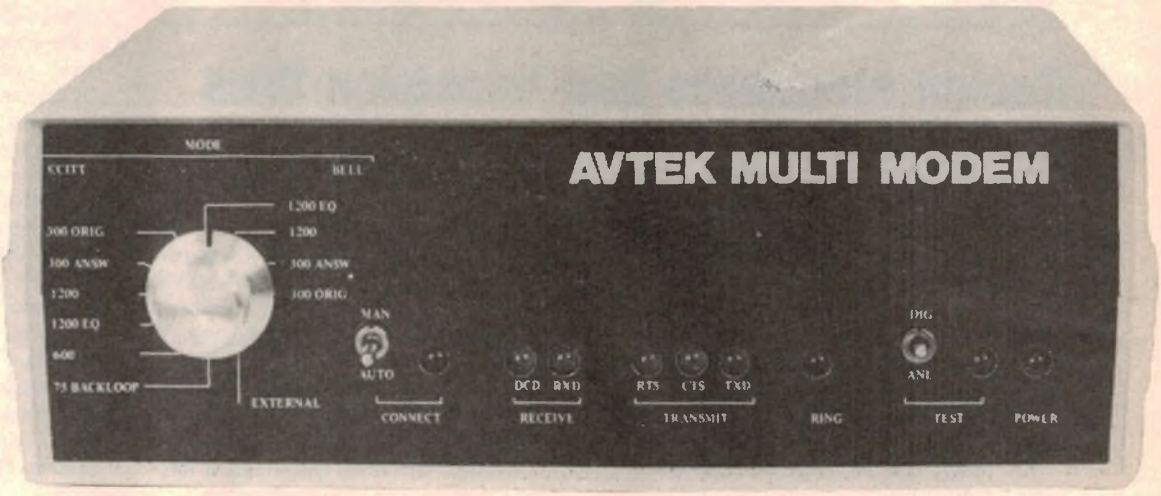
If you're interested I would send you relevant details from the police report when they become available. If you, yourself, cannot help, then perhaps you could publish, in part, my letter and others readers could help with their experiences.

F. Matzka, Morphett Vale, SA.

COMMENT: Readers with information on this subject can contact Mr Matzka via "Electronics Australia".

Versatile multi-

This versatile direct connect modem is based on a new special purpose integrated circuit and supports full duplex 300bps and half duplex 600 and 1200bps operation to both the Australian CCITT and the US Bell standards



Data communication is one of the fastest growing areas of computing, both in the personal and business fields. Communication between computers allows near-instanteous transfer of business information between widely scattered sites, allows programmers and students to work from home with a terminal connected to a remote computer system, and lets hobbyists swap programs over the telephone lines.

The number of dial-up information services and computer bulletin boards also seems to be increasing each month, with new announcements by commercial service organisations, computer distributors and an increasing number of computer clubs. If you don't mind running up the telephone bill there are also the attractions of networks in other countries, such as the US Compuserve system.

The device which makes all this possible is the "modem", the link between the digital world of computers and the telephone system.

Why use a modem?

The logic signals used in computers (typicaly 0 and 5V) cannot be sent more than a few metres over cables, and even with the ±15V signals of the RS232C standard, transmission distances are limited to a few hundred metres. The attentuation of signals over a long cable run combined with injected noise and interference from other sources will quickly degrade a square wave signal.

The alternative is to convert the logic signals to bursts of tones which can be transferred over any medium that can pass an audio signal, such as a telephone line, radio link or intercom cable. One audio frequency is selected to represent a logic "0" and another to represent a "1", a process known as "Frequency Shift Keying" (FSK). The device which does this conversion is known as an FSK modem.

"Modem" is a combination of the words "modulator" and "demodulator". At one end of the line the digital signals are modulated onto an audio carrier tone for transmission over the voice-grade link, and at the other end the received audio tone is demodulated to recover the digital information.

Modems are categorised by the speed at which they transmit and the frequecy of the tones used to represent the digital data.

Data transmission rates are expressed in bits per second (bps), although the term "baud" is often used interchangeably. Strictly speaking "baud" refers to the number of signal transitions on the communications line, rather than the amount of data represented by these transitions. In some cases, a single change of state may represent multiple data bits, and therefore the data transmission rate will be higher than the baud rate. We'll use "bps" throughout.

Modems capable of transmission rates of up to 2400bps are generally classified as "low speed". However, the 3kHz bandwidth of voice-grade telephone lines means that these are the only modems which can be used over the public phone network. Higher speed modems require the use of "dedicated" lines which are leased from Telecom. We won't consider this type of equipment.

Table 1: Operating Modes

Mode	Rate (BPS)	Duplex	Description
1	300	Full	Bell 103 Originate
2	300	Full	Bell 103 Answer
3	1200	Half	Bell 202
4	1200	Half	Bell 202 with equaliser
5	300	Full	CCITT V21 Originate
6	300	Full	CCITT V21 Answer
7	1200	Half	CCITT V23 Mode 2
8	1200	Half	CCITT V23 Mode 2 with equaliser
9	600	Half	CCITT V23 Mode 1

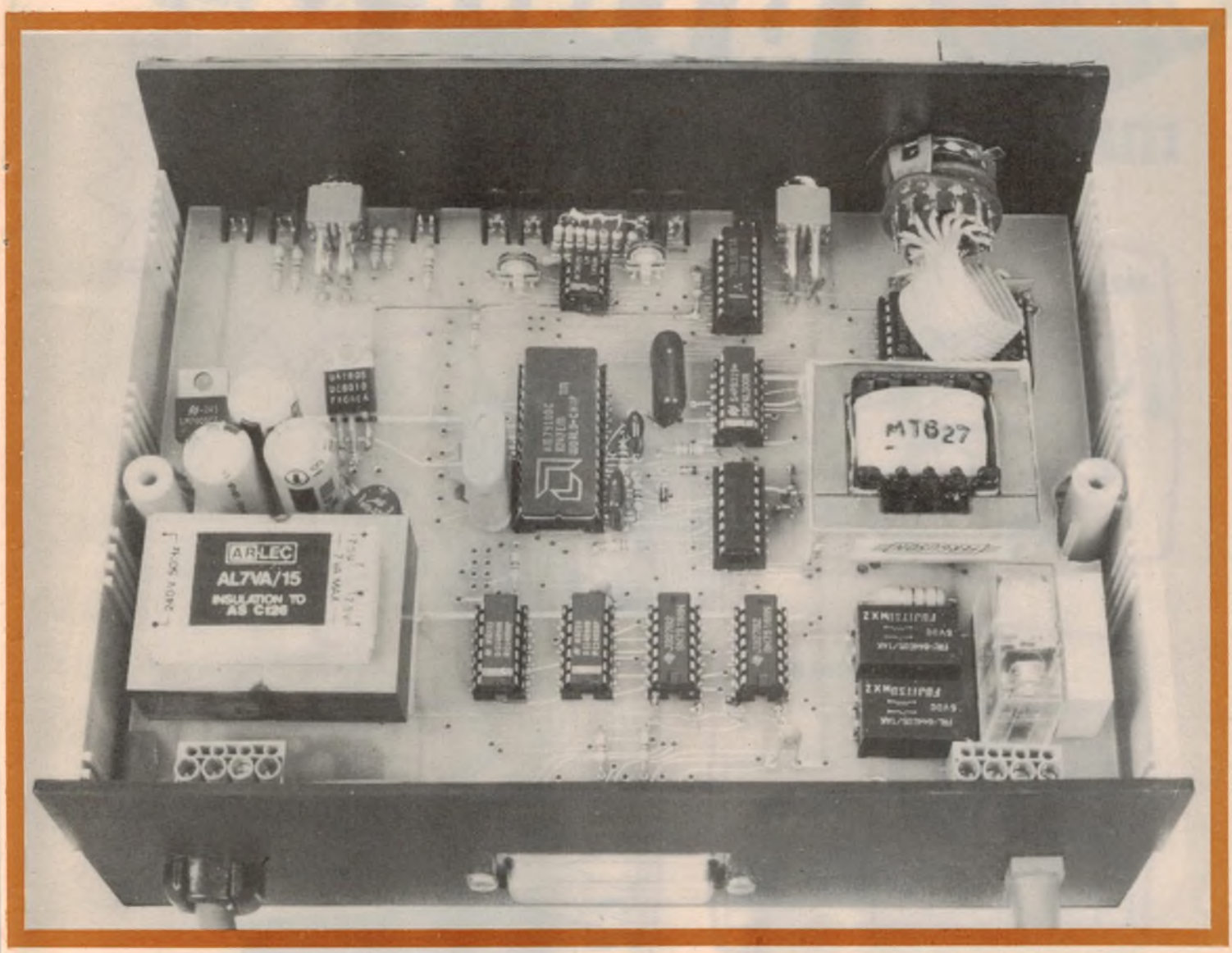
Data transmission standards

To allow data communications between diverse equipment, standards have been set for transmission rates and the frequencies of the audio tones used. Two sets of standards are in common use, one from the International Consultative Committee on Telecommunications (CCITT) and the other the Bell Telephone standard. The CCITT standards are generally used thoughout Europe and Australia and the Bell standard is used in the USA.

For 300bps transmission the relevant standards are the Bell 103/113/108 and the CCITT V.21, while 600 and 1200bps standards are designated Bell 202 and CCITT V.23.

standard modem

by PETER VERNON



Since communications usually involve transmission of data in both directions, a convention has been established to prevent the two sets of data interfering with each other. One of the pair of communicating modems is arbitarily called the "originating" party and the other the "answering" party. These designations do not necessarily conform to the actual role of the parties in the communication process – all that is necessary is for one of the pair to call itself the answerer and the other the originator.

Under the 300bps V.21 standard the "originate" device transmits a logic 0 as a 1180Hz tone and a logic 1 as a 980Hz tone. The originating end also receives zeroes and ones as tones of 1850Hz and 1650Hz respectively. At the "answer" device, the receive and transmit frequencies are interchanged.

The two sets of frequencies allow data to be transmitted and received simultaneously at 300bps, a mode of operation called "full duplex". The higher bandwidth of 600 and 1200bps transmissions on the other hand, does not permit full duplex operation – data is handled in one direction at a time, or "half duplex".

A limited form of full duplex operation is sometimes used however, with the main transmission operating at 1200bps and a "back channel" working at 75bps for verification of data.

There are a number of minor differences between this prototype unit and the production models of the modem (see text).

The AMD World Chip

Until recently, modem equipment has either been complex and unwiedly to construct and align or has been capable of using only a limited number of data transmission formats. The most complicated and troublesome parts of a modem are usually the filters used to separate and condition the transmitted and received audio tones.

This new direct-connect modem changes all that. It is based on a new

Continued on page 95

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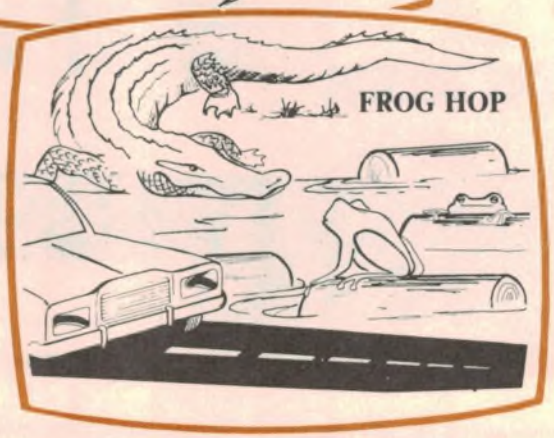

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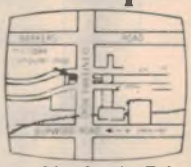

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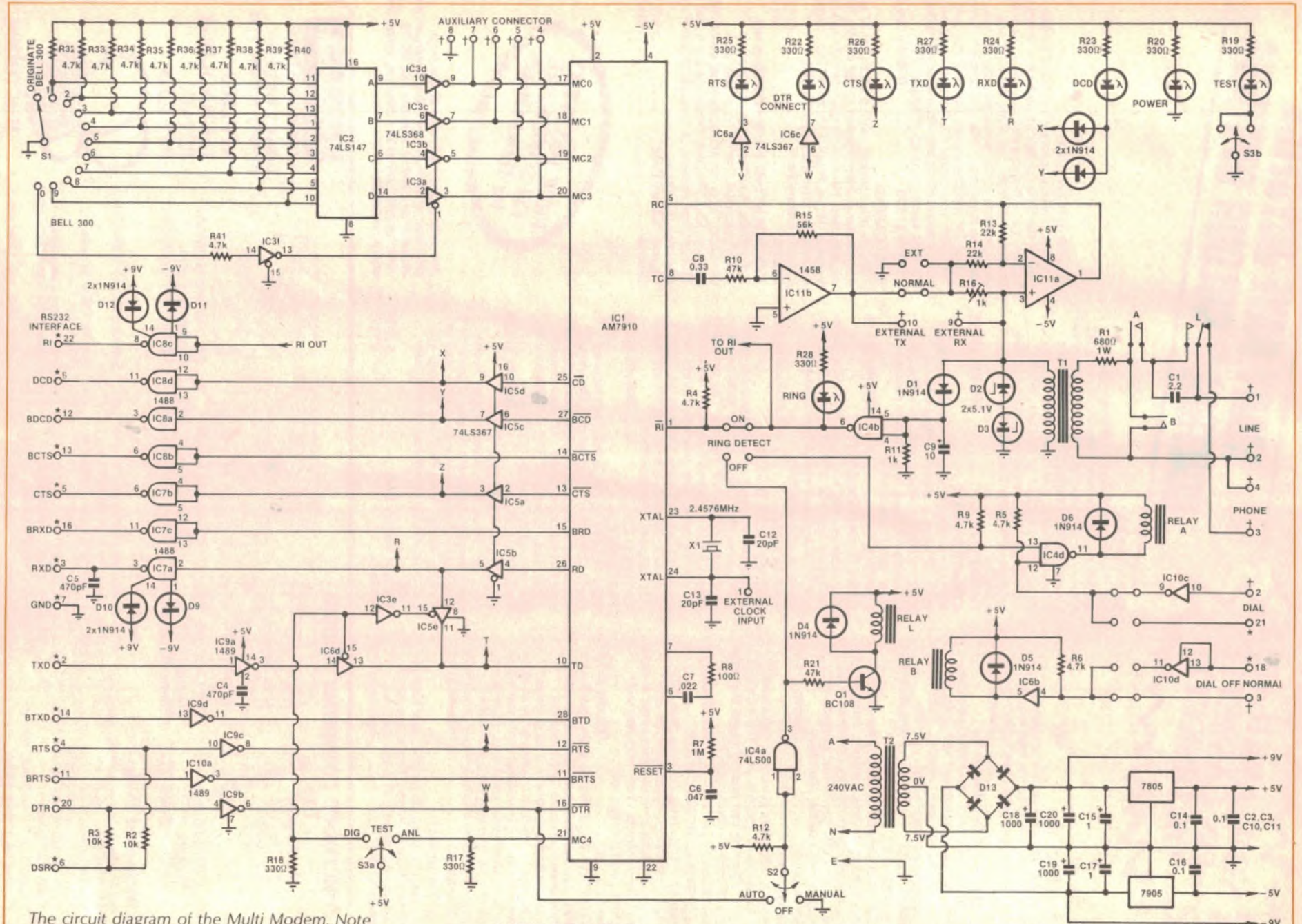


The circuit diagram of the Multi Modem. Note that R29, R30 and R31 are not used.

AVTEK MULTI MODEM

Versatile multi-standard modem

Continued from page 91

integrated circuit from Advanced Micro Devices, the Am7910 "World Chip". All the major functions of the modem are performed by this chip, with 10 other commonly available ICs providing interfaces to the computer and data transmission line. Nine different data transmission standards are supported, including the CCITT V.21 and V.23 300bps and 1200bps formats and the Bell 103 and 202 standards.

A data bit received from the modem is translated into the Electronic Industries Association (EIA) standard known as RS-232C. This standard defines a 0 as a voltage level between +5V and +15V and a 1 as a level between −5V and −15V. Voltages between −5V and +5V are undefined.

The circuit

The circuit of the modem can be divided into four main sections. These are:

- The line interface which provides relay switching to loop the communications line, detection of ringing signals and, most importantly, DC isolation between the modem and the communications line;
- An analog section which handles modulation and demodulation of the audio tones. This is carried out by the Am7910 (IC1) and operational amplifier IC11;
- A computer interface which converts data and control signals to and from the modem into RS232C levels for connection to a standard serial interface as provided on most computers. Once again, this task is carried out by the Am7910 (IC1);
- A power supply, which provides ±5V for the analog and control logic circuits and a nominal ±9V for the RS232C interface section.

The incoming communications line is switched by relay "L", which determines whether the modem is connected to the line. The operation of this relay can be controlled manually by the front panel "connect" switch (S2) of the modem or by the computer by the Data Terminal Ready (DTR) line of the RS232C interface. In the centre "off" position, the front panel switch prevents the modem being connected to the line, regardless of the state of DTR.

Relays A and B allow the computer to dial a number. To dial, the B relay is closed and the A relay (which is normally closed) is pulsed by the computer in accordance with a preset pattern to simulate the action of an ordinary rotary dial.

A 600Ω to 600Ω isolation transformer is used to isolate potentially dangerous voltages from the telephone line and also to match the modem output to the communications line.

To allow a computer connected to the modem to answer the telephone automatically it is necessary to detect the incoming ring signal. When the modem is connected to the line, the ring signal is passed via a 2.2μF capacitor and the isolation transformer to diode D1. This diode rectifies the ring signal and charges a 1μF capacitor until the input of NAND gate 4b is taken high. The output of the NAND gate lights the "Ring" indicator LED on the front panel of the modem and drives the RI input of the Am7910.

If ring detect is not required a link on the printed circuit board can be changed to ensure that the A relay only operates when the L relay is closed, so the 2.2μF capacitor does not appear across the line.

All of the timing functions of the modem are controlled by an on-chip oscillator which requires either a crystal or an external clock frequency of 2.4576MHz. The auxiliary connector on the PCB has provision for the connection of an external clock input if this frequency is available from elsewhere in the system, in which case the crystal must be omitted.

Analog functions

Modulation and demodulation of the audio tone signals are performed by the Am7910 chip and the receive and transmit amplifier formed by a 1458 dual op amp (IC11). The transmitter section of this circuit (IC11b) amplifies the signal from the 7910 to drive the communications line while the receiver section (IC11a) couples the incoming signal from the line transformer to the 7910 while also attenuating the unwanted transmit signal fed to the receive input. Although the transmitted and received signals are on different frequencies, the transmit signal will overload the receiver input if it is at too high a level.

Provision has also been made for the transmit and receive signals to be connected to separate lines via the auxiliary connector on the modem PCB. This option allows "four wire" operation and can be used if two wire pairs are available (in an internal intercom system, for example) or if two radio channels are being used. Using four wire operation permits transmission in both directions simultaneously at 1200 baud.

The mode control inputs to the Am7910 are in BCD (binary coded decimal) format. IC2 is a priority encoder which produces the appropriate BCD code for one of 10 inputs selected by the front panel rotary switch. Nine communications formats are available, as listed in Table 1. Also available is a test function and an "external" position which disables buffer IC3 and allows codes to be supplied by an external device, opening up the possibility of using some of the less common formats supported by the Am7910 World Chip.

Computer Interface

The World Chip uses TTL levels, and although these could be connected directly to a UART or similar device in the computer, 5V levels are easily affected by noise when transmitted over more than about a metre of cable. In order to simplify connection between the modem and a computer, the TTL levels are converted into RS232C signals.

The actual conversion of TTL levels to RS232C signals is performed by MC1488 RS232 line drivers (IC7 and IC8) and MC1489 line receivers (IC9 and IC10). Connections between the computer and the modem are via the standard RS232C 25-pin D-type connector, and are as shown on the circuit diagram.

Power Supply

The Am7910 requires regulated supplies of ±5V, with ±9V used for the RS232C drivers. These voltages are supplied from a 15V centre-tapped transformer via a bridge rectifier and, for the 5V lines, three terminal regulators. The ±9V supplies are not regulated, but considerable attention has been paid to filtering and bypassing the supply rails to ensure stability.

As designed the PCB allows the use either a Ferguson or Arlec PCB mounting mains transformer or input from an external source of AC, such as a plugpack with a centre-tapped 15V output.

Design and availability

The "Multi-Modem" was designed by David Griffiths and Geoff Radcliffe and is available exclusively from Avtek Electronics Pty Ltd, 119 York St, Sydney, (02) 267 8777 or 172 Liverpool Rd, Enfield, NSW (02) 745 2122. Enquiries in writing should be made to PO Box Q302, Queen Victoria Building, Sydney, 2000. Cost of a complete kit, including case, front panel and all parts is $229.

Versatile multi-standard modem

The LEDs on the front panel indicate the status of the power supply, the test switch and RS-232C interface lines for Ready To Send (RTS, from the terminal), Data Terminal Ready (DTR, from the terminal), Clear to Send (CTS, from the modem to the terminal) and Data Carrier Detect (DCD, from the modem). Two other LEDs on the transmit data and receive data lines are provided to verify correct operation of the modem.

Construction

Construction of the modem is straightforward. Avtek Electronics will be supplying a complete kit of parts, including a front panel, pre-punched cabinet and a double-sided printed circuit board with plated-through holes. Connections to the board are made to PCB mounting terminal blocks and the DB-25 connector, while rotary switch S1 is mounted on a smaller PCB which in turn is soldered to the main board.

The photographs of the modem are of an early prototype unit and do not show this small PCB. The prototype also shows two trimpots on the board which in fact have been replaced by fixed resistors in production units.

There are 10 small signal diodes and two zener diodes on the board. Some of these are mounted vertically, although shown as horizontal on the parts overlay. The orientation of these diodes must be watched carefully. Note that the pull-up resistors for the rotary switch inputs and front panel LEDs are supplied in the form of a single-in-line package which is mounted with the indicator dot to the left front.

