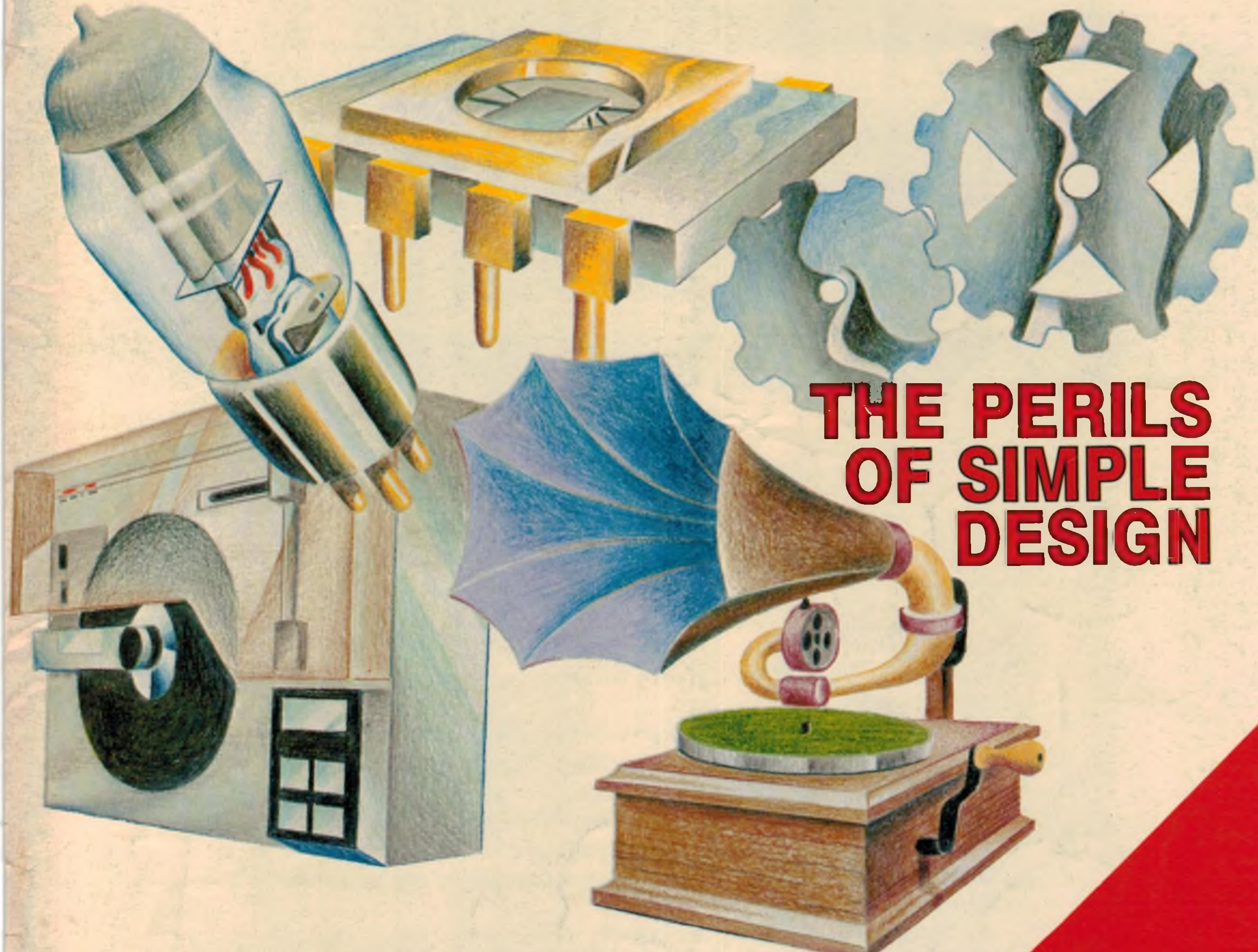
ELECTRONICS AUSTRALIA

VIDEO, HIFI & COMPUTERS

MAY, 1982

AUST $1.90* NZ $2.10



THE PERILS OF SIMPLE DESIGN

LCD TACHO / DWELL METER FOR CARS

HIGH QUALITY PHONO PREAMPLIFIER

LOW POWER 12 - 240V AC INVERTER

S - 100 PRINTER INTERFACE FOR THE SUPER - 80 COMPUTER

50-PRIZE AUSTRALIAN BEGINNING CONTEST

ELECTRONICS AUSTRALIA

Volume 44, No. 5
May, 1982

AUSTRALIA'S LARGEST SELLING ELECTRONICS MAGAZINE

Tacho/Dwell Meter

This tacho/dwell meter with LCD display is compatible with both conventional and electronic ignition systems, and can be easily fitted to most cars. Turn to page 42 for the details.

You can power mains appliances rated up to 40W or vary the speed of a turntable with this new 12/240V inverter. As a bonus, the unit will also work backwards as a trickle charger.

COMING NEXT MONTH! — Find out what's coming by turning to page 58.

On the cover

Which is best: a complex design or a simple design? Conventional wisdom dictates the latter, but Stephen Salter of the University of Edinburgh takes the opposing viewpoint. Don't miss his article "The Perils of Simple Design" starting on page 10. Cover artwork by Andrew Powell.

FEATURES

HIFI, VIDEO AND COMPUTERS

PROJECTS AND CIRCUITS

PERSONAL COMPUTERS

AMATEUR RADIO, CB SCENE, DX

COLUMNS

DEPARTMENTS

Editorial Viewpoint

EDITOR-IN-CHIEF
Neville Williams
M.I.R.E.E. (Aust.) (VK2XV)

EDITOR
Leo Simpson

ASSISTANT EDITOR
Greg Swain. B.Sc. (Hons. Sydney)

TECHNICAL PROJECTS
John Clarke. B.E. (Elect., NSWIT)
Peter Vernon. B.A. L.L.B. (NSW)
Paul de Noskowski
Jeff Skeen
Colin Dawson

GRAPHICS
Robert Flynn

PRODUCTION
Danny Hooper

SECRETARIAL
Pam Hilliar

ADVERTISING MANAGER
Selwyn Sayers

CIRCULATION MANAGER
Alan Parker

Technology in the outback . . .

On the cover and on page 10 of this issue, we feature an article which expresses support for modern technology, as distinct from older and perhaps simpler ways of doing things.

Whether or not we agree with the writer, the fact is that we find ourselves surrounded by consumer items involving ever higher (and more obscure) levels of technology: TV receivers, hifi systems, communications equipment, video games and computers and, of course, VCRs.

Such gear is impressive and convenient when it's working properly but quite enigmatic when it's not! Many of us, who would once have assumed responsibility for our own troubleshooting, now take the easy way out: we refer it back to the distributors, where they hopefully have service personnel trained to deal with the particular model.

And this is the kind of advice we give others who ask for it: don't fiddle with the gear yourself; don't trust it to someone without the appropriate experience; refer it back to the distributor, or their agent in your district.

In urban areas it works out well enough but how do consumers get on who live hundreds — even thousands — of kilometres from the brand-name service centre? From some of the reports in "Forum" on page 24, and a previous instalment of "Forum" in the February issue, the answer seems to be that consumers in those areas don't fare very well at all.

The cost and the hazards of long-distance transport deter them from sending the equipment to the nearest capital city and, as a first resort, they have to rely on their "local" serviceman, whatever that may mean in country terms. And the local serviceman faces the daunting task of troubleshooting a model on which he is unlikely to have had specialised training and for which he may not even have been able to obtain a manual!

Admittedly, the situation is unsatisfactory but it is also unavoidable, if we acknowledge the right of people who live in remote areas to share the modern conveniences that the rest of us enjoy. What is deplorable is the suspicion that comes through: that the problems of people and servicemen in remote areas are being aggravated by the laxity of manufacturers and distributors in the city; by letters not answered and parts not despatched.

It might be helpful if their managers could have on the desk an extension of the "bush telegraph". They might discover how their precious brand-name is loved or hated out around Bullamakanka!

Neville Williams

Registered by Australia Post — publication No. NBP0240.
Printed by Magazine Printers Pty Ltd. of Regent Street, Sydney and Masterprint Pty Ltd of Dubbo, NSW, for Magazine Promotions, of Regent St, Sydney.

Editorial Office
57 Regent St, Sydney 2008.
Phone (02) 699 3622 Telex 25027.
Postal Address: PO Box 163, Chippendale, 2008.

Advertising Offices
Sydney — 57 Regent St, Sydney 2008.
Phone (02) 699 3622 Telex 25027.
NSW Advertising Sales Manager: Narciso (Chit) Pimentel.
Melbourne — 392 Little Collins St. Melbourne 3000. Phone (03) 602 3033.
Representative: Mark Christian.
Adelaide — Charles F. Brown & Associates Ltd. 278 Halifax St, Adelaide, 5000.
Representative: Sandy Shaw (08) 267 4433.
Perth — 454 Murray Street, Perth 6000.
Representative: Ashley Croft (09) 21 8217.

Subscriptions
Subscription Dept, John Fairfax & Sons Ltd, GPO Box 506, Sydney 2001.
Enquiries: Phone (02) 20944, ext 2589.

Circulation Office
21 Morley Ave, Rosebery, Sydney 2018.
Phone (02) 663 3911.

Distribution
Distributed in NSW by Magazine Promotions, 57 Regent St, Sydney; in Victoria by Magazine Promotions, 392 Little Collins Street, Melbourne; in South Australia by Magazine Promotions, 101-105 Waymouth St, Adelaide; in Western Australia by Magazine Promotions, 454 Murray Street, Perth; in Queensland by Gordon and Gotch (A'asia) Ltd; in Tasmania by Ingle Distributors, 93 Macquarie St, Hobart; in New Zealand by Gordon and Gotch (NZ) Ltd, Adelaide Rd, Wellington.

News Highlights

Pilots learn to fly with mirrors

Where can pilots land a DC-10 in Tokyo, enter the air traffic pattern over San Diego or fly a Swedish fighter plane over the Baltic Sea, all without leaving the ground? Such experiences are commonplace at McDonnell Douglas Electronics' headquarters, and it's all done with mirrors.

Commercial pilots for 35 airlines in 22 countries and all US air force pilots now learn to fly on computer controlled flight simulators.

Centre of production for the flight simulators is the city of St Charles, in the US state of Missouri, home of McDonnell Douglas Aircraft Corporation. There, simulators made by Vital Visual Systems let pilots fly the world without leaving home.

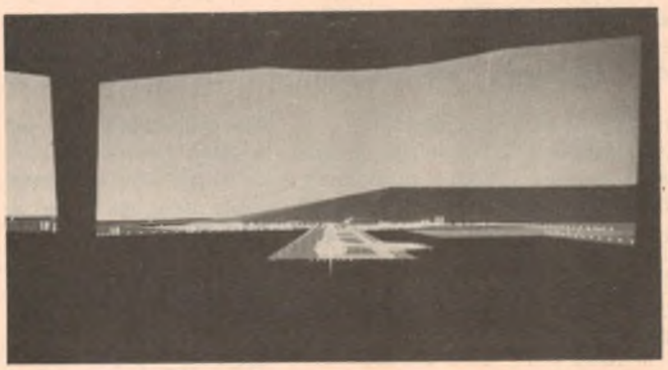
But the computer and screen alone is not enough. An image projected on a flat screen cannot convince the pilot that he is looking at hundreds of kilometres of terrain so that's where the mirrors come in. With the Vital simulators the pilot never looks directly at the screen. Instead he sees the video image reflected in a curved mirror. The mirrors complete the illusion begun by the computer, giving the impression of depth.

The simulators are built around precision, distortion-free mirrors made of acrylic plastic. A computer holds information on the topography and lighting patterns of the world's major airports, and can project these patterns on a video display, altering the view as the pilot in the simulator moves his controls.

The mirrors begin as unexciting pieces of clear plastic, some more than two metres square and up to 10cm thick. First they are trimmed to a circular shape and put in an oven where heat and pressure reform them into concave dishes – something like a contact lens made for a giant.

After polishing, the outer sections of the plastic form are cut away to produce a curved rectangular mirror. Pure aluminium is then applied in a vacuum chamber to create the reflective surface, followed by a protective coating.

The actual number of mirrors used in a simulator depends on the training task to be carried out. In many commercial aircraft simulators four mirrors are used – one for each of the cockpits two front and two quarter windows. Military aircraft simulators can require up to seven mirrors.



Pilot's eye view of Hong Kong airport at dusk – by computer.

FCC gives go-ahead for new forms of community television

The United States Federal Communications Commission (FCC) recently gave final approval to a new system of low-powered television that is expected to open the way for up to 3000 to 4000 new television stations across the US in the next three years.

Over the last four years the low-powered television concept has evolved from a modest attempt to bring more television services to rural and inner-city areas to a bold new approach of bringing published material and satellite distributed movies into the home.

Present plans call for the low power television stations to broadcast on as little as 10W, reaching an audience within a radius of 15 kilometres or so. Broadcasts would use the spectrum between the more powerful signals of established VHF and UHF sat stations. Some engineers have other plans which involve tying the stations together by satellite to reach vast audiences.

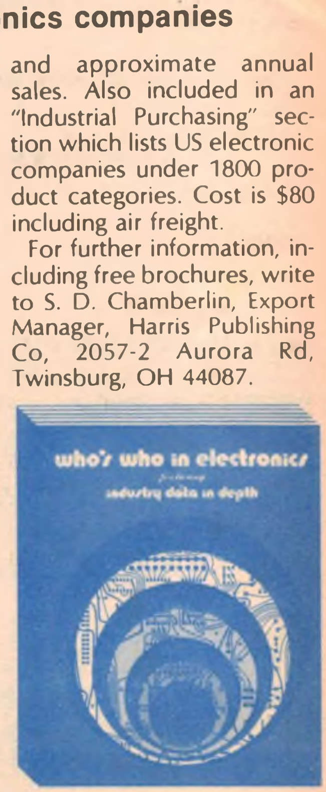
Around 6500 applications are already on file with the FCC, but the chief of the Commission's Broadcast Bureau, Mr Laurence Harris, says that he expects as many as 18,000 applications to be ultimately lodged. Giving approval to the concept, the FCC ruled that preference for licences would be given to applicants who represent minority groups, and those who promise to provide their communities with new types of television programs.

Directory of US electronics companies

Companies trading with firms in the United States will be interested in two new publications from Harris Publishing Company. The Electronic Industry Telephone Directory lists nearly 19,000 manufacturers, representatives and distributors of electronic components and equipment in the United States. The directory contains an alphabetical listing of company names and a purchasing section which lists companies under 3500 different product categories.

For more detailed information the "Who's Who in Electronics" lists over 13,000 manufacturers, distributors and representatives. There are three alphabetic sections and three geographic sections which contain detailed information on company personnel, products, size, and approximate annual sales. Also included in an "Industrial Purchasing" section which lists US electronic companies under 1800 product categories. Cost is $80 including air freight.

For further information, including free brochures, write to S. D. Chamberlin, Export Manager, Harris Publishing Co, 2057-2 Aurora Rd, Twinsburg, OH 44087.



ANZ banks on furniture for computer operators' health

Three years ago the ANZ bank headquarters in Melbourne had a problem with tenosynovitis, a muscular problem affecting people who make constant, repetitive movements. Those affected were operators in the bank's computer data entry section.

Motivated by Mr Herman Bettonvil, manager of the Data Entry Section, the bank sought advice from doctors, ergonomists and engineers to determine the cause of the problem and possible solutions. No clear cut answers emerged, but one obvious step in reducing the incidence of the disease was to improve the comfort of VDU operators.

First steps were to ensure correct seating and to make work tables adjustable to suit each operator. Data Decor, a Melbourne-based computer furniture specialist, produced furniture for evaluation. The test model was a basic design of a table divided into three sections, with the height and tilt of each section separately adjustable.

The sample tables were put into use and testing carried out by data entry staff within their work environment. With the advice of Data Decor representatives a final design was developed from the basic unit. According to Senior Manager of the Data Entry Section, Mr Neville Elvish, the staff worked out the necessary alterations for optimum comfort after about a month of use.

The left half of the work station table is fixed and the right-hand section divided in half, with both halves independently adjustable, moving up and down and tilting through all planes. All sections of the table include anti-glare surfaces, and the Honeywell terminals used by the bank have a moveable keyboard, linked to the VDU by a flexible cable.

By adapting the two sections of the table an operator can, for example, tilt the display screen up or down for reading comfort and tilt and turn the keyboard so that the forearms are resting on the tabletop.

Mr Elvish said that the Bank Employees Union had taken an interest in the staff problem. The Union produced an ergonomics report on the work stations which included many suggestions subsequently taken up by the bank. Because of staff involvement in the choice of configuration of the work stations employees have welcomed the changes.

Mr Elvish concludes "Although it is difficult to be precise about which measures had most effect on the problem, the changes have effectively improved the situation. No new cases of tenosynovitis have been reported in the past three months".

Nuclear power — radiation "negligible"

According to the newsletter of the Uranium Information Centre Ltd, US researchers testing areas around four nuclear power stations in the United States have found that the reactors contributed "negligible" amounts of radiation to the environment.

The researchers examined soil, vegetation and air samples around the Brown's Ferry plant in Alabama, Rancho Sec in California and the Zion and Quad Cities stations in Illinois. Of the radionuclides found around the stations, almost all originated from nuclear weapons tests fallout, and were in concentrations considerably below the permitted safety standards.

Researchers were able to distinguish between radiation from nuclear fallout and from nuclear power stations because the two have different ratios of plutonium and cesium isotopes. The study was conducted by the Battelle Pacific Northwest Laboratories.

Flat screens for TVs and computers

Flat panel displays, until recently used mostly for small displays in calculators and electronic watches are now more suitable for use in large computer and television displays thanks to recent developments.

In fact, a recent report from the market research firm International Resource Development predicts that the market for flat panel displays will pass $500 million by the end of the decade, compared to $50 million in 1981.

Reinforcing this view, IRD point out that four Japanese companies (Hitachi, Matsushita, Shinsu Seiki and Toshiba) have demonstrated prototype flat panel "pocket television" sets, and several of these are expected to come into quantity production soon. Meanwhile Sinclair Research in the UK has demonstrated a pocket television prototype which uses a modified cathode ray tube, with components rearranged to provide a flat profile.

IR camera sees through smoke

An electronic camera developed in Britain to enable firemen to see through smoke was demonstrated recently in Australia by a trade mission from Britain's Electronic Components Industry Association.

The English Electric Valve Company of Chelmsford, Essex, makes the Pyroelectric camera. The company says that the device can greatly reduce the time taken to cross smoke-filled areas of burning buildings, enabling rescue operations to be carried out quickly.

The camera works by converting infrared radiation to a video signal, which can be viewed on an integral monitor. It is lightweight and portable, and built to withstand conditions met in fire-fighting.

A laboratory version of the camera is also available, with uses in research, medical and other fields. The company's Australian agent is GEC Automation and Controls, 373 Horsley Rd, Milperra, NSW 2214.

Microelectronics conference for SA

The National Committee on Electronics and Telecommunications of the Institution of Engineers Australia will hold a conference in South Australia from May 12-14th on aspects of electronic chip technology.

Called Microelectronics '82, the conference will bring together leaders in integrated circuit processing, design, testing, packaging and architecture, with six invited papers to be presented by internationally recognised experts in their fields.

The conference is particularly timely. In October of last year a report submitted to the Government pressed for increased Australian activity in research and design of microelectronic devices, for both economic and strategic reasons. The CSIRO recently began its own VLSI program (Very Large Scale Integration) program, and many industries are applying the technology in products and manufacturing processes.

For more information contact Dr K. Eshraghian, Microelectronics '82, c/- The Institution of Engineers Australia, 11 Bagot Street, North Adelaide, SA, 5006.

NEWS HIGHLIGHTS

Portable computer for the blind

Computer terminals for the blind and partially sighted are in the news following the announcement in Britain of a Braille terminal and IBM's release of a talking add-on for its standard 3278 terminal.

Clarke and Smith Manufacturing Co Ltd of the UK has produced a computer in a briefcase, called "Brailink", which enables blind people to program computers and use data services and information banks. The machine operates as a normal computer terminal but also feeds back information to the user in Braille on a touch strip located above the keyboard. Up to 48 characters can be represented on the single line tactile strip.

Two miniature cassette recorders are built into the terminal for permanent storage of data and programs, and information on the cassette tapes can be read by other computers so that users can exchange data.

IBM introduced their "talking typewriter" some years ago, but have now extended the idea to computer terminals. The company now offers what it calls an "audio output feature" for its standard 3278 terminal. Using electronically synthesised speech the terminal enables users to hear any information which is displayed on the screen, including system status, special characters and text outputs.

The speech synthesiser is driven from the same area of memory as the display screen, while the terminal's keyboard has been expanded to include an additional 16 key keypad, similar to that of a push-button telephone, for control of the speech feature. Using the machine requires a skill at touchtyping, although for an untrained typist using the terminal the computer can be programmed to announce each letter after each keystroke.

Blind computer programmer Gary Robinson uses the Brailink terminal.

Three audio output formats can be selected. The computer can read out the contents of the screen with each word pronounced separately, but without punctuation, or can announce punctuation and spaces as they are found. In the third mode the computer spells out each word or group of characters.

Although IBM has said very little about the potential of the talking terminal it is obvious that sophisticated electronic message centres could be created, for use by both blind and sighted people. Terminals could store messages and speak them out on demand, perhaps by telephone.

Melbourne plans for "Third Wave"

Melbourne's planning and construction authority, the Melbourne Metropolitan Board of Works, is currently undertaking a study of the implications for town planning of predictions in Alvin Toffler's book "The Third Wave".

According to a report in Pacific Computer Weekly, the Board's researchers are looking at the prospect of sweeping changes in the location and layout of shopping, residential and industrial areas due to the widespread use of microcomputer networks.

Toffler's book is the latest and most popular examination of the ways in which networks of linked microprocessors will affect our lives. He predicts the growth of large numbers of small-scale manufacturers using flexible automated production equipment, growing automation in all industries and a great increase in the number of people working at home. Decentralisation of large organisations and "shopping by computer" are two other possible effects.

The Melbourne Metropolitan Board of Works is investigating planning for the future based on Toffler's work. For example, if the number of small industries does increase because of the cost efficiencies of automation, demand for industrial areas close to transport and residential areas can be expected to increase. At the same time large-scale concerns are expected to concentrate their operations on single sites to take advantage of integrated robotic production lines, automated warehousing and stock control, which will mean a bigger demand for large industrial sites close to the city.

Possibly, also, electronic shopping will become routine, with computers linked to home television sets allowing most items to be ordered from large automated warehouses on the fringes of the city. Traditional shopping centres would then become social and recreational centres rather than suppliers of the majority of household goods.

These are just some of the changes in living patterns which may be brought about by the "microcomputer revolution". While some may see the Melbourne Board's study as premature, it is encouraging that some at least are planning for the future.

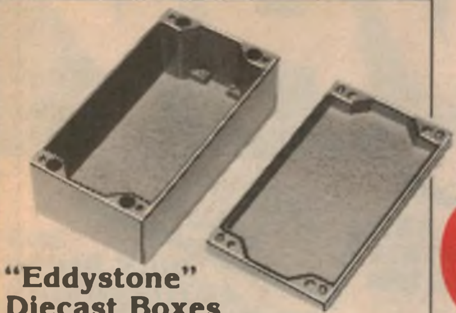
Business briefs

- Bill Edge's Electronic Agencies can supply printed circuit boards for all Electronics Australia projects. (That's right – *all* projects, right back to the time when we first began using PCBs for our designs). Call in at Electronic Agencies, 115-117 Parramatta Rd, Concord, NSW, or 123 York St, Sydney.

- Dick Smith Electronics has opened a store in Bondi Junction, Sydney. Situated at the corner of Oxford and Adelaide Streets, the store stocks kits, components and audio and computer equipment.

- G & D Circuits Pty Ltd is a PCB design and manufacturing plant in the Newcastle area. Call at Unit 6, 50 Medcalf St, Warners Bay, Newcastle, NSW, or write to PO Box 144, Cardiff, 2285 for details.

SEAL OF SATISFACTION
MAGRATH'S
WORLD OF ELECTRONICS



"Eddystone" Diecast Boxes

10% Off List All popular sizes

		Dimensions MM	Now $
6357P	Diecast	187.7×119.5×77.8	8.61
6827P	Diecast	187.7×119.5×52.4	7.16
6908P	Diecast	119.1× 93.6×52.4	4.50
7970P	Diecast	187.3×187.3×63.5	18.18
7134P	Diecast	111.1× 60.3×27.0	2.88
7969P	Diecast	92.1× 38.1×27.0	1.52
9732P	Diecast W/Prf	125.0× 80.0×45.0	12.83
9920P	Diecast W/Prf	220.0×120.0×66.0	32.53
9902M	Plastic	119.0× 93.7×52.3	2.92
9901M	Plastic	111.1× 60.3×27.0	2.52

MAGRATH'S 6-PACK SPECIALS

6 for the price of 5

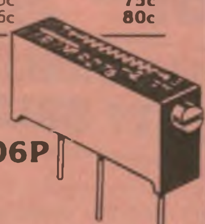
DIGITAL & LINEAR

6×4016B	$1.50
6×4066B	$2.40
6×4511B	$3.45
6×74LS00	$1.00
6×74LS14	$2.00
6×74LS90	$2.10
6×LM324	$2.10
6×LM340KC-12	$6.00
6×LM340T-5	$2.55
6×74C04	$1.00
6×74C02	$1.00

TANTALUM CAPACITORS

QUALITY KEMET RESIN DIPPED ALL 20% TOLERANCE

		NORMAL PRICE EACH	SPECIAL PRICE PER PACK OF 6
0.33 uFD	35V	6c	30c
0.47 uFD	35V	11c	55c
1.5 uFD	35V	12c	60c
3.3 uFD	35V	12c	60c
6.8 uFD	35V	25c	$1.25
10 uFD	35V	29c	$1.45
22 uFD	25V	81c	$4.05
4.7 uFD	20V	15c	75c
10 uFD	16V	16c	80c



BOURNS MODEL 3006P CERMET TRIMPOTS

15 TURN 1.25 WATT
ALL POPULAR VALUES

Pack No. 1 One of each value: 200 ohms, 1K, 5K, 20K, 100K, 500K — Price per pack $5.16

Pack No. 2 One of each value: 500 ohms, 2K, 10K, 50K, 200K, 1 MEG — Price per pack $5.16

TRIO TEST INSTRUMENTS

OSCILLOSCOPES

15MHz, 130mm Dual-Trace Triggered Sweep
CS-1560A11
$610.00 inc. probes.

10MHz, 130mm Dual-Trace Triggered Sweep
CS-1562A
$580.00 inc. probes.

15MHz, 75mm Dual-Trace Triggered Sweep, Portable
CS-1352
$699.00 inc. probes.
Battery extra.

DIGITAL MULTIMETER

DL703
$250.00

E SERIES

RF Signal Generator, 100kHz — 30MHz
SG-402
$112.00

CR Oscillator, 20Hz — 200kHz
AG202A
$149.00

Other TRIO Test Instruments plus all accessories available.

Fantastic new Panel Meter 0-1mA DC.

Easy to fit,
No cut-out needed.

Remember the last time you fitted an 0-1mA panel meter — hard cutting out the hole wasn't it?
Try our new flush mounting meter. Mounts easily with 2 screws or double sided adhesive pads — all supplied.

$8.46

Low Cost Video Monitor — not a converted TV set.

18 MHZ Video Bandwidth

Special At **$211**

The KG12CBLP is a green phosphor video monitor.

- Excellent resolution.
- Display format 80×24 lines.
- 1.0 volt peak-to-peak composite.
- Negative video input signal.
- Interfaces to most personal and small computer systems.

MINITOOL ELECTRONICS TOOLS

These tools have to be seen to be believed. Perfect for electronic work, modelling, carving — any job that requires a fine, detailed, professional finish.

Jig Saw, Obital Sander, Pistol Drill, Drill Stand, Power Supply — **All $37.00 each Tax exempt**

Angle Grinder, Flexible Shaft & Grindstick — **$47.00 each Tax exempt**

All accessories available

J.H. MAGRATH & Co.
208 Little Lonsdale Street, Melbourne, Vic., 3000.
Telephone: (03) 663 3731

BLEECON Push Pull Locking Audio Connectors

L 1904/3/FP	3 Pole, Plug	$3.17
L 1904/3/CSF	3 Pole Socket, Flush Mount	$3.36
L 1904/4/FP	4 Pole Plug	$3.27
L 1904/4/CSF	4 Pole Socket, Flush Mount	$3.50
L 1904/5/FP	5 Pole Plug	$3.40
L 1904/5/CSF	5 Pole Socket, Flush Mount	$3.66
L 1904/6/FP	6 Pole Plug	$4.02
L 1904/6/CSF	6 Pole Socket, Flush Mount	$4.09
L 1904/7/FP	7 Pole Plug	$4.24
L 1904/7/CSF	7 Pole Socket, Flush Mount	$4.30

C&K SWITCHES The best in the business.

PUSH BUTTON

Model Number			
8121	SPDT	Snap-acting	$2.10
8221	DPDT	Snap-acting	$3.05
8161	SPDT	Alternate action 6A	$1.80
8531	Mom.N.O.	Subminiature	$1.12
8533	Mom.N.O.	Subminiature	$1.12
8631	Mom.N.O.	Microminiature	$1.20

TOGGLE SWITCHES

7101 SPDT	$0.90
7103 SPDT	$1.35
7105 SPDT	$1.52
7107 SPDT	$1.62
7108 SPDT	$1.35
7201 DPDT	$1.40
7203 DPDT	$1.90
7205 DPDT	$2.35
7207 DPDT	$1.87
7208 DPDT	$1.85
7211 DPDT	$2.80
7301 3PDT	$3.10

GET YOUR 6809 SOFTWARE FROM MAGRATHS

MAGRATHS MONEY SAVERS

DIGITAL & LINEAR

See 6-Pack Specials for super prices on asterisked products.

4011B	.19c
* 4016B	.30c
4023B	.19c
4028B	.55c
* 4066B	.44c
* 4511B	.69c
4520B	.74c
7406	.20c
7414	.33c
74164	.48c
74365	.37c
* 74LS00	.20c
* 74LS14	.40c
74LS47	.72c
* 74LS90	.42c
74LS161	.53c
81LS95	.87c
81LS98	.88c
LM301A DIP	.35c
LM308 DIP	.49c
* LM324	.42c
LM339 DIP	.42c
* LM340KC-12	$1.20
* LM340T-5	.51c
LM340T-15	.60c
LM386N	.60c
LM555	.25c
LM741N DIP	.23c
LM741 DIP	.36c
* 74C04	.20c
* 74C02	.20c
74C89	$1.50
IN4002	.05c
IN4148	.04c

BONUS COUPON

Present this coupon for 5% discount on all purchases.

Name ....
Purchase amount $ ....
Authorised ....

Valid until June 30th, 1982 EA

POPULAR "D" CONNECTORS 25 WAY SUITABLE FOR COMPUTER INTERFACE -FROM MAGRATHS

Add Sales Tax if applicable
Prices valid until stock sold.
Prices subject to alteration

welcome here

WHY

Here's why you should insist on quality DICK SMITH SEMI'S

- ★ All top quality recognised brand names
- ★ Up to ⅓ the price of other suppliers. Save up to 66%.
- ★ Guaranteed Quality
- ★ No need to buy 10 when you only want one.
- ★ Quantity discounts
- ★ No job lots, end of run or below spec devices.
- ★ When you buy semiconductors from DS you buy with confidence.

TOP SELLERS

Cat No.	Description	1-9	10 up
Z-1300	DS547	.14	-
Z-1308	DS548	.14	-
Z-1319	DS549	.14	-
Z-1329	DS549c	.34	-
Z-1340	DS557	.17	-
Z-1348	DS558	.17	-
Z-1359	BC159	.17	-
Z-1443	BD139	.55	-
Z-1444	BD140	.55	-
Z-2145	2N3055	1.00	-
Z-2242	BC328	.20	.17
Z-2252	BC338	.35	.30
Z-3042	DSOA91	.20	.15
Z-3120	IN9141	.08	.06
Z-3202	IN4002	.10	-
Z-3204	IN4004	.15	-
Z-3207	IN4007	.20	.15
Z-3222	IN5404	.45	.35
Z-3531	6V8 Zener diode	.40	.30
Z-3547	15V Zener diode	.40	.30
Z-3228	IN5408	.50	.45
Z-4000	Flashing LED	.45	.40
Z-4010	Sml Red LED	.20	-
Z-4020	" green LED	.28	-
Z-4030	Lge red LED	.20	.10
Z-4032	" green LED	.30	.25
Z-4034	Yellow LED	.55	.45
Z-4040	Rect. red LED	45	.35
Z-4042	" green LED	45	.35
Z-4150	FND500	1.35	-
Z-4510	Triac SC141D	1.50	1.25
Z-4802	Double LDR	80	.70
Z-5601	4001 Nor gate	40	-
Z-5617	4017 Dec counter	1.20	-
Z-6105	UA 4136 quad amps	2.00	-
Z-6145	DS555 timer	40	35
Z-6382	LM741 op amp	40	-
Z-6545	7805	1.20	-
Z-6552	7812	1.20	-
Z-9310	4116 RAM	3.95	-

AMAZING FLASHING LED!

Amazing! Inside this standard size (5mm) red LED is a tiny microcircuit which causes it to flash! All you do is apply voltage. Think of the dozens of uses where a flashing warning is needed. Cat Z-4000

FANTASTIC VALUE!
SAVE 70%!

45¢

SINCLAIR ZX81 OWNERS

NEW MATRIX PRINTER

Designed exclusively for use with ZX81 the printer offers full alphanumerics across 32 columns. AND highly sophisticated graphics. Cat X-5004

ONLY $190

Paper to suit printer
5 rolls
Cat X-5005 **$24.50**

EXPANSION PACK

ONLY $150

Expand the ZX 81 to a massive 16K bytes — the maximum it can handle. Simply plug it onto the expansion edge connector at the back of your computer and away you go! Cat X-5002

POWER SUPPLY

This Sinclair ZX 81 Power Supply simply plugs into any 240V socket and gives an output of 9.5V DC @ 700mA. Cat X-5001

ONLY $17.50

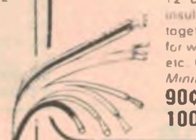
INCREDIBLE VALUE!

THE DICK SMITH AUTORANGING DIGITAL MULTIMETER

At last — a fantastic auto-ranging budget priced multimeter! This LCD Digital Multimeter is a portable 3½ digit compact-sized tester ideally suited for field, lab, bench, shop and home applications.
Features include: ★Overload protection ★Low battery voltage automatically detected and displayed ★Low cost ★Battery operated (takes two 1.5V batteries)
Cat Q-1446

AND ONLY $49.50

RAINBOW CABLE



12 colour coded strands of insulated conductor bonded together in a flat cable. Ideal for wiring looms or intercoms, etc. Cat W-2045
Minimum order 5 metres
90¢/m
100m or more 70¢/m

NOW A HIGH RESOLUTION MONITOR AT AN AFFORDABLE PRICE

With this monitor added to your computer system, you'll be able to use it for almost limitless applications such as accounts, statistics, medical, education, amusement etc. Features an anti-glare screen allowing for easier and sharper viewing. A must for the serious hobbyist or professional.
Cat X-1200

$349

NEW DICK SMITH SOLDER STATION

ONLY $59.50

UNBELIEVABLE QUANTITY SOLD!

Before you buy a soldering station, check 1) is the temperature continuously variable without changing the tip? 2) Do you have a meter readout of the temperatures? Why buy an iron without these useful features?

DON'T PAY OVER $70.00

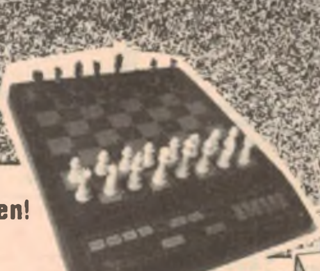
If you're serious about good soldering, there's only one way to do it — with a temperature controlled soldering iron. Until now, temperature controlled soldering irons have been expensive but Dick Smith has solved that problem! This superb soldering iron offers you the best quality at an unbelievably low price. Cat T-2000

27MHz 5 FOOT WHIP ANTENNA

We now have in stock this superb quality antenna just right for your CB or marine radio. Comes complete with PL 259 plug. Cat D-4074

$14.95

The best Chess Game we've seen! 6 LEVEL CHESS COMPUTER



Become a chess grandmaster with this amazing unit. Easy to master with six graduated levels of learning to increase your skills, and it even plays against itself. Because it doesn't play two games the same way, you can never predict what moves it will make. Forward and backward keys allow you to retrace moves and grasp general patterns. Cat Y-1260

INCLUDES CHESS MEN & POWER SUPPLY

ONLY $275

VALUE TRANSFORMERS

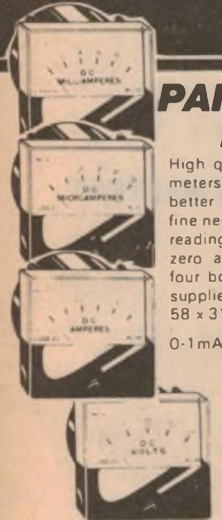
If your project is costing too much, try one of our quality transformers, specially made for us so we can bring you quality at a down to earth price.

Model M-2840 with a primary voltage of 240V AC, secondary voltage 9V CT current of 150mA, flying leads termination. Cat M-2840 **$3.90**

Model M-2155 with a primary voltage of 240V AC, secondary voltage 6.3, 7.5, 8.5, 9.5, 12.6, and 15, multi-tapped, current 1 amp, solder lug termination. Cat M-2155 **$5.90**

PAY MORE?

BUY AT DICK SMITH'S CONSISTENTLY LOW PRICES!



PANEL MOUNT METERS

High quality range of moving coil meters with full scale accuracy of better than 2%. All meters have a fine needle for optimum accuracy in reading and all have a mechanical zero adjustment. Mounting is by four bolts, with nuts and washers supplied. Dimensions: Scale area — 58 x 31mm Overall — 58 x 52mm

0-1mA (100 ohms) Cat. Q-2010

0-50uA (2400 ohms) Cat. Q-2020

0-50A (3 ohms shunt) Cat. Q-2030

0-20V DC (100 ohms) Cat. Q-2040

VALUE! $8.95 each 10 or more $7.95 each

METRIC KNOBS

An aluminimum knob with fine vertical lines. Superb on amplifiers, etc 40mm dia., 20mm deep. Cat. H-3846

$1.60 each 10 or more **$1.40 each**

Satin aluminium finish with knurled body for positive grip. 25mm dia., 17mm deep. Cat. H-3843

90c each 10 or more **80c each**

VALUE HEATSINKS

ROUND TO-5

Manufactured to exacting tolerances for a snug fit to give the best heat transfer. Cat. H-3412

55c each
10 or more 45c each

POWERFIN FOR TO-3

This TO-3 heatsink gives the greatest possible heat dissipation in the smallest possible space. Unique fin design. Cat. H-3400

$1.35 each
10 or more $1.20 ea

100MHz x 1/x 10 CRO PROBE

This versatile probe set will suit virtually any CRO and give you all the features of a probe set you would pay $$$ more for! Cat. Q-1245

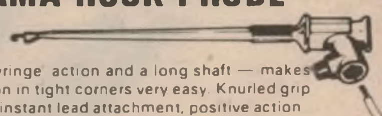
Working Voltage: 600V Pk (or 600V DC)

Includes: IC Adaptor tip — Spring clip — Insulating shroud — BNC Adaptor — Trimming tool — Plastic Wallet for safe keeping!

$35.50

GREAT VALUE!

MIYAMA HOOK PROBE

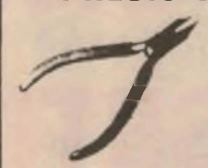


With a 'syringe' action and a long shaft — makes connection in tight corners very easy. Knurled grip screw for instant lead attachment, positive action and sure grip for all your test work.

RED Cat. W-4589 BLACK Cat. W-4590

WHY PAY MORE? **$2.50 each**

PRECISION CUTTERS



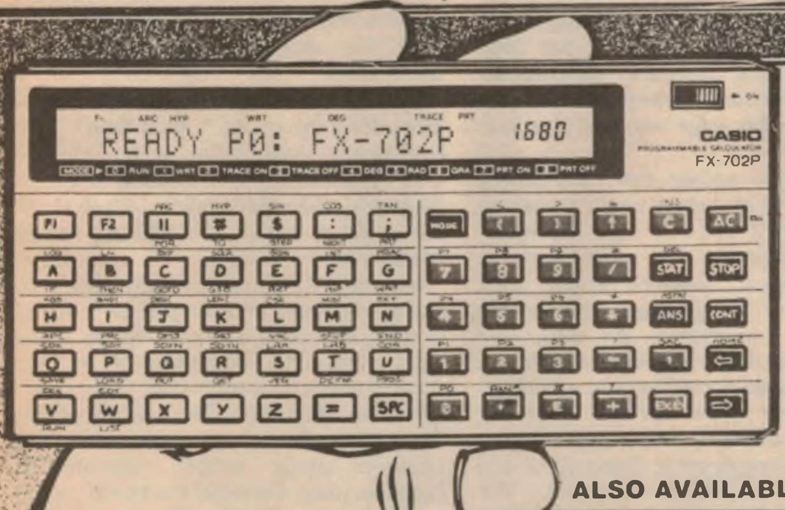
Highest quality cutters. Ideal for PC board, transistor and IC work. These cutters are spring loaded for ease of operation. Length 110mm, jaws 24mm. Cat. T-3310

$8.50

MINI LONG NOSE PLIERS

Drop forged steel, chrome plated finish with soft plastic handle grips. Long nose complete with in-built cutter. Length 100mm. Cat T-3562

$4.25



NOW a hand held computer at a DICK SMITH PRICE!

The all new Casio FX-702P was designed with the 'professional' in mind. It incorporates BASIC computer language and some great features, especially for its size! Features include: 7 program modes, multi-function keyboard, two function keys and the ability to program in multi-mode, 10 digit accuracy, 62 character input buffer, 9 error codes, 226 maximum memory. With all this going for it, the Casio FX-702P could well be our most popular portable computer ever! Why not drop into one of our stores, and see for yourself?! Cat. X-5100

UNBEATABLE VALUE **$259**

ALSO AVAILABLE:

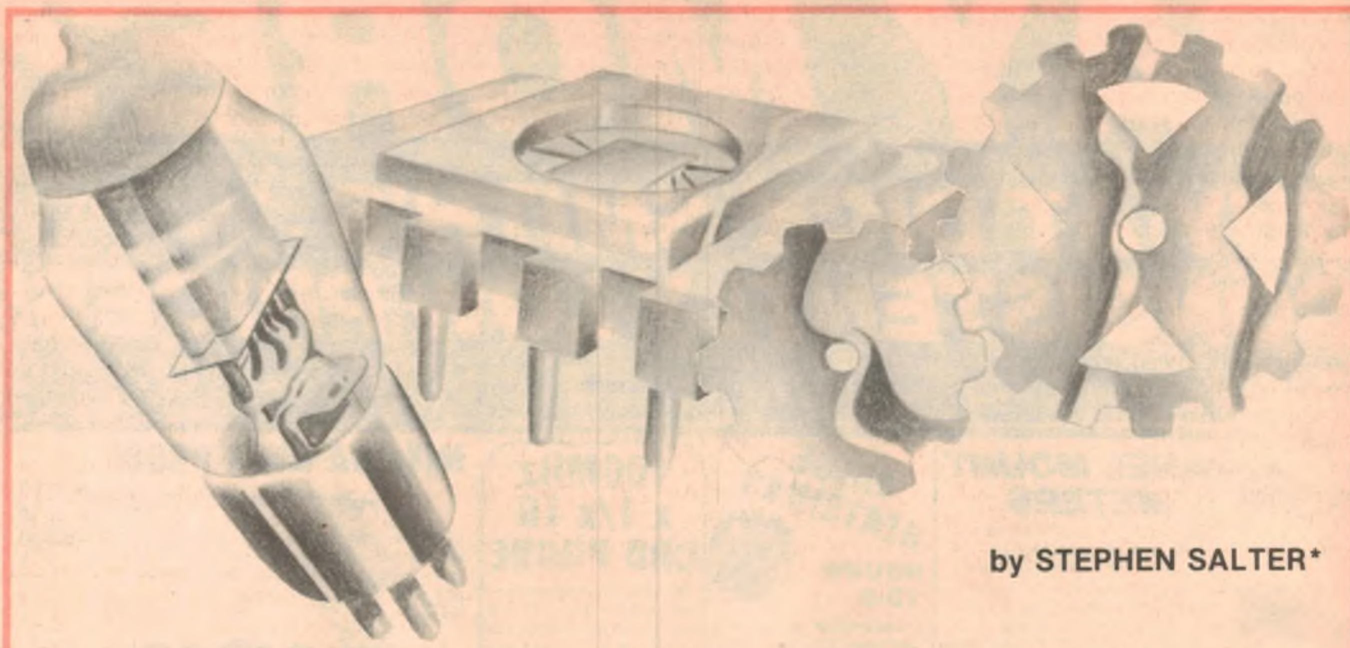
Cat. Q-3125 Cassette Interface $51.90
Cat. Q-3127 Printer $126.50

DICK SMITH Electronics

DSE/A241/LM

See our Address Page for address details

bankcard welcome here



by STEPHEN SALTER*

The perils of simple design

Simplicity has gained a false supremacy. Complicated devices work better, are easier to use, and are more reliable!

IF ALL ENGINEERS and scientists in a country accepted some monstrous fallacy – such as that force equalled mass times velocity – we would expect that the projects selected for research and the designs selected for production would suffer as a result. Engineering equipment would perform indifferently and the country would lose out to nations with a better grasp of such an important piece of physics.

I believe that many people, in all countries, suffer from a disadvantage of similar magnitude. If we ask a random selection of engineers, technical administrators or politicians whether they prefer a simple engineering design to a complicated one the answer is almost invariably on the side of simplicity. Most textbooks on design (except the remarkable series by Gordon Glegg, when a lecturer in engineering at the University of Cambridge) emphasise its importance. The BBC program *Tomorrow's World* uses it for everything. Inventors proudly claim simplicity for their new inventions. Selection committees base their decisions heavily on it. I want to convince this large majority that it is wrong.

Most people accept that engineering gets along much better when we agree on systems of units to measure quantities and develop the instruments to give numerical answers about their values. We can measure the tensile strength of a material or the value of a voltage and then calculate whether a part can sustain a load or pass a current. Unfortunately there are no units for measuring simplicity. We cannot scan a probe over engineering drawings or clip leads into a circuit test-point. We have instead to rely on subjective psychological judgements made by "experts". I ask the reader to imagine that we are trying to make a "simplicity meter" by collecting groups of subjects, posing them carefully chosen questions and then analysing the replies. I suggest that we confine our attention to measurements of the simplicity of the engineering solutions to problems rather than the simplicity of the problems themselves.

The first observation is that the meter gives different answers according to the background and training of the subjects. Civil engineers pale at computer circuit diagrams while electronics people shudder at the problems of building a bridge in the middle of winter.

Secondly, the simplicity meter gives different readings at different periods of history. A striking example of this came from a letter to the Institution of Electrical Engineers' journal *Electronics and Power* in May 1981. The author of this letter thought it *axiomatic* that any engineer prefer simple solutions to complex ones. He cited the bicycle as an instance of a simple solution. (Axioms are powerful things. They mean that you have shut your mind to all other possibilities.)

Let me make it clear that I am not attacking bicycles. Bicycles are superbly efficient and successful machines. Most people would agree that they are indeed simpler than cars and aeroplanes. But

* Stephen Salter is a reader in mechanical engineering at the University of Edinburgh.

bicycle technology is mature. Bicycles evolved during the last half of the 19th century to reach their present state of development by about 1905. To be successful, they needed the invention, development and production of ball bearings, sprockets, roller chains, the free-wheel and gear-changing mechanisms. The pneumatic tyre required advances in the processing of rubber. Lightweight frames needed thin-walled drawn steel tubing. (The most expensive bicycles today use tubing with carefully graded wall thickness to give extra strength near the ends.)

If you think that bicycles are simple, try building one with the tools and materials in a blacksmith's forge. These would be an accurate example of the resources available to the bicycle pioneers. The plain fact is that bicycles were *complicated* solutions to the problem of providing cheap personal transport to people who would otherwise have walked or ridden horses. They would have appeared totally unbelievable and impossibily complicated to the leading engineers of the preceding age.

Our meter readings of simplicity are also distorted with respect to the two sides of the front panel of a machine. For example, the first screw-cutting lathes came with a set of change wheels. The turner had to calculate the ratios needed for the pitch of his thread, select wheels with the suitable number of teeth and mount them on the machine. This arrangement lasted about a hundred years. A modern lathe has a group of levers or dials which select a wide range of gear ratios from a complicated enclosed box. The older system was undoubtedly simpler from the point of view of the lathe factory. But the modern arrangement is simpler from the point of view of the lathe operator, who makes quicker changes with fewer mistakes. Gears are cleaner, better lubricated and safer.

"A truly simple car would have a single cylinder engine with straight-through clutchless transmission."

The lathes in my workshop even have a clever gadget which prevents me engaging the lead screw nut except at the right moment and then disengages it for me when the exact length of thread has been cut. The modern lathe-person enjoys simplicity of operation thanks to a complicated mechanism with lots of moving parts hidden from sight. Simplicity on one side of the controls means complexity on the other.

This pattern is universal. We may believe that electronic circuit design has been simplified by the availability of cheap reliable microcircuits. A television manufacturer mounted a recent advertising campaign around this very point. But we must look at the whole scene. Inside the factory that makes the microcircuits that go into the "simplified" television set are extremely complicated machines with superb optical and mechanical accuracy. Materials are purified to an astonishing degree and extraordinary levels of cleanliness are necessary. The substitution of electronic parts for mechanical ones invariably requires large increases in *overall* complexity. This is done because it leads to cheapness, reliability and improved specifications. The overwhelming trend of modern technology is to simplify final use by increasing complexity everywhere else.

It begins to look as if our simplicity meter has some unfortunate characteristics. It gives different readings to different users. The readings change with time. They are even different when measurements are made in different stages of a chain of production and use. But perhaps with further design effort we can produce correcting networks and carefully controlled methods of statistical analysis which may produce a more satisfactory instrument. I ask you to imagine that we have done this and that now our selection committee can place a range of designs in rank order of simplicity. Let us see whether this rank order is a good pointer to ultimate performance. The advocates of simplicity will win their case if the majority of examples fulfil their predictions.

They will not do well if they choose, for instance, the development of firearms. We moved decisively away from muzzle-loading smooth-bore matchlocks to rifled barrels with automatic breech-loading. We are now adding telescopic sights and image intensifiers. At every stage firearms have pushed design and machine-tool technology to their limits as extra and more accurate moving parts are added.

What about photography? The first cameras were wooden boxes with elementary lenses. Exposures were made by removing the lens cap. Modern single-lens reflex cameras have over one hundred accurate moving parts. They have multi-element lenses with low *f*-numbers that are computer-designed to approach the diffraction limit of resolution. Molecular layer coatings provide superb light transmission. Many lenses have zooming and close focusing. Shutter speeds are controlled by measurements of light from the film during the actual exposure, and they span five orders of magnitude. Signals can be sent to terminate electronic flashes. Motorised wind-on and even automatic focusing are possible. What is even more extraordinary is that despite superior performance and inflation the cost of cameras has steadily fallen.

In music, the valveless bugle produces the trumpet, the harp becomes the piano. In telecommunications, the STD exchange replaces operators, and satellites replace undersea cables. Epoxy resins replace animal- and starch-based glues. Shakeproof washers are added to stop nuts coming loose. Heat treatment increases the hardness and strength of metals. Plywood gives better overall strength than natural wood. In navigation, we have moved from cross-staff and compass through sextant and chronometer to Decca, Loran, inertial platforms and Doppler radars. In arithmetic we move from Napier's bones and books of tables to the slide-rule and then to electronic calculators, in optics from the magnifying glass to the compound microscope and from the telescope to prismatic binoculars. In cars, crash gears give way to synchromesh and then to automatic transmission. Beam axles give way to independent suspension. Front wheel drive is superseding rear wheel drive. Fuel injection will replace the carburettor and electronic ignition the contact breaker. Overhead camshafts have beaten side-valves. Hydraulic servo-assisted brakes have swept away rod-actuated ones and we can expect anti-

ACADEMIC'S CALCULATORS:

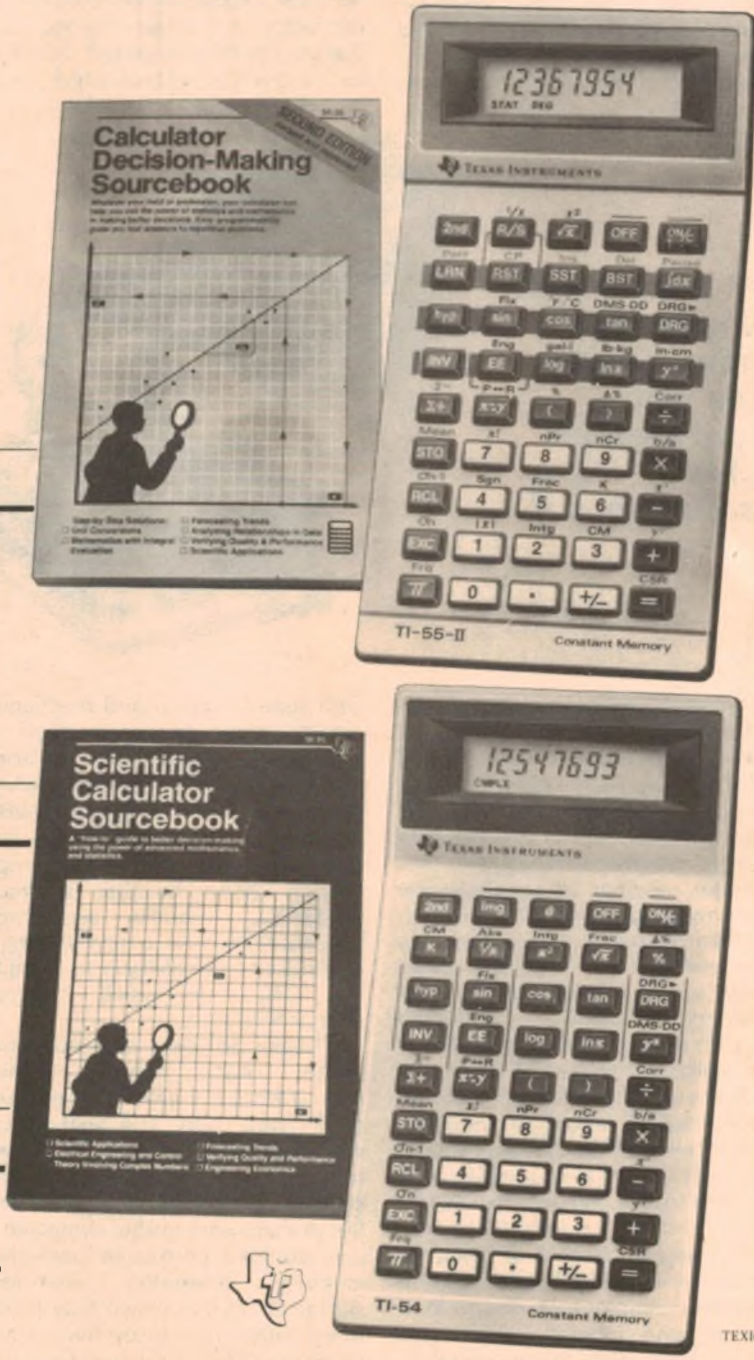
FROM TEXAS INSTRUMENTS-THE PEOPLE WHO INVENTED ELECTRONIC HANDHELD CALCULATORS

Students and graduates working in the scientific, statistical and engineering disciplines will find these new TI advanced scientific calculators an invaluable asset.

TI have developed them specifically to provide you with an economical, yet sophisticated calculator for academic or professional use.

Each comes with a comprehensive Sourcebook which will ensure you use either the TI-55-II or the TI-54 to their fullest capacity.

Check these main features and pick the TI scientific calculator that suits your requirements.



TI-55-II Suggested Retail $59.95

Advanced LCD Slide rule model with programming and statistics.

- ☐ Unit Conversions.
- ☐ Mathematics with Integral Evaluation.
- ☐ Forecasting Trends.
- ☐ Analysing Relationships.
- ☐ Verifying Quality and Performance.
- ☐ Scientific Applications.

TI-54 Suggested Retail $45.00

Advanced LCD scientific model for engineering and scientific professionals.

- ☐ Scientific Applications.
- ☐ Electrical Engineering and Control Theory involving Complex Numbers.
- ☐ Forecasting Trends.
- ☐ Verifying Quality and Performance.
- ☐ Engineering Economics.

Free Sourcebook with TI-55-II and TI-54 worth $6.95

Available at leading retailers.

TEXAS INSTRUMENTS
AUSTRALIA LIMITED
Where electronic innovation comes first

TEX10066

The perils of simple design . . .

locking devices to become widespread.

Despite such examples, a leading car manufacturer announced a recent model with the headline: "Simple is efficient". The advertisements went on to contradict the statement by listing all the attractive, new and complicated design features. A truly simple car would have a single cylinder engine with straight-through clutchless transmission, no differential or suspension, and nothing in the way of heaters, windscreen wipers or lights.

For a long time I have been provoking colleagues and acquaintances by asking them to produce examples of the success of simplicity in any field or human endeavour. Only three have emerged. I now extend the challenge to readers. There are only two rules. First, you must consider the whole sequence of events from the designer's drawing board through all the factories which produce component parts. Secondly, you must compare each design with those competing with it, those it supersedes and the later design which will supersede it.

Can it be that "simplicity", this complicated word, is changing its meaning? The Bible gives us a splendid view of English in the 17th century. In every single occurrence of the word *simplicity* the meaning is negative. It is taken to be the antonym of wisdom and subtlety — not at all what engineers should aim for (see *Proverbs* ch 1 v 4 and 22). We can trace later usages of the word in the *Oxford English Dictionary*, and again more than half the examples are pejorative.

Can we learn anything from current spoken language? I have for some time noted the use of the word in technical discussion. Readers may learn much from repeating this exercise. Five examples stand out.

My first (best given in a bored casual drawl) goes something like this: "Extending the fifth order hyperbolic convolution polynomial transforms to non-integral numbers of dimensions is basically quite simple." The speaker covers eight blackboards faster than his audience can blink. The translation is plain: "If I find this stuff simple while you don't I must be a very clever fellow, far above you lot and therefore long overdue for promotion".

A second usage arises when someone has been striving to understand what may be quite a complicated idea. If, after a struggle, insight suddenly arrives and if the idea is elegant, subtle or fresh, he may smile warmly, drive his fist into the palm of his hand, slap a thigh, and say "Of course. I see. How beautiful. It's so *simple*". He feels satisfaction at understanding the new concept and he needs to demonstrate his mastery to others. It would be embarrassing to ask why it has taken humanity so long to come up with the idea. I learned a better expression for this meaning from students at the Massachusetts Institute of Technology. It was "real neat". No verbal confusions over there.

A third case is frequent in technical advertising. The product being sold uses a higher level of technology than the customer has been used to. The advertiser needs to reassure him that the new device will not reveal his inferiority. "X x x pressure transducers are simple and reliable" is immediately contradicted in the next breath: "They use third generation silicon technology for the diaphragm element." I am all in favour of third-generation silicon but to call it simple is a lie. The advertiser is trying to conceal the bloody struggles of two generations.

When used of their work by inventors, *simple* means "Supporting this project won't cost you millions in R&D". This use shows that they are ignorant of the daunting tasks ahead and the ghastly concealed problems waiting to pounce. The thought is "If we call it simple often enough the gods will make it so". But they don't.

> **"The thought is: if we call it simple often enough the gods will make it so. But they don't."**

My final example of the technical use of the word comes in a last-ditch defence of an obsolete and inferior design challenged by a superior one: "These aluminium pressure die-castings look flashy enough and of course they are a bit lighter. But our old cast iron sand mouldings are much simpler. Do we really need the lighter design? The new plant is very expensive." Appeals to simplicity are being used to delay investment and hold back improvements in design. One can hear the dying echoes of the last words of the British motorcycle industry.

What can have led to this deplorable state of affairs in which a word can threaten our entire commercial future? Is it that there are sound principles which may be mistaken for simplicity? It is certainly good to use design features which save material or machining operations. It is certainly right to avoid tortuous drive routes, unnecessary parts, conflicting constraints and stress concentrations. We should be in favour of elegance, style, clever economies and downright cunning. It is wise to use mechanisms with modes of behaviour which are within your methods of mathematical analysis and materials with chemical interactions which you understand. But all such considerations can be examined with sharp quantitative arguments. We can weigh the metal, count the components, time the machining operations and calculate the stress distributions. We can select the best designs and further improve them by using precise numbers rather than nebulous value judgements or simplicity levels which serve only to stifle creative thought.