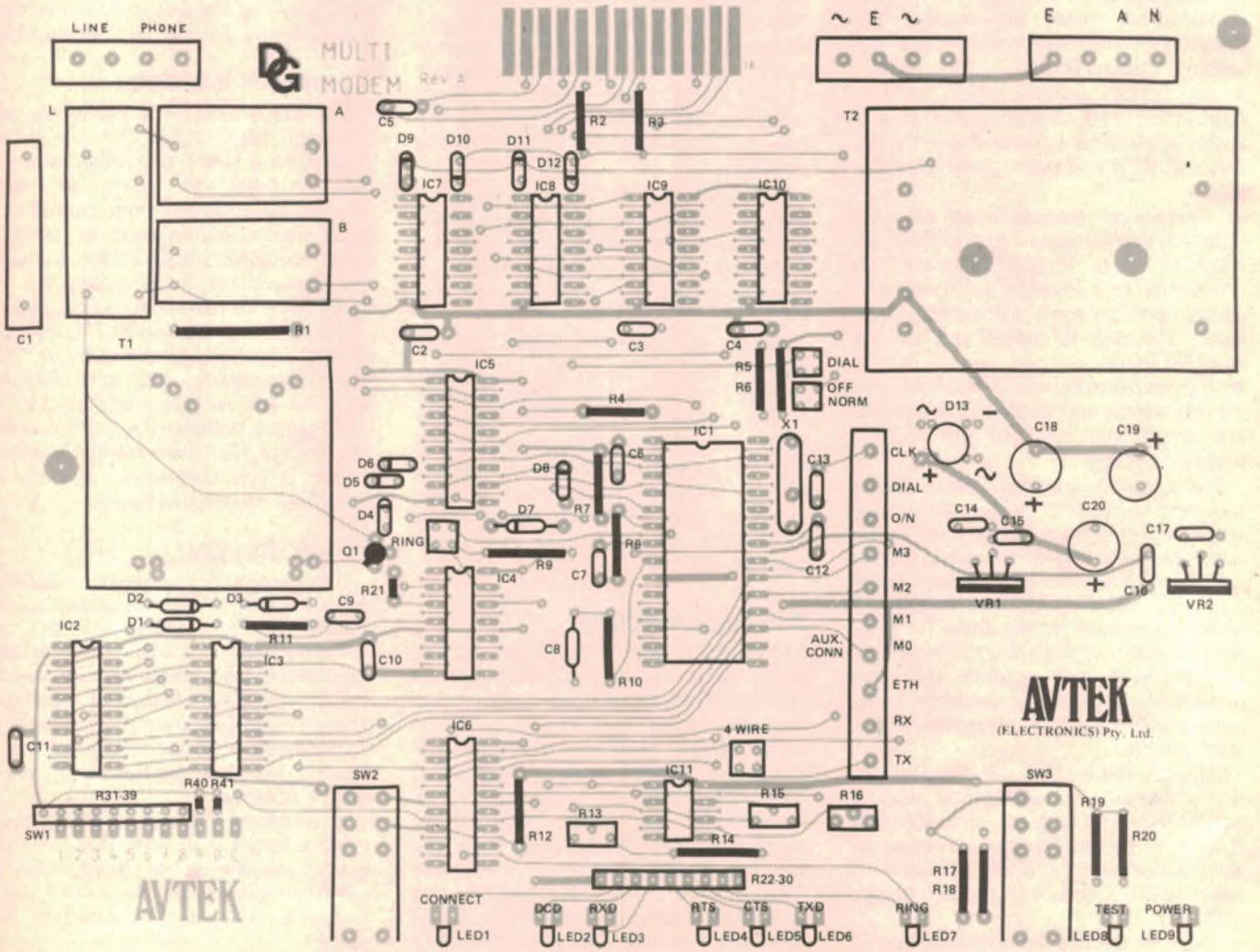
The voltage regulators, electrolytic and tantalum capacitors and encapsulated bridge rectifier are also polarised and must be mounted as shown by the component overlay diagram.

The DB-25 connector supplied is a wire-wrap type. It slides onto the board with one set of pins in contact with the fingers on each of the upper and lower sides of the PCB and is soldered in place. Check the placement of the board in the case by pushing the switches hard up against the front panel and positioning the DB-25 connector so that it is flush against the rear panel before soldering the pins in place. The switch mountings and the screws in the DB-25 connector hold the circuit board in place.

Sockets are provied for all ICs and should be used. Take care when handling the modem chip itself. It is an NMOS component and is sensitive to static electricity. At around $70 each, incorrect handling could be an expensive mistake. The Am7910 should be the last component mounted on the board, and then only after the board has been checked and correct power supply voltages verified on the pins of the 28-pin socket.

Continued on p128

Component placement is as shown below. VR1 and VR2 are the +5V and −5V voltage regulators respectively.



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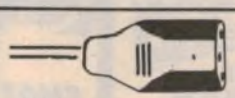

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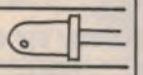

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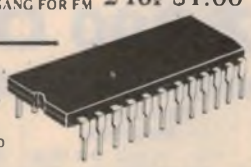

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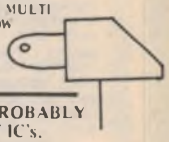

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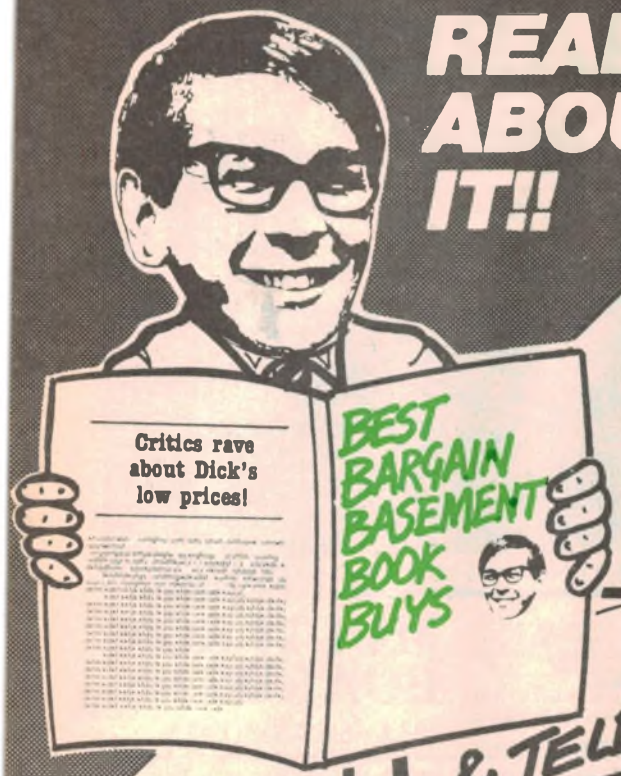

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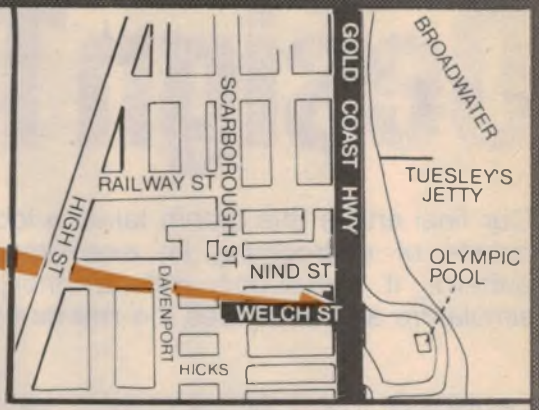

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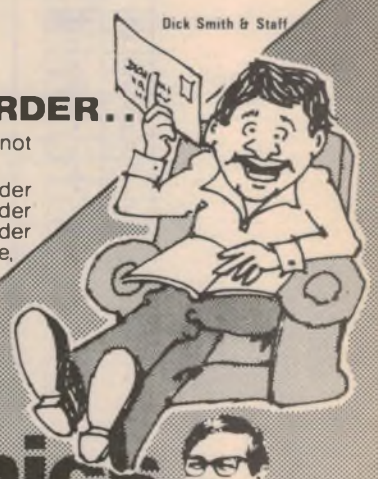


DICK SMITH Electronics

DSE/A665/PAI

Design Techniques for

Our final article this month takes a look at scanner circuitry as a means of overcoming an ever-repeating, monotonous rhythm pattern. It concludes with a brief discussion of instrument simulators and describes the relevant circuitry.

As discussed in Part 1, the basic 16 and 32-beat counters, when connected to the instruments via the diode matrix, result in an ever-repeating, monotonous rhythm. The way to overcome this disadvantage is to introduce more than one pattern per rhythm selection. Leaving the rhythm selector switch in its chosen position (eg, "swing"), another circuit connects one diode pattern after the other to the instrument simulators. In Part 1, Fig. 13, this "scanner" was illustrated as a rotating switch. In practice, we use a counter, enabling electronic switches.

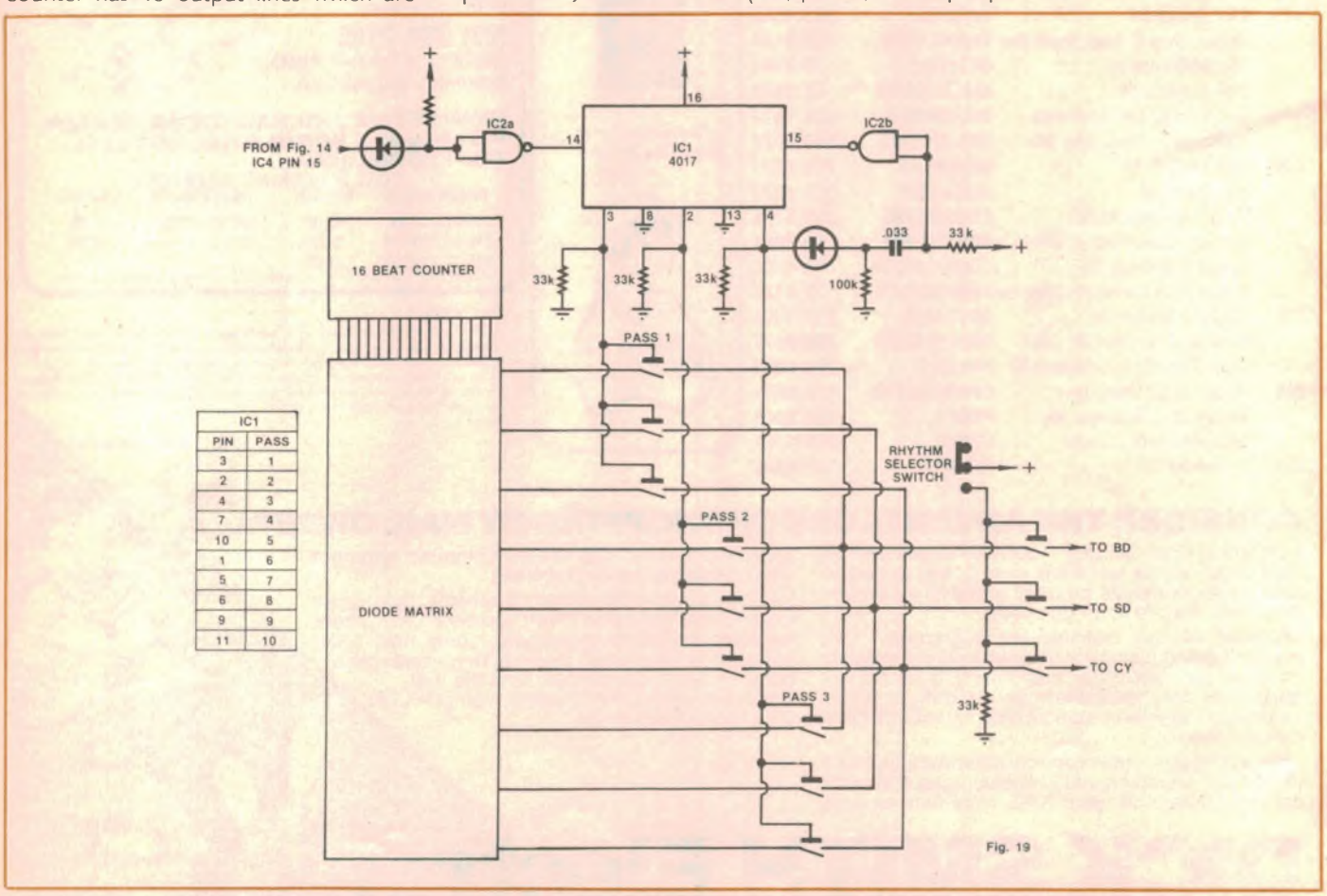
Fig. 19 shows the circuit of the scanner. It can be used in conjunction with 16 or 32-beat counters. The actual scanner is a Johnson counter, type 4017. This counter has 10 output lines which are normally low. Each output line is connected to any required number of switch elements in 4016 bilateral switches, as described before under rhythm selector switches.

At the start of a cycle, line 1 (pin 3) of the 4017 goes high, enabling the connected electronic switches to conduct any pulses from the diode matrix to the instruments. The 16-beat counter (Fig. 14) runs through its 16 output lines. When the downbeat arrives again (Fig. 14, IC4, pin 15), the output line goes low, but does not as yet produce a positive output pulse, for the instrument line, via the differentiating network and diode.

The falling (leading) edge of this pulse is converted into a rising edge by IC2a (Fig. 19) and is subsequently fed to the input of the Johnson counter (IC1, pin 14, Fig. 19). This causes the counter to switch to output line 2 (pin 2), enabling the next diode matrix to be connected to the instruments via a set of electronic switches. This process is accomplished well before the downbeat pulse is generated, ie, when pin 15 of IC4, Fig. 14 returns to high (trailing edge).

In this way we can connect up to eight different patterns per rhythm selection, which largely overcomes the problem of monotony. Obviously, one does not have to design a different pattern for each pass but one can repeat pattern 1 (pass 1) on pass 4 as an example.

It is not necessary to use all 10 output lines. The counter can be reset after any number of lines by connecting the pin corresponding to the last pass (which will still be heard) via a differentiating network and an inverter (IC2b, Fig. 19) to the reset input pin 15 of IC1. The new input pulse on pin 14 (next pass) will cause the last output to go low again. The falling edge of this pulse is used to reset the counter well before the first instrument output pulse arrives.

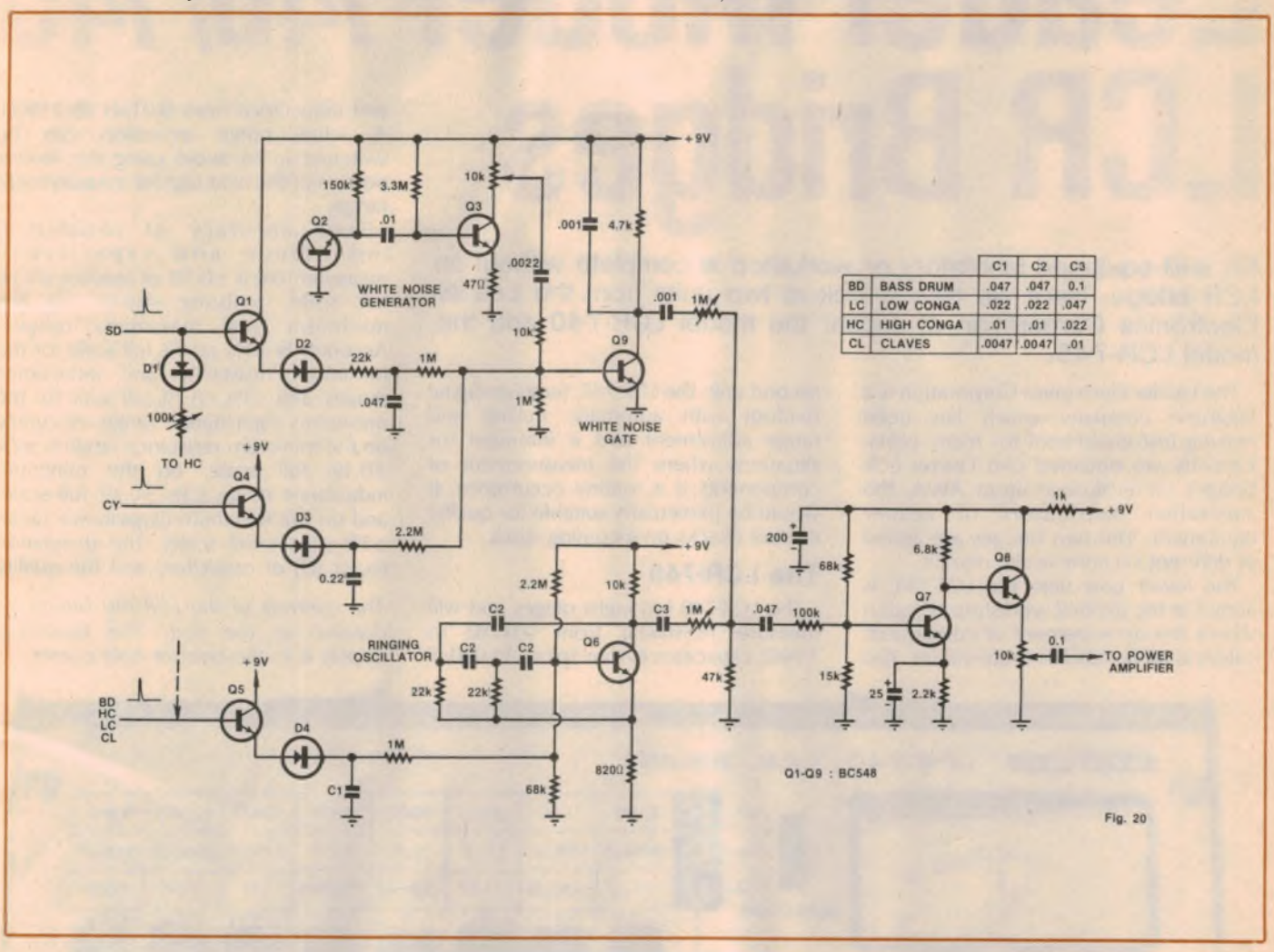


IC1	
PIN	PASS
3	1
2	2
4	3
7	4
10	5
1	6
5	7
6	8
9	9
11	10

Fig. 19

Rhythm Generators Part 3

by NICK LABORDUS 5/3 Durham Close, North Ryde, NSW, 2113



		C1	C2	C3
BD	BASS DRUM	.047	.047	0.1
LC	LOW CONGA	.022	.022	.047
HC	HIGH CONGA	.01	.01	.022
CL	CLAVES	.0047	.0047	.01

Fig. 20

Although any extension of this circuit is a simple repetition of circuitry, the whole thing can become rather complicated for an elaborate rhythm unit and it is not a project for an inexperienced home constructor. As an example, a rhythm unit with, say, 10 different rhythm selections on a 16-beat basis, using six instrument simulators for each selection and pass, and assuming four passes per rhythm selection, would require, for the scanner alone, 10 x 6 x 4 = 240 electronic switches or sixty 4016 ICs. The rhythm selector switches require another 60 switch elements (fifteen 4016 ICs). The design of the relevant printed circuit board is an adventure in itself!

Finally, here is a brief discussion on instrument simulators with a suggested design as a basis for experiment.

Instrument simulators can be grouped into two main classes:

(a) sinusoidal oscillators
(b) white noise generators

The simulators in class (a) represent percussion instruments like bass drum, bongo, conga, woodblock, etc. Class (b) represents the cymbal, brushes, etc. Some instruments require the combination of the two, like snare drum, maracas, etc.

There are many ways to realise instrument simulating circuits. Basically, the difference in sound is determined by two aspects, ie, the pitch (frequency) of the sound and the envelope (shape and duration). One way to get the required effect is to have generators that constantly produce the different sine wave frequencies, and white noise, and to control the envelope by gates, activated by the input pulses. This method is almost always used for the class (b) simulators but for the class (a) versions there is another method.

This one uses oscillators tuned to different pitches and set to a point where they just do not oscillate. The arrival of the input pulse will disturb this situation and will cause the oscillator to produce a damped sine wave, the damping time of which can be adjusted to some extent by the point of oscillation setting. These circuits are called "ringing oscillators". Fig. 20 gives some examples of both versions.

Q1, Q4 and Q5 are buffer stages that convert the low energy output pulses from the counters into pulses of sufficient power to activate the following circuits. An RC network at their output shapes the pulse (eg, the envelope of the drum sound). The higher the capacitor, the longer the decay of the sound.

Q2 is a white noise generator that

continued on page 135

Electronics Australia reviews

Leader Model 740/745 LCR Bridges

No well-equipped laboratory or workshop is complete without an LCR bridge. Here we take a look at two units from the Leader Electronics Corporation of Japan: the model LCR-740 and the model LCR-745.

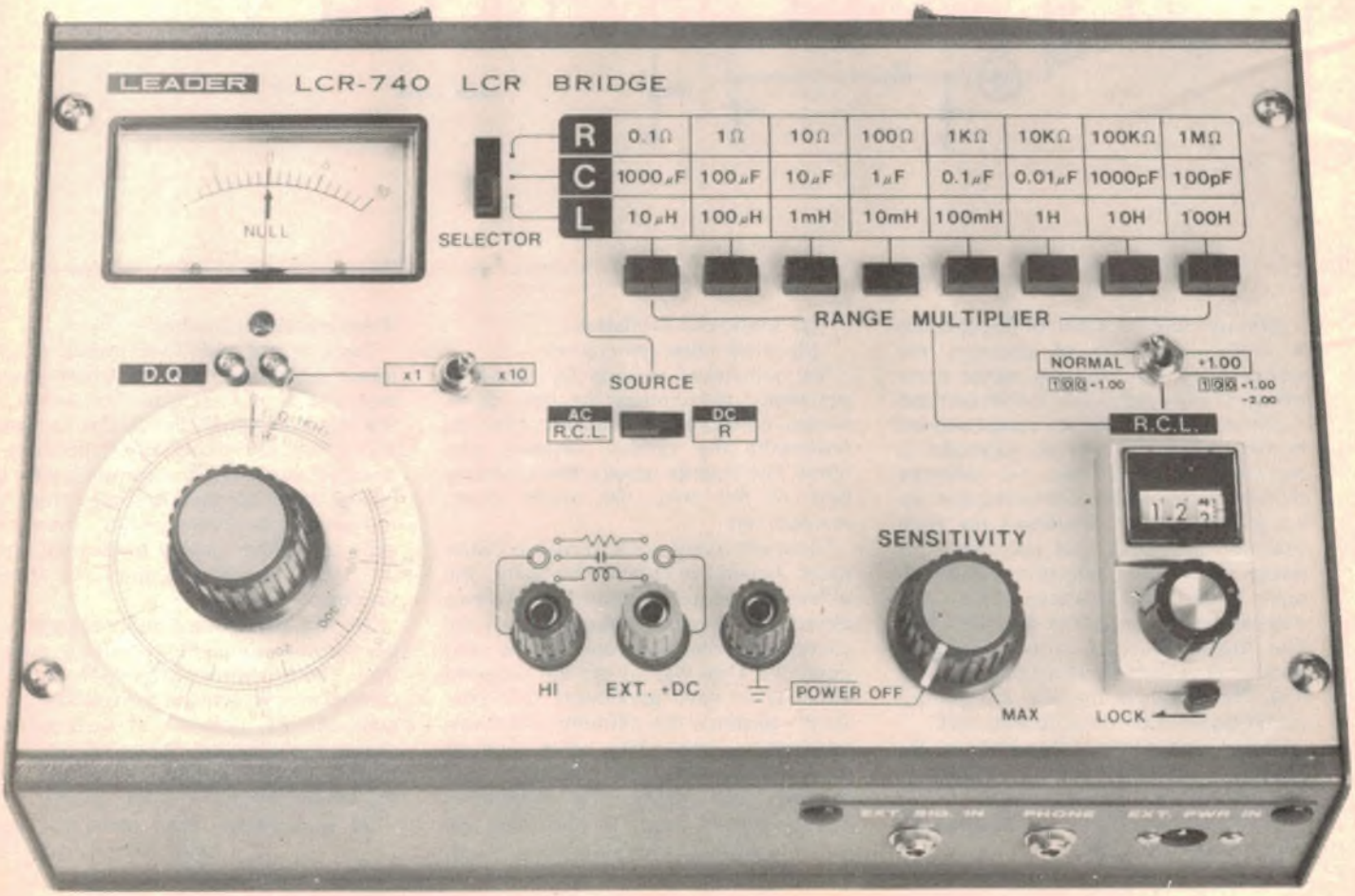
The Leader Electronics Corporation is a Japanese company which has been making test equipment for many years. Recently we obtained two Leader LCR bridges for evaluation from AWA, the Australian distributors of Leader equipment. The two bridges are aimed at different sections of the market.

The lower cost unit, the LCR-740, is aimed at the general workshop situation where the measurement of component values is an occasional requirement. The second unit, the LCR-745, features digital readout with automatic nulling and range adjustment and is intended for situations where the measurement of components is a routine occurrence. It would be particularly suitable for quality control checks on incoming stock.

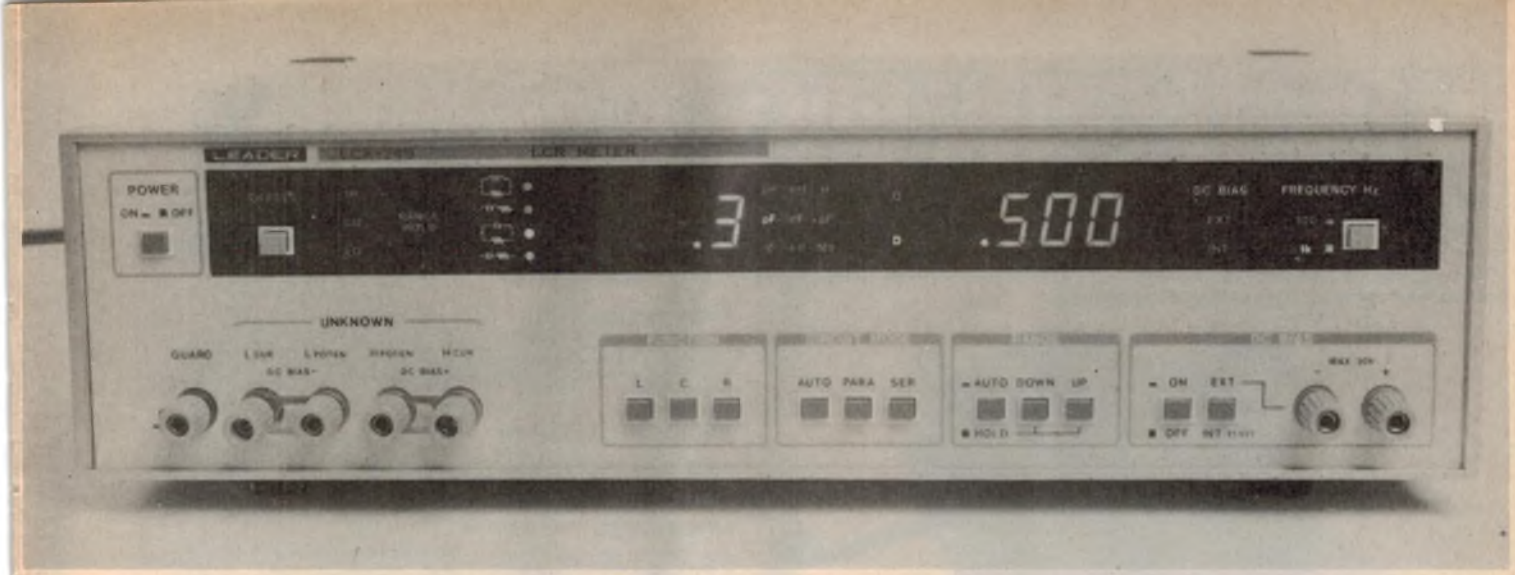
The LCR-740

The LCR-740 has eight ranges and will measure resistance from 0.001Ω to 11MΩ, capacitance from 1pF to 11,000μF and inductance from 0.01μH to 1100H. A +10% range extension can be switched in to avoid using the lowest portion of the next highest measurement range.

Basic accuracy of resistance, inductance and capacitance measurement is ±0.5% of reading ±0.1% full scale, reducing slightly for the minimum and maximum ranges. Accuracy is ±1% ±0.1% full scale for the maximum resistance and inductance ranges, and ±3% ±0.1% full scale for the maximum capacitance range. Accuracy on the minimum resistance range is ±2% ±0.1% full scale, on the minimum inductance range ±3% ±0.1% full scale, and on the minimum capacitance range ±1% ±0.1% full scale. The dissipation factor (D) of capacitors and the quality



The controls of the LCR-740 bridge, as detailed in the text. The numerical display is in the bottom right corner.



The LCR-745 is a more advanced model featuring digital readout, auto-ranging, and auto nulling.

factor (Q) of inductors may also be measured over the range of 0.01 to 30. Accuracy of D and Q measurements is ±10% ±3 scale divisions.

Inductance and capacitance measurements are made at 1kHz, which is generated by an internal oscillator. A panel switch allows resistance measurements to be made at either DC or 1kHz.

A jackplug socket also allows an external signal of between 50Hz and 40kHz to be fed into the bridge and measurements made at this frequency. This facility is useful for iron cored inductors and electrolytic capacitors whose values are frequency dependent, and may need to be tested at the intended operating frequency.

The LCR-740 comes in a small, sloping front metal case with approximate dimensions of 240 x 170 x 85mm (W x D x H). Weight is 2kg. A single 9V battery supplies power or an external 9VDC power supply may be connected via a panel socket.

The controls are fairly standard for a hand nulled bridge. In the top left hand corner is a centre zero "null" meter which indicates the degree of balance of the bridge. Below this is a D.Q dial control which compensates the bridge for series resistance in components under test. It indicates the Q or D of inductors and capacitors directly.

On the top right of the panel is a three by eight switching matrix. A 3-position slide switch on the left of the matrix selects resistance, capacitance or inductance, while a row of eight pushbuttons under the matrix selects the desired range. A 2-position source switch in the centre of the panel selects AC or DC for resistance measurements.

Below the source switch are three input terminals to connect the component to be measured. The component is connected to the left hand and centre terminals, while the right hand terminal is permanently earthed. The latter facilitates the connection of an external DC supply to increase the accuracy of high value resistor measurements.

To the right of the input terminals is a combined power on/off switch and null sensitivity control, together with a 10 turn vernier drive and associated numerical display. When the bridge is nulled, the component value is found by multiplying the vernier reading by the selected range multiplier.

A small toggle switch changes the vernier range from the normal zero to 10 range to one to 11 range. This helps reduce the ±0.1% full scale error component by allowing measurements which would normally be made on the lowest portion of a range to be made on the highest portion of the next lowest range.

Also supplied with the LCR-740 is a small earphone which plugs into the lower front panel and allows the bridge to be nulled by ear. As the bridge is tuned closer to the null, the level of the tone decreases. The centre of the null is found by adjusting for the lowest volume.

While this is a good idea in theory, in practice the differences in tone become too slight to be heard as the bridge moves toward null. Consequently, the centre of the null cannot be located with any degree of accuracy.

We found the LCR-740 a very simple and easy bridge to use with no evidence of the false nulling which makes some AC bridges so hard to use. We checked the bridge against several 0.5% tolerance capacitors and the readings were within the 0.5% limits. We also compared bridge resistance measurements with measurements by our digital multimeter (0.2% accuracy) and in each case there was extremely good agreement.

We have no standard inductors in our laboratory but we did compare measurements of several off-the-shelf inductors on the two bridges. In each case, the readings differed by less than ±0.5%. Certainly, we have no reason to doubt the claimed accuracy figures for inductance measurements.

The only complaint we have with the LCR-740 bridge concerns the two end resistance ranges: the 0.1Ω and 1MΩ ranges. When measuring resistance on either of these ranges, the meter shows almost no deflection from the null position. Consequently, it is almost impossible to find the null with any degree of accuracy. The manual describes how an external DC supply may be used to overcome this problem on the 1MΩ range, but not for the 0.1Ω range.

The only way to obtain a usable null on the 0.1Ω range is to use an AC source. This is suitable for measuring resistor values, but cannot be used to measure the resistance of coils as the AC impedance will alter the reading.

In summary, the LCR-740 LCR Bridge is an easy-to-use unit that generally met its specifications. It is well made and should find a ready place in most electronics workshops.

The LCR-745

The larger bridge, the LCR-745 is much more complicated internally than the LCR-740 and consequently carries a higher price. Dimensions are 400mm x 300mm x 100mm (W x D x H) and the weight is 5.5kg. Power supply is 240VAC only.

Unlike the LCR-740, the model 745 requires little manual adjustment. It boasts an internal microprocessor and features autoranging, auto-nulling, digital readouts, and an automatic offset function. It measures resistance from .001Ω to 19.99MΩ, capacitance from 0.1pF to 1,999μF, and inductance from 0.1μF to 199.9H.

The front panel is an off-white colour with a large dark section designed to highlight two readouts. These are two

Continued on page 108

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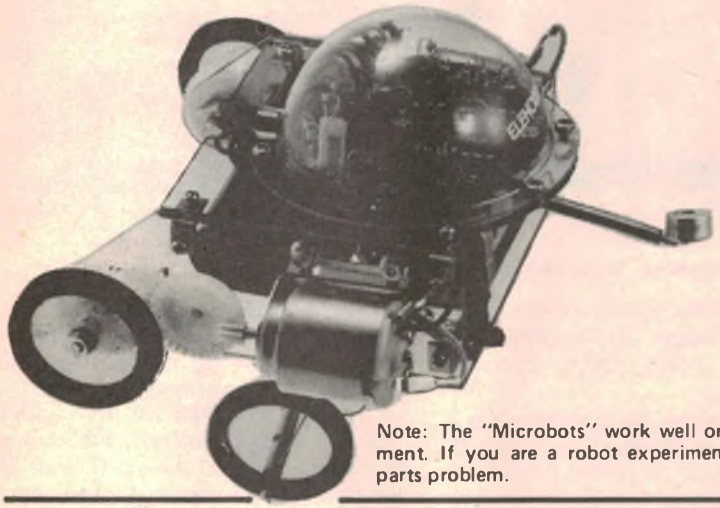

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MEMOCON CRAWLER (not illustrated)

This robot is controlled by a keyboard which is supplied. The operation of the unit is programmed by the keyboard and stored in RAM. All movements can be controlled as well by lights (beams) and sound (buzzer).
A very sophisticated unit.
Cat. KJ-6686 $79.95

Note: The "Microbots" work well on their own but can also be used as a platform for robotic development. If you are a robot experimenter you will find them useful as they help resolve the mechanical parts problem.

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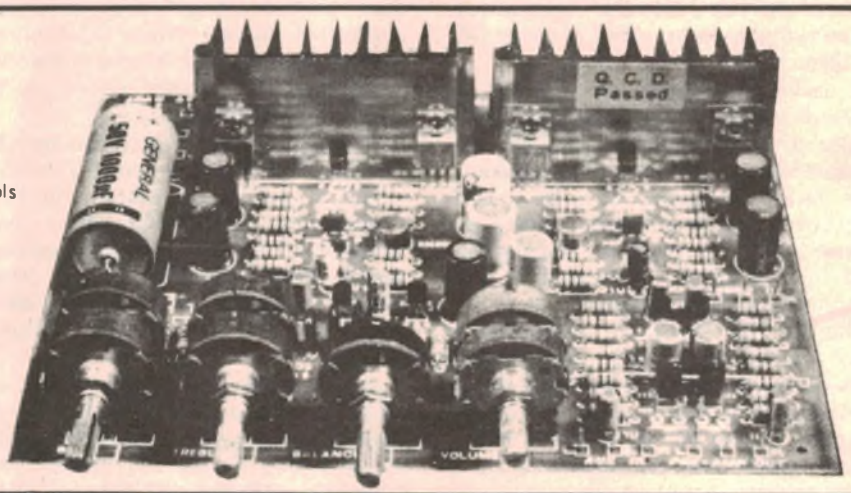

minitune

Ref: EA June 1983

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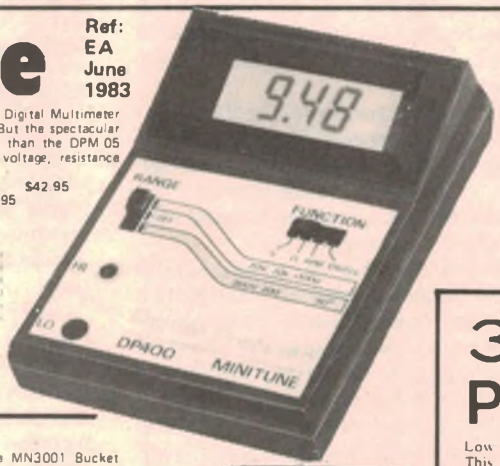
Resistance	2000Ω	100mΩ	0.5% ± 3 digits
	20kΩ	10Ω	0.5% ± 1 digit
R.P.M.	20,000r.p.m.	10r.p.m.	1% ± 3 digits
Dwell	90°	0.1°	2% ± 3 digits

$42.95



NEW ETI JOYSTICK CONTROLLER

Ref: ETI Dec '83

True proportional control with this kit. Includes recommended joystick unit.

ONLY $24.95

BBD EFFECTS BOX

Fantastic low-cost instrument using the versatile MN3001 Bucket Brigade Delay Line to achieve brilliant sonic effects. Now you can emulate the commercial rock groups with Phasing, Flanging, Reverb and Echo. The Jaycar kit includes all components INCLUDING IC sockets and the TU-04 box. (Not cut down but this is easily done) Jaycar has a specially built cabinet for this kit with all holes pre punched etc., at only $10 extra but only if you buy the original kit from us. Available as a separate item for $29.50. WHEN THE KIT IS PURCHASED WITH THE DE-LUXE CASE THE TU-04 CASE WILL NOT BE SUPPLIED.

Special cabinet to suit Cat. HB-6445 $10
Complete Kit Cat. KE-1522 ONLY $79

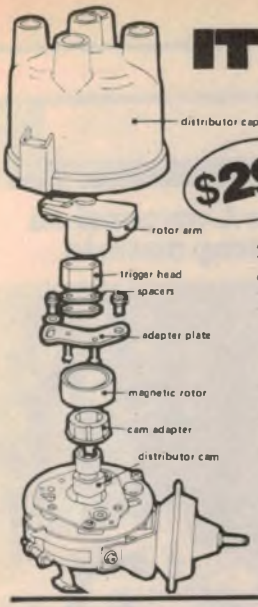
3½ DIGITAL PANEL METER (not illustrated)

Low cost unit. Completely self-contained. No longer an expensive proposition! This easy-to-build kit (takes about 1 hour) is self-contained, compact and even comes with a front panel filter/bezel. It can be battery 6V or DC powered.

- 200mV. Full scale (+/– 199.9mV)
- Input impedance 10 to the twelvth ohms
- Required DC 5-6V @ 150mA
- Guaranteed to reset to zero at zero input voltage
- Automatic reverse polarity indication
- Assembly instructions include notes on using your DPM for: Amp-meter, AC-Voltmter, Anmeter, Thermometer, Frequency Counter, Capacitance Meter (circuits supplied)

STAGGERING VALUE $29.95
Cat. KJ-6670

IT HAD TO HAPPEN



$29.95

With this kit and the interface electronics you can forget about contact breaker point problems!
Cat. KJ-6655 $29.95

New PCB for TAI Kit includes Hall Effect interface. Cat. HP-8786 ONLY $3.95

PLEASE NOTE
this system must be used in conjunction with an electronic ignition. The Hall Effect device will not switch enough current to replace the contact breaker points on their own!

A professionally engineered electronic ("breakerless") contact breaker system.
Yes, only Jaycar has a complete Hall effect triggerhead assembly designed to adapt to an extensive number of cars. Each kit contains the following:
- HALL EFFECT TRIGGER HEAD
- MAGNETIC ROTORS FOR BOTH 4 & 6 CYLINDER CARS
- OVER 6 CAM LOBE ADAPTORS
- OVER A DOZEN DIFFERENT ADAPTOR PLATES FOR YOUR PARTICULAR DISTRIBUTOR
- OTHER HARDWARE (i.e. SCREWS etc.)
- YOU CAN REMOVE THIS SYSTEM AND RE-EQUIP YOUR CAR WITH THE ORIGINAL
- BREAKER POINTS WHEN YOU SELL THE CAR!
- AS EASY TO INSTALL AS A SET OF POINTS!
- INSTRUCTIONS (SIMPLE TO FOLLOW) INCLUDED!

This set is designed to fit most European and Japanese cars. In fact it will also fit many Australian cars fitted with Lucas, Bosch, Motorcraft, AC Delco or Autolite electrics. If you wish to check first, please send SAE for car/distributor list.
Because we have no way of knowing, you get the fitting set for ALL of the distributors available. Basically you end up with a jar full of parts that you don't need to use! (Perhaps for your next car?)
Quite frankly, we are amazed that we can supply such a comprehensive kit for this price. To produce a kit that will adapt to the dozens of different distributors around is amazing!
Remember, once you have installed a breakerless system it will never wear out and that part of your system will remain in tune FOR EVER.
We expect this kit to sell well. To ensure that you receive one, check with us early!
Cat. KJ6655

Jaycar will not be knowingly undersold FOR GOODS OF THE SAME QUALITY. If you find that a competitor is cheaper, get all the facts and tell us! If you are right we will match OR LOWER his price!
Please understand that we cannot match the price of goods that are NOT the same quality as ours.

500MHz DFM

Ref: EA Dec '81 – Feb '82
Jaycar has by far the best kit version of this project in Australia. We now supply 2 x GOLD plated BNC input connectors at no extra cost!
KA-1390 (50MHz) $129
KA-1392 (500MHz option) $20

VIDEO ENHANCER

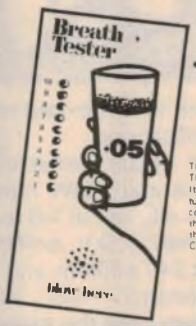
Ref: EA Oct 1983
Get improved performance from your VCR.
Cat. KE-7016 $35.00

Breath Tester

$35

In all states and territories in Australia it is an offence to drive a vehicle with an alcohol blood concentration above a certain limit. In most states it's 0.05 others 0.08. Either way it's only a relatively small number of alcoholic drinks.
Because it's only a small number of drinks, many people (quite wrongly) believe that they remain below the statutory limit.
The KA1522 Breath Tester can help here. A unit with the same circuit diagram was featured in May "Electronics Australia". It CANNOT give you an actual blood/alcohol content reading, however it can go close. And it can give you a relative reading between inebriated friends!!! Great at parties!!!
Grab the whole kit now for only $29.95. You never know, it may save your licence or your life!

ONLY $29.95



Video Amplifier/-Buffer

Ref: EA Aug 1983

The answer to a maidens prayer!
This device can be made to fit inside a TV set (or in a separate box if necessary). It basically enables you to connect straight into the video drive of your TV, turning it into a colour monitor. This means that the video signal from your computer, VCR, TV game etc., does not need to be converted to RF and go through the TV IF strip. You will be amazed by the clearer, sharper signal that has less interference! Notes on how to fit to various TV sets are included.
Cat. KA-1527 $14.95

Jiffy Box to suit HB-6003 $2.20

INFRA RED DIMMER KIT

$25.95

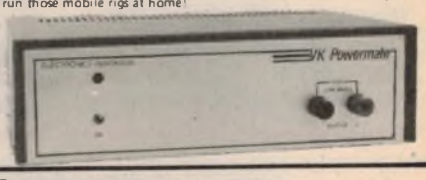
Ref: EA January 1984
Now you can dim or turn off the lights from the comfort of your armchair!
Short form kit contains all parts for I.R. kit. Note this must be used with a Jaycar KA-1509 Touch Sensitive Dimmer ($19.95)
Cat. KA-1530 $25.95

VK POWERMATE – NEW MODEL

$89.95 comp

Ref: EA Dec '82
Get up to 13.8V @ 10 amps to run those mobile rigs at home!
The Jaycar kit is complete.

$89.95



50V/5A laboratory power supply

Ref: EA May/June 1983
Cat. KE-1520
$149.00

ETI 644

DIRECT CONNECT MODEM

Ref: ETI
October 1982

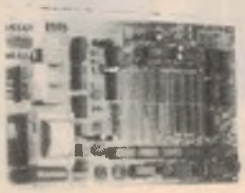
Two models (i) Short form which contains ALL PCB components as specified by ETI (BEWARE!!!). The genuine ETI PCB with plated-thru holes, solder mask and component overlay is supplied. We also supply at NO EXTRA CHARGE a full set of quality IC sockets. A must with plated-thru PCB's – Remember this when making comparisons (ii) Full kit. Includes: all of the above plus 12V plug-pack, case, front panel, switch and LED bezel and Cannon DB-25 RS-232 connector. Makes a complete stand alone modem. *Capable of a range of Answer/Originate operating modes * Selectable Baud rate * Software controlled * Uses new patented technique * More reliable and faster than most acoustic modems. Arlec transformer as used in this project only $22.00

"NEW UPGRADED MODEL FEATURING THE LATEST IMPROVEMENTS AND MODIFICATIONS"

SHORTFORM KIT Cat. KE-4600 ONLY $169

COMPLETE KIT Cat. KE-4601 ONLY $199

LESS SPECIAL DISCOUNT
JANUARY ONLY 10%



VIDEO SENSATION AT LAST

A Video Enhancer/ Distribution Amplifier designed EXCLUSIVELY for AUSTRALIA

NOT A KIT
BUILT, TESTED AND GUARANTEED

Jaycar has had designed a high quality, high performance Video Enhancer which is specifically for the Australian 625 line 50 frame PAL D system.
As far as we know it is the ONLY Australian designed, Australian built unit available!!
But, guess what? The Jaycar AV6501 Enhancer is CHEAPER than its inferior imported Asian counterparts!!
This unit is professionally designed and University tested! It works and it works well.

$59.95

Jaycar

Incorporating ELECTRONIC AGENCIES

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HURSTVILLE 121 FOREST ROAD – PHONE: (02) 570 7000

NUMBER 1 FOR KITS

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$25 – $49.99 ($4.50) $50 – $99.99 ($6.50)
$100 – $198 ($8.00) Over $199 ($10)
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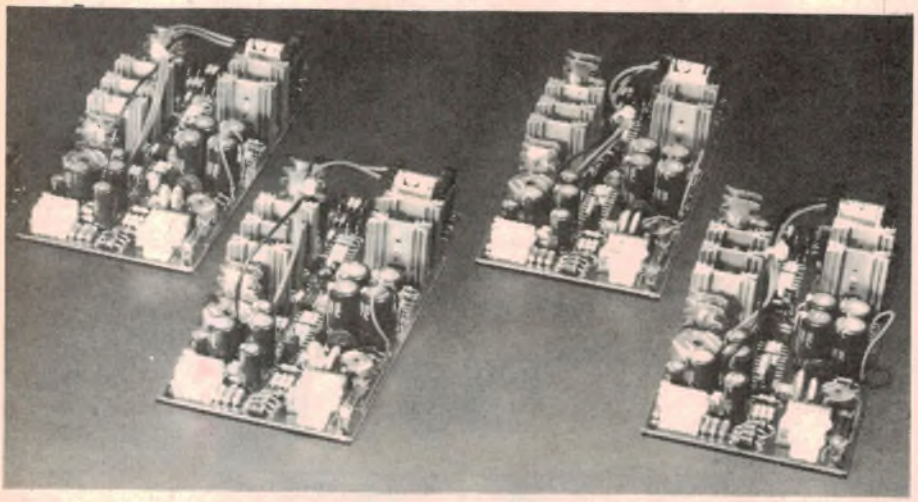


High spec power supplies

Scientific Electronics advise that, in addition to their SM80AE1 power supply mentioned in October 1983, they have two more versions of the SM80AE series. All have been designed and manufactured in Australia to meet Telecom specification 1302.