It is my belief that simplicity has won its false supremacy because of the restrictions in time and money that are so often placed on engineers by politicians. The ground work is cheaper and quicker for simple projects than for complicated ones. Nothing is more certain to cause failure than the lack of proper research development and testing. If time and money are fixed too low the simpler designs have an unfair advantage. The most complicated of them that can just be properly researched within the constraints will win. We can all think of cases where an ambitious project is given too little time or money, and fails through a trivial cause. The failure is wrongly attributed to its complexity. Simplicity gains an undeserved victory. But time and money can be restricted only locally. If an idea is good there will be another place and another time when engineers who are properly supported will make the idea succeed.

It is tempting to hope that correct understanding of these issues could lead to a renaissance in British engineering. Bright-eyed youngsters would flock to the profession. A wind of change would rid us of simpletons. Our shipyards would have to work double time to supply the vessels which, laden to the gunwhales, would carry advanced technology exports to the despairing Japanese. Our goods would once again be renowned for their design, reliability and longevity.

Reprinted by permission from "New Scientist", Vol 93 No. 1294. Copyright IPC Magazines 1982.

CELEBRATION SA

THE CELEBRATION IS STILL GOING ON AT OUR NEW

drum SYNTHESISER KIT

Original design from the UK magazine "Electronics and Music Maker" April 1981. Self-contained unit produces a variety of fixed and falling pitch effects. Trigger by tapping the unit itself or by striking a drum to which the unit is attached. The Jaycar "SYNTOM" comes complete with high quality pre-drilled moulded all ABS box 152 x 80 x 47mm with professional silk-screened front panel.
FEATURES: Decay from less than 0.1 second to several seconds, pitch control, sweep control and volume on/off.

As used by WARREN CANN of "ULTRAVOX"

$36.50

FABULOUS "MOTOROLA"

Hi-Power Piezo Horn Tweeters. The almost universal choice in high power P.A. or Hi-Fi applications today

KSN 1005A 50WRMS 4KHz-40KHz ONLY $15.00
KSN 1025A 100WRMS 2.4KHz-25KHz ONLY $24.00

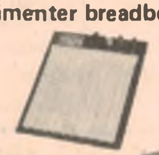
quality motorola

1982 SHOWBAG

Once again, the response this year has been absolutely fantastic!
Also once again we completely ran-out long before demand was exhausted. If you missed out we apologise — please remember to ALWAYS order early when you see a great bargain like this.

EXPERIMENTER BREADBOARDS

We stock a great range of experimenter breadboards.



WB-TH — total 200 holes	$8.95
WB-2N — total 840 holes	$12.95
WB-4N — total 1680 holes	$24.50
WB-6N — total 2420 holes	$39.50

Speakers Slashed

High Power PA speakers slashed!!!!!
Well respected Plessy/Foster brand.

12" 50W rms C300K05
Normally $69.50
This month $39.50
SAVE $30.00

15" 240W rms C380K50
Normally $245.00
Last Month $175.00
SAVE $100.00 This Month $145.00

Limited quantities

ETONE QUALITY

Remember! We have the best range of ETONE speakers in town — at the best prices.

Type No.	Size	Description	Power	Price
600	6"	Passive radiator	—	$18.50
605	6"	Midrange	120W(rms)	$32.00
608	6"	Woofer	80W(rms)	$34.55
108	10"	Woofer	50W(rms)	$35.00
518	12"	Woofer	100W(rms)	$49.00
		P.A. UNITS		
131	10"	Woofer	60W(rms)	$52.50
246	12"	Woofer, twin cone	100W(rms)	$79.00
267	12"	Woofer	150W(rms)	$133.00
801	15"	Woofer	200W(rms)	$218.00

WE ALSO CARRY HIGH POWER MIDRANGE AND HIGH FREQUENCY HORNS.

spring reverb

We have purchased a small quantity of high quality US-made spring reverb units. This 3-spring model is the one used in such amps as 'PEAVEY' etc. Grab a spare now or build a complete reverb system with free circuit supplied.

$34.50

AN ECONOMICAL MAINS FILTER!! 250VAC @ 3A

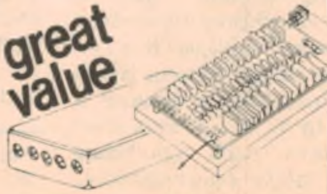
250V AC @ 3A. Insertion loss: line-to-line 20dB 0.8 - 30MHz. Line-to-ground 30dB 0.7-30MHz Ideal for computers, amps etc.

only **14.50**

Ioniser Kits

Save a fortune on our very popular Ioniser kits.
SHORT FORM Normally $24.50
SAVE $5.00 NOW ONLY $19.50
FULL KIT Normally $45.00
SAVE $5.50 NOW ONLY $39.50

great value



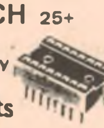
FLASHING LEDs

from **45¢** 10 up

You don't have to buy 2 from us!
1-9 49c each

SPECIAL 16 PIN IC SOCKET

OVER 50% OFF
FROM 18 CENTS EACH 25+



normally 40c
25 cents 1-9
16 pin I.C. sockets "CAMBION" BRAND
10 up 20c each
25+ 18c each

SOLDER WICK

Swiss made QUALITY
ROCK BOTTOM PRICES
You could pay $1.95 for a Taiwanese version of this 3mm wide x 1.7 metre long.

SAVE 30c ONLY **$1.65**

LE CONTINUED!!

ADDRESS. CALL IN NOW FOR GREAT SAVINGS!

EL-CHEAPO CRYSTALS

We have permanently reduced the price of our crystals.

FREQUENCY	HOLDER	OLD	NEW	COMMENTS
1.000MHz	HC-33	$16.50	$12.50	6800, 6500 uP
1.8432MHz	HC-33	$12.50	$9.50	Baudrate generator
2.000MHz	HC-33	$8.50	$7.50	6800, 6500 uP
3.000MHz	HC-18	$8.50	$7.50	8021 thru 8048
4.000MHz	HC-18	$7.50	$6.50	6802, 6808 etc.
4.433619MHz	HC-18	$7.50	$6.50	PAL TV subcarrier
4.9152MHz	HC-18	$7.50	$6.50	Standard clock
5.000MHz	HC-18	$6.50	$5.50	1802,3,TMS9985,40
8.867238MHz	HC-18	$7.50	$5.50	PAL TV 2xsubcarrier
10.000MHz	HC-18	$9.50	$9.50	Parallel res for Freq cntr
12.000MHz	HC-18	$6.50	$5.50	8086 etc.
16.000MHz	HC-18	$6.50	$5.50	several MPU's
20.000MHz	HC-18	$8.50	$7.50	808A, 822Y etc.

ALL crystals have low aging rate, tolerance 0.005% @ 25 degree C

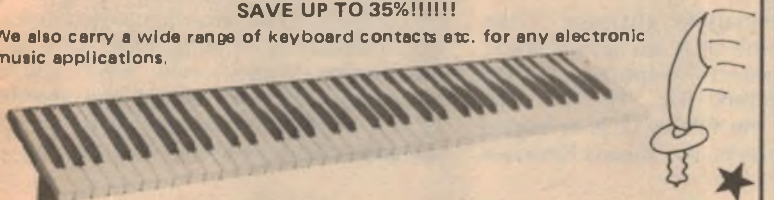
KEYBOARD BARGAINS

We are now direct importing keyboards from a major Italian manufacturer. Because there is now no middleman, we can pass on great savings!

SIZE	DESCRIPTION	PREVIOUS PRICE	NEW	SAVE
49 note	C-C Wedge Front Keys	$117.00	$85.00	$52.00
61 note	C-C Wedge Front Keys	$146.00	$95.00	$51.00
73 note	F-F Square (Piano) Front Keys	$169.50	$125.00	$44.50
88 note	A-F Square (Piano) Front Keys	$190.00	$175.00	$15.00

SAVE UP TO 35%!!!!!!

We also carry a wide range of keyboard contacts etc. for any electronic music applications.



FANTASTIC NEWS

Famous PIHER Brand Trimpots. PAY NO MORE for these European made sealed trimmer potentiometers. They are DUST SEALED not flimsy punched bakelite types that are not enclosed

CHECK OUR GREAT RANGE!!

TYPE	SIZE	RESISTANCE	PRICE 1-9	PRICE 10+
PT10V	10mm Horizontal mount Vertical adjust	100 ohms, 1K, 2K, 5K, 10K, 20K, 50K, 100K	$0.40	$0.35
PT10H	10mm Vertical mount Horizontal adjust	100, 200, 500 ohms, 1K, 2K, 5K, 10K, 20K, 50K, 100K, 200K, 500K	$0.40	$0.35
PT15LH	15mm Vertical mount Horizontal adjust	100, 200, 500 ohms, 1K, 2K, 5K, 10K, 20K, 50K, 100K, 200K, 500K, 1M, 2M	$0.45	$0.40

III NEW ADDRESS III

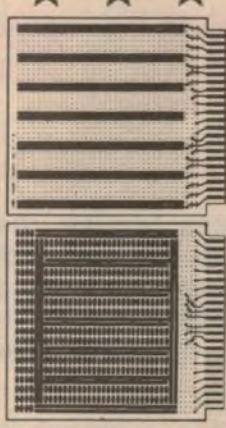
Jaycar 125 YORK ST SYDNEY 2000

Ph. 2646688 Telex 72293

Mail Orders To:
Box K-39 Haymarket 2000

SHOP HOURS
Mon-Fri 9 to 5.30
Sat 9 to 3
Thurs night to 8pm

Post and Packing charges
$5-$9.99 ($1) $10-$24.99 ($2)
$25-$49.99 ($3) $50-$99.99 ($4)
$100 up ($5.50)



PC BOARD (WIRE WRAP)

4 x 4.5 x 1/16 inch board made of glass coated EPOXY Laminate. Solder coated 1 oz. copper pads. Provision for a 22/44 two sided edge connector, with contacts on standard .156 spacing. Edge contacts are non-dedicated.

Contains a matrix of .040 in. diameter holes on .100 inch centers. The component side contains 76 two-hole pads that can accommodate any DIP size from 6-40 pins, as well as discrete components. Two independent bus systems are provided for voltage and ground on both sides of the board. In addition, the component side contains 14 individual busses running the full length of the board for complete wiring flexibility.

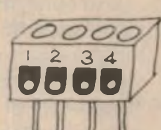
H-PCB-1 $12.50

(WIRE WRAP) TERMINAL BOARD

Pre punched board with 2,130 holes, .042 dia., on .0.1" x 0.1" hole matrix, plus corner mounting holes. Made of .062 thick glass coated epoxy laminate. Outside dimensions 6.3 x 3.94 inches (100 x 160mm). Convenient, economical for assembling circuit components in both experimental and production units.

PC-01 only $9.95

P.C.B. SCREW TERMINAL STRIPS

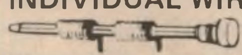


P.C.B. mount "Chocolate Block" type connectors 4 and 8 way

4 way $3.95
8 way $4.95

Pins are solder plated copper, 1mm diameter, on 5mm centres.

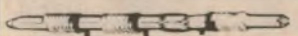
INDIVIDUAL WIRE—WRAP PINS



WWT-1 Single sided pin with head

12 cents each
10 cents each 100+

Both units feature:
- .025 (0.63) square post
- 3 level wire wrap
- Gold plating



WWT-4 Double sided terminal (wrap both sides)

10 cents each
8 cents each 100+

WIRESTRIPPER BARGAIN

Clamp action wirestrippers (the best type) REDUCED.
NORMALLY $11.00
THIS MONTH ONLY

$8.50

'TEX TOOL'

24 PIN Zero-Insertion Force I.C. Sockets. Great for E-PROM Burners etc.

$12.50

New colour LCDs and "Super Bright" LEDs

Advances in display electronics

Want a LED that's 10 times brighter than normal types? Or perhaps a LED that produces the same light output, but uses a tenth of the current? How about a bright green one, instead of the normal washed-out yellow-green? They will be available shortly in Australia courtesy of Stanley Electric Company.

Stanley Electric Company of Japan is little known in this country, although they could well have made all the light bulbs in your car. The company, founded in 1920, has grown to be one of the leaders in Japan's lighting industry, specialising in semiconductors, electric motor vehicle light bulbs and other lighting equipment. It is likely to become more well known, however, for its range of Light Emitting Diodes.

One of the latest products of the company is its "Super Bright" Light Emitting Diode (LED). Stanley Electric has received awards in Japan for an unprecedent continuous production technique for the Super Bright red LEDs using gallium aluminium arsenide (GaAlAs) and Super Bright pure green LEDs using gallium phosphide (GaP).

The red LEDs have a luminous intensity of 160mcd (millicandelas) at 20mA, while the green LEDs have an output of 80mcd at 20mA. Yellow and amber devices are also available, using gallium arsenite phosphide (GaAsP) to attain extreme brightness.

In contrast, standard LEDs have a luminous intensity of around 2 to 10mcd, rising to 20mcd for high efficiency types. Stanley LEDs are thus about six times brighter than conventional high efficiency types for the same power consumption.

Current-versus-brightness characteristics of the LEDs are almost linear; brightness is directly proportional to the operating current (Fig. 1). The high brightness of the Stanley LEDs at normal operating currents also means luminous intensity comparable to that of conventional LEDs for around one tenth of the power consumption. The new devices are thus ideal for low current circuits such as battery powered equipment.

Among LEDs presently marketed, those close to a green colour have low luminous intensities, while LEDs with a higher luminous intensity emit a yellowish green light. Stanley Electric's new high intensity pure green LED overcomes this deficiency, emitting a pure green colour (wavelength 555 nanometres) with a high brightness.

With the appearance of the pure green LED, high intensity LEDs can be used together with conventional red LEDs to further expand the applications of these versatile devices. Previously, where red and green LEDs were used as a pair of indicators (say, red for a warning and green for normal operation), the green LED of the pair had a low luminous intensity, introducing an unbalanced look to the display. Stanley's new green LEDs allow balanced pairs of red and green LEDs to be used, considerably expanding the applications of this type of display.

Characteristics		Symbol	Test Conditions	Red			Green			Yellow			Amber			Units
				Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	
Forward Voltage		V_F	$I_F = 20mA$		1.7	2.0		2.1	2.5		2.1	2.5		2.2	2.5	V
Luminous Intensity	EBR EBG EPY EAA	I_V	$I_F = 20mA$	80	160		50	80		80	160		60	90		mcd
	BR BG PY AA	I_V	$I_F = 20mA$	40	80		20	40		40	80		30	60		mcd
Peak Emission Wave Length		λ_P	$I_F = 20mA$		660			555			570			605		nm
Spectral Line Half Width		$\Delta\lambda$	$I_F = 20mA$		30			30			30			30		nm
Reverse Voltage		V_R	$I_F = 100\mu A$	4			4			4			4			V

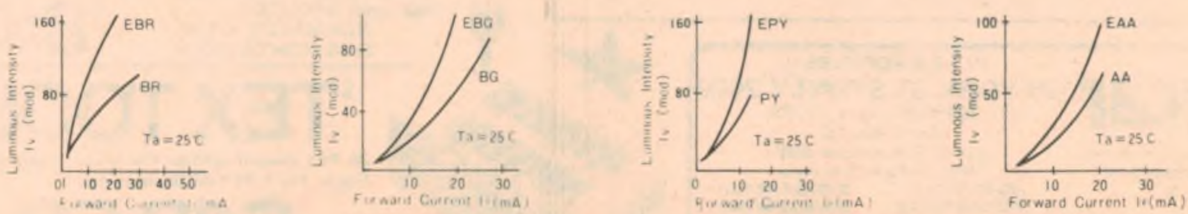
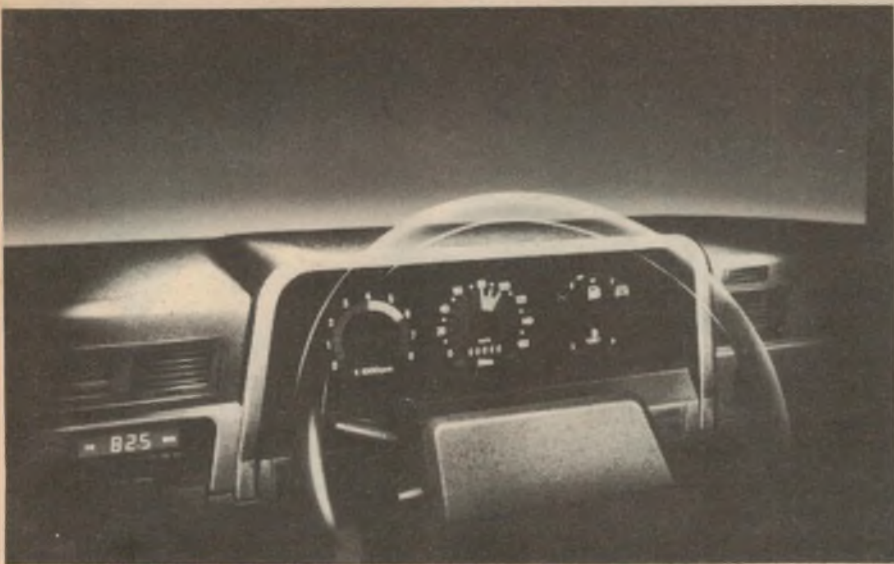
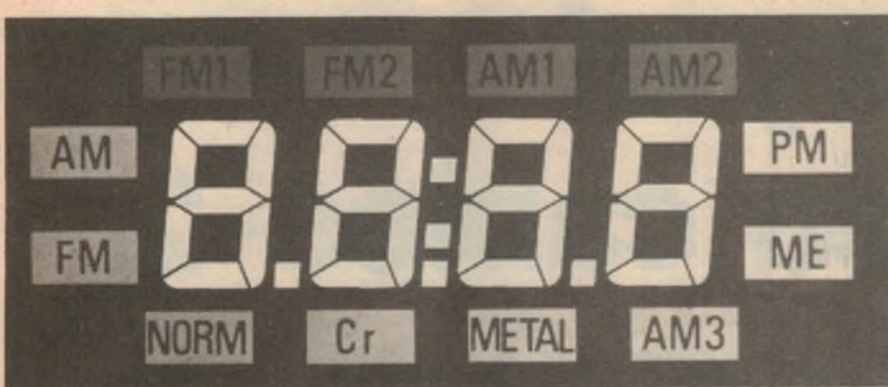


Fig. 1 Graphs above show luminous intensity against forward current. Note that two types are available in each colour – Extra Bright (EB) and Bright. "Super Bright" is the trade name. Electrical and optical characteristics are shown in table.



Dashboard of the future has multi-colour LCD speedometer, tacho and indicators.



Multi-purpose display, shown with all annunicators lit, comes in many colours.

Stanley LEDs are available in a low dome shape, triangular and rectangular formats and a narrow "chimney" shape as well as the standard round shape. Custom made devices can also be supplied (for large purchasers only, of course) which freely combine the range of colours, shapes and brightness levels to meet particular requirements.

Stanley Electric Company developed the new LEDs in conjunction with the Research Development Corporation of Japan, a government body. Development work concentrated on putting into practice a new method of semiconductor crystal growth called "continuous liquid-phase epitaxial technology" invented by Professor Jun-ichi Nishizawa of Tohoku University's Electrical Communications Laboratory.

The new process relies on the temperature difference between the upper and lower layers of the molten metal in which the crystal material is dissolved. Semiconductor materials continuously melt in the solvent metal on the high temperature side, and the temperature gradient within the solvent creates a slope in the concentration of materials through the solvent. The crystal material is transported to the low temperature side of the solvent by this concentration and temperature diffusion and is deposited on a substrate crystal.

Temperatures in the various sections of the crystal growing equipment remain constant over time. Densities of impurities and other parameters of the crystals can be kept constant during the growing process, as there is no longer the need to re-heat the crystal solution at each stage of the process. The constant temperature gradient means that crystals in various stages of growth can exist simultaneously in different parts of the solution, so many crystals can be grown simultaneously, all with the same closely controlled characteristics. The manufacturing process is thus well suited for mass production.

Applications of LEDs have expanded considerably in the past few years, as more and more colours and styles have become available. As displays, LEDs have the advantages of a long service life, high reliability and compactness. Stanley's high intensity LEDs and their continuous manufacturing process will simultaneously expand the applications for the devices while reducing costs.

At the moment they cost slightly more than conventional LEDs, although mass production is steadily reducing this price difference. Some 50 million of the new LEDs are being produced each month, although until recently they were sold only in Japan.

At first the "Super Bright" LEDs were used mainly for audio equipment and home electric appliances produced by other Japanese manufacturers, but they are being increasingly used for communications equipment, computers and industrial equipment. Australian manufacturers and hobbyists will soon have an opportunity to use the LEDs, as they are being imported by Soanar Electronics Pty Ltd and will shortly be available in the shops.

Liquid crystal displays

Encouraged by its success with LEDs, Stanley Electric Company is currently moving into the manufacture of liquid crystal displays (LCDs), using the same technology. The company recently set aside $10 million for a new plant at its Ina works in Japan. The new plant is scheduled to begin production of LCDs later this year.

As a late-comer to the LCD field, Stanley plans to concentrate on production of displays for automobiles and industrial equipment, rather than for watches and calculators, where competition is already strong. Current developments are aimed at the introduction of LCDs into computer terminals and car instrument displays.

Stanley's single colour LCDs use a process known as "guest-host" technology, in which two types of liquid crystal material are combined in the one display. Advantages of this process include a brighter display with a wider viewing angle and greater temperature stability.

Stanley Electric Co manufactures liquid crystal displays in various sizes from 20mm x 15mm to 280mm x 140mm. A variety of standard design patterns are available, including clock displays, radio tuner frequency displays, multimeter panels and numeric displays for industrial measuring instruments. A range of contrast-enhancing background colours are available, including black, blue, red, green, orange and brown. For large displays, Stanley makes single digits which can be up to 100mm high.

There are around 15 manufacturers of LCDs currently operating in Japan. The displays have great possibilities, with applications including automobile automotive electronics, computers and (possibly) flat screen television.

For the moment we can be content with Stanley LCDs in a range of vivid colours, said to "outshine all others".

HMS Agamemnon strikes heavy weather during the laying of the Atlantic cable of 1857.

The story of undersea cables-2

The history of telecommunications is full of stirring tales, but perhaps none more so than the story of the development of the globe-girdling network of cables which carry telegrams and the spoken word beneath the seas. Continued from last month, this article traces events up to the present.

One of the most heroic sagas of telecommunications history is found in the story of the first bridging of the Atlantic by the telegraph. It is a story of 10 years of continuous, courageous effort in the face of repeated failure, of fortunes being gambled on what must have seemed to most a lost cause, of men braving great physical dangers as well as public ridicule time and time again, and persisting until success was at last achieved.

The project brought together some of the most remarkable men of a remarkable era. The promoter of the scheme and the main driving force behind it was an American, Cyrus Field. Although only 34 years old when he first become fired with the ambition to link the USA and Britain by submarine telegraph, he had already retired from the New York business world with a comfortable fortune. In 1856, having been persuaded to buy up the assets of the bankrupt Newfoundland Electric Telegraph Company, he took passage to England in search of backers and practical support for his bold scheme. There he met the leading submarine cable experts of the day, including John Brett of Channel cable fame.

The odds against success were great and were made even greater by the haste with which the over-eager directors pushed the project forward. The first meeting of the Atlantic Telegraph Company took place at Liverpool on November 2, 1856. Within a few days, £350,000 had been subscribed, mostly by British investors. By the following August, 4000 kilometres of cable had been manufactured and loaded into two specially converted warships, one British and one American. No ship then afloat could have carried the whole cable. Laying, from the USS *Niagara*, steaming slowly westward from the coast of Ireland, lasted only a few days. After 480 kilometres the cable snapped, the end disappearing into the ocean depths.

After raising more capital, Field persuaded the British and American navies to assist him again the following June. This time, *Niagara* and the old wooden warship HMS *Agamemnon*, started in mid-Atlantic, splicing the ends of their respective halves of the cable together and steaming in opposite directions. Three times in two days they came together, spliced ends and commenced laying. Each time, the cable failed electrically, or parted. On the third day the break came after 300 kilometres had been paid out. Foiled once more, the fleet returned again to port.

Field, refusing to be beaten, asked his directors to back another attempt. Several resigned. But the ships were back in mid-Atlantic by July 29. This time, after many setbacks the operation ended successfully. On August 5, 1858, the first telegraph message crossed the Atlantic. From *Agamemnon*, at her anchorage in Valentia Bay, Ireland, to *Niagara*, anchored in Trinity Bay, Newfoundland. It reported that the shore end had been safely landed.

Although a further 10 days passed before the line handled any traffic, wild enthusiasm greeted the news of its completion. Queen Victoria telegraphed congratulations to President Buchanan. (It is recorded that transmission of this message took 16 hours.) Charles Bright, the Atlantic Telegraph Company's 26-year-old Chief Engineer, received a knighthood. A banquet in New York honoured Cyrus Field.

The rejoicing, however, proved to be premature. A message addressed to

Field from London on the very day of the banquet turned out to be the last one carried by the cable. The line died on September 1. Another eight years would pass before England and America communicated by telegraph once more.

Committee of Enquiry

A committee appointed jointly by the British Government and the Atlantic Telegraph Company conducted a lengthy enquiry into the whole problem of submarine cable failures. The Government had become involved since sinking £800,000 of public money into a cable laid through the Red Sea to India, which had also failed. The simple truth was that the engineers were having to build up their knowledge of this new technology by a process of trial and error.

Considering the primitive state of electrical science at that time, it is amazing that telegraphic messages had been transmitted across the Atlantic at all. Few of those who worked with electricity had more than a superficial understanding of its properties. No agreed units existed for measuring current, potential difference, or resistance. George Ohm had recently died (1854), bequeathing to the world his law on the constant relationship between these three characteristics of an electrical circuit but the law was not generally known. One of the "expert" witnesses who addressed the committee of enquiry stated that he "dissented entirely" from the "theory of circuits."

The American States, between 1861 and 1865, passed through the Civil War. Still, the indefatigable Cyrus Field pressed on, shuttling back and forth across the Atlantic, talking investors into putting up more money, directing the design and manufacture of a new cable, making shipping and naval support arrangements for a fourth expedition. Towards the end of June 1865 (a few weeks after the assassination of President Lincoln), the *Great Eastern* left England carrying another 4100 kilometre length of cable.

The Great Eastern

The great iron ship, with its 18m paddle wheels and 7m screw, was the biggest and most manoeuvrable ocean-going vessel afloat. Conversion of this leviathan into a cable layer rescued both its owners and the cable promoters from embarrassment. Since its launching, the ship had steadily lost money for a succession of owners. Yet its availability at this time came as a great stroke of luck for the Atlantic Telegraph Company. It was the only ship of the day which could have carried the complete cable. The necessity for bringing two ships together in mid-ocean to splice cable ends was thus removed.

Much had been learnt by the engineers. This 1865 cable was the heaviest so far made, more than 3cm thick and heavily armoured. Yet further lessons remained to be learnt. Further disappointments lay ahead.

Several electrical faults were found during paying out. Each one necessitated stopping the ship, laboriously manhandling the suspended cable around from the stern to the bow, turning the ship about and steaming in the reverse direction, heaving cable inboard until the fault had been brought in. Several times, a spike of iron was discovered embedded in the cable, arousing the suspicion that someone among the crew was a saboteur. Later, the spikes were found to be pieces of the armouring wire from the cable itself, broken off and driven through the insulation by the motion of the ship and the shifting of the heavy coils of cable in the storage tank.

With two-thirds of the distance covered and only 1000 kilometres left to go, a fault was observed. The procedure of picking up cable, by now regarded as routine, turned difficult as the huge ship began to veer in a wind. The cable snapped. The end sank from sight into two thousand fathoms of water.

Valiant efforts were made to raise the lost wire, using a five-pronged grapnel on an improvised 8 kilometre length of line. For nine days the ship drifted silently with the mid-ocean breeze, shifted position and drifted again, dragging the grapnel along the ocean bottom. Fogs and unfavourable winds caused long interruptions. Three times the long probe encountered something on the sea-bed, hauling in began – and the rope broke. After the third attempt, with insufficient rope left to reach bottom, Chief Engineer Canning admitted defeat. The expedition returned to Ireland.

A year later, in July 1866, *Great Eastern* and her escorts sailed westward once more carrying yet another improved cable, festooning it along the Atlantic bed as they went. Aboard the ship, sharing the nerve-wracking tension, as on all the earlier expeditions, were Cyrus Field and one of his co-directors, Professor William Thomson of Glasgow University (later to become Lord Kelvin). After a fortnight's voyage without incident, the great ship anchored in Trinity Bay, Newfoundland, on July 27. The end was hauled ashore at a place appropriately called Heart's Content. Two days later, New York and London were linked by wire and exchanging messages. This time, the operation had succeeded splendidly. Never again would the two sides of the North Atlantic be remote from one another.

The trans-Atlantic telegraph cable earned £1000 on its first day of operation. And it continued to operate for five years, with high efficiency, before it needed any repair. Soon, groups of British businessmen were forming companies to lay cables to the farthest corners of the earth. In 1870, the *Great Eastern* laid a cable across the Indian Ocean which linked Suez and Bombay. Further cables laid in that same year joined Madras (connected to Bombay by the Indian landline), Penang and Singapore. The British Australian Telegraph Company, formed in London in January 1870, put a cable between Singapore and Batavia (present-day Djakarta). Australia's long isolation was about to be ended.

Overland Telegraph officers Little, Patterson, Todd and Mitchell pose next to a supply wagon near the Roper River, NT 1872.

The Australian scene

During the years of the struggle to establish the Atlantic telegraph, explorers in Australia were giving their lives to find ways across the inhospitable inland of the empty continent. Burke and Wills perished on their way back to Melbourne from the Gulf of Carpentaria in 1861. Scotsman John McDouall Stuart, who had made a profession of exploring, set out upon the first of his three epic journeys to find a way from south to north in 1858 – just as Englishmen on the far side of the world were loading cable into the *Niagara* and the *Agamemnon*. On April 22, 1860, Stuart wrote in his diary: "I am now camped in the centre of Australia. I have marked a tree and planted the British flag." In 1862, his ambition achieved, he was carried back to South Australia on a stretcher by his companions. Blind and ailing, but triumphant, he retired to England where he died two years later.

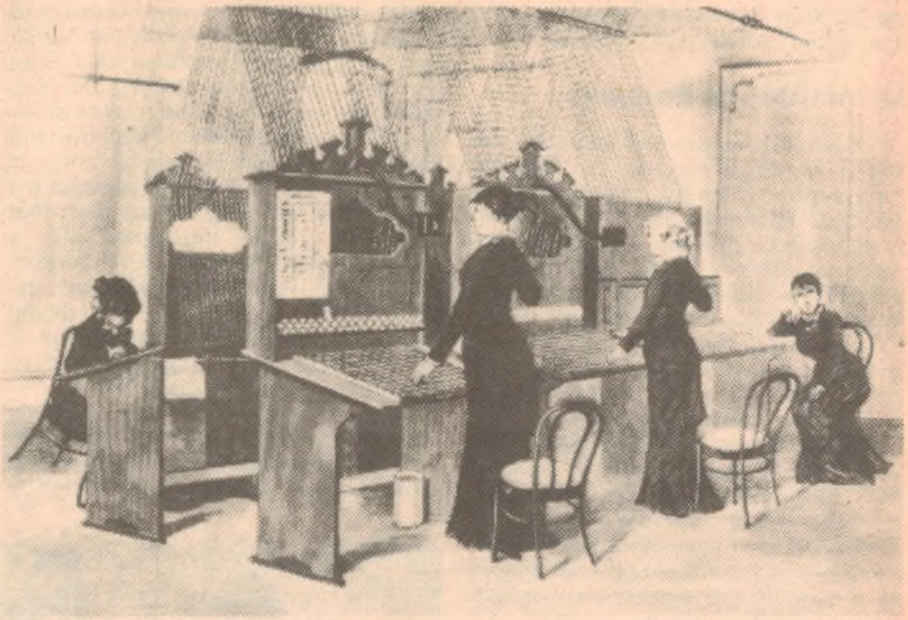
Within another ten years, a telegraph wire followed the route blazed by Stuart, reaching all the way from Port Augusta across the Centre to Port Darwin. There the wire met a submarine cable laid across the Timor Sea in 1871 by ships under contract to the British Australian Telegraph Co. This 1600 kilometre cable extended to Banjuwangi, at the eastern tip of Java, from where Dutch landlines ran to Batavia. So, in the 84th year since the founding of the settlement at Sydney Cove, Australia became linked with the outside world by telegraph.

The overland telegraph line from South Australia to the shore of Port Darwin took two years to build and cost six men's lives. The history of its construction is another of the great sagas of the 19th century.

The citizens of the major cities of the southern and eastern colonies found themselves able to communicate by telegram direct with England and most other principal overseas countries from October 1872. Messages could now be exchanged with London in hours instead of weeks. This liberation from "the tyranny of distance" (to borrow a vivid phrase from author Geoffrey Blainey) was greeted with great excitement and rejoicing. Businessmen, newspapermen and administrators hailed the advent of the international telegraph as though it marked the dawn of the millennium. Typically, a speaker at an official banquet in Sydney on November 15 referred to the opening of the line three weeks before as ". . . the greatest and by far the most wonderful event that has ever occurred in the history of this country."

International telephone

Four years later, Australia and New Zealand were linked by telegraph cable. That was 1876, the year in which Alexander Graham Bell patented and demonstrated his telephone. Before long, the cable engineers were thinking in terms of girdling the earth with a magic chain that could carry speech. But another three-quarters of a century would pass before this became possible.



An early telephone exchange, a loom of wires and plugs, Stockholm, 1884.

Whilst the use of the telephone grew very rapidly, especially in America, Britain and the countries of Europe, development of a satisfactory submarine telephone cable to span all but the shortest underwater distances proved enormously difficult. Not until the arrival of the electronic age did the engineers have any means of overcoming the major problem, which was loss of signal strength over long lengths of cable. The first trans-oceanic telephone circuits were radio circuits, opened in the late 1920s and early '30s. But research engineers within two great organisations on opposite sides of the Atlantic were by this time patiently working, in cooperation with British and American manufacturing concerns, on the invention which was to make long-distance submarine telepathy possible: the submersible repeater.

No longer is the story of communications technology a romantic legend of individual achievement, as in the days of the 19th-century pioneers. No longer is it a game for the dedicated amateur working in a back room with little capital and some makeshift equipment, guided by the spark of genius. Now we step into the present-day world of the professional communications engineer. The two bodies mainly responsible for the successful development of the submarine telephone cables were the USA's Bell Telephone Laboratories and the British Post Office. These two institutions, after years of research, and many trials with repeatered telephone cables in this respective home waters, pooled their technological resources in the 1950s to design a cable that would carry speech across the Atlantic. This cable, TAT-1, came into operation on September 25, 1956 – just 90 years and two months after the opening of the first commercially successful trans-Atlantic telegraph cable.

The advent of high-quality trans-oceanic telephony triggered an explosion in public demand for international telecommunications facilities which continues to test the resourcefulness of national administrations throughout the world – as it does the ingenuity of the engineers. To enable international networks to keep pace with demand, it has been necessary for submarine cables of ever greater capacity to be produced.

The record is astonishing. That first Atlantic telephone cable, TAT-1 (actually two separate cables, one working in each direction), initially led the field with 36 two-way voice circuits. The first cables of the British Commonwealth submarine telephone cable network were designed to carry 80 two-way voice circuits. These included CANTAT-1, between Britain and Canada, opened December 1961, and COMPAC, joining Canada, New Zealand and Australia, opened December 1963. CANTAT-2, laid in 1974, has 1840 voice circuits. In 1976, a cable was laid across the Atlantic providing 4000 circuits. And another, planned for laying in the 1980s, may be able to handle 16,000 simultaneous telephone conversations.

Submersible repeaters, like the coaxial submarine cables into which they are spliced, must be as near to flawless as it is possible for human skills to make them. They must operate continuously, with complete reliability, whilst lying on the ocean floor for periods of 20 years or more. (TAT-1 has already been in service

ROD IRVING ELECTRONICS

425 HIGH STREET, NORTHCOTE 3070. MELBOURNE. (03) 489-8131.

ELECTRONIC COMPONENT SUPPLIERS, DESIGNERS & MANUFACTURERS.
RITRONICS WHOLESALE (03) 489-7099. MAIL ORDERS (03) 481-1436.
TELEX: AA38897

For heavier items add additional postage. Extra heavy items sent Comet freight on. Prices subject to change without notice. Send 60c and SAE for free catalogues. Minimum pack and post $1.00. Bankcard Mail Orders welcome.

DIP SWITCHES SPST

P N	No. Switches	Price
SD3	3	1.60
SD4	4	1.70
SD5	5	1.90
SD6	6	2.30
SD7	7	2.40
SD8	8	2.50
SD9	9	2.70
SD10	10	3.00

WIRE WRAP 3-LEVEL

	1-9	10-25
8 Pin	1.00	.90
14 Pin	1.10	1.00
16 Pin	1.20	1.70

18 Pin	1.50	1.40
20 Pin	1.80	1.60
22 Pin	1.90	1.70
24 Pin	2.00	1.80
28 Pin	2.20	2.10
36 Pin	2.60	2.40
40 Pin	2.90	2.70

COMPUTER GRADE ELECTRO

2900uf	40V	6.50
6800uf	16V	6.40
10 000uf	16V	9.00
10 000uf	25V	9.50
10 000uf	40V	11.90
15 000uf	40V	12.00
22,000uf	25V	12.90
22,000uf	40V	23.00
27,000uf	35V	23.50
33,000uf	16V	23.50
68,000uf	16V	21.50
100,000uf	10V	20.50

MULTISTRAND RIBBON CABLE
Price per metre

	1-9	10+
10 Way	.90	.80
12 Way	1.00	.90
16 Way	1.20	1.10
20 Way	1.70	1.60
40 Way	3.20	3.00

SUPER SPECIALS

2708	$ 4.50	BU326	$ 1.90
2716	$ 4.90	Z80S10	$21.00
2732	$ 8.00	1771	$19.00
6800	$ 7.90	1791	$59.00
6802	$11.00	1795	$59.00
6809	$22.00	4116	$ 1.95
8085	$12.50	2114	$ 1.95
8080	$ 7.00	TA7205	$ 3.30
6821	$ 3.50	100 Red Leds	$ 9.00
Z80P10	$ 5.00	BUX80	$ 3.90
		BU126	$ 1.90

CMOS	
4000	.40
4001A	.40
4001B	.40
4002	.50
4006	1.10
4007	.50
4008	1.00
4009	.80
4010	.50
4011	.40
4012	.50
4013	.80
4014	1.70
4015	.90
4016	.70
4017	1.50
4018	1.50
4019	.60
4020	1.20
4021	1.10
4022	1.05
4023	.70
4024	1.00
4025	.50
4026	2.20
4027	.60
4028	.90
4029	1.20
4030	.60
4031	2.20
4034	3.00
4035	1.30
4039	.70
4040	1.70
4041	1.05
4042	.70
4043	.70
4044	.70
4046	1.20
4047	1.20
4048	.60
4049	.60
4050	.60
4051	1.00
4052	.80
4053	.80
4060	2.00
4066	.80
4068	.60
4069	.70
4070	.50
4071	.60
4072	.50
4073	.60
4075	.60
4076	1.20
4077	.50
4078	.60
4081	.60
4082	.60
4089	1.00
4093	.80
4503	.60
4510	1.50
4511	1.50
4512	1.10
4514	2.50
4516	1.40
4518	1.50
4519	.55
4520	1.60
4522	1.25
4527	1.20
4528	1.25
4529	1.60
4539	1.60
4541	1.60
4543	2.00
4553	5.50
4555	1.00
40097	.95
40098	.95
40175	1.00
74C SERIES	
74C100	.40
74C02	.40

74C04	.40
74C08	.40
74C10	.40
74C14	.90
74C20	.40
74C30	.40
74C32	.40
74C42	1.10
74C48	1.55
74C73	.75
74C74	.70
74C76	.75
74C83	1.40
74C85	1.20
74C86	.80
74C90	.80
74C93	1.40
74C95	.95
74C107	.70
74C150	3.40
74C151	1.00
74C160	.90
74C192	.90
74C164	1.10
74C173	1.00
74C174	.80
74C175	1.00
74C192	1.20
74C195	1.00
74C221	1.90
74C373	1.80
74C374	2.00
74C901	.90
74C902	.90
74C905	11.20
74C906	.90
74C907	.80
74C915	1.50
74C922	6.00
74C923	5.00
74C925	7.50
74C926	7.50
74C927	5.90
74C932	5.50
80C SERIES	
MM80C95	.90
80C96	.90
MM80297	.90
80C98	.90
LINEAR	
LH0002	9.50
LH0022CD	16.60
LH0042CH	8.60
LH0070	12.70
LH0071	12.70
TL071	1.00
TL072	1.50
TL082	1.50
SAK140	2.20
UAA170	3.50
UAA180	3.50
TCA220	2.20
LM301	.50
LM301-H	.50
LM304-H	1.70
LM305-H	.80
LM307-CN	.40
LM307-H	.90
LM308	.70
LM308-H	1.20
LM310-N	2.20
LM310-H	2.60
311	.60
LM311	.60
LM311-H	1.20
LM318	2.80
LM322	3.90
LM324	1.20
LM325	3.10
LM329 DZ	1.40
LM334-Z	1.30
LM335	12.40
LM336-Z	3.20
LM339	.90
LM348	1.10
LM349	1.80
LF351-N	.70

LF356-AN	1.10
LF357	1.10
LM358	.70
LM373	4.10
LM374	5.40
LM376	.70
LM377	2.90
LM379	5.70
LM308 8PIN	1.30
LM380 14PIN	1.50
LM318A-N	2.40
LM318N	1.80
LM382N	2.00
LM383	2.70
LM384	2.40
LM386	1.00
LM387	1.30
LM391	1.80
LM393	.80
LF398	5.00
8038	6.00
NE530	1.10
OM350	9.90
555	.40
556	1.10
LM565	1.30
LM565CH	2.00
NE566	2.50
LM567	1.50
NE571	6.50
LM709 14PIN	.70
UA710CA	.60
LM710-CH	.90
711	.80
UA711-H	.85
UA716HC	6.25
723	.50
LM723CH	1.10
LM725	3.90
LM733	1.20
UA739	2.00
741	.25
LM741-H	1.20
UA747	1.00
UA747HC	2.20
UA748	.50
UA748HC	1.25
UA753	1.80
UA760HC	4.10
UA777	2.40
UA777HC	2.65
9334	1.70
UA743	1.80
UA760HC	4.10
UA796HC	1.70
LM802	1.10
LM1310N	2.40
1408	4.90
LM1458	.60
UA1488	1.50
UA1489	1.50
MC1495	7.30
MC1496L	11.40
LM1558	1.50
LM1596	1.40
LM1380	3.10
LM2902	1.40
LM2917 8PIN	2.80
LM2917	3.10
CA3028	1.80
LM3039	.90
CA3046	1.70
3065	.45
LM3080	1.20
LM3089	3.90
CA3130T	1.40
CA3130E	1.80
CA3140	1.40
3401	.70
3611	1.10
LM3900	.90
LM3909	1.00
LM3914N	3.90
4136	1.40
LM4250	1.25

UA4558TC	1.40
MM5837	2.50
LM7555	1.80
Mc10116L	.95
LF13741	.60
LF1374-1H	.70
DS75452	.60
76477	4.90
75451	.60
75491	1.40
75492	1.40
TTL (s)	
74S00	.80
74S02	.80
74S04	.80
74S10	.75
74S11	.75
74S32	.75
75S51	.75
74S74	1.20
74S86	1.40
74S112	1.20
74S135	2.20
74S138	3.20
74S157	2.95
74S158	2.95
74S182	3.30
7400 SERIES	
7400	.40
7401	.40
7402	.40
7403	.40
7404	.40
7405	.50
7406	.50
7407	.50
7408	.40
7409	.40
7410	.40
7411	.40
7412	.40
7413	.50
7414	.70
7416	.50
7417	.60
7420	.40
7421	.40
7423	.50
7425	.45
7426	.40
7427	.40
7430	.40
7432	.40
7437	.40
7438	.50
7440	.50
7441	1.00
7442	.50
7443	1.40
7444	1.20
7445	1.10
7446	1.00
7447	1.00
7448	1.00
7450	.50
7451	.50
7453	.40
8126	2.20
9300	.60
9307	1.80
9308	1.20
7454	.60
7472	.60
7473	.60
7474	.60
7475	.60
7476	.60
7480	.65
7482	1.80
7483	.80
7485	.80
7486	.60
7489	2.60
7490	.70
7491	.55
7492	.60
7493	.60

7494	.90
7495	.45
7496	.80
7497	2.50
74107	.80
74109	.60
74116	2.20
74121	.45
74122	.65
74123	.60
74125	.55
74126	.60
74132	.80
74141	1.10
74145	.85
74147	2.00
74148	1.40
74150	1.20
74151	.60
74152	4.90
74153	.70
74154	1.20
74155	.90
8T28	3.00
9310	.65
9311	1.00
9312	1.35
74156	1.50
74157	.60
74161	1.00
74162	1.00
74163	.85
74164	.60
74165	.60
74174	.50
74175	.90
74176	1.10
74177	1.10
74180	.90
74181	2.30
74182	.90
74184	1.20
74185	1.20
74190	1.00
74191	1.50
74192	1.70
74193	.80
74194	1.10
74195	.65
74196	.85
74197	1.10
74198	1.10
74199	1.30
74221	.90
74290	.90
73293	.90
74365	.80
74366	.80
74367	1.00
74368	1.00
8T96	1.80
9314	1.30
9368	1.75
9370	2.00
74LS SERIES	
74LS00	.40
74LS01	.40
74LS02	.40
74LS03	.40
74LS05	.40
74LS08	.40
74LS09	.40
74LS10	.40
74LS11	.40
74LS13	.50
74LS14	.90
74LS15	.40
74LS20	.40
74LS21	.40
74LS22	.40
74LS26	.40
74LS28	.40
74LS30	.40
74LS32	.40
74LS33	.40
74LS37	.50
74LS38	.50

74LS40	.50
74LS42	.75
74LS47	.85
74LS48	1.00
74LS49	1.00
74LS51	.40
74LS54	.50
74LS55	.55
74LS58	.65
74LS73	.55
74LS74	.60
74LS75	.45
74LS76	.50
74LS78	.50
74LS83	1.00
74LS85	1.00
74LS86	.50
74LS90	.70
74LS92	.90
74LS93	.80
74LS95	.65
74LS96	1.55
74LS107	.60
74LS109	.60
74LS112	.60
74LS113	.65
74LS114	.50
74LS122	.50
74LS123	.75
74LS125	.50
74LS126	.70
74LS132	.80
74LS133	.50
74LS136	.50
74LS138	1.20
74LS139	.85
74LS151	.75
74LS153	.60
74LS154	1.50
74LS155	1.00
74LS156	1.00
74LS157	.90
74LS158	.70
74LS160	.85
74LS161	.85
74LS162	.00
74LS163	.85
74LS164	1.30
74LS165	.50
74LS168	1.90
74LS169	1.90
74LS170	2.80
74LS173	.90
74LS174	.90
74LS175	.90
74LS181	2.50
74LS189	3.80
74LS190	1.30
74LS191	1.10
74LS192	.85
74LS193	.85
74LS194	.70
74LS195	.80
74LS196	1.25
74LS197	1.10
74LS221	1.10
74LS245	2.35
74LS247	.90
74LS249	1.30
74LS251	.80
74LS253	.90
74LS257	.65
74LS258	.50
74LS259	2.45
74LS260	.90
74LS266	.90
74LS273	1.60
74LS279	.65
74LS283	1.15
74LS290	1.10
74LS293	1.15
74LS295	1.60
74LS298	1.00
74LS352	1.30
74LS353	1.30
74LS365	.80
74LS366	.70
74LS367	.90
74LS368	.90
74LS373	1.50
74LS374	1.70
74LS386	.50
74LS670	2.70
81LS95	2.10
95H90	11.50
11C90	19.50
81LS96	2.10

81LS97	2.10
TRANSISTORS	
2N301	2.20
2N657	.60
2N930	.60
2N1613	1.10
2N1711	.50
2N1893	1.30
2N2219A	.60
PN2222	.20
PN2222	.30
2N2463	.35
2N2484	.65
2N2646	.70
2N2647	1.10
2N2894	.80
2N2904	.45
2N2905	.40
2N2906	.45
2N2913	1.20
PN2907	.30
2N3053	.60
2N3054	.90
2N3055	.90
2N3301	.40
2N3440	1.10
2N3502	.70
2N3503	.70
2N3563	.30
2N3564	.30
2N3569	.30
PN3565	.30
PN3566	.30
PN3567	.30
2N3568	.30
2N3638	.30
2N3639	.30
2N3640	.30
2N3641	.30
2N3645	.30
PN3642	.30
PN3643	.30
PN3644	.30
2N3646	.30
2N3692	.50
2N3693	.35
2N3702	.30
PN3694	.30
2N3704	.30
2N3709	.30
2N3713	2.20
2N3819	.80
2N3866	2.00
2N3904	.30
2N3906	.30
2N4030	1.10
2N4032	.55
2N4033	.90
2N4036	1.00
2N4037	.90
PN4121	.30
2N4234	1.60
2N4235	1.90
2N4236	2.20
2N4248	.30
PN4249	.30
2N4250	.30
2N4258	.30
2N4292	.70
2N4354	.30
2N4355	.30
2N4356	.30
2N4396	5.00
2N4401	.50
2N4402	.50
2N4403	.50
2N4416	1.00
2N4906	2.80
PN4868	.30
2N5088	.30
2N5089	.30
2N5179	1.90
2N5303	3.30
2N5320	.80
2N5401	.30
2N5458	.70
2N5459	.70
2N5461	.70
2N5484	.70
2N5485	.70
2N5486	.70
2N5769	.30
2N5770	.25
2N5830	.25
2N5831	.30
2N5856	.30
2N5873	1.10

2N5874	1.40
2N5961	.30
2N5963	1.10
2N6027	.60
3N201	.90
AC127	.70
AC128	.70
AC187	.70
AC188	.70
AD149	2.50
AD161	1.70
AD162	1.70
BC318	.30
BC319	.18
BC327	.15
BC328	.30
BC337	.30
BC338	.30
BC547	.15
BC548	.15
BC549	.15
BC549C	.40
BC557	.16
BC558	.16
BC559	.16
BC637	.25
BC638	.36
BC639	.80
BC640	.80
BCY70	.85
BCY71	.85
BD115	1.50
BD135	.70
BD136	.70
BD137	.70
BD138	.70
BD139	.70
BD140	.70
BD235	.65
BD234	.50
BD237	.50
BD262	1.20
BD301	.75
BD302	.75
BD263	1.25
BD435	.75
BD646	1.70
BD647	1.80
BD675	.80
BDV64B	4.50
BDV65B	4.50
BF115	.50
BF173	.70
BF180	.70
BF195	.30
BF198	.30
BF199	.30
BF336	.80
BF337	.80
BF458	.90
BF494	.40
BFX85	.75
BFY50	.90
BFY90	1.30
BSV17	1.00
BU126	3.00
BU208	3.00
BUX80	7.90
F12955	1.40
F13055	.75
MEL12	.90
BU326A	3.40
MJ2955	1.00
MJ4032	7.40
MJ802	3.40
MJ4035	6.90
MJ4502	3.70
MJE340	1.20
MJE350	1.70
MJE295	1.90
MJE8055	1.90
MJE3521	.60
MJ15003	4.00
MJ15004	4.00
QF102	.60
MPF131	1.40
MPSA05	.60
MPSA06	.60
MPSA12	.60
MPSA14	.60
MPSA42	.60
MPSA56	.60
MPSA92	.60
MRF475	4.40
T131B	.90
T13PIC	1.00
TIP29B	.90

TIP32C	1.00
TIP33A	1.10
TIP34A	1.20
TIP24B	1.50
TIP42B	1.10
TIP110	1.30
TIP120	1.30
TIP2955	1.20
TIP3055	1.20
VN88AF	2.50
MICRO CHIPS	
ADCO 800	12.00
OACO 080	2.00
2012 200 NS	2.00
2102 350 NS	2.00
2102 450 NS	1.40
2102 650 NS	1.40
2111	8.60
2114 150 NS	11.15
2114 300 NS	3.90
2114 450 NS	3.50
8-31	3.30
32 up	3.10
2513	14.50
2516	55.00
2532	69.00
2650	23.00
2708	8.50
2716	12.00
4116	5.50
5101	9.00
MM5204	12.50
MM5220	7.20
MM5307	18.00
MM5309	6.50
MM5312	9.00
MM5369	2.60
5387	8.50
MM5395	6.50
6502	10.50
6508	5.50
6520	5.50
6522	10.00
6523	17.00
6551	17.00
MC6900P	9.00
MC6802	13.60
MC6808	12.50
6810A	4.90
6820	5.50
6821	6.00
6850	5.15
6852	6.40
7106	12.60
7107	15.00
7210	13.20
Z80 CPU	14.00
Z80A CPU	16.00
Z80 P10	13.80
Z80A P10	16.50
Z80 CTC	13.80
Z80A CTC	16.50
Z80 DMA	40.70
Z80 S10 0	56.90
Z80 S10 1	56.90
Z80 S10 2	56.90
Z80A S10 0	63.00
Z80A S10 1	63.00
Z80A S10 2	63.00
8035	27.00
INS8050	15.00
INS8080	8.00
P8085	25.00
8155	22.00
8165	22.00
8205	5.00
P8212	4.00
8214	8.00
8216	5.90
8224N	5.50
8224	7.50
8226	5.90
8228	9.50
8238	8.00
8243	8.00
8251	14.00
INS8251	6.50
8253	19.50
8255A	8.60
8257	99.00
8259	99.00
8275	99.00
8278	99.00

8295	25.00
DM8578	3.50
Ay-5-2376	19.56
8748A	99.00
8755A	99.00
MCT2	.80
MCT6	3.30
MCT275	1.50
MCC671	3.00
4N28	.85
4N33	1.20
4N26	.85
MM80C95	.90
80C96	.90
MM80C97	.90
8098	.90
OPTOCOUPLERS	
MCT2	1.00
MCT6	3.30
MC275	1.50
MCC671	3.00
4N28	1.00
4N33	1.20
4N26	1.00
VOLTAGE REGULATORS	
78L05	.40
LM341P 5	.80
7805	1.00
7905	1.70
LM309K	1.20
7805K	2.10
LM323-K	6.90
78H05KC	8.50
LM341p 8	.80
78L12CP	.40
79L12	.65
LM341P12	.75
7812	1.00
7912	1.90
7812KC	2.15
7912KC	2.60
79H12KC	8.00
78L15	.35
79L15	.65
LM341P15	.80
7815	1.00
7915CT	1.80
7915KC	2.60
78H15KC	6.50
78L18	.35
7818	1.40
78L24	.35
79L24	.65
7824	1.10
LM371T	2.40
LM337T	3.80
LM317K	4.50
LM337K	5.90
LM350K	8.40
78HGKC	10.50
78P05	16.50
BRIDGES	
VM48	1.50
W02	.60
W04	.60
KHPC02	2.00
KBP602	2.50
KBP604	2.60
KBP606	2.80
KHPC1002	2.60
KBPC1004	3.20
KBPC1006	3.20
MDA3501	3.20
MDA3502	3.20
MDA3504	3.40
DISPLAYS	
MAN2A	6.30
MAN72A	2.20
MAN74A	2.20
MAN52A	3.40
MAN82A	3.40
MAN84A	3.40
MAN6740	3.60
MAN8610	3.30
MAN8640	3.30
TIL306	12.00
DL704	2.20
DL707	2.30
DL747	3.40
DL750	4.00
FND357	1.80
FND50L	1.80
FND507	1.80

TO ORDER: Heavy items sent Comet Freight on. Mail Order phone 481-1436. Wholesale Customers phone: RITRONICS WHOLESALE 489-7099. Mail Orders to P.O. 235 Northcote 3070. Minimum P&P $2. Add extra for heavy items, registration and certified mail. Prices, spec. subject to change without notice.

for 20 years. A North Sea cable with seven repeaters has been working since 1954.) Throughout that time they must function with unflagging efficiency, each one amplifying the signals in the line several thousand times, so that the sound of each speaker's voice is received at the other end undistorted, without fading, sounding utterly natural.

Seabed surveys

When men first began to lay telegraph cables beneath the seas, in the middle of the 19th century, they found themselves confronted by a completely unexplored region of the earth; the oceanic depths. Before that time, geography had stopped just beyond the shoreline. Until the development of modern diving techniques, most of this vast region – more than seven-tenths of the earth's surface – remained as inaccessible as the most distant planet. Information about the depth of water in the open seas was sketchy and unreliable for it originated from random soundings taken by sailors with weighted, hand-hauled lines. The nature of the terrain at the bottom of those seas remained a mystery.

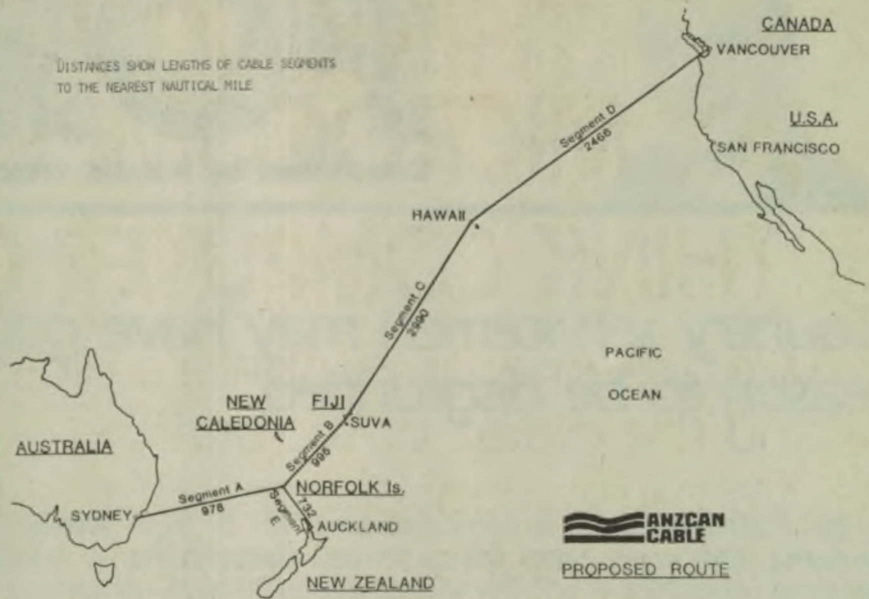
These days, when telecommunications engineers plan the route for a new transoceanic cable, they start by collecting detailed information about the terrain. Usually this means carrying out oceanographic surveys. They need to know exactly where they will encounter underwater mountains and such possible causes of trouble as deep trenches. Apart from the risk of earthquake activity, however, the major hazards to submarine cables are man-caused. In the relatively shallow waters above the continental shelves, cables are vulnerable to damage by ships' anchors or trawling gear. Techniques have been developed for burying cables in the sea-bed, using a special plough to gouge a channel. Such ploughs are highly sophisticated pieces of equipment, sometimes carrying television cameras and underwater lighting so that the route may be visually surveyed. Where a rocky bottom makes cable burial impossible, particularly in coastal waters, armoured cable is used.

Despite the dynamic and unpredictable nature of the environment in which they must operate, submarine cables have proved to an outstandingly durable and reliable medium. When you consider that there are scores of thousands of kilometres of cable draped along the sea-beds, all operating day and night, continuously, year in and year out, the achievement of the cable engineers is nothing less than astounding.

Repeaters in a modern cable may be as much as 2.5 metres long and contain more than 300 components, all of which must be thoroughly tested to ensure a working life of (usually) 25 years. A repeater, snug in its polythene sleeve and encased in a brass cylinder, may be more than 20cm thick – by contrast with the usual cable diameter of about 4cm yet it must be led through the paying-out gear of the cable layer without interrupting the steady progress of the laying operation. And it must be strong enough to withstand the great pressure of water at the ocean bottom – as much as 62000kPa at a depth of 6000 metres. The whole system must be mechanically robust enough to stand being hooked by grapnels and lifted from the depths, in heavy loops several kilometres long, when repairs are necessary.

What other servant of man can match the submarine cable for service? Once it has been made, it is lowered into the darkness of the ocean depths to perform its task unseen for perhaps a quarter of a century. Think of the cable, lying there, the next time you talk to someone overseas by phone or read a report supplied to your newspaper by an overseas "wire service".

ANZCAN — THE BIGGEST YET



Australia's Overseas Telecommunications Commission (OTC) will play a major role in the world's largest undersea cable project, the ANZCAN Submarine Telephone Cable System.

The 15,000 kilometre cable will link Australia to Vancouver, Canada, passing through Norfolk Island, Fiji and Hawaii, with a "spur line" to Auckland. The United States and several other countries will use the ANZCAN cable as an international link, carrying telephone, telex, facsimile and digital data communications.