The additional models are SM80AE2 and SM80AE3. Model 2 is a four rail version and model 3 is a six rail version. They are offered with standard rails or to customer specification.

All are short circuit protected, have 80W continuous and 150W ratings, are more than 60% efficient at full load, and have better than 3.5kV isolation. All measure 108 x 240 x 45mm and carry a five year warranty, with complete technical back-up from the makers.

Additional information is available from Scientific Electronics, 6 Holloway Drive, Bayswater, Victoria. Phone (03) 762 5777.

Sharp LCD screen with 80 x 16 lines

The Sharp Corporation has developed a liquid crystal display screen capable of displaying 16 lines of 80 characters each or graphics with a resolution of 480 × 128 pixels. Designated the LM-480001G, the unit provides a viewing area of 237mm × 70.5mm, in a slim, lightweight package.

High contrast and a wide viewing angle are achieved by use of a newly developed wide area cell design which can be driven at a relatively high duty cycle (1/64 duty). With the increasing importance of portable computers using LCD screens the new Sharp display is certain to find many applications.

Also from Sharp is a new programmable CMOS LCD driver, the LH5008, which can be operated in ½, ⅓ or ¼ duty cycles to drive up to 14 digits of a 7-segment display or eight digits of a 14-segment display.

In the 7-segment display mode, numeric characters and six mathematical symbols can be shown, while the 14-segment mode allows 36 alphanumerics and 13 other symbols. Input to the display controller is in 8-bit serial form and the device is packaged in a 60-pin "flat pack".

For further information on the 80 × 16 LCD panel or the LH5008 display driver contact Daneva Australia Pty Ltd, PO Box 114, Sandringham, Vic, 3191. Phone (03) 598 5622.

DATEL

Data Conversion Components

Data conversion component's catalogue

Elmeasco Instruments has announced the release of a new, 376 page data conversion component product catalogue produced by Datel. It contains full engineering data on the following monolithic, hybrid and modular products: A/D and D/A converters, data acquisition subsystems, sample-hold amplifiers, operational amplifiers, instrumentation amplifiers, isolation amplifiers, analog multiplexers, and special function circuits.

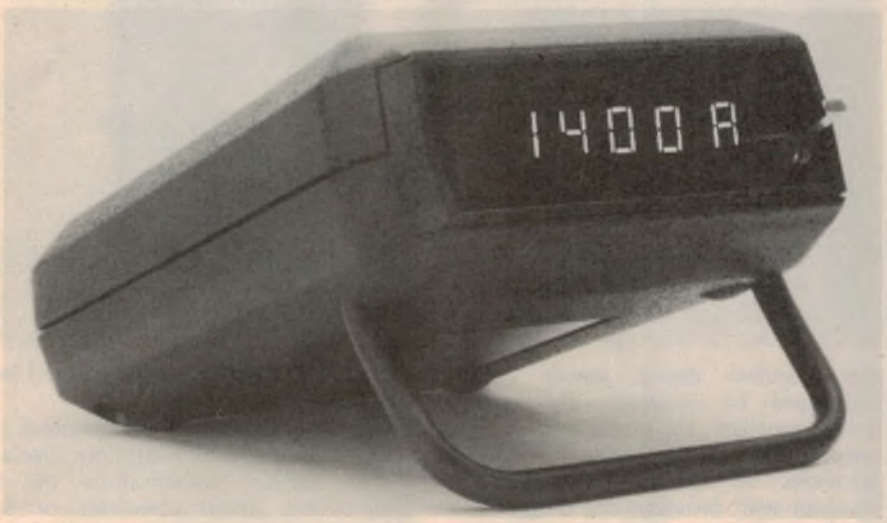
Products are organised into quick selection tables that are arranged by function and performance to ease product selection for any given application. Complete data sheets are included for key products along with tutorial information and an ordering guide.

A copy may be obtained by request on company letterhead to: Elmeasco Instruments Pty Ltd, PO Box 30, Concord, NSW 2137.

Mobile radio ident system

Signalling Technology Pty Ltd has released a new low cost Automatic Number Identification (ANI) System for use in existing or new mobile radio systems.

The ANI system provides a "quiet base" facility whereby the base station responds only to suitably encoded signals from its own mobiles, ignoring signals from other users sharing the same channel.



Designed for quick and simple installation, the system comprises of a small encoder which is installed in the mobile, and a wall-mounted decoder plus an attractive desk-mounted display unit at base.

To initiate calls from a mobile, the caller simply activates the microphone "press-to-talk" button which automatically transmits the mobile's identity to the display unit at base. The ANI simultaneously opens the channel, enabling immediate response from base in the normal manner. For base to initiate a call, the operator simply activates the display unit's "quiet base" switch.

The system carries a 12 month warranty with full service backing, and it complies with the Department of Communications regulation for mandatory fitment of "Quiet base" facility to all new radio installations.

Further information from Signalling Technology Pty Ltd, Factory 8, 2 Apsley Place, Seaford, Vic. 3198.

High performance CRO from BWD Instruments

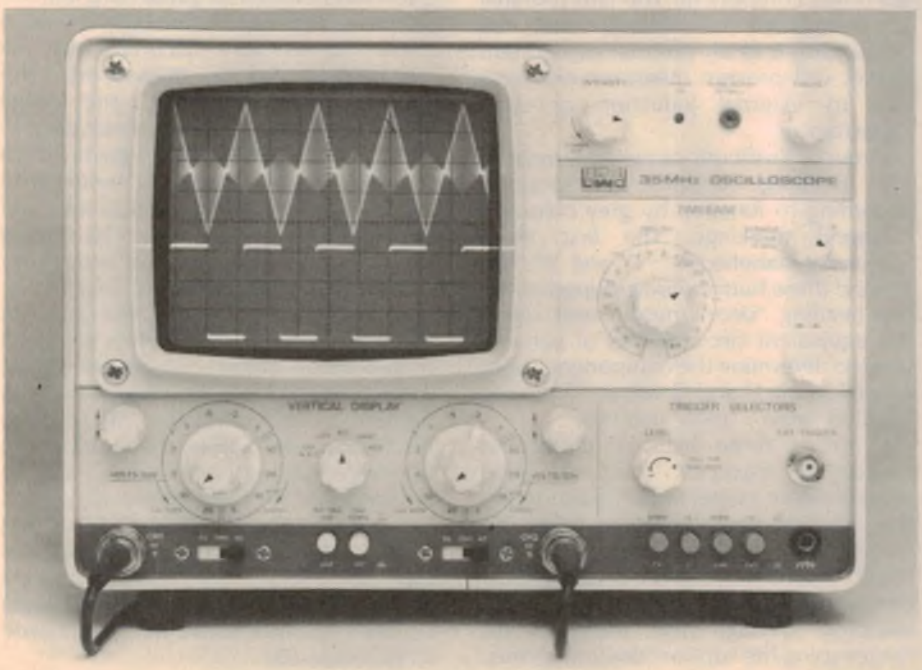
BWD Instruments has released its new generation oscilloscope, Model 824. This instrument is designed, manufactured, and serviced in Australia, and the makers claim that is is more than competitive with imported units.

The 824 is a dual-trace CRO using a CRT with an internal graticule. Brief specifications are as follows: DC to 35MHz (−3dB) bandwidth, 10ns rise time, 2mV to 20V/division sensitivity, and triggering to 50MHz plus TV line and frame lock with automatic changeover.

The vertical amplifiers can be displayed independently, alternatively, chopped, or added. The amplifiers and timebase calibrations are rated to hold within 3% over the temperature range +5°C to +40°C, and up to 95% humidity. It also ignores power line changes from 195V to 264V.

The CRT display features an 8 division x 10 division graticule, each division measuring 9.5mm. The instrument itself measures 250 x 350 x 178mm (W x D x H) and weighs 7.8kg.

For further information contact BWD Instruments Pty Ltd, PO Box 325 Springvale, Victoria, 3171; or PO Box 62 Rydalmere, NSW, 2166.



Keller International spot welding gun

The Kelarc spot welding gun is a new device from Keller International Pty Ltd which enables welds to be made from one side of any clean-surfaced 18 to 26 gauge steel.

Claimed to be ideal for automotive use and repairs, the welding gun works from a 50A transformer and is trigger operated. In use the gun is held firmly against the metal surface and the trigger pulled back to withdraw the carbon welding electrode. Relaxing the pressure on the trigger then forms a small molten puddle next to the spring-loaded welding electrode. On pulling back the trigger again an arc is struck, allowing the weld to be completed in four to five seconds.

The welding gun is manufactured in England and is imported exclusively by the Sovereign Welding Centre, Nobby's Creek Rd, Murwillumbah, NSW, 2484. Phone (066) 79 1455.

New Products...

Listen in to the Space Shuttle with GFS down converter

GFS Electronic Imports now has availabe a 2.3GHz down converter kit, the Model RX-2300. The kit is designed to go together easily and can be tuned to any 50MHz band between 1.69 and 2.7GHz. Transmissions of interest in this band include weather satellites, NASA's S-band Space Shuttle video and audio link, and a NASA beacon on the moon.

The IF of the down converter can be selected by the user between 54 and 220MHz.

All components are supplied with the kit, including a comprehensive instruction manual, diecast metal box and the required BNC connectors. Cost is $89 plus $5 post and packing.

GFS have also announced price reductions of up to 30% on their range of Soar energy monitors. Soar units available from GFS are the MW-200 and MW-200SD and the companion MR-200 chart recorder.

Both the MW-200 and the MW-200SD are portable digital power meters designed to monitor the energy consumption of mains powered appliances. The Model MW-200 provides an instantaneous kilowatt readout with provision for output to a single channel chart recorder such as the MR-200. With this combination the user can monitor peak demand power or use the accumulated kilowatt/hour feature, which automatically integrates power demand over a preset time period from 1 minute to 99 hours.

The MW-200SD model provides just the accumulated kilowatt/hour display.

For further information on the microwave down converter or Soar energy monitors, plus a wide range of commercial, marine and amateur radio gear, contact GFS Electronic Imports, PO Box 97, Mitcham, Vic, 3132. Phone (03) 873 3939.

Leader LCR bridge . . . cont'd from p103

green 3½-digit LED displays. One is used for the component value, the other to indicate D and Q values associated with capacitance and inductance measurements. Back-lit annunciators on either side of the 3½-digit displays indicate the measurement range and the status of the bridge.

The D and Q values are measured using either a series or parallel equivalent circuit. The choice is indicated by a small green LED adjacent to one of four small circuit schematics drawn on the front panel. A pushbutton switch allows the user to select either 120Hz or 1kHz as the measurement frequency.

An "offset" pushbutton is provided to cancel residual or unwanted readings. This control may be used in two ways. First, it can be used to remove any residual value produced by the bridge wiring and terminals which would otherwise add to the value of the component under test. Second, it allows quick comparisons to be made between component values.

For example, if a standard value component is connected to the bridge and the offset button pushed, the bridge will be offset by the standard value, even after the standard is removed. If other components are now connected, the display will indicate by how much they deviate from the standard. This function has obvious uses in quality control.

Five input terminals are provided, four of which are for connections to the unknown component. The fifth terminal is connected to chassis and, by connecting it to an external component shield, will prevent measurement error due to external induction or stray capacitance.

A row of pushbuttons controls most of the functions. Buttons are grouped according to function by grey coloured surround markings. The first three buttons are labelled "L", "C" and "R". The second three buttons are grouped under the heading "circuit mode" and select the equivalent circuit (series or parallel) used to determine the component value, as well as the D and Q values. These are labelled "auto", "para" and "ser".

A further three buttons, under the heading "range", control the measurement range. In the "auto" mode the LCR-745 automatically selects the correct measurement range. In the "hold" mode the correct measurement range must be manually set by single stepping through the measurement ranges using the "up" or "down" buttons.

The last two buttons control the application of bias voltages to capacitors. The first button switches between bias or no bias while the second button switches between an internal 1.5V bias source or an external bias source. External bias voltages of up to 30V may be applied.

It is not practical to quote hard and fast accuracy figures for the LCR-745 since these figures vary according to the parameter being measured, the measurement frequency, the range setting and the equivalent circuit used to model the component. As a guide, in the middle ranges accuracy is better than ±0.5% for inductance, resistance, and capacitance measurements. This degree of accuracy should be good enough for all but the most stringent laboratory.

In practice, we found the LCR-745 extremely easy to use. When switched to automatic mode, component values are displayed in less time than it takes to tighten up the terminals. All readings obtained were within the component tolerances and, as before, we have no reason to doubt the claimed accuracy.

Prices are $318.24 for the LCR-740 and $1551.42 for the LCR-745, including sales tax. For further information contact Amalgamated Wireless (Australasia) Limited, 422 Lane Cove Rd, North Ryde 2113, NSW. (JS)

Domestic solar power systems

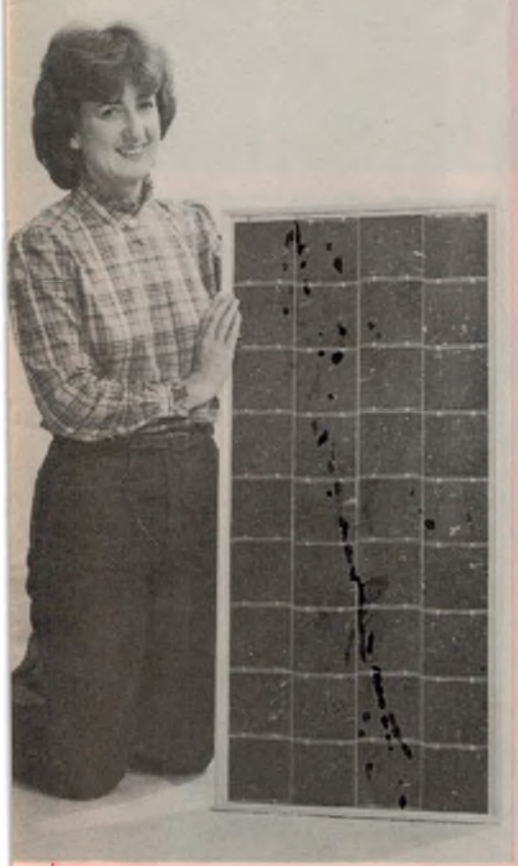
Amtex Electronics, Australian specialists in solar electricity, has released a new solar module featuring square solar cells. The square cells are the first of a new generation of solar modules from Amtex featuring polycrystalline silicon material. Amtex claims the new solar modules are more efficient and economical for domestic use in remote areas.

Amtex has a range of five complete systems based on these new solar modules. Each system comes complete with batteries, cables etc down to the last bolt and nut, and is designed for installation by a handyman.

Included in the range are two DC models for small power requirements, and three AC models offering capacities of one, two and four kilowatt hours of energy per day.

With the new Amtex modules, a home can be supplied with 240V AC solar power from $7300 upwards. The smaller DC model, the Solar Lighting Kit, is $695.

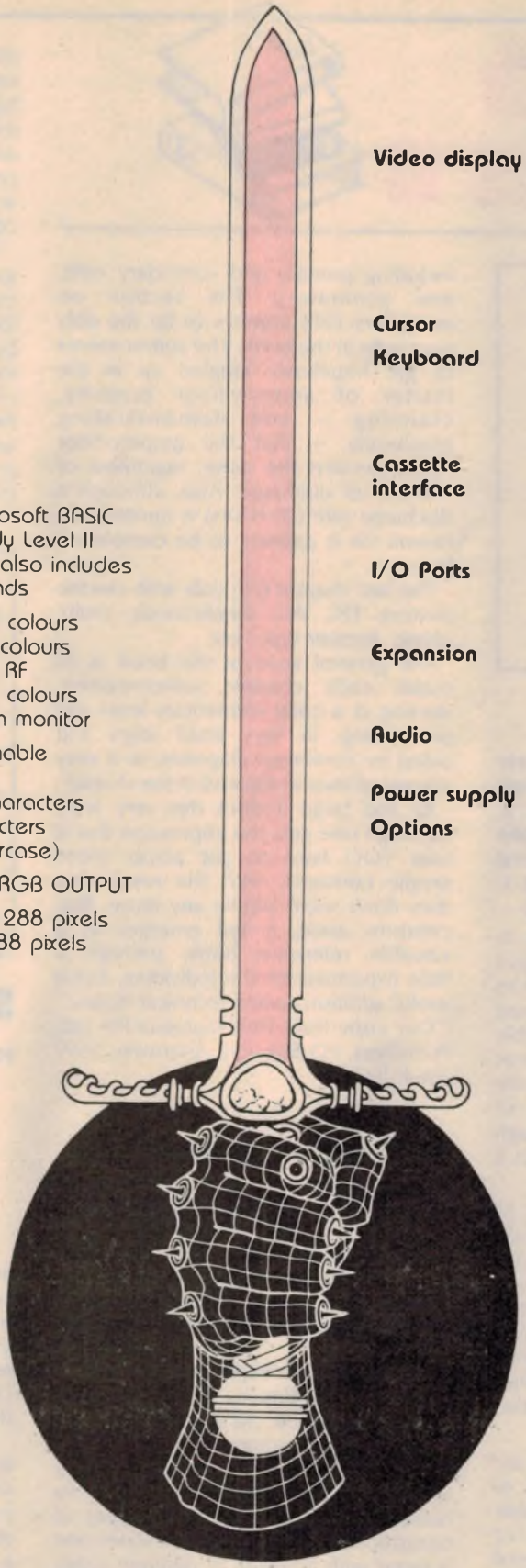
Further information from Amtex Electronics, 11 Spring St, Chatswood, NSW 2067. Phone (02) 411 1323.




Excalibur 64

EXCALIBUR 64
TECHNICAL SPECIFICATIONS

CPU	Z80A
Clock speed	4 Mhz
Total RAM	70K
Screen Mem	2K
Colour Mem	2K
PCG Mem	2K
User RAM under Disk drives	64K
Actual user RAM under BASIC	48K
Language	Extended Microsoft BASIC Similar to Tandy Level II Disc Basic but also includes colour commands
Colour	32 foreground colours 8 background colours using video or RF 27 foreground colours using RGB with monitor
Graphics mode	128 programmable characters 128 graphic characters 96 ASCII characters (includes lowercase)
Video	RF, video and RGB OUTPUT
Resolution	Low res 320 x 288 pixels Hi res 640 x 288 pixels
Video display	24 lines x 40 characters 7 x 12 dot matrix (TV or monitor) 24 lines x 80 characters 7 x 12 dot matrix (monitor preferred)
Cursor	Flashing block
Keyboard	Full size 60 key QWERTY layout 4 programmable function keys – 8 functions
Cassette interface	Built in software controlled at 1200 and 300 baud – Kansas City (counter timer circuit)
I/O Ports	Serial. full RS 232C Parallel. 8 bit centronics compatable
Expansion	2 expansion ports on board each providing all major control and data lines
Audio	Single channel 3 octaves programmable under BASIC
Power supply	On board
Options	Disc controller board Direct connect Modem



EXCALIBUR 64.

BGR COMPUTERS P/L

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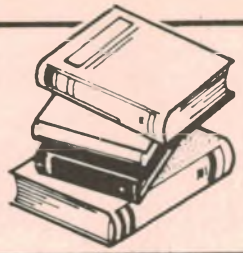
Books & Literature



Electrical principles

ELECTRICITY ONE-SEVEN edited by Harry Mileaf. Published by Hayden Book Company Inc, New Jersey, USA, 1978. Hard covers, 150 × 235mm, 1000 pages (approx), copiously illustrated with diagrams, ISBN 0-8104-5952-3. Recommended retail price $49.50.

As the title suggests, this book is concerned with electricity, as distinct from electronics, and so would seem to be directed at a more restricted audience than most generally available textbooks. In fact, this approach is not as restrictive as might be imagined. On the one hand, an understanding of electronics pre-supposes a thorough grounding in electricity, out of which it evolved.

On the other hand, the coverage of this book is greater than the title might suggest. It stops short of valves, transistors, and ICs, but only just. As well as the obvious DC and AC circuits and components it progresses logically into the effects of inductance and capacitance, resonance, low and high pass filters, pi and "T" networks, optimum tuned circuit coupling etc.

In fact, the first four chapters are devoted to these subjects, some of which are dealt with at considerable depth. Chapter 5 covers meters of various kinds, including the traditional moving coil meter and the application of shunts, multipliers, rectifiers etc to produce the typical multimeter. Moving iron, hot wire, and thermocouple systems are also explained in detail.

Chapter 6 covers power sources, including primary and secondary cells, and generators. The section on secondary cells appears to be the only sour note in the book. The author seems to get hopelessly tangled up in the matter of ampere-hour capacity, claiming – and demonstrating graphically – that the ampere-hour figure remains the same, regardless of the rate of discharge. Also, although a discharge rate (20 hours) is quoted, the reason for it appears to be completely lost.

The last chapter (7) deals with electric motors: DC, AC, synchronous, multi-phase, stepper types etc.

The general style of the book is to make each chapter self-contained, starting at a quite elementary level and proceeding, in very small steps and aided by numerous diagrams, to a very advanced level at the end of the chapter.

By and large it does this very well, although one gets the impression that it tries TOO hard to get across some simple concepts, with the result that they don't seem simple any more. But, critisisms aside, it still emerges as a valuable reference book, perhaps a little expensive for the individual, but a useful addition to any technical library.

Our copy from Holt-Saunders Pty Ltd, Publishers, PO Box 154, Artarmon, NSW 2064. (PGW).

Electronic components

ELECTRONIC COMPONENTS AND SYSTEMS by W. H. Dennis. Published by Butterworths Pty Ltd, 271 Lane Cove Rd, North Ryde. Hard covers 258 pages, 222 x 142mm, numerous line drawings. ISBN 0 408 01111 4 $33.60.

This would be a handy reference book for anyone embarking on a course of theoretical study into electronic or electrical engineering as it gives a useful background to most of the components one is likely to encounter and gives reasons for choosing different types of construction. This is important when one is faced with a wealth of different types of capacitors, resistors etc and without the hindsight of experience, it is easy to choose a component on electrical values alone, with sometimes disastrous results.

There are thirteen chapters ranging from basic aspects of electronic and physical properties of materials, passive components, active semiconductors, bipolar transistors, diodes, field effect devices, fabrication of semiconductors, analog and digital circuitry, digital computers, microprocessors, very large scale integration and optoelectronic components.

The many line illustrations are simple and to the point, but the book suffers from some sloppy proof reading, such as leaving in an incorrect 2 lines, followed by the correct copy, to quote an example. This book would be OK for a certificate level student, although for detailed application information one would need some of the data books published by device manufacturers. (NJM).

Schematic diagrams

HOW TO READ AND INTERPRET SCHEMATIC DIAGRAMS by J. Richard Johnson. Published by Hayden Book Co Inc, New Jersey, USA, 1982. Soft covers, 150 × 229mm, 196 pages, copiously illustrated with diagrams. ISBN 0-8104-0868-6. Recommended retail price $15.95.

This is a rather unusual book in that the title does not, perhaps, quite do it justice. It is not simply an explanation of the role of schematic diagrams, or how they are drawn, or comparison of schematic symbols with their physical counterparts. It does, in fact, do all these things, but it goes a lot deeper than that.

It is almost as though the author set out to produce such a simple explanation of the schematic but, somewhere along the line, things got out of hand, and the tail started to wag the dog. If so, then it was a happy accident, because the end result is a most useful book that should fill a gap on many a library shelf.

What, in fact, emerges is a detailed description of both the actual components represented by schematic symbols – resistors, capacitors,

switches, solid state devices etc – and the circuits in which they are used.

The descriptions include detailed drawings of the components and, in the case of solid state devices, cross sectional drawings of the more complex versions, such as JFETS, MOSFETS, etc together with thumbnail sketches of their main characteristics. The action of an SCR, for example, is explained using a two transistor, discrete circuit arrangement to lead logically to the four layer practical device.

These are followed by a number of what might be termed "basic circuits", designed to show how the components are used. These include single and multi-stage amplifiers, including push-pull configurations, oscillators – Hartly, Colpitts, Armstrong, resistance coupled, blocking – and examples of digital logic circuits. And so far, we are only into chapter two.

There are many more examples, too numerous to mention. Suffice it to say that if you want to brush up on the circuit of a Darlington pair, an RS flip-flop, or a product detector, this book will oblige.

Other chapter headings give some idea of the coverage: Chapter 3, Functional sequence and block diagrams; 4, Power supplies; 5, Audio system diagrams; 6, Radio Receivers; 7, Radio transmitter and transceiver diagrams; 8 TV receiver diagrams; 9, Computer diagrams.

This book should prove an invaluable reference for any student beginning a career in electronics, or any older enthusiast trying to catch up on today's solid state configurations.

Well worth investigating.

Our copy from Holt-Saunders Pty Ltd, Publishers, PO Box 154, Artarmon, NSW 2064. (PGW).

New Babani titles

NEW BABANI TITLES: Various authors, published 1983 by Bernard Babani Ltd, London, England. Soft covers, 110 x 176mm, around 100 pages each, illustrated with diagrams.

THE ART OF PROGRAMMING THE ZX SPECTRUM by M. James ISBN 0 85934 094 5

Introducing the Sinclair spectrum colour computer, this book opens with "Getting to know your Spectrum" and includes chapters on low and high resolution graphics, the use of the RND function, sound effects, screen animation and Basic programming. Plenty of examples are provided for each topic.

PRACTICAL ELECTRONIC BUILDING BLOCKS BOOKS 1 and 2 by R. A. Penfold. ISBN 0 85934 092 9 and 0 85934 093 7.

These two books are a useful collection of circuits intended to fulfill specific functions in a variety of electronics projects. Book 1 covers oscillators of all types, monostable multivibrators and a "miscellaneous" category including power supplies, rectifiers and simple filters. Book 2 covers amplifiers, more complex filter circuits and, in the miscellaneous category, trigger circuits, a window discriminator and digital logic gates.

Except for some items based on devices from the UK company Ferranti the circuits use common CMOS and the 555 timer chip. All designs are fully explained and illustrated and the books would be a useful reference for hobbyists. Price is $5.85 each.

THE PRE-COMPUTER BOOK by F. A. Wilson ISBN 0 85934 090 2

Intended for readers who want a quick but thorough introduction to computers, this book covers hardware components, binary arithmetic, machine language and introductory Basic and screen graphics. With eight chapters and five appendices there is a wealth of information for the beginner. Price is $5.85.

HOW TO DESIGN AND MAKE YOUR OWN PCBS by R. A. Penfold ISBN 0 85934 096 1.

In three chapters this covers design and manufacturing of printed circuit boards using etch-resist inks and photographic techniques. Examples are given for each step of the various processes described with the emphasis on the practical aspects of PCB design and construction. For $5.85 the book seems like good value for anyone interested in the subject.

EASY ADD-ON PROJECTS FOR SPECTRUM, ZX81 & ACE by Owen Bishop ISBN 0 85934 099 6

Seventeen projects are described, with full constructional and programming details for the three computers of the title. The projects are simple and inexpensive, using commonly available parts. Included are a pulse detector, five switch keypad, a motor controller, light pen, thermometer and barometer among others. With minor alterations the projects could also be used with other Z80-based computer systems.

For further information on these and other Babani titles contact the Technical Book and Magazine Company Pty Ltd, 289-299 Swanston St, Melbourne, Vic. 3000. Phone (03) 663 3951.

ROD IRVING ELECTRONICS

425 HIGH ST, NORTHCOTE 3070 VIC   PHONE (03) 489 8866

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Build a low cost parabola, along with a high gain headphone amplifier to help when listening to those natural activities such as babbling brooks, singing birds or perhaps even more sinister noises. The current cost of components for this project is around $15 including sales tax, but not the cost of batteries or headphones.

EA NOVEMBER '83

TV PATTERN GENERATOR $25

Make sure your TV is up to the mark with this low cost Pattern Generator which uses just seven ICs and gives three patterns: Dot, crosshatch and blank raster. The current cost of parts for this project is approximately $25 which includes sales tax but not the cost of a modulator or 9V mains plugpack.

EA NOVEMBER '83

ETI-268 NICAD FLOAT CHARGER

$9.00 ETI MARCH '83

Keep your NiCad batteries in tip-top condition with this cheap, simple charger.

ETI-1512 ELECTRIC FENCE TESTER

$24.50

ETI FEB '83

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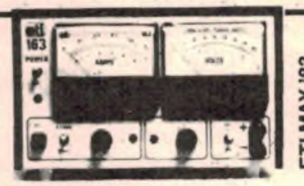
ETI-1516 MODEL ENGINE IGNITION SYSTEM $41.50

ETI JUNE '83

Get sure starts every time and no more glow plug burnouts on your model engines.



ETI-163 LAB SUPPLY $159

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Fully variable 0–40 V current limited 0–5 A supply with both voltage and current metering (two ranges: 0–0.5 A/0–5 A). This employs a conventional series-pass regulator, not a switchmode type with its attendant problems, but dissipation is reduced by a unique relay switching system switching between taps on the transformer secondary.

ETI-668 MICROBEE EPROM PROGRAMMER $47.50

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Simple, low cost programmer for the MicroBee can program 2716s, 2732s and 2764s.

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ETI JUNE '83

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ETI-323 HEADLIGHT DELAY UNIT $17.50

ETI MAY '83

Park your car and turn off the lights. Can't see where you're going? Press the button and the headlights come on to light your way, switching off automatically after 50 seconds. This is a simple, easy to build, low cost project.

ETI-1515 DRILL/BLENDER SPEED CONTROLLER $27.50

ETI APRIL '83

This project provides a full range of speed control for appliances having 'universal' ac motors. Once the speed is set, the motor will maintain that speed from no-load to heavy-load. Great for drills, blenders, grinders, etc.

ETI-162 30 V/1 A FULLY PROTECTED POWER SUPPLY $47.50

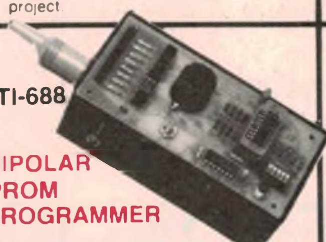
ETI DEC '83

The last power supply we did was the phenomenally popular ETI-131. This low cost supply features full protection, output variation from 0 V to 30 V and selectable current limit. Both voltage and current metering is provided.

ETI-654 APPLE II ANALOGUE/DIGITAL INTERFACE

$159.00 ETI MARCH '83

This project will give your Apple a set of 8-bit digital inputs and outputs plus one analogue input and one analogue output. Applications include: driving a robot, recording science experiment results, etc (digital only shown).



ETI-688 BIPOLAR PROM PROGRAMMER

$47.50 ETI JUNE '83

Every digital workshop should have one! Can be used to program the popular fusible-link PROMs like the 74S188/288, 82S23 and 82S123 etc.

ETI-461 GENERAL PURPOSE BALANCED INPUT PREAMP $20.00

ETI DEC '83

This project can be used as a balanced mic amp with low impedance input, a low or high impedance input differential amplifier or a balanced input instrumentation amplifier.

ETI-164 ZENER TESTER

$9.50 ETI MAY '83

A simple, low cost add-on for your multimeter. This checks zeners and reads out the zener voltage directly on your multimeter. It can also check LEDs and ordinary diodes.

ETI-334 AUTO TESTER

$17.00 ETI JAN '83

Just the thing to keep in the glovebox or toolkit to find those nasty electrical bugaboos that occur at awkward times. Simple to build, simple to use.

ETI-335 PUSHBUTTON PROGRAMMABLE WIPER CONTROLLER

$28.50 ETI MARCH '83

No more fiddling with knobs and not getting the delay between wipes that you want—this windscreen wiper controller is simply programmed with two pushbuttons to provide the wiping delay you need.

ETI-733 RADIOTELETYPE CONVERTER FOR THE MICROBEE $20.00

ETI APRIL '83

Have your computer print the latest news from the international shortwave news service. Just hook up this project between your shortwave receiver's audio output and the MicroBee's parallel port. A simple bit of software does the decoding. Can be hooked up to other computers too.

48-50 A'BECKETT ST, MELBOURNE 3000 VIC   PHONE (03) 347 9251

Mail Order Delivery Instructions: Minimum Pack and Post $3.00 for Australia Post. Please allow extra for bigger orders and Certified, Airmail or Registered Post. Minimum order is $5.00. Please address orders to Mail Order Department, PO BOX 235, NORTHCOTE 3070 VICTORIA. PHONE (03) 481 1436.

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MAY EA 1982

12/240 volt inverter 40 WATTS

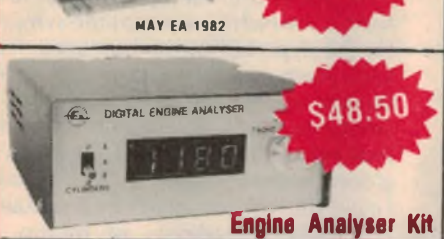
$49.50

MAY EA 1982

SPECIFICATIONS FOR 300W INVERTER

Nominal Supply Voltage	12V DC
Output voltage	see table
Frequency	50Hz ± .005%
Regulation	see table
Maximum Load	300VA
Current Limiting	30A (primary)
Efficiency	see table

Resistive load W	Output voltage (RMS)	Input current (A)	Efficiency (%)	Battery life 40Ah/20h rate (minutes)
no load	210	1.2	0	–
40	235	4.5	60	240
100	240	11.3	62	80
140	240	15.0	69	60
200	240	20.1	78	50
240	240	24.0	79	32
300	235	29.6	82	28



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REMOTE INFRARED TV SOUND CONTROL

$40

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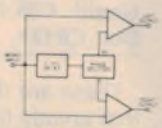
STEREO SYNTHESISER FOR TUNERS AND VCRs

Enjoy the benefits of stereo sound from your video cassette recorder, TV or AM tuner with this Stereo Synthesiser. The circuit uses just four ICs and is easy to build.



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Analogue and Digital Storage CRO Kit

EA POWER UP

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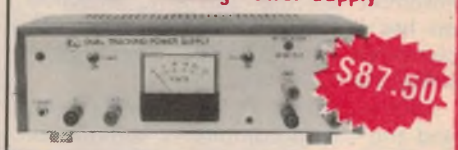
EA NOV 1982

Led Head Lightchaser

(Battery and headband extra)

$12

Duel Tracking Power Supply



$87.50

100w Sub-Wooler Amplifier

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JULY EA 1982

EA DIGITAL READOUT FOR SW RECIEVERS

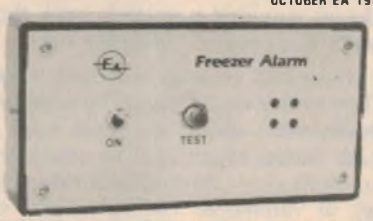
$72.00 COMPLETE

OCTOBER EA 1982

EA EASY-TO-BUILD FREEZER ALARM

$21

OCTOBER EA 1982



PLUG PACK REGULATOR

$14

Plugpack Extra

Want to add digital frequency readout to an AM radio or shortwave communications receiver that uses an old-fashioned analog dial? This unit features a bright four-digit LED display, 1kHz resolution, and a 0.2s update time that's fast enough to follow the tuning knob.

SPECIFICATIONS

Ranges (full scale): 0-10MHz and 10-30MHz (optional).

Display: Four digit.

Resolution: 1kHz with division switch set to divide by one; 10kHz with division switch set to divide by 10.

Sensitivity: Less than 100mV from 500kHz to 30MHz.

Offset frequency: Prototype set to 455kHz, but any offset frequency can be programmed.

EA THEREMIN $34.50

JUNE EA 1982

EA ELECTRONIC STARTER FOR FLUORESCENT LAMPS

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REVIEWS OF RECENT
Records & Tapes
CLASSICAL • POPULAR • SPECIAL INTEREST

BEETHOVEN

BEETHOVEN
Piano Quartet in E Flat major, OP16.
SUTHERLAND
Divertimento for String Trio.
TURINA
Piano Quartet in A Minor. New England Ensemble of Australia. Cherry Pie/Festival Audiophile Analog Disc LA 07723.

That sterling body, the New England Ensemble of Australia, actually the Piano-Quartet-in-Residence at the University of New England in Armidale, NSW, again shows its mettle in this program of well contrasted items. They start with Beethoven's Piano Quartet in E Flat which they perform with impressive unanimity of thought and execution.

First among equals is pianist Wendy Lorenz, whose delicious cream-smooth passage work and sensitive nuancing add much to the success of the ensemble. But then this is no reflection on her colleagues' excellence for the piano part always tends to stand out in string chamber music.

All the playing is superlatively good and the sound completely faithful. For the latter much credit is due to the sound engineer, Max Harding. The players all show true insight into the spirit of the music and the balance between instruments is always perfect. A performance Australia should be proud to present to the world.

On the reverse side you will find a string trio by Australian composer Margaret Sutherland which uses much polytonality. It is all very neatly put together but if you're looking for a true melody you won't find one except in the second movement. A galloping account of a motoric finale leads to an effective end.

Turina's A Minor Piano Quartet completes the program. Some of its tunes are a little commonplace but the atmosphere is always unquestionable Spanish. Its juicy harmonies might well appeal to many. The second movement is quite charming but tends to be salon Spanish. The New Englanders make it all very colourful. And the choice of items should achieve popularity with many different tastes. These Cherry Pie/Festival issues deserve the highest praise.

BEETHOVEN

Piano Sonatas Nos. 12 and 13, Glenn Gould. CBS Masterworks Series Analog Disc CB321.

These are the last recordings made by that greatly talented but highly eccentric pianist Glenn Gould. He seemed to delight in playing mostly Bach and Beethoven differently from anyone else. Sometimes this came off, other times it didn't.

His technique was formidable, his imagination vast if often perverse. He identified himself with the most unlikely artists and composers and usually made out a good case for himself in the sleeve notes written by him that accompanied his recordings. Yet to a trained ear they always sounded purposely odd, though on rare occasions blindingly right.

These two sonatas are cases in point. They both differ widely from what was in Beethoven's day true sonata form. The 12th Sonata might well be considered a crooked work starting as it does with a set of variations. The splendidly clean sound shows up Gould's beautifully clean playing. His interpretation has the air of having been deeply pondered. Of outstanding interest is his treatment of the staccato variation, decidedly odd, but at the same time oddly convincing.

There is nothing light or sprightly about Gould's Scherzo (2nd movement). His playing is aggressively persuasive and there is nothing gentle about the trio – which is perversely not really a trio. Gould's reading can only be described as pugnacious where all other pianists I have heard play it lyrically.

He passes without pause to the Funeral March in which he wastes little sympathy on the departed or the bereaved. It's all very matter of fact and in the second section you'll hear more pugnacity. He relents towards the end as if taking a final regretful farewell. He disperses the gloom without delay in a prestissimo Finale throughout which he maintains a pianola-like steadiness of tempo and touch.

Though often using the wilful opposite of customary treatment Gould certainly has something different to say and says it thumbing his nose at posterity and futurity – if that is the word. And as far as I could hear he had at last given up his habit of singing audibly during his recording.

The 13th Sonata is subtitled "Sonata in the manner of a fantasia". Nothing could be better suited to Gould. He starts the first movement with some ungainly sounding chords then goes on to a violently contrasted strict time alla marcia. And there is no questioning his clarity both of dexterity and thought whatever you may think of the latter. The subtitle tells the tale. Then almost startlingly comes a fast portion that could not be played more fiercely or faster. It all ends in a delightful fading.

Then comes the scherzo played in strict time (dotted) and taken at speed that also couldn't be faster and full of the usual violent contrasts. He still used strict time in the third movement, quite metronomic in fact and certainly not the way any other pianist I know would present an adagio. Yet it is all strangely tender. The recital ends with a fast but joyless finale with more strict time. The whole record may sound odd to most ears but it will not fail to interest.

BRAHMS

The Four Concertos. Soloists Daniel Barenboim (piano); Isaac Stern and Pinchas Zyckerman (violins), and Lynn Harrell (cello). All with Zubin Mehta and the New York Philharmonic. CBS Masterworks Analog Discs CBS79410 Max37871.

This handsome issue of the four Brahms' Concertos on four boxed analog discs should prove very useful for those starting a record library. Among more

experienced readers there are bound to be those who enthusiastically approve and others who already own other versions that they prefer. The piano concertos for instance, are both played by Barenboim – very will indeed I might add. But there are sure to be buyers who prefer the Ashkenazy performances while others go back to Backhaus and still others to Arrau. But that is always the way with collections.

Isaac Stern looks after the Violin Concerto admirably but, then again, others might clamour for Huberman and many will have other favourites, irrespective of the improvement in sound technique since they were made. The Double concerto is given a fine airing by Zuckerman and Harrell (cello).

All the accompaniments, or perhaps orchestral parts are better words, are provided by Mehta and the New York Philharmonic and whatever you may think of Mehta's work on his own he is undoubtedly a fine accompanist. In the space available here it is not possible to comment on any of the works separately but I can thoroughly recommend the set to anybody who wants the concertos in compendious form.

RIMSKY-KORSAKOV

Symphony No. 2, "Antar". Russian Easter Festival Overture. Philips Digital Disc 9500951. Rotterdam Symphony Orchestra conducted by David Zinman.

Although Rimsky-Korsakov called this his second symphony it is not strictly speaking a symphony at all but a symphonic suite in the manner of Scheherazade.

I find it inferior to the latter for many reasons. You hear the main "Antar" theme much too often. Indeed whenever R-K has nothing else to say he just has it played. His habit of constantly repeating two-bar phrases gets tiresome after a while. And more importantly the music hasn't the same attractive voluptuousness as Scheherazade.

Yet it is not a bad work. It has a magnificent chief theme (Antar) and plenty of healthy vigour. The cover notes refer to its orientalism but I could hear little of it. I have known the brilliant scherzo-like movement for many years but have not heard it since a boy. If that sounds paradoxical it is because in his first London season after World War I Diaghileff used it as an interlude between two short ballets. The conductor, Eugene Goossens, then known as Junior.

Of the four movements I like the last best. And on the second side you will find the excellent Russian Easter Overture, an always exciting and colourful piece. The playing throughout is first class and it is good to see the fine Rotterdam Orchestra coming in for a turn where the Concertgebouw has had it all its own way for so many years. And David Zinman seems to be the sort of conductor the musicians like playing for. The digital sound is first rate.

DEBUSSY

Chansons. 21 songs sung by Gerard Souzay accompanied by Danton Baldwin. DGG Collectors' Series. (Analog) 2543813.

A surprising number of musicians and music lovers are unaware of the important role songwriting took in Debussy's work. Indeed his first biographer wrote that if Debussy, like Hugo Wolf, had written practically nothing but songs he would still have remained one of the most "striking and unusual figures in the history of music."

Debussy's interest in songwriting started just about the same time that lieder composition was on the wane. True it remained among the great, Wolf and Richard Strauss, but other Germanic composers' attention had started to fade. So too had the fashionable vocal recital, most on the same mode, a bracket of baroque first, then several German Lieder, and concluding usually in the second half, a few odds and ends of French chansons, English ballads and suchlike.

For conclusion there was usually something "cute". The singer oddly always carried a tiny book hopefully unseen in the palm of the hand. Did this contain the words? Or were the singers all blessed with perfect pitch and therein was the starting note to remind them?

This disc contains some of the most refined singing in the literature of music, music of refinement sung with the utmost sensibility. Most French love their language and Souzay's pronunciation of every syllable should be a lesson to every aspiring singer. His phrasing always has the emphasis in exactly the right place.

Except for one or two items, none of the songs are hackneyed. Most you will be hearing for the first time. And if you are like me you will marvel at the delicate skill of Debussy's setting, whether serious, flippant, ironic or any other mood you can think of. Some described the material in the texts, others show the effect of the words on the composer, still others are just exercises in melody, all are vastly interesting and enjoyable.

Souzay, an artist who has never, I imagine, had a bad notice, hates critics yet gives them a generous program to work on. But fair ones, I am sure, will receive his offering with the same delight that I did. To singers and non-singers alike I can recommend this with the greatest enthusiasm. Danton Baldwin is a competent accompanist but there are subtleties in the piano parts that sometimes elude him. The sound is perfect.

GUITAR FOLK SONGS

THE GUITAR IS THE SONG – Recital of folk songs by John Williams (guitarist) and an orchestra which includes some strange instruments. CBS Digital Disc FM378526.

Do not be misled by the title into thinking this record is just a collection of tunes picked out in guitar solos by this splendid performer. On the contrary it is a series of ingeniously arranged folk songs from many lands which Williams integrated into the whole with great skill.

Some of the accompaniments use exotic or old-time instruments with gratifying effect. For example, tin whistles, a fiddle instead of a violin (what's the difference?) and plenty of violins too. There is a quatro, charango, guitaron, mandolin and more usual orchestral instruments. The songs were gathered in Venezuela, Ethiopia, and many European and American sources. The sound is splendidly clean digital.

The balance between soloist and acompaniment is always sensitively adjusted – no mean feat this and everything is played with great flair by all. Very few of the 14 items are hackneyed. Indeed many will be strange to the average listener. They were to me. All are interesting, some are beautiful.

To give an idea of the general quality of the production, when you have a well known ditty like Shenandoah the setting is very original. This should be of value to all musicians whether or not they are interested in the guitar or John Williams. (J.R.)

Records & Tapes

Here is the first batch of Compact Discs to be formally reviewed in these columns. They include Telarc's notorious "1812" and their much vaunted "Rite of Spring", together with the Tchaikovsky Fifth and Handel's "Water Music", both from Delos.

Although compact discs and players have been available for some time in Australia, it has been on a fairly haphazard basis, and not really one on which to try to plan reviews. Now, with CD players on the shelves and a more predictable supply of discs, we will try to include regular reviews in future issues.

All four records below are available through specialist record stores and some hifi dealers but, in the event of difficulty, contact can be made through the distributor: PC Stereo Pty Ltd, PO Box 272, Mount Gravatt, Qld 4122.

TCHAIKOVSKY

1812, Op 49. Cappricio Italien, Op 45. Cossack Dance from Mazeppa. Erich Kunzel conducting the Cincinnati Symphony Orchestra. Telarc Compact Digital CD-80041.