The cable will be capable of handling over 1300 simultaneous telephone calls, 16 times as many as the COMPAC cable, which was laid in 1962 and is now nearing the end of its service.

As well as providing links to Norfolk Island, New Zealand, Fiji and Hawaii, the cable will provide direct access from Australia to communications networks in the United States, and through further microwave and cable links to Europe.

Repeaters will be used to boost signal levels along the cable, at intervals of about 13 kilometres. The repeaters will be manufactured at a plant set up by UK company Standard Telephone and Cable Ltd, at Liverpool on the outskirts of Sydney.

Work has already begun on the $A400 million cable, which is expected to be operational by late 1984. ANZCAN will serve Australia's growing need for international communications links — currently increasing at around 30% a year.

The cable will cross the Pacific at depths of up to six kilometres.

Contracts have been signed with two companies, Standard Telephone and Cables Ltd and Nippon Electric Co Ltd for the manufacture and laying of the cable system. Each contract includes the design of the system, supply of equipment and cables, laying operations and training of technical staff.

Cables and satellites complement each other in the international network, and provide backup for each other in case of emergencies.

The ANZCAN cable will be the biggest telecommunications project in the world, even in this age of satellites. Cables will continue to share world communications traffic with satellites for many years to come.

FORUM

Conducted by Neville Williams

Country servicemen may have good reason to be disgruntled

In the February issue, a correspondent, M. B. from Western Australia, had some bitter things to say about VCRs — video cassette recorders — and the lack of adequate back-up service. Two other readers, with servicing experience in remote areas, have come to his support and one of them has had a go at me, for good measure!

Just to recap, briefly, M.B. identified himself as an electronic serviceman working in the Derby area of Western Australia – about as far as you can get from Sydney, where most of the suppliers are based.

Reacting to a remark in an editorial about video "being on the boil", he pointed out that people in the Broome-Derby-Darwin area might see things rather differently. Isolated from manufacturers' service depots, and often denied repair manuals and spare parts, servicemen like himself were all too familiar with VCRs being out of action for months on end.

He could not agree that VCRs were any kind of a technological triumph, or that they worked well. Breakdowns were so frequent and so prolonged that, from the viewpoint of his clients, the average VCR might more fairly be described as a rip-off!

Nor did M.B. spare the technical press. The editorial writers were too easily dazzled by gee-whiz technology and gimmicks, and not sufficiently critical of lousy wiring, aluminium shavings, loose screws and dry joints! He missed the kind of articles that were published ten years ago.

He would much prefer to be saying nice things about his own industry but, in this country at least, the electronics industry appears to be in poor shape.

M.B's letter obviously struck a sympathetic chord for a reader now resident in Lane Cove, NSW. And, equally, my own remarks generated a discord, as will be evident:

Dear Mr Williams,

I have just finished reading your "Forum" column in the February issue of "Electronics Australia" and I must say that I am aghast at your veiled insult to M.B. as you finished your column.

Again and again, I have found this same "imperialistic" attitude, which you as a "southerner" and a "city slicker" so ably demonstrate here.

After 17 years of remote service experience of the kind of which M.B. speaks (obtained in NG, PNG and the far west and central areas of Qld) I cannot do more than agree with him, most loudly.

I am currently employed by a large electronic manufacturer (a major defence contractor also) and I find, much to my dismay, that this company does not, as a matter of policy, provide service information and circuitry, nor handbooks, nor does it stock spare parts for new machines, let alone those for older equipment.

The company is involved in one thing only – sales of the newest and brightest and shiniest machines. No soak tests, no spare parts, and no training for their service department staff.

My own experience with this company and others, and their products over a great many years, fully vindicates M.B's comments and, Mr Williams, I stand beside M.B. and accuse you and your colleagues of failing to whip the industry about this trouble in the past.

The classic statement "dust" I have heard before; wrong! Transportation is always a problem but only because design is poor mechanically.

It is well nigh impossible to obtain any pertinent information in these remote areas, let alone spare parts. Where will it end?

D.B. (Lane Cove, NSW)

Fair enough, although I am concerned at the accusation that I offered M.B. a "veiled insult", sufficient to render D.B. "aghast".

I must insist that I had no intention of so doing. I may present people's views, discuss them and, at times, disagree with them but there is certainly no mileage in subjecting readers to ridicule or insult!

In commenting on M.B's letter, I indicated that it was the first complaint of that nature we had received about modern VCRs but I certainly did not reject it on that account.

On the contrary, in column three of page 22 (Feb issue) I conceded that VCR problems could be occurring in urban areas, without attracting much attention or comment, simply because service facilities and/or replacement units were readily to hand.

More than that, and I quote: "motivated by M.B's letter, I began to ask deliberate questions around the industry about unit failures and possible delays in the supply of spare parts. And I got some interesting answers . . . "

These answers included an admission that some suppliers had indeed been caught with their spares down. There were suggestions that the failure rate of new units might have been aggravated by transport traumas, by the ingress of dust, by electrostatic destruction of logic control circuitry, and by head fouling due to the use of poor quality cassettes.

All this was reported in good faith and certainly without any disrespect to the correspondent, expressed or implied. Indeed, the reference to electrostatic effects caught the eye of our "Serviceman", who rang to say that he had personally encountered this trouble in the field – as we tipped – in units other than VCRs.

The one sentence in M.B's letter that triggered a bit of a double-take was his reference to aluminium shavings. As we said: "If we came across that in a quality brand product – and of all things in a VCR – that would be news indeed. We could hardly miss it or ignore it."

In the last paragraph, still puzzled by the reference to aluminium shavings, and by a complaint more outspoken than any we had heard to date, we simply wondered out loud. Was the complaint representative of VCRs throughout the country? Was the picture quite as black as M.B. had painted or had he penned the letter at a time when he felt particularly disgruntled?

In serviceman's terms: "in the wake of a particularly nasty intermittent?"

HA, HA . . . OOPS!

It was meant to be a good-natured quip. If it came across as a veiled insult, I'm sorry. It certainly wasn't meant that way.

Apart from insult, or not, D.B. supports M.B. in broad principle, based on his own past experience. Unfortunately, except by inference, he is not in a position to contribute to the discussion about present-day VCRs.

However, I do want to comment on one particular statement by D.B. about his employer:

" . . . this company does not, as a matter of policy, provide service information, nor circuitry nor handbooks, nor does it stock spares of new machines . . . no soak tests, no training of their service department staff."

Flowing from this he says:

"I accuse you and your colleagues of failing to whip the industry about this trouble in the past."

The fact is that, before one can justly "whip" the industry, one has to be made aware of an industry-wide pattern of failure in the various areas. It is lamentable that D.B's employer (allegedly) shows so little concern for customers and, in so doing, may well be in breach of consumer laws. On the other hand, we frequently hear about companies conducting multi-day seminars for service staff, following the introduction of new models and new equipment. They do it as a matter of self-preservation!

But we did take up the matter of the unwillingness of some companies to provide service data for those who expressed a need for it.

About two years ago, TESA (The Television and Electronic Services Association) recommended to the Minister for Business and Consumer Affairs that it be made mandatory for manufacturers to provide a circuit diagram, at least, for all items of electronic equipment released to the public.

Our then editor, Jamieson Rowe, took the matter up in his editorial in the June '79 issue and expressed support for the TESA initiative. He also recommended that interested people should make direct representation to the Minister.

It so happened that Jim became more personally involved, shortly afterwards, when he tried to obtain a manual for his (then) latest pride and joy – a super-8 sound movie camera. Despite his considerable academic and practical qualifications, the suppliers indicated that they considered it their responsibility, and theirs alone, to affect any repairs or adjustments to the camera – for the appropriate charge, of course!

Flowing from this situation, and the mail which was prompted by the June editorial, it became evident that there were two strongly held points of view.

On the one hand, servicemen and technically qualified owners felt that they had an automatic right of access to service manuals, at a reasonable cost.

Many companies, on the other hand, held the view that their high technology products should only be serviced by people who had attended a familiarisation seminar or had worked on the gear under supervision. They were not at all keen on the idea of non-specialist servicemen attempting repairs and adjustments, relying purely on a supportive manual.

A great many arguments were put up and shot down and, in due course, Jim Rowe discussed the matter with the authorities in this state – but without much hope of resolution. I quote from his editorial in the August '79 issue:

Hmm . . . Hmm (YAWN!)

"This seems to me to be a restrictive trade practice . . . However, it appears that I must be naive because, when I raised the matter with the NSW Department of Consumer Affairs, and the NSW office of the Trade Practices Commission, neither seemed to regard it very seriously. All I could get from a TPC spokesman was a rather circumspect and non-committal response, to the effect that they 'might perhaps be able to pursue the matter if consumers presented them with enough evidence'.

"I was left with the distinct impression that it would be very unwise to hold my breath!"

In short, and contrary to D.B's impression, we've been down that track before.

The second letter, from South Australia, follows naturally from this point and I quote it:

Dear Sir,

I would like to add to M.B's letter from Derby WA in Forum Column.

We too are a small service centre, serving a relatively small community but,

SHERIDAN ELECTRONICS

"Top brands and prime spec too"

See our ad in ETI for even more bargains

ELECTRONIC COMPONENT KINGS

Bargain Packs

New monster bargain packs – great for hobbyists and servicemen!

MONSTER RELAY PACK
Contains 20 relays new and unused. Mixed types ! 12-24 and 48 volt
ONLY $5-00 (Worth 10 fold)

MONSTER SWITCH PACK
Contains 30 mixed new and unused switches (includes pushbutton, toggle, rocker, slider and micro types).
Unbelievable value at only $5-00 –worth over $25-00

MONSTER POT PACK
Large selection of pots (includes single, dual, switch, slider etc.) 30 in all.
Fantastic value at only $5-00. Our normal retail value over $25-00

MONSTER CAPACITOR PACK
½kg of new and unused capacitors (electro, polyester, ceramic and styro types) Well over one hundred per bag.
Only $5-00 – WE'RE CRAZY!

MONSTER RESISTOR PACK
At least 400 per bag all mixed values in ¼, ½, 1 and 2 watt 10%–5% & 2% carbon types.
A must at only $3-00

MONSTER COMPONENT PACK
Contains heaps of electronic bits and pieces (like pots, coils, relays, caps, resistors, connectors, transformers etc etc.) weighs 1¼kg.
Giveaway price $5-00

BUY ONE OF EACH OF THE ABOVE PACKS AND PAY ONLY $25-00!

Please note: all packs $3-00 P&P each $6-00 P&P for all 5

Flashing LEDs

Genuine Siemans – not cheap equivalents, selling at less than cost! These are genuine long life high reliability flashing LEDs. If you don't think there's any difference – have a look at these! Just $1-00 each any quantity

100kΩ Multiturn pots

Top quality Amphenol 10 turn 100kΩ pots. Overall size 25mm diameter with ¼" shaft. Type 4201B. Normally priced over $10 each – our price $5-00 each $4-50 10up

Super loud solid state buzzer

Operates on 12V 110mA, 85dB @ 3m. Some of our competitors sell these for $7-00. Only $2-50 each or just $2-25 each 10up. Save 20% on our normal low price

Computer chip price crash

	EACH	10 up
2114-3	$1-50	$1-40
4116-2	$2-00	$1-80
2708	$4-50	$4-00
2716	$5-50	$5-00
2732	$9-00	$8-10
2764	$19-00	$17-50
6116-15	$10-00	$9-00

Bulk purchase of GE SCRs

At these prices how can you say no? Top quality products from the inventors of the SCR.

			1-99	100up
C106C1	100V	4A	40¢	35¢
C106F1	50V	4A	35¢	30¢
C122F	50V	8A	60¢	50¢

SUPER COMPONENT SPECIALS – TRY TO BEAT THESE!

Clearance prices. First come first served while stocks last.

Transistors ½ Price

BC547 and BC557 only 8¢ each 1-99 6¢ each 100up
TIP29B NPN Power transistor 20¢ ea 1-99 15¢ ea 100up
2N6028 PUT 45¢ each 1-99 40¢ each 100up

Integrated Circuits

CA3013 Linear wide band amplifier discriminator. Discontinued – were $1-50! 50¢ ea. 1-99 45¢ ea 100up
TAA611 2W Audio amp (data included) $1-50 each $1-25 each 10up
AY-3-8550 TV Game Chip. Giving 'em away while stocks last at $2-50 each or $2-00 each 10up

8038 Waveform generator IC. Reduced from $7.50 each to only $5.00 each or $4.50 10up
76477 Sound Generator IC. As used in the EA train sound generator. Reduced to only $3.50 each or $3.20 each 10up

Power MOSFETs

2SK134 & 2SJ49 – Just look at our price!
As used in ETI5000 and Playmaster MOSFET amplifiers $4-95 each or $4-50 each 10up. Don't pay $6-95!

Red 5mm LEDs

Selling at below our wholesale price! 7¢ each 1-99 or just 5¢ each for 100up
SEL610 common anode and SEL611 common cathode green 0.4" LED displays (data supplied) $1-00 each 80¢ each 10up

Clock module

MA1002B from National Semiconductor. Data supplied. Clearance price $9-00 each – less than cost!!!

IC sockets

High quality 14 pin and 16 pin tin plated IC sockets – unbeatable price: 15¢ each 13¢ 10up 12¢ 100up

S100 Connectors

Solder spill type. Less than half price – only $4-50 each or just $4-25 for 10up.

24 pin header lead

60cm long multicolour ribbon with 24 pin DIL header plugs each end. Only $3-50 each or $3-00 10up

SHERIDAN ELECTRONICS

164-166 Redfern St., Redfern NSW 2016
Phone 699 6912
Mail Orders to Dept EA, PO Box 229 Redfern 2016

Mail Charges:-

Mail Order Charges:-	
$5.00-$9.99	$1.10
$10.00-$24.99	$2.20
$25.00-$49.99	$3.30
$50.00-$99.99	$4.40
$100.00 or over	$5.50

Heavy or bulky items sent freight forward by 'Overnighters'

Trading Hours	
Mon-Fri	9am-5.30pm
Thursday	9am-7pm
Saturday	9am-12noon

due to the fact that I am the only electronics serviceman for an area of 22,500 sq. km, suffer similar problems to M.B.

Although VCRs are just becoming popular in this area at this stage, service problems on this type of equipment are not so great at the moment. However, I have similar problems to M.B. in regard to information and spare parts on other electronic equipment. Due to my isolation, when it comes to servicing all of the weird and wonderful pieces of modern electronic equipment, I know very little about how it works, apart from what I manage to nut out for myself.

Because of the fact that I am basically a service organisation, and deal in sales to a very small extent, I service a very wide range of brand names and types of equipment.

I am not supplied with service data or training courses, as my city colleagues. When I have problems with equipment that I don't have service information for or knowledge about, I am faced with the dilemma of what to do.

My choices are to spend a great deal of time trying to trace the fault without service data and, in many cases, not being able to honestly charge the customer for all this time; or trying to procure a circuit diagram from the manufacturer by either writing to them, and receiving no answer, or phoning them at considerable expense, quite often still without satisfactory results.

This usually means a long wait by the customer, having no other form of entertainment in this area.

The latest effort has been an attempt to obtain a circuit diagram for a piece of equipment which broke down in June '81. I ordered the diagram from their Adelaide office, but was informed that I would have to order it from their Sydney office. The order was posted to them by the end of June and, until this month, I had heard absolutely nothing. After three phone calls to Sydney, I was informed that when I posted a cheque for $7, they would forward the service data to me. I am still waiting! And this is by no means an isolated case.

In regard to spare parts, exactly the same situation applies. One example is another job that I ordered parts for in July '81. When the manufacturer was unable to supply all the parts necessary, I had to pay approximately $60 for the parts they had, with the remaining being back-ordered, with the promise that they would phone as soon as the parts arrived, so I could forward the necessary payment. I am also still waiting.

This also is a far from isolated case. I currently have 19 jobs in my workshop waiting for parts.

I am absolutely convinced that servicemen in the country are in the main ignored. I have found it necessary to travel the 500km to Adelaide once a month at my own expense in an attempt to chase up parts. On several occasions I have been able to walk into spare parts departments in Adelaide and purchase off the shelves, items that I have been waiting months for, as was the case just last week.

I agree with comments by M.B. regarding electronics magazines falling down on their job. It is all very well to know all the specifications for all this new equipment coming out, but how does it work?

I did my training back in the good old valve days and anything that I now know about solid state equipment is what I have had to teach myself, with no-one to call on when difficulties arise.

I am extremely frustrated.

K.P. (Kimba, SA).

One would need to be indifferent indeed, not to generate some kind of fellow feeling for K.P.

It is noticeable that he doesn't complain about the equipment itself – perhaps accepting that failures are inevitable. But he certainly does complain about the difficulty of obtaining information and spare parts. It must be frustrating indeed to have to travel 500km to obtain something that could easily have come by post!

The sorry thing is that lapses of this kind aren't the fault of an impersonal, amorphous thing called "the industry". In the ultimate they come down to the thoughtlessness and carelessness of ordinary individuals who just don't bother to keep track of incoming stock and outstanding orders. And, if "whipping the industry" is a thankless task, trying to change people is a forlorn hope indeed!

In the final section of his letter K.P. joins M.B. in accusing electronics magazines generally – not just EA – of "falling down on their job". He looks back on the "good old valve days" when magazines could explain and readers could understand how things worked.

So do we, K.P.! So do we. And so does just about every other editor that I've ever spoken to! Life was simple in those far-off days.

While equipment had to be built around valves, the dictates of economy, size and reliability limited the number of "active" circuit functions (basic amplifiers, oscillators, etc) to a dozen or two. It was a monster circuit indeed that could not be totally represented on a double-spread magazine page, or reasonably described in the associated article.

Moreover, there were certain gradually evolving conventions about valve technology that allowed both writers and readers to graduate from one circuit to the next by comparison and contrast. Technology progressed at a manageable rate.

But even in those days – and I would remind K.P. of this – "Electronics Australia" (or "Radio, TV & Hobbies" as it was) published very few commercial circuits. We left that to organisations which specialised in manuals and service data. In a broadly based electronics magazine, enough circuits to meet the needs of servicemen would be totally off-putting to other readers.

With the arrival of transistors and, more particularly integrated circuits, the number of active circuit functions has multiplied from dozens to hundreds, even thousands, and the task of depicting, explaining and comprehending commercial equipment has grown with it. If we didn't publish commercial circuits in valve days, we certainly wouldn't want to do it now.

In fact, I wonder who would?

It so happens that, while I was writing this, I came upon our Assistant Editor, Greg Swain, agonising over a letter from a reader who wanted us to "get down to tin tacks" and publish a circuit and explanation of a VCR.

Out of curiosity, I picked up one of the few manuals we have around the place – for an obsolete Philips VCR. The circuit was distributed over several double and triple-fold sheets, which could not have been accommodated in EA, anyway.

Even on the basis of area, the circuitry would have more than filled a dozen of our pages.

36-PAGE CIRCUIT

Out of further curiosity, I rang the service manager of one of the local distributors. How "big" was one of their recent VCR circuits?

Too big, he said, to accommodate on fold-out sheets of manageable size and readable print. The circuit had been broken down into sections and spread over about 36 individual pages!

That's not a circuit; it's a suburban street directory!

Fancy, not only attempting to publish it, but trying to explain it as well!

Not knowing what had led up to the inquiry, he explained that the circuit and the thick manual of which it formed a part would normally be used by servicemen who had been through a training seminar.

"What about a serviceman who hadn't had that opportunity? Who had to work straight off the manual?"

He grunted: "I'd feel sorry for him!"

I ended up with the impression that, if M.B. had indeed been disgruntled on the day that he wrote the original letter, one could hardly blame him!

STUDIO FORMAT
ETI 5000 STEREO CONTROL PREAMPLIFIER

There have been countless accolades exclaiming this brilliant design by Australia's top audio design engineer David Tilbrook — and with good reason.

SHEER SUPERB SOUND CLARITY
Together with noise levels that would do studio equipment proud.

PART OF THE SECRET IS . . .
the use of very fast response time "State of the art" OP amp semis, which have only become readily available in recent times.

As a demonstration of our faith in this classic designed preamplifier we proudly release the **STUDIO FORMAT 5000 PREAMP** which includes some very worthwhile refinements as detailed here:—

* Gold plated RCA Jacks on all phono inputs.
* 1 x pair gold plated RCA Line Plugs, supplied.
* Military spec. National Semiconductor LM 394's employed.
* Low capacitance screened cable, supplied; IC sockets provided throughout; Multicoloured led display.
* Metal film 1% resistors used throughout all audio circuitry.
* Pretinned PCB's.
* Satin Black brush finished, aluminium control knobs.

FACILITIES AND SPECIFICATIONS

Inputs

Low Level	— Moving coil, moving magnet 1, moving magnet 2.
High Level	— Tuner, Aux 1, Aux 2.
Tape	— Tape 1, Tape 2.
Calibration	— Inbuilt 400HZ Oscillator.

Led Level Meters

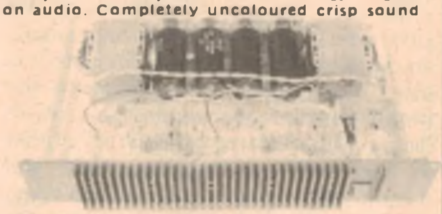
Mode selection to	— Source, tape 1 record level, tape 2 record level.
Range	— Calibrated −48 to +9db.
Display	— Peak and average level simultaneously.
Frequency Response	15 HZ – 130 KHZ + 0db − 1 DB.
Distortion	— Less than .003% all inputs.
S/N Ratio	— Greater than 100 db (A weighted) High Level IP/S. Greater than 92 db (A weighted) Moving Magnet IP. Greater than 75 db (A weighted) Moving Coil IP.
Monitor Output	— Enables comparison of record level to source levels.

DELUXE STUDIO FORMAT 5000 PREAMP KIT K 5001 . . . **$275.00**
Complete kit includes all ETI specified parts plus the Studio Format Package.
Full instruction booklet included.

SEE ETI MAGAZINE JULY '81—OCT. '81 FOR FULL DETAILS.

ETI 5000 STEREO MOSFET AMPLIFIER

See ETI magazine Jan. '81—April '81. New generation mosfet power semis facilitate David Tilbrook's classic power amplifier. Listening tests prove it surpasses even the best in conventional amplifiers in low fatigue, high definition audio. Completely uncoloured crisp sound purity.



EVEN BETTER: This beautifully engineered amp design is based principally on two identical printed circuit boards with a minimum of other wiring, thus enabling even a relative "beginner" to accomplish building this project as long as the step by step instructions are followed.

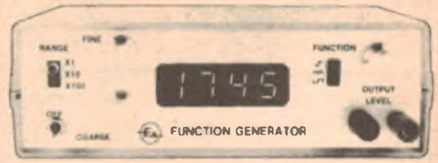
The Altronics Kit includes the **DELUXE FINISH FRONT PANEL HEATSINK**.

* Original specified chassis bar design case * All metal work finished satin black. * Flux shorting strap transformers used to minimise hum * Low leakage power supply electrolytics used.

SPECIFICATIONS:
Power Output: 100 watts into 8 ohms x 2. **Frequency Response:** 8 HZ - 20 KHZ + 0db − .4db.
Noise: 116 db below full output. **Input sensitivity:** 1V RMS for 100 W output.
DISTORTION: Less than .001% at 1 KHZ and full output.
STABILITY: Unconditional stable.

COMPLETE MOSFET AMP KIT K 5005 . . . . **$289.00**

FUNCTION GENERATOR WITH DIGITAL DISPLAY



EA's new Function Generator covers the frequency range from 15Hz to 170kHz in three ranges with coarse and fine frequency controls. An economical 4-digit display has been incorporated to eliminate dial calibration. Sine wave distortion can be trimmed to around 0.5%.
See EA April, 1982

K 2505 . . . . **$79.50**

ALTRONICS POWER SUPPLY

BASED ON EA LM 317K PROJECT
Every workshop, school and hobbyist should get one now!

* Overload and short circuit protected.
* Full voltage and current metering.
* 3-32 volt output at 1 AMP.
* Uses LM 317K variable regulator.
* Full instructions and every last part included.

VALUE PLUS!

K 3200 . . . . **$39.95**

DIGITAL CAPACITANCE METER

Electronics Australia Project. Measures 1PF — 99.99 UF. 240V Mains Powered. Bright LED Display. Easy to build. Complete kit of parts and full instructions.

K 2520 . . . . **$45.00**

DUAL TRACKING POWER SUPPLY

+ and — 22V up to 2 AMPS
+ 5V at .9 AMP
Fully Protected against short circuits, overloads and thermal runaway.
See EA March, 1982

K 2507 . . . . **$86.00**

DIGITAL FREQUENCY METER

See Electronics Aust. Mag. Dec. 81-Feb. '82

500 MHZ, 7 DIGIT RESOLUTION PLUS PERIOD MEASUREMENT FEATURE

IMPORTANT NOTES:
(1) This project is well within the scope of the "not so experienced" as virtually all components are contained on a single PCB.
(2) ALTRONICS USE ONLY THE SPECIFIED INTERSCIL LSI — BEWARE OF INFERIOR KITS THAT DO NOT CONFORM TO THE ORIGINAL DESIGN.

* Prepunched and screened front panel, no drilling or filling required. * Bright high efficiency 7 segment display. * Frequency ranges 0-10MHz, 0-50MHz, 10-50MHz (with optional pre-scaler) * 4 gating times — 01, .1, 1, 10 seconds. * 4 period measuring ranges 1, 10, 100 and 1000 input cycles give 0.1uS resolution. * High input sensitivity — 10mV to 30MHz, 100mV at 50MHz @ 1M input impedance, 200mV at 500MHz @ 75 ohms input impedance. * High accuracy — typically better than .005%/count uncalibrated.

Costs a fraction of commercial counters.

EXCLUSIVE ALTRONICS KIT FEATURES:

* IC sockets provided throughout.
* Low aging 10,000 MHZ XTAL.
* Thermalloy heatsink for 5V regulator.
* Quality Pactec Instrument Case

K 2500 (50 MHZ version) **$119.50**
K 2501 Pre scaler . . . . **$ 26.00**
(add for 500 MHZ version)

DIGITAL THERMOMETER LCD

See EA Feb. '82. Fantastic new project. * 1°C Resolution * Has inbuilt sensor for portable use * External sensor capacity allows measurement of fish tanks, heatsinks etc. Uses brand new DPM-200 15mm LCD Display. Easy to build.

K 2530 . . . **$59.95**

ALTRONICS ... ALTRONICS ... ALTRONICS ... ALTRONICS ...

WESTON CAR SOUND

* Superb Japanese Engineering.
* Rugged and Reliable.
* State of the Art Electronics.

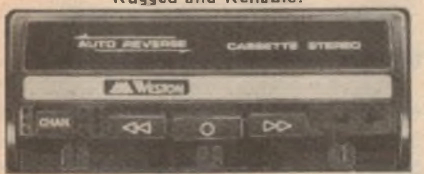
Famous LANKAR SPEAKER SYSTEMS

We are absolutely delighted with our range of LANKAR Car Sound Speaker Systems — if you've already got a set you will know what we mean — beautifully engineered, physically and acoustically. Definitely Australia's best value for money in speakers. All kits are supplied C/W mounting hardware, terminals, cable etc.

WESTON CAR SOUND AUTO REVERSE CASSETTE DECK CS100

* 8 watts per channel * Quality patented tape transport mechanism * Fast forward and rewind * All IC circuitry * Frequency response 33-10 KHZ. Dimensions: 48H x 120W x 165D.

Rugged and Reliable!



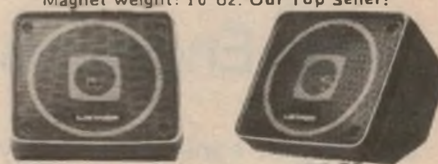
C 9110 . . . . **$69.50**

* ALTRONICS DIRECT IMPORT ELECTRONICS CATALOGUE *

Our first edition catalogue was released with Electronics Australia Magazine March 1982. If you missed out send $1.00 to cover packing and postage — You will be amazed at the savings ALTRONICS offer in comparison to the "Heavyweights" of the Electronics Component Industry.

FLUSH OR REAR MOUNT COAXIAL CONVERTIBLES

Use them as they are or discard the PVC removable shells and flush mount. 15 watt max. input. Frequency response: 100-15,000 HZ. Impedance: 4 OHM Magnet weight: 10 oz. **Our Top Seller!**

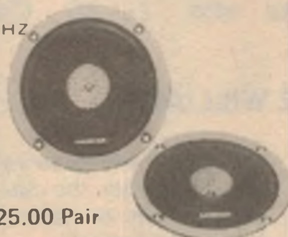


C 9312 . . . . **$39.50**

20 WATT TWIN CONE 5"

5" (120mm) slim line one piece fixing, air suspension type
100 HZ - 12,000 HZ
Impedance: 4 OHM
Magnet: 5 oz.

Max. Power 15W



C 9320 . . . . **$25.00 Pair**

20 WATT TWIN CONE 4"

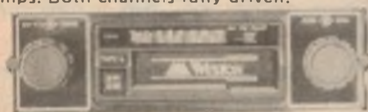
4" (106mm). air suspension speakers. C/W grills and fixing screws, cable etc. 110-15,000 HZ. Impedance: 4 OHM Magnet: 6 oz.

Max. Power 20W

C 9325 . . . . **$29.95 Pair**

AM/FM CASSETTE CS500

* Quality AM/FM receiver * Sensitivity 3UV FM, 10 UV AM * 6 watts per channel power output * 33-10 KHZ frequency response * Wow and flutter less than .2% * Output impedance 4-16 OHMS * Power source DC 13.2V neg. ground 350 MA No. sig. to 2.5 amps. Both channels fully driven.



C 9120 . . . . **$89.50**

3-WAY SEPARATE SPEAKER SYSTEM

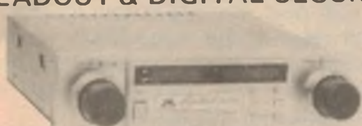
GPX 650 3 WAY SEPARATE SPEAKER SYSTEM

Positively brilliant and worth every cent! Supplied with complete installation kit, screws, wiring and connectors.

Max. Power 40W

C 9350 . . . . **$79.50**

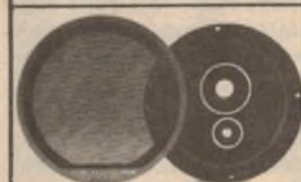
CS4000 THE POWER HOUSE MASSIVE 25 WATTS/CHANNEL WITH DIGIT FREQUENCY READOUT & DIGITAL CLOCK



HIGH FIDELITY AM/FM CASSETTE

Super sensitive AM/FM receiver with superb fidelity inbuilt amplifier. When you feel you owe it to yourself to go "top shelf" this is the one, and at our price why not anyway! **DIGITAL DISPLAY** gives continuous readout of signal frequency or at the flick of a switch becomes a digital clock. **DX-LOCAL** sensitivity switch. **FREQUENCY RESPONSE** 40 HZ—10 KHZ. **STANDARD IN-DASH MOUNTING.**

C 9130 . . . . **$179.50**



VIVANCO SPEAKERS

Top of the line car stereo speakers. In the classic tradition of fine motoring such as Mercedes and Daimler we now proudly offer a limited range of true natural fidelity Vivanco Speaker Systems. As you may guess, they are not cheap-but then fine reproduction never was!

30 WATT TRIAXIAL

136mm (5.3 in.). 80-22 KHZ, 4 OHM Impedance, weight 800 gm.

C 9230 Pair including grills **$59.50**

60 WATT TRIAXIAL

156mm (6 in.). 80-22 KHZ, 4 OHM Impedance, weight 1.3kgs.

C 9260 Pair including grills **$89.50**

60 WATT THREE WAY BOX SPEAKERS

Air suspension bass driver. 50-22 KHZ, 4 OHM impedance, weight 2.8kgs. Dimensions: 226W x 130H x 179D.

C 9270 Pair inc. wiring **$169**

OVER 1,000 KITS TO CLEAR ½ PRICE!

Famous ETI Project Electronics Kits

		Normally	NOW
K 0141	Continuity Tester	$4.00	$2.00
K 0143	Heads or Tails	$3.50	$1.75
K 0145	500 Second Timer	$4.50	$2.25
K 0147	Morse Practice Set	$3.50	$1.75
K 0511	Battery Saver	$3.90	$1.95
K 0148	Buzzboard	$3.90	$1.95
K 0161	Basic Amplifier	$5.50	$2.75
K 0166	Temperature Alarm	$4.90	$2.45
K 0167	Singing Moisture Meter	$4.90	$2.45
K 0163	Electronic Bongos	$5.00	$2.50
K 0162	Simple AM Tuner	$6.50	$3.25
B 9994	Project Elect. Bk. (Features all above kits)	$4.75	$2.40

STOP PRESS!!

AC ADAPTORS

All Brand New
All S.E.C. Approved
M 9990 4.5V 150Ma
M 9991 6V 150Ma
M 9992 9V 150Ma

All A CRAZY $4 each

Great for Calculators, Portable Radios, Dictation Recorders, and for charging NICAD Batteries.

$2 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 your receive goods. Weight limited 10kgs.

$4 DELIVERY AUSTRALIA WIDE We process your order day received and despatch via Jetservice for delivery next day.

BANKCARD HOLDERS CAN PHONE ORDER UP TO 8PM (EST) FOR NEXT DAY DELIVERY — SOUNDS INCREDIBLE DOESN'T IT? Alright you cynics just try us! Weight limit 3.3kgs. Jetservice cannot deliver to P.O. box numbers (Australia Post would have a fit).

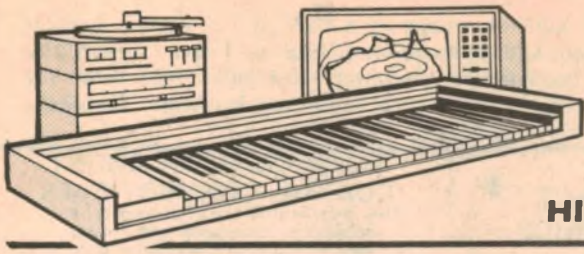
$10.00 HEAVY HEAVY SERVICE — AUSTRALIA WIDE All orders over 10kgs must travel on the heavy service, that is — road express. Delivery time 7 days average.

ALTRONICS
105 Stirling St. PERTH
(09) 328 1599
for instant service

All Mail Orders: BOX 8280 PERTH Stirling St. WA 6000

ALTRONICS .. ALTRONICS ... ALTRONICS ... ALTRONICS ... ALTRONICS ... ALTRONICS ... ALTRONICS ... ALTRONICS ...

BANKCARD JETSERVICE-DELIVERY NEXT DAY BANKCARD JETSERVICE-



Audio-video Electronics

HIFI • HOME VIDEO • PROFESSIONAL AUDIO

Audio Engineers to handle dbx in Australia

At a recent symposium in Sydney, Scott Berdell, International Sales Manager of dbx Inc, explained and demonstrated some of the domestic audio products currently being produced by his company. Among them was the 20/20 Computerised Equaliser/Analyser.

by NEVILLE WILLIAMS

At the symposium, General Manager of Audio Engineers Pty Ltd, Gary Fitzsimmons, announced to dealers and to press representatives that Audio Engineers had been appointed as Australian distributors for dbx domestic products.

Audio Engineers' address is 342 Kent St, Sydney and their telephone number is (02) 29 6731.

The first part of the presentation by Scott Berdell was an audio-visual demonstration of domestic noise reduction systems — in particular Dolby-B, Dolby-C and dbx. The equipment available included a turntable and cassette player with typical and noise-only discs and tapes, a high quality stereo amplifier system, and a very versatile TV-style display, able to show instantaneous peak and RMS levels over the audio spectrum.

Not unduly hampered by modesty, the lecturer observed that the letters "NR" (Noise Reduction) were not really appropriate for the dbx system: "We should really be talking about 'NE' — Noise Elimination!"

In fact, the demonstration which followed, tended to lend substance to this bit of whimsy.

As heard through the loudspeakers, and displayed on the screen, the subjective impact of broadband noise was shown to be significantly reduced by Dolby-B NR. It was still further reduced by the new Dolby-C system, although the low frequency "rumble" content still remained.

By contrast, dbx noise reduction was shown to operate uniformly right across the spectrum, giving an effective noise reduction of about 30dB. When this potential is added to what can be achieved by ordinary good quality disc and cassette recording technology, the overall result is a virtually noise-free recording with a dynamic range equal to the demands of a live performance.

The dbx noise reduction operates by compressing the dynamic range of an input signal over the full audio spectrum, and in a linear fashion, by a ratio of 2:1, just before it is recorded on to tape or disc. Therefore a signal which has a dynamic range of, say, 90dB (-75dB to +15dB) is compressed to a range of 45dB (-37.5dB to +7.5dB).

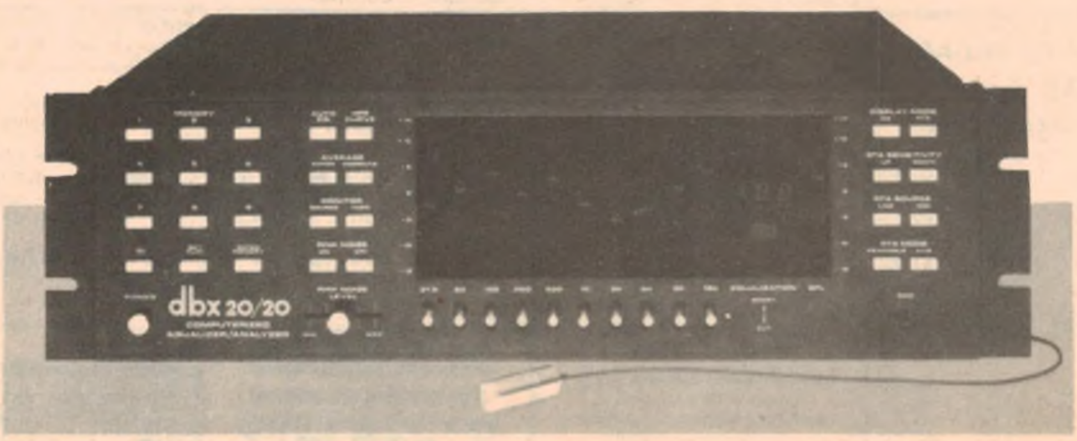
This makes it very much easier to accommodate on the recording medium:

On tape, it can be more easily kept above the noise floor and below the level at which the magnetic system overloads.

- Because the amplitude of the high frequency content can be restrained, there can be a direct improvement in high frequency response.
- On disc, the signal can likewise be kept clear of the noise floor, while the reduction in peak groove modulation reduces the demands on the mechanics of the system.

In the home, the signal from a dbx encoded cassette or disc is passed through a decoder, which can either be a separate unit or a decoder stage built right into an amplifier or cassette deck.

An "intelligent" graphic equaliser from dbx



With the aid of a pink noise signal and its own microphone, the dbx 20/20 will adjust to an optimum curve automatically in 15 seconds. It will also store the curve in its memory bank.

(An example of the latter is the Technics RS-M270X cassette deck reviewed in our November issue, and the somewhat less expensive RS-M240. Other dbx equipped Technics units are in the pipeline).

The decoder restores the signal to its original dynamic range, in effect expanding it outwards from the median level. Loud signals are made louder and soft signals made softer. This last observation is most important because, in making soft signals softer, dbx also has the effect of rendering residual noise such as inter-track tape hiss or disc surface "prickle" virtually inaudible.

Subjectively, the music does seem to jump out of silence and to reach quite startling peak levels.

Scott Berdell likened this dynamic range to what might be expected in a concert hall — the sort of sound that "produces goose pimples on your arms and a tingling in your spine!"

TAKE IT EASY!

With some spirit, our Editor, Leo Simpson, challenged the assumption that the kind of dynamic range being demonstrated and the kind of peak levels being generated were not representative of what people could tolerate in the average home. But, alas, an audience of hifi dealers was not about to support such assertions.

Spectacle they could understand; spectacle they could demonstrate; spectacle they could sell! What was this fellow Simpson trying to do to them?

Later, over dinner, I was able to communicate some of the reservations that have been expressed by our readers in recent months.

In this atmosphere, Scott Berdell was prepared to concede that listening conditions in the home were not always compatible with a wide dynamic range and that a large section of the buying public might tend to reject recordings which went too far.

He offered the further opinion that one of the least compatible environments for wide dynamic range was in the average family car. The dynamic "window" between ambient noise and a level that could be painful or dangerously distracting was far too narrow for spectacular dynamics — with or without dbx!

In fact, he had not come to talk about either mood music or in-car stereo. His aim was to show how dbx technology made available full, natural dynamic range for those situations in which it was appropriate and desirable.

One other point that came out of the over-dinner conversation was

THE SANSUI "COMPU-EQUALISER"

At the time of the dbx presentation in Sydney, the lecturer stated, as his opinion, that the dbx 20/20 was a unique development. However, a brochure which reached us about the same time — direct from Sansui in Japan — indicated that their new SE-9 "Compu-Equaliser" had been designed concurrently to do much the same job.

On the information available, the SE-9 appears to be somewhat less elaborate than the dbx 20/20 but the concept is certainly very similar.

On appearance, the SE-9 is a more obvious derivative of a conventional graphic equaliser, with directly accessable manual sliders controlling the contours of the left and right stereo channels. There are eight frequency bands for each (the 20-20 has 10), the frequencies in Hertz being: 80, 160, 315, 630, 1.25k, 2.5k, 5k and 10k. Range of adjustment is plus and minus 12dB.

From the controls, it would seem that the SE-9 is intended to be patched into the amplifier tape loop, with access still available to the signal path through sockets and controls on the SE-9 itself. Provision is made for two tape recorders, even where the amplifier itself has provision for only one.

To the left of the panel is a "spectrum analyser" display using 8-ladder LEDs, ostensibly blue in colour and calibrated from −24dB at the bottom to +3dB at the top. Panel switching allows the contour of the compensation in use to be displayed or the frequency spectrum of the signal being amplified, using the same bands as the graphic equaliser. The display can be switched to either left or right channel or to show a composite of both.

PINK NOISE, MICROPHONE, COMPUTER

To this point, the SE-9 could be seen as an elaborate graphic equaliser but there is more to it. Like the 20-20, it is equipped with an in-built pink noise generator, a microphone which allows it to "listen" in sequence to the left- and right-hand loudspeakers and a computer which can compare the energy distribution of the sound as heard with what it should be, as per the source signal.

But, instead of relying on an electronic adjustment of gain and an electronic display, the SE-9 links the output of the computer to two tiny motors which physically alter each of the potentiometer settings. The operator therefore sees the unit set itself up for optimum system/room response, an operation that takes about 30 seconds to complete. The settings can be modified subsequently, if the operator so desires.

A memory system can store the computer curve for optimum listening, ready for instant recall. Indeed, there is provision to store up to four curves including suggestions by Sansui for a sound "menu" – curves that might be considered appropriate for rock and pops, disco sound and low-level relaxed listening.

The fourth, for in-car listening, can be used to make tapes to suit the acoustics of an average car system.

A "cancel" button serves to bypass the frequency shaping system, allowing instantaneous comparison of the direct and modified signal.

Frequency response is rated as 10Hz to 100kHz (+0 to −1dB), total harmonic distortion 0.008% at 1V/600 ohms output, and signal/noise ratio 110dB. Gain at 1kHz is unity, with all sliders set at 0dB "Flat".

LOGIC DM1 REFERENCE TURNTABLE NOW AVAILABLE

In March last, A. V. Dale Electronics was appointed as Australian agent and exclusive distributor in this country for Logic Products, of Warwickshire, UK. Logic Products are best known for the DM 101 Reference Turntable, pictured below, which is likely to retail in Australia for about $800.

The DM 101 Reference Turntable has been advertised frequently in UK hifi magazines but, to date, very few have been imported into Australia. They should be available ex-stock from A. V. Dale Electronics by the time you read this.

Logic Ltd claim that the turntable fully justifies the description "Reference Standard" and that it is competitive with other prestige turntables which retail for a considerably higher price. Performance claims appear to be based, not so much on gee-whiz technology as all-the-way precision.

It is sold primarily as a turntable, to which the purchaser may add the high quality tonearm of his choosing. However while the unit will accept most quality arms, the manufacturers have made special provision for the types most likely to be chosen.

The turntable is a two-speed belt-drive design, powered by a 24-pole synchronous motor, electronically controlled by a plug-in PC board assembly.

The platter itself is of two-piece aluminium construction, precision machined and fitted with a bonded felt mat. It is supported by a diamond-lapped steel spindle running in twin bronze bushes, with thrust being taken by a concentric ball and a precision steel thrust pad.

An 8mm thick aluminium chassis provides a rigid mounting for the turntable and arm, being supported, in turn, at three points, with a pair of tension springs at each point. The turntable can be levelled from the top, in a system which is claimed to be both convenient to set up and effective in isolating the whole assembly from acoustic feedback.

The plinth, as shown, has a satin black top and either black or veneered sides and comes complete with a detachable smoked acrylic dust cover. Overall dimensions are 356 x 483 x 152mm.

For details: Nigel Cowan, A. V. Dale Electronics, 274 Victoria St, Brunswick, Vic 3056. Phone (02) 387 6170.

AUDIO-VIDEO ELECTRONICS — Continued

especially noteworthy and in flat contradiction of what is commonly repeated as a criticism of the dbx system.

Someone mentioned the need for a cassette recorder, to be used in conjunction with dbx NR, to exhibit an unusually flat frequency response; any non-linearity would be doubled, by the system, along with the dynamic range.

For example, if the cassette system, on playback, exhibited a peak of 4dB at 8kHz, it would emerge, after expansion, as a peak of 8dB. Similarly, a droop of 5dB would end up as a much larger droop of 10dB.

Scott Berdell admitted that a test performed with a single pure sine wave might produce this result and lead to that conclusion. That would come about because the RMS detector, measuring the signal and controlling the gain of the VCA (Voltage Controlled Amplifier) would be responding only and totally to that one sine wave.

Program material is not like that, rarely if ever comprising a single sine wave. It normally contains energy distributed across the spectrum and the RMS detector measures the RMS value of the total signal, not just that of a component at a particular frequency. Therefore the situation of dbx doubling discrepencies in the response curve does not arise in practice.

On ordinary program material, additional frequency error is, at best, not discernable and, at worst, considerably less than 2:1.

Obviously, there is every reason to seek a flat response from a tape system, whether or not dbx is in use. However, the penalties of using a less than perfect tape system with dbx noise reduction are not nearly as serious as they have been made out.

Indeed, Scott Berdell was quite expansive about the merits of the RMS detector system currently being used by his company and, of course, the associated voltage controlled amplifier (VCA). Expansion/compression tracking, he said is extremely good, and not dependent on a critical reference level, as is the case with other systems. "Breathing" effects are minimal and the distortion right through the encode/decode process typically less than 0.1%.

Getting back to the lecture session, quite an array of dbx audio equipment was on display, along with relevant brochures. Most of the models are now carried in stock by Audio Engineers and these include the following units:

To the audiophile, nothing is more fr strating than dr p outs.

Nothing destroys the seductive effect of good hi fi faster than the shattering silence of a drop out.

Having a favourite piece of music disappear before your very ears is most disconcerting.

Especially since, unlike other aspects of recording and playback, this one is actually out of your control.

Or is it?

The fact is, some tapes are drop-out prone while others are not.

A major Melbourne tape dealer* recently pointed out that "the absolute lowest percentage of faulty tapes is TDK".

Certainly, TDK does have a remarkable reputation for reliability.

To understand why the drop outs that occur with some other brands rarely occur with TDK, you need to understand first of all what causes them.

Classically, it has to do with a discontinuity of the magnetic coating.

With cheap tapes, this may be a section which has no coating at all.

But usually, it's due to imperfections called "nodules."

These minute irregularities may be clusters of oxides, or filter fibres trapped in the tape, or acetate particles...or even foreign matter such as dust.

By forcing the tape away from the recording or playback heads, they result in partial or total decrease in output.

TDK comes as close as technology currently allows to eliminating these nodules.

The company has spent 46 years studying the mysteries of ferrite (it was the first to commercialise this magnetic material).

By formulating uniquely uniform particles of ferrite oxide and, in turn, packing them together in a uniquely uniform arrangement, TDK manages to avoid clumps and gaps in its tape.

Additionally, engineers and craftsmen at the plant wear surgically clean robes and even vacuum the air to avoid foreign contaminants.

Finally, each roll of tape is polished.

But the cassette mechanism, as well as manufacture, can be a source of drop outs.

All TDK cassettes are precision instruments.

The unique double-clamp system for anchoring the tape to the hub virtually prevents the hub bumps that are a notorious cause of drop outs.

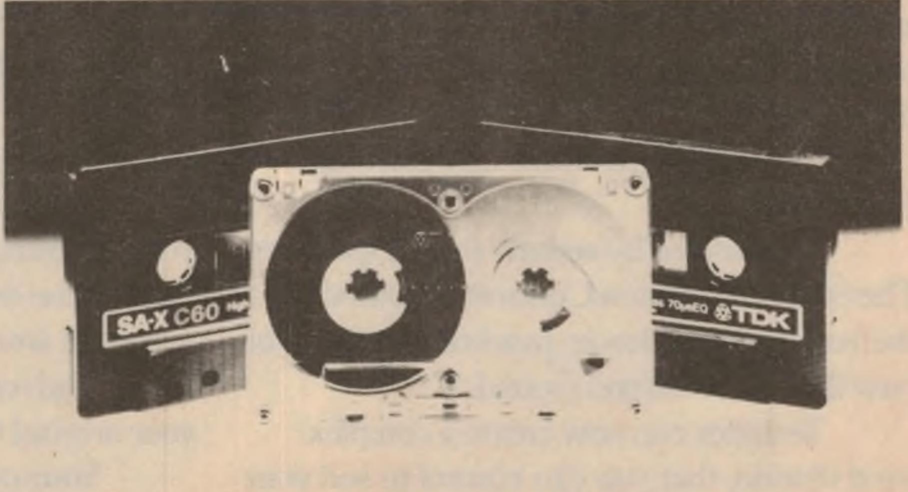
The winding mechanism, together with the parallel-to-within-one-micron edges, is designed to minimise kinks and twists.

If you have a TDK tape handy, inspect it (actually, it's already been through a series of ruthless inspections at the factory). The standard of engineering of the cassette itself is evidence of the standard of the tape inside.

Note: Any person practising tape recording should observe the provisions of the Copyright Act 1968.

TDK

"TDK does amazing things to my system."



*Steve Sartori, The Record Centre.

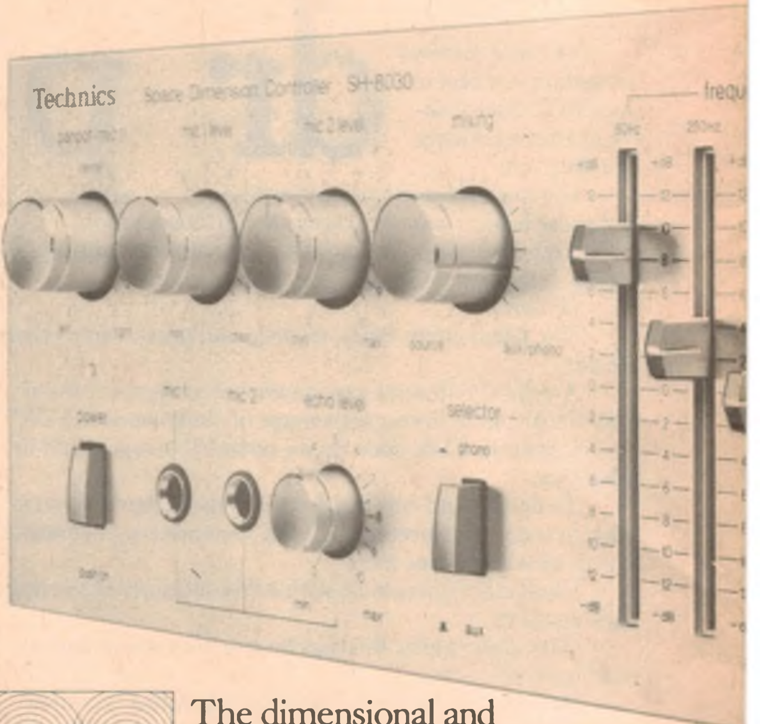
Bevins TDK1

Why Technics Space Dimen

Leave the walls where they are. Why do so many users of good quality sound equipment wish to change or modify their listening environment?

Because no matter how good a stereo set-up may be, it will always lack a vital ingredient of a live performance – the ambience and echo characteristic of a concert hall – the third dimension of sound.

Now Technics can provide an interesting answer.



Let Technics process the signal. To add this extra dimension to sound reproduction, Technics have developed a special signal processing device – the Space Dimension Controller.

You may think the name sounds dramatic.

The effect this processing has on conventional stereo reproduction is more than dramatic.

Conventional Stereo Reproduction. | With Ambience Effect. | With Ambience Plus Echo Effect.

It is stunning; a whole new listening experience.

Surrounded by sound – from 2 speakers. The Space Dimension Controller is based on the results of studies in psychoacoustics – or how the brain interprets sound.

Technics can now create a complex aural illusion, that you can control to suit your personal tastes.

The dimensional and echo facilities on this remarkable device add presence and impact to the sounds you hear.

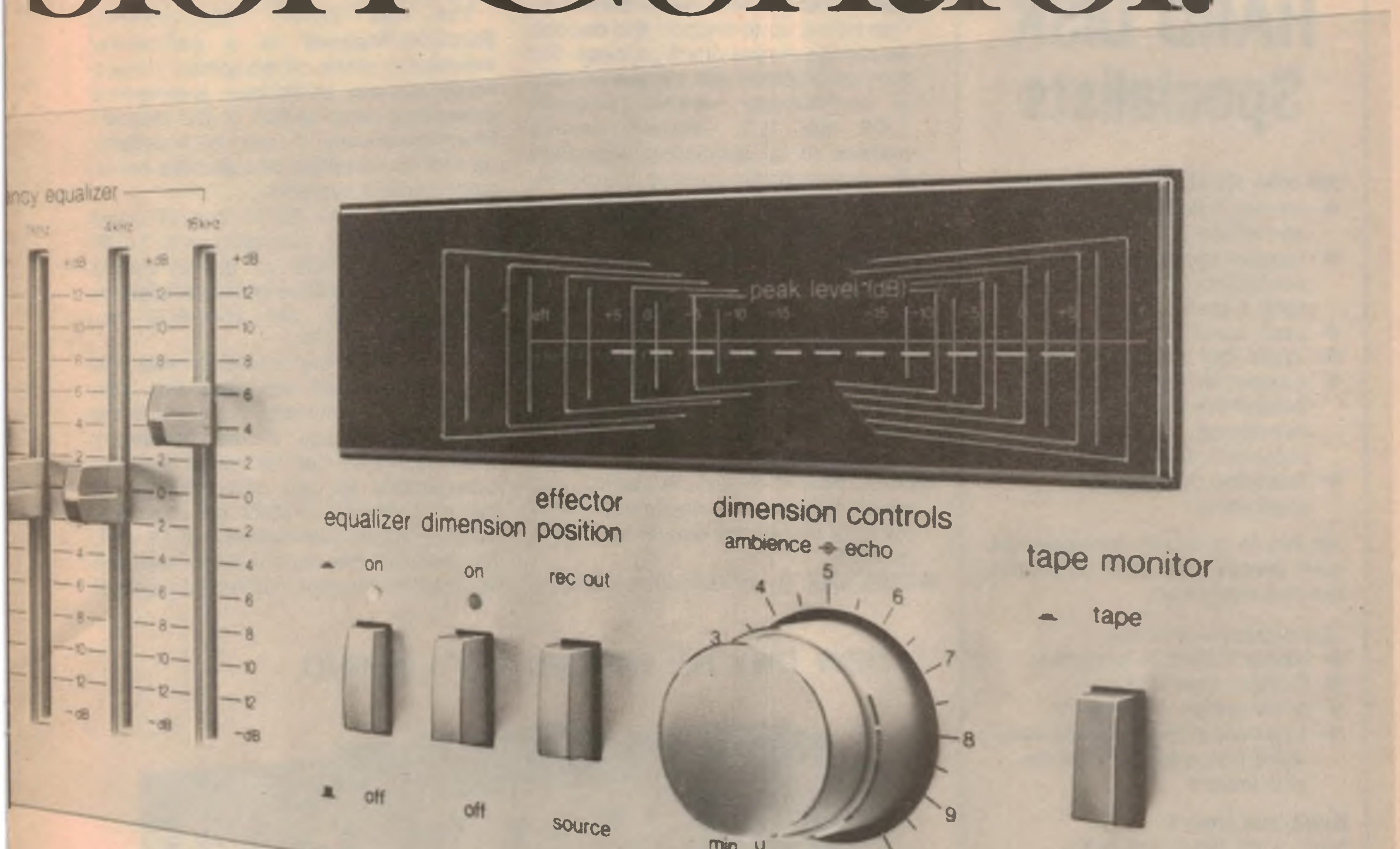
They can completely alter your 'listening stage'.

From being limited to the space between your speakers, the Sound Dimension Controller expands the stereo image to a maximum of 240° – in other words, to 30° *behind you.*

And remember, this is still using only your original two speakers.

Your own concert hall or recording studio. Technics have included other useful

developed
sion Control.



additional
facilities as well: A built-in graphic equalizer; a 'pan pot' (a device to relocate the aural position of anything recorded through the Mic 1 input); plus a program source mixer for fade effects using a second turntable.

However you choose to use the Space Dimension Controller, the end result will be a vastly more entertaining and exciting performance from your existing system.

Of course, all Technics components have a full two-year warranty.

Ask your Technics dealer for a demonstration. Very soon.

Technics
Expanding the music experience.

Dailey/NPA114

MODEL 224: dbx encode/decode unit intended for use in advanced home recording situations, involving 3-head tape decks and the need for real-time monitoring during record. Offers 85dB S/N ratio from open-reel and 80dB from cassette. Also provides facilities for dbx disc decoding and playback.

MODEL 222: dbx encode/decode unit for use with 2-head decks. Otherwise similar to the model 224.

MODEL 128: Dynamic range enhancer. Can be set up to encode and decode as per the normal dbx II process. But the compression and expansion ratio is continuously variable between 1.00 and 2.0, allowing existing material to be judiciously expanded for improved dynamics in the home, or compressed for limited home or in-car listening. Also applicable to disc playback situations.

MODEL 21: Disc decoder for the playback of dbx-encoded stereo discs in the home.

MODEL 3BX: Advanced dynamic range expander, adjustable to a ratio of 1.5 and intended to increase the dynamic impact of existing recordings or radio broadcasts.

MODEL 3BX-R: A remote control unit which operates in conjunction with the 3BX for greater convenience and flexibility.

MODEL 2BX: Dynamic range expander, somewhat less elaborate and less costly than the 3BX.

MODEL 1BX: Economy model dynamic range expander.

MODEL 20/20: Computerised equaliser/analyser. Further remarks follow later.

DISCS, dbx ENCODED: Over 80 titles are now available from analog or digital masters, and graded into three categories: Platinum, Gold and Silver series.

The dbx 20/20 Computerised Equaliser/Analyser is a particularly impressive piece of equipment, which could put any particularly well-heeled enthusiast away ahead of the Jones'! More realistically, it could be a setting-up tool for installers of elaborate hifi or indoor sound systems.

Essentially, the 20/20 is a 10-band graphic equaliser, providing up to 14dB of boost or 15dB of cut in bands centred on the following frequencies (in Hertz); 31.5, 63, 125, 250, 500, 1k, 2k, 4k, 8k and 16k.

By patching the equaliser into the signal chain and adjusting the gain upwards or downwards in the individual bands, the shape of the frequency response curve can be varied at will to compensate for any shortcomings in the reproducing system on or in the listening room. Alternatively, or as well, the analyser can be set up to enhance the dramatic impact of different types of

A new mini hifi system from Sanyo

High performance in a small space is the hallmark of Sanyo's new Mini System II. The amplifier features volume, bass, treble and loudness controls, with a low frequency filter, headphone socket and input facilities for a turntable. Rated power output is 28W per channel. The tuner covers AM, FM and two short-wave bands, with push-button band selection and a 5-LED S-meter. And, despite its compact size, the cassette deck offers metal compatability, soft-touch controls and stereo microphone input. RRP for the System II complete is $665.00.

music — classical, rock, instrumental, vocal, etc.

This applies for any graphic equaliser but there the similarity finishes between "any graphic equaliser" and the 20/20.

In the normal equaliser the gain in the individual channels is controlled by manual slider pots, based on subjective judgment. Unfortunately, subjective judgment is seldom equal to the task and the user can end up very confused and very uncertain whether the selected settings are the best ones.

The 20/20 computerised equaliser/analyser takes over that job completely and automatically.

It contains a built-in pink noise generator, providing a signal which can be fed through the amplifier and loudspeakers. Alternatively, for an overall system check, it can accept a pink noise signal from disc or tape, where such is available.