Originally recorded in 1979, this grouping of Tchaikovsky concert miniatures was released as an LP-stereo pressing in that same year and reviewed in our February '80 issue. The three items are all well known – perhaps too well known for some.

The 1812 Overture was composed by a rather unwilling Tchaikovsky to commemorate the 25th anniversary of the accession of Tsar Alexander II, and the opening of the Cathedral of Christ the Redeemer. Almost of necessity, his theme centred on the defeat of the French invaders, and his mix of folk tunes, the Marseillaise, cannons, and church bells signalling victory, perpetuated Russian folklore rather than the real defeat of the French by the Russian winter. But, like many other good stories, the "1812" has lived on.

"Capriccio Italien" is Tchaikovsky's musical impression of Italy, following a visit to that country and combines snippets of popular songs and dance tunes, the songs of Venetian gondoliers and the more military sounds heard in Rome.

The "Cossack Dance" is a popular segment from his otherwise unsuccessful opera "Mazeppa", completed in 1883.

The orchestral account of the three items is well recorded and was commended as such in the first review. While it dates back to 1979, the master was made on the then new Soundstream digital recorder and is consequently well up to the standard required for a compact disc.

What makes the recording "notorious", is the decision by Kunzel and Telarc to fulfill Tchaikovsky's original intention of performing the work out-of-doors, with orchestra, brass band, church bells and cannon. Telarc duly recorded a carillon and cannon separately and mixed them into the orchestral master tape, under computer control, and at a very substantial level.

Considering the enormously complex sound, the LP pressings were very good and the compact disc is even better. It will not pose any tracking problems for indifferent players, as did the analog pressings, but the huge low-frequency signal from the cannon will certainly pose problems for many amplifier systems, as per the Telarc's warning on the pack and in the booklet. (See the discussion in "Forum").

As a technical exercise, a talking point and a demonstration of sheer bass-end power, Telarc's "1812" remains an industry benchmark and you may want a copy primarily on that account. On the other hand, if your interest centres on the music, do be careful with the cannon during the last couple of minutes of the overture. (W.N.W.)

HANDEL

The Water Music (Complete). Gerard Schwarz conducting the Los Angeles Chamber Orchestra. Delos compact compact disc D/CD 3010.

Whether as the virtuoso trumpeter of earlier years or, more recently, as Musical Director of the Los Angeles Chamber Orchestra and the Y Chamber Symphony of New York, I have come to expect precise playing and sharp, clean sound from Gerard Schwarz. To date, my judgment has been based on digitally sourced analog recordings but in this, his first compact disc to come into my hands, the sound comes right up to expectations: completely clean, completely noise-free and with not a trace of congestion.

In part, of course, this is due to Schwarz' partiality for small rather than large orchestras – an attitude that needs to be explained when it conflicts with convention but which involves no such problem in this particular recording. It certainly makes for a spacious, although not necessarily a small, sound.

In the accompanying booklet, Amelia Haygood points out the "The Celebrated Water Musick" as it was originally called, represents possibly the finest and best known orchestral music written by George Frideric Handel (1685-1759). As such, it has retained its popularity since the early part of the 18th century.

It gains its name from the fact that most of the pieces were written for Royal water parties on the Thames, although it is likely that a few pieces from other occasions have found their way into the "complete" collection.

Amelia Haygood quotes an account of a Royal barge party on the Thames, hosted by George I, from "The Daily Courant" of July 19, 1717. The 50-odd musicians were grouped on a large barge, drifting with the tide alongside the Royal barge. George I appreciated their efforts so much that he requested them to repeat the program several times during the leisurely journey.

Handel's free use of wind instruments in Water Music and his assumption that the basic score would be embellished provides scope for the expertise of the conductor in this area.

The program is divided into three suites as follows: Suite I in F, pieces 1 to 9; Suite II in D: pieces 10 to 14; Suite III in G, pieces 15 to 18. Each piece is individually listed and timed on the inside front cover of the booklet and inserting the disc in the player registers a total playing time of 54 minutes 12 seconds – reasonable useage of a nominal 60-minute disc.

Unless I am much mistaken, this is going to prove a very popular disc. Its complete clarity and transparency would make it an excellent choice for demonstration purposes. It holds interest for the musically inclined and provides pleasant listening for those who are not. A good one to include among your initial purchases of compact discs. (W.N.W.)

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Cat X-3272

DICK SMITH Electronics

See page 98 for full address details

DSE A686 PA1

Records & Tapes *Continued*

TCHAIKOVSKY

Symphony No.5 in E minor. Op64. Eugene Ormandy conducting the Philadelphia Orchestra. Delos compact disc D/CD 3015.

This particular performance was recorded in April 1981 in the historic "old Met" in Philadelphia. A one-time spacious 4500-seat opera house, built in 1908 by Oscar Hammerstein, the Met became a second home for the Metropolitan Opera and a recording venue for the late Leopold Stokowski.

But, with the surrounding area falling into depression, the building lost favour until "rediscovered" in 1977 as a desirable recording venue for major works – environment notwithstanding.

For conductor Eugene Ormandy, this particular performance must have sparked many memories. It was back in October 1931 that he first conducted the Philadelphia Orchestra, stepping into a breach created by the sudden illness of Toscannini who was, in turn, filling in for Stokowski. Ormandy made such an impression that he became Musical Director in 1936 and held the post until 1980.

And what better work for an occasion that virtually brought that association to a close than the Tchaikovsky 5th, with its familiar theme in the second movement and its waltz-like third movement that might as easily have come out of "Swan Lake" or "Sleeping Beauty". Tchaikovsky himself felt self-conscious about the work for a time ("a certain gaudiness and artificiality") but later reacted much more warmly to it.

Those who do not know the work well, will find it very listenable and the accompanying booklet gives a detailed insight into the music by Herbert Kupferberg.

In a further note, producer of the recording, Harold Lawrence points out that Tchaikovsky's 5th Symphony exploits the full dynamic spectrum in the first four minutes, although one must add that the Delos approach is to handle dynamic range with restraint rather than the sometimes ostentation of Telarc.

When we reviewed the LP pressing in the June '82 issue, we commended the performance by conductor and orchestra alike, as well as the recording itself, captured by three B&K microphones ranged in front of the orchestra and a Soundstream digital recorder.

That evaluation still holds but, once again, running Delos' best from 1982 against their new CD version, the subtle differences always favour the latter: better texture in the treble and cleaner bass due in part, I feel sure, to the elimination of acoustic feedback from the loudspeakers.

While the context has changed, the observation in our June '82 issue still applies: In short, well worth consideration, if you have a place for it in your collection. (W.N.W.)

STRAVINSKY

The Rite of Spring (Le Sacre du Printemps). Lorin Maazel conducting the Cleveland Orchestra. Telarc Compact Disc CD-80054.

This recording was reviewed in the March '81 issue as a digitally sourced analog pressing and much of what we said on that occasion still applies.

As a challenge to conductor, musicians, and engineers alike, Stravinsky's "Rite of Spring" was a natural addition, at the time, to Telarc's digitally sourced repertoire, with its periods of almost whisper quietness demanding

minimal noise level, its tonal complexities elsewhere demanding low intermodulation, and its loud drumbeats requiring freedom from bass-end overload.

The booklet which comes with the compact disc carries the same notes by Michael Murray as did the LP jacket, dealing principally with the composer and the work. It was composed originally as a ballet score dramatising ancient Slavonic fertility rites and so scandalised the audience at its first performance in May 1913 at the Ballets Russes that it caused a riot of protest.

Some months later it was presented again as a concert performance and, this time, conscious of the score rather than the source of the inspiration, the audience gave a standing ovation.

In competition with about 20 other versions, Maazel's reading attracted its share of comment and criticism, including the observation quoted in our March '81 review that Maazel had shown a tendency to turn Stravinsky's rather "mechanistic and fragmented music" into a kind of "Debussy with a beat". However the same critic had to concede that the recording itself was technically outstanding, the best yet and a "must hear" disc. Certainly, since then, it has received frequent mention in lists of top hifi demonstration pressings.

In view of that, it was interesting to run the original LP and the CD version in parallel, switching from one to the other by way of an A-B test. Yes, the LP is good, but the compact disc is better, with not even the occasional surface click, and with even better transparency in the more complex passages.

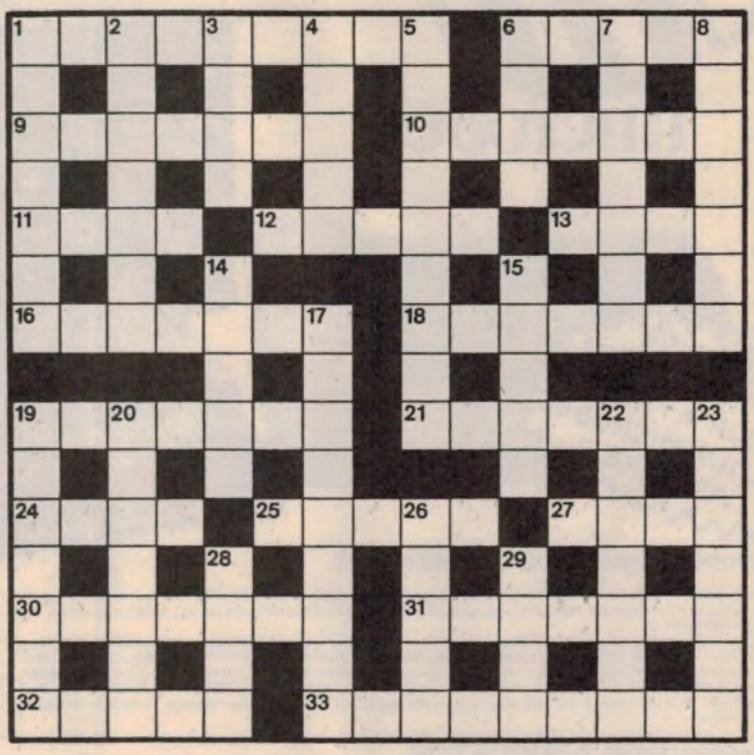
These days, with so many titles being issued on compact disc, Telarc face much stiffer competition but I imagine that CD-80054 will attract quite a few buyers, curious to have the means of comparing LP and CD versions. (W.N.W.)

Solution for December

S	E	M	I	C	O	N	D	U	C	T	O	R	S	
O		E		H		U		N		E		A		X
L	A	G	G	I	N	G		F	A	R	A	D	A	Y
D		O		P		G		I		A		I		P
E	C	H	O		T	E	S	L	A		F	O	I	L
R		M		J		T		L		L		E		O
	A	S	T	O	N		B	E	H	I	N	D	I	T
S				U		R	E	D		G				S
P	A	R	A	L	L	E	L		O	H	M	I	C	
E		E		E		C		F		T		L		H
A	R	C	S		I	O	N	I	C		B	L	U	E
K		E		A		R		L		Z		E		N
E	M	I	T	T	E	D		T	R	I	G	G	E	R
R		V		T		E		E		N		A		Y
	S	E	C	O	N	D	A	R	Y	C	E	L	L	

Electronics Australia

JANUARY CROSSWORD



ACROSS

1. Range of frequencies. (9)
6. Gas used in globes. (5)
9. Sort of arrest prevented by an electronic pacemaker. (7)
10. Antennae. (7)
11. Test undertaken by would-be radio operators. (4)
12. Radar screen images. (5)
13. Blacken by overheating. (4)
16. Cables carrying input signals. (7)
18. The kind of scanner which uses a photoelectric cell. (7)
19. Type of data display. (7)
21. Electrode of a transistor. (7)
24. Electric unit. (4)
25. Parts of valves. (5)
27. Unipolar multielectrode semiconductor devices. (4)
30. Degenerate. (7)
31. Pulse detector. (7)
32. Simulates a loudspeaker load. (5)
33. Coherent ray. (5,4).

DOWN

1. Developed across an inductor (4,1,1,1)
2. Logic circuit. (3,4)
3. Kind of antenna. (4)
4. Transfer for panel labelling. (5)
5. Listening device. (9)
6. The motion of air at an electrified point. (4)
7. Type of equaliser. (7)
8. Air inlet (7)
14. Frequency unit. (5)
15. Bare insulated wire. (5)
17. Device utilising photovoltaic effect. (5,4)
19. What the crossover network did to the frequencies. (7)
20. Element present in some semiconductors. (7)
22. Operational zone for medical electronics. (7)
23. Appropriate place for a speaker. (7)
26. Tape recorders. (5)
28. Kind of current commonly the cause of losses. (4)
29. Rough edge in Scottish speakers ? (4)

Microbee-No.1 for computers
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Jaycar Electronic Agencies is proud to announce the 1984 range of microbee computers — at new low prices!! The microbee Series 2 machines are ALL supplied with built-in communications capability, dual font 80 character by 24 line & 65 character by 16 line displays. Remember, your microbee is obsolete-proof with g'teed upward expandability.

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Demand for projects using the microbee is so great that 'Electronics Today' are now planning to run a microbee project every month during 1984. So far ETI has described the light pen, EPROM programmer, a radio TTY printer, the world's first home facsimile receiver and ROM expander board for the microbee. Virtually every local computer magazine has run reviews and/or columns devoted entirely to the microbee. If you want to be part of the MICROCOMPUTER GENERATION in 1984 then microbee Series 2 Experimenter is the ideal starting point. Of course you can expand your microbee Series 2 Experimenter as your need grows.

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The microbee Series 2 was specifically designed to serve the needs of the EDUCATION MARKET. Let's face it, the primary non-business use for most personal microcomputers is to increase our learning capabilities either about computers (computer awareness) or about life itself. microbee Series 2 has now been officially approved by Education Departments in NSW, WA and Queensland and is being carefully considered in virtually all other states and by the National Schools Commission at the time this ad was going to press.
The microbee Educator uses BATTERY BACKED NON-VOLATILE CMOS RAM so your programs are saved in the microbee Series 2 after the power is switched off. Students can bring the microbee Series 2 Educator home from school to complete assignments ready for class the next day. With the optional BEEMODEM you can use your microbee Series 2 Educator to talk to other computers or information networks.

$449

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microbee Series 2 PERSONAL COMMUNICATOR

With the BUILT-IN WORDBEE in ROM as well as MICROWORLD BASIC and NETWORKING, the Personal Communicator is a powerful home computer ideal for virtually any home use from wordprocessing, spreadsheet analysis, eduction and even experimentation with the computer concepts as they evolve during the year. With the optional BEEMODEM you can send WORDBEE files across any telephone line to another computer. Bee the first on your block to have home telex!

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microbee Series 2 ADVANCED PERSONAL COMPUTER

Now for the first time in Australia: the microbee Series 2 Advanced Personal Computer with 400K disk drive. Then add bundled world class software such as CP/M, MICROSOFT BASIC, MULTIPLAN, WORDSTAR and a powerful library of support programs and you will have some idea as to why the microbee Series 2 Advanced Personal Computer is the most powerful and best price/performance computer in its class. What's more any existing microbee owner can convert his microbee to the Series 2 APC at any time.
The microbee Series 2 APC uses the popular Z80 microprocessor and runs standard CP/M so that users have access to the vast library of CP/M software available world wide. MICROSOFT BASIC is now supplied on disk. WORDSTAR, according to independent surveys now accounts for 50% of ALL word processing software now in use so the designers of the Series 2 APC decided to purchase the OEM rights for your benefit. MULTIPLAN is considered by many to be one of the most powerful spreadsheets yet produced for the microcomputer.

$1495

Cat. XE-4200
SINGLE 400K DISK DRIVE

$1795

DUAL 400K DISK DRIVE
Cat. XE-4300

MICROBEE

KITS—KITS—KITS—KITS—KITS—KITS—KITS

ETI 733 RTTY Convertor. Ref: ETI April 1983. This simple project allows you to hook up your MicroBee to a HF receiver and print radio teletype messages on a monitor screen. Listen to world news for FREE!!
Cat. KE-4654 — ONLY $17.95

ETI 649 MicroBee Light Pen. Ref: ETI August 1983. This simple, low cost device plugs into the Bee's 8 bit port. The "pen" gives you an entry into the world of light pens and interactive software.
Cat. KE-4656 — SHORTFORM $19.50
SPECIAL PROBE CASE TO SUIT (as specified in ETI article) Cat. HB-6400 — $19.95

ETI 668 MicroBee EPROM Programmer. Ref: ETI February 1983. This simple, low cost EPROM programmer just plugs into the Bee's I/O port and enables you to save programs in any of the 5 different common EPROMs available (2716, 2532, 2732, 2732A, 2764). Kit comes complete with 'Personality' plug and all IC sockets.
Cat. KE-4650 — $39.95

Parallel Interface Kit for the MicroBee. Includes 15 pin 'D' plug – add $15.00 if Centronics plug required.
Cat. KE-7017 — $15.00

BRILLIANT!

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KEY FEATURES
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* 1 YEAR WARRANTY
* NO ADJUSTABLE CIRCUITRY
* DESIGNED IN AUSTRALIA
* MADE IN AUSTRALIA

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Cat. YC-1350

UNBEATABLE VALUE

microbee SOFTWARE

DISASSEMBLER By Dreamcards

Some may say "Not another Disassembler". But this one has a difference. It allows you to set out where the data fields are so the computer is saving time, not rying to disassemble data. A program you shouldn't be without.
Cat. XE-6915 $15.00

CHEAPIE By Dreamcards

Two top quality programs for the price of one. The best Hangman we've seen yet on side A and a superb version of Battleship on side B. Both have excellent graphics.
Cat. XE-6920 $15.00

CANNIBALS AND MISSIONARIES

The old logic problem game of transferring 3 Cannibals and 3 Missionaries from one side of a river to the other in a boat that holds two. If there are more Cannibals than Missionaries on either side at any time the Cannibals revert to their favourite form of feeding.
Cat. XE-6925 $14.95

COMPOSER BEE

This is a very well written program for music. This program allows you to compose, play, edit, transpose as well as being able to load and save your music. A program that has been a long time in the writing and well worth buying.
Cat. XE-6930 $22.50

WORD ADVENTURE

A program with very good graphics using little characters to entice the user to think what word is either a synonym, antonym or homonym of the word they are showing. Everytime you get it wrong you are given more clues. After the clues run out you must face the Dragon when you must spell the word he is holding correctly before you.
Cat. XE-6935 $14.95

PONTOON

A quality fast moving card game where up to 6 players can play against the computer who is banker.
Cat. XE-6940 $14.95

MUSIC – B – MYTEK

MusicB is a music Composer/Editor that lets you create and save music and sound effects with a flexibility that makes chopsticks of the Basic PLAY command. MusicB is a great way to learn and play music! Comprehensive instructions are included.
Cat. XE-7010 $20.00

TRSBEE – MYTEK

TRSBEE is a package of three programs that loads TRS-80 Model 1 and 3 program tapes into the MicroBee without any additional hardware. Although some program editing will still be required prior to their running, the majority of program typing time is saved by TRSBEE. The first program loads TRS-80 BASIC programs into MicroWorld BASIC. Most prgrams may then be edited and run. The second program in the package loads any TRS-80 machine code file into MicroBee memory. The third program loads TRS-80 assembler files into the MicroBee EDITOR/ASSEMBLER. Any TRS-80 Model 1 or 3 tape may be loaded. TRSBEE opens up a whole new world of possible software on your MicroBee!
Cat. XE-7005 $30.00

HOUSEHOLD REGISTER

This program will simplify the task of determing the value of your home's contents for insurance purposes, as well as providing descriptions of all listed items in the event of their loss or destruction. Effects are catalogued by name, description and value. Nine separate rooms are provided, and up to 28 items may be listed in each.
Cat. XE-7000 $15.95

STAT PACK – STATISTICS

This program is a general purpose graph plotting, linear regression, line of best fit and correlation program. It features a t-test of significance for the correlation coefficient and, if no evidence of correlation is found, a determination of minimum sample size is performed.
Cat. XE-6999 $14.95

BASIC TUTORIAL–

Is a super teaching aid for any classroom Basic Tutorial is a set of 9 interactive exercises designed for teaching Basic to the computer novice. No previous knowledge is assumed. Basic Tutorial uses a unique double screen technique to display both the normal computer output and the tutorial exercises at the one time. This allows the student to use the MicroBee in the normal way, while the tutorial instructions appear in the lower half of the screen.
Cat. XE-6860 $20.00

MACHINE CODE TUTORIAL – MYTEK

Consists of 8 interactive exercises designed for teaching machine code programming and related topics as they apply to the MicroBee computer. Only a general knowledge of the BASIC language is assumed. Machine Code Tutorial is designed to bridge the gap bewteen BASIC programming and being able to understand and use typical Z80 manuals.
Cat. XE-6855 $25.00

BUDGET – SPREADSHEET

This program is designed to speed up and simplify the task of framing a usable financial budget. Applications range from personal or household to small business finances. A quality program.
Cat. XE-6850 $15.95

DECODE

Basic decoder and listing formatter

This programme will be an invaluable aid to any one taking first steps in understanding machine code or wants to expand their library of proven machine code routines. Decode will (a) print imbedded machine code routines fully and accurately (b) print all unprintable characters (c) provide a clearer, easier to read listing and send all output to a printer if so required. ED ASM is not required.
Cat. XE-6765 $15.95

DATABEE

This program is a well written data base management system that utilised the MicroBee to its fullest to provide a Data Management System similar to those found on larger and more expensive systems. This comes complete with large bound manual.
Cat. XE-6945 $19.95

ASTEROIDS PLUS – MYTEK

Asteroids Plus is one of the finest high resolution graphic arcade games available for the MicroBee computer. It features 3-D point by point resolution graphics, shields, sound effects, intelligent objects, guided missiles, black holes and a score board. If you enjoy playing computer games, you will be captivated by Asteroids Plus.
Cat. XE-6297 $22.50

BEEZ 80 – MYTEK

This secret code disassembler will disassemble any code sequence. Nothing is illegal. It will allow you to program with codes that no other disassembler can decipher!
Cat. XE-6298 $20.00

SPACE INVADERS

One of the most popular programmes ever released. This version was written especially for the MicroBee.
Cat. XE-6030 $14.95

FORTH

A new language for the MicroBee. Comes complete with interpreter on one side of the tape and supporting programs on the other side. As well as this it includes a very well written, bound manual.
Cat. XE-6965 $45.00

PSYCHOTEC By Dreamcards

Psychotec provides a striking example of artificial intelligence, allowing a dialogue in English between computer and operator, the computer playing the role of psychiatrist and the operator being a "patient" on the couch. Leaves other "similar" types for dead.
Cat. XE-6875 $15.95

MERLIN By Dreamcards

Merlin is a 32K adventure set in England during the dark ages. Your task is to search through the dark forest inhabited by robbers, outlaws and creatures with awesome magic powers to find a legendary sword. An excellent adventure.
Cat. XE-6870 $25.00

PROGRAMMING HINTS

Consists of a collection of modules which you may use to improve your own BASIC programs. They are all linked together under a menu driven display which allows you to RUN or LIST each module to see how they work.
Cat. XE-6895 $14.95

LOG – GENERAL PURPOSE INDEX

This program is designed to suit a wide range of records where indexing (and later searching) can be on one or two words, or on a string of up to 15 characters. Each record consists of its index heading, plus up to 12 lines of text. Each line can contain up to 41 characters.
Cat. XE-6890 $15.95