Each 20/20 is provided with its own individually calibrated microphone, which can be placed in the normal listening position in the room. When the "Auto Eq" button is pressed, the equaliser "listens" to the pink noise through its microphone and, in the space of 15 seconds, adjusts each of its channels automatically for optimum pink noise energy distribution across the spectrum. The actual profile of the channel settings is displayed by a series of LED indicators.

The settings can be stored in a computer style memory and recalled at any time by pressing the appropriate button. Importantly, the memory is protected by a back-up supply in the event of a power blackout or inadvertent disconnection from the mains.

The 20/20 has provision to store up to 10 curves which makes it possible to record optimum equalisation for up to ten different listening positions around the room. But a "compute" button allows these readings to be averaged into a single curve to provide the best all-round compensation for the room as a whole.

Of course, the user can manipulate the computed curve or set up other curves subjectively to suit different kinds of music. But there is no need to make notes or to set the curves up again manually. Once settled upon, they can be stored in the memory and recalled in an instant, at the touch of a button.

And, at the touch of another button, the sound can be compared instantly with what it would be with all channels "flat".

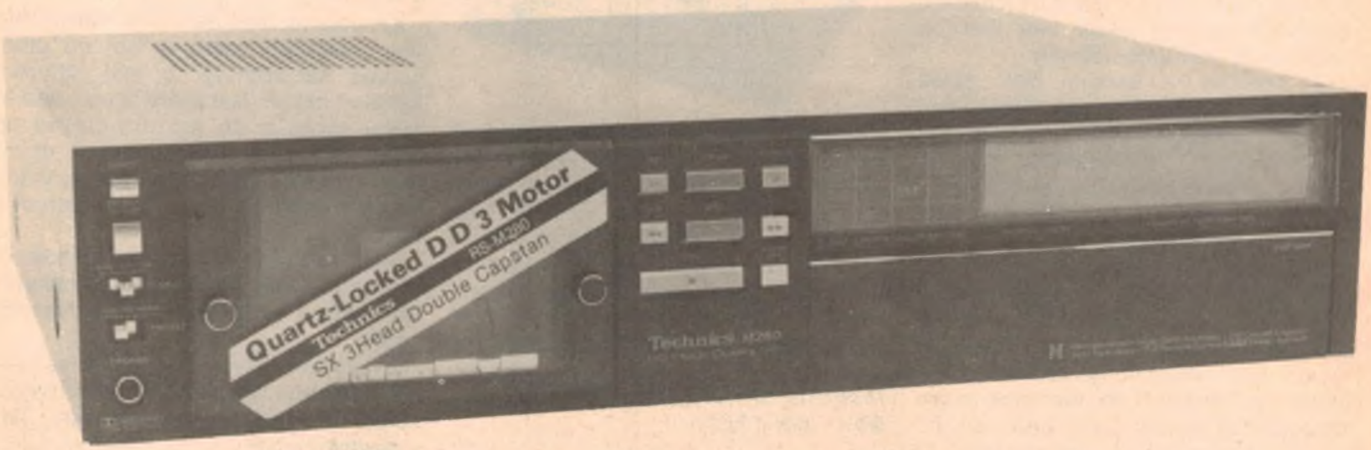
It's a fascinating piece of gear and the ultimate new toy for the well heeled audio enthusiast who already has everything else!

For further information about dbx products, contact Audio Engineers Pty Ltd, 342 Kent St, Sydney 2000. Phone (02) 29 6731.

VPI Industries has produced what it describes as the world's first, affordable professional quality record cleaning machine, the VPI HW-16. Designed for record archives, radio stations, hifi salons, etc, it is said to thoroughly wash and clean a record within 35 seconds. It uses a distilled water and alcohol mix and creates no mess. It is distributed by Singer Products Co Inc, 875 Merrick Ave, New York 11590.

HIFI REVIEW

Technics RS-M280 3-head cassette deck



Just introduced to the local market is a new line of Technics cassette recorders featuring automatic tape selection and soft touch transport controls. Top of this line is the RS-M280, which incorporates a dual capstan, tight-loop tape-drive system to ensure constant tape tension and optimum tape to head contact. It also features a three-head system with separate record and replay channels; and separate Dolby B encoders and decoders.

Slotted into the upper middle-price range of cassette recorders, the Technics RS-M280 has the usual high standard of construction that characterises Technics products. The black front panel has a satin anodised finish, with the pushbuttons for transport control grouped together just to the left of centre. The upper right hand area of the front panel contains displays of machine status, tape counter (electronic) and twin bar-graph level meters.

Below these displays is a blank panel which is actually a cover plate, hinged at its lower edge. It opens to reveal all the controls for audio setting and adjustment.

With the cover plate closed the machine looks particularly neat and uncluttered. However we can not completely agree with this design philosophy, since the commonly used controls (eg tape monitor and record level) are not immediately available. Further, being recessed, they are fiddly to operate; especially as their small size is not particularly suited to adult fingers.

Physical dimensions of the M280 are 430 x 97 x 340mm (W x H x D) while the mass is 6.3kg. A further gripe – the great depth of many contemporary hifi components often poses problems. After all, many standard shelves are only 305mm deep. Thus it would appear more sensible to reduce the depth and increase the height of hifi components, which would provide more front panel area and so enable larger knobs to be used (vide the Technics RS-M63).

Apart from the usual record level controls (dual concentric) and Dolby B selector, the M280 also provides controls for line output level, tape monitor, MPX filter selection, auto/manual tape selection, HF bias adjust, record input selection (of which more later) and record level calibration.

In auto mode the tape selector automatically sets HF bias level, recording equalisation and replay characteristic, according to the identification holes provided in the cassette body. After cassette insertion the appropriate window is illuminated in the first column of the matrix array (machine status) to indicate tape type (normal, CrO2, FeCr or Metal).

Only two selections are provided in "manual" mode: Metal and FeCr. FeCr cassettes do not carry identification "holes", and some early Metal cassettes also omit them. But what about old CrO_2 cassettes without identification? Or previously recorded cassettes whose recording characteristic had been deliberately chosen to be opposite to normal for that body type? We would prefer that the manual override apply to all four tape types, not just two, which would make the M280 a more versatile machine.

Being of three head design with separate record and replay channels, the M280 has a source/tape switch (A-B selector) to enable aural and visual comparisons of the material being recorded. The position of this switch is indicated in the second column of the matrix array. In common with a select few machines, this facility is taken a step further with the inclusion of an inbuilt two-tone test oscillator and panel-mounted adjustors for HF bias and record levels. It is thus possible to manually optimise the recording characteristics of the M280 for the particular cassette tape being used – a very desirable feature.

The previously mentioned record input selector has four positions – microphone input, line input, 400Hz and 400Hz/8kHz internal oscillator. Record calibration is carried out in two steps. Firstly, the input selector is set to the 400Hz position, and visual A-B comparisons of level are carried out. If the recorded level differs from the input (400Hz tone), the two screwdriver trimpots (for left and right channels) are adjusted to give an exact level match. On completion of this step the input selector is set to the 400Hz/8kHz position, then, in a similar fashion to the above, the bias control is adjusted so that the replay levels of the left and right channels are identical.

The selector is then returned to the 400Hz position and a check made that altering the bias has not disturbed the record level settings. If so the calibration procedure should be repeated. In this way the recorder may be optimised to almost any brand and formulation of cassette tape.

Note that in the 400Hz/8kHz position the left channel is being fed 400Hz tone, whilst the 8kHz tone is applied to the right. Thus, in this mode there is a simultaneous display of mid and high-frequency tones, such that the effect of varying the bias is immediately obvious. Having completed calibration the selector may be returned to either mic or line for normal music recording.

Similarly to tape type, the source/tape monitoring, MPX filter and Dolby B selection are displayed in the third and fourth columns of the matrix array respectively.

Between the matrix array and the level meters is located the large display for the electronic counter. One count corresponds to two rotations of the takeup spindle, and there are four fractional divisions which correspond to half-turns of the spindle. Although we have not examined all recorders in Technics' new range, we noted that the budget-priced RS-M07 (with mechanical counter) provides exactly the same count as the premium M280.

This will ensure easy place location from one new Technics machine to another. A microprocessor-controlled memory facility forms part of the electronic counter and, in conjunction with a selector switch (located to the left of the tape compartment), makes it possible to perform repeat, play, or stop functions as the figures revert to the "000" position.

The repeat function may operate from either the beginning of the tape to the 000 position, with automatic rewind to the start of the tape and repeat play; or, with automatic rewind from the end of the tape to the 000 position, and then repeat play.

Two capstans, one on the supply side, the other on the takeup side of the heads, are used to transport the tape past the heads. This is the so-called "tight loop" drive system which ensures constant tape tension and thus, constant tape to head contact, with the normal pressure pad (contained in the cassette body) being more or less redundant. Note that for proper operation of a tight loop system the supply capstan must be fractionally smaller in diameter than the takeup, otherwise a loose loop would develop.

The drive (take-up) capstan is directly driven by a quartz-locked motor, with the take-up spool driven by a separate motor.

Unlike most other machines in the same price range, the soft touch transport controls on the RS-M280 actuate a high speed motor which performs the appropriate functions via a gear and belt system. This results in smoother engagement of the pressure rollers and heads than is obtained with solenoid-controlled decks. Interfacing with electronically controlled transports is a relatively simple matter, so Technics offer a plug-in remote control unit as an extra-cost accessory.

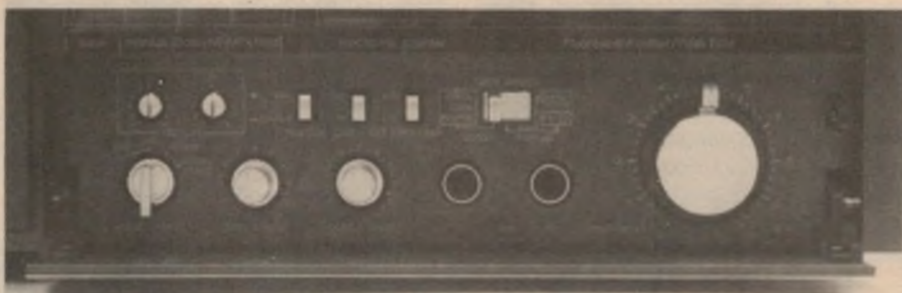
Level metering is performed by twin fluorescent bar-graph displays providing eighteen discrete steps, eleven coloured blue from −20 to −1dB, with the remaining seven from 0 to +8dB being orange. Each segment contains three thin vertical bars, which result in a pleasing appearance. They feature an auto reset peak hold function whereby the last highest peak is held for about two seconds, unless a higher peak occurs in that time period.

During this two-second period the instantaneous lower levels may be observed varying to the left of the "held" peak. Whilst display characteristics for bar-graph meters have not yet been standardised, we feel that those on this recorder must be near optimum.

Scale calibration of the meters was excellent, being within ±0.5dB over the meter range from −20 to +8dB. At the 0dB metering point, line output level measured 700mV with the Output Level control set to maximum. Internal output impedance varied between about 2.4kΩ and 4.3kΩ, the exact value dependent upon the setting of the output level. Calibration of the metering circuit is such that a recorded level of 160nWb/m produces 0dB replay level.

In common with most bar-graph meters they are labelled "peak" reading, but appear to be considerably faster in response than those fitted to equivalent or lower-priced recorders. Thus they provide a closer indication of program peaks than do slower responding meters — which means they can be considered to be truly peak reading. Unfortunately their fast response coupled with their scale calibration can result in the production of low-level recordings, or the erroneous criticism that previously recorded cassettes have excessive level.

As an example, comparing the levels of a prerecorded cassette on both the M280's meters and standard VU meters showed that the peak meters were consistently reading 8 to 10dB higher than the VU meters. Note that the sensitivity of each type of meter had been set to indicate 0dB on reference level (160nWb/m) steady tone. The above 10dB variation in readings is consistent with the expected difference between true peak reading and VU meters. As the standard VU meter provides calibrations for peaks up to +3dB, perhaps Technics should consider recalibrating their peak meters to provide for +13dB peaks? With this done, level metering on the M280 would earn a five star rating.



Close-up view showing the cover plate hinged down to reveal the various controls, including Dolby NR, HF bias adjustment, and record level calibration.

Peak wow and flutter was measured at between 0.05 and 0.08% DIN weighted — an excellent performance. Tape speed was found to be 0.25% slow, indicating that the review machine possibly required adjustment. Compared with similar machines which take about 90 seconds to rewind (or fast forward) a C60 cassette, the M280 takes only 75 seconds — a distinct improvement, although still short of the 50 odd seconds set by the industry standard.

We were a little surprised to find that audible cueing facilities were not provided for the fast forward and rewind modes. As several other machines in the Technics range include this facility, we can not understand why it was omitted. Once one has become used to audible cueing, it is difficult to locate tape position without it.

The replay frequency response tended to droop a little in the high frequency region, being about 3½dB down at 10kHz when playing a Philips test cassette. Providing the HF bias is optimised to the cassette, the overall (record and replay) frequency response is very good indeed, being within ±1dB from 40Hz to 17kHz when using type I (ferric oxide) cassettes. This marginally improved to 18kHz for both type II (CrO_2) and type IV (metal) cassettes.

With type I cassettes response was −2½dB at 30Hz, and −8dB at 20Hz. These figures improved slightly to −2dB and −7dB for the types II and IV cassettes.

Interchannel separation measured between 40 and 46dB for frequencies between 50Hz and 3kHz, decreasing to 33dB at 10kHz and 30dB at 15kHz. At low frequencies it was 37dB at 40Hz and 28dB at 30Hz.

Crosstalk between forward and reverse tracks (tracks 2 and 3) was better than 55dB for frequencies above 100Hz. At 50Hz it was 50dB, at 40Hz 45dB, and at 30Hz it measured 36dB. Both crosstalk and interchannel separation figures are as good as, or better than, any competitive cassette recorder.

Selecting the MPX filter introduces a 35dB notch at 19kHz into the recording channels. This will remove any residual 19kHz pilot tone emanating from an FM tuner. The Dolby noise reduction circuitry could mistrack if this tone were not suppressed. Thus it is only necessary to use the MPX filter when recording an FM broadcast. At all other times it should be switched out of circuit as it slightly affects the response at other frequencies. It reduces the 15kHz level by 0.7dB, and the response at 16kHz by 2dB.

At 1kHz, the total harmonic distortion measured 1% at 0dB input level, 2½% at +6dB, and 7% at +10dB when using a type I cassette (TDK "OD"). With a type II cassette (Technics RT-60XA) the distortion was 1.5% at 0dB, 7% at +6dB and 11% at +10dB. A type IV cassette (TDK "MA") gave essentially the same results as the type II. These results are not particularly impressive, particularly those obtained from the types II and IV cassettes. Insufficient HF bias appears to be the problem. However, if the bias is increased to improve these figures, the high frequency response suffers.

We were somewhat surprised by these figures because our evaluation of the Technics RS-M270X cassette recorder (EA, November, 1981) showed an excellent result. With types II and IV tapes the M270X produced 1.7% distortion at the +6dB level, and 4.7% at +10dB. The results were even better with type I tapes (1.5% and 3%). It would appear that Technics should increase both the record channel pre-emphasis and HF bias on the M280 to achieve similar results to the M270X.

Unweighted signal-to-noise ratio below a level of 200nWb/m (Dolby reference level) measured 52dB for type I cassettes, 56dB for type II, and 55dB for type IV cassettes. Engaging Dolby noise reduction improved these figures to 61dB, 65dB and 64dB respectively. Although not quite the best noise figures we have seen, they certainly place the M280 near the top of the list for quietness.

In conclusion, we found the performance of the Technics RS-M280 to be on a par with other machines in its price group. Its attractions include the three head system with separate record and replay channels, the inbuilt calibration facilities coupled with adjustable bias and record level controls, its excellent finish and presentation, and the very smooth action of its transport and pushbutton controls. Any purchaser would be very contented with his choice of machine. It should give years of satisfaction.

Recommended retail price of the M280 is $749 including sales tax. RCA to RCA audio cables are supplied with the unit, with four RCA sockets being located on the back panel for line input and output connections. Further information can be obtained from high fidelity retailers, or the distributors: National Panasonic (Australia) Pty Ltd, 95-99 Epping Rd, North Ryde, NSW, 2113 (P. de N.).

NEC PC-8000

A low cost, high performance microcomputer system designed for your needs..from $1,500

Includes sales tax

PC8000 combines the most wanted features of several leading microcomputers together with a few wonders of its own

INTRODUCTORY OFFER
FREE MEMBERSHIP IN THE 'AUSTRALIAN BEGINNING'
NORMALLY $100

Check these features..

- 5 user-programmable function keys. Up to 10 different user-defined routines can be activated using these keys and the shift key.
- 82-key keyboard features function keys and numeric keypad.
- 248-symbol character set.
- Z-80A equivalent microprocessor, running at 4MHz.
- CP/M™ disk operating system compatibility.
- N-key rollover.
- Standard memory features 24K bytes of ROM and 32K bytes or RAM
- 64K RAM is available with the PC-8012AI/O unit.
- 160 x 100 matrix of high resolution graphics, powerful control directly from the keyboard.
- Interfaces include color monitor, monochromatic monitor, audio cassette, Centronics™ printer.
- Screen formats of 20 or 25 lines and 36, 40, 72 or 80 characters per line, with adjustable scrolling window.
- A powerful editor simplifies programming and includes 4-way cursor control, · character insert and delete.
- Terminal mode available with a single command.
- I/O unit for plug-in circuit boards.

HANIMEX
means business

For Authorised Dealers phone:

SYDNEY 938-0400 ● MELBOURNE 64-1111 ● BRISBANE 262-7555 ● ADELAIDE 46-9031 ● PERTH 381-4622

Fit this to the dashboard of your car

Tacho/dwell meter with digital display

This digital tachometer with LCD readout is compatible with both electronic and conventional ignition systems and can be used with any 4, 6 or 8-cylinder petrol engine. At the flick of a switch, it also measures dwell angle to provide a quick check on engine tune.

by GREG SWAIN & JEFF SKEEN

No enthusiastic motorist would be without a tachometer to monitor gear change points, or to accurately set engine idling speed. Our new LCD Tacho/Dwell Meter is small enough to fit the dashboard of most cars, or can be built into a separate case for use only during engine tune-ups. With petrol prices now hovering around the 37 cents per litre mark, correct engine tune is more important than ever.

Main features of the unit include a 3½-digit LCD display and the ability to measure up to 12,000rpm, 8000rpm or 6000rpm on 4, 6 or 8-cylinder engines respectively. The corresponding dwell ranges are 0-90°, 0-60° and 0-45°. Note that the unit is calibrated during construction to suit only one particular engine category (either 4, 6 or 8-cylinder).

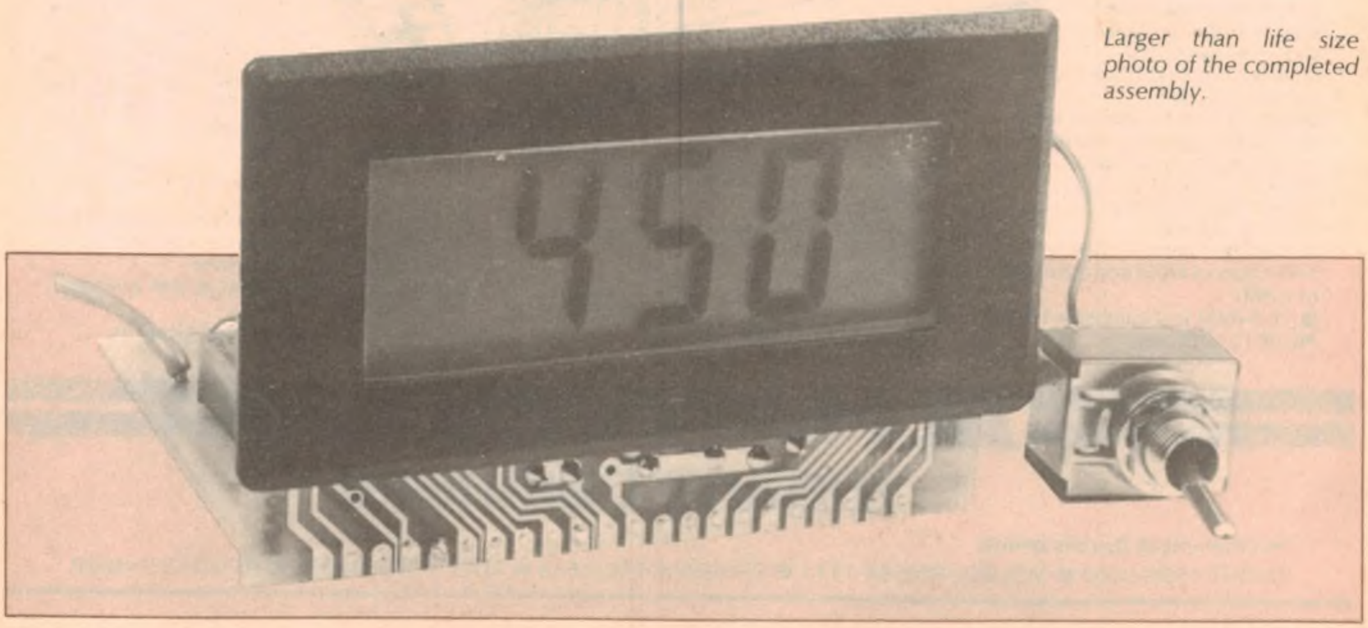
One important feature of the unit is that it is compatible with all current electronic ignition systems, including breakerless systems and transistor-assisted and capacitor discharge systems in which the points are retained. Only three leads are required to connect the unit for use: two to the power supply and the third to the points or to the transistor side of the ignition coil in the case of a breakerless system.

Readers who have fitted transistor-assisted ignition (TAI) to their cars can either connect to the points or to the ignition coil. However, while the tacho readings will be the same in both cases, the dwell readings will differ if the TAI has electronic dwell extension. In one position, the dwell meter will give the duty cycle of the points; in the other (ie to the coil), it will give the extended dwell reading.

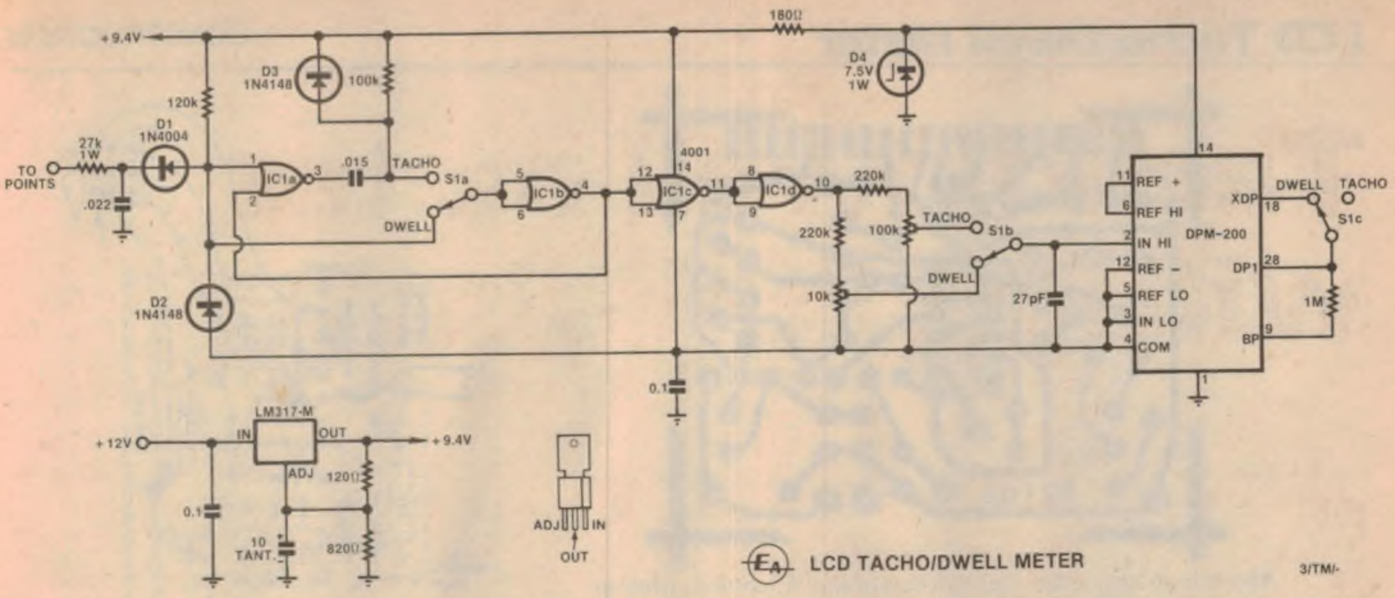
What is dwell?

Dwell is actually a measure of the duty cycle of the points and is defined as the angle through which the distributor shaft rotates while the points are closed. A 4-cylinder engine, for example, has four distributor cam lobes spaced 90° apart and this represents the maximum possible dwell angle (ie points permanently closed). Similarly, a 6-cylinder engine has 60° cam lobes, while an 8-cyclinder engine has 45° cam lobes.

In practice, the dwell angle is usually between one half and two thirds the cam lobe angle – typically 30°-35° for a 6-cylinder engine. The dwell angle should remain constant for all engine speeds (since the duty cycle remains the same), although a variation of one or



Larger than life size photo of the completed assembly.



The tacho circuit consists of a one-shot monostable (IC1a and IC1b), an integrator and the LCD module.

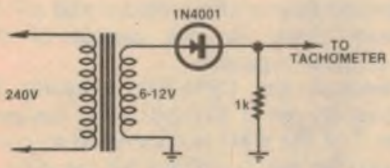
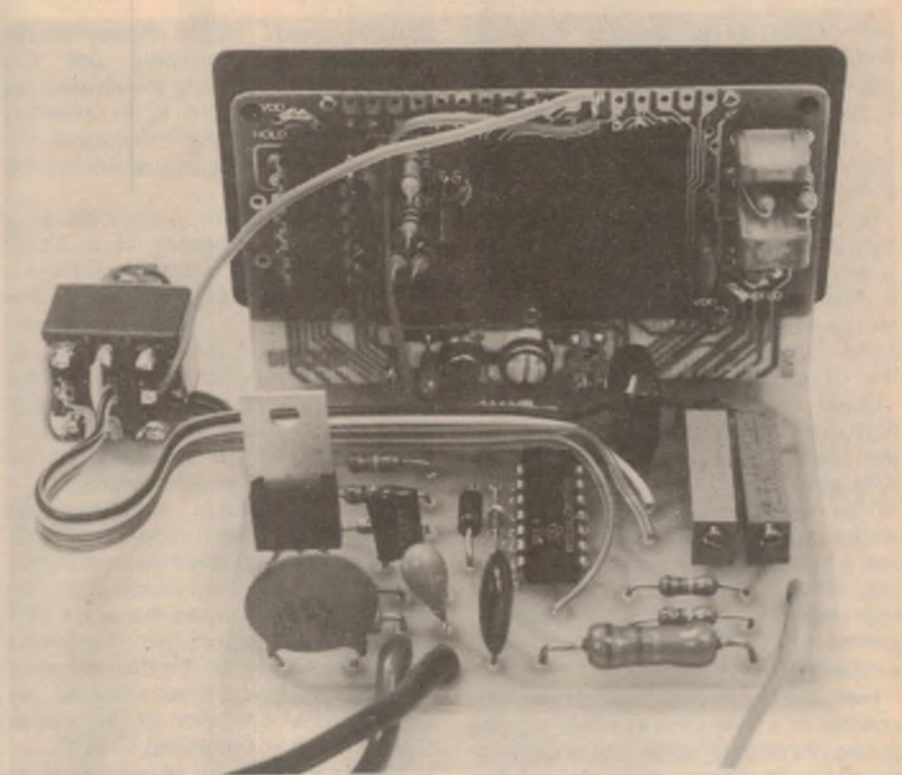


FIG. 1

Use this simple circuit to calibrate the tachometer range.



Rear view of the prototype. Note the wiring to the top of the DPM-200 module.

two degrees is usually encountered. Anything greater than that could indicate points bounce or a worn distributor.

Correct adjustment of the dwell angle is important to engine performance, and is a compromise between points life at low rpm and spark energy at high rpm. All you have to do is adjust the points gap until the correct reading is indicated on the display. This done, ignition timing adjustments can be carried out with the aid of the tachometer range.

How it works

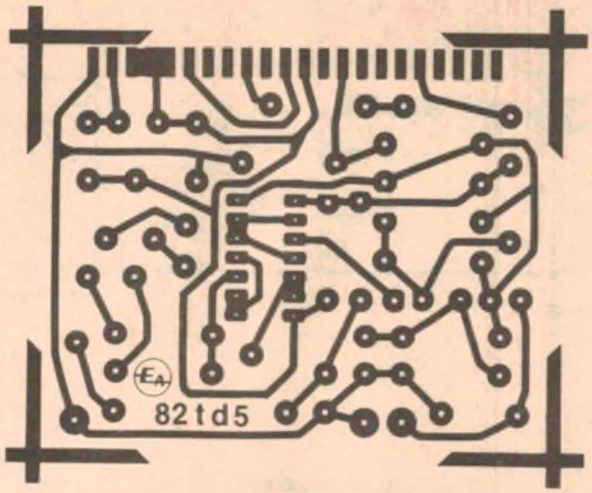
Heart of the circuit is the DPM-200 LCD voltmeter module as used previously in the Digital Thermometer and the LCD Digital Capacitance Meter. Apart from the module itself, the design uses just one IC, a 3-terminal regulator and a handful of other components.

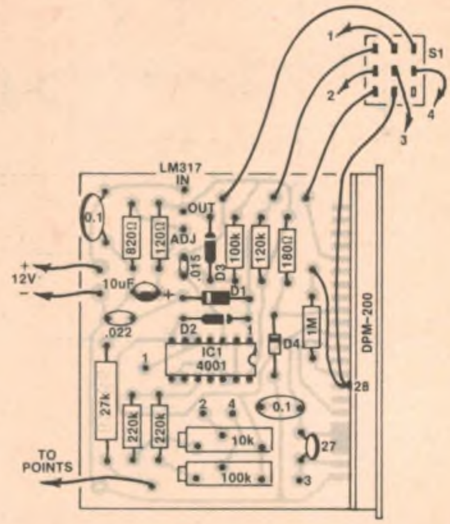
Signal input for both the tacho and dwell ranges is taken from across the points (or switching transistor) and passes firstly via an RC filter consisting of a 27kΩ 1W resistor and a .022μF capacitor. The job of the filter is to attenuate the large initial positive voltage spike from the coil, as well as coil primary oscillations. Following the RC filter are two silicon diodes (D1 and D2) and a 120kΩ pull-up resistor which translate the voltage across the points to a 5.3V (approx) peak square wave signal.

This voltage translation takes place as follows. When the input is at +12V (ie the points are open), D1 is reverse biased and the 120kΩ resistor pulls pin 1 of IC1a to the positive supply rail (+9.4V). When the points are closed, D1 and D2 are forward biased and pull pin 1 to +4.1V, or 0.6V below the common level (COM) of IC1. Note: the DPM-200 module maintains its common pin (pin 4) at Vcc − 2.8V = +4.7V.

In the tachometer mode, the "cleaned-up" points signal triggers a one-shot monostable consisting of NOR gates IC1a and IC1b. Let's assume initially that the points are closed and that the input to pin 1 of IC1a is low. Since the period of the monostable is quite short, it follows that the output of the monostable (pin 4) and pin 2 are also low, and that pins 3, 5 and 6 are all high (ie the .015μF capacitor is discharged).

When the signal input to IC1a subsequently goes high, pins 3, 5 and 6 are all pulled low, and the output of the monostable switches high. The .015μF capacitor now charges via the 100kΩ resistor towards the positive supply rail





Above is an actual-size reproduction of the PC pattern, while at right is the wiring diagram.

and, when it reaches the threshold voltage of IC1b, pin 4 switches low to end the monostable timing period. Finally, the points close again, pulling the pin 1 of IC1a low and resetting the monostable ready for the next positive-going trigger pulse.

Because it is connected directly to the output of the monostable, pin 2 is high whenever the output of the monostable is high. This step ensures that the monostable can not be retriggered by noise during the timing period (ie while the .015μF capacitor is charging).

Diode D3 ensures that the input of IC1b does not go more than 0.6V above the positive supply rail when pin 3 of IC1a goes high. It also ensures that the .015μF capacitor has sufficient time to discharge before the points open again and a new timing period begins. In practice, there is some loss of accuracy at high engine speeds, the unit reading approximately 2.5% low at 8000rpm on a 6-cylinder engine.

The output of the monostable thus consists of a train of brief positive-going pulses of constant width and amplitude, the pulse rate depending on the number of times the points open and close. These pulses are buffered by inverters IC1c and IC1d and applied to a voltage divider consisting of a 220kΩ resistor and 100kΩ trimpot. A 27pF capacitor then integrates the pulses to produce a steady DC voltage on the input of the DPM-200 module.

The voltage appearing on pin 2 of the DPM-200 will be proportional to the monostable pulse rate and can thus be directly related to engine speed. By suitably adjusting the 100kΩ trimpot, we can therefore calibrate the unit to read directly in rpm.

Compared to the tachometer circuit, operation of the dwell circuit is relatively straightforward. Dwell measurements are made by switching out the monostable and feeding the cleaned-up points signal direct to IC1b. Inverters IC1b,c,d buffer and invert this signal, the output of IC1d going high whenever the points are closed.

The output of IC1d is then fed to a voltage divider consisting of a 220kΩ resistor and a 10kΩ trimpot, and thence to the 27pF integrating capacitor. In this case, however, the voltage produced across the 27pF capacitor is proportional to the duty cycle of the output waveform of IC1d, and thus to the duty cycle of the points. The 10kΩ trimpot allows the circuit to be calibrated to read the dwell angle directly in degrees.

Switch S1 selects between the tachometer and dwell ranges, with S1c switching in the decimal point annunciator (DP1) for dwell measurements. The 1MΩ resistor connected between DP1 and the backplane pin (pin 9) prevents noise from turning on the decimal point annunciator when it is not required, yet allows normal operation of the annunciator when it is connected to XDP.

The power supply circuit consists of an LM317 3-terminal adjustable regulator, which provides a regulated 9.4V rail to power the CMOS IC. Supply decoupling is provided by a 0.1μF ceramic capacitor on the input of the regulator, while the 10μF capacitor connected to the ADJ terminal improves the ripple rejection of the supply to 80dB. The DPM-200 module is powered from a 7.5V rail derived from a 180Ω resistor and a 7.5V zener diode on the output of the 3-terminal regulator.

Because the DPM-200 maintains its common pin at Vcc-2.8V, and because pin 7 of the 4001 is connected to common, the supply voltage for the 4001 is therefore 9.4 − (7.5 − 2.8) = 4.7V. The 0.1μF capacitor on the common pin bypasses any noise which might otherwise affect the reading.

> We estimate that the current cost of components for this project is
>
> **$54**
>
> This includes sales tax.

Construction

All components except the switch are mounted on a small PCB which is soldered at right angles to the DPM-200 display module. The two connector strips on the edges of the PCB and the module take care of most of the necessary connections, thus keeping wiring to a minimum.

Assemble the PCB (code 82td5) according to the wiring diagram, taking care to ensure that all polarised components are correctly oriented. Observe the usual precautions when soldering in the 4001 CMOS IC: avoid handling the pins; connect the barrel of your soldering iron to the common track on the PCB using a clip lead; and solder pins 7 and 14 first to enable the internal static protection circuitry.

When the PCB is complete, it can be soldered component side up to the display module. Butt the two together at right angles with the lower edge of the display module overlapping the PCB by about 2mm. Now solder the two outermost connections. Adjust the assembly as necessary, then solder the remaining connections.

Connections to the 3-pole switch can be run using rainbow cable, but the points lead should be rated at 240V in order to achieve acceptable insulation rating. The 22kΩ input resistor should be

PARTS LIST

1 printed circuit board, code 82td5, 67 × 53mm
1 DPM-200 LCD module
1 3-pole 2-position toggle switch

SEMICONDUCTORS
1 LM317M or LM317T 3-terminal adjustable voltage regulator
1 4001 quad NOR gate
2 1N4148 diodes
1 1N4004 diode
1 7.5V 1W zener diode

CAPACITORS
1 10µF 25VW tantalum
1 0.1µF greencap ("COM" bypass)
1 0.1µF ceramic (supply bypass)
1 .022µF greencap
1 .015µF greencap
1 27pF ceramic

RESISTORS (¼W, 5% unless stated)
1 x 1MΩ 2 x 220kΩ, 1 x 120kΩ, 1 x 100kΩ, 1 x 27kΩ 1W, 1 x 820Ω, 1 x 180Ω, 1 x 120Ω, 1 x 100kΩ multiturn trimpot, 1 x 10kΩ multiturn trimpot.

MISCELLANEOUS
Hook-up wire for power supply connections and points lead, 15cm 8-way rainbow cable, solder, automotive spade connectors etc.

rated at 1W. Use automotive hook-up wire for the power supply connections — red for the positive, black for earth.

Calibration

Once construction is complete, connect the unit to a suitable 12V supply and proceed with the calibration. The tachometer is calibrated by using the mains as a frequency reference. Apply a half-wave rectified signal from a 6-12V AC transformer (see Fig. 1) and adjust the 100kΩ trimpot so that the display reads 1500rpm for a 4-cylinder engine, 1000rpm for a 6-cylinder engine, or 750rpm for an 8-cylinder engine.

The dwell calibration is even easier. All you have to do is short the points lead to earth and adjust the 10kΩ trimpot for a full-scale reading: 90° for a 4-cylinder engine, 60° for a 6-cylinder engine, or 45° for an 8-cylinder engine. The display should read 00.0 with the points lead open circuit.

Installation should present few problems, although the task may be rather time consuming. Probably the best approach is to fit the assembly into a suitable case, which can then be mounted on the dashboard. The earth connection can be made to any convenient point on the chassis, while the +12V should be taken from the ignition switch or from an appropriate point on the fuse panel.

The brilliant new Playmasters. . .

the speaker system you'll be proud to build!

look how easy

Dick Smith brings you this superbly styled speaker system to suit your room, your decor — and your pocket! It has been acoustically designed by Neville Williams, MIREE (Aust.) Editor-In-Chief of Electronics Australia magazine. We're proud of this outstanding new design, just as proud as you'll be when you hear them perform for you. They feature a completely new format and appearance, starting with the strikingly new grilles featuring the new 'Playmaster' logo. And the design doesn't end with the appearance. Special steps have been taken to ensure this Playmaster kit meets or exceeds the standards of commercial speakers — the ones you'd pay hundreds of dollars more for! You don't need special tools, material or skill to build this superb kit. All you need is a couple of hours of your time, a tube of glue plus a couple of hand tools. They'll look and sound so great your friends will never believe you built them!

and look at these new features

★ All-new design in attractive woodgrain finish to complement decor ★ Separate level control for high and mid ranges - tailor the sound to suit your listening environment. ★ Special speaker sealant material supplied to ensure absolute air tightness ★ New design ribbed woofer with massive 30cm cone for accurate bass reproduction ★ Built-in plinth to raise speaker off floor level for minimum audio colouration ★ Manufactured to the exacting standards of the original design published in Electronics Australia magazine. ★ Acoustically transparent silk-like grille cloth heat welded to support frame

Assemble the cabinet and insert the crossovers as per instruction supplied. Bind the final join with masking tape to give strength while the join sets.

Mount tweeter and mid range speakers. Connect the faders, seat them and screw into position. Note the use of a gasket (above) for prevention of air leaks.

Place and connect the woofer making sure a gasket is in place first. The pic above shows the correct method of "guarding the cone". One hand covers the cone and guides the screwdriver blade. By using this method you can prevent costly damage to your speakers.

Fitting the front grille to the completed speaker. After you've done this you're finished. Happy listening!

look at these low prices

300mm SYSTEM KITS

TOTAL KIT SYSTEM ONLY $374 PAIR!

SPEAKER KIT CROSSOVERS & FADERS

The ultimate! As well as the huge 300mm woofer for the best bass reproduction, this kit includes high and mid range faders, and 3 way crossover with high power handling capacity.
Cat C-2042

LOW $175.00 PER PAIR

ENCLOSURE KITS

The 'big daddy' of them all: a pair of large 70 litre cabinets for the ultimate in sound reproduction. A magnificent performer you'll be proud to own.
Cat C-2632

LOW $159.10 PER PAIR

DELUXE SPEAKER GRILLES

Give your speakers high class quality with these superb speaker grilles. Handsome new design featuring the new 'Playmaster' logo.
Cat C-2612

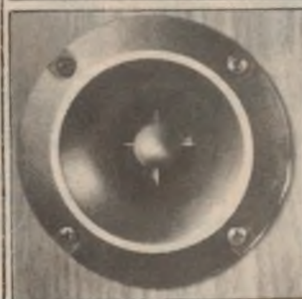
LOW $39.90 PER PAIR

Another superb easy-to-build DICK SMITH KIT

$100's Cheaper than equivalent units!

look at the superb finish

The handsome design of the new 'Playmaster' logo adds a touch of class to your speakers. Superbly finished in silver on black background they help to give your speakers an appearance you'll be proud to show. SUPPLIED WITH ENCLOSURE KIT



A magnificent addition to our range of quality speakers, this superb tweeter is an ideal replacement for the tweeter in your speaker system, or as an addition to your Playmaster kit. They can be used with or without crossovers and will handle up to 40 watts continuous power rating. Cat C-2005

$12.95

PLAYMASTER

These high quality faders give you the control you need over the sound from your system. Dual concentric, heavy duty wire wound elements ensure proper loading of the crossover and amplifier at all times. One high and one mid-range fader is included in the 300mm System kit, but they are also sold seperately should you wish to upgrade your existing system. SUPPLIED WITH C-2042 SPEAKER KIT

Cat C-7210 .... Mid Range **$7.95**

Cat C-7212 .... High Range **$7.95**

look what they say

"... the end result represents outstanding value for money. Whether you buy it in kit form or fully assembled, we are sure you will be pleased with sound quality."

"... the new Playmaster 3-70L has generous power handling capacity so that it can give a good account of itself on virtually any type of music."

Neville Williams & Leo Simpson
(EA, March 1982.)

DICK SMITH ELECTRONICS

See our other advertisements for full address details

DSE/A224/FA

DICK SMITH KITS

EASY TO BUILD

We supply everything you will need to assemble the kits, right down to the last nut and bolt. We even include full instructions rewritten by our technical specialists to make construction easy.

LOOK SO GOOD

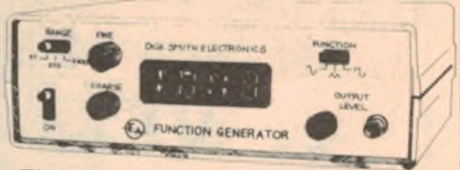
Imagine how proud you will be when you are able to show a fully assembled kit to your friends and say 'I built it myself!' They look so good your friends will never believe you.

QUALITY COMPONENTS

We only use brand new, prime spec components in our kits. If we do have to make parts substitutions we check these out with the designer of the project first before we make the change.

NEW

FUNCTION GENERATOR



This kit produces sine/triangle and square waves over a frequency range from below 20Hz to over 160KHz! It has four digit LED readout enabling accurate frequency setting. This kit makes an ideal companion for our frequency counter kit (Cat K-3439).

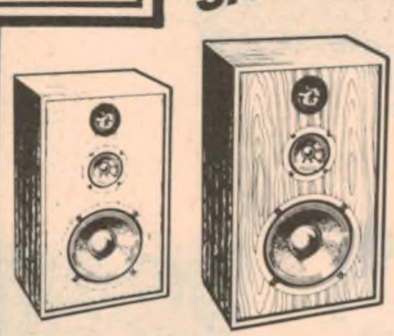
Cat K-3520 **ONLY $59.50**

The case shown above is optional at extra cost. (Cat H-2505 $19.95).

SEE E.A. APRIL 82

SAVE A FORTUNE ON THESE QUALITY SPEAKER KITS!

Famous Playmaster



Now Dick Smith offers you these superb speaker kits just right for your needs. All are manufactured to exacting standards of E.A. specifications. All kits include 3 magnificent speakers (woofer, mid-range and tweeter), superbly re-designed cabinets to suit any decor, full instructions, wiring harness with clip on connections (no soldering required). All kit prices are per pair.

8" 3 WAY SYSTEM
200mm SPEAKER KIT
Cat C-2046 **$89.50**
BOX KIT Cat C-2626 **$82.00**

ONLY $171.50

10" 3 WAY SYSTEM
250mm SPEAKER KIT
Cat C-2044 **$149.00**
BOX KIT Cat C-2624 **$115.00**

ONLY $264

$100's less than equivalent pre-built units!

STOCKS LIMITED AT THIS PRICE - SO HURRY!!

SOUND LEVEL METER

This unit will measure noise in its many forms. Measures levels of less than 20dB to levels greater than 120dB with fast or slow response times. A large VU meter gives easy readings and the meter range is selectable in 9 steps. The kit is mounted in a zippy box and is battery powered.
Cat K-3476

ONLY $35.50

NEW

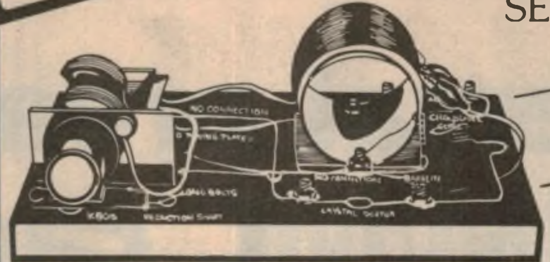
PERCUSSION SYNTHESIZER

Now we've got rhythm with this percussion synthesizer. Produces the sounds of drums, cymbals, snares and bongos. You can play manually or by total electronic control. By the simple connection of a sequencer you can have automatic rhythm, just right for learning the basics of timing in music.
Cat K-3517

ONLY $47.50

NEW

FOR FAMILY FUN REDISCOVER THE CRYSTAL SET WITH THE DICK SMITH CRYSTAL SET



- ★ No batteries
- ★ Surprisingly good sound
- ★ Foolproof circuits

A most satisfying project that will give you lots of satisfaction. It can pull in a surprising number of broadcast stations and produce good sound when connected to a stereo system. AND it even works during a blackout!
Cat K-2650

ONLY $6.90

SEE EA APRIL 82

NEW IMPROVED

SOUND EFFECTS GENERATOR

Now supplied with Tiger Moth sound 'free of charge'
(See ETI March '82)

One of the attractions of the more sophisticated video games is the realistic sound effects that match the action - gunshots, bomb whistles and explosions etc. This kit employs just one IC to do all the hard work.
Cat K-3508

ONLY $17.50

LOW FUEL INDICATOR

Ever been embarrassed by running out of petrol at the wrong time? This easy to assemble kit will help prevent this from happening. Single PCB project with audible and visual alarm.
Cat K-3260

ONLY $15.00

240V CONTROL TIMER

Switch an appliance on for a preset period any time, night or day. Large lighted LCD clock and tough die-cast case combine to give rugged reliability.
Cat K-3085

ONLY $49.00

HOT CANARY

This great gimmick kit will keep any child, or adult, amused for hours. An electronic bird noise maker that sounds just like a real bird! Cat K-3395

ONLY $15.50

BUILD IT YOURSELF FOR UNDER $100!

The Dick Smith Professional Frequency Counter

•500MHz, 7 digit resolution •with optional pre scaler

A completely new frequency & period counter using the latest IC technology. The low component count makes it a very reliable and easy to build unit. It will measure frequency to 500MHz (with optional pre scaler) and period both with a 7 digit resolution.
Features include ★Professional design and finish - use high quality instrument case ★Easy to build with virtually all wiring on PCB's ★High accuracy ★All switches are integral to the display board and front panel. Based on E.A design Dec. 81 issue.
Cat K-3439

with exclusive DICK SMITH simplified circuit board wiring, step-by-step instructions & quality pre-punched & printed front panel

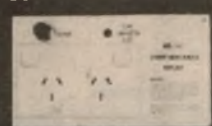
$99.50

PRE SCALER

Convert your Cat K-3439 Frequency Counter to 10-500 MHz with this optional pre-scaler. It's a must for just
Cat K-3432 **$29.95**

PROTECT YOUR LIFE & EQUIPMENT

CORE BALANCE RELAY



This could save your life and protect your equipment. The Core Balance Relay electronically detects fault currents and trips a relay which cuts the power. The relay cannot be reset until the fault has been corrected. Portable unit moulded into a tough plastic case and runs off 240V.
Cat K-3315

$52

Multi-function Timer Stopwatch

Use as a stopwatch, countdown timer or event timer! Selectable timing rates between 0.01 and 1.0 seconds make this ideal for sporting events, darkrooms etc. Wiring for the unit for any of seven different functions is possible.
Cat K-3435

ONLY $39.50

YOU COULD WIN A MILLION!

LOTTO/POOLS SELECTOR

Push button, with large LED display makes it easy. Supplied with an attractive front label. Good luck!
Cat K-3392

$19.95

LEDS AND LADDERS

Based on the old 'Snakes and Ladders' game, we've replaced snakes with LEDS! This kit has been updated with new circuitry and simplified controls so the whole family can enjoy playing. Complete kit includes front panel sticker and zippy box.
Cat K-3390

ONLY $16.50

DICK SMITH Electronics

See our address page for full address details

DSE/A239/PAI

State-of-the-art design has ultra-low distortion

Universal preamplifier for MM/MC cartridges

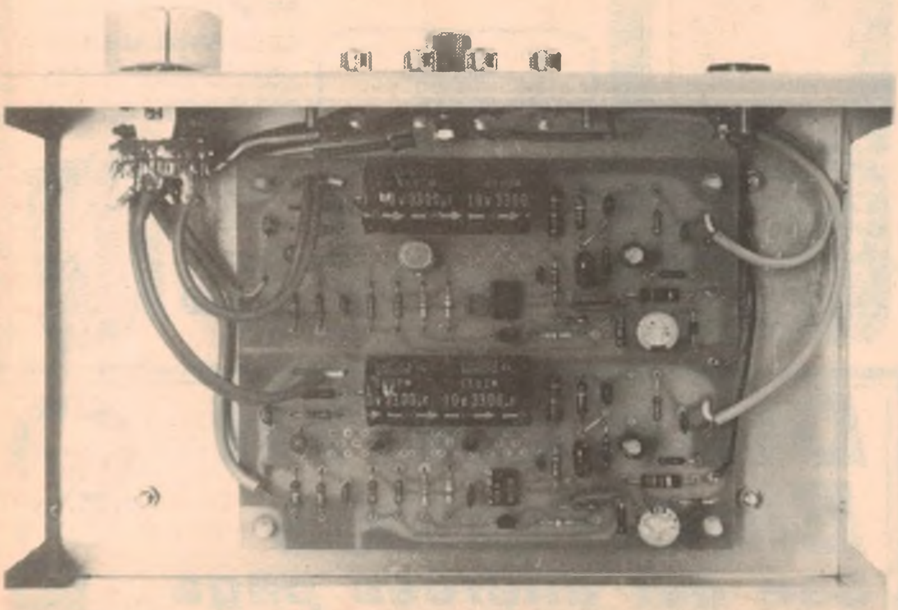
Many current and older stereo amplifiers do not have input facilities for moving coil cartridges and, in many cases, their existing moving magnet phono preamplifier is not really comparable with later designs. This new Universal Phono Preamplifier has ultra-low noise and distortion and is switchable to suit moving magnet or moving coil phono cartridges.

by PAUL DE NOSKOWSKI and LEO SIMPSON

Whether one has great regard for moving coil cartridges or whether you regard their increasing popularity as a silly fad, there is no doubt that the renaissance of the moving coil cartridge has caused designers of stereo amplifiers to reassess their preamplifier circuits very carefully. The greatly increased gain required by moving coil cartridges, hereafter referred to as MC cartridges, means that preamplifier design has become far more stringent, particularly in regard to signal-to-noise ratio.

A number of state-of-the-art amplifiers we have seen and tested lately have brought home to us the fact that the last preamplifier design developed by EA was getting rather long in the tooth. The preamplifier in question was first published in the November 1973 issue and was subsequently featured in the Playmaster Twin 25, Forty-Forty and Mosfet stereo amplifier designs with slight changes in each case. This preamplifier has certainly stood the test of time very well indeed. Countless thousand stereo amplifiers are running reliably with this circuit and, in absolute terms, they are very quiet.

In fact, the most oft-commented feature of the recent Playmaster amplifier designs, particularly the Playmaster Mosfet Stereo Amplifier described in January and February 1981, has been their excellent quietness. People have left them running for days on end without realising they were on. And compared with the large majority of mass-produced stereo amplifiers and stereo receivers, the Playmasters have stood up very well.



This version of the new Universal Phono Preamplifier uses an LM394 dual transistor in one channel and two Hitachi 2SC2545 transistors in the other.

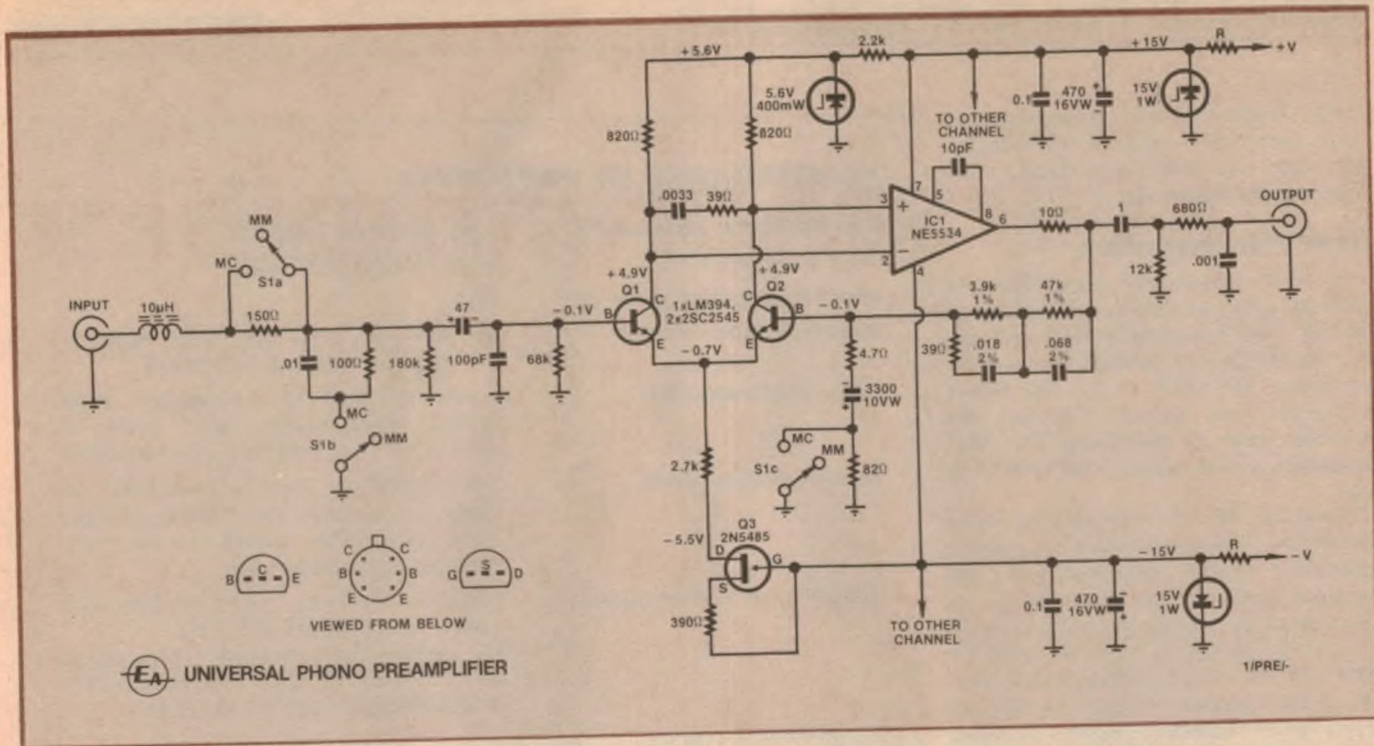
But now we are glad to report that our new preamplifier will put the old design completely "in the shade".

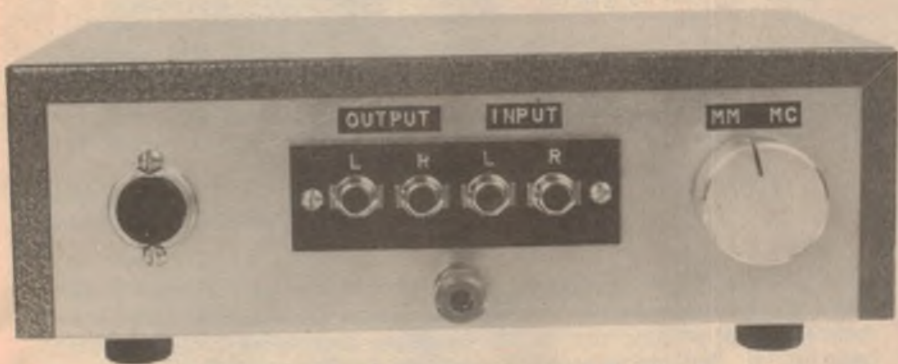
Without any doubt, the new preamplifier is quieter than the old, by at least 8dB! This refers to the moving magnet (MM) mode only, since the old preamplifier was not configured for MC cartridges.

In fact, while (at the time of writing) we have yet to perform the considerable calculations necessary to prove it beyond all doubts, it would appear that in the moving magnet mode, the new preamplifier is within just a couple of dB of the theoretical maximum possible signal-to-noise ratio.

This is because for any preamplifier design, the ultimate signal-to-noise ratio possible is determined by the noise voltage actually generated by the cartridge. This is logical when you think about it because not only will the cartridge resistance itself generate a noise voltage but depending on how well it is shielded, the cartridge will also generate a hum voltage.

In the MC mode, the new preamplifier is also very quiet but it could possibly be bettered by some "head-amps" used in front of good standard RIAA preamps. These head-amps would presumably have their operating conditions optimised for MC cartridges. Principally, this means that their collector operating currents would be a good deal higher than would be optimum in typical MM





We built our preamplifier into a K & W instrument case, although ideally the case should be of all-steel construction to provide maximum hum shielding.

preamps. But even though some of the latest head-amps may better our universal design, it is doubtful whether their input overload margin would be anywhere near as good. But more of that later.

Let us now discuss the principal performance paramaters of the new preamplifier in some detail. The specifications are summarised in a panel elsewhere in this article.

In the MM mode, there are three figures quoted for signal-to-noise ratio. The first two are for resistive termination while the third is measured with a typical MM cartridge which simulates an actual listening situation. We do not see the point of quoting signal-to-noise ratios with a short circuit input because it is not only unrealistic (nobody listens to records with the preamplifier inputs shorted!), but also gives results which are much better than can be expected in practice.

The cartridge actually used in these tests was a Stanton 500A picked mainly because its inductance and series resistance figures are close to those recommended for signal-to-noise tests by the IHF-A-202, 1978 specification. Many of the newer cartridges in use today will have a lower inductance than the Stanton and so can be expected to give an even better signal-noise figure. This is because the lower overall impedance of the cartridge tends to shunt off noise generated by the preamplifier input resistors.

Correspondingly, if your cartridge inductance is on the higher side, you can expect that the residual noise will be slightly worse than the figures quoted. This is a general rule with most preamplifiers these days, by the way. All the MM S/N figures are referred to an input signal level of 5mV RMS at 1kHz, as per the above IHF test specification. This means that 6dB must be added to figures noted here to make them directly comparable with the figures published for our preamplifiers in the past which were referred to an input signal of 10mV RMS.

All our S/N figures are unweighted by the way, rather than using the "A" weighting suggested in the IHF specification. We do not use "A" weighting because it can conceal noise problems at the low frequency end, particularly hum and ripple components which can be surprisingly audible against an otherwise quiet background.

If you are attempting to make comparisons between the figures noted here and weighted figures for other preamplifiers, you would be reasonably fair in adding about 5 or 6dB to our unweighted figures to gain a more favourable comparison. But make no mistake, this new preamplifier is really quiet. In fact, there is a fair chance that with many amplifiers, noise in the later tone control stages will swamp the noise produced by the preamplifier.

Overload margin referred to the 5mV RMS reference level is a generous 30dB or 160mV maximum at 1kHz. More importantly, the overload margin is inversely proportional to the RIAA characteristic so that at 10kHz, for example, the maximum input signal is 13.7dB higher or about 775mV RMS.

In this respect, our universal preamplifier is superior to those "head-amps" which have a flat frequency response and therefore a constant overload characteristic across the whole audio band. So while some head-amps may be able to accept a higher input signal at mid-frequencies, our design has a good overload margin over the entire audio range.

These remarks are also applicable to

some "esoteric" RIAA preamplifiers we have seen which perform the equalisation over two amplifying stages, some using passive networks.

Harmonic Distortion

Harmonic distortion is very difficult to quantify when it becomes as low as it is on our new preamplifier. Not only are the signal levels vanishingly low and approaching the limits of the test equipment but one cannot even be sure whether one is measuring the non-linearities of the output load resistor or not.

However, for the record, we have published comprehensive harmonic distortion figures, together with the residual harmonic distortion figures of the Sound Technology equipment which was used. The results apply for both the MM and MC modes, although in theory, the greater applied feedback would give even lower distortion figures. In short, harmonic distortion is b----y low, but we don't know just how low it is.

Equalisation in the new preamplifier includes the IEC (International Electrotechnical Commission) proposal of a 7950us time-constant for rolloff of frequencies below 20Hz. This means that there is less response to record warps and arm/cartridge resonances at these low frequencies.

When this new time-constant is taken into account, the RIAA equalisation of the new preamplifier is within ±0.3dB over the range from 40Hz to 20kHz and within ±0.5dB from 40Hz down to 20Hz. However, the only way that kit builders can ensure that they obtain the same performance is to use the specified 1% resistors and 2% capacitors.

It may be thought that such close adherence to the RIAA curve is not really necessary. However, consider that a +1dB error in the equalisation characteristic at 10kHz really amounts to a small lift to an entire portion of the audio spectrum which can markedly change the sound of the cartridge.

PERFORMANCE OF PROTOTYPE

Nominal input impedance:	50kΩ(MM) or 100Ω(MC)
1kHz voltage gain:	35dB(MM) or 60dB(MC)
Internal output impedance:	700Ω
Maximum output level:	9V RMS at 1kHz into 50kΩ load for 0.002% total harmonic distortion
Frequency response:	within ±0.3dB of "proposed" RIAA replay characteristic from 40Hz to 20kHz, and ±0.5dB from 20Hz to 40Hz
Maximum input level:	160mV(MM) or 9mV(MC) at 1kHz. At other frequencies the maximum input level follows the inverse of the "old" RIAA replay characteristic
Distortion at 8 volts output:	0.003% 40Hz to 10kHz, 0.004% at 15kHz, and 0.005% at 20kHz NB: Residual test equipment distortion is 0.002% from 40Hz to 10kHz, 0.003% at 15kHz, and 0.0035% at 20kHz.
Signal-to-noise ratios:*	
MM mode (referred to a 5mV input level at 1kHz):	84dB with 1kΩ resistive termination 77dB with 10kΩ resistive termination 77dB with a typical MM cartridge (500mH inductance, 700Ω resistance)
MC mode (referred to 500μV) input level at 1kHz):	76dB with 100Ω resistive termination (IHF-A-202, 1978 recommended termination) 74dB with Ortofon MC20 MkII pickup cartridge (lower figure due to stray hum fields)

Note that the above input levels are in accordance with the IHF-A-202, 1978 standard measurement methods for audio amplifiers. However, a more realistic reference input level for MC cartridges is probably 150μV, in which case the MC signal-to-noise ratios would be 65dB and 63dB respectively.

* Taken with LM394 dual transistor in first stage.

Interchannel separation:	
MM mode:	90dB 20Hz to 400Hz, 85dB at 1kHz, 56dB at 10kHz, 51dB at 15kHz and 48dB at 20kHz.
MC Mode:	90dB 20Hz to 3kHz, 85dB at 10kHz and 78dB at 20kHz.
Minimum power requirement:	±18 VDC at 30mA.

Circuit Description

Broadly, the circuit concept of this new preamplifier is the same as that for our previously successful preamp in that it uses two low noise transistors (or a transistor array) to drive an operational amplifier IC. However, this apparent similarity belies the considerable differences in the devices used and the operating parameters.

Two ultra-low-noise transistors in a differential pair drive the inputs of op amp IC1. The collector currents of these transistors are set at the best compromise in noise performance between the two modes (MM and MC) of operation. The resulting compromise figure of 0.85mA is biased for a better result in the MC mode and has made it necessary to incorporate a FET current source in the "tail" of the differential amplifier to ensure good common mode and supply rejection as well as optimum gain.

The op amp used is the Signetics NE5534 which, in itself, can be regarded as a low noise type but more particularly, it has the ability to drive a 600Ω load. This is important because it has allowed us to reduce the series resistance of the feedback network by a factor of about 12. This means a very worthwhile reduction in residual noise generated by the feedback network.

There is no way in which a TL071 or 741 op amp used in our previous designs could drive this low value of load and still deliver full output. So it is this reduction in the feedback path resistance which is the single most important factor in the improvement in noise performance obtained in this design.

Since the NE5534 is not internally compensated (ie not stable in unity gain applications where the negative feedback is high), an external 10pF compensation

JUST WRAP™ WIRE WRAPPING TOOL

WHY CUT? WHY STRIP? WHY SLIT? WHY NOT JUST WRAP?

JW-1-B	BLUE WIRE
JW-1-W	WHITE WIRE
JW-1-Y	YELLOW WIRE
JW-1-R	RED WIRE

JUST WRAP REPLACEMENT ROLLS

R-JW-B	BLUE WIRE	50 ft. Roll
R-JW-W	WHITE WIRE	50 ft. Roll
R-JW-Y	YELLOW WIRE	50 ft. Roll
R-JW-R	RED WIRE	50 ft. Roll

UNWRAP TOOL FOR JUST WRAP

JUW-1	UNWRAPPING TOOL

JUST WRAP KIT

JWK-6	JUST WRAP KIT

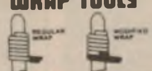
"HOBBY" WIRE WRAPPING TOOL BATTERY POWERED

BW-2630	FOR AWG 26-30

Use "C" size NICAD Batteries, not included. Bits not included.

BT-30	BIT FOR AWG 30
BT-2828	BIT FOR AWG 26-28

HOBBY WRAP TOOLS



WSU-30	REGULAR WRAP
WSU-30M	MODIFIED WRAP

PRE-STRIPPED WIRE WRAPPING WIRE

Wire for wire wrapping, AWG 30 (0.25mm) KYNAR® wire, 50 wires per package stripped 1" both ends.

® KYNAR PENNWALT

30-B-50-010	30 AWG blue Wire 1" Long
30 Y 50 010	30 AWG Yellow Wire 1" Long
30 W 50 010	30 AWG White Wire 1" Long
30 R 50 010	30 AWG Red Wire 1" Long
30 B 50 020	30 AWG Blue Wire 2" Long
30 Y 50 020	30 AWG Yellow Wire 2" Long
30 W 50 020	30 AWG White Wire 2" Long
30 R 50 020	30 AWG Red Wire 2" Long
30 B 50 030	30 AWG Blue Wire 3" Long
30 Y 50 030	30 AWG Yellow Wire 3" Long
30 W 50 030	30 AWG White Wire 3" Long
30 R 50 030	30 AWG Red Wire 3" Long
30 B 50 040	30 AWG Blue Wire 4" Long
30 Y 50 040	30 AWG Yellow Wire 4" Long
30 W 50 040	30 AWG White Wire 4" Long
30 R 50 040	30 AWG Red Wire 4" Long
30 B 50 050	30 AWG Blue Wire 5" Long
30 Y 50 050	30 AWG Yellow Wire 5" Long
30 W 50 050	30 AWG White Wire 5" Long
30 R 50 050	30 AWG Red Wire 5" Long
30 B 50 060	30 AWG Blue Wire 6" Long
30 Y 50 060	30 AWG Yellow Wire 6" Long
30 W 50 060	30 AWG White Wire 6" Long
30 R 50 060	30 AWG Red Wire 6" Long

TRI-COLOR DISPENSER

WD-30-TRI	TRI-COLOR DISPENSER
R-30-TRI	REPLACEMENT ROLLS

WIRE DISPENSER

WD-30-B	BLUE WIRE
WD-30-Y	YELLOW WIRE
WD-30-W	WHITE WIRE
WD-30-R	RED WIRE

DISPENSER REPLACEMENT ROLLS

R-30B-0050	30-AWG BLUE 50 FT. ROLL
R-30Y-0050	30-AWG YELLOW 50 FT. ROLL
R-30W-0050	30-AWG WHITE 50 FT. ROLL
R-30R-0050	30-AWG RED 50 FT. ROLL

®KYNAR PENNWALT

HOOK-UP WIRE

HK-18	18 AWG	25 FT	SOLID CONDUCTOR
HK-20	20 AWG	25 FT	SOLID CONDUCTOR
HK-22	22 AWG	50 FT	SOLID CONDUCTOR
HK-24	24 AWG	50 FT	SOLID CONDUCTOR
HK-26	26 AWG	50 FT	SOLID CONDUCTOR
SHK-18	18 AWG	25 FT	STRANDED CONDUCTOR
SHK-20	20 AWG	25 FT	STRANDED CONDUCTOR
SHK-22	22 AWG	50 FT	STRANDED CONDUCTOR
SHK-24	24 AWG	50 FT	STRANDED CONDUCTOR
SHK-26	26 AWG	50 FT	STRANDED CONDUCTOR

PRB-1 DIGITAL LOGIC PROBE

- DC to > 50 MHZ
- 10 Nsec. pulse response
- 120 K Ω impedance
- Automatic pulse stretching to 50 Nsec.
- Automatic resetting memory
- Open circuit detection
- Automatic threshold resetting
- Compatible with all logic families 4-15 VDC
- Range extended to 15-25 VDC with optional PA-1 adapter
- Supply O.V.P. to ≤ 70 VDC
- No switches/no calibration

PRB-1	DIGITAL LOGIC PROBE

PROTOTYPE BOARD CM-100

TERMINALS: 1,020 TEST POINTS. 188 separate 5 point terminals, plus 2 horizontal bus lines of 40 common test points each.

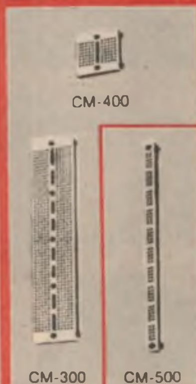
SIZE: 6½" Wide, 5" Long.

CM-100	MODULAR PROTOTYPE BOARD

PROTOTYPE BOARD CM-200

TERMINALS: 630 TEST POINTS. 94 separate 5 point terminals, plus 4 bus lines of 40 common test points each. SIZE: 6" Wide, 3½" Long.

CM-200	MODULAR PROTOTYPE BOARD



PROTOTYPE BOARD CM-300, CM-400

CM-300 and CM-400 have two separated rows of five interconnected contacts each. Each pin of a DIP inserted in the strip will have four additional tie-points per pin to insert connecting wires. They accept leads and components up to .032 in. diameter. Interconnections are readily made with RW-50 Jumper Wire. All contact sockets are on a .100 in. square grid (1⅜ in. wide)

CM-300	MODULAR PROTOTYPE BOARD
CM-400	MODULAR PROTOTYPE BOARD

MODULAR BUS STRIP

CM-500 is a bus strip to be used in conjunction with CM-300 and CM-400 for distribution of power and common signed lines. Two separate rows of common terminals, grouped into clusters of five. All contact sockets are on a .100 in. square grid.

CM-500	MODULAR BUS STRIP

DIP IC INSERTION TOOLS WITH PIN STRAIGHTNER

Narrow profile. Pin straightener built into tool. Automatic ejector.

INS-1416	14-16 PIN DIP/IC INSERTER

MOS, CMOS-SAFE

GROUND STRAP NOT INCLUDED

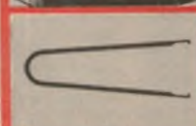
MOS-1416	14-16 PIN, MOS CMOS SAFE INSERTER
MOS-2428	24-28 PIN, MOS CMOS SAFE INSERTER

36-40 PIN CMOS-SAFE IC INSERTION TOOL

Aligns bent out pins. Includes terminal lug for attachment of ground strap.

GROUND STRAP NOT INCLUDED

MOS-40	36-40 PIN CMOS SAFE INSERTION TOOL



DIP IC EXTRACTOR TOOL

Extracts all LSI, MSI and SSI devices of from 8 to 24 pins.

EX-1	EXTRACTOR TOOL

24-40 CMOS-SAFE EXTRACTOR TOOL

Removes 24-40 pin IC's, .600" centers. C-MOS safe. Includes terminal lug for attachment of ground strap.

GROUND STRAP NOT INCLUDED

EX-2	CMOS SAFE EXTRACTOR TOOL

Ampec ELECTRONICS PTY. LTD.

1 WELLINGTON STREET, ROZELLE, N.S.W. 2039 AUSTRALIA
TELEPHONE: (02) 818 1166
CABLE ADDRESS: AMPEC SYDNEY TELEX: AA27136
POSTAL ADDRESS: P.O. BOX 132, ROZELLE, N.S.W. 2039 AUSTRALIA

ROD IRVING ELECTRONICS

425 HIGH STREET, NORTHCOTE 3070, MELBOURNE, VICTORIA. Ph (03) 489 8131. Telex No. 38897

KITS—KITS—KITS—KITS

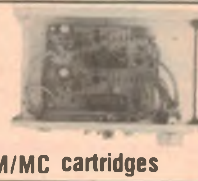
Tacho/dwell meter with digital display

$54

12/240 volt Inverter

$55

$35



Universal preamplifier for MM/MC cartridges

Large Screen TV Storage Cro Adaptor

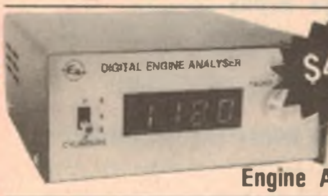
$110

Voice-Operated Relay

$15.00

Vocal Canceller

$20



$48.50

Engine Analyser Kit

Eprom Programmer

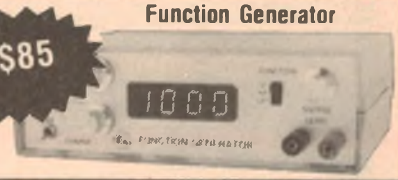
$55.00

$169.00

Analogue and Digital Storage CRO Kit

Function Generator

$85



$79.00

Onto our 3rd run of this kit.

Duel Tracking Power Supply

$86.00

NOW A $99 Computer!

Plugs into any TV!
ETI 660

Starter Kit (1K RAM, B&W video)	$99.00
9V, 200mA plugback to suit	$12.50
Colour video option	$16.00
RAM EXPANSION (add to PCB)	$9.00

As with all new kits, please phone first to check stocks

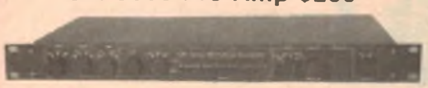
$60.00

Digital Thermometer

$17.00

SIMPLE METRONOME

ETI 5000 Pre Amp $239



Come in and hear the fantastic combination of the ETI5000 power amp & preamp playing through the ETI4000/1 and 2 speaker systems. EX STOCK.

ETI POWER AMP ONLY $279

The front panel is now better finished than ever and has no holes visible. The fins themselves are tapped from the rear. Complete kit price is just $275. Remember the super finish front panel at no extra charge. EX STOCK.
We have now sold 150 of this kit and expect to sell hundreds more.

LE GONG

Fantastic doorbell using the new Siemens SAB 0600 chip.
Kit of parts $15

INCREDIBLE!!!

E/A has really done it this time. Display your Hi/Fi response on your colour TV. It will really impress your friends. Kit of parts $99

Over 200 Sold

			$
ET729	UHF TV Masthead Amp	Apr 81	36.00
ET730	UHF TV Converter	May 81	37.50
ET760	Video Mod. to suit 660 Micro	Spt 81	14.50
ET1501A	Negative Ion Generator	Apr 81	39.00
	Dream 6800		109.00
	Dream 6802		109.00
	Pwr. Supply to suit Dream Micro Kit		29.50
	Hex Keypad 19 Keys		28.50
79TI11	Transistor Assisted Ign	Nov 79	34.00
79UPS6	Universal Power Supply	Jun 79	29.50
80TC12	Bipolar Train Controller	Dec 80	28.00
80CM3A	Digital Capacitance Mtr.	Mar 80	52.50
80PG6	TV Pattern Generator	Jun 80	52.50
80TV8	TV CRO Adapter	Aug 80	29.00
80LL7	Leds & Ladders	Jul 80	19.50
80BM10	Car Battery Monitor	Oct 80	6.50
80SA10	Stereo Amp Mosfet	Jan 81	169.00
80DC10	Digital Storage Cro Ad.	Nov 80	78.00
80LS12	Selectalott	Dec 80	22.50
80LBR12	Light Beam Relay	Nov 80	13.00
80FB12	Guitar Fuzz Box	Dec 80	19.50
80TM8A	Digital Engine Analyser	Aug 80	48.50
80PP7A	Eprom Programmer	Jul 80	72.50
80RM12	CylonVoice Stimulator	Jan 81	18.50
80RAM12	RAM Expansion for Dream	Dec 80	39.00
80PA6	Playmaster 300W Amp Module	Jun 80	63.00
80TRS11	TRS 80 Printer Serial In.	Nov 80	15.00
81DC2	Le Gong Doorbell	Feb 80	15.00
81GA3	Colour Graphic Analyser	Mar 81	99.00
81IR4A	Infra-Red Relay	Apr 81	39.00
81SP1	RS232 TRS80 System 80 In	Feb 81	15.00
81SW1	Oscilloscope Switch	Feb 81	58.00
81DC3B	Digital/Analog Store. Cro.	Mar 81	169.00
'81WS10	Wind Speed Indicator	Oct 81	43.50
81P6	Pool/Lotto Selector	Jun 81	24.50
81A010	Audio Test Unit Cass. Deck	Oct 81	47.50
81MC8	Musicolour IV	Aug 81	79.00
81SG9	LED Sandglass	Spt 81	22.50
81CI9	Digital Clock Thermometer	Spt 81	80.00
81SS11	Slide Cross Fader	Nov 81	80.00
81GA9	Photon Torpedo Game	Spt 81	23.50
81SW7	Train Steam Whistle	Jul 81	17.50
81HB4A	Heart Rate Monitor	Apr 81	84.00
81SP5	Sound Pressure Meter	May 81	37.00
81OR7	Electronic Organ	Jul 81	59.00
81CH12	Christmas Decoration	Dec 81	15.00
81fm10a	500MHz Digital Freq. Mtr	Dec 81	135.00
HE102	Guitar Phaser	Jun 81	25.00
HE103	Transistor Tester		9.40
HE104	AM Tuner	May 81	7.50
HE105	Basic Amplifier	May 81	9.50

			$
HE106	FM Radio Microphone	May 81	6.50
HE107	Electronic Dice	Jun 81	5.95
HE108	Power Supply		11.95
HE110	Unmistakabell		6.90
HE111	Ohmeter		19.90
HE112	Micromixer		11.90
HE117	House and Car Alarm		16.90
HE121	Scratch and Hiss Filter		9.00
HE127	Siren		3.90
ET043	Heads or Tails	Oct 76	3.50
ET044	Two Tone Doorbell	Oct 76	4.50
ET047	Morse Practice Set	Dec 76	3.50
ET048	Buzz Board	Dec 76	3.90
ET061	Simple Audio Amp	Oct 76	5.50
ET062	Simple AM Tuner	Mar 77	6.50
ET063	Electronic Bongos	Nov 79	5.00
ET065	Electronic Siren	Dec 79	5.50
ET066	Temp Alarm	Dec 79	4.90
ET068	LED Dice	Oct 76	5.90
ET072	Two Octave Organ	Jne 78	8.50
ET084	Car Alarm	Jan 77	12.00
ET147	Electronic Dummy Load	Oct 80	89.00
ET149	2 Tone Generator	Jul 80	34.90
ET157	Crystal Marker	Uct 81	34.50
ET158	Low Ohms Meter	Nov 81	29.50
ET256	Humidity Meter		19.50
ET257	Universal Relay Board	May 81	12.50
ET258	Mini Drill Speed Controller	Jul 81	8.00
ET326	Exp. Scale LED Voltmeter	Spt 80	12.50
ET327	Turn/Hazard Indicator	Oct 80	22.00
ET328	LED Oil Temp Meter	Jan 81	15.50
ET329	Exp. Scale Vehicle Ammeter	Feb 81	19.00
ET330	Car Alarm	Jul 81	27.50
ET332	Electronic Stethoscope	Aug 81	34.00
ET438	LED Level Meter		11.95
ET445	General Purpose Preamp	Jul 76	8.50
ET455	Loud Speaker Protector	Mar 80	25.50
ET458	LED Level Meter	Jne 81	27.00
ET466	300W Amp Module	Feb 80	63.00
ET467	4 Input Mike Preamp	Jul 80	27.50
ET470	60W Amp Module Series 4000 TPV 6		26.00
ET471	Audio Preamp Series 4000 TPV 6		45.50
ET472	Power Supply for Series 4000 TPV 6		24.00
ET473	Moving Coil Preamp Series 4000 TPV 6		54.00
ET475	AM Tuner	Spt 80	89.00
ET476	Series 3000 Amp 25W Stereo	Nov 80	84.00
ET477	Series 5000 Pwr. Amp Mod 150W	Jan 81	58.00
	Series 5000 Pwr. Amp Complete Kit		275.00
ET478MC	Moving Coil Preamp (5000)	Spt 81	18.50

Bankcard Mail Orders Welcome

Please debit my Bankcard.
Bankcard No. ....
Expiry Date ....
Name ....
Signature ....

Post & Pack $2.50 small kits, heavier kits add extra postage
Prices subject to change without notice. Send 60c and SAE for pricelists. Phone (03) 489 8131.
MAIL ORDERS: PO Box 235, Northcote, Vic 3070.

capacitor is connected between pins 5 and 8 of the IC. This reduces the open-loop gain at high frequencies and confers the appropriate order of stability. In addition, a 39Ω resistor is inserted in the feedback loop to prevent the gain rolling off unnecessarily at supersonic frequencies. This reduces distortion at high frequencies which would otherwise occur due to excessive loading by the feedback network.

Other measures to ensure stability are the step network between the collectors of the input differential pair and a 150Ω "stopper" resistor in series with the input when in the MM mode. In the MC mode this stopper resistor is not necessary and it is switched out to prevent degradation of the signal-to-noise ratio which would otherwise be the result of inserting a relatively high value resistor in series with a low resistance source.

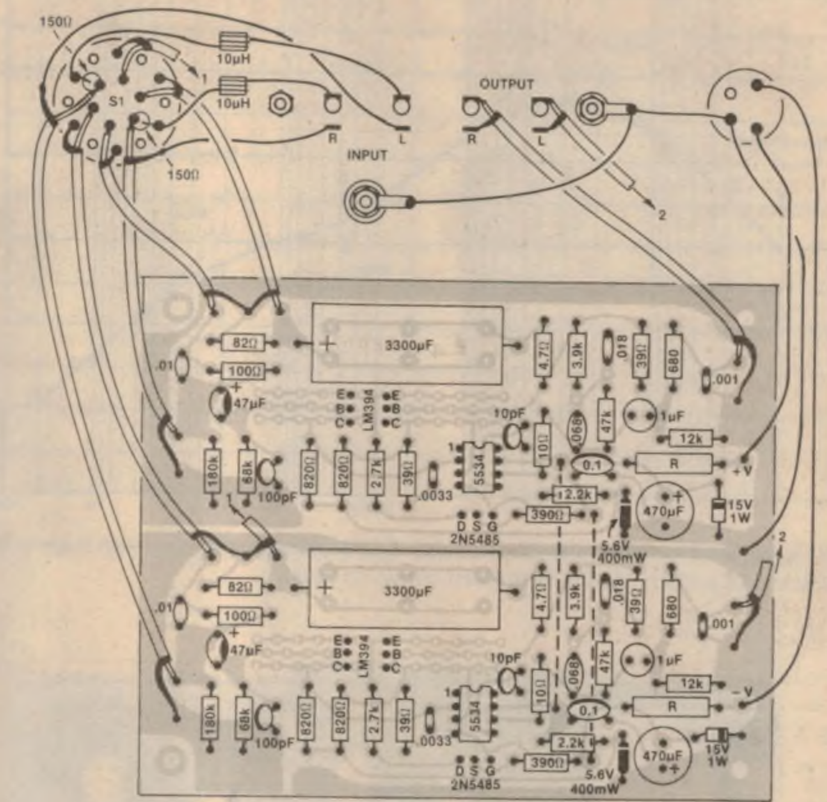
Also in the input network is a 47μF tantalum coupling capacitor which provides a low impedance path via the cartridge for noise produced by the 68kΩ bias and input load resistor. We should comment here that tantalum capacitors are often deprecated in high performance preamplifier designs because AC signals across them can modulate their capacitance and thus cause distortion. However, since the input signals are so small this effect is not at all evident and distortion is very low, as already discussed.

Readers may ask why we did not eliminate the capacitor altogether and just couple the cartridge in direct. After all the resultant DC current which would flow through the cartridge would be negligible and would not cause any problems. In fact, this is precisely what we did in the Playmaster Mosfet version of the previous preamplifier.

However, since this new preamplifier operates in two modes, the input offset voltage would be changed, as would the output offset voltage, whenever the mode was changed. This could lead to switching transients and, possibly, reduce output voltage swing.

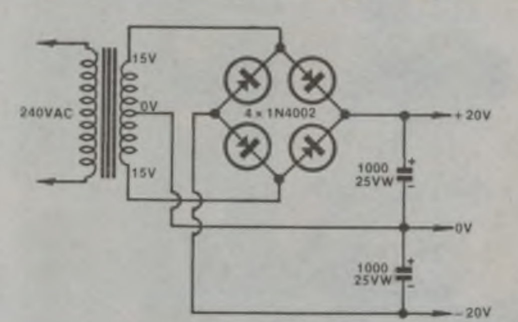
Sensitivity to stray RF signals into the input leads is eliminated by the small inductor and 100pF capacitor across the input signal path. This inductor can either be in the form of a 10μH choke or five and a half turns of 28 B&S enamelled copper wire threaded through an FX1115 ferrite bead. Two such inductors will be required, one for each channel.

A six-pole, two position switch is used to select the mode. One pole (in each channel) is used to switch out the 150Ω stopper resistors in each channel, as already discussed. The second pole is used to switch the 100Ω plus .01μF input



Component overlay diagram for the new high-performance preamplifier. See text regarding alternative transistors for the differential input pair.

This simple power supply can be used to power the new preamplifier and should be housed separately to avoid hum.

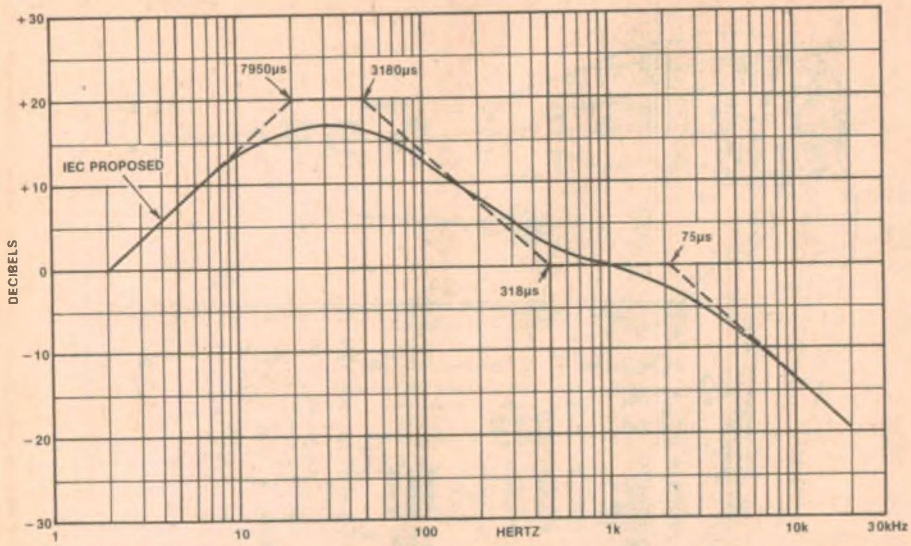


loading network for the MC cartridge in each channel while the remaining poles switch the shunt leg of the feedback network, to change the gain.

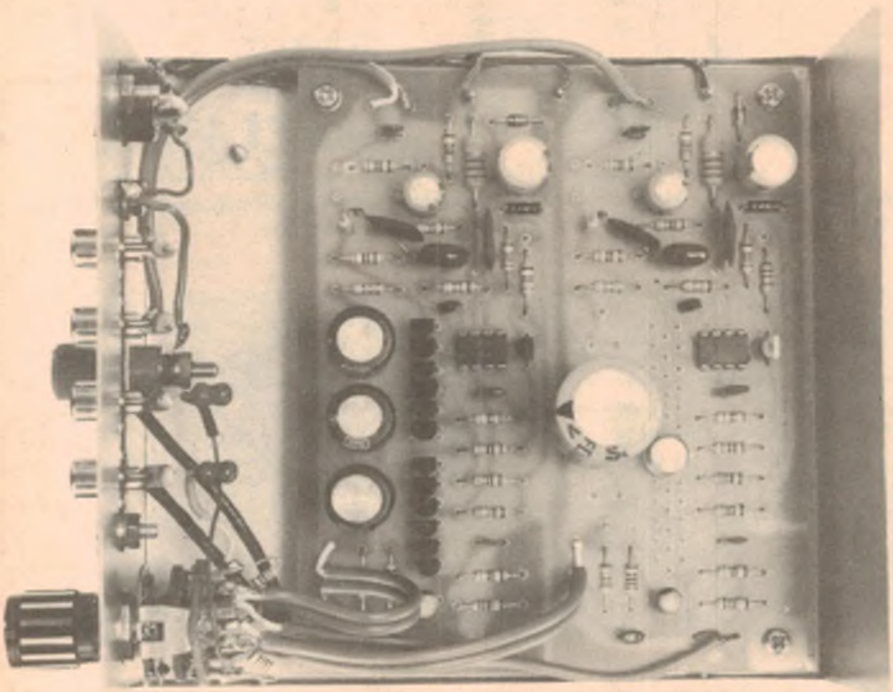
As it is, the preamplifer can be expected to have very small DC offset voltages at the outputs: of the order of a few tens of millivolts, depending on the closeness of match in the input differential pair. If the LM394 is used, this match is very close and the offset very small.

The two 1% resistors and two 2% capacitors in the feedback network determine the three RIAA time-constants of 75μs, 318μs and 3180μs, corresponding to breakpoints at 2122Hz, 500.5Hz and 50.05Hz respectively. The additional time-constant of 7950μs, corresponding to a breakpoint at 20Hz, is provided by the combination of the 1μF output capacitor and the 12kΩ resistor across the output.

Incidentally, anyone who takes the trouble to calculate the time-constants based on single RC combinations in the feedback network will find errors in the result. This is particularly the case for the output RC network which, by itself, has a time constant of 12000μs (ie 12ms). However, when bass rolloff in the shunt leg of the feedback network (ie in the 3300μF capacitor) is taken into account, the 7950μs time-constant is closely adhered to. Similarly, other interactions in the feedback network have been taken into consideration to produce very



RIAA characteristic of the new preamplifier. Equalisation is within ±0.3dB from 40Hz to 20kHz and within ±0.5dB from 40Hz down to 20Hz.



This second version of the preamplifier uses 12 BC550C transistors in one channel and an LM394 in the other. Note the use of PC mounting electrolytics instead of the 3300μF pigtail electrolytics.

close adherence to the RIAA curve.

Note also that the components specified for the 7950μs time-constant assume that the input impedance of the following amplifier will be 50kΩ. For other input impedances, the 12kΩ resistor will have to be adjusted so that the parallel combination of the shunt resistor (ie., 12kΩ) and amplifier input impedance is approximately 10kΩ. For example, if the input impedance of the following amplifier stage is 30kΩ, increase the 12kΩ resistor to 15kΩ.

It is most important that the 1μF output coupling capacitor is not a tantalum type because in this application a tantalum capacitor will cause a marked increase in distortion at low frequencies. You may use a metallised polyester (greencap) or, as we did, a bipolar electrolytic type.

Bipolar electroltyic capacitors are generally specified as being within ±20% of value but in our experience, they are normally well within ±10% which is adequate for this application. And they don't add to the distortion!

PARTS LIST

HARDWARE

- *1 PC board, code 82p5, 125 x 102mm*
- *1 6-pole, 2-position switch*
- *1 knob to suit*
- *2 FX1115 ferrite beads and ½-metre 28-gauge B&S enamelled copper wire (or 2 10μH RF chokes)*
- *1 metre hook-up wire*
- *1 metre light-duty shielded audio cable*

ADDITIONAL HARDWARE
(for free-standing unit)

- *1 mild steel case, 200 x 130 x 65mm*
- *1 4-way RCA socket panel*
- *1 4-pin DIN socket and plug*
- *4 Richco CBS-6N plastic PC board supports solder lug*
- *4 rubber feet*
- *1 binding post terminal for chassis earth*

SEMICONDUCTORS

- *2 1N752 zener diodes (5.6V, 400mW; do not use 1W types)*
- *2 1N4744 zener diodes (15V, 1 watt)*
- *2 2N5485 field effect transistors*
- *2 LM394 dual transistors (or 4 Hitachi 2SC2545 transistors)*
- *2 NE5534 operational amplifiers*

RESISTORS
(¼W, 5% tolerance)
2 x 180kΩ, 2 x 68kΩ, 2 x 12kΩ, 2 x 2.7kΩ, 2 x 2.2kΩ, 4 x 820Ω, 2 x 680Ω, 2 x 390Ω, 2 x 150Ω, 2 x 100Ω, 4 x 39Ω and 2 x 10Ω.
(¼W, 1% tolerance, metal film)
2 x 47kΩ, 2 x 3.9kΩ, 2 x 82Ω, 2 x 4.7Ω.
(½W, 1W or 5W)
2 off, as per accompanying table

CAPACITORS

- *2 3300μF, 10V axial lead electrolytics (or 6 1000μF, 10V PC electrolytics)*
- *2 470μF, 16V PC electrolytics*
- *2 47μF, 6.3V tantalums*
- *2 1.0μF, 25V bipolar PC electrolytics*
- *2 0.1μF, 25V ceramic*
- *2 0.068μF greencaps (metallised polyester), 2% tolerance*
- *2 0.018μF greencaps, 2% tolerance*
- *2 0.01μF greencaps (or miniature ceramic)*
- *2 3300pF greencaps*
- *2 1000pF greencaps*
- *2 100pF ceramic NPO*
- *2 10pF ceramic NPO*

MISCELLANEOUS
Machine screws and nuts, solder, PC stakes etc.

JAYCAR KITS ⇕ SUPERIOR QUALITY

Digital Thermometer EA2/82

Ref: EA Feb 1982
Read the temperature in your room (or outside) from 0 degrees C to 100 degrees C in fact to within 0.1 degree C. Fantastic resolution on a bright easy-to-read display. INC CASE

DIGITAL CAPACITANCE METER * * *

BOTH **$59** each

Ref: EA March 1982
This kit once again uses the amazing DPM 200 LCD display/driver module (see below). Capable of measuring capacitance from 1pF to 19.99uF it is a must in every workshop or lab.

Kit includes case.

500MHz Digital Frequency Period Meter

REF: EA Dec '81 – Feb '82

NOW BACK IN STOCK! The best version of this kit in Australia is now back in stock. Why settle for an inferior kit at the same price as ours?

500MHz option only $26 extra
50MHz Version $119

ONLY $119

Tilting Bail to suit ONLY $4.95

Other people may appear to be selling this kit for less. But you GET less!!! Exclusive Jaycar features: * Heavy gauge front panel. Pre-punched, and silkscreened. (NOT Scotchcal). * Low aging rate 10.000 MHz crystal * Quality IC sockets provided (A MUST) * All metal film resistors used (1% 50ppm) * Thermalloy heatsink for +5V regulator
Beware of advertised units that do not conform to the original design. They may have inferior performance.

THE BEST QUALITY KIT VERSION OF THIS PROJECT IN AUSTRALIA

DON'T FORGET!! EA AND ETI FROM JAYCAR COST ONLY $1.00 EACH – BELOW COST!!!

Brilliant 5000 Series Amps — "NO COMPROMISE"

$299 SUPERFINISH

$275 'BLUEPRINT'

The standard 5000 pre-amp is available at $245 – no more than others but still better.

It is pleasing to see that many, many hundreds of Australians appreciate a quality kit when they see IT. The 5000 MOSFET P.A. and Pre-amp are so good they are attracting International interest. (We will be exporting our first shipment of these to - would you believe an Asian country - as you read this). Many people still can't comprehend their current performance specs make them the BEST amps in the WORLD.
WRITE FOR A FREE LEAFLET

Function Generator

Ref: EA April 1982

"Pigeon Pair" companion to the new 500MHz DFM. Low distortion generator of sine, square and triangular waveforms. From below 20Hz to over 160kHz. Inbuilt 4 digit frequency counter in de-luxe Pac-Tec case. Only $85
JAYCAR EXCLUSIVE – 1% 50ppm metal film resistors used for stability and it's still only $85!!!

Only **$85**

CUDLIPP CRICKET

Ref: EA Feb 1982

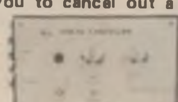
One of the most popular kits ever produced by Jaycar. Cudlipp chirps back to you when you talk. Talk about frustrating! Great fun to hide in someones desk!!
The Jaycar kit comes exclusively with 8 great big colourful 2 watt carbon resistors that you use as legs.
Great fun for only

$12.50

vocal canceller *

Ref: EA April 1982

This project enables you to cancel out a singers voice on a record so that you can insert your own.



BE A STAR FOR ONLY **$19.50**

NEW!!! LCD TACHO KIT!

ref: EA May 1982

new

- FITS INTO YOUR DASHBOARD
- RPM, DWELL DISPLAY

$49.50

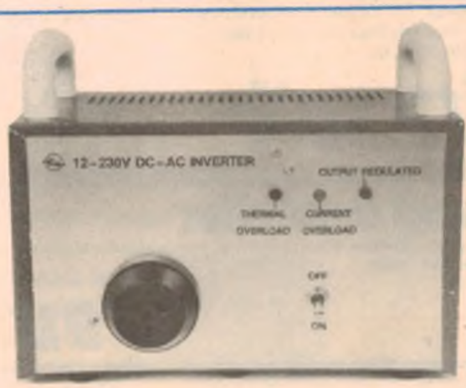
!!! NEW ADDRESS !!!

Jaycar 125 YORK ST SYDNEY 2000
Ph. 2646688 Telex 72293

Mail Orders To:
Box K-39 Haymarket 2000

SHOP HOURS
Mon-Fri 9 to 5.30
Sat 9 to 3
Thurs night to 8pm

Post and Packing charges
$5-$9.99 ($1) $10-$24.99 ($2)
$25-$49.99 ($3) $50-$99.99 ($4)
$100 up ($5.50)



Coming Next Month*

Heart-Rate Monitor

Based on a 3½-digit LCD module, our new heart-rate monitor is both compact and portable. Carry it with you when you go jogging!

Playmaster 3-56L Speaker

Housed in an attractive 56-litre cabinet, the new 3-56L loudspeaker system is just right for the average-size room. Full details June "Electronics Australia".

This new high-power 12/230V AC inverter is suitable for driving mains appliances rated up to 300VA. You can use it to power hand tools, colour TV sets, audio gear and other appliances when a mains supply is not available.

*Our planning for this issue is well advanced but circumstances may change the final content. However, we will make every attempt to include the articles mentioned here.

ON SALE: Wednesday, May 5

Four zener diodes are used in the circuit. Two 15V 1W zeners provide regulated supplies for the entire preamplifier while an additional 5.6V 400mW zener in each channel reduces the voltage fed to the input differential pair. This also protects the Fet current source from possible breakdown in the event of a gross overload which could occur if someone hamfistedly drops the cartridge onto the record. The 5.6V zener must a be 400mW type, by the way. A 1W type is not suitable.

The resistor feeding each 15V zener is marked as "R" and suitable values together with recommended power ratings to suit various amplifier supply rails are tabulated below. If you wish to power the preamplifier separately, we do not recommend that the supply be housed in the same case, to avoid hum. A suggested power supply circuit with ±20V rails to feed the zeners is also provided with this article.

Transistor types

While we have specified an LM394 as the input differential pair for each channel of the preamplifier, there is a suitable substitute in the form of a pair of Hitachi 2SC2545 transistors. We tried these transistors in our prototypes and found them to be excellent. In fact, in the MC mode, they are actually 1 to 2dB better than the LM394 although in the MM mode, they are about 1dB worse.

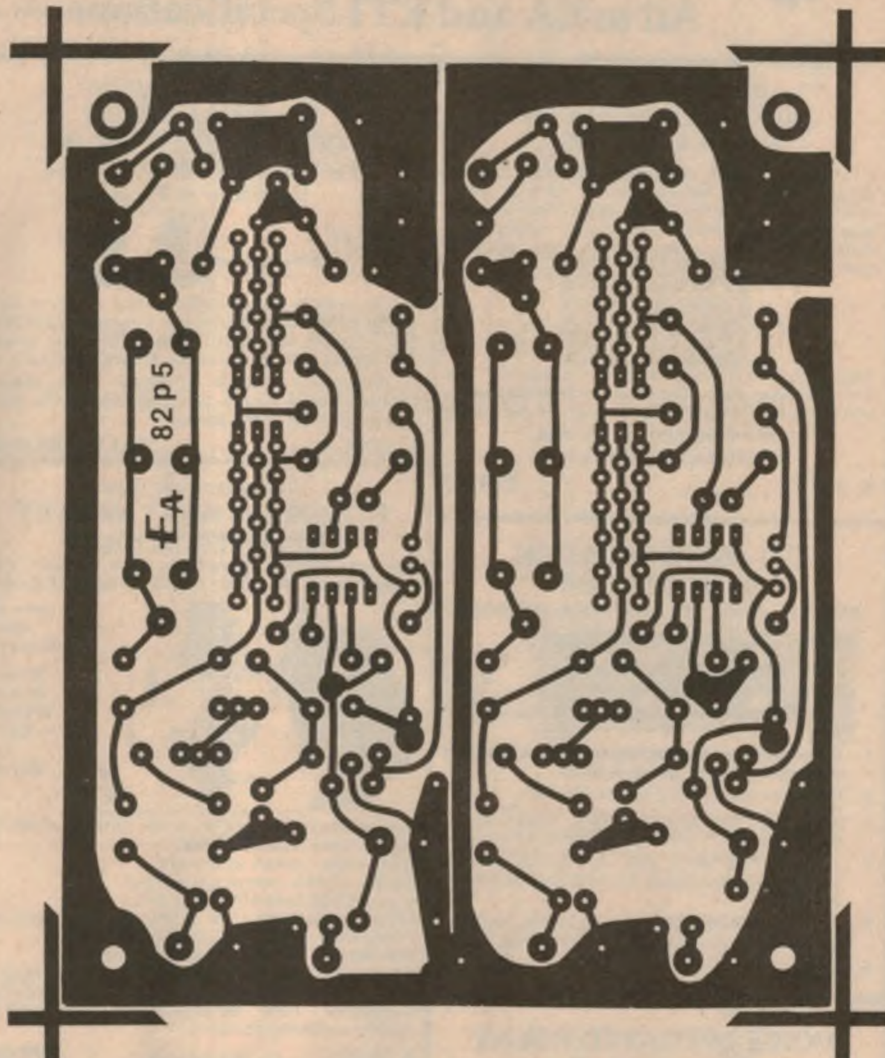
Unfortunately, at the time of writing, these 2SC2545 transistors are not generally available in Australia although Hitachi transistors are distributed in this country by Plessey Components. They are ideal for the job and are used in a number of high performance Japanese amplifiers. They are, in fact, available as a spare part for some of these amplifiers.

It is also possible to substitute 12 BC550Cs (2 x 6) in each channel but the resulting performance vis-a-vis noise is not up to the standard of the LM394 and is about 2dB worse in both MM and MC modes and is quite noticeable. A pity!

Construction

If you decide to install this new preamplifier inside an existing amplifier, a great deal of care will be required to ensure that hum pickup is not a problem. Similarly, if you decide to house the preamplifier in a separate case, it should ideally be all-steel construction to provide effective hum shielding.

Note that if a separate housing is used it must be provided with an earthing terminal to connect the arm or turntable earth, otherwise 50Hz "buzz" will be apparent.



Above: actual size reproduction of the PC board artwork (code 82p5).

We estimate that the current cost of components for this project is

$35

including sales tax. This does not include the cost of the additional hardware required for a free-standing unit or the cost of a separate power supply if required.

Below: use this table to determine the value of the two resistors marked "R".

± Supply Voltage	'R'	Wattage
18	100Ω	½W
20	150Ω	½W
22	220Ω	½W
25	330Ω	1W
30	470Ω	1W
35	680Ω	1W
40	820Ω	1W
45-50	1kΩ	5W
50-60	1.2kΩ	5W
60-75	1.5kΩ	5W
70-90	1.8kΩ	5W

All the components for the preamplifier, with the exception of the input inductors and switch, are accommodated on a PC board measuring 124 x 102mm and coded 82p5. If you wish to build the preamplifier to provide MM or MC mode alone, the switch may be omitted and the relevant components either omitted or wired in permanently. In the MM mode, this modification would have the benefit of improving the high frequency crosstalk figures which would appear to be mainly due to capacitance in the switch.

Care should be taken to observe the polarity of electrolytics, transistors and diodes. Provision has been made for a

Continued on p130

ALTRONICS ... ALTRONICS ... ALTRONICS ... ALTRONICS ...

SUPER POPULAR QUALITY KITS

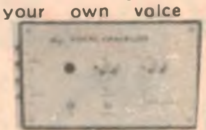
All to EA and ETI Specifications — All Guaranteed

Kit of the Month

VOCAL CANCELLER

SEE EA APRIL '82

If you have ever imagined yourself as lead vocalist with a famous band, here is your chance to "audition". You can cancel out the lead vocal on almost any stereo record and substitute your own voice or musical instrument.



This self powered kit simply "plugs in" the line between your turntable or tape deck etc. and amplifier and **PRESTO** your in business.

Low noise TL071 IC's used.

FANTASTIC VALUE!

K 1070 . . . . **$19.50**

ETI 469 PERCUSSION SYNTHESIZER

SEE ETI APRIL '82 FOR FULL DETAILS

Superb Sigea Case Included.

1. Simulates drums, cymbals, snares, bongos and lots of other weird sounds.
2. Play manually like a set of drums.
3. Provision for programming (plays automatically). ETI advise sequencer to follow.
4. The ALTRONICS Kit is housed in the superb looking Sigea EC 1002 case as used by ETI.
5. The ALTRONICS Kit includes enough hardware to flush mount all controls.

K 1040 . . . . **$89.50**

VOICE OPERATED RELAY

SEE EA APRIL '82

This versatile voice-operated relay (or VOX) has a variety of applications. It can be used to control a tape recorder, as a VOX circuit for a transmitter, or to control a slide projector. It can be used with any low or high impedance microphone, or a high level source such as a tape recorder.

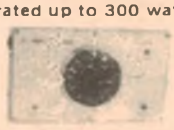
* Operates on 9-12V DC. *
* Manual overide facility. *
* Max. 3 amp DC switching capacity. *

K 1085 . . . . **$14.50**

PHOTOGRAPHIC TIMER

SEE EA APRIL '82

Want an easy-to-build photographic enlarger timer that won't cost an arm and a leg? This new Phototimer has 12 separate settings ranging from 2 to 90 seconds, and can handle enlargers rated up to 300 watts.



Altronics UB2 Jiffy Box Included with Kit.

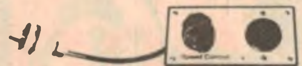
Professional Screened Front Panel and Dial Included. Mains Plug and Socket Supplied.

K 6055 . . . . $39.50

At last the ever popular . . .

EA DRILL SPEED CONTROLLER MK II

For Universal Brush Type Motors Drawing up to 3 amps.



Varies motor speed from a few RPM to full speed while maintaining good torque. Suitable for:— Drills and Drill Presses; Circular Saws; Jig Saws; Food Mixers; Movie Projectors.

ALTRONICS Kit is complete with mains flex and plug and is supplied with Jiffy Box and solid steel front panel.

K 6005 . . . . **VALUE $13.95**

The Powerhouse

ETI 499 150 WATT MOSFET AMPLIFIER MODULE

For all those audiophile's who haven't yet experienced the sheer purity of Mosfet Audio now is your chance!

Single Board Design — Easy To Build.

Power Output: 150W RMS into 4 OHMS. 100W RMS into 8 OHMS.
Distortion: .006% at 1 KHZ.
Noise: 114db below full output.
Hum: 98db below full output.
Input Sensitivity: 1V RMS for full output.
Frequency Response: 10HZ—60KHZ.
Stability: Unconditionally stable.
Exclusive: Low inductance Noble wire wound ballast resistors used in Mosfet Drain circuits.
Exclusive: Low leakage, long life power supply electrolytics used.

K 5020 . . . (Less Heatsink) **$79.50**

SEE ETI MAGAZINE MARCH '82

BRIDGING ADAPTOR ETI 479

SEE ETI MARCH '82

Obtain 300 Watts RMS from 2 ETI 479 5000 Series Mosfet Modules.

Easy to build and fit and the already superb Mosfet amp performance is enhanced to an incredible high order of specification performance.

Great for high power PA, stage sound applications.

K 5015 . . . . **$13.95**

MUSICOLOUR IV EA PROJECT

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.

K 1004 . . . . **$79.50**

VALUE PACKED EA AND ETI KITS TO CLEAR

K 7711 EA Sound Level Meter Kit (includes wooden Mic. Block)
Was $34.50 **NOW $25.00**

K 7715 ETI 561 Metal Detector Kit (includes prewound coil)
Was $29.50 **NOW $20.00**

K 7720 ETI 330 Car Alarm (Current Trip with Exit/Entry delay)
Was $28.50 **NOW $22.50**

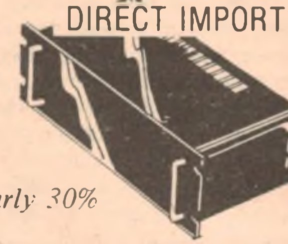
K 7716 ETI 084 Car Alarm (Current Sensing type)
Was $12.50 **NOW $9.00**

K 7705 EA Photon Torpedo
Was $24.00 **NOW $16.00**

Why pay Dick Smith $49.95?

RACK MOUNTING CABINET (3 Unit 132mm high) Black Anodised Front Panel

DIRECT IMPORT



Save nearly 30%

We're overstocked — so out they go. Get a real pro-finish like "Nakamichi" and "Technics" with our rack cabinets.

Our price is only $39.50

H 0400 . . . . . . 4 or more **$36.00 each**

ALTRONICS DIRECT IMPORT ELECTRONICS CATALOGUE

Our first edition catalogue was released with Electronics Australia Magazine March 1982. If you missed out, send $1.00 to cover package and post and you will be amazed at the savings ALTRONICS offer in comparison to the "Heavyweights" of the Electronics Component Industry.

$2 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.

$4 Delivery Australia Wide: We process your order day received and despatch via Jetservice for delivery next day.

Bankcard Holders can phone order up to 8pm (EST) for next day delivery — Sounds incredible doesn't it? Alright you cynics just try us! Weight limit 3.3kgs. Jetservice cannot deliver to P.O. box numbers (Australia Post would have a fit!)

ALTRONICS
105 Stirling St. PERTH
(09) 328 1599
for instant service

ALL MAIL ORDERS: BOX 8280 PERTH Stirling St. WA 6000

ALTRONICS ... ALTRONICS ... ALTRONICS ... ALTRONICS ...

ALTRONICS ... ALTRONICS ... ALTRONICS ... ALTRONICS ...

BANKCARD JETSERVICE-DELIVERY NEXT DAY BANKCARD JETSERVICE-

Low-power design also works as a battery charger

12/240V inverter for small appliances

This 12/240V inverter can be used to power mains appliances rated up to 40W, or to vary the speed of a turntable. As a bonus, it will also work backwards as a trickle charger to top up the battery when the power is on.

by JEFF SKEEN

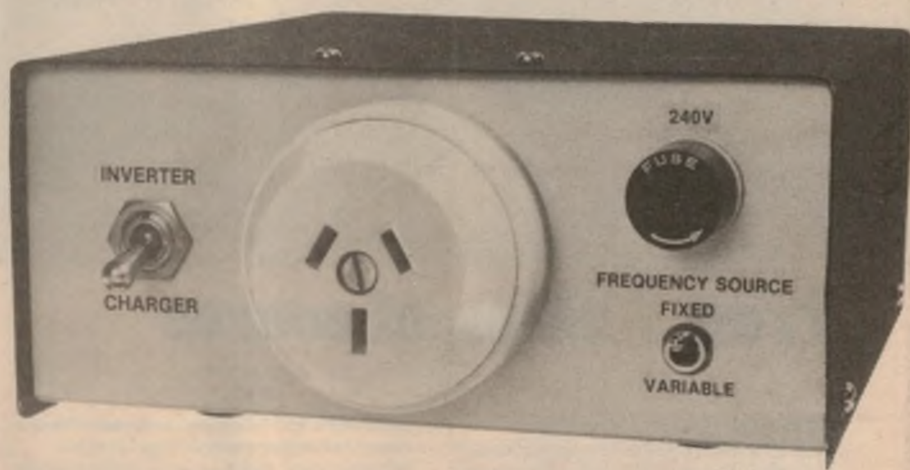
How do you operate a turntable in a caravan, or an electric shaver when you're in the bush? Our new 12/240V Inverter will let you do both things. It should prove particularly handy as a fixed frequency source for small appliances (including turntables) in recreational vehicles, or as a variable frequency source for a belt or idler-driven (but not direct-drive) turntable so that pitch and tempo of the music can be adjusted.

If you're roughing it in the bush, you need only have access to a 12V car battery to power a mains-operated "stubble grinder" – that is if you are uncivilised enough to use an electric shaver! We should point out, however, that this unit will not operate a fluorescent tube since the output is incapable of generating sufficient starting voltage.

Finally, back in civilisation, you can use the 12/240V inverter as an emergency battery charger or simply to top up the battery when power is available.

A transistor inverter can be either self-oscillating or driven. However, the low cost and relative compactness of a self-excited inverter are outweighed by two disadvantages: both frequency and output voltage are notoriously variable with changes in supply voltage and load. In addition, the transformer used in a self-excited inverter has to meet close specifications on leakage inductance, mutual inductance and winding resistance if the operating frequency is to stay within the design limits.

In a driven inverter, on the other hand, these problems are eliminated. The design presented here actually contains two separate oscillators: a crystal-locked oscillator giving a precise 50Hz output, and a variable RC oscillator with a nominal output frequency of 50Hz. Either of these oscillators may be selected to drive the inverter by means of a front panel switch.



View of the completed prototype, housed in a standard metal case. It can power appliances rated up to 40W, or can work backwards as a trickle charger.

How it works

Four transistors and two integrated circuits form the heart of the design. Essentially, two antiphase signals are derived from either the fixed or variable frequency timebase and used to drive a transistor output stage. This in turn drives a transformer with a centre-tapped winding, which is used in the step-up mode rather than the normal step-down mode.

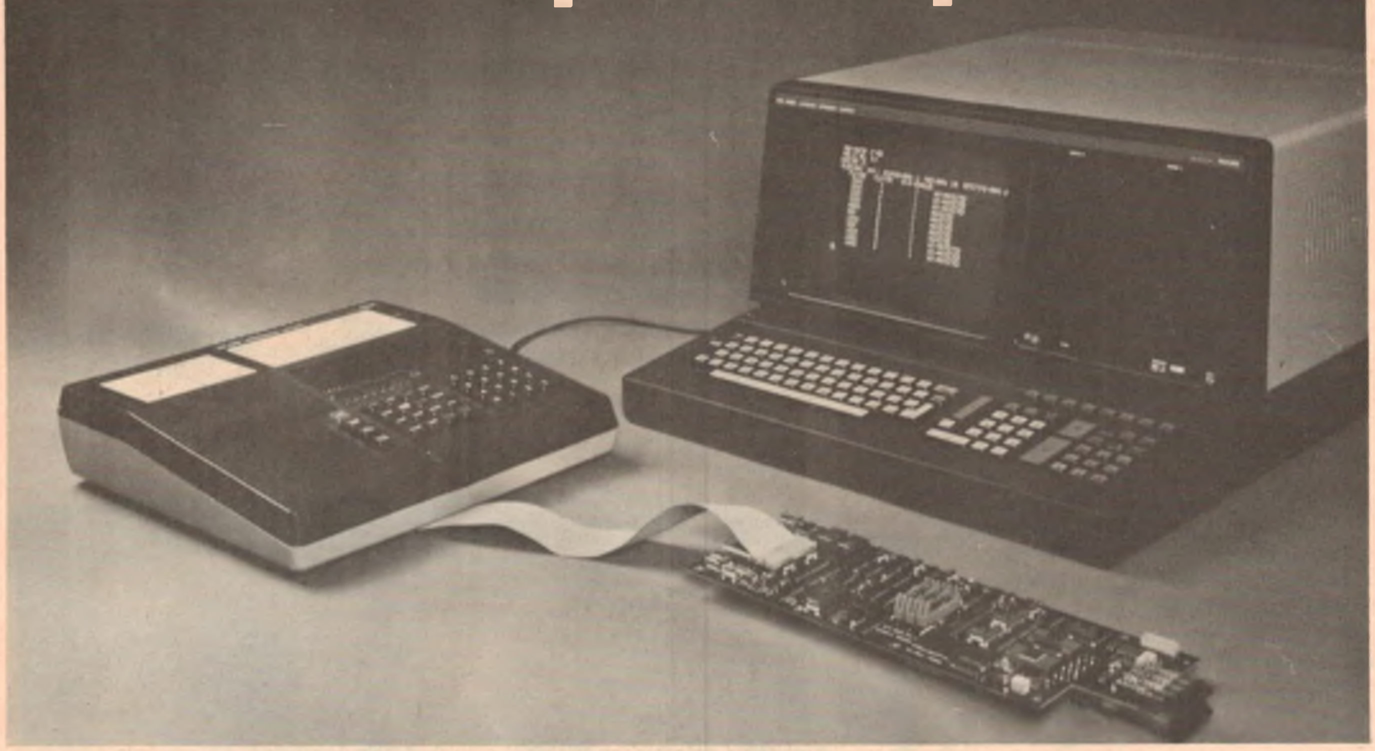
In more detail, gates IC1a, b, c form a standard three-inverter CMOS oscillator with a nominal output frequency of 50Hz. In practice, the output frequency can be varied over a small range – 44-58Hz on the prototype – by means of a 100kΩ trimpot. The 1N4148 diode and series 220kΩ resistor in the feedback path ensure a 50% duty cycle, and thus maximum efficiency of the inverter.

IC2, an MM5369EYRN CMOS mask programmable divider, provides the fixed frequency reference. It works in conjunction with an American standard colour TV subcarrier crystal operating at 3.5795MHz, and divides this frequency down to give a 50Hz output. This is a very economical method of obtaining an accurate 50Hz timebase since both the 5369 and the 3.5795MHz crystal are quite cheap.

However, there is one minor drawback in this application – the output of the 5369 has a 45%/55% duty cycle. While this ultimately results in some loss of efficiency, it is by no means serious enough to warrant a more expensive timebase.

Switch S1 selects between the outputs of the two oscillators and passes the signal to inverters IC1d and IC1e. IC1d, IC1e and IC1f buffer and invert the selected oscillator output to give two signals, 180° out of phase, as pins 4 and 10. These signals are then fed via 1kΩ current limiting resistors to PNP Darlington transistors Q1 and Q3. Thus,

START SMALL.... THINK BIG with microcomputer development tools



From Philips, of course

PM 4300 the Universal μC Instructor.
To quickly learn and master microprocessor designing. To use and compare the newest microprocessors, 8 bits and 16 bits, without delay.
Personality modules are available for the 8086, 8088, Z8002, Z80, 8048 and soon for the 6801, 68000, 6809 etc. ....

PM 4421 the Philips μC Development System.
To write programs in assembly language or in PASCAL. To perform efficiently the integration of software and hardware using real-time in-circuit emulation, symbolic logic analysis, I/O simulation, multiprocessor debugging etc. Assemblers already exist or will be shortly introduced for the 68000, 6800, 6801, 6802, 6809, 8086, 8085, 8080, Z8000, Z80, 6502, 6500/1, 2650, TMS 1000, 8048 family.

PM 4300 + PM 4421 : A ready solution for the new microprocessors. It is now possible to develop source programs on the PM 4421 and to transfer the corresponding object programs in the RAM memory of the PM 4300.
Debugging can then be carried out in the user's application environment with the use of the PM 4300 emulation probe and specialized function keys.
That way a design engineer who wants to take advantage of a new microprocessor coming on the market can find support from the Philips Development Tools without costly delays.