MINE DROP

You are a tank running around a maze gathering all the supplies you can. It sounds easy, but you have a guided missile hot on your trail. Your only defence is a remote controlled mine which you drop and explode at will. A very fast joystick or key controlled game.
Cat. XE-6960 $14.95

PENETRATOR

A low resolution graphic version of the popular game "Scrambler". You must defeat the rockets and bomb the radars in an effort to get to the next stage which is even harder. This game can be either controlled by a Joystick or by keys. Being in Lores graphics it is a very fast game. If you are bored with the same land pattern you can devise your own.
Cat. XE-6955 $19.95

SPACE PATROL

A lot like Penetrator but in high resolution graphics. You must battle your way through the various stages where at the last stage you have four chances of blowing up a neutron bomb shelter. If you are successful, the next round is a lot harder.
Cat. XE-6950 $16.95

METEOR RESCUE – MYTEK

Your mission is to rescue stranded astronauts. You are the commander of the Landing Module docked in space with the mother ship. It is your responsibility to guide the landing module through a meteor field, down to the surface of the planet, to land safely on a landing pad. An astronaut will then run to your landing module and you will blast off. You must use your lasers if necessary and dock with the mother ship again. A total of six astronauts must be shuffled to the mother ship.
Cat. XE-7020 $17.50

CORVILLE CASTLE

Corville Castle is an adventure which will take you to a far away place of mystic castles, fierce monsters and evil warlocks. You must enter the warlocks castle and find some dark secret which will help you to destroy the warlock. But remember, you only have until dusk.
Cat. XE-6285 $16.95

NEW SOFTWARE FOR JANUARY

KING KONG – from MYTEK

Just like the arcade game of a similar name. The game consists of several frames which you must complete to rescue your sweetheart from Kong. Excellent graphics and sound. Joystick compatible.
Cat. XE-7054 $20.00

CHOPPER – from MYTEK

A fast action packed game which must rate as one of Mytek's best. You have full control of a helicopter and you must fly over enemy lines to rescue your allies. Fast realistic graphics and excellent sound.
Cat. XE-7055 $20.00

SKETCH PAD

A program to help you design your own P.C.G. characters. Simple commands allow easy drawing of circles, polygons and boxes etc. These then can be dumped to tape to be used in a future program. Comes complete with manual.
Cat. XE-7056 $19.95

PRINTERS MATE

This program is two screen dump programs to suit CP80, MX80, DT80, 800P and FAX80 printers. One program is a screen dump utility while the other prints out memory contents in both hexidecimal and ASCII characters. A must for use with printers.
Cat. XE-7051 $17.50

DUO – ONE

Another two programs for the price of one from Dreamcards. One side has poker, and the other is Casino which is a three reel poker machine. Both use Hires graphics. Excellent value.
Cat. XE-7052 $15.95

EXTENDED TURTLE

A "Turtle" program which has been written by a teacher and has been several months in the writing. This is one of the best Turtle programs written and comes complete with a 40 page clearly written manual with many helpful drawings.
Cat. XE-7053 $29.50

DEFENDER – FROM MYTEK

This long awaited program is finally available. Defender needs no introduction. The Defender arcade game is one of the most popular ever produced and the Mytek version is brilliant, a rival for Asteroids Plus.
Cat. XE-7036 $22.50

DESTROYER

You are the UFO and you must destroy the enemy city buildings before you can land. You have no control over the UFO except for the three bombs on every pass you make over the city. But beware the UFO gets lower with every pass. Good graphics and sound.
Cat. XE-7048 $14.95

COULOMBS LAW

This program is another in the series of Physics simulations. The first part is a tutorial and the second is a simulation of the experiment.
Cat. XE-7049 $14.95

BACKGAMMON – FROM MYTEK

This game conforms exactly to that set down in the official rules of the International Backgammon Association, including the rules of doubling and scoring.
Cat. XE-7050 $17.50

POOLS AND LOTTO

Two programs to help make life easier for the Pools and Lotto enthusiast. The first program chooses your numbers for the week and the second program allows you to input your numbers into a program and when Lotto night arrives you can input the winning numbers and the computer will check your Lotto for you.
Cat. XE-7045 $14.95

WONDER WORDS

This program allows you to input 20 words and the computer will create a Wonder Word puzzle. This can be either sent to a printer or solved on the screen or let the computer solve it. Just the program for Wonder Word enthusiasts.
Cat. XE-7046 $14.95

GEO–TECH DRAWING

This is the first tape in a series to assist students in grasping the fundamentals of geometric and technical drawing. It uses good graphics with excellent explanations.
Cat. XE-7047 $14.95

Micronews

IBM unveils the PC Junior

The long-awaited smaller version of the IBM Personal Computer has been released in the United States. Known as the "Peanut" before its release, the new "PC Junior" is available in two versions, both much cheaper (in the US) than the PC.

Both versions are based on the Intel 8088 microprocessor and run MS PC-DOS 2.1 (not version 1.1 or 2.0, currently used by the IBM PC and its competitors). The basic version is expected to sell for around $US669 and includes 64K of RAM, of which 16K is dedicated to the screen, and 64K of ROM.

Two cartridge slots are provided for plug-in software and there are also ports for a printer, disk drive, modem and joysticks. A novel feature is the 62-key keyboard, which uses an infrared link rather than a connecting cable and so is truly detachable. Operation of the infrared link requires a direct line of sight to the logic unit, and an optional keyboard cable is available if required.

The enhanced version of the PC Junior includes 128K of RAM and a built-in half-height 13cm disk drive with a storage capacity of 360K. It is expected to sell for $US1,239. It also includes peripheral ports, expansion slots and the cordless keyboard.

The operating system requires 24K of RAM, and excluding the screen buffer and Basic storage area, only 18K of usable memory is available in the basic version of the Junior, or 82K in the enhanced version. The basic version handles only a 40 column text display and needs the 64K memory expansion module to handle 80 column displays.

Expansion capability is limited, with only three slots available to take a colour graphics display adapter, disk drive controller, and communications interface.

Because of the use of PC DOS 2.1, existing software for the IBM PC and XT will not run on the Junior without modification, but it is expected that as version 2.1 becomes available for the larger machines, the line will be completely software compatible, subject only to memory constraints.

Software available for the system at the time of launch includes the Easywriter 1.5 word processing program, Software Publishing Corporation's "PFS File and Report" system, Microsoft Basic, Logo, a home budgeting program and calendar and a number of games.

Some commentators believe that IBM will initially be unable to meet the demand for the PC Junior. Estimates of 1984 production range from 500,000 to 600,000, far short of likely demand, and before Christmas some dealers were restricted to as few as 10 units. Delivery delays for the larger PC are still around 6 to 8 weeks in some parts of the United States, and speculation is that IBM announced the Junior prematurely to ensure that prospective customers did not buy competitor's products during the Christmas season. Given the likely level of demand for the PC Junior and slow deliveries in the US, it will probably be a long time before the machine is available in Australia.

SME systems releases new multiuser processor

Australian computer manufacturer SME Systems Pty Ltd has released the Unicorn MPU-700, an advanced seven-user computer system claimed to be the fastest and most flexible multiprocessor system currently available.

Able to support up to seven users and four printers or other peripherals, the MPU-700 allows equal speed of access to each user by providing separate processors and memory for each application. Mass storage, printers, graphics displays and other peripherals are shared between all users and controlled by an additional "service processor".

A unique feature of the system is that it is capable of downloading different versions of CP/M to individual users. In this way both 8-bit and 16-bit software can be run simultaneously by Z80-based and 8086-based processors respectively. The processors operate in parallel, sharing the same system resources and data files.

A wide range of options is available, including extended I/O communications boards, A/D and D/A interfaces and high resolution colour graphics boards. Expansion facilities are also available to extend the MPU-700 to a 16 user system with up to 512MB of disk storage.

Although not widely known outside their own field SME have manufactured and sold over 300 systems during the past two years from its Unicorn and MPU-100 series, most of which have found their way into scientific and industrial sites "where power, speed and reliability are key factors" says SME Systems Managing Director Mike Pratt.

In addition to fully built-up systems SME also offer a range of 20 S-100 boards, including the latest release, a set of high resolution colour graphics display controller boards.

For further information contact SME Systems at 22 Queen St, Mitcham, Vic. 3132. Phone (03) 874 3666.

New hand held computer from MSI

MSI Data Australia Pty Ltd now has available a hand-held computer, said to be ideal for sales order entry, inventory, payroll reporting and other small scale data collection uses where small size and convenient calculator-like features are required.

The MSI-55 has a 12 character liquid crystal display and a 4K CMOS memory and uses wristwatch-type batteries. An acoustic telephone coupler is built-in, making the system completely self-contained.

For further information and details of other MSI models contact Graham Boulton, MSI Data Australia Pty Ltd, Cnr Welch Street and Pacific Highway, Underwood, Qld, 4119. Phone (07) 341 1551.

TI user groups going strong

Texas Instruments' announcement that it is discontinuing production of the TI-99/4A and getting out of the home computer business has not fazed Shane Anderson, the national co-ordinator of TI-99/4A user groups. Along with their withdrawal from the market, TI has announced that third-party vendors will be permitted to supply software and peripherals for the unit, a turn-around which may give a new lease of life to the system.

TI users groups in Sydney are planning a full day workshop on the first Saturday of February, following the success of last year's effort. The group also publishes a comprehensive newsletter and maintains a software library and "Programmers Crisis Line" to provide assistance over the telephone.

While the all day workshop will be held in Sydney, TI-99/4A users groups are also in Brisbane, Canberra, Melbourne, Adelaide, Hobart and Perth. The Sydney group has the details, at PO Box 149, Pennant Hills, NSW, 2120.

Super-80 software and tutorials

Bemak Pty Ltd is a Canberra based supplier of software for the Super-80 computer, with a product range which includes games, programmer's utilities and a word processing program. The company is currently investigating the extent of interest in learning Z80 assembly language on the Super-80. If sufficient interest is shown Bemak plans to run a correspondence course next year to cover the ins and outs of Z80 programming.

In addition to software and the planned correspondence course Bemak has available information on overhauling and servicing the Super-80, which it will make available to customers free of charge.

For further information on software or for details of the proposed programming course contact Bemak Pty Ltd, PO Box 218, Belconnen, ACT, 2616.

Micronews

Problem-solving software

The Australian Industrial Research and Development Incentives Board (AIRDIB) has approved an application from Kingdom Pty Ltd of Ryde, NSW, for financial assistance to research and develop "a revolutionary new way of using a computer".

It is claimed that the new software, called "Orion", will have the ability to solve a wide range of numerical and logical problems without conventional programming.

Unlike software such as fourth generation languages and other program generating systems, Orion does not produce programs from a library of stored routines. The program is written in a standard computer language and operates to build up a solution based on a network of facts and rules which connect these facts.

The software allows models of a problem to be built from independent statements of known facts. The computer then determines the links and relationships between the known variables and if the model is complete, produces a numeric solution. If the model is incomplete the computer will indicate the deficiencies and accept "what if" questions to complete the model.

Sanyo launches IBM competitor

Sanyo Data Systems Pty Ltd launched its answer to the IBM PC last month. Called the MBC 555, the new machine is seen as a separate product from the company's range of business computers, and is described as a "true personal computer".

Features of the system include an 8088 processor and 128K bytes of memory, expandable on-board to 256K. Two 13cm disk drives are built in, providing 320K of storage, and high resolution (600 × 200) graphics are available using an optional high resolution video monitor.

"We see the MBC 555 as a real alternative to IBM's personal computer" said Mark Johnson, managing director of Sanyo Data Systems. "It is compatible with the IBM, yet offers the additional incentive of being half the cost of the IBM".

For further information contact Sanyo Data Systems Pty Ltd, 127 Walker St, North Sydney, NSW 2060. (02) 929 4644.

Non-volatile storage with the "Datasafe"

A new Australian company, JED Microprocessors Pty Ltd, has released their "DataSafe", a self-contained battery powered memory module which can be used with any computer, dedicated controller or data logging equipment.

The DataSafe consists of up to 64K bytes of low power CMOS RAM powered by a lithium battery and enclosed in a diecast metal box. Overall dimensions are 11.5 × 6 × 3cm and connection is by means of a 15-pin D-type connector. Three output lines and one input line carry enable signals and shift data into the store from the parallel port of any computer system.

Coupled with simple software routines the DataSafe can replace cassette tapes, EPROMs and bubble memories in any application which requires long-term storage of data. In a data logging application, for example, data can be read in over a period of weeks and then read out by plugging the unit into the parallel port of an office computer. Data can be maintained for over a year on battery power.

DataSafe units are available in 8, 16, 32 and 64K byte capacities, and a version is also available with two sockets to allow the transportation of 2764 EPROMs.

For further information contact JED Microprocessors Pty Ltd, PO Box 30, Boronia, Vic, 3155. Phone (03) 762 3308.

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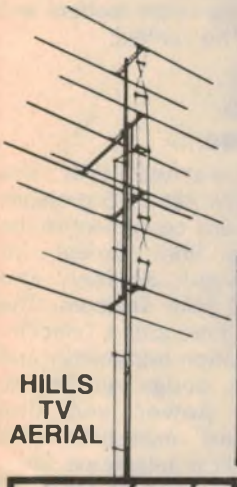

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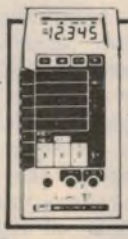

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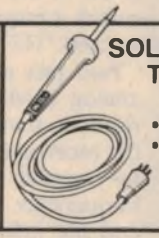

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SPECIFICATIONS:

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T.H.D.@ 1KHz	0.005% (MOS)	Slew rate	20V/μs (MOS)
	0.015% (HYB)		15V/μs (HYB)
I.D.	below the limit of the spectrum analyser B&K 2031.	Damping Factor better than 400, 8R @ 100Hz Input sensit. 500mV/100KR	

● No adjustment required ● No external components ● Only 5 wires to connect, input, output, common, ± power supply ● Fully imported with guaranteed performance.

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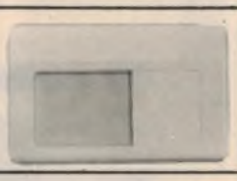

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SK1200	12 keys	$6.90
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Available in 4, 12 & 16 keys or any combinations with your own choice of colours (6) and symbols. Each kit contains the keyboard, the face plate, the overlay, keyboard terminal & an 8 pins connector (fits into a 16 pins IC socket).

Cat No.	Keys	
SK0011	4	$4.80
SK0021	12	$7.80
SK0031	16	$9.20

Colour patches $0.80 per pack
16 pcs per pack per colour
White, Silver, Grey,
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Face plate & Overlay available in different combinations of the three kit sets.

The best transformers available to match the power amp modules !!! **TOROIDAL TRANSFORMERS** as used in the ELEKTOR kits (see ELEKTOR Sept issue).

Standard 240VAC/50Hz primary; dual secondary voltage. 6+6, 9+9, 12+12, 15+15, 18+18, 22+22, 25+25, 30+30, 35+35, 40+40, 45+45, 50+50 & 55+55. Multiply the voltage by the current in rms to find the power required.

Cat. No.	Power	Unit price
MT0 series	15VA	$21.50
MT1 series	30VA	$24.50
MT2 series	50VA	$31.95
MT3 series	80VA	$33.95
MT4 series	120VA	$38.50

Cat. No.	Power	Unit price
MT5 series	160VA	$46.50
MT6 series	225VA	$56.50
MT7 series	300VA	$66.50
MT8 series	500VA	$90.50
MT9 series	625VA	$110.50

CAR BOOSTER AMP. MODULES ZH 3015 $37.50

30W/4R output. Extremely rugged both mech. and elect., just connect between existing hifi & car spks or from tape o/p, req. 8-18V dc.

FAST SPEED BIFET IC PRE AMP KT2800	$ 40.00
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WE STOCK ALTRONICS KITS, ETI & EA CIRCUIT BOARDS

Versatile multi-standard modem

Continued from page 96

The grommets supplied should be used for the mains and telephone cord entry points. The mains cord must be of the three wire type and should be securely anchored with a cable clamp to the base of the cabinet, and active, neutral and earth wires connected to the terminal block on the PCB.

Operation

Using the modem is simple, as the three front panel controls are normally set once and then disregarded.

The mode switch is a 12-position rotary type located on the left of the front panel. Nine positions select the desired operating mode, including the data rate, answer or originate mode, and CCITT or Bell standard. A 10th position provides for loopback testing of the 75bps back channel of the CCITT V.23 standard when used in conjunction with the "Test" switch.

The 11th position allows control of the operating mode from an external source if connections are made via the auxilliary connector on the PCB. The 12th position on the mode switch is not used.

The "Connect" switch determines when the modem is connected to the communications line. In the Manual position the modem is permanently connected, with the line looped back to other equipment via the PCB mounted line terminal block. The centre OFF position disables the connection logic, placing the modem permanently off-line. The AUTO position puts the modem under computer control, with a connection made by taking the DTR line high. For normal operation with a computer which drives the DTR line, the switch would normally be left in the AUTO position.

For normal operation the "Test" switch is left in the centre position. When the switch is moved from the centre position the red "TEST" LED will light.

Two test positions are available. The analog (ANL) test mode connects the modem transmitter output directly to the receiver input and forces the modem to transmit and receive on the same frequencies. It tests the local terminal and the link to and from the modem, since whatever is typed on the terminal will be sent directly back via the modem.

The Digital test position can only be used from the other end of the transmission line. It connects the received digital data back to the transmitter of the modem, which means that whatever data is received from the remote terminal will be transmitted back immediately. This mode can only be used with the 300bps standards as it naturally requires full duplex transmission on the line.

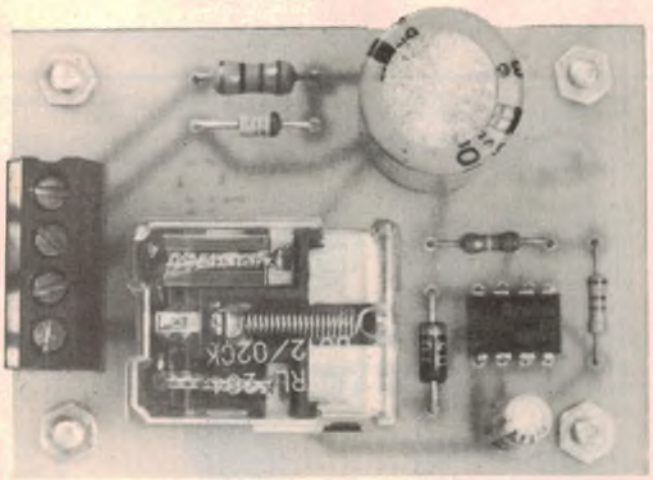
With the cooperation of the user at the other end of the communications link the correct operation of the modem and the line can easily be verified.

Connection to telephone lines

Readers are warned that the Telecommunications Act 1975 prohibits the connection of any equipment to the public telephone lines except for Telecom approved devices and equipment leased from Telecom. The modem described here uses a Telecom-approved line isolation transformer and follows relevant design guidelines, separating the power and line connections and matching the impedance of typical telephone lines. However, it is not a Telecom approved device.

Readers wishing to secure Telecom approval for the unit once built should contact the Regulatory Branch, Data Division, Telecom Australia Headquarters, 199 William St, Melbourne, for an application form and details of the documents which must be submitted with the application. A fee is payable for type approval testing.

Next month in Electronics Australia**



PLUS: Cricket stump microphone

Get the inside story on how TCN Channel 9 brings you the sounds of the cricket. As our story shows, you couldn't get much closer to the action!

** Although these articles have been prepared for publication, circumstances may change the final content. However, we will make every attempt to include the articles featured here.

◄ Ignition killer for cars

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

UHF television down-converter

Give your VHF-only television set a new lease of life with our UHF down-converter. This project can be continuously tuned to receive UHF transmissions from channels 21 to 63 and provides a converted output on any VHF channel from 0 to 11.

Telephone bell extender

For the hard of hearing, or simply for those who must be out of range of the 'phone, our new telephone bell extender provides a hard-to-ignore alert activated by the standard ringing tone.

Micronews

Simple terminal for telephone data

Interact Technology Pty Ltd has announced a new low cost computer access device known as "MIT" (for "Miniature Inquiry Terminal"). The portable unit is placed over the mouthpiece of a telephone and allows the user to communicate with a computer system using touch-tone dialling signals generated from a numeric keypad.

At the other end of the telephone line a computer equipped with a voice modem and appropriate software can decode the tones and send pre-recorded voice messages back to the user or ask for information to be entered for processing.

The MIT will sell for around $50 according to the manufacturers, with typical applications including credit card verification, telephone ordering, data collection and access to information services.

The MIT is a compact, waterproof unit and can operate for up to five years from internal batteries.

Interact Technology Pty Ltd is a market development company specialising in Australian electronic and computer

products. Directors Don Breen and Peter Whitelaw aim to fill a growing need in high technology industries by taking an innovative product from the design stage through to manufacturing and marketing, on a joint venture basis.

For further information on MIT or the company contact Peter Whitelaw (03) 299 2099.

News from the Clubs

● The Sydney Forth Group meets on the second Friday of each month at 7.00pm in Room LG16, Morven Brown Building, University of NSW. The group has begun publishing a newsletter which is included in the price of membership ($20 per year, $10 for students). Because of the diversity of hardware used by members priority has been given to developing a standard cassette interface to allow exchange of programs. A software library is available to members.

For further information contact Peter Treagle, 10 Bina Ave, Yowie Bay, 2228, or phone (02) 524 7490.

● A new computer users group has been formed for users of the Tandy MC-10 and other 6800/03-based systems. A special invitation is extended by the group to users of the Dream 6800 computer. For details write to Frank Rees, 27 King St, Boort, Victoria, enclosing a stamped, self-addressed envelope.

● Some micromputer users in Victoria, concerned with the support of the Osborne computer now that Osborne in Australia has ceased operation, have set up a users' group in Melbourne. The first meeting was held in December with the support of Direct Data, one of the distributors of the Osborne computer in Victoria.

Direct Data has collected a considerable amount of public domain software for the Osborne, plus spare parts and catalogs. There will be a charge for copying and the supply of disks to members of the users' group and a fee of $1.00 to cover the cost of each meeting.

For further information contact Alison West at Direct Data, PO Box 241, Vic, 3143. (03) 20 6949.

● A new group for users of the VZ 200 computer has been formed in Victoria. Plans are to publish a newsletter every six weeks and to set up a software library for the use of members.

Subscription to the group of $10 per year and further information is available from Luigi Chiodo, 24 Don St, Reservoir, Vic 3073.

MicroBee software from Tom Moffat

Hobart firm High-Tech Tasmania has released a new 4K MicroBee software package in EPROM. The 4K package containing 11 programs was written by Tom Moffat, an author well known to MicroBee users.

Although any of the programs can be called from BASIC, most of the package has been directed at machine code programmers. Included is a debugging routine that freezes a program in mid-run and displays the contents of all the Z-80's registers, and a memory dump facility that provides a hexadecimal listing of any memory area, to both the screen and a printer. A program called "BASCON" provides on-screen conversions among the decimal, hexadecimal, and binary number bases, a task usually done from tables in a book.