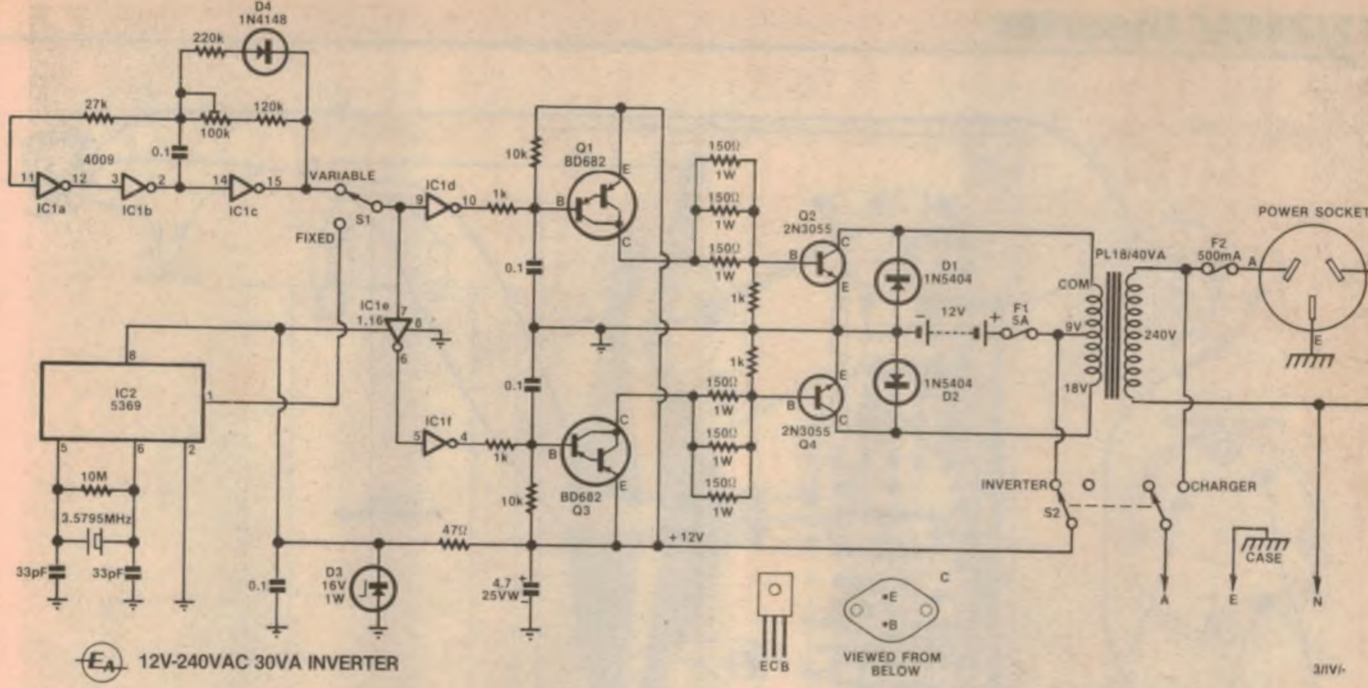
For more detailed information phone
Philips Scientific and Industrial Equipment:
Sydney — Tom Nealon
Mike Meechan 888 8222
Melbourne — Ralph Brown 690 6366
Brisbane — Eleanor Futter 44 0191
Adelaide — Duncan Glenn 223 4022
Perth — Lois Woodcock 277 4199
NEW ZEALAND
Wellington — Steve Morris 859 859

PHILIPS Test & Measuring Instruments

PHILIPS

□ OSCILLOSCOPES 10 - 150 MHz □ DIGITAL & ANALOGUE MULTIMETERS □ CONVERSATIONAL DATA LOGGERS □ RECORDERS CHART & X-Y □ LF & RF OSCILLATORS □ MICROWAVE EQUIPMENT
□ DC POWER SUPPLIES & AC STABILIZERS □ FREQUENCY COUNTERS & TIMERS □ TV STUDIO & TRANSMISSION INSTRUMENTATION □ PULSE GENERATORS □ AUDIO & VIDEO SERVICE EQUIPMENT

AHEARN S146



The circuit consists of two switch-selectable oscillators driving a power amplifier stage and a step-up transformer.

when Q1 is on, Q3 is off and vice versa.

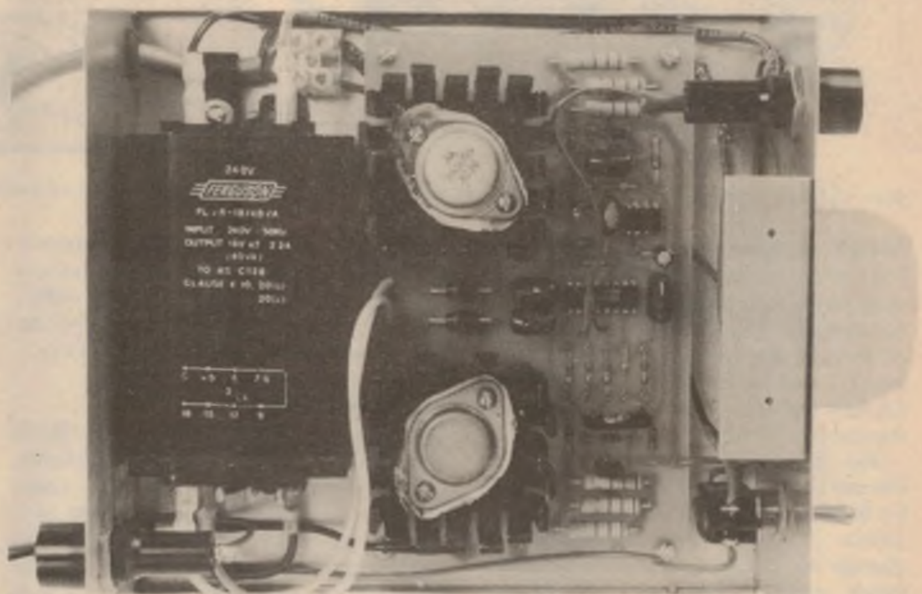
Note the 0.1μF capacitors connected to the bases of the BD682 Darlington transistors. These slow the switching times of the Darlingtons to produce a degree of waveform rounding to reduce switching spikes in the output of the inverter. The 10kΩ pullup resistors ensure that the BD682 transistors are fully cut-off when the outputs of IC1d and IC1f go high.

The output transistors (Q2 and Q4) are 2N3055 types, one for each phase, and are connected across the transformer primary. Base drive current to the 2N3055s is limited by a parallel combination of three 150Ω 1W resistors to about 200mA to ensure low saturation voltages in Q2 and Q4 at maximum load. The 1kΩ resistors pull the bases to ground potential to ensure cut-off of the 2N3055s when the BD682s are cut-off.

How does the transformer itself work? Consider Q2 turned on. This pulls Q2's collector low and applies approximately 12V to half of the transformer primary. By transformer action, 12V appears across the other half of the winding so that the collector of Q4 has +24V applied to it. Similarly, when Q4 turns on and Q2 is off, Q2 has +24V applied to its collector.

Thus the whole transformer primary has a 50Hz square wave applied to it, ie. +24V peak in one direction and then the other, in a push-pull mode. Therefore, the voltage applied to the whole transformer primary is about 24V RMS. The transformer then steps this waveform up in the secondary to provide a nominal 240V RMS (after losses).

Diodes D1 and D2 protect the output



Be sure to use a metal case, and keep all mains wiring neat and tidy. There is no need to isolate the transistor cases from the heatsinks.

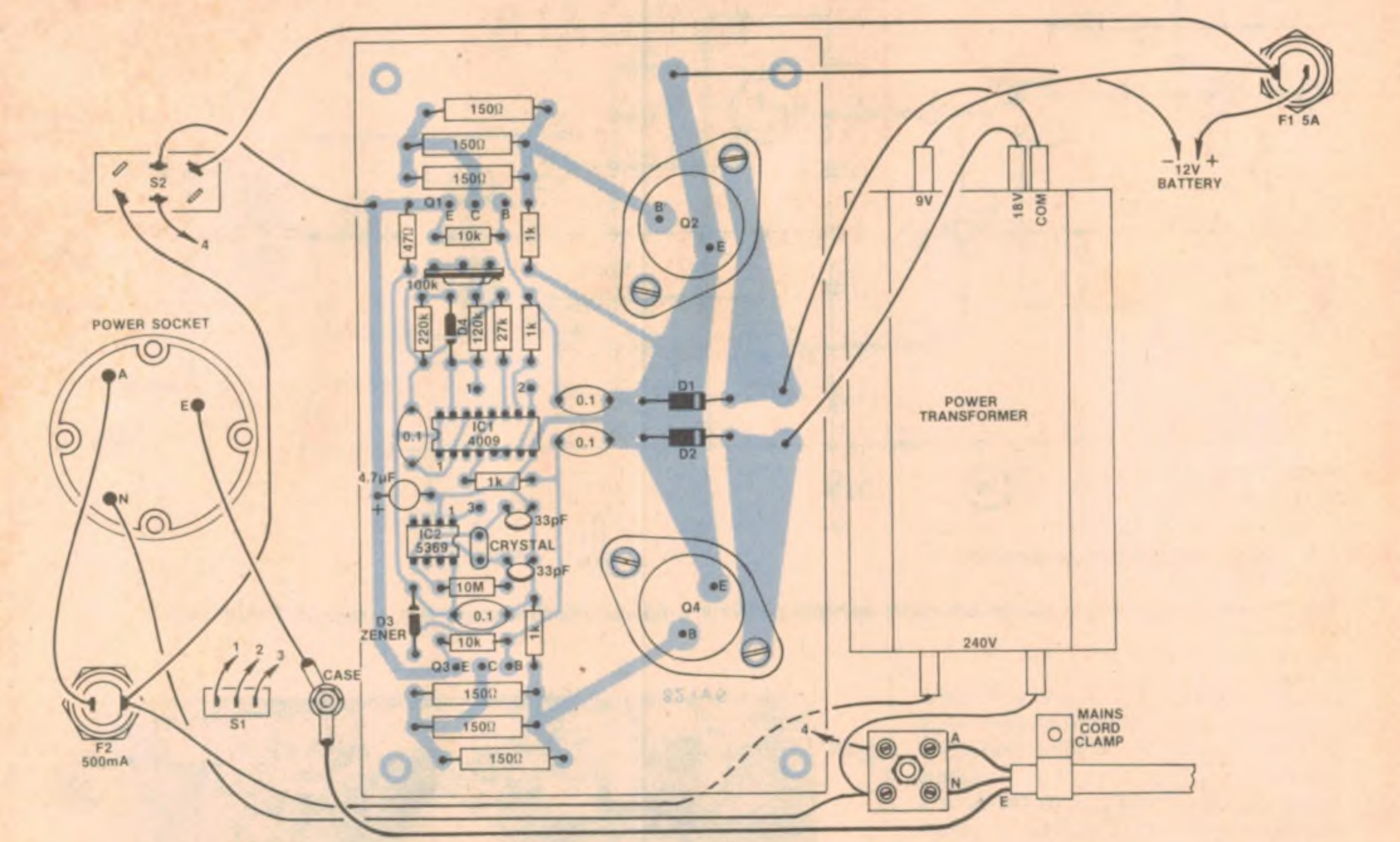
SPECIFICATIONS

INVERTER MODE

No load output voltage: 275V AC (approx) at 12.25V input.
No load input current: 700mA at 12.25V input.
Output voltage with resistive load: see graph.

CHARGER MODE

Charging current: 600mA (maximum).
Charging voltage (no load): 15V peak.



Note that the connection details to switch S2 may vary according to the type of switch supplied.

transistors against reactive currents flowing in the transformer windings, and provide protection against reversed battery connection. If the battery is accidentally connected the wrong way round, D1 and D2 will be forward biased and the 5A fuse will blow. No further damage to the circuit will occur.

One further advantage accrues from the use of D1 and D2: the circuit can also be used in reverse as a battery charger! Switch S2 selects either the inverter or charger modes of operation and, in the latter case, connects the output transformer to the mains in the conventional manner. Diodes D1 and D2 full-wave rectify the transformer output to provide a no load voltage of approximately 15V peak.

The charging current is approximately 0.6A maximum – sufficient to trickle charge a partially flat battery when a mains supply is available.

Power for the inverter circuitry is derived directly from the 12V battery. A 47Ω resistor, a 4.7μF capacitor and a 0.1μF capacitor decouple the supply line to the CMOS ICs, while a 16V zener diode clips any voltage spikes that could otherwise damage the ICS.

For applications where the frequency of the 240V supply is non-critical, the 5369 and associated circuitry can be omitted for a saving of approximately $9. If the frequency of the RC oscillator is to remain fixed at approximately 50Hz, the trimpot and series 120kΩ resistor can be replaced by a single 150kΩ resistor.

Construction

A single printed circuit board (PCB) coded 82iv5 and measuring 146 x 90mm accommodates most of the components. Using the wiring diagram as a guide, commence construction by soldering the various components to the PCB. Check your work carefully as you go, and make sure that all polarised components (transistors, diodes, ICs and the electrolytic capacitor) are soldered in the right way round.

The two CMOS ICs and the 2N3055 output transistors should be left till last. Observe the usual precautions when soldering the CMOS ICs: connect the barrel of your soldering iron to the earth track on the PCB using a small clip lead, and solder the supply pins first. The supply pins are pins 8 and 16 for the 4009, and pins 2 and 8 for the 5369.

> We estimate that the current cost of components for this project is
>
> **$55**
>
> This includes sales tax.

The 2N3055 transistors are mounted on TO-3 "Powerfin" heatsinks measuring 50mm square by 25mm high. Smear the underside of the transistors with thermal grease, then bolt the transistors and heatsink assemblies to the PCB using machine screws and nuts. There is no need to electrically isolate the transistors from the heatsinks, but don't forget to solder the transistor leads on the underside of the PCB.

Once the PCB assembly has been completed, you can start fitting the hardware to the case. The case we used measures 160 x 184 x 70mm and consists of an aluminium base fitted with a steel lid.

Temporarily position the various items inside the case and mark and drill mounting holes for the PCB, transformer, mains terminal block and solder lug. You will also have to drill holes for the mains socket, the two front panel switches, the front and rear panel fuses, and entry holes for the mains cable and the battery leads. Deburr all holes with a large drill.

This done, mount the various items of hardware in the case and complete the wiring according to the wiring diagram. The mains cord enters through a grom-

"Horizontal jitter, my eye! I'm calling the vet!" (Radio-Electronics).

meted hole on the rear of the chassis and must be securely clamped. Terminate the active (brown) and neutral (blue) leads in the insulated terminal block, and solder the earth lead (green or green/yellow) to the solder lug bolted to the case.

Note that all wiring, with the exception of the wiring to switch S1, should be mains rated. Cover any exposed switch or fuse terminals at mains potential with insulating tape, and don't forget to fit rubber grommets to the entry holes for the battery leads and mains socket wiring. The battery leads (red for positive, black for negative) are secured by wrapping them in insulating tape and using a suitable clamp fashioned from scrap aluminium.

The PCB is mounted using 9mm tapped brass spacers and machine screws. It must be positioned carefully in the case so that the T0-3 heatsinks do not short to the transformer frame or so that it does not foul the front panel switches. You should also check to ensure that the 2N3055 mounting screws do not short against the bottom of the case.

Because the case is made of only light gauge aluminium, additional support must be provided for the front panel so that it does not bend when you push a plug into the socket. We solved the problem by means of an L-shaped aluminium bracket as shown in the photographs. This is secured to the front panel using the same screws and nuts that support the mains socket, and is subsequently fastened to the lid of the case using self-tapping screws.

Ignore, for the moment, the urge to "hook 'er up and try 'er out"! Before so doing, go back over the project and check carefully for wiring errors. In particular, you should check the action of switch S2 with a multimeter, as the wiring details may vary according to the switch type.

Assuming that all is well, connect up a 12V battery and check that the voltage

HIGH RESOLUTION, HIGH VISIBILITY GRAPHICS

MicroBee brings you unsurpassed graphics facilities under easy to learn BASIC control. In low resolution mode (128x48 units) you can generate 'chunky' graphics and run Tandy programmes. For finer control a couple of keystrokes, switch you to high resolution graphics (512x256 units) and still let you combine them with text. Doing all this is easy for MicroBee. It shares the same intelligent VDU controller IC with IBM's new personal computer. So, like the IBM, MicroBee has a fully programmable screen display. MicroBee's standard 16 line by 64 character upper/lower case format can be updated to the professional 80x24 format to run CP/M programs. No need for expensive add ons.
Simple, easy to use BASIC commands make using your MicroBee easy, even if you're just getting into computers.

UNIQUE CONTINUOUS MEMORY AND BUILT IN SOUND

Only MicroBee brings you this great facility. You can hold programs and data in continuous memory when you switch off, or move to a new location. There's no longer any need to store on cassette or floppy discs at the end of the day. A power failure doesn't mean the loss of valuable programs or data. An inbuilt battery holds everything in memory until power is restored or you switch on again. MicroBee, your portable terminal.
MicroBee's built in sound facilities bring you two octaves of music to tune up your programming skills. Again under simple to use BASIC control. Add sound to your game programs. Or maybe write your own music. The speaker is inbuilt. And it's so easy to learn. MicroBee brings you unique facilities and opens up new programming opportunities.
MicroBee, the personal computer that never forgets.

SERIAL AND PARALLEL PORTS READY.

Your MicroBee is fully equipped to interface and communicate with the outside world. The programmable RS232 standard port means connecting a serial printer, modem or another computer is as simple as plugging it in. MicroBee's built in software means you're ready to run at 300 or 1200 baud. When you're ready to go further, use MicroBee's parallel port and connect up joysticks, Centronics type printers or any other peripherals needing a parallel port. Even the cassette interface has something special. It will store and load programmes at 300 or 1200 baud in either BASIC or Z80 code as well as letting you merge lines into an already existing BASIC program.
MicroBee works happily with your ordinary audio cassette recorder, and gives you a good load and save every time, even at the higher (1200 baud) rate. It's as simple as plugging it in with MicroBee.

microbee does

EXPANSION POWER

If you're not sure how you'll be using your MicroBee in the future, we've thought of that too. MicroBee is designed for inexpensive future expansion. The basic MicroBee with 16K of user RAM easily converts to 32K with a changeover board. Adding ROM (Read Only Memory) up to 28K is as easy as plugging it in to the memory board. Want S100 expansion? MicroBee goes one better. Its unique Z80 expansion bus lets your MicroBee interface with S100 as well as all the other expansion busses.

And if you're thinking of using disc drives and want to be able to run world standard CP/M Software, MicroBee's still with you. The soon to be released memory board and factory mod convert your MicroBee to 48K RAM, running CP/M with the ability to take disc drives. So you can run the same programs as IBM, DEC, Xerox and HP do on their Micros. MicroBee, ready when you are.

POWERFUL 16K MICROWORLD BASIC

Programming has never been simpler. Novice or experienced programmer, you'll find MicroBee's 16K BASIC in ROM a delight to use. MicroWorld gives you everything you get with other BASICs plus extra help. Like special error reporting and editing. And support of the built in sound and graphics facilities. So MicroBee's powers aren't hard to use. The BASIC also controls printers and modems. Writing programs is simpler because of the BASIC's search and replace ability. When you want to go further, **MicroWorld Editor/Assembler** helps you use Z80 code and write USR subroutines. It's in ROM for instant access. Or get going right away with **Cassette Programs.** From only $6.95 each. Chose from games like Chase, Target, ZTrek, Solitaire, Wumpus, Biorythm, Calender Maker or utilities like Typing Drill, Diagnostic, Textmaster.

SOFTWARE SUPPORT

As a MicroBee owner, you'll become a member of the MicroWorld Users' group, and receive our newsletter and updates. Your kit comes on 14 day satisfaction guarantee. And there's a $50 complete cover service coupon if you have trouble.

You can phone order MicroBee on (02) 487 3798. Use your Bankcard. Or to Mail Order your MicroBee just write to:- **MicroBee, Box 311, Hornsby NSW 2077**

Due to enormous demand, MicroBee deliveries have been delayed.

Complete kit
Includes 16K RAM, 16K ROM BASIC, all manuals.

$399

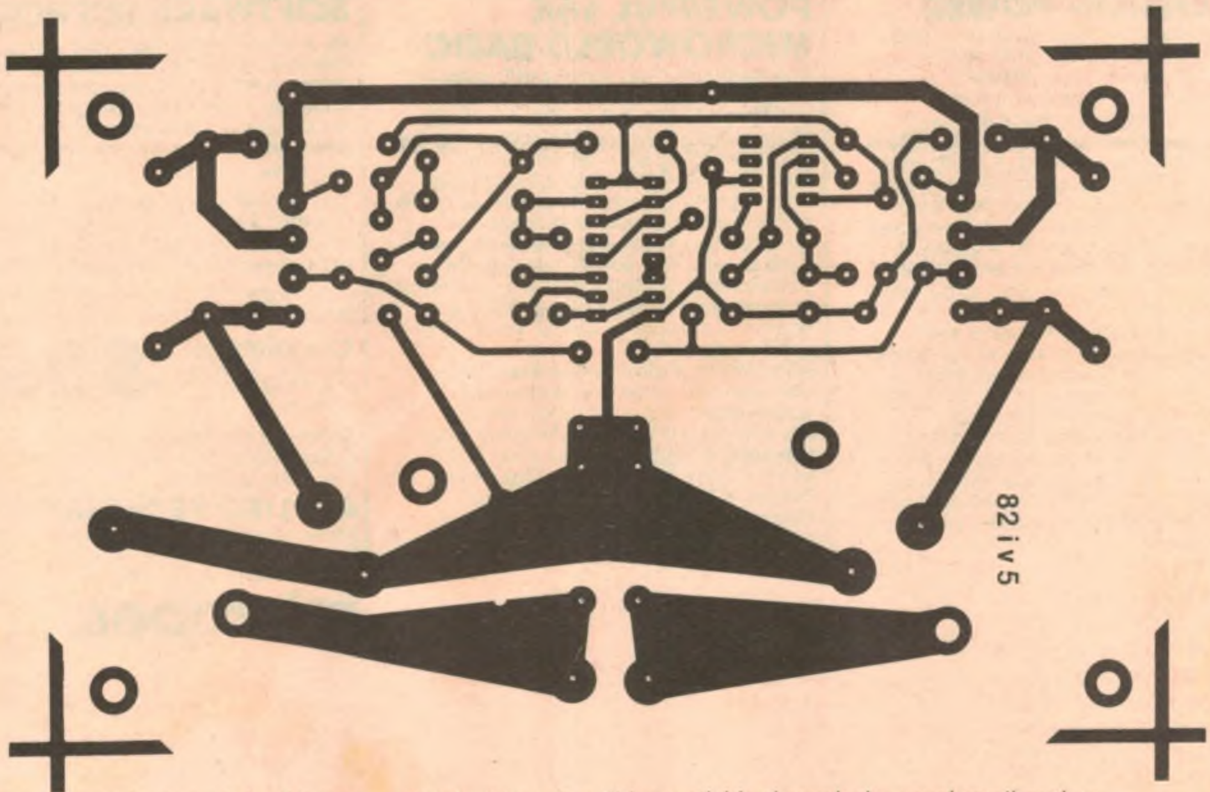
Software includes:
Editor/Assembler (ROMs, Manual) $49.50
Cassette software (each) $6.95

APPLIED TECHNOLOGY
Showroom/Office 1 A Pattison Ave., Waitara
Hours 9-5 Monday to Saturday.
Phone (02) 487 2711 Telex APPTEC 72767

microbee

more, simply

Glover & Assoc. AT/24



Actual size reproduction of the PC pattern. Finished boards will be available through the usual retail outlets.

PARTS LIST

1 printed circuit board, code 82iv5, 145 x 89mm
1 metal case, 160 x 184 x 70mm
1 PL18/40VA low profile transformer
1 2-way insulated mains terminal block
4 9mm tapped brass spacers
1 mains cord and plug
2 car battery clips
5 rubber grommets (4 small, 1 large)
1 mains cable clamp
1 small clamp (to secure battery leads)
2 fuseholders, type 3AG panel mount
1 5A fuse, 3AG
1 0.5A fuse, 3AG
1 surface-mounting mains socket
1 SPDT switch
1 DPDT 5A, 240VAC switch
1 solder lug
1 metre black, 240VAC rated hook-up wire
2 metres red, 240VAC rated hook-up wire
1 10cm length, green, 240VAC rated hook-up wire
1 10cm length, 3-way rainbow cable
2 TO-3 heatsinks, 50 x 50 x 25mm
1 piece scrap aluminium, 65 x 60 x 1mm
2 small self-tapping screws

SEMICONDUCTORS
2 2N3055 NPN transistors
2 BD682 PNP Darlington transistors
2 1N5404 diodes
1 1N4148 diode
1 16V 1W zener diode
1 4009 hex inverter
1 5369EYRN oscillator divider with 50Hz output (available from Dick Smith Electronics)

CAPACITORS
1 4.7μF 25VW electrolytic
4 0.1μF greencaps
2 33pF ceramic

RESISTORS
(¼W, 5% unless stated)
1 x 10MΩ 10%, 1 x 220kΩ, 1 x 120kΩ, 1 x 27kΩ, 2 x 10kΩ, 4 x 1kΩ, 6 x 150Ω 1W, 1 x 47Ω, 1 x 100kΩ large trimpot

MISCELLANEOUS
Machine screws and nuts, washers, solder, etc.

across the primary of the transformer (ie, between the collectors of Q2 and Q4) is approximately 24V AC. Next measure the voltage across the secondary (240V side) of the transformer. You should get a reading of approximately 275V AC unloaded.

Note: exercise extreme care when measuring these voltages. An electric shock could be fatal!

If everything is operating normally, the heatsinks on the 2N3055 transistors will run slightly warm to the touch. If, however, one heatsink becomes quite hot while the other stays cold, the selected oscillator is probably not working.

As a final check, connect up your turntable, select the variable frequency oscillator, and check that the speed of the turntable can be varied by varying the 100kΩ trimpot. A conventional panel-mounting potentiometer can be used in place of the trimpot if frequent adjustment of the oscillator is required.

That's it! Next month we plan to describe a high-power 300VA inverter that can run lighting, colour TV sets and VCRs, stereos or other appliances in the absence of mains power. Given the power generating problems of the eastern states, it should prove a popular project.

The world's most asked-for DMM's: Now, there's more to ask for than ever before.

When people ask for test equipment with unsurpassed engineering excellence and proven durability, the choice is clear. They ask for Fluke.

And that simple fact has made the Fluke 8020 Series of handhelds the world's most popular DMM's.

As the world leader, we're committed to continually refine and improve the performance of our instruments. Because in our book, that's what leadership is all about.

Our most popular DMM's improved inside and out

The new 8020B Series of handhelds incorporate important refinements realized from a careful analysis of the hundreds of thousands of Fluke DMM's in use today.

Outside, we redesigned the front panel for greater ease of operation. We added non-skid rubber feet, and made our shock-resistant case even tougher. You'll find a new tilt bail with a locking detent, too.

Inside, we designed double-fuse protection on the current inputs for maximum safety in case of an accidental overload. And added high-speed continuity beepers on three models that respond to even the fastest mechanical contacts.

The most asked for measurement capabilities

All this, plus the same superior functions and features that have made the 8020 Series the most asked-for DMM's in the world: Choices of 0.25% and 0.1% basic dc accuracy. Crisp, bright liquid crystal displays. And a selection of models that lets you match the performance you desire to your budget.

Selection Guide

	DC Voltage	AC Voltage	DC Current	AC Current	Resistance	Diode Test	Conductance	Continuity	Logic Level	Temperature	Peak-Hold	DC Accuracy
8022B	•	•	•	•	•	•						0.25%
8021B	•	•	•	•	•	•		•				0.25%
8020B	•	•	•	•	•	•	•	•				0.1%
8024B	•	•	•	•	•	•	•	•	•	•	•	0.1%

All four models are backed by a two-year parts and labor warranty with a guaranteed two-year calibration cycle.

Ask for more information.

Call; use the coupon below, or contact your Fluke stocking distributor, to order Fluke DMM or to request complete specifications.

FLUKE®

sold and serviced by

ELMEASCO
Instruments Pty. Ltd.

and leading electronics suppliers.

We use more metal oxide varistors, diodes, thermistors, fuses and resistors than any other manufacturer to protect you and your DMM in case of an accidental overload.

High-speed continuity beepers, now featured on three Fluke DMM's, mean these meters won't slow you down when trouble shooting multi-wire cables.

Tough, heat and shock-resistant lenses protect our custom-designed liquid crystal displays from solder splashes and other field abuses.

bankcard
welcome here

Fast-Response Coupon

☐ *Please send data on Fluke DMMs.*

Name: . . . .

Address: . . . .

. . . . Postcode: . . . .

Phone: . . . .

P.O. BOX 30, CONCORD, N.S.W. 2137
13-15 McDonald Street, Mortlake. 2137
Tel: (02) 736-2888 Telex: AA25887
P.O. BOX 107, MT. WAVERLEY, VIC. 3149
21-23 Anthony Drive, Mt. Waverley. 3149
Tel: (03) 233-4044 Telex: AA36206
Adelaide: 271-1839
Brisbane: 229-3161
Perth: 398-3362

We pay our engineers while they

The day you join the Air Force you start receiving a salary. Even though you're a full time student either at the RMIT (Royal Melbourne Institute of Technology) or the WAIT (Western Australian Institute of Technology).

At the WAIT you can study communications or electronics. At the RMIT you can study mechanical, aeronautical, communications or electronics engineering.

All of them lead to a degree.

When you graduate as an officer you will be posted to one of several RAAF bases.

There you will undertake design projects, supervise maintenance and have the management of maintenance resources for some of the most sophisticated equipment in the country.

ONCE YOU KNOW WHERE YOU'RE GOING YOU CAN REALLY FLY.

As a graduate officer you have more than merely an engineering degree. Because in the RAAF you are also given training in management and administration.

So by the time you're about 22, you will be much further advanced than your civilian counterparts. Not only because of your technical expertise, but also your capacity to accept responsibility. After all, by then you could be in charge of a hangar full of aeroplanes and anything up to 30 men.

To enter the Engineer Cadet Scheme you must be an Australian citizen under 20 on January 1st of your year of entry and meet our selection requirements.

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.

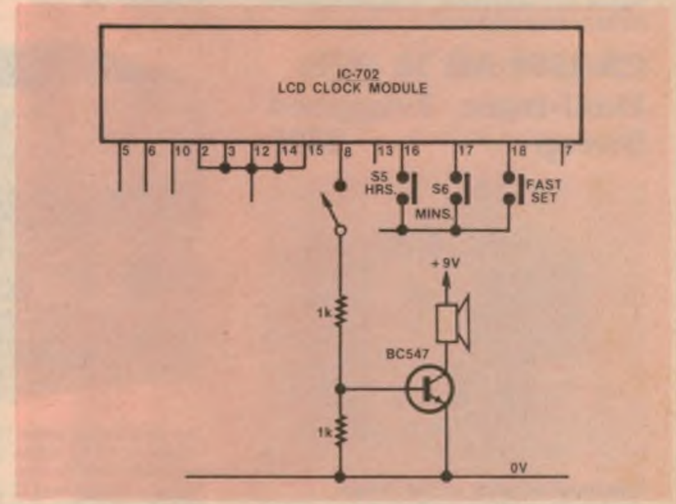
Alarm and Fast Shift for EA Control Timer

By adding a few components to the Control Timer (EA, April, 1980), its versatility is increased for only a small cash outlay. The modifications enable the unit to double as an alarm clock, and the time setting – both timer and clock – to be "fast shifted" in a similar manner to commercial units.

The LCD Clock Module generates an alarm signal which is amplified to drive a miniature loudspeaker. The alarm output taken from pin 8 is a 2.048kHz tone, modulated at 8Hz and pulsed at a one-second rate. This signal is taken via a single-pole switch to a simple one-stage transistor amplifier which feeds the loudspeaker. The resultant sound has a pleasant pulsed tone, which serves as an effective alarm. It will sound for four minutes if not turned off beforehand.

Fast shift of time setting is accomplished by connecting a pushbutton switch between pin 18 of the Clock Module and the common bus which links S2, S3a, S4, S5 and S6. This fast increment switch actually provides several functions:

- When setting "normal" time it resets seconds to 00 for accurate setting;
- When used in conjunction with the hours and minutes buttons (for normal time setting), it fast shifts the hours and minutes respectively;
- If both this switch and the hours button are pressed simultaneously when setting control time, it alternately changes AM and PM every second; and



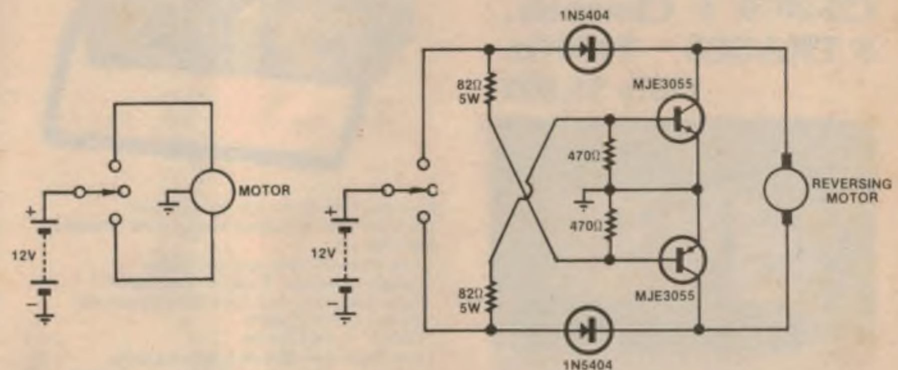
- When used in conjunction with the minutes button (for setting control time), it increments tens of minutes by one decade per second.

R. Loh,
Kyneton, Vic.

Power Inverter for Motor-Driven Antenna

The traditional motor-driven antenna installed in motor vehicles has one side of the motor grounded, plus two terminals connecting to separate field coil windings. These are connected to two contacts of a "centre-off" two-way switch so that battery polarity can be reversed, depending upon whether it is desired to raise or lower the antenna. For this application a single-pole switch is supplied.

Some contemporary antennas apparently use a "permag" motor whose windings are not grounded to its framework. Motor reversal is obtained by reversing the polarity of the current fed to its two floating terminals. Control of this type of antenna usually requires a two-pole switch, with one pole grounded and the other connected to battery. Thus, if such an antenna is used to replace one of the former type, it would be necessary to replace the original single-pole switch with a two-pole version. In many cases this is undesirable as the replacement switch may not match the decor of the instrument panel.



The accompanying circuit solves the problem. Assuming the single-pole switch applies power to one-half of the circuit, current flows via an 82Ω 5W resistor into the base of an MJE3055 transistor, switching it on. Current also flows via a 1N5404 diode to the antenna motor. The other side of the motor is returned to ground via the switched-on MJE3055. The second 1N5404 diode prevents the other MJE3055 from switching on. In addition, it is held cut-off by the 470Ω resistor connected between its base and ground.

Exactly the same applies when power is applied to the other side of the circuit, except that the functions of all components are reversed. Compared to the previous situation, the motor will run in the opposite direction.

Note that since it only takes some three to four seconds to raise or lower the antenna, it is unnecessary to mount the MJE3055s on heatsinks. But for continuous duty applications heatsinks should be included.

P. Albert,
Neutral Bay, NSW.

VALUE & PERFORMANCE INSTRUMENTS FOR THE SERIOUS USER

TRIO

Time proven under Australian conditions TRIO oscilloscopes represent the best value available Performance and reliability to please you—and prices to keep you happy!

CS-1560 AII 15 MHz Dual-trace, Triggered Sweep $525

The most popular in the range!
- Sensitivity 10mV/Div. (Triggers at 0.5 Div. Typ.)
- CH1, CH2, DUAL, ADD, and SUB
- Risetime 23nS
- XY Mode
- Triggered Sweep and Auto.
- Sweep Time 0.5μS/Div.-0.5S/Div and XY
- Price does not include probes.

NEW!

CS-2070 4 Channels, 8 TRACES 70 MHz Only $1,995

TREMENDOUS VALUE NEW RELEASE
A 70 MHz Scope for less than the price of many 50 MHz Scopes.
Features include:
- 4 Channel, 8 Trace display making use of alternating delayed sweep
- Dual sweep with completely independent A and B sweeps.
- 1mV/Div. sensitivity all the way to 70 MHz.
- Sweep time to 5nS/Div. for easy-viewing of fast signals.
- Delayed sweep intensity control.
- Bright, Clear CRT.
- Price includes 2 probes.

TRIO PR 654 Regulated Power Supply $385

The ideal bench power supply from TRIO, renowned for its dependability and unmatched price/performance ratio.
- Output Voltage and Current 0-35V/3A
- Ripple: Less than 1.5mVpp
- Remote Control: Remote Sensing and Remote Programming

B&K Model 3020 Sweep/Function Generator $479

Four instruments for the price of one!
The most versatile signal source ever offered by B&K Precision.
- Four instruments in one package— Sweep Generator, Function Generator, Pulse Generator and Tone Burst Generator.
- Covers 0.02Hz-2MHz
- 1000:1 Tuning Range
- Low Distortion High Accuracy Outputs
- Three Step Attenuator Plus Vernier Control
- Internal Linear and Log Sweeps
- Tone Burst Output is Front Panel or Externally Programmable

TRIO

B+K PRECISION

B&K Model 1820 80MHz Counter With Period Function $399

A truly user oriented instrument. Push buttons allow rapid selection of all modes. For frequency measurements the 1820 reads to a typical top frequency of 100MHz (80MHz guaranteed) and reads signals as low as 5Hz.
- 5Hz to 80MHz guaranteed (100MHz Typ.)
- Period measurements from 5Hz to 1MHz
- Period average, auto and manual positions
- One PPM resolution
- Totalises to 999999 plus overflow
- Elapsed time measurements from .01 to 9999.99 seconds plus overflow
- 1MΩ input impedance
- Bright .43" high LED readouts

Greenpar Oscilloscope Probes $30

Switched 100 MHz Professional quality probes — Outstanding value for money!
- Switchable 1:1 (10 MHz), 10:1 (100 MHz).
- 1.2 m long.
- Capacitance only 12pf.
- Risetime better than 3.5nS (10:1).
- Working Voltage 600V DC or peak AC.

All prices plus Sales Tax if applicable

PARAMETERS PTY LTD
PERFECTION•IN MEASUREMENT

Sydney: 439 3288
Melbourne: 580 7444.

Available at a Leading Stockist near you

The Serviceman

The customer's story — help or hindrance?

In any service situation the customer's version of the fault plays a vital role. But important though it is, it can also be misleading. Knowing what to accept and what to reject is all part of being a serviceman.

As a suburban serviceman I don't have much to do with fringe area conditions, high gain antennas, masthead amplifiers and the like. But the undulating terrain of the Sydney suburban area is such that a small percentage of viewers, in deep gullies or on the wrong side of the hill, are nearly as badly off as real fringe viewers 150km away.

Such was the situation in the present case. It was a fairly elaborate setup; a high gain antenna on a tall mast, a masthead amplifier and, in the house, a splitter network supplying two sets, a Pye T29 and a small General of about 36cm.

It was the lady of the house who rang me, and she explained that they had recently experienced a severe electrical storm and, more importantly, what appeared to be a very close-at-hand lightning strike with the flash and the crack occurring virtually simultaneously.

When the TV sets were next turned on, both were faulty. The Pye, according to the lady, ". . . won't work at all and has a very loud hum in it." The General was only a little better. It had sound and a picture, but it was so snowy as to be unwatchable.

Like the customer, I blamed the lightning strike. In more detail I assumed that it had knocked out the masthead amplifier, thus accounting for the snow on the General set, and that there had probably been a surge or spike on the mains which had damaged the Pye set.

When I finally came face to face with the sets I switched on the Pye, only to be greeted by a frighteningly loud hum; louder than anything I had heard from a set in a long time. My reaction was to switch off immediately, fearing that something was seriously wrong, probably in the power supply.

Next I tried the General. Surprisingly, this produced a near-perfect picture, with nary a suspicion of snow. I gave it a routine once-over — height, linearity, fine tuning, etc — but there seemed to be no reason why it had previously produced a snowy picture.

That is, until I went back to the Pye set and took a closer look at the whole setup. In fact, the customer had made two mistakes which lead to the confusion. When she had switched on the Pye set and been greeted with the nerve shattering hum she had — understandably — snapped the set off at the power point immediately.

Then she tried the General set, only to find a snowy picture, and concluded that it, also, had been damaged. The explanation was that the power supply for the masthead amplifier was fed from the same power point as the Pye set. So, in switching off the set she had also switched off the amplifier, leaving the General with very little signal.

"The man's here to fix the television aerial" (Radio Times).

Fortunately, I had switched the Pye set off with its own switch, leaving the power point turned on. Otherwise I might have gone off on a wild goose chase and wasted precious time looking for a non-existent fault.

(A colleague from a fringe area tells me that switched off masthead amplifiers are a frequent cause of unnecessary service calls, and are the first thing to be checked in any such system.)

But the fault in the Pye set was real enough and, from the violent nature of the hum, I had a feeling that it would be anything but "routine".

A PERFECT PICTURE

Fearing something drastic in the power supply I removed the back of the set and watched closely for any signs of distress as I gingerly switched on again. In fact, there were no fireworks and, after an appropriate period, I realised that we had a perfect picture on the screen, together with some weak sound behind the hum.

This pointed up the customer's second mistake: her assumption that the set had failed completely. In truth, she hadn't left it on long enough to produce a picture — for which I can't blame her — but had assumed a total failure. As it turned out, it wasn't all that important, but it does highlight how careful one has to be in accepting the customer's comments at face value.

But the presence of a perfect picture did alter my approach. Whereas I had previously assumed a basic power supply or filtering problem, this now seemed highly unlikely. If there was such a problem, it would almost certainly show up as hum in the picture in one form or another.

Nor did it seem likely that it was a filtering failure confined to the audio system supply rail. The audio system operates from a 25V rail but this same 25V source also provides a 15V rail via a dropping resistor and a 12V regulated rail via regulator transistor, Q48. Any hum on the 25V rail would show up in these other two supplies, which feed picture circuits.

I also noted that the hum was almost totally unaffected by the volume control setting. This, with the absence of hum in the picture, seemed to confine the fault to the main audio board. This consists of six transistors, plus the usual assortment of resistors and capacitors, in a typical audio amplifier configuration.

In greater detail it consists of a complementary-symmetry pair (AY8140/AY9140), a driver for each (BC327/BC337), a preamplifier (BC547), and a bias transistor (BC548), the whole thing being direct coupled.

The first thing I checked was the 25V rail, but this was spot on. Next I checked the centre voltage of the output pair which, again, came up spot on at just a little below half the rail voltage. That seemed to rule out any gross imbalance in the output stage, but I also checked the base/emitter voltage of the output pair, and then the same voltage on each of the other four transistors.

This is a very useful test, since this voltage is fairly constant for most transistor types at around 0.6V and any significant departure from this value usually indicates trouble, either in the transistor itself, or the immediate associated circuitry. But once again I drew a blank; everything appeared to be normal.

In fact, I finished up making a complete voltage check of the whole board without turning up a single clue.

A Live Antenna Fatality

The last few years have seen an apparent increase in the number of incidents involving TV antennas which, somehow, have become tangled up with the power mains. There have been a number of reports in overseas technical journals, mainly from the USA of accidents involving live antennas, some of them fatal.

Closer to home, in the May 1981 notes I described how a fellow serviceman encountered a live antenna with unpleasant rather than fatal consequences. More recently (August 1981), I published a reader's story describing a similar potentially lethal situation which again fortunately resulted in nothing more than a nasty shock.

But a more serious report appeared in the Sydney *Sun* newspaper for Wednesday, February 17, 1982. Under the heading "TV WIRE KILLS BABY", it describes a live TV antenna accident in the district of Bega on the NSW South Coast.

According to the report, the TV antenna was bolted to a down pipe and a faulty house switch had allowed the TV antenna to become live. It was said that the baby, whose mother had been visiting the house, touched the down pipe and received severe burns and a fatal shock.

No other details are available at the time of writing and, since the matter is sub judice pending a coroner's inquest, it is not possible to speculate. However, I plan to tell the full story when it is possible to do so.

A FAULTY TRANSISTOR?

But I was still convinced that one of the transistors must be faulty in some subtle way, if only because most of the other components seemed to have been cleared. And so began the rather tedious task of testing each transistor in turn, either by measurement or substitution.

I started with the output pair. I had no substitutes with me, so they were tested with the multimeter, the two drivers having been first removed to leave the bases floating. As far as I could tell from this test there were no shorts or open circuits in either transistor.

Next I checked the two drivers. Having removed them, this was most easily done by substituting new ones, since they were standard low-cost types which I normally carry. The result was negative. I then checked the bias transistor in the same way, with the same result.

That left only the preamp, and I was half afraid to try it, being just about out of ideas if that didn't work. The only thing I was still not sure about was whether my testing of the output transistors had been conclusive.

But having come this far I went ahead and changed the preamp anyway. And believe it or not, that was the answer; the hum vanished and the audio quality was back to normal. Why? Frankly, I didn't have a clue. In fact, right then, I was more interested in tidying up and finishing the job than worrying about the whys and wherefores. But I did earmark the faulty transistor for further checking.

Back at the shop, I put it on the bench tester. On a leakage test it read normal, but the shock came when I switched to the beta test; its beta was zero. So here we had a transistor which had no open circuits, no leakage or short circuits — in short, which functioned perfectly in the DC sense — but which had no gain whatsoever. A rare one indeed.

And, at first glance, it didn't seem to do anything to explain the hum problem. But then I took another look at the circuit and tried to formulate a theory which could explain it. The first thing that struck me was the filtering for the 25V rail. It consisted of a single 1000μF capacitor which, considering the job it had to do, seemed to be barely adequate.

Yet it obviously was adequate, because the set did not normally suffer any hum problems. More precisely, my theory was that, while the 25V rail might have a relatively high ripple content, the amplifier was able to deliver a hum-free signal by reason of an in-built ability to reject hum.

If so, one of the hum rejecting mechanisms would be the negative feedback loop, of which this transistor formed a part. So the theory was that failure of the preamplifier had destroyed the feedback loop and, with it, the amplifier's ability to reject a high, but otherwise acceptable, ripple content on the 25V rail.

It was a somewhat tenuous theory, and by no means completely acceptable. The main flaw seemed to be that the hum level was, as I mentioned earlier, disconcertingly high. I found it hard to accept that any amplifier design would depend on negative feedback alone to reject this order of ripple. For one thing, it would call for a very high level of feedback; much higher than a simple amplifier like this could tolerate.

But the broad concept seemed to make sense, so I put it to one of the staff members at the "EA" office; a two-calculator man who knows all about amplifiers of this kind. He wasn't at all surprised by the story, having experienced similar problems himself, and he agreed that my broad concept was correct.

It appears that amplifiers of this kind do have a high in-built hum rejection capability and, as a result can be, and often are, operated from supply rails with a relatively high ripple content. Where my theory fell down was in assuming that the feedback network alone was responsible for the hum rejection capability.

This capability is quite fundamental to amplifiers of this general design, so that the feedback loop is only part of the story. In fact, he did attempt to explain the mechanism in some detail, but it is hard for a two-calculator man to explain things like this to a one-calculator (four functions only) bloke like myself.

Suffice it to say that the gain of this stage is vital to the hum rejection capability, quite apart from its effect on the feedback loop. To emphasise the point he went on to cite examples from his own experience. These were not due to the failure of the transistor, but to careless wiring on the part of production line operators or home constructors.

More precisely, it involved fitting a

SPECIALS SPECIALS SPECIALS SPECIALS

!!!!!!!!!! THE SAVINGS FROM JAYCAR CONTINUE !!!!!!!!!!

LOW-COST COLLET-TYPE KNOBS

"Made in England" Quality. Economical slide-on fit to any ¼" shaft pot with flat (i.e. Soanar or Jaycar pot.) Dull black finish on body with choice of SEVEN bright coloured snap-in tops.

Knob body ONLY $0.50 ea 1-9
$0.45 ea 10+

Caps ONLY $0.10 ea any quantity

Cap Colours: Red, Green, White, Yellow, Grey, Blue and Black

NE5534's SLASHED!!

Why use noisy '741's when you can upgrade to fast ultra-low noise 5534's for only a little extra? Pin for pin compatible with the 741.

Standard unit 5534N only $1.50 (10+ $1.45 ea)
Special low noise 5534AN only $1.98 (10+ $1.75 ea)

TOP OCTAVE SYNTHESISER

G.I. AY-1.0212

This hard to get I.C. is now available. Will generate tempered musical scale from 1.58MHz clock.

NORMALLY $24.50 SAVE $5.00

NOW $19.50

MURATA PIEZO ALARMS

Very loud. Would wake the dead — Official!!!
As used in ETI reversing alarm project.

ONLY $4.95 ea

Sub-Woofer Sensation

Free Air Resonance 32Hz

SPECS: Diameter 10" (250mm) cast frame • QT= 0.39 • VAS= 631 • Power Handling: 100W (RMS) • Voice Coil = 2" (51mm) dia. • Magnet Assy. = 3kg (6.6lbs).

Because of bulk buying we have been able to bring this unit to you at an unbelievable price. Normally this unit would sell for well over $100 (they are overseas).

THE INTRODUCTORY PRICE FOR THIS UNIT? ONLY $79.50

A FREE SUBWOOFER CABINET DESIGN IS PROVIDED WITH EACH UNIT!

ONLY $79.50 ea

THERMALLOY HEATSINKS

US made quality. Suitable for voltage regulators or any TO-220 style device.

TWO STYLES:
(i) Horizontal multifin $0.50
(ii) Vertical clip $0.45

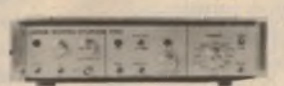
Digital Storage CRO Adaptor

Ref: Feb 1982 EA

Not only can you avoid buying an expensive CRO but you can have the features of the REALLY expensive ones!!!

- Can display very slow waveforms
- One shot triggering
- Inbuilt graticle shows on TV screen
- Crystal locked timebase
- DC-100kHz bandwidth
- capable of storage operation

Staggering value at $110.



$110

Lyrebird Piano Kit NEW LOW PRICE...

REF: EA 11/81-1/82

$475

SAVE $50!!!

NEW LOW PRICE!! Because we are shipping keyboards and other expensive components in bulk due to high demand, we can pass savings on to YOU.

You can now have a magnificent "Lyrebird" 6 octave touch sensitive piano now for only $475!! That's a staggering $50 off the old price.

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?

BOOKS — BOOKS — BOOKS — BOOKS — BOOKS

MOTOROLA R.F. Data Manual 235x180mm (45mm thick)

Over 800 pages. The complete treatise on R.F. devices by the inventors. Includes theory, copious application notes and latest specifications of the vast Motorola range of semiconductors.

ONLY $12.50

Power Device Data 235x180mm (40mm thick)

Approx. 600 pages. Comprehensive (we mean it!) data on the entire range of Motorola power transistors and Thyristors (including diacs and triacs).

ONLY $9.50

150W MOSFET AMP KIT

EXCLUSIVE!!! Special heavy duty EXTRUDED heatsink bracket.

Ref: ETI March 1982

At last high power, with the stability and inherent safety of MOSFETS.
Genuine 150W RMS with power supply on the PCB!! You only need to connect the power trannie and Philips 65D heatsink!!

PF4361/1 transformer $39.50
65D heatsink, drilled, tapped & black anodised $39.50
ETI MODULE ONLY $79.50

EA dual tracking P/S

EXCLUSIVE!! US-MADE 10 TURN .25% LINEARITY POT used for greater accuracy

$84.50

Ref: EA March '82

1% resistors used NOT 2%.

At last!! A dual-tracking power supply with fixed +5V reg. at a reasonable price!!

YOU PAY NO MORE FOR A QUALITY JAYCAR KIT!!

EPROM PROGRAMMER

$39.50

Ref: EA Jan 1982

This versatile kit enables you to program the popular EPROMS WITHOUT a computer!!

Includes 24 pin socket.
Zero insertion force socket to suit only $12.50

Jaycar

!!! NEW ADDRESS !!!
125 YORK ST SYDNEY 2000
Ph. 2646688 Telex 72293

SHOP HOURS
Mon-Fri 9 to 5.30
Sat 9 to 3
Thurs night to 8pm

Mail Orders To:
Box K-39 Haymarket 2000

Post and Packing charges
$5-$9.99 ($1) $10-$24.99 ($2)
$25-$49.99 ($3) $50-$99.99 ($4)
$100 up ($5.50)

wrong polarity transistor in this position; ie, a PNP instead of an NPN. Strangely enough, such a device will work reasonably well in the DC sense, such that voltages will appear to be approximately normal. But it will have virtually no gain and leave the amplifier wide open to all the ripple on the supply rail.

FLASHGUN FAILURE

My next story is quite different from the previous one — and, indeed from most of my day-to-day jobs. Readers may remember that in my March 1982 notes, in relating how I saved a portable radio from the tip, I mentioned that it was one of three items so destined, one of the other two being a small photographic flash gun.

My experience with electronic flash guns, apart from using one now and again, has been strictly limited and I reasoned that my only hope of salvaging this item was if the fault was a very obvious one. However, it seemed worthwhile to give it a go, not so much because I wanted the unit myself — I already have one — but to return it to my friend in return for the portable which he insisted I keep.

Like the portable, the flash gun had been purchased during my friend's overseas trip but, unlike the portable, it had remained virtually unused since the day it was bought. In fact, it had never been used to take a photograph; simply fired a few times to confirm that it worked, then pushed into a cupboard and more or less forgotten.

I'm not sure why this happened, except that, for a number of reasons, my friend's interest in photography apparently waned for several years. More recently his interest was re-awakened and he fished out the gun when someone asked him to record some special event. It was then that it failed to fire.

As I said before, my knowledge of these things is limited, though I understand their basic principle. The flash comes from a gas tube connected to a large electrolytic capacitor charged to something between 300 and 500V. When the gas in the tube is ionised the capacitor discharges through the gas, producing a very short duration (1/1000s or less), high intensity flash.

The tube does not trigger with the voltage applied from the capacitor. Triggering is via a third electrode to which is applied a very much higher voltage pulse, around 5000V usually. This trigger circuit connects to the camera contacts.

Having recalled this much theory I opened the unit and tried to identify the various components. It was a rather novel design in that, while being small enough to mount directly on the camera, it provided for both mains and battery operation. There were no batteries in the case and, as far as I could tell, there never had been any.

Having looked it over and picked out the major components, I connected a meter across the main storage capacitor, plugged into the mains, and switched on. The meter needle swung across the scale and in a few seconds reached the 300V mark, where it stopped. At the same time a small neon lamp ignited to indicate that the system was ready to fire.

Except that it wouldn't fire. The fact that the main capacitor appeared to charge normally seemed to rule out a fault in about half of the circuit. What was left was the flash tube itself and the trigger circuit: a trigger transformer, a small plastic capacitor, and a couple of resistors.

I soon cleared the resistors with the ohm meter, and the capacitor by substitution. The trigger transformer was harder to get at, but I eventually established that both the primary and secondary windings were continuous. (It was, in fact, an auto-transformer configuration, with only three terminals.)

That seemed to leave only the tube. Fortunately, I have a friend in the import business who handles these items and, more importantly, is well clued up electronically. A phone call put him in the picture and set him up for a couple of questions. First, could the tube have failed after so little use and, second, if it had could he supply a replacement from the description I gave him?

His answer to the first question was yes, these tubes can die of old age. It seems that a small percentage suffer slow leaks around the glass-to-metal seals, and eventually fail to fire at all, or fire intermittently. And, yes, he did have a replacement in stock. Then he added that I was welcome to borrow one to confirm our theory.

So, some days later, while in his neck of the woods, I picked up the tube. A couple more days went by before I had time to try it but, by then, having talked it over again with him, I was convinced that we had picked the fault.

It was quite a let-down, therefore, when I fired everything up, pressed the trigger switch and nothing happened. So it wasn't the tube; but if not, what was it? What was there left?

The trigger transformer seemed the most likely suspect, in spite of my previous tests. It suddenly occurred to me that I had not considered the possibility of a shorted turn; a long shot, for sure, but about all that was left.

Another phone call to my friend aquainted him with the bad news, then raised the matter of trigger transformers. Yes, he had those too, although physical compatibility could be a problem.

So, at the first opportunity I returned the tube, and picked up a selection of transformers. Back at the bench I selected the one closest in size and wired it temporarily into circuit. (Mounting it permanently was obviously going to be a tricky job.)

Then I fired everything up again, and pressed the trigger switch. And, presto, off went the flash. I fired it several times in my enthusiasm and it never missed once. So that was it, a faulty trigger transformer and almost certainly a shorted turn.

The next thing was to mount the trigger transformer, which had to wait until I had some time to spare. But I found time eventually and, tricky though it was, I eventually fitted it into the space available. Then I tested the system again, and it fired every time.

I could well end the story here and make it sound like a complete success. The truth is, it didn't turn out that way. I left the unit on the bench, still switched on, while I gathered up the two halves of the case and the assembly bolts, preparatory to putting it all back together.

Suddenly there was a loud crack from inside the works, for all the world like a high voltage flash-over. A quick check showed that the voltage across the main capacitor was still at 300 and the neon tube was still glowing. I pressed the trigger switch, and the tube flashed. What was going on?

It wasn't until I turned the works over that I realised what had happened. There was a small pool of liquid on the bench below where the main capacitor had been and the flexible seal on top of the capacitor had a small bulge and a puncture in it. The crack I had heard had been the bursting of this seal, not a flash-over.

And that, I'm afraid, wrote "finish" to the whole exercise. Even though the capacitor still worked, in a fashion, it was obvious that it could not go back in the case. Nor have I had any luck, so, far, in finding a suitable replacement.

With the benefit of hindsight, I was probably remiss in not ensuring that the capacitor was re-formed after lying idle so long. But, as I have remarked before, "You can't win 'em all".

If you have a factual and interesting story to tell about electronic servicing, write it in your own words and sent it to "The Serviceman", c/- "Electronics Australia", Box 163, Chippendale 2008. If the Serviceman uses it in his column, we will pay an appropriate fee.

ALTRONICS ... ALTRONICS ... ALTRONICS ... ALTRONICS ...

$ TAX TIME SELLOUT — 'OUCH!' $

YES! It's that dreaded tax time again and as we're compelled to grace the Treasury Coffers with just about all our ready cash (and some of the banks!) we are liquidating all of these quality products at cost or even below cost — YOU REAP THE BENEFIT!

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 . . . . ~~$3.50~~ per sheet

NOW $2.00 a sheet — GAD!

WEATHERPROOF SIREN HORN

12V DC operated — Deafening Siren Wail. Super handy for audio signalling, secruity systems etc. Current drain 500MA approx. Completely weatherproof. Attractive off-white PVC finish.

S 5058 . . . ~~$19.50~~ **NOW $15.00 ea. STREWTH!**

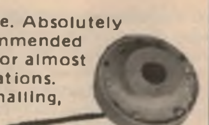
MINI BUZZER 5-15V DC

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 . . . ~~$1.95~~

NOW $1.00 each

PIEZO ALARM



Similar to "Sonalert" type. Absolutely ear piercing sound. Recommended voltage 5-15V DC. Ideal for almost all audio signalling applications. i.e. fire, water and gas signalling, computer alarms, etc.

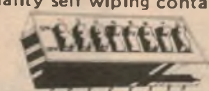
S 5066 . . . ~~$4.95~~ **NOW $3.00 each HEY!**

SOLDERING IRON STAND UNIVERSAL TYPE

T 1302 . . . ~~$5.95~~ **NOW $4.00 GOSH!**

DIL SWITCH 8 WAY

8 Pole PCB Mount Dil Switch. Quality self wiping contacts.

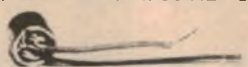


S 3060 . . . ~~$2.00~~ **NOW $1.50 each**

FANDAMTASTIC!

MIC INSERT ELECTRET

Great little replacement for tape recorders, etc. Handy for hobby projects. Includes data sheet and application circuit. 50 HZ - 15 KHZ



C 0170 . . . ~~$1.95~~ **NOW $1.00--OUCH!**

Incredible!

UNIVERSAL MULTIMETER

PORTABLE WITH BENCH STAND

23 ranges at less than $1 per range.

* 20,000 OHMS/Volt DC * 10,000 OHMS/Volt AC * Mirror backed scale * Overload protected * Unique carry handle doubles as a bench stand * High-impact resistant case * Uses 1 AA Penlight batter (incl.) * Comes complete with battery, test leads and instructions. **RANGES: DC Voltage** 0-.25, 1, 2.5, 10, 25, 100, 250, 1000. **AC Voltage** 0-10, 25, 100, 250, 1000 **Decibles** 20 to +22db **DC Current** 0-50, 500 UA, 0-5, 50, 500MA **OHM Meter** 0-6 megohms in 4 ranges, 30 ohms centre scale. Size 135 x 91 x 39

Q 1002 . . **$22.50** 4 or more . . **$21.00**

A FREE Carry Case Cat. Q 1012 $3.50 value with every meter purchased from this advert — YES! that's right — yours for the asking.

MC MURDO ROCKER SWITCH

DPDT ILLUMINATED RED

250V Neon lamp inbuilt. Contact rating 250V AC 15A. Panel cutout 27 x 22mm. Positive "snap in" mounting.

S 3240 . . ~~$2.50~~

NOW $1.25 each

LAVALIER (LAPEL)

Superb little microphone. Clips to tie, shirt etc. Ideal for lecturers, religious speakers, stage work etc. Uses 1.5V alkaline manganese LR44 batter (supplied). Includes tie clip.

C 0353 . . ~~$29.95~~

NOW $20.00 each

MINI SPEAKER 57mm

200MW 8 OHM

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

C 0610 . . ~~$1.90~~

NOW $1.00

FUSE HOLDER 3AG

32 x 6.3mm Fuse

S 6000 . . . ~~.95~~

NOW .60c

FND 500 .5 IN DISPLAY

Z 0190

NOW .80c

$2 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.

$4 Delivery Australia Wide: We process your order day received and despatch via Jetservice for delivery next day.

Bankcard Holders can phone order up to 8pm (EST) for next day delivery — Sounds incredible doesn't it? Alright you cynics just try us! Weight limit 3.3kgs. Jetservice cannot deliver to P.O. box numbers (Australia Post would have a fit!)

Dear Customer — Yes all these products are all first quality — and what's more, we're up to the rafters with stock.

PERSONAL SHOPPERS ONLY

With every store purchase of $30.00 or more ask for a FREE $5.00 purchase voucher. This voucher can then be used with any subsequent purchase from ALTRONICS — NOT VALID UNTIL DAY AFTER ISSUE DATE. Sorry not available to mail order customers.

INCREDIBLE OFFER ON EA's and ETI's JUST $1.00 EACH TO PERSONAL STORE CUSTOMERS!

That's right — EA and ETI Magazines are just $1.00 each to our valued Electronic Enthusiast store customers. We want more Electronic Enthusiastis to buy these great magazines and build the fascinating projects described each month — So as an ALTRONICS customer service to you WE ARE SELLING THEM FOR AROUND HALF PRICE — JUST $1.00 EACH

Limit: 1 of each mag. per customer. Sorry, this offer is not available to Mail Order Customers.

ALTRONICS
105 Stirling St. PERTH
(09) 328 1599
for instant service

All Mail Orders: BOX 8280 PERTH Stirling St. WA 6000

ALTRONICS ... ALTRONICS ... ALTRONICS ... ALTRONICS ... ALTRONICS ...

ALTRONICS ... ALTRONICS ... ALTRONICS ... ALTRONICS ... ALTRONICS ...

BANKCARD JETSERVICE-DELIVERY NEXT DAY BANKCARD JETSERVICE-

Simple circuit uses two ICs & one transistor!

Low-cost, versatile CMOS touch switch

Using only two low power CMOS ICs and a few other components, this sensitive touch switch offers both simplicity and reliability. It can be used to control mains powered equipment such as reading lamps or appliances, or its low power consumption allows it to be economically battery operated.

by COLIN DAWSON

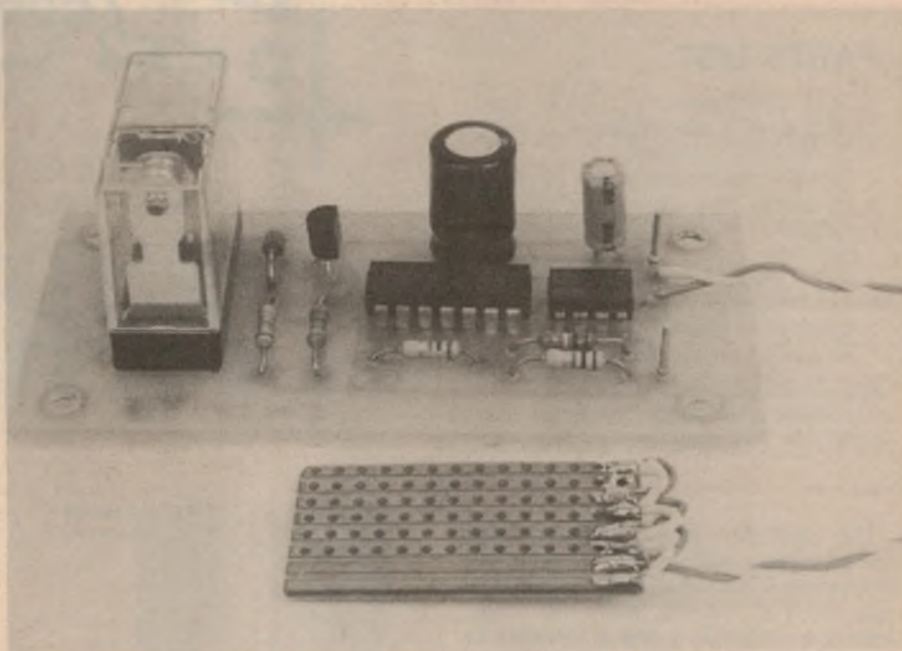
Whilst there are several touch switch circuits and projects available, we have found that they generally have excessive current drain for battery operation, or are unreliable. Instead of switching over cleanly when touched, they sometimes suffer "contact bounce". If this happens, it is a matter of luck whether the circuit ends up on or off.

Imagine that you have retired for the night and reach for the touch switch to turn your bedside reading lamp off. The lamp flickers, but stays on, and you end up doing an impression of a bongo player on the touch switch just to turn it off. Clearly, there is room for improvement.

To overcome the problem of false triggering, a 7555 IC has been used as the touch sensor. This IC is the CMOS equivalent of the 555 timer. When triggered by a touch, it begins a brief timing cycle during which it can not be retriggered. Hence "contact bounce" does not cause the device to change state several times. The timing cycle lasts for only about half a second after which the circuit is rearmed.

To achieve touch on touch off sequencing, a 4013 IC – a CMOS flipflop – has been used. With each successive trigger, its output changes state. It is used to drive a transistor which can either drive small loads directly or switch a relay.

The relay may not be required if the touch switch is used with battery-powered equipment. This will give the circuit a current drain of only about one milliamp when triggered (without a load), as compared to around 30mA with a relay. With a standby current of only 100μA or so, it will run for several months on a single 9V battery.



Touch Switch can control both mains and battery-powered equipment.

Circuit description

The touch plate is not in fact a plate but more accurately a grid with two sets of tracks. One set goes to 0V and the other to the trigger (pin 2) of the 7555 (IC1). Normally, there is no continuity between the tracks. When you place your finger on the grid, however, the resistance of your skin allows a minute current flow between the tracks. The 7555, which requires only about 50pA to trigger, senses this "touch" and begins its ½s timing cycle.

When ICl is triggered, the output (pin 3) goes high and remains high while ever the voltage across C1 remains below 2/3 supply. C1, initially discharged, now begins to charge via R1 and, after about half a second, reaches 2/3 supply. The output at pin 3 now goes low and the 7555 is reset ready for the next trigger pulse. During this timing cycle, the 7555 can not be retriggered.

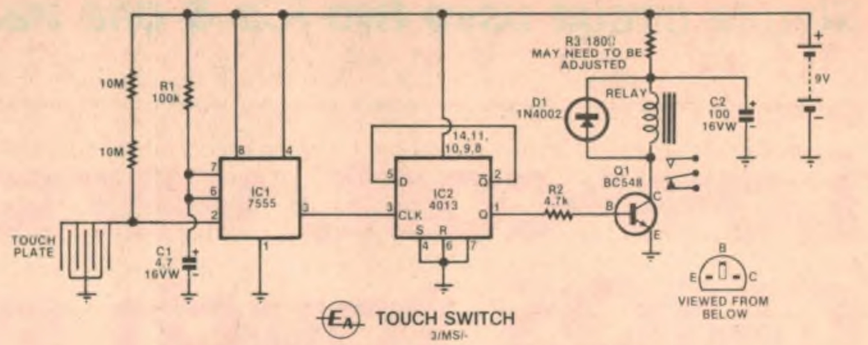
The output of IC1 is connected to the clock input (pin 3) of the 4013, a dual D-type flipflop (IC2). We have connected the $\bar{Q}$ output (pin 2) to the data input (pin 5). This causes the Q output (pin 1) to change state each time a pulse is applied to the clock input (pin 3), which gives the flipflop on/off sequencing.

The flipflop also has set (pin 4) and reset (pin 6) functions, but these have not been used in this circuit and have been tied to the negative supply rail. The inputs on IC2b have been tied to the positive supply rail to prevent unwanted oscillations.

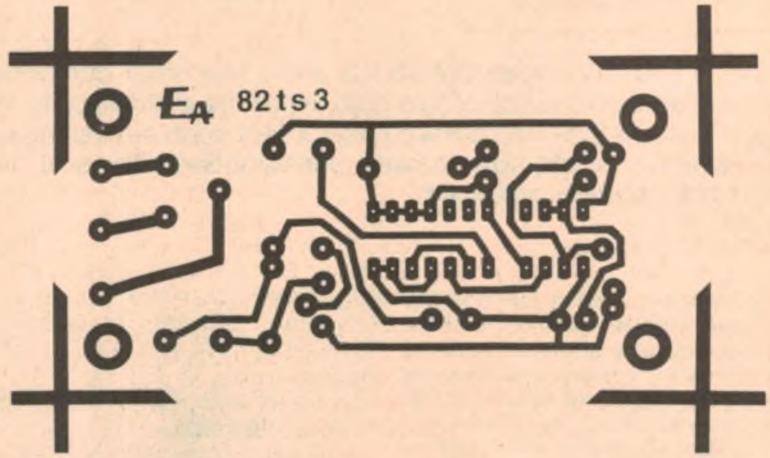
The Q output of IC2a is connected via R2 to the base of transistor Q1. This transistor has been specified as a BC548, which is suitable for controlling the relay. It could, however, drive small loads of up to 100mA directly, such as LEDs or a buzzer. If a power transistor were used in its place – such as a BD139 – then loads of up to a few watts could be driven directly.

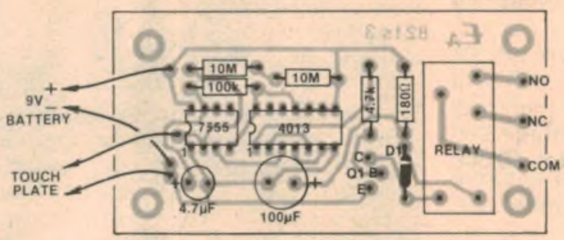
Note that R3 – in series with the relay coil – is optional. If used, this resistor will reduce the relay coil current and increase battery life. Whilst most relays will hold in at a voltage well below their nominal rating, the pull-in voltage may be only slightly below the rating. For this reason, R3 must be used in conjunction with C2, which provides an initial application of full voltage to the relay.

C2 charges via R3 when the relay is not activated. As soon as the relay coil is connected to 0V by transistor Q1, the capacitor discharges through the coil. Once the capacitor has discharged, the coil voltage is effectively reduced by R3.



The circuit consists of a 7555 monostable, a 4013 CMOS flipflop, and a transistor driving a relay.



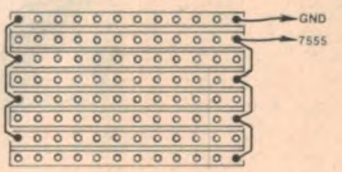


Above is the PC pattern, actual size. At left is the component layout.

PARTS LIST

- 1 7555 CMOS timer
- 1 4013 CMOS dual flipflop
- 1 BC548 NPN transistor
- 1 1N4002 diode (see text)
- 1 PC board, 84 x 43mm, code 82ts3
- 1 100μF/16VW electrolytic capacitor (see text)
- 1 4.7μF/16VW electrolytic capacitor
- 1 12V relay (see text)
- 1 touch plate (see text)
- 1 9V battery or plugpack

RESISTORS (5%, ¼ or ½W)
2 x 10MΩ, 1 x 100kΩ, 1 x 4.7kΩ, 1 x 180Ω ½W (see text)



This diagram shows how the stripboard touch plate is wired.

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

$12

This includes sales tax.

The particular relay you choose and the operating voltage of the circuit will determine what value of R3 you use. If you use a 9V battery and a 12V relay, you may find that a link is needed instead of R3. It is simply a matter of trial and error to find the optimum value for R3.

Diode D1 protects the circuit from the relay's inductive voltages. Obviously, if you do not use a relay then D1, along with C2 and R3, is not required. Simply connect the load in series between the +9V rail and Q1's collector (low-powered battery-operated equipment only).

Without the relay, the circuit will operate over a wide range of voltages from 5-15V. A 9V transistor battery will be quite adequate, but remember that if the touch switch and the equipment have separate batteries their negative terminals must be connected.

Using the relay eliminates this requirement, but a larger battery or a plugpack would have to be used.

Construction

All of the components except the actual touch plate are mounted on a printed circuit board coded 82ts3 and measuring 84 x 43cm. Mount the resistors and capacitors first, followed by the transistor.

If you have decided to use a relay, install either R3 or a link. Remember, the value of R3 will depend on your use of the circuit, but we have nominally suggested 180Ω. You will not require C2 or D1 unless you have used the relay.

When you have dealt with these components, you are ready to mount the ICs. As they are both CMOS devices, they can be damaged by static electricity, so handle them as little as possible. Ground the tip of your soldering iron to the earth track on the PC board using a small clip lead, and solder the power supply pins first. These are pins 4 and 8 for the 7555, and pins 7 and 14 for the 4013.

To make the actual touch plate we suggest that you use a piece of stripboard. Link every second track and connect them to the 0V rail. Now link the alternate tracks and connect them to the

Continued on p134

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.

Wireless Weekly 3d

May 1932

Radio rain: Someone has written to the League of Nations asking that all European broadcasting be stopped for six weeks in order to determine whether the radio waves in the atmosphere are causing the prevailing wet weather. The writer urged the appointment of a special commission to make observations of the climatic conditions during the radioless lull and then publish a report that would either condemn or acquit radio.

☆ ☆ ☆

Fidelity: Those who can appreciate the difference between noise and music will probably appreciate the twin-tube combined detector and output valve, as I understand that it gives audio amplification with perfectly straight line frequency response from about 30 to 10,000 cycles.

☆ ☆ ☆

An inevitable evil: Consolation is offered to static-weary listeners by a Paris correspondent who declares that electrical interference should be borne cheerfully as an inevitable evil like ". . . the smell of the neighbour's kitchen, the piano scales of the young lady next door, the vocal villanies of suburban tenors, the horn of the motor car, the smoking factory . . ." The correspondent was reported missing next day, mysterious circumstances surrounding the case.

☆ ☆ ☆

Frankenstein — He Made A Monster: One friend of mine designed for himself a remarkable superhet with reflex systems throughout and many weird and wonderful gadgets. Unfortunately, the set did not turn out too well and, even after several weeks of messing about, it still failed to do anything but squeal. Meeting him in the street last Thursday, he stood telling me about it and then said: "Every time I see that poster I think of that darn superhet." Glancing up at the hoarding, I saw the words, "Frankenstein — he made a monster."

RADIO TELEVISION AND HOBBIES 1/6

May 1957

Bomb Dust: The wraps are off one of the greatest of scientific studies under way today — world-wide in scope, of utmost concern to everyone on earth. Known only as project Sunshine, and only recently made available by the US Atomic Energy Commission, its aim is to gauge the hazard to health of the radioactive strontium 90 that nuclear bomb tests are depositing in our soil, our food, and finally in us.

For recent evidence puts the finger on strontium 90, a potential cause of bone cancer and of leukemia or blood cancer, as the principal hazard of the radioactive fallout that A-bombs and H-bombs are scattering all over the earth.

☆ ☆ ☆

Our TV set: Exactly 12 months ago, in an Editorial, we asked the question, "Can a complete TV set be built in the home?". In this article we give you a practical and positive answer to that most pertinent question. What's more, we present here the description of a full-scale receiver which can, in fact, be built at home with no more facilities than are available to any well-informed radio enthusiast.

To us, personally, this description ranks as something of a milestone, recalling other "historic" occasions — the first home-built "Ham" transmitter, the first superhet, the first tape recorder, to mention those which come immediately to mind.

All of these in turn involved their own particular problems, but a complete television receiver overshadows them as the most complex and the most ambitious radio project we've ever presented for home construction.

☆ ☆ ☆

Noise elimination: A proposed noise elimination system in Boeing's new planes use a microphone and amplifier to pick up noise from the cabin, and feeds it back into the cabin exactly 180 degrees out of phase, through loudspeakers. The idea is that two sounds of opposite phase will cancel out.

S-100 board has serial & parallel ports

A printer interface for the Super-80

The long awaited Super-80 printer interface is here! Hard copy of programs and data is now easy to achieve, either with a Centronics type parallel printer or a serial input machine. Read on for details.

by PETER VERNON

Since we published the popular Super-80 computer project many readers have asked us about using a printer with the computer. Now Dick Smith Electronics has come up with a printer interface board which plugs directly into the S100 expansion slot of the Super-80. It is supplied as a complete kit of parts which can be put together inside an hour.

The big advantage of this printer interface is that is can be built in two forms: as a parallel printer port only, or as both a parallel and a serial RS232C port. Which version you build depends on the type of printer you will be using and on other capabilities required for your Super-80.

Use of the interface board is not restricted to printers. With the serial port you can use a 300 baud modem for telephone data communication, for example, or have two Super-80s linked together and transferring data to each other (great for games with a friend!).

The interface board measures 253 × 72mm. It features the familiar S100 circuit board connector at the bottom, a 34-pin section at the top to take the edge connector of a Centronics printer cable, and space for connector pins for the RS-232C interface at the right hand side. The board is double-sided with plated through holes, and the S100 pins have been gold flashed to ensure reliable contact with the connector on the main computer board.

One point is extremely important. The S100 connector on the Super-80 board is designed to take a motherboard, containing additional S100 slots. Because of this, the connector is installed "back to front", with pin 1 at the right hand side of the Super-80 board, looking from the front. The printer interface board is therefore installed with the component side towards the rear of the Super-80 board. Great sorrow will ensue if the board is plugged in the wrong way round, as the pins at the right of the S100 connector carry the unregulated +8V and ±16V, feeding the regulators on the printer board.

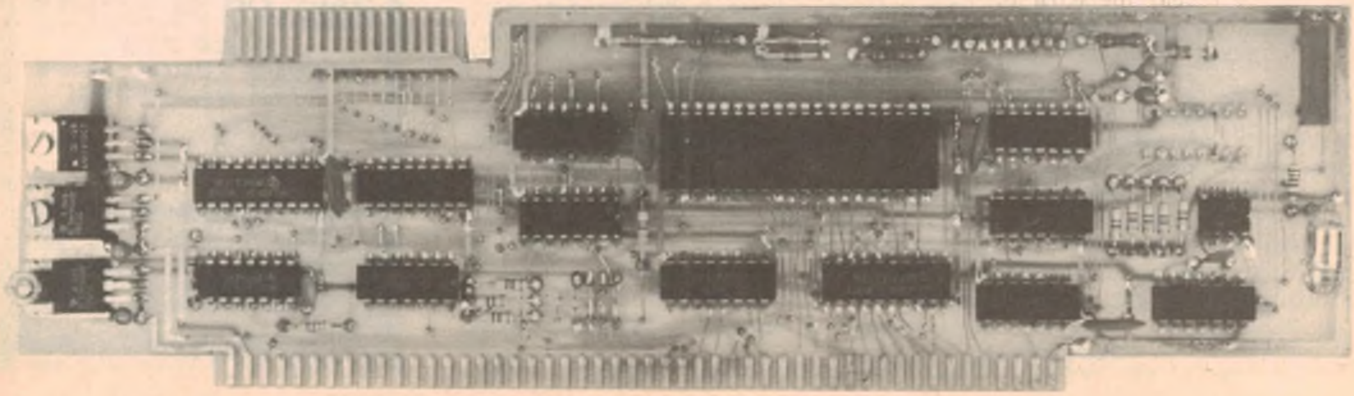
Before we go into a detailed description of how the board works, we should say that it is quite possible to construct the parallel printer interface and get it working without understanding exactly what is happening. For this reason we will describe the construction and operation of the unit first, with the circuit description following for really dedicated enthusiasts.

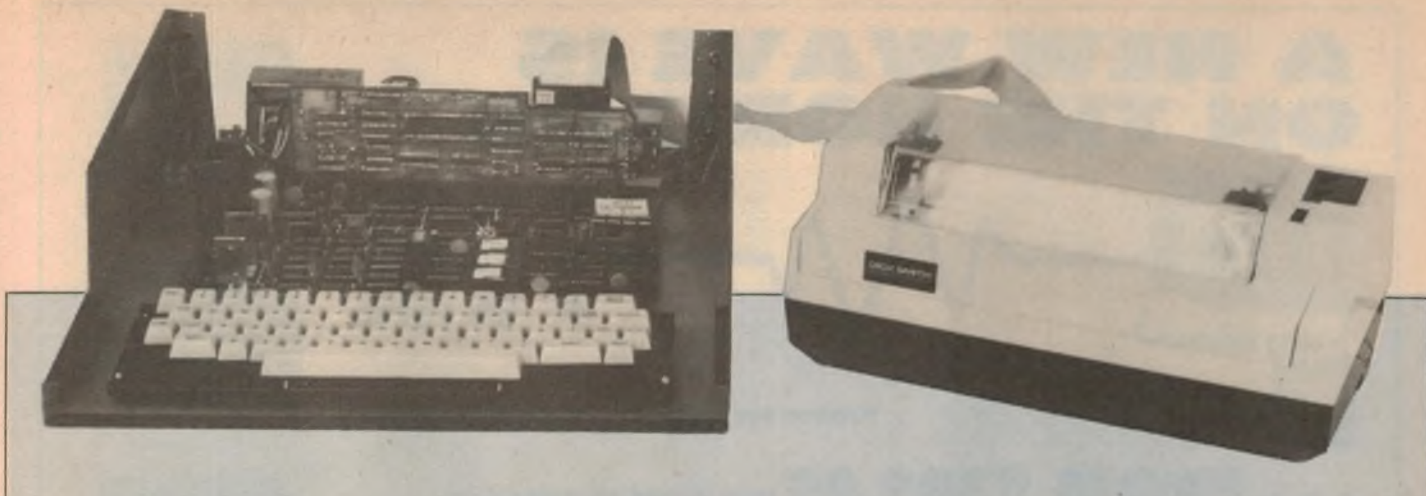
Using the serial interface is a little more difficult. There are several links to be installed which control the parameters of the serial data transmission. These links must be set to match the parameters of the receiving device. Usually the manual which comes with the device will have these details while Table 1 shows the function of each link on the board required for the serial interface circuitry.

Construction

If you haven't already done so, you will first have to assemble the S100 interface circuit on the Super-80 board. This involves installing capacitor C3 for additional power supply filtering, and five integrated circuits in the white cross-hatched area of the computer board, as well as the 100-pin S100 connector. Full details for this section of the Super-80

Super-80 printer interface board when fully populated provides both Centronics interface and RS232C serial port.





Super-80 (yes, in a case!) working with the GP80 printer. Installation in a case will be covered in a later issue.

were published in the October, 1981 issue.

Begin construction of the printer interface board with the passive components. There are 16 resistors and 12 capacitors, five of which are tantalum types which must be correctly orientated according to the component overlay. There are also four zener diodes and a multi-turn potentiometer to be installed. If you only require the parallel port, some of these components are omitted, as indicated in the parts list.

Power supply regulators are next. If you are only interested in the parallel printer interface, only U1, the +5V regulator, need be installed. Otherwise, install all three regulators, carefully bending the pins down about 5mm from the case. You may like to bolt the regulators down before soldering as a check on their fit. The 10mm threaded spacer included in the kit is fitted to the +5V regulator and serves as a heatsink. Install this regulator with the head of the bolt on the back of the board, and the spacer threaded on from the component side.

Following the regulators install the integrated circuits. For the parallel interface, install U4, U5, U6, U7, U8, U9 and U11. If you require the serial interface, install the remaining ICs as well. Note that there is a link on the underside of the board, beneath U12, which must be cut if this chip is installed. The link runs from pin 18 to pin 19, and should be left intact if only the parallel port is assembled (ie U12 is not installed). Use a 40-pin socket for the UART chip, U10.

Before using the board there are a number of links to be installed, as shown on the overlay diagram. Links J1 to J4 set the most significant half of the address of the devices on the board. For example, with all the links installed, comparator U11 will select the printer port when address lines A7 to A4 are all zero. With no links installed (as on our board), the printer board will be selected when these four address lines are "1", giving the parallel printer port an address of "FC". The software given here is designed for this address. See "How it works" for details.

The cable used to connect a printer to the interface board must have a 34-way edge connector at one end and a standard Centronics connector at the other. We used a standard cable from Dick Smith Electronics catalog number X-4014, although you can wire your own, pin 1 to pin 1, pin 2 to pin 2 etc.

Getting it up and running

With the board completed we can move on to actually using it. For our tests we used the Dick Smith Electronics GP80 dot matrix printer, a machine which is ideal for this application. It is a Centronics type printer, with the standard parallel input connector popularised by the Centronics company. A printer cable from DSE completed the set up.

With the Super-80 switched off, plug the printer interface board into the S100 connector. Remember that the component side of the interface board should face the rear of the computer. Don't use too much force to insert the printer board, as flexing the Super-80 board will place stress on the PCB tracks and socket connections. A little gentle wriggling and some patience will pay off here. It may also be an idea to include some additional support underneath the S100 connector such as two stick-on rubber feet, or similar.

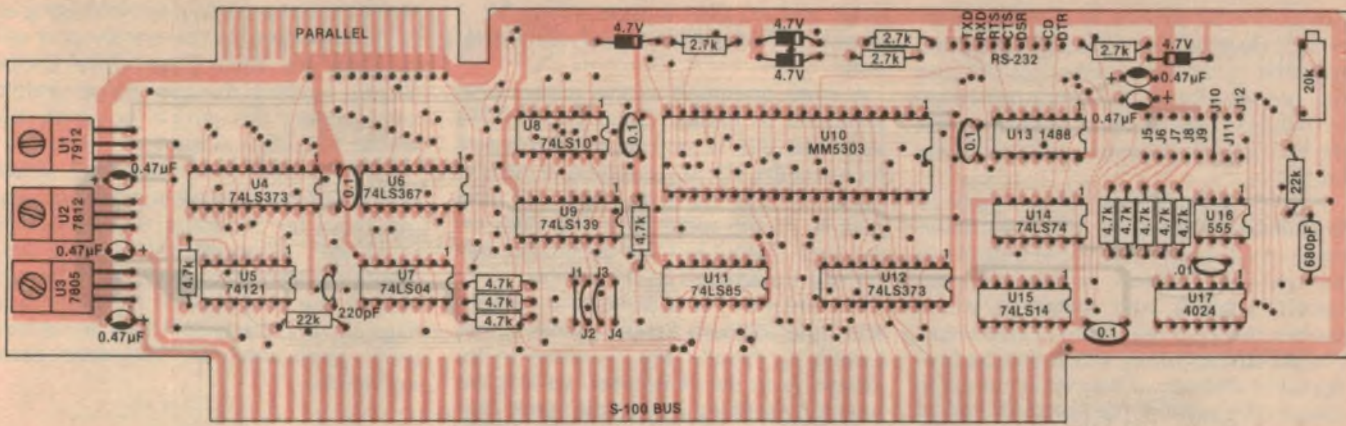
Assuming that you are using a Centronics type printer, connect the edge connector of the printer cable to the circuit board fingers at the right hand side of the interface board. The single colour-coded wire of the printer cable is "number one" and should be on the left hand side as you look towards the board. Install the Amphenol connector on the other end of the cable in the socket at the rear of the printer.

Switch on your video display and the printer, then the Super-80. The next step is to load the software for the parallel printer driver. Go to the Monitor (with the "MON" command from Basic). Use "E 0000" to enter the program in Listing 1. Begin with "55" and go on until you have entered "C9" in address location 000A. If you have left links J1 to J4 open, enter the program as shown. If you have used a different address for your printer board, change "FC" to whatever address you have used.

Return to Basic when you have finished entering the printer program. Now whenever you do an "LPRINT" or "LLIST" in Basic the printer will respond. "LLIST" is used for listing Basic programs on the printer, while "LPRINT" is used in the same way as a "PRINT" statement within a program, but instead of printing on the video screen it will direct the output to your printer.

Note that the Super-80 Basic interpreter is designed to automatically send a line feed after each carriage return. However, most printers are set up to also insert a line feed after a carriage return. The result: two line feeds at the end of each line and double spaced printing.

Fortunately, this is easy to avoid. "Automatic line feed" on most printers is controlled by a wire link or a DIP switched inside the printer. The manual accompanying your printer will have the details. Simply follow the directions to disable the automatic line feed of the printer for single spaced printing.



Note the position of the links on the overlay diagram. For a Centronics interface only some components may be left off.

How it works

There are four main functions on the printer interface board which must be accessed by the computer. These are a port for parallel printer data, a parallel printer status port, and UART data and status registers.

"UART" by the way, stands for "Universal Asynchronous Receiver Transmitter". "Aysnchronous" in the designation refers to the UART's ability to transmit and receive data without being synchronised to the device at the other end of the serial line. In other words, the two parts of the system, the computer and, say, an RS232C printer, do not share a common clock frequency. Instead, data is synchronised by the transmission of a start bit at the beginning of each data byte.

The Z80 microprocessor on the Super-80 board addresses Input/Output devices separately from memory, and provides bus control signals which distinguish between memory operations and I/O operations. The lower eight bits of the address bus are used to specify I/O locations, giving 256 possible port addresses. The address of each device on the interface board consists of a unique combination of these eight address lines with either SINP, the S100 bus signal which designates input to the processor, or SOUT, designating output from the processor.

The address decoding logic for the printer interface board consists of U8, part of U7 and U11, as shown on the main circuit diagram. When address lines A2 and A3 are high ("1"), comparator U11 will be enabled. The comparator will then compare the state of address lines A4 to A7 with the switch settings of links J1 to J4. If the address lines match the link settings, the comparator will produce an output labelled "BSEL" to select the devices on the printer board.

You can vary the top half of the address by closing combinations of the links. If you want the board to respond when A7 is "0", for example, close link J4 and leave the other three open. This would correspond to an address of "7C" (01111100). Open links place a "1" on the corresponding inputs of comparator U11, which produces a "true" signal when these match the four bits of the address on A4-A7.

In other words if we leave links J1 to J4 open, the comparator output will be true for an address which has all 1's for the upper 4 bits. Eight bit addresses which have bits 2 and 3 high are then FC, FD, FE and FF (convert these to binary for a check).

The Super-80 uses ports at addresses F0 to FB for its own purposes (reading the keyboard, controlling the video and cassette interface etc). Because of incomplete decoding on the board, the functions of these addresses are also fulfilled by the block E0 to EB. Addressing the printer interface board with the four upper lines set to "F" will thus use the unreserved ports in the locations in the Super-80 I/O block. Leave J1 to J4 open to do this.

TABLE 1

ADDRESS	READ FROM	WRITE TO
FC	Produces Print Status Read $\overline{\text{PSR}}$	Produces Print Data Write strobe $\overline{\text{PDW}}$
FD	Produces UART Status Read $\overline{\text{USR}}$	Produces UART Status Write $\overline{\text{USW}}$
FE	Reads data from the UART $\overline{\text{UDR}}$	Writes data to the UART $\overline{\text{UDW}}$ for transmission

TABLE 2

LINK	FUNCTION
J5	Enables parity checking if installed
J6	Installed for 1 stop bit, open for 2 stop bits
J7	J7 only installed for 6 bit data Both J7 and J8 open for 8 bit data
J8	J8 only installed for 7 bit data Both installed for 5 bit data
J9	Odd parity if installed, even parity if open, provided that parity is enabled by installing J5

Control strobes

The BSEL signal from the address comparator is gated with SOUT and $\overline{\text{PWR}}$ by one section of U8. $\overline{\text{PWR}}$ is an S100 by status signal which indicates that the processor is currently sending data to the S100 bus connector.

PWR is an active low signal, inverted by one gate of U7, so that a "1" at pin 4 of U7 indicates valid data on the processor data bus. When gated with SOUT and BSEL by U8, the output enables one half of the dual one-of-four decoder U9 to produce write strobes to each of the interface devices. SINP and BSEL are gated together by another section of U8, and this output enables the other half of U9 to produce read strobes, indicating that the processor is requesting data from the interface.

Address lines A0 and A1 are input to both halves of decoder U9. They determine which one of the three outputs of the relevant section of the decoder becomes active, and therefore, which specific device is read from or written to. The six strobe pulses which can be produced by this part of the circuit can write data to the parallel port or to the serial port, request status information from either port, or write status information to the serial port. All the possible combinations of strobe pulses, and the addresses which produce the appropriate stobe, are shown in Table 1.

The parallel printer port

The parallel printer section consists of U4, U5 and part of U6. When the microprocessor performs a read operation from the printer port, a Printer Status Read ($\overline{PSR}$) signal is produced at pin 4 of U9. This signal is applied to the enable input (pin 15) of U6, gating the printer busy bit onto bit 7 of the data bus. When this bit is "1" the printer is busy, and no data is sent. When bit 7 goes to "0" the printer is ready for further data.

A write operation to the printer port produces a Printer Data Write $\overline{PDW}$ signal on pin 12 of U9, which triggers monostable U5 to produce a strobe pulse of the correct length for the printer. At the same time, the data on the Data Output bus will be latched into U4 and transmitted to the printer.

We are now in a position to understand the software for the printer driver (Listing 1). Initially, the character to be printed is in the A register, so first we save it by pushing it onto the stack. This frees the A register to receive the printer status, which we get by an Input instruction.

Having read the printer status we must check the state of bit 7 of the A register, and this is most easily done by rotating the contents of the register one place to the left, so that bit 7 moves into the Carry flag. If bit 7 is "1" (printer busy), the carry flag will be set, so the program loops around and checks the status again. It will keep looping until the printer status busy bit is "0".

If the carry flag is "0", the program does not loop and the next instruction is executed. This instruction "pops" the previous contents of A off the stack and places it back in the A register. This is the character we want to print. Executing an OUT instruction to the printer port will generate the Print Data Write Strobe ($\overline{PDW}$), latching the byte to be printed and sending the strobe pulse to the printer to initiate printing.

To help you understand the actual operations involved we suggest you read our series on "Programming in Machine Language". Although the articles deal with a different microprocessor they do explain the concepts of rotation, carry flags etc, and these concepts are universally applicable to microprocessor operations.

The serial interface

For serial data communication the most important part of the circuit is the UART U10. This device is designed to take parallel data from the computer's data-out bus and convert it to serial form for transmission, and to receive serial data and assemble it into parallel format bytes for the computer's data-in bus.

Various outputs of the decoder U9 are used to enable the functions of the UART. In describing this section of the circuit we will work backwards from the software, shown in Listing 2.

The first step, after saving the contents of register A on the stack (PUSH AF), is to send a Request To Send (RTS) signal, setting this line to a "1" indicating that the computer is ready to transmit data. We do this by setting bit 6 of the A register and outputting the contents of A to the UART status port, addressed at FD. Bit 6 set, and all other bits "0" is 40 in hex.

An OUT instruction to port FD generates the UART Status Write strobe $\overline{USW}$ on pin 11 on U9, which clocks the data on bit 6 of the Data Out lines through flipflop U14. The RTS signal appears on pin 8 of U14 as a +5V TTL level, and is translated to the +12V RS232C level by the RS232C driver U13.

Following request to send, we read the status of the UART from port FD, checking the Clear To Send (CTS) line. When the device at the other end of the serial link is ready to receive a new character it will set this line high. The UART Status Read $\overline{USR}$, will enable the Tri-state buffer U6 to gate this signal onto bit 6 of the Read Data (RD) line to the processor.

Note that CTS is also an RS232C level signal and is clamped by a 4.7V zener diode to convert it to TTL level. We read it by an IN operation from port FD, and test it with a BIT 6, A instruction, looping until the CTS bit is set.

Since the RS232C device is now ready to receive data we must check if the UART is ready to transmit. Inside the UART is a transmit buffer which holds the byte to be transmitted. Obviously,

PARTS LIST

1 PCB
1 74121 monostable
1 74LS04 hex inverter
1 74LS373 octal latch
1 74LS367 hex bus driver
1 74LS10 triple 3-input NAND gate
1 74LS139 dual 2-to-4 line decoder
1 74LS85 4-bit magnitude comparator
1 LM7805 +5V regulator

CAPACITORS
1 0.47μF 35VW tantalum
1 220pF ceramic
4 0.1μF ceramic

RESISTORS (¼W, 5%)
1 × 22kΩ, 5 × 4.7kΩ

MISCELLANEOUS
1 6BA 10mm bolt
1 6BA threaded spacer

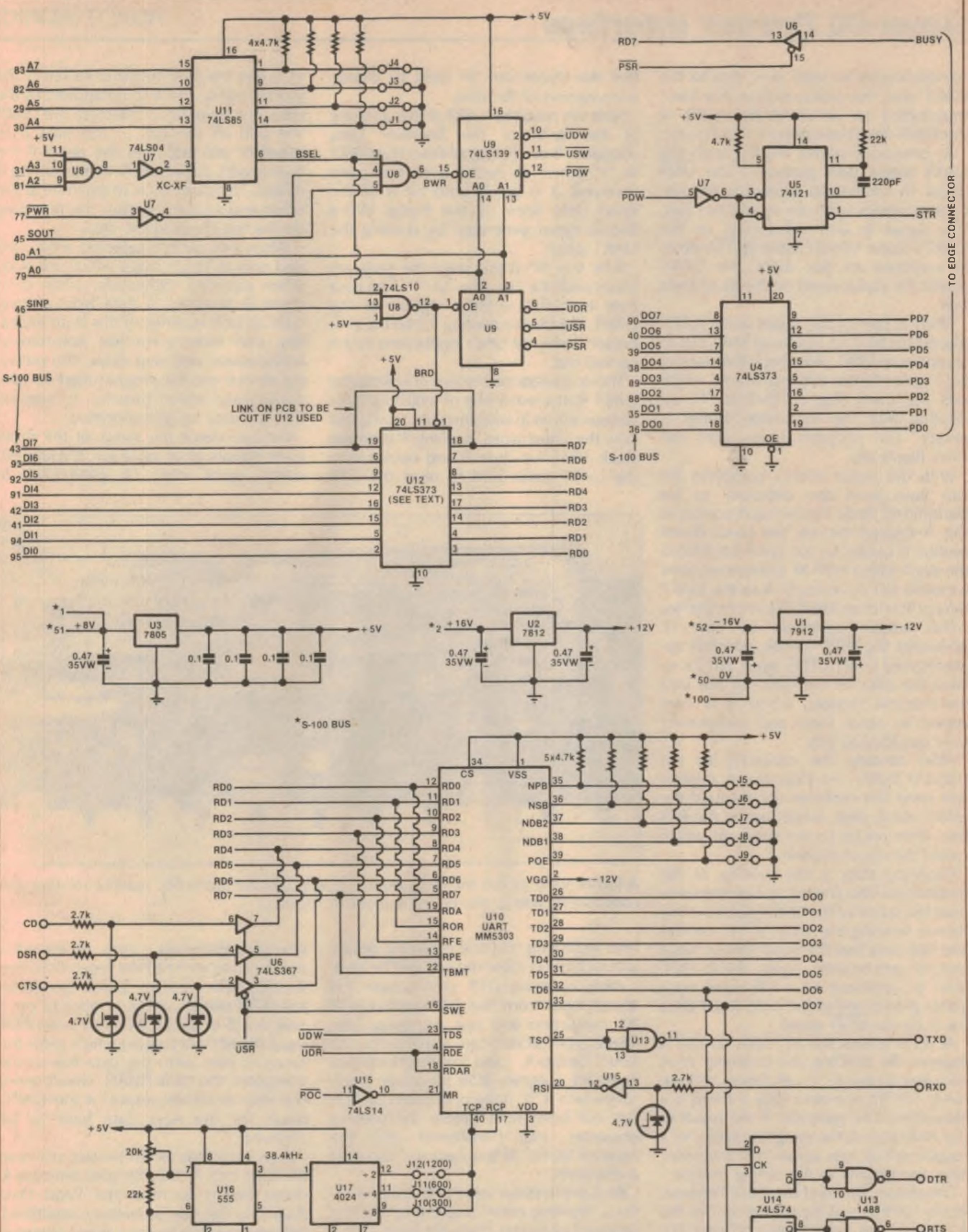
EXTRA PARTS FOR SERIAL INTERFACE
1 MM5303 or AY-3-1015 UART
1 MC1488 RS232C transmitter
1 74LS74 dual flipflop
1 74LS14 hex Schmitt trigger inverter
1 CD4024 binary counter
1 74LS373 octal latch
1 555 timer
4 4.7V zener diodes
1 LM7812 +12V regulator
1 LM7912 −12V regulator

CAPACITORS
4 0.47μF 35VW tantalum
1 .01μF ceramic
1 680pF polystyrene

RESISTORS (¼W, 5% unless stated)
1 × 22kΩ 1%, 5 × 4.7kΩ, 4 × 2.7kΩ
1 20kΩ multi-turn potentiometer

MISCELLANEOUS
2 6BA nuts and bolts
9 circuit board pins.

COST
The complete kit of parts for the Super-80 Printer Interface (DSE catalog number K3610) costs $69.50. This includes sales tax, but does not include the cost of the printer cable.



SUPER-80 PRINTER INTERFACE

we don't want to send new data to the UART until the previous data has been transmitted, so we check the status of the TBMT flag (Transmitter Buffer Empty).

As previously stated, reading from the UART status port generates the USR signal. In addition to gating the RS232C control signals onto the Read Data bus, this signal is also connected to the UART's Status Word Enable (SWE) input. In response to this input the UART places the status word on the Read Data bus.

TBMT is part of the status word and is placed on bit 7 of the Read Data bus in response to USR. We check the state of bit 7 with a Rotate Left instruction, which sets the Carry flag if TBMT is "1", indicating that the transmitter buffer is empty. The program loops until the carry flag is set.

With the status checks complete we can now send the character to be transmitted. Basic leaves this character in the A register before the serial driver routine is called, so we get it back from the stack with a POP AF instruction. Next we send the contents of A to the UART data port with an OUT (FE), A instruction.

The output operation to port FE generates the UDW strobe, which is applied to the UART's TDS input, pin 23, to latch the data on the data out bus into the transmit register, where it is converted to serial form and transmitted over our RS232C link.

After sending the character to the transmit buffer we clear the A register and send the contents out through the UART status port, which resets the RTS line, then return to the program which called the driver routine.

Receiving data is the reverse of the transmit process (Listing 3). First step is to read the status of the DSR input from the device sending the data. A "1" on this line indicates that the serial device has a byte of data to send. Again, the RS232C level is translated to a TTL level by a zener diode, and gated onto Read Data line 5 by the USR signal.

IN A,FD inputs the RD lines to the A register. By ANDing the contents of A with hex 20 (bit 5 "1", all others "0") the result will be non-zero only if there is a character to be received. If the result of the AND is zero the program jumps to a routine which sets up all the processor flags and returns to the calling routine.

Otherwise, we send the Data Terminal Ready (DTR) signal, by setting bit 7 of the A register and outputting it to port FD. This operation produces the UART Status Write signal which clocks bit 7 through flipflop U14 to produce the DTR. Once again, the output of the flipflop is converted to an RS232C signal by one gate of driver U13. At the other end of the line this signal can be used to initiate transmission of the data.

Next we read the UART status, looking at the state of the Receiver Data Available line. This signal from the UART is "1" when an entire byte has been received. It is gated onto bit 0 of the Read Data lines by the Status Word Enable signal generated by reading the UART status.

If bit 0 is "0" at this stage the program loops until the line goes to "1". The data byte is in the receiver register of the UART, but before reading it into the processor there are other operations to be carried out.

These operations involve checking the UART status word, bits of which indicate various errors in transmission, so we first save the status word, pushing A onto the stack. Next we clear A and output it to the UART status port to reset the DTR line, indicating that the receiving device is busy and no more data should be sent.

After resetting DTR we recover the status word from the stack with a POP AF instruction and test the error bits. Three types of error are signalled by the UART on bits 1, 2 and 3 of the Read Data lines. Bit 1 signals ROR (Receiver Overrun) which is "1" if the previous character has not been read before the present character was transferred into the receiver buffer. In this case we have lost a character.

Bit 2 of the status word is RFE, and is "1" for a "framing error", indicating that the received character does not have a stop bit, and is incorrect. Bit 3 is RPE, for "parity error", which signals an error if parity checking is enabled.

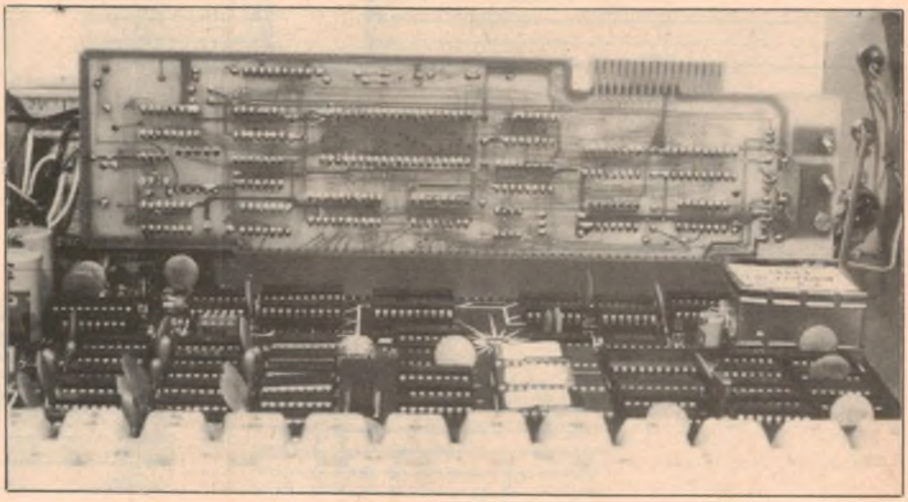
A "parity bit" is an extra bit added to the data received and transmitted data as an error check. The NPB line and the POE line are used together to select the type of parity check to be applied to the data. If even parity is selected, the UART will add all the bits in the data byte together and add 1 to the result if the sum is odd. If the sum is even nothing is added. The parity bit is stripped off at the other end of the line after the receiving device has checked the data.

When odd parity is selected, a bit is added only to those bytes which are even when summed. Obviously, when even parity is selected, a data byte arriving with an odd number of bits is an indication that some error has occurred in transmission, and vice versa. The receiving device can be programmed to take appropriate action (usually, to request that the data be re-transmitted).

We can check the status of the three error signals all at once by ANDing the status word with 0E (00001110 in binary). If the result is zero, no error has occurred, so we read the receiver buffer. Reading the receiver buffer generates the UDR strobe, which is input to pin 4 and pin 18 of the UART. Pin 4 is the RDE input (Read Data Enable) which gates the received data onto the data bus to the computer. Pin 18 is RDAR, which resets the data available output of the UART, ready for the next data byte to be received.

If an error has occurred we still read the data into A, but the only purpose in doing this is to reset the Read Data Available flag, as previously described. Before returning to the calling program, A is cleared, and then ORed with itself to set the processor flags. The Z flag set indicates that no valid character has been received.

Any of the read strobes will enable U12, which is used as an 8-bit buffer.



Another view of the interface board installed in the Super-80. Again note that the component side of the board is towards the rear.

Printer Interface

Data to be read from the interface board, either status bits or data received by the UART, will be enabled onto the S100 data in bus by this latch.

If the serial interface is not installed then U12 will not be required, as the parallel interface only produces one status bit (the printer busy signal on data line 7) and this is already gated by one Tri-state gate of U6. If U12 is installed, however, be sure to cut the printed track between pins 18 and 19 of the chip, as previously mentioned.

The procedure for reading and writing serial data may sound complex, but the software published here takes care of the details. A thorough understanding of the process is required, though, if you want to write your own software drivers.

Note that in both Listings 1 and 2, the actual driver program is preceded by a 55 (hex) byte. This is a flag which the Basic interpreter reads to determine if a printer driver is in memory. If the flag is present, Basic will use the driver in response to "LPRINT" and "LLIST" statements.

The rate at which data will be received and transmitted (known as the baud rate) is controlled by the baud rate clock inputs of the UART, pins 17 and 40. These two inputs are connected together, since we want the transmitter and receiver both working at the same baud rate, and are driven from the output of the baud rate clock generator, ICs U16 and U17.

The clock rate must be 16 times the desired baud rate. Clock pulses are produced by U16, a 555 timer IC wired in astable configuration. A 20kΩ multi-turn potentiometer allows the output of the 555 (pin 3) to be accurately trimmed to 38.4kHz. The output of the 555 is then fed to a 4024 binary counter (U17), which divides down to produce the required clock rate via link J10 (300 baud), J11 (600 baud) or J12 (1200 baud). Note

LISTING 1: CENTRONICS DRIVER

```
0000      55               Flag for Basic
0001      F5     PUSH AF   Save character on stack
0002 *1   DB FC  IN A,(FC) Get printer status
0004      17     RLA       Rotate bit 7 into carry
0005      38 FB  JR C *1   If C=1 loop till C reset
0007      F1     POP AF    Get character off stack
0008      D3 FC  OUT (FC),A And send to printer
000A      C9     RET       Then return to caller
```

LISTING 2: RS232C TRANSMIT

```
0000      55                   Flag for basic
0001      F5     PUSH AF       Save character on stack
0002      3E 80  LD A,10000000B Set bit 7 in A
0004      D3 FD  OUT (FD),A    Send it to UART status port
0006 *1   DB FD  IN A,(FD)     Read UART status
0008      CB 77  BIT 6,A       Test bit 6 in A
000A      28 FA  JR Z,*1       Loop until CTS is "1"
000C      17     RLA           Put TBMT bit in Carry
000D      30 F7  JR NC,*1      Loop until TBMT=1
000F      F1     POP AF        Get character from stack
0010      D3 FE  OUT (FE),A    Send it to UART data port
0012      AF     XOR A         Clear A
0013      D3 FD  OUT (FD),A    Reset the RTS line
0015      C9     RET           Then return to caller
```

LISTING 3: RS232C RECEIVE

```
0000      DB FD  IN A,(FD)      Get UART status
0002      E6 20  AND 00100000B  Test Data Set Ready bit
0004      28 1A  JR Z,*1        If DSR=0 then return
0006      3E 80  LD A,10000000B Set bit 7 in A
0008      D3 FD  OUT (FD),A     Send Data Terminal Ready
000A *2   DB FD  IN A,(FD)      Get UART status
000C      CB 47  BIT 0,A        Test Data Available bit
000E      28 FA  JR Z,*2        Loop until data available
0010      F5     PUSH AF        Save UART status
0011      AF     XOR A          Clear A
0012      D3 FD  OUT (FD),A     Reset DTR
0014      F1     POP AF         Restore UART status to A
0015      E6 E0  AND 00001110B  Test error bits
0017      28 05  JR Z,*3        No errors, jump to get data
0019      DB FE  IN A,(FE)      Clear status bits by reading
001B      AF     XOR A          Clear A
001C      18 02  JR *1          And jump to return
001E *3   DB FE  IN A,(FE)      Read UART data
0020 *1   B7     OR A           Set processor flags
0021      C9     RET            And return
```

Above: routines to use the interface board. For bi-directional communication via RS232C, Listing 3 should follow on from Listing 2 in memory.

```
00010 REM **** SCREEN DUMP ****
00020 REM
00030 B=48640
00040 FOR L=0 TO 15
00050 FOR C=0 TO 31
00060 P=B+L*32+C
00070 N=PEEK(P)
00080 LPRINT[A1 N];
00090 NEXT C:LPRINT
00100 NEXT L
```

```
00999 REM **** PRINTER DRIVER ****
01000 FOR L=0 TO 10
01010 READ A
01020 POKE L,A
01030 NEXT L
01040 DATA 85,245,219,252,23,56
01050 DATA 251,241,211,252,201
```

Above: this Basic program includes the Centronics printer routine in data statements. It will place the routine in memory at 0000-000A. At left is a Basic program which will print the contents of the video screen. Variable B should be adjusted depending on the size of memory of your system. For 32K is should be 32256, for 16K, 15872.

that only one of these links is installed, depending on which baud rate you want to use.

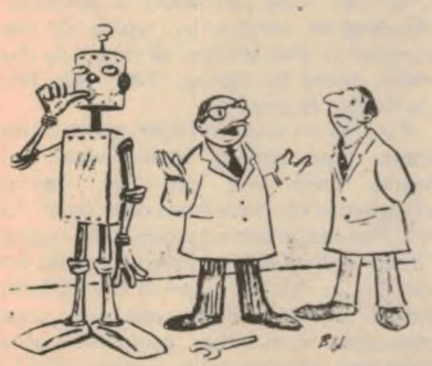
One signal yet to be discussed is the reset line, MR. This is an active high line, while the S100 Power on Clear ($\overline{POC}$) is active low. For this reason the S100 signal is inverted before being applied to pin 21 of the UART.

Five other signal lines are also important to the operation of the UART: NPB (No Parity Bit), NSB (Number of Stop Bits), NDB1 and NDB2 (Number of Data Bits per character), and POE (Parity Odd or Even). These are used to program a set of operating parameters into the UART by means of links J5-J9, which should be set to match the parameters of the serial device with which the computer is to communicate.

NDB1 and NDB2 are used to select one of four possible word lengths – 5,6,7 or 8 bits. For 8-bit data, both J7 and J8 should be left open. The NSB line selects the number of stop bits used to indicate the end of each data byte. When closed, link J6 selects 1 stop bit, and when open 2 stop bits are sent. This link should also be set to match the requirements of the device you are communicating with. The parameters selected by these links are fed into the UART by the CS line, which is tied high in our circuit.

Links 5 and 9 set the parity parameters. Insert link J5 to enable parity checking. With link J9 in place, odd parity will be selected, while leaving J9 open selects even parity. Again, these parameters should be set to match the parameters of the device you want the computer to communicate with. See Table 2.

As soon as space permits, we will describe how to install the Super-80 in the metal case shown in one of the photographs. Together with the printer interface and a lower case character generator (see P111 Feb '82), it will turn your Super-80 into a full-feature computer. Don't miss out!



"Of course, our technology is still in its infancy".

("Electronic Age")

Computer power by telephone

Dial a number and connect your microcomputer or terminal by telephone to a powerful "mainframe" computer — that's the promise of the "Australian Beginning". Launched in March, the "Australian Beginning" provides two-way communication with the vast capabilities of a Data General computer, with a huge range of information services, programs and processing power.

by PETER VERNON

Similar services have been available overseas for some time, and some intrepid characters in Australia have linked up with one of the largest, the US-based *Source*. Quite apart from the costs of a satellite link, there are disadvantages to the overseas based services. Obviously they don't include Australian news, information or advertising. Neither is it possible to load programs from the central computer to the user's microcomputer, chiefly because the error rate of the communication link is too high for transfer of working programs.

Based in Melbourne, and with plans to expand to Sydney, Adelaide, Perth and Brisbane, the *Australian Beginning* suffers from none of these problems. Australian information services, programs and processing power are just a phone call away.

The *Australian Beginning* is not a viewdata service. It is much more. Systems such as teletext offer information over a television set – it is a one-way system. Viewdata systems allow two-way communication via a cable network or telephone system with a handset allowing the user to select the information he requires.

The *Australian Beginning* also offers the information services, but it includes many more facilities. You can send messages to other users, for instance, and reply to messages on the bulletin board. You can also load programs from the main computer to your own microcomputer, and store them for later use, or store the results of your programs in the "archives" of the *Australian Beginning*. There are also programs which can be run on the main computer, with only the results transmitted to you. It's a bit like having a giant computer of your own attached directly to your microcomputer.

Equipment required

To take advantage of the services offered by the *Australian Beginning* you need a microcomputer or terminal and an "acoustic modem", a device which converts the ones and zeros of computer code into audible tones which can be sent over the telephone.

Modems connect to your computer or terminal with a line called an "RS232C" communications line – if your computer does not already have an RS232 interface you will need to add one. *Electronics Australia* has published several inexpensive designs for interfaces for the TRS-80 and System-80 computers, while some systems, particularly those built around the S100 bus, already include the interface.

You will also need a computer program to operate the modem and communicate with the big computers used by the *Australian Beginning*. These "terminal" programs are usually available from the same place you bought your computer. The *Australian Beginning* also supplies a "front end" program for each particular computer so that all microcomputers communicate with the data base in the same way.

Connection is easy. After dialling up the service the user places the handset of his telephone into the modem. When the central computer answers, a request for the user's name appears on the screen of the terminal.

Each user is given a "username" and a unique password, which ensures that no one else has access to areas of the main computer memory that you have reserved (or to your account with the *Australian Beginning)*. After connecting to the data service you will be asked for your user name and password. If either is typed incorrectly you will be asked to try again.

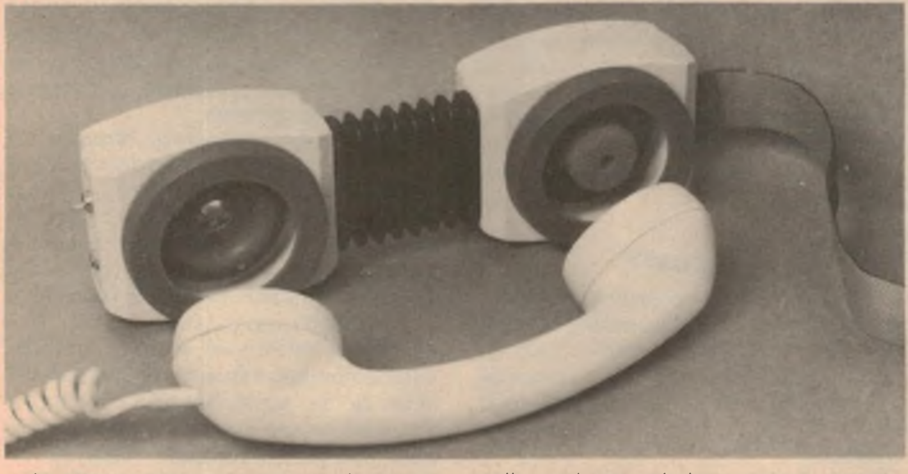
Once you've "logged in" to the *Australian Beginning* the first menu of services available will appear on the screen of your own computer. By typing in a number you can select the particular service that you want to use. These first choices are "information services", the software bank, mainframe storage, Electronic shopping, the bulletin board, private communications and "Help".

Typing "1", for instance, will produce a list of all the information services available – anything from the weather to current news to a guide to restaurants in your city. You can select a particular information service by typing in the number of that service, or return to the main menu by typing "TAB" (for The *Australian Beginning*).

If you don't want to return to the main menu (you already know what you want), then you can use special commands to move from one "page" to another of the services available. Typing "BULL" for example allows you to go directly to the first page of the bulletin board service, where you can read messages from other users and post messages of your own. Typing "SOFT" will move you to the software bank, where you can see what programs are available for your particular computer.

The Apple II is well-supported on the Australian Beginning, with over 1000 programs available.

The Exidy Sorcerer computer can also be used with the Australian Beginning.



Whatever computer you use, however, you'll need one of these — an acoustic coupler, or modem, to connect your computer to the service via the telephone.

Perhaps you want a copy of a particular computer program — just consult the list of what's available for your machine. Already there are over a thousand programs available for the Apple II computer for example. The lists of programs are constantly updated, with items added in the last thirty days tagged with an asterisk for easy reference.

Programs available include games, educational aids, diagnostic tools and financial applications, to name a few. Programs can be "down loaded" — one of the big advantages of the *Australian Beginning* over similar services from overseas. If your terminal is capable of it (disk drive, large memory), you can take the program from the central computer directly into the memory of your own microcomputer and make a permanent record of it. It's then yours to use, any time you want.

Alternatively there are programs which you can use on the mainframe computer. These programs may be too big for your microcomputer to run, or may be written in a computer language which is not available for your machine. You can still use them through the *Australian Beginning*.

In this way, complex financial modelling packages, for example, are available for use over the phone. Mainframe commands are "Archive", "Retrieve" and "Run". The Archive command lets you save your own data on magnetic tape at the *Australian Beginning* headquarters, either because there is too much data for your own computer to store or as a back-up in case you lose your own copy of the data.

This is likely to be a big plus with business users, who can also use the service as remote storage for their records, avoiding the need for a large computer on their own premises. Business records on the system are protected by a second level of passwords, to ensure complete confidentiality. There are additional charges for using the archiving services, over and above your normal connection costs.

Data that you have stored on the system is recalled by the "Retrieve" command. Every user has a private area of the mainframe memory which is a directory of data that has been stored on the *Australian Beginning* archives. Recalling data is a matter of going to this directory "page" and typing "Retrieve N", where N is the number of the data file you wish to recall.

Which computer can I use?

At present a number of computer systems are "approved" for use, including widely-used personal computers such as the Apple II, TRS-80, System 80, Atari, Commodore, Hitachi "Peach", the NEC PC8000, Casio

Dial up data base for Australia

computers and a wide range of systems using CP/M, a standard software system offered on computers by many manufacturers.

Note, however, that "approved" means that the *Australian Beginning* undertakes to include programs for these computers in the database. Many other types of microcomputers can use the service, calling up information and mainframe processing power, although there may not be programs specifically designed for these particular machines.