The largest program in the package, occupying just under half the EPROM, is a disassembler that converts pure machine code into assembly language and can also display ASCII-coded data sections of a program. The disassembler allows a user to study the workings of any machine language program. In addition the EPROM contains a program called "SCRDMP" which, when called from within a program, provides an exact copy of the MicroBee's screen to a C-ITOH printer, graphics and all.

For those who use the MicroBee's editor/assembler as a word processor, there are some programs to make the task easier. MANU sends control codes to a C-ITOH printer to set it up in manuscript format with a large left margin, and double spacing. WORDS provides a count of the words written into the EDASM's primary file. There's also a program to initialise the MicroBee for use with a parallel printer. The MicroBee does not do this itself except under BASIC.

Finally, three general use programs represent a "best of Tom Moffat" collection: The highly popular radioteletype decoding program, the fascimilie "picture plucker" program, and the MicroBee audio frequency counter.

The memory for the eleven programs, presented individually, would run to much more than 4K. The space saving is achieved by sharing subroutines among several programs. The package is available in a type 2532 EPROM for both the standard (2MHz) Microbee, and the IC model (3.375MHz). The cost, including postage and full instructions, is $50.00. Inquiries to High-Tech Tasmania, 39 Pillinger Drive, Fern Tree, Tasmania 7101.

BEST VALUE BY FAR!

the brilliant VZ-200

OVER 10,000 SOLD IN JUST A FEW MONTHS!

find out more!

look at this great range of educational, financial & games software

SPEED READING*
Ideal for improving reading and comprehension skills—written by an experienced Australian primary school teacher! Cat X-7257.

TYPING TEACHER
Even if you're a complete newcomer, this program will quickly get you familiar and confident with the keyboard. Cat X-7258.

ELEMENTARY GEOMETRY*
Not too strong on geometry? This program should help. It uses a friendly explanation/quiz approach. Cat X-7256.

STATISTICS 1
A great introduction to the basic principles of statistical analysis. Tests your knowledge with examples! Cat X-7251.

STATISTICS 2*
Following on from Stat. 1, this program views more advanced concepts (eg: the Chi square test). Cat X-7252.

MATRIX*
Working out mathematical matrices can be a real chore. Use this program to help develop your skills. Cat X-7253.

TENNIS/GOLF LESSON*
Challenge your computer to a game of tennis or golf. It plays by the rules, so you'll learn about the game. Cat X-7254.

Exciting New Games

POKER–Cat X-7233 SLOT MACHINE – Cat X-7234 BLACK JACK*–Cat X-7235 CIRCUS–Cat X-7236 BIORHYTHM–Cat X-7237 HORSE RACING*–Cat X-7238 VZ INVADERS–Cat X-7239 DYNASTY DERBY*–Cat X-7240 VZ GHOST HUNT–Cat X-7242 HOPPY–Cat X-7243 SUPER

...and lots more, too! Come on in— there's something for everyone! Just $12.50 EA

Sky-high action & thrills!

Amazing! Try your hand at Lear Jet* (Cat X-7241)...or play Air Traffic Controller* (Cat X-7249. It's fast, furious and lots of fun. **$29.95 EA**

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Are you a 'babe in the woods' when it comes to computing? Here's a book written just for you — in language you can understand! Cat B-7200.

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VZ-200 Technical Manual

Want to get the most from your VZ-200? This technical manual explains all the ins and outs, ups and downs. For the real computer enthusiast or beginner who wants to know more. Cat B-7204.

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Tried, trusted and true programs for your VZ-200. There's something for everyone — and remember, they're all written in BASIC so you can save them on cassette. That means you'll only have to key them in once, to use them anytime! Cat B-7202.

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NEW

Joystick Controllers

AND INTERFACE!

A pair of sturdy, super-responsive joysticks that add a whole new dimension to action games! Cat X-7212.

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DICK SMITH

Personal Computer

With all the personal computers around these days, you're probably wondering which one is the best value.

Before you buy any computer, take a look at three things: its power (or usefulness), its back-up and its price/future.

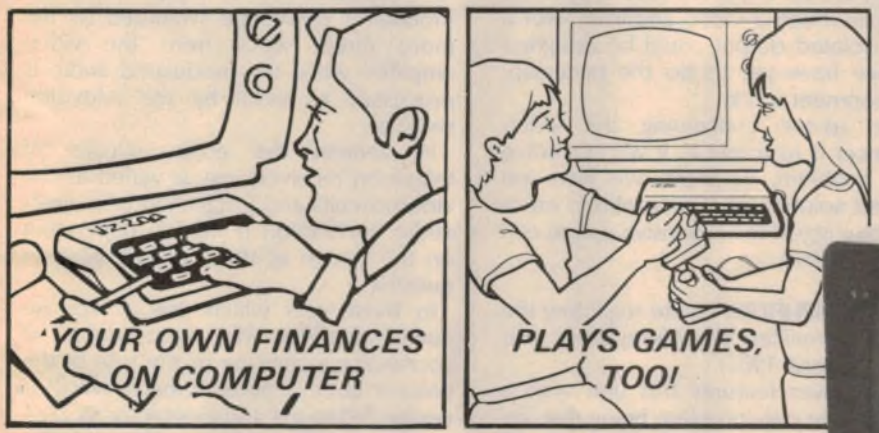
The Dick Smith VZ-200 features an 8K Microsoft BASIC, PLUS an additional 8K 'enhancements'. Compare that to the Tandy MC-10! And it has 8K user memory inbuilt: compare that to the VIC 20!

The Dick Smith VZ-200 is backed, of course, by the Dick Smith Electronics organisation. Complete technical and service facilities, program development, etc — all guaranteed.

The Dick Smith VZ-200 sells for only $199 — the first personal colour computer in Australia to sell below $200! There are many other computers now being unloaded around this figure — but be careful! Some companies have already gone broke and others may be drastically reducing prices just to clear dead stock! You could be buying an 'orphan'!

It's the computer for today! Don't miss your chance – snap one up for an amazing $199

NOW IS THE TIME TO BUY!



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Colour Monitor

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$389

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Use a Centronics type printer!

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Lets your VZ-200 talk to almost any Centronics-type printer. Top quality! Cat X-7210.

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Four-colour Printer/Plotter

Don't buy just a printer — here's a fantastic NEW 4-colour printer that's an X-Y plotter as well! Produce graphs, pie charts, printing in many different sizes and colours. It's all so easy to do, using simple commands in your BASIC programs! Cat X-7208

$299

DICK SMITH Electronics

See page 99 for address details.

DSE/A690/TH

Information centre

PAINTING TV ANTENNAS: I believe painting an antenna with metallic paint, as suggested in your article in the November issue, will be disastrous. I painted a yagi with some grey metallic paint and it has not worked since, as the metallic paint is an excellent radio shield. The solution is to use insulating lacquer which works well. (W.L., Thredbo, NSW.)

● Our reaction to your suggestion that metallic paint shields an antenna is that it is erroneous. Possibly your antenna did not work after you painted it but the paint probably had little to do with it. Possibly, the metallic paint shorted out the dipole connection and thereby rendered the unit ineffective but that is really not the fault of the paint.

VIDEO INTERFACE PROBLEMS: I own a Commodore 64 and a Philips 16CT 3010/75 TV and the results are not all I think they should be. My daughter has the same computer and a National TV with much superior results. All the adjustments possible will not bring mine up to the same standard. I was, therefore, very interested in the Video Amplifier project in the August issue. Is there not a way a floating connection can be made to a live chassis?

Then, in an American magazine, I saw an advert for a video enhancer which would enable your TV to give far superior results to a monitor, which brings me to my second question. In your opinion, would the Video Enhancer described in the October issue serve any useful purpose between my computer and TV?

If the answer is no in both cases, is there any other solution? If there is, would you consider making a project out of it? The 64 is, I'm told, both selling well and quite notorious for its fluttering graphics. (W.K., Dynnyrne, Tas.)

● The problems you are experiencing with your Commodore 64 computer probably stem from limitations within the computer's RF modulator. We assume that you have tried swapping modulators and that you have tried adjusting the fine tuning on your TV set. Although we haven't tried it, it may be worthwhile experimenting with alternative RF modulators.

How close together are the computer and the TV set? Try separating them as far as possible. It's just possible that the hum field from the computer could be affecting the TV.

Unfortunately there is no easy, safe way of using the EA Video Amplifer (August, 1983) with a live chassis TV set. If there was, we would have included this information in the article. Do not attempt this connection under any circumstances, otherwise you could get a nasty shock. There are several possible ways in which a video amplifier with a fully isolated output could be designed but we have yet to do the necessary development work.

Our advice concerning the video enhancer is to forget it. It will not solve your problem. In short, we have no present solution to your problem other than to suggest the expensive option of a video monitor.

VIDEO AMPLIFIERS: I write regarding the Video Amplifier for Computers and VCRs (August 1983).

Your cover features this unit with a VIC-20. The only problem being that, by itself, it won't work with the VIC-20 because of the need for a sound channel.

My experience in electronics is only in kit building and I intend to get someone to connect it to the TV for me. My question is how can sound from the VIC be connected to the TV? (B.F., Blayney, NSW.)

● While we haven't tried it, if you are using a television receiver modified for direct video entry, it should be possible to inject the audio signal via the VIC-20s RF modulator. The video from the modulator should be swamped by the more direct signal from the video amplifier while the modulated audio is processed as usual by the television receiver.

In general the audio circuits of television receivers are as varied as the video circuits and installation of a direct audio connection is heavily dependent on the design of the actual receiver in question.

In those sets which use a separate audio amplifier the best point of connection would be to the side of the volume control potentiometer which is connected to the audio detector. A 25μF electrolytic capacitor in series with the new audio input would probably be required to avoid upsetting the DC bias conditions of the audio amplifier section

Remote Dimmer is untouchable

I would appreciate some assistance with a problem I am having with the Touch-lamp Dimmer control (April 1983). I bought four kits, which all functioned perfectly, until I attached a remote unit to one of them to use as a two-way switch. All of a sudden, I had a "non-touch" dimmer, which could be activated by holding my hand some distance away from the touch plate. I have also experienced the light turning on and off by itself. Great fun when this happens at two o'clock in the morning.

I checked with the kit supplier (Jaycar) who checked over my work and said everything looked OK. I then proceeded to replace all the components in the remote unit, all to no avail. Then completely by mistake, I discovered that if I removed the aluminium touch plate from the face of the remote, and used the contact spring as a touch plate, the whole unit operated perfectly.

It seems that the unit is just oversensitive, but I am at a loss how to control it. During humid weather, it sometimes goes completely berserk, dimming up-down at will. (P.R., North Turramurra, 2074.)

● The problem of too much sensitivity can apply to both the remote control and the Touch-lamp Dimmer itself. It often occurs in houses of solid brick construction and in rooms which have metallic wallpaper. As we remarked in the April 1983 article, the polycarbonate plate tends to collect a greasy film which can cause false triggering.

In your case though it seems clear that the remote control circuit is too sensitive. This can be easily remedied by reducing the value of the 3.3MΩ resistor at the base of Q1. Try reducing the value to 1.5MΩ.

Similarly, if the Touch-lamp Dimmer itself is too sensitive, reduce the 1MΩ resistor at pin 5 of the S576A IC.

of the set.

In many cases, however, the audio section of the set is not independent of other circuit functions. Many modern sets, for example, use a combination sound IF/detector/volume control and audio amplifier integrated circuit. In these cases the volume control serves to vary a DC voltage which is fed into the internal volume control circuitry of the IC. Connecting a sound source to the volume control in this case would be useless without additional modifications to the receiver.

Perhaps the simplest solution to the problem would be to couple the audio output of the computer to a separate audio amplifier. Indeed the Commodore 64 user's manual suggests the use of the home hifi to obtain the best results from the computer's sound synthesiser.

Another approach would be to mount a small amplifier inside the television receiver and connect this to the TV speaker in place of the set's own audio output. This approach has the advantage of being independent of the audio circuitry of a particular set.

The computer depicted on the cover of the August 1983 issue was actually a Commodore 64.

TRANSISTOR ASSISTED IGNITION: I recently purchased a Transistor Assisted Ignition kit from Dick Smith Electronics. The unit seems to be working quite well but whenever it is connected the tacho reads about 300-400rpm. Dick Smith's technical department suggested that I write to you to try to get some information on rectifying this problem. The car is a 1971 4.2 Jaguar. (A.W., Campbelltown, NSW.)

● The rough diagram included with your letter seems to indicate that the tachometer works by monitoring the current drain of the ignition coil. Clearly there must be more to it than that since the current drain of the ignition system actually tends to reduce as the spark rate increases.

Supposing that the tachometer itself contains circuitry to ignore the DC current and monitor the voltage spikes, then it should work equally well with the Transistor Assisted Ignition, whether or not it has dwell extension. Your comment that the tacho reads 300-400rpm is also confusing. Does it read this all the time, regardless of engine speed? Can any reader throw light on this subject?

ADMIRAL SOUND SYSTEM: I have an Admiral solid state sound system (radio, tape recorder and turntable) model number STC 751. Unfortunately the power transformer and stepdown transformer in the tape recorder are blown. Could you please tell me if there is an Admiral agent where parts are available, or where I could get the circuit.

It appears the two transformers are connected in parallel, giving a 120V supply to the turntable and tape recorder drive motor. The main transformer has a centre tap primary winding with two secondary outputs; 15 and 6V, I think. The tape transformer has a 120V and I think a 6V output. The manufacturer's identification numbers on the transformers are as follows:

Main transformer ELT-1106 17-41.

Tape transformer TS1410104/7.0K3T.K.

Maybe you have details of compatible transformers or know someone that may. Failing all else, I may have to look at replacing the two drive motors. Any details you can give me on the above would be greatly appreciated. (L. Lomax, 58 O'Reilly Street, Mundingburra, Qld.)

● Unfortunately, we have no information on this company which has been out of business for many years. We have published your name and address in case one of our readers can help you.

EARTH LEAKAGE: I first read in a magazine (not EA) "The Safety Device . . . is a core balance earth leakage protection unit. It is intended to detect current leakages from the active or neutral line to the earth line of the house wiring. If the leakage current is above a certain low current (typically from 10 to 20mA) a circuit breaker will trip within the device."

I always thought that these core balance earth leakage units worked in a leakage to earth rather than on a leakage through the earth wire. Am I wrong? Does this mean that if, with one of these units connected, I touch a hot wire, and the appliance is not wired to earth, I'll get a handful of 240 volts? (J.R., Wahroonga, NSW.)

● The text you quote is confusing two different systems of mains fault protection. The first is the earth leakage circuit breaker which was arranged to sense the presence of a small leakage current to earth and thus break the circuit. These were to be found on the switchboard of many homes prior to the 1960s but they have now lost favour.

The second and more modern system is the core balance relay. This senses an imbalance between the active and neutral currents and by implication, a fault current to earth. With either of these units, if you touch the active wire you will certainly get a shock but the core balance relay should act fast enough to ensure that the power is removed before the shock becomes fatal.

Core balance relays are a very useful safety product. Ideally, every home should have one installed on the switchboard. Alternatively, you can protect a whole power circuit by installing the Clipsal core balance relay cum dual power point.

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ADDRESS: All requests to the Assistant Editor, "Electronics Australia", Box 163, Chippendale, 2008.

Notes & Errata

DUAL TRACE CRO ADAPTER (CDI, November 1983): There is an error in the circuit diagram. The 560Ω resistor should go to the base of Q11 and not to the anode of D3. Also, the base of Q11 and the anode of D3 should be linked. Capacitors C1 and C2, referred to in the text, are the 15pF capacitors in parallel with VR3 and VR4. Finally, Q13 should be labelled 2N4035.

TACHO/DWELL METER (July 1983, File 3/TM/18): On the circuit diagram the supply pins for IC2 have been transposed. Pin 4 should be the positive supply and pin 11 ground. The PCB overlay is correct.

50 & 25 YEARS AGO

"Electronics Australia" is one of the longest running technical publications in the world. We started as "Wireless Weekly" in August 1922 and became "Radio and Hobbies in Australia" in April 1939. The title was changed to "Radio, Television and Hobbies" in February 1955 and finally, to "Electronics Australia" in April 1965. Below we feature some items from past issues.

January 1934

From one amateur to another: Marconi paid a surprise visit to the amateur station at the Chicago Fair, inspected the equipment, and said it was a very fine bit of work. "No, no," says the young man who built it, "it was built by only an amateur." "Ah," says Marconi, "I'm only an amateur myself."

☆ ☆ ☆

"The more things change . . ." Better and brighter programs is the promise of every radio station for the year 1934.

We have the assurance of Major Conder that the national stations will continue the process of bringing to perfection "The Balanced Program." 2KY will continue "The Popular Program." 2UW will uphold "the excellence of their musical reputation." 2CH will specialise in "easy-listened-to music." 2UE will improve its fine sporting sessions, and so on.

☆ ☆ ☆

Cure for loneliness: The influence of wireless broadcasting upon residents of the Pacific Islands is revealed in a letter received this week by 4TO at Townsville. The writer, a storekeeper at Milne Bay, Papua, is a man of nearly 70. He says that loneliness used to be almost an ache, but wireless has altered things. "Take last night as an instance; at 5.59 I switched on the Radiola as usual to check the clock. From then on until bedtime there was not a moment of dullness. Contrast that with the time when one spent 350 evenings a year absolutely alone." The writer says that in a few months he will be retiring. He hopes to call at 4TO to see the "works" of a broadcasting station.

Toe the line or else: On October 26 the Nazis arrested Dr Hans Bredow. Dr Hans Bredow, less than three years ago, was one of the most respected men in Germany; he organised German broadcasting in 1923; he was a Secretary of State; in 1926 he left the Ministry to become Radio Commissioner, at the head of all German broadcasting; he was also chairman of the board of the German Broadcasting Company; he resigned his positions in February, 1933, saying (but more graciously) that he didn't feel inclined to dance to Adolf's tin whistle. Now they are charging him with "breaches of trust".

☆ ☆ ☆

An honour in advance: Marchese Marconi, on the occasion of his visit to Japan, has been presented with the Grand Cordon of the Order of the Rising Sun, by his Majesty, the Emperor.

January 1959

We're still waiting: The revelation that both RCA in America and EMI in England have perfected methods of modulating stereo programs on standard AM radio stations is of the greatest interest.

By using a double-sideband type of transmission most difficulties appear to have been solved. There is no disturbance to the AM station and its place in the broadcast band.

A receiver which can separate the two sidebands and thus extract the stereo effect will obviously be more complicated and costly than the normal type, but how much more is not yet clear. The standard receiver will not know the station is being used for stereo, for it will receive both sidebands as before. Thus the system will be quite compatible.

Our first passenger jet: Australian aviation history will be made when the first Boeing 707 jet stratoliner comes into service with Qantas Empire Airways this year. The Australian version will have a cruising speed of between 500 and 600mph and carry up to 120 passengers in perfect comfort.

Statistics on the aircraft give an appreciation of the staggering engineering problem in bringing it into physical form.

The overall weight, for example, of the 707 is 110 tons – against 60 tons for the Super Constellation. Speed is 550mph against 275mph for the Super Constellation.

Total fuel capacity is 14,500 imperial gallons stored in seven huge nylon and rubber bladder cells enclosed by the wing structure. A total of 609 gallons of water is carried to supply the water injection system which provides additional thrust during take-off.

☆ ☆ ☆

US exports atomic power: The first licence for export of a US manufactured power reactor has been issued by the Atomic Energy Commission.

The licence, dated November 6, 1958, authorised shipment of the reactor to Belgium for installation at the nuclear development centre at Mol, about 30 miles east of Antwerp. The reactor, fuelled by uranium with a maximum enrichment of 4.43% U-235, will have a thermal power output of 43,000 kilowatts and will produce 11,500 kilowatts of electricity for feeding into the Belgian electrical system through the switching station at the Mol steam plant.

☆ ☆ ☆

Nuclear plane? Aviation Week magazine's report that Russia was flying a nuclear-powered plane brought immediate reaction.

The United States had been doing development work on an atomic-powered plane for 13 years.

But the rate of progress had been held back by erratic financing of the project.

Aviation Week said the Russian plane had been flying for about two months.

It said the plane was 195ft long, had a wing span of 78ft, and weighed 150 tons.

The United States first used a nuclear reactor to provide heat to power a jet engine in January 1956.

EA marketplace EA marketplace

FOR SALE

VINTAGE RADIO VALVES: Huge range of new and unused many pre-war types trade enquiries welcome. Macarthur Radio-TV. Katoomba, NSW 2780. (047) 82 1722.

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ROBOTS: Hitchcock Robotics offers Kit robots and component parts. Interested? Send stamped SAE for catalog. Note, we have changed our address to PO Box 833, Ringwood, Vic 3134. We would also like to hear from people wishing to contribute or subscribe to a robotics newsletter.

OSCILLOSCOPE: National Portable Vp-5650A with dual trace DC-50MHz delayed sweep as new with all probes, manual, etc, $1000, Peter (099) 36 6035.

TRS 80: Colour computer. 32K, extended colour Basic, two Disk Drives, Joysticks. $1700 ono. Ring Michael on (03) 606 8362 or (03) 842 2004 (ah).

AMIDON FERROMAGNETIC CORES: Types to suit all receiver and transmitter applications. For data and price list send and A4 size SASE to: RJ & US Imports, P.O. Box 157, Mortdale, NSW, 2223.

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WANTED

CIRCUIT DIAGRAM: For an AWA radiola 715c valve radio. Will pay good price. G. Brooker, (049) 63 4469.

RAY GILLETT, MELBOURNE: Radiola coils. Mechanic cannot raise you on number you gave us. 64438. Please phone Rogers 15 Morella Road, Mosman NSW. (02) 969 5768. Urgent.

Rhythm Generators. . .continued from p101

feeds its constant output signal to Q9, which is turned off under normal conditions. A positive input pulse will allow TR4 to conduct according to the envelope of the input pulse. This results in a sound similar to brushes and cymbals. In our example we have filtered the white noise slightly by introducing a .001μF capacitor in the output. For further experiments one can try inductors or RC networks to obtain the required effects.

Q6 and its components form a "ringing oscillator", the basic frequency of which is determined by C2 and the 22k resistors, according to the C2 values in the table. One such oscillator, with suitable value components, will be needed for each instrument to be simulated (bass drum, high conga, low conga, claves etc). The values of C3, shown in the table may be varied experimentally.

The output signals are fed to a preamplifier TQ7 and Q8 via trimpots, the latter allowing balancing of the relative volumes of each instrument.

Unlike the rhythm circuits, which can operate over a fairly wide range of supply voltage, the instrument simulators are rather more critical. They are best operated from a fixed supply voltage, such as 9V for battery operation, or 12V from a (preferably regulated) power supply.

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Telephone 290 3377.
DSE also has branches and resellers throughout Australia.

Jaycar Electronics
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Sydney 2000.
Telephone 29 2098.

115-117 Parramatta Road,
Concord, 2137.
Telephone 745 3077.

Radio Despatch Service,
869 George Street,
Sydney 2000.
Telephone 211 0816.

RCS Radio Pty Ltd,
651 Forest Road,
Bexley, NSW 2207.
Telephone: 587 3491

VIC.

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Telephone 489 8131.

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