For users of the Exidy Sorcerer, however, an independent company, *Software Source*, will be providing a special users' section on the *Australian Beginning*, with programs which can be loaded from the database to the user's computer and then stored on cassette tape for permanent use. They will also offer CP/M programs modified for the Sorcerer. Let's hope more companies follow the lead of *Software Source*.

using the system is then $10 an hour between 8am and 6pm and $4.50 an hour 6pm to 8am — obviously it pays to go off-peak! Users who have the misfortune not to live in Melbourne(?), however, will be up for the cost of an STD phone call as well — at least until the *Australian Beginning* sets up data bases in other capital cities.

Who can use it?

The *Australian Beginning* is for everyone. Computer hobbyists will be interested in the programs and information services on computer products which are available. Businesses can use the service both as a source of information and as a complement to their existing computer system, offering "archival" storage as back-up for business data and access to more computer power for large jobs.

The users' manual supplied to each

Data General main-frame computer is the work-horse of the Australian Beginning.

It is possible to use the *Australian Beginning* without a computer at all. A simple terminal will suffice to call up information and to use the mainframe computer for running programs, while the *Australian Beginning's* own "archival" storage can be used to store data. Of course, this option requires that the user be connected for the full time he is using the programs, and the use of the *Australian Beginning* "front end" program.

What does it cost?

Total cost for the necessary equipment varies. Typically an acoustically-coupled modem costs around $400, with an RS232 interface to your computer around $100 if it is not already provided. This is in addition to the cost of your computer.

Initial membership of the Australian Beginning costs $100. The charge for

member of the *Australian Beginning* explains in simple terms how to call up the service and how to use it once you are connected. At any time you are using the service you can call up a "Help" function which explains the particular area of the service you are in or how to use a particular command, depending on your requirements.

Gary Alpert, managing director of *Computer Country*, is the driving force behind the *Australian Beginning*. In a year of concentrated effort he and his enthusiastic team have built the service from an idea to an operating system. He says "the *Australian Beginning* represents a revolutionary step, and the computer industry in general and the microcomputer industry specifically will never be the same; because after today the term micro will refer only to the price and not to computer capacity . . . This is what this revolution is about — computers for the people."

50 $100 prizes to be won!

ELECTRONICS AUSTRALIA AUSTRALIAN BEGINNING IDEAS CONTEST

To celebrate the inauguration of the "Australian Beginning" Computer Information Service, the Company and "Electronics Australia" are conducting this competition. The prize for each successful entrant is a free membership of the "Australian Beginning", worth $100, and there are 50 memberships to be won.

The aim of the contest is to find out what people may want from the "Australian Beginning". The winners will be selected from those who come up with the best suggestion in one of the following categories:

(a) A new information service for the "Australian Beginning".
(b) Software to be added to the existing data base.
(c) Any other services which can be added to the "Australian Beginning".

Entries should be of 25 words or less.

(Remember, you only need to make one suggestion, in one or other of the categories listed above.)

Contest conditions and how to enter

CUT OUT the entry form printed below. Alternatively, in states where this requirement is forbidden by law, make a clear, same-size photostat copy of the entry form.

PRINT your suggestion clearly in the space provided on the form. Fill in the remaining information and post your entry so as to reach the "Electronics Australia" Sydney office, not later than 5pm on June 30th, 1982. Each of the 50 selected suggestions will win free membership to the "Australian Beginning". What could be easier?

ADDRESS your entry to "Electronics Australia", PO Box 163, Chippendale, NSW, 2008. Mark the envelope "Australian Beginning Competition".

JUDGING will be performed by a Melbourne-based representative of "Electronics Australia" and of the "Australian Beginning Pty Ltd". The judges' decision will be final and no correspondence will be entered into.

Winners will be notified and their names published in the August 1982 or subsequent issue of "Electronics Australia".

IN THE event of two or more entries being exactly the same, preference will go to the neatest (or neater) entries. Limit one entry per reader. If a winner is already a member of the Australian Beginning, he/she may allocate the free membership to a person of their choosing.

ALL ENTRIES become the property of "Australian Beginning Pty Ltd". The prizes are not redeemable for cash. Employees, and their immediate families, of "Magazine Promotions", "John Fairfax and Sons Ltd" and the "Australian Beginning" and their associated advertising agencies are not eligible to enter the competition.

PRIZES will be allocated to the winners, by arrangement, by "The Australian Beginning (Sales) Pty Ltd", 364 LaTrobe St, Melbourne, Vic 3000.

Use this form for your entry, or a photostat in states where this requirement is contrary to law. Post your entry to "Electronics Australia, PO Box 163, Chippendale, NSW 2008. To arrive before 5pm, 30 June 1982.

NAME: ....

ADDRESS: ....

.... Post Code ....

My suggestion for the "Australian Beginning" is

....

....

....

(25 words or less, please)

☐ Are you already a member of the Australian Beginning?

☐ If not, do you intend joining?

☐ Do you own a computer?

What type?

☐ Are you a member of a computer club or user group?

Which one?

☐ What is your main interest in computer? eg hardware, software, business applications, games, educational etc

COMPUTER COUNTRY PTY LTD

338 Queen St, Melbourne, Victoria 3000, (03) 329 7533

FREE TRIP TO MELBOURNE

HITACHI "PEACH"

One of the most powerful new microcomputers on the market which uses the 6809 microprocessor. Comes with excellent super high resolution graphics — 640 × 200 dots and has a 40/80 character × 25 lines user programmable screen configuration.

ONE OF THE BEST COLOUR COMPUTERS ON THE MARKET

Computer Country is now proud to announce its "FREE TRIP TO MELBOURNE" plan. This plan applies only to interstate purchasers (non-Victorian) of an Hitachi Peach Computer Package.

(Note — Plan applies only to those systems having a minimum configuration value of $4,000 retail without sales tax.)

This is the perfect opportunity to purchase one of the best computers systems on the microcomputer market. You can just buy hardware or add on any one of a number of software packages available which include word processing, general accounting, statistics, entertainment and educational.

This choice will give you a great price, a great computer system, a free trip to Melbourne and a special training session as well.

All in all — a great deal from Computer Country.

Computer Country has done it again!

THE OSBORNE 1 HAS ARRIVED

For $2,200 including sales tax, you get the following, all in one package.

Hardware

1. Z80A CPU with 64K RAM.
2. Dual floppy disk drives.
3. 5" CRT.
4. Business keyboard with numeric keypad and cursor keys.
5. RS-232C Interface.
6. IEEE 488 Interface.
7. Weatherproof, portable housing.

Software

1. CP/M Operating System.
2. WORDSTAR word processing with MAILMERGE.
3. SUPERCALC electronic spreadsheet.
4. C-BASIC.
5. M-BASIC.

Come to

COMPUTER COUNTRY

338 QUEEN STREET, MELBOURNE, VIC., 3000
Tel. (03) 329 7533

Books & Literature

Electronic Test Equipment Projects

ELECTRONIC TEST EQUIPMENT PROJECTS, by Alan C. Ainslie. Published 1981 by (Newnes) Butterworths Pty Ltd, 271-273 Lane Cove Rd, North Ryde 2113. Soft Covers 216 x 135mm. 88 pages. Illustrations and diagrams. Price $8.95

In this slim volume the author has presented a range of test equipment projects to help a hobbyist set up his home workshop at low cost.

The projects are: Power Supply – DC millivoltmeter – Electronic resistance meter – RF signal generator – AC millivoltmeter – Capacitance meter – Audio Oscillator – Square wave unit – Direct reading frequency meter – Function generator – TTL pulse generator – Total harmonic distortion meter.

Seven of the projects have same-size printed circuit diagrams, the others are shown on stripboard but one problem with the PC layouts is the pale green ink in which they have been printed. This would make it difficult to photograph, unless one resorted to panchromatic litho film and a suitable filter to render the green as black. However, as the diagrams are uncomplicated it would be no great difficulty to trace, either with an Indian ink pen or with adhesive drafting materials, such as Bishop's or Chart-pak.

Many of the projects have been paralleled in this and similar magazines with all the usual constructional details to help the home constructor. In this book, only sketchy ideas on construction of the completed instrument are given, so that it would be mainly aimed at the person with constructional experience. Each project has a parts list, with most of the components being common types, with the exception of one or two ICs.

The appendix gives a description of the manufacture of printed circuit boards, using the Dalo resist pen technique. Within its limitations on constuction information, this would make a useful ideas book for those setting out to equip the home electronics workshop. (N.J.M.)

Amateur Radio Handbook

1982 RADIO AMATEUR'S HANDBOOK, published by the American Radio Relay League, Newington, CT.06111, USA. Stiff paper covers, pages not numbered, 272mm x 207mm, freely illustrated.

This is the 59th edition of the "Radio Amateur's Handbook" which has, since its beginning, sold some six million copies! According to the foreward, it has been extensively revised and updated for 1982.

The actual chapter headings are identical with the previous edition and may be summarised as follows:

1 Amateur radio; 2-5 Basic theory and practice; 6-10 Transmitting and receiving systems, VHF and UHF, fixed and mobile; 11-14 Modes, code, SSB, FM, specialised systems; 15 Interference; 16 Test equipment and measurements; 17 Construction and data tables; 18-21 Antennas and transmission lines for HF, VHF and UHF; 22 Operating a station; 23 Vacuum tubes and semiconductors. Index.

By today's standards, the book represents exceptional value for anyone with an interest in amateur radio or even in communications technology generally. Not everyone will want every copy of the ARRL Handbook but, if you've missed a couple of years, the up-date should be well worth having.

The book is available from McGill's Authorised Newsagency, 187-193 Elizabeth St, Melbourne 3000; or from Technical Book and Magazine Co Pty Ltd, 289-299 Swanston St, Melbourne 3000.

110 Timer Projects using the 555 IC

110 IC TIMER PROJECTS FOR THE HOME CONSTRUCTOR, By Jules H. Gilder. Published by (Newnes) Butterworths Pty Ltd, 271-273 Lane Cove Road, North Ryde 2113. Soft Covers 230mm x 148mm, 115 pages, numerous line diagrams. $11.50

This reviewer's first encounter with the 555 timer IC was in 1973 when "Electronics Australia" described an electronic enlarger timer using the new 555 device and here, nine years later, it is still a standard item in the catalogs, so it is not so surprising to find a book devoted to exploiting some of the uses for it.

After a six page explanation of the 555, there are seven chapters with the following headings – Monostable circuits – Astable circuits – Logic circuits – Timer-based instruments – Automotive applications – Alarms and Control circuits – Power supplies and Converters.

The largest section, on instruments, contains 37 circuit ideas, ranging from a tester for 555's to oscilloscope calibrators and pulse generators. Many of the ideas have come from the American publications "Electronic Design" and "Electronics" and where applicable, the volume number etc are given for further reference.

For any experimenter, this would be a most useful source book of proven applications for a chip that has become an industry building block. The other sections cover a range of circuits for home, industry, lab and hobby applications that would keep someone busy for months, trying them out. (N.J.M.)

Basic Programs for the Exidy Sorcerer

32 BASIC PROGRAMS FOR THE EXIDY SORCERER: Tom Rugg, Phil Feldman, and Kevin McCabe. Soft covers, 262 pages, 135 x 215mm with listings and photographs, Published by Dilithium Press, Beaverton, Oregon, USA 1981. Price $24.95.

This book contains programs in Basic for the Exidy Sorcerer microcomputer. The 32 programs range from a biorhythm calculator to educational programs, games, graphics displays and mathematics problems. Each is particularly designed for the Sorcerer, and many of them take advantage of the computer's unique graphics capability.

Each program in the book is presented as a separate chapter, with a description of the purpose of each program and "How to use it" preceding each listing. Listings are photographically reproduced

HALF PRICE COMPUTER!

it had to happen!

OVER 1600 SOLD

Are you fed up with 'built up' projects?

Why not build this very high quality kit computer and save over 50% on equivalent built up units!

A FULL SIZE COMPUTER KIT

You are supplied with a full board including power-on EPROM monitor, 16K of RAM, cassette interface (relay activated) for universal control of any tape recorder, TV modulator and direct video output PLUS full size professional keyboard — not a 'feel less' toy.

ALL THIS FOR ONLY $239.50

Cat. K-3600

OUR MOST POPULAR KIT EVER!

Any extra parts shown in illustration are sold as separate, chargeable items

OPTIONAL EXTRAS

Transformer (M-2325)	$23.00
BASIC Interpreter (tape) (K-3602)	$12.50
IC Socket Set (K-3603)	$12.50

Yes, this would make the fully assembled computer with above options

ONLY $387.50!

THE FANTASTIC SUPER 80

Construction details and a full copy of the EA article is supplied with each kit. We also have available two very comprehensive manuals to assist in construction and programming:

SUPER 80 Technical Manual (B-3600)	$9.50
SUPER 80 BASIC Handbook (B-3602)	$9.50

This book lists over 50 separate versatile commands. Features arithmetic and integer functions, user-defined functions, machine language routines, text editing, string operations. Also contains 25 error codes to assist you in programming.

ADVANCED OPTIONS AVAILABLE:

Lower Case Generator Option (K-3607)	$49.00
BASIC in EPROM (K-3604)	$49.50
S-100 Expansion Unit (K-3606)	$19.50
Metal Case (H-3200)	$39.50

DICK SMITH ELECTRONICS

- SYDNEY 290 3377
- TIGHES HILL 61 1896
- WOLLONGONG 28 3800
- MELBOURNE 67 9834
- FYSHWICK 80 4944
- BURANDA 391 6233
- ADELAIDE 212 1962
- PERTH 328 6944

DSE/A163M/LM

from print-outs made on a dot matrix printer, and they are readable, if a little hard on the eyes.

Following each listing are suggestions for "easy changes" – modifications which can be made to suit the program to different requirements, a list of main routines and variables, and "suggested projects" – changes to be made to produce other applications or major variations of the original. Photographs of the screen display accompany the programs where appropriate.

The programs presented here cover a wide range. We haven't tried them all, but had no problems with those that we did test out. The preface of the book gives details of recommended procedures for entering and checking out the programs, including "What to do when nothing works".

Whether you are interested in business or scientific applications, games or educational programs you will find an example in this book. If you use the Exidy Sorcerer, "32 Programs" is well worth a look.

Our review copy came for from Computer Gallery, 66 Walker St, North Sydney 2060. (PV)

Interference Handbook

INTERFERENCE HANDBOOK, by William R. Nelson, Published 1981 by Radio Publications, Inc, USA. Soft covers, 247 pages, 208 x 140mm. Illustrated with photographs and diagrams. Price $12.70.

Written by an "interference investigator" for an American power utility, this book gives an interesting and very practical account of how to trace and cure interference to television and radio communication from all sorts of mains sources. The author talks at length about all the types of domestic appliances and how they can cause interference.

He also spends quite a lot of time discussing the methods by which American power utilities trace the source of power line interference and the new power pole hardware which minimises interference. Some of this hardware is becoming evident in Australia.

Some readers who are experienced in RF techniques may find parts of the book a trifle laboured but for most readers, the book will be a practical, down-to-earth and entertaining discussion of what is often a vexing subject. I can give it a high recommendation. I only wish that Australian power authorities were as conscientious about eliminating power line interference as the author's employer appears to be.

We received copies of the book from Dick Smith Electronics and from Technical Book & Magazine Company, Melbourne. (L.D.S.)

Amateur Radio

by Pierce Healy, VK2APQ

Antarctic expedition completes its work

The final story of the Oceanic Research Foundation expedition and the first 1296MHz trans-Tasman contact are the highlights reported this month.

Since last month's report many interesting contacts have been made with VK0DL on board the Oceanic Research Foundation schooner the "Dick Smith Explorer".

Propagation conditions were very patchy for several days, due to magnetic disturbances, while the expedition sailed through ice strewn seas east of Commonwealth Bay, around the Mertz Glacier, then westward to the French Antarctic base, Dumont D'urville, arriving on the 8th February, 1982.

The commander and personnel at the base were outstanding in their hospitality to the expedition, and many firm friendships were established.

Sheltering in a safe anchorage, they remained at Dumont D'urville until February 22, 1982. When weather permitted, excursions were made to nearby icebergs for scientific studies to be made.

Communication with VK0DL during that period was very good and more was learned of the hazards that had been encountered since leaving Commonwealth Bay.

These included conditions that caused the loss of the antenna on the stern of the schooner during an encounter with pack ice, following a late evening sked on February 5. Another occurred while sheltering from a blizzard in the lee of an iceberg on February 6, when an oil pipe on the motor split, resulting in total loss of oil. Temporary repairs were made, followed by an eight hour trip through dangerous seas to Dumont D'urville.

On the other hand, description of the fantastic ice formations, and bird and sea life was most interesting and informative. So, also, was the description of the facilities and living conditions provided for the personnel at the French base, and the fact that engineers had made a new pipe for the motor.

During their stay at Dumont D'urville many messages of greetings were passed, and personal conversations between members of the expedition and relatives and friends were arranged by New Zealand and Australian amateurs. This enabled close contact to be maintained and no doubt was a great help in dispelling anxiety.

It was also learned that there were two French amateurs at the base and I had the pleasure of a contact with one of them, Bernard FB8YI. Both Bernard and Jean-Claude, FB8YJ, will be stationed at Dumont D'urville for the next 12 months and will be looking for CW contacts with Australian stations.

One discussion considered worthy of note took place between my (VK2APQ) ten year old twin grandchildren and Barbara Muhvich aboard the "Dick Smith Explorer" at Dumont D'urville. In answer to their questions, Barbara told them about the penguins, other bird life, seals, icebergs, and what it was like in Antarctica. This unexpected opportunity to speak to someone who, at the time, was actually experiencing Antarctic conditions and was willing to answer their questions was a memorable twenty minutes in the formative years of their education.

It was an experience that could be fostered by educationalists and the government departments which administer Antarctic bases. By allowing first hand participation, it would provide a way of imparting knowledge of an area which may well be very important when school age children reach maturity in a few years time.

At present, such an experience is so rare that disbelief was expressed by their school mates when told of the things they had learned during their talk with Barbara. Some even expressed doubts that such a conversation had ever taken place.

In regard to propagation, conditions were generally acceptable to very good, QRM being the limiting factor on weaker signals. Some seemingly selective blackouts due to skip or to polar magnetic disturbances did occur but on these occasions stations in either Sydney, Auckland, Macquarie Island, or Hobart were able to relay messages. On most occasions, stations not receiving VK0DL were being received clearly in Antarctica.

There were only three occasions during the 14 week voyage that contact was not made as scheduled and only twice was it necessary to use CW (Morse code) to obtain position reports.

An interesting phenomenon was observed on February 18, 1982, on 14105kHz at 0905UTC. VK0DL was not audible in Sydney but was strength two in Auckland NZ. All other stations on the net had normal signals in Sydney. Within ten minutes the effect of a severe solar disturbance became audible, sounding like many trains roaring through a tunnel, wiping out all signals. After twenty minutes band noise returned to normal and VK0DL became readable five, and strength seven. Stations in New Zealand as well as those in Australia reported the same effect as all signals returned to normal. Polar flutter at various rates was often noted and reported by all stations.

Departure from Dumont D'urville was delayed for three days by a blizzard, but the expedition left on February 22, with all their scientific tasks successfully completed. They set a course for Sydney, under power, and hove to the first night in "iceberg territory".

As they proceeded cautiously northward through ice fields to open water, weather conditions were variable and miserable. Force seven (65km/h) winds whipped up very rough seas, and fierce rain squalls. On one occasion a force eleven (110km/h) gust accompanied by a nine metre high rogue wave threw the schooner on its beam ends.

On the more pleasant side was a two-way radio contact that must be recorded. On February 28, 1982, a unique contact, suggested by Harry Caldecot VK2DA, was achieved.

Monitored by VK2DA and myself (VK2APQ), contact was established and an hour long QSO followed between VK0DL/MM and VE8RCS in Alert on

DON'T FORGET TO CHECK WITH US BEFORE YOU BUY A COMPUTER OR OTHER PRODUCTS

RITRONICS WHOLESALE

425 HIGH STREET, NORTHCOTE 3070, MELBOURNE, VICTORIA

64K SS50 STATIC NOW AVAILABLE $399 + tax

64K S100 STATIC NOW AVAILABLE $399 + tax

MASSIVE PRICE CUTS ON BIG BOARD COMPUTER

S100 COMPUTER PRODUCTS

16K EPROM CARD-S 100 BUSS

$89.50 KIT

BLANK PC BOARD $49

USES 2708's!

Thousands of personal and business systems around the world use this board with complete satisfaction. Puts 16K of software on line at **ALL TIMES!** Kit features a top quality soldermasked and silk-screened PC board and first run parts and sockets. Any number of EPROM locations may be disabled to avoid any memory conflicts. Fully buffered and has WAIT STATE capabilities.

OUR 450 NS 2708'S ARE $5.90EA WITH PURCHASE OF KIT

ASSEMBLED AND FULLY TESTED ADD $36

32K S-100 EPROM CARD

NEW!

$99.95 KIT

USES 2716's

Blank PC Board – $59

ASSEMBLED & TESTED ADD $30

SPECIAL: 2716 EPROM's (450 NS) Are $5.90 EA. With Above Kit.

KIT FEATURES

1. Uses +5V only 2716 (2K×8) EPROM's
2. Allows up to 32K of software on line
3. IEEE S-100 Compatible
4. Addressable as two independent 16K blocks
5. Cromemco extended or Northstar bank select
6. On board wait state circuitry if needed
7. Any or all EPROM locations can be disabled
8. Double sided PC board, solder masked, silk-screened
9. Gold plated contact fingers
10. Unselected EPROM's automatically powered down for low power
11. Fully buffered and bypassed
12. Easy and quick to assemble

AVAILABLE AGAIN

- 16K Dynamic Ram Board
- Fully Expandable to 64K
- Assembled, tested and guaranteed
- S100 Compatible

16K Dynamic RAM Board assembled and tested Special $269 plus tax (4mHz) $299 plus tax (4mHz) This must be the best offer available on quality tested dynamic RAM boards

32K Assembled and tested	$289 plus tax (4mHz)
48K Assembled and tested	$309 plus tax (4mHz)
64K Assembled and tested	$329 plus tax (4mHz)

16K STATIC RAM KIT-S 100 BUSS

KIT $189
A&T $219

KIT FEATURES

4. ON BOARD SELECTABLE WAIT STATES

BLANK PC BOARD W DATA	$49
LOW PROFILE SOCKET SET	$22
SUPPORT ICS & CAPS	$29
ASSEMBLED & TESTED	ADD $30

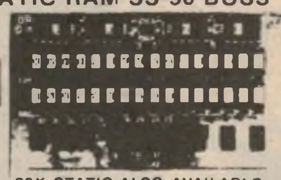
OUR #1 SELLING RAM BOARD!

16K STATIC RAM SS-50 BUSS

PRICE CUT!

$199 KIT
A&T $219

FULLY STATIC AT DYNAMIC PRICES



32K STATIC ALSO AVAILABLE

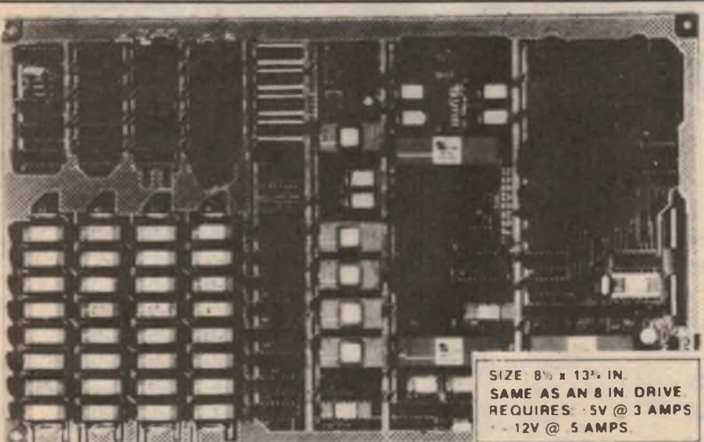
FOR SWTPC 6800 BUSS!

BLANK PC BOARD – $49 COMPLETE SOCKET SET – $22 SUPPORT IC'S AND CAPS – $45

NOW A $99 Computer!

Plugs into any TV!
ETI 660

ETI636 7 SLOT MOTHERBOARD WITH ACTIVE TERMINATION
Kit of Parts $89.00 Assembled and tested $115.00 inc tax
RITRON COMPUTER GRADE POWER SUPPLY +5V Reg. 10A ± 16V Unreg Kit of parts $89.90 inc tax A&T $109.00 inc tax
Write for list of other power supplies. Tax free prices also available



SIZE 8½ x 13¾ IN.
SAME AS AN 8 IN. DRIVE
REQUIRES: 5V @ 3 AMPS
-12V @ .5 AMPS

SINGLE BOARD COMPUTER KIT
NOW ONLY $499 + TAX (17½%)

Also available, *Assembled & Tested*

Blank PCB's with Roms $625 + TAX

THE FERGUSON PROJECT: Three years in the works, and maybe too good to be true. A tribute to hard headed, no compromise, high performance, American engineering! The Big Board gives you all the most needed computing features on one board at a very reasonable cost. The Big Board was designed from scratch to run the latest version of CP/M*. Just imagine all the off-the-shelf software that can be run on the Big Board without any modifications needed! Take a Big Board, add a couple of 8 inch disc drives, power supply, and an enclosure, and you have a total Business System for about 1/3 the cost you might expect to pay.

FEATURES: (Remember, all this on one board!)

64K RAM

Uses industry standard 4116 RAM'S. All 64K is available to the user, our VIDEO and EPROM sections do not make holes in system RAM. Also, very special care was taken in the RAM array PC layout to eliminate potential noise and glitches.

Z-80 CPU

Running at 2.5 MHZ. Handles all 4116 RAM refresh and supports Mode 2 INTERUPTS. Fully buffered and runs 8080 software.

24 x 80 CHARACTER VIDEO

With a crisp, flicker-free display that looks extremely sharp even on small monitors. Hardware scroll and full cursor control. Composite video or split video and sync. Character set is supplied on a 2716 style ROM making customized fonts easy. Sync pulses can be any desired length or polarity. Video may be inverted or true.

SERIAL I/O (OPTIONAL)

Full 2 channels using the Z80 SIO and the SMC 8116 Baud Rate Generator. FULL RS232! For synchronous or asynchronous communication. In synchronous mode, the clocks can be transmitted or received by a modem. Both channels can be set up for either data-communication or data-terminals. Supports mode 2 Int. Price for all parts and connectors: $65

FLOPPY DISC CONTROLLER

Uses WD1771 controller chip with a TTL Data Separator for enhanced reliability. IBM 3740 compatible. Supports up to four 8 inch disc drives. Directly compatible with standard Shugart drives such as the SA800 or SA801. Drives can be configured for remote AC off-on. Runs CP/M* 2.2

BASIC I/O

Consists of a separate parallel port (Z80 PIO) for use with an ASCII encoded keyboard for input. Output would be on the 80 x 24 Video Display.

FOUR PORT PARALLEL I/O (OPTIONAL)

Uses Z-80 PIO. Full 16 bits, fully buffered, bi-directional. User selectable hand shake polarity. Set of all parts and connectors for parallel I/O: $29

REAL TIME CLOCK (OPTIONAL)

Uses Z-80 CTC. Can be configured as a Counter on Real Time Clock. Set of all parts: $19

PFM 3.0 2K SYSTEM MONITOR

The real power of the Big Board lies in its PFM 3.0 on board monitor. PFM commands include: Dump Memory, Boot CP/M*, Copy, Examine, Fill Memory, Test Memory, Go To, Read and Write I/O Ports, Disc Read (Drive, Track, Sector), and Search. PFM occupies one of the four 2716 EPROM locations provided. It does not occupy any of the 64K of system RAM!

Bankcard Mail Orders Welcome

Please debit my Bankcard
Bankcard No. ____________
Expiry Date ____________
Name ____________
Signature ____________

General enquiries (03) 489-8131. Mail order enquiries (03) 481-1436. Ritronics Wholesale (03) 489-7099. (Tax Exempt Enquiries)

Prices subject to change without notice. Send 60¢ and SAE for free Price lists. MAIL ORDERS PO BOX 235, NORTHCOTE. Vic. 3070. Minimum pack and post $5.00. Telex AA38897.

PLEASE WRITE OR RING FOR THE BEST POSSIBLE PRICES ON DISC DRIVES, PRINTERS AND OTHER COMPUTER COMPONENTS.

AMATEUR RADIO

Ellesmere Island, Canada's most northerly township only a few hundred kilometres from the north pole. This contact was unique because it was between two privately organised polar expeditions, the Oceanic Research Foundation expedition and the "Dick Smith Explorer" and the Trans-Globe expedition base camp at Alert.

During the contact, Dr David Lewis and Jenni Bassett on the Explorer conversed with Lady Virginia Fiennes, wife of the Trans-Globe Expedition leader, Sir Ranulph Fiennes. Sir Ranulph was at that time with a walking party of four who planned to cross the North Pole on their way to Spitzbergen, to complete the last part of the expedition.

This contact is another first for amateur radio, bringing together for the first time two expeditions at the polar extremes, in a direct radio link.

As the expedition was east of Tasmania, sailing closer to Sydney, only the New Zealand stations could maintain contact on 14105kHz with VK0DL/MM. To overcome this propagation problem, the net moved to 7051kHz and good signals from the schooner were again received in Sydney as well as New Zealand. This change allowed the net to operate as a unit until the "Dick Smith Explorer" arrived in Sydney.

The final berthing at Circular Quay, Sydney on Monday March 15, 1982, was an exciting and colourful event, widely reported in the press and television news.

It was a great pleasure to again meet in person members of the expedition after closely following their progress and activities since December 12, 1981.

Don Richards, VK2BXM/VK0DL, and myself, VK2APQ, express our deep appreciation to all who regularly joined the "Oceanic Research Foundation" net and helped to make the communication side of the expedition such an outstanding success.

To have been unable to establish daily contact on only three occasions during the 94 days, in a part of the globe renowned for its unpredictable propagation vagaries and weather conditions, in the south magnetic pole area, can be claimed as a noteworthy achievement by amateur radio.

In recognition of the efforts of those who regularly operated and assisted on the "ORF NET" here, in alphabetical and numerical order, are their station call signs:

VK2DA, VK2IH, VK2ALH, VK2BCP, VK2BQS, VK2ZQC, VK6ART, VK7BP, VK7EB, VK7ER, VK7GD, VK7KJ, VK0AN, VK0HW, VK0SJ, ZL1AAS, ZL1AZV, ZL2NV, ZL2AZM, ZL2BJI, ZL3FM, ZL3AFQ.

73 DE VK2APQ — ORF NET coordinator.

1296MHz TRANS-TASMAN RECORD

Last month brief mention was made of the first trans-Tasman two-way contact on the 1296MHz amateur band. The operators involved were Dick Norman, VK2BDN in Croydon, NSW and Brian Ryal, ZL1AVZ in Auckland, New Zealand.

Here is a report on the contact and comment on propagation conditions prior to the event as told by Dick Norman, VK2BDN.

Dick Norman and his 1296MHz equipment.

"At 1930EAST on January 25, 1982, a telephone call was received to let me know that the 144MHz band was open to New Zealand. I decided to try the 432MHz band and a contact was established with ZL2VT which lasted for an hour. Later ZL2TAL, ZL2THG and ZL1BG were worked. All signals were around S8 and the band was still open at 2200EAST. Noting that similar conditions on 432MHz had existed two years ago, and having considerably improved the equipment, the 1296MHz band was tried, but without success.

"On February 8, 1982, a similar opening occured on 432MHz with signals at S9 until after midnight. The next morning I decided to try 432MHz band again and at 0630EAST contact was made with ZL1AVZ, signals being R5, S9, both ways.

"Brian Ryal, (ZL1AVZ) suggested we try 1296MHz. I arranged to leave a carrier running on 1296MHz while I had breakfast. Brian called on 432MHz saying that he was receiving my 1296MHz carrier. I called him, using SSB, suggesting that he also use 1296MHz. He did, and at 0745EAST our two-way contact commenced and lasted for twenty minutes.

"Brian used CW and SSB. I reported his signal as R5, S2. He reported my signal as R5, S3. The contact was even more remarkable as Brian's power was five watts on CW and 1.3 watts on SSB. His equipment was a Microwave Modules transverter to a 4-metre diameter dish antenna. My power was 35 watts from a home built SSB transmitter using a 2C39 mixer driving a 2C39 amplifier to two 27 element loop yagi antennas. The receiver was a Microwave modules preamplifier and converter to 144MHz.

"The calculated distance for the contact is 2134km (1326 miles) and does appear to be a new Australian and New Zealand record."

Dick also expresses his appreciation to Geoff Campbell, VK2ZQC, for the many tests carried out with him, computer calculations made, and encouragement given.

The photograph showing Dick and his 1296MHz equipment was taken by Geoff.

SOUTH EAST RADIO GROUP INC. MOUNT GAMBIER: This group will be holding its 18th annual convention on the Queen's Birthday holiday weekend on June 12-14, 1982.

The usual field events and scrambles, plus several new ones, have been planned. Activities have been planned to entertain amateurs and their families, extending over the whole weekend.

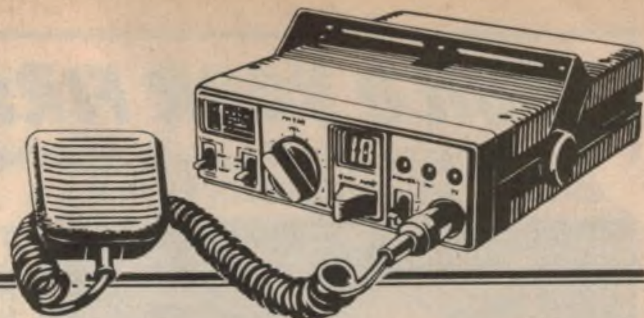
In past conventions, the catering by the ladies committee has been a main feature.

Convention registration forms may be obtained by sending an SAE to The Registrar, SERG, PO Box 1103, Mount Gambier 5290 South Australia. Also enquiries may be made by checking in to the SERG net on Monday nights at 2030CST on 3585kHz.

Excellent prizes will be awarded for all events.

Radio clubs and other organisations, as well as individual amateur operators, are invited to submit news and notes of their activities for inclusion in these columns. Photographs will be published when of sufficient general interest, and where space permits. All material should be sent to Pierce Healy at 69 Taylor Street, Bankstown, NSW 2200.

The Australian CB SCENE



An urgent need for unity and co-operation

My remarks in the March issue, about the possible emergence of a National CB organisation has prompted a lengthy letter of comment from a reader in South Australia. Because it represents a legitimate and constructive point of view, I will quote the main substance of it.

The letter comes from Mr Matt Mattson of Killburn, South Australia and, after some initial and personal good wishes, continues:

"Dear Jan,

I have read with interest your CB Scene articles in 'Electronics Australia.' I have been 'into' CB since it first came into Australia and have seen many clubs come and go.

Your last report in the March '82 edition that there is 'A National CB Organisation – At Long Last?' seemed to me to be very one-sided. Please don't get me wrong, Jan. I'm all for a National Organisation, with a united voice in dialogue with the authorities. It just seemed that the article made more mention of the NCRA, and little of the other groups.

Your remark that the ACBRO and the NCRA were also negotiating terms of Association is heart warming. However, you failed to mention that ACBRO is an Australia-wide group, and that it is an incorporated body with Senator Ron Elstob as its patron.

I believe that ACBRO have tried many times to gain the support of CB operators and have a united voice with the authorities but it seems that their efforts have fallen on deaf ears. I believe that, somewhere along the line, there are personality clashes. This is a pity, as the many groups appear to have the interest of all CBers at heart.

There are many subjects I could talk about, but I do not wish to take up too much of your time. However, as you are the Assistant State Secretary (Qld) for the NCRA would you please put me in touch with someone in regards to NCRA's activities in South Australia. I would like to be able to further the CB cause:

1. To promote and maintain good relations between all CB operators throughout Australia.

2. To become involved in a nationally incorporated body, serving the CB operators.

3. To promote public interest in the better side of CB.

Thank you sincerely, Jan, for reading this letter."

Matthew M. Mattson.

Thank you for your letter, Matt, and I hope that I may be able to answer the points which you have raised to your satisfaction. I must begin by clarifying one point, namely my position within the NCRA. While I was, at one stage, the Assistant State Secretary of the Queensland Division, I am currently the National Liaison Officer. The NCRA is now governed only by the National Council, the State Divisions having come under direct National control, due to costs.

Position notwithstanding, I try to be as unbiased as I can in my articles, in relation to CB groups, and endeavour to pass on all the information that I receive from them. It is only natural that I should know more about the operation of the NCRA than I do about the others, and some imbalance is unavoidable if they do not keep me fully briefed.

Perhaps I'm a bit proud of the NCRA but don't forget that it has been going since late 1976 and has never missed a submission on any relevant issue. Our office bearers have held discussions with Ministers and Departmental officials, the latter on both a State and Federal level. We have had Ministers, Departmental Heads and State Superintendents at our meetings, and have had monthly columns appearing in National magazines since 1977. The NCRA is the co-founder of the World Personal Radio Congress and has overseas affiliates.

The NCRA is not an incorporated body, simply because it cannot become incorporated in any state so long as the word "National" appears in its name. There is no intention to change the name at this stage.

Even so, I personally doubt if any widely based CB organisation will be able to hold out for much longer without the injection of Federal funds. It is no secret that the NCRA is having trouble, and I can only assume that the same applies to the other groups. Special interest groups, such as the CRRA may be in a better position. I hope so.

Matt mentions that the difficulties facing the ACBRO could, in part, be due to personality clashes. Well many clubs and organisations (not to mention governments) have come undone due to personality problems. The only hope is that the antagonists realise the harm they are doing to their peer group and try to keep the problems to a low-key plane. The NCRA has had its share and its critics still drag up episodes from the past which are best forgotten.

As stated earlier, the NCRA does not have State Divisions any longer, although there are a few clubs affiliated with it in South Australia. The best advice I can give, if you would like to join the organisation, is to write to Terry Watkin, the National Director, at the address which appears at the end of the column.

The one thing which prevents a member of the National Executive getting around to see executives of the other organisations for round table talks is finance. Perhaps if the other groups are more financial, they could send a representative to Brisbane. I am sure that it would be worthwhile.

Matt Mattson's ideals are most, most worthy and I am sure that he and others like him would be an asset to any organisation which they chose to join. Too often these days the operators forget that they do have obligations to those that work on their behalf.

Once again I will repeat the call I made in the March issue . . . all operators please join one of the associations which is working for you. Without your assistance none of them can long survive.

Jan Christensen,
PO Box 406,
Fortitude Valley, QLD 4006.

Shortwave Scene

by Arthur Cushen, MBE

WARC decisions now taking shape

Two of the major decisions at the World Administrative Conference held in Geneva in 1979 have been put into practice, the use of UTC in place of GMT in time references and the opening of a new shortwave band in the 13MHz area.

Shortwave listeners will have noted international broadcasting stations making reference to UTC instead of GMT when making frequency and schedule announcements. Co-ordinated Universal Time (UTC) is now used by many stations including Radio Canada, Radio Nederland, Swiss Radio International, Radio Sweden International and many more, while printed material from these stations is also showing the UTC time reference. UTC is equivalent to GMT but is based on a more accurate means of time conversion.

Expansion of the shortwave bands is also taking place, as the Geneva Conference increased the size of many of the international bands. The 6 and 7MHz bands were not altered but all other bands were increased except the 26MHz band which was reduced in its range. A new band, the 13MHz band, is already beginning to be used by broadcasters.

Radio Pakistan's external service is the first station to be monitored using the new 22-metre band on 13605kHz. The World Administrative Radio Conference held in Geneva in 1979 agreed on the use of the frequencies from 13600-13800kHz for broadcasting from January 1, 1982, provided the present occupiers had moved elsewhere.

The Turkish Service of Radio Pakistan, beamed to Europe from 1630-1730UTC was transmitting on 17620 and 13605kHz, the latter frequency replacing 15585kHz. The BBC Monitoring Service reports that the Turkish segment includes a five minute news summary in English at 1650UTC.

GOSPEL STATIONS

PHILIPPINES: Far East Broadcasting Co Manila, has an English transmission to Australia 0800-1000UTC on 11890kHz. They are also using the low powered 2kW transmitter on 21515kHz for English programs at 2300-0500 and 0800-1000UTC.

SEYCHELLES: The Far East Broadcasting Association schedule for May-September shows that English will be broadcast 0400-0500UTC on 11810 and 15200kHz; 0715-0815UTC on 15235 and 17740kHz; and 1430-1530UTC on 11865 and 15325kHz.

SWAZILAND: Trans World Radio has several English transmissions but those audible in this region are 0430-0445UTC on 5055; 0445-0630UTC on 5055 and 9640kHz; 0645-0835UTC on 9640 and 11760kHz; 1800-1945 Monday to Friday 6070 and 1800-2015 Saturday and Sunday 6070kHz.

RADIO KOREA

The Korean Broadcasting System was founded in 1926 and in 1948 came under the control of the Korean Government of the Ministry of Culture and Information. March, 1973, marked a turning point for public broadcasting in Korea, as the Korean Broadcasting System attained complete autonomy in programming and broadcasting policy with its new status as a public corporation. The amalgamation of the networks, an epoch-making event in the 50 year history of broadcasting in Korea, virtually put an end to the era of commercial broadcasting in the country. KBS's powerful medium-wave, FM and television network consists of a key station in Seoul and 21 local stations, as well as 294 transmitting and relay stations, employing a staff of 5510. Radio Korea, the overseas Service of the Korean Broadcasting System, is serving the world in ten languages for a total of 102 program hours daily, with 19 channels using medium and shortwave.

Radio Korea broadcasts in English several times each day, giving good reception in this area. The broadcasts at 1000-1100UTC is on 9570; 1130-1230UTC on 9870kHz and 15575kHz; 1330-1430UTC on 9720; and 2130-2230 on 15575kHz. The General Service can be received at 0200-0300UTC on 15575kHz; 0400-0500UTC on 7275 and 9640kHz; 1300-1400UTC on 6135kHz and at 2130-2230UTC on 15375kHz.

LISTENING BRIEFS

TAIWAN: The "Voice of Free China" at Taipei broadcasts in English to Australia at 0100-0200UTC and 0300-0350UTC on 11825, 15345 and 17890kHz, and at 0300 broadcasts on frequency of 17800kHz are added. A further transmission in English 2030-2130 is on 9610, 9765, 11860, 15225 and 17720kHz.

Notes from readers should be sent to Arthur Cushen, 212 Earn Street, Invercargill NZ. All times are UTC (GMT). Add eight hours for WAST, 10 hours for EAST and 12 hours for NZT. In areas observing daylight time, add a further hour.

BIG SAVINGS for NZ hobbyists

A discriminating detector under $250!

That's the brilliant TECHNA

FANTASTIC VALUE AT ONLY $249.50 NZ

This is the ideal unit to throw in the boot of the car when you go away for a weekend or on holiday. What better way to pay for that holiday than to find a hidden cache of treasure or a gleaming nugget of gold. It so easy to use the whole family can join in AND it discriminates between rubbish and treasure!
Cat Y-1066.

METAL DETECTING

This fantastic book covers all aspects of treasure hunting using metal detectors. Techniques in finding coins, bottles and other items are covered in detail. Hundreds of diagrams and photographs.
Cat B-4520 .... **NZ $6.50**

THE AUST'N GOLD FINDER

A superb piece of writing from someone who has been out in the bush searching for Gold. This book gives the latest techniques in looking for Gold and more importantly where and how to look for it.
Cat B-4525 **NZ $2.60**

AUST'N GEM & TREASURE HUNTER YEAR BOOK 1981

127 pages for the serious treasure hunter and for the person who uses the latest in hunting techniques.
Cat B-4536 **NZ $3.25**

WANT THE ULTIMATE?

If you want the best available metal detector, then this is the one for you. A precise instruction sheet is included which allows you to operate the unit quickly, but it is intended for the serious prospector who is willing to learn the intricacies of the unit.

D-TEX METAL DETECTOR (with 2 search coils!)

Features ★VLF/TR discrimination circuitry & selector switch ★Push button retuning mounted in the handle ★Waterproof search coils ★Uses 4 x 9V transistor batteries.
Cat Y-1076

ONLY $695.00 NZ

For the convenience of our thousands of New Zealand customers, Dick Smith Electronics now has a retail centre open in Auckland. With a large range of quality Dick Smith products (as much as we're allowed to bring into New Zealand), this store is open to both retail and wholesale customers. It offers prices up to 50% less — and more — than the prices you've been forced to pay in the past — and since we've opened, we've found many of our competitors prices have dropped — which is good for all hobbyists, whether they're Dick Smith customers or not. We also have a large number of authorised re-sellers throughout New Zealand, so you're never far away from quality, value & service.

GREAT IDEA FOR THE HANDYMAN!

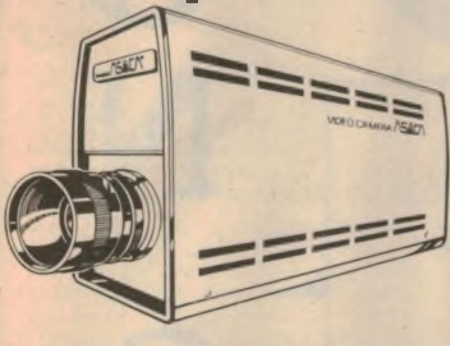
Ideal for use in the home, office or factory.

METAL & PIPE LOCATOR

How often have you needed to find a nail in a wall or piece of timber, locate a gas or water pipe, or wires behind plaster? This little beauty will do just that, and lots of other jobs requiring metal location. Has sensitivity control and a metal indication light, and operates from a single 9V battery.
Cat Y-1060

VALUE AT $14.95 NZ

The basis of a LOW COST CCTV or surveillance system



DICK SMITH'S B & W VIDEO CAMERA

There are numerous cameras on the market today that can be used in surveillance systems, or with video cassette recorders etc. They are generally colour cameras and cost between $1,000 to $20,000 or more. This CCTV camera will be ideal for nearly 99% of all general use and as such represents outstanding value for money! Comes complete with instruction book, lens and co-ax connector.

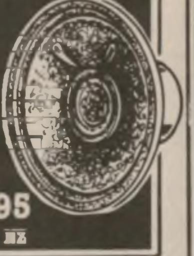
LOOK AT SOME OF THE FEATURES

★Uses modern solid state circuitry ★2/3 inch SEPARATE MESH Vidicon tube for high quality pictures ★Switchable video/RF output means it will work directly into a TV set or into a special TV monitor ★Low noise picture ★Can be used in wide range of lighting conditions.
Cat Y-1195

AND LOOK AT THE LOW PRICE $795.00 NZ

COMPARE OUR PRICES

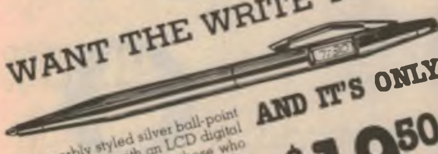
57mm MINI SPEAKER



This 57mm mini speaker has performance - in fact we found that it offered more performance than speakers up to 75mm in diameter! Nominal impedance of 8 ohms make it ideal for many purposes.
Cat C-2222

WHY PAY MORE
THOUSANDS OF USES $2.95 NZ

WANT THE WRITE TIME?



A superbly styled silver ball-point pen complete with an LCD digital clock inside. Great for those who don't like to wear watches. The clock shows day, date and seconds, and the pen has a retractable nib and uses standard Parker refills.
Cat Y-1030

AND IT'S ONLY $19.50 NZ

QUALITY HEADPHONES

These ultralight mylar headphones are so light, you'd hardly know you were wearing them. Earpads are soft foam that are acoustically transparent so that every sound is faithfully reproduced. They come with lead and 3.5mm stereo jack. Cat C-4106

ONLY $19.95 NZ

NEW KITS

PROTECT YOUR LIFE & EQUIPMENT

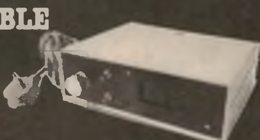
The Core Balance Relay electronically detects earth fault currents and trips a relay which cuts the power. The relay cannot be reset until the fault is repaired. Designed to run 240V, this unit is portable and built into a tough moulded plastic case.
Cat K-3315

ONLY $74.50 NZ

DIGITAL CLOCK/ THERMOMETER

This kit gives you all the features of a digital alarm clock as well as a thermometer. The thermometer will display in either Fahrenheit or Celsius and the clock will even turn your radio on for you. Fitted with an alarm (speaker included) and snooze button, the clock is mains powered with battery back up. No case is supplied.
Cat K-3436

UNBEATABLE VALUE $94.00 NZ



LOW DISTORTION AUDIO OSCILLATOR

The Audio Oscillator uses the characteristic low noise of a VMOS device to give an ultra-low distortion output. The kit comes in a sturdy chassis with black perpsex front panel, silkscreened with white lettering. LED power indicator also acts as dial marker.
Cat K-3467

ONLY $99.50 NZ

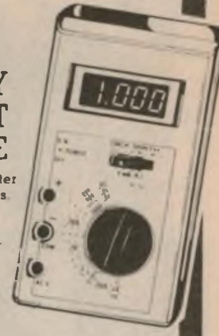
ETI METAL LOCATOR

From Electronics Today International, this detector is the equivalent of many induction balance detectors in the hundreds-of-dollars bracket. You build it yourself - so you save! All components are supplied but the coil former and dowel for the shaft is left up to you. Are you ready to go out and find a fortune? You could with this beauty!
Cat K-3100

ONLY $59.00 NZ

LCD MULTIMETER

SAVE $20!



QUALITY 3.5 DIGIT 20 RANGE

We're proud to offer this superb multimeter to hobbyists, technicians and engineers. It offers exceptional performance, together with a highly legible liquid crystal display for very low power consumption. PLUS this unit has overload protection - so you won't 'cook' it if you make a few errors!
Cat Q-1450

ONLY $75.00 NZ

POWER/SWR METER

Now you can measure the output power of a CB transmitter and the matching conditions between transmitter and antenna. Large easy to read measurements.
Cat Q-1350

$19.95 NZ

LOW COST SIGNAL INJECTOR

Check out both audio and RF circuits (harmonics extend to many MHz) simply and easily. Self contained, battery operated with probe and earth clips.
Cat Q-1270

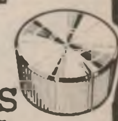
AND ONLY $11.50 NZ

ECONOMICAL DIGITAL LCD MULTIMETER

Ideal for the hobbyist and the professional — makes an ideal addition to any tool box. Has 13 ranges, liquid crystal display, bonus carrying case and probe.
Cat Q-1445

ONLY $65.00 NZ

GIVE YOUR PROJECT A PROFESSIONAL FINISH! ALUMINIUM KNOBS FOR METRIC POTS



A new large knob with a diameter of 40mm
Cat H-3846 $1.95 NZ

Smaller version in the same style as the above. Diameter 20mm.
Cat H-3842 $1.38 NZ

DICK SMITH Electronics

98 Carlton Gore Rd. Newmarket
Auckland. Tel: (649) 50 4409
Mail Orders: PO Box 9452, Newmarket NZ
WHY PAY MORE?

DSE/A245/PA

ON SALE NOW

- Alphabetical list of 800 feature movies you can buy or rent — and who from.
- Ho-Ho Movies — A look at sixty years of comedy on film
- Video games have just celebrated their 10th anniversary. From ping-pong to galactic battles.
- A powerful new training resource — Bell & Howell combine video discs and the "Apple" computer.
- Bill Collins, well known film buff and TV personality has his say on the presentation of video home movies.
- Cassette Reviews — A closer look at humorous and other cassettes.
- Review — We report on National's new NV-7200 video cassette recorder.
- Video Accessories — gadgets that are emerging overseas for home video enthusiasts.

NOW the low cost answer to model control

The DICK SMITH three channel digital proportional radio control

D.O.C.
APPROVAL
NO. 195003

Imagine! A fully digital proportional 3 channel radio control system for under $100.00! Compare elsewhere at $150 and more
This outstanding system features three individually controlled channels, with 'trim' offset controls. Two channels are joystick controlled, the third a slider control (ideal for throttle, etc.)

- Complete with receiver, battery holder and three servos (spare battery holders and servos available so you aren't tied to just one model!)
- Ideal for models of all types: boats, planes, vehicles, etc.
- Top range transmitter and ultra-sensitive receiver
- Crystals are changeable for different operating frequencies
- Requires 10 pen light cells. Cat. S-3003: 22 cents each

GET INTO RADIO CONTROL MODELS NOW!

A MASTERPIECE IN STATE-OF-THE-ART RADIO TECHNOLOGY

AVAILABLE SOON: 4 channel radio control. Cat Y-1240. $149.50.
See your local store for availability and further details.

Complete with transmitter; receiver; battery holder; 3 servos

DICK BREAKS $100 BARRIER

only $99

Cat Y-1230 P&P $4

DSE A182/PA1

DICK SMITH Electronics

SEE OUR ADDRESS PAGE FOR FULL ADDRESS DETAILS

REVIEWS OF RECENT

Records & Tapes

CLASSICAL ● POPULAR ● SPECIAL INTEREST

VARSANO SATIE — Orchestral and piano recordings

SATIE — Monotones. Pieces comprising music for a ballet including Jack In The Box, Three Pear-Shaped Pieces and Two Preludes. World Record Club Stereo Disc R 08616.

The pieces assembled here were put together in Paris in 1920, to make up a ballet in collaboration with avant garde painter Picabia. Its name was the title of this record. Nearly all the items were orchestrated by other composers of varying degrees of contemporary fame at the time. The great majority of the pieces were originally composed by Satie for piano.

Satie was a hermit-like alcoholic, always hard up and in dress favouring bowler hats the shape of that worn by one of the two men in Cezanne's picture, "The Card Players". Until recently, Satie was remembered outside France more by his witty comments on other composers' music than for his own. Nowadays, interest has revived in his work.

But although, during his life, his music was largely ignored by the public, it had considerable influence on other French composers of the period including even such disparate musicians as Debussy and Poulenc.

As an instrument, the piano was admirably suited to Satie's austere Apollonian style and only a very few of the orchestrations on this disc really come off. For instance, Debussy's scoring of the First and Third Gymnopedies is much too scented to suit their ascetic line — too tarted up.

Jack In The Box, orchestrated by Milhaud is the most successful, with Poulenc's Two Posthumous Preludes a close second. The least successful in my opinion is Desormiere's treatment of the Three Pear-Shaped Pieces which had long won quite a reputation as a piano duet and, in that form, showed Satie at his best.

But, despite the often inadequate transcriptions, the disc is well worth having, as it will preserve so many pieces by the eccentric composer which, separately, might otherwise have been lost or forgotten.

The Covent Garden Opera Orchestra play everything satisfactorily. The conductor is John Lanchberry who himself competently orchestrated Bands 1 and 4 containing the Prelude to Eginhard and the Three Gnossiennes — although none of this music responds with any gratitude to orchestral sound. One factor that contributes to the success of Jack In The Box is its cheeky jauntiness contrasting well after so many slow tempos that precede it.

The engineering is good, although Side 1 of my pressing is a bit prickly. (J.R.)

PIANO: "Much better"

SATIE — A selection of the composer's piano music, all of them, 14 in number, brief. Daniel Vasano (piano). CBS Stereo Masterworks Disc SBR 236039.

The young French pianist, whose first British recording this seems to be, uses the piano to give a much better idea of the real effectiveness of much of Satie's music. He starts with the first Gnossienne then goes on to three waltzes with a title so ambiguous as to be untranslatable into sensible English.

But then Satie nearly always gave his compositions cryptic or contradictory titles. For instance Band 4, translated, reads "Last But One Thoughts" and consists of three short pieces, an Idyll (to Debussy), a Morning Serenade (to Dukas), and a Meditation (to Roussel).

Listening to Varsano's excellent playing of the recital after hearing the Satie orchestral music reviewed above, reveals how much better the original piano version sounds. Varsano plays them all with great taste and more than adequate technique.

By the way, in the Last But One Thoughts, although each is dedicated to a different composer contemporary to Satie, I could detect no effort to parody their styles. While the various Gymnopedies and Gnossiennes are scattered throughout the recital, apparently at random, the fact is that they are really chosen with great care to achieve the best contrasts with what precedes and follows them.

The analog sound is first rate and successfully reveals the many subtleties in Varsano's refined playing. (J.R.)

GALWAY: "Peerless"

JAMES GALWAY PLAYS REINECKE — Sonata, Op 167 with pianist Phillip Moll; Concerto in D, Op 283 with the London Philharmonic Orchestra conducted by Hiroyuki Iwaki. Red Seal Digital Disc ATC1 — 4034 Stereo.

Judging by the photograph on the back of the elegant double record container of this disc, James Galway's now thoroughly exploited golden flute has begun to develop a halo. So has its richly gifted player, and in my opinion both have been well earned.

Reviews in this section are by Julian Russell (J.R.), Paul Frolich (P.F.), Neville Williams (W.N.W.), ... Simpson (L.D.S.), Norman Marks (N.J.M.), Greg Swain (G.S.), and Danny Hooper (D.H.).

The instrument is a beautiful piece of craftsmanship and, if Galway is not today's finest flute player, who is? But will the present day deluge of exploitation of his gifts end up by cheapening him? I doubt it because, beneath all his virtuosity, is a serious musician of genuine worth.

In a search for novelty he offers here a recital of music by Reinecke. Who the devil is Reinecke, you may well ask? The information is conveyed by Phillip Moll's copious annotations of the tiresome parsing and analysis type. Moll also provides the piano part in the performance of the Sonata.

Till now, Reinecke (1824-1910) has meant nothing more than a name to me, despite his vast output as a composer of the German Romantic School and considerable activity as a pianist, violinist, teacher and conductor of the famous Leipzig Gewandhaus Orchestra. (The "famous" applies to the Gewandhaus, not the orchestra!)

In the two of his works under review, he reveals himself as a composer of a few good ideas lenghthily treated. The music is very much in the Romantic style and he obviously knew how to provide virtuosos with good material presented here by Galway with his usual dazzling facility and good taste.

Unfortunately, no one apparently told Reinecke when to stop, and not even Galway's towering talent of personality and talent can prevent an occasional yawn. Now and again a really fine idea will win back interest with a jerk but, alas, not for long.

At the best, you are left with adding an ever growing respect to your already vast admiration of Galway — Jimmy to his friends. Reinecke seems doomed to be as completely forgotten as Josef Holbrooke. Who nowadays remembers the latter's operatic trilogy, The Children of Don?

The Sonata has the sub-title Undine (the spirit of the fountain) and it runs along fluidly under the expert hands of both players. In the Concerto, Galway is ably supported by the London Philharmonic under Hiroyuki Iwaki.

Please don't let what I've written above put you off indulging yourself if you're in the mood for a seance of pleasantly relaxing, if not exciting enjoyment. The sound is good, clear, cool digital. And, of course Galway's playing is, as usual, peerless. It should also be a must for all flautists. (J.R.)

INAUGURAL RECITALS

SYDNEY OPERA HOUSE CONCERT HALL GRAND ORGAN. Inaugural season, various organists. From Move Records, Box 266, Carlton South, Vic 3053.

The Grand Organ in the Opera House Concert Hall is now so much an accepted part of the Sydney music scene that it comes almost as a surprise to realise that it is only three years ago that we were speculating as to how the much debated instrument would sound.

In fact, the eight tracks on this disc were some of the items that provided Sydneysiders with reassuring, if early, answers. They were part of the inaugural season in June, 1979, recorded by the Australian Broadcasting Commission, on behalf of the Sydney Opera House Trust and now released through Move records.

The album comes in a well presented double-fold jacket, with pictures of the Opera House, organ, and its designer, Ron Sharp. There is a stop list and a brief summary of the instrument, adapted from an article in this magazine, prepared by its then Editor, Jamieson Rowe.

In fact, it would make an excellent presentation album for friends overseas who may be organ buffs.

The eight tracks, with a total playing time of about 44 minutes provide a variety of sound and style. They are listed briefly, preceded in each case by the name of the organist: Christa Rumsey: Grand Choeur (Dubois); Christa Rumsey: Passacaglia in D minor (Kerll); William Pierce: Canon in B minor (Schumann); Douglas Lawrence: Noel, Cette Journee (Lebeque); Christa Rumsey: Trumpet Voluntary (Bennett); Robert Ampt: Prelude for Christmas Time (Schiedermayer); Robert Ampt: Six Pieces for Mechanical Clock (Haydn); Donald Hollier: Prelude and Fugue on BACH (Liszt).

Brief notes identify the organists and their music. For added interest, a number of clipping reprints have been included from newspapers of the day, reporting on the inaugural concert.

The recording itself gives a good account of the organ from the tiny, distant sounds to the full weight of the bass pipes. The surface is not without a few stray clicks but they are not such as to detract from the enjoyment of an historic and interesting recording. Well worth a hearing. (W.N.W.)

☆ ☆ ☆

PHASES OF THE MOON — Traditional Chinese music and composed pieces played by Chinese musicians on traditional instruments. Recorded in China in stereo for CBS Masterworks. SBR236040.

Don't buy this charming record of Chinese music expecting to hear sound like that on the first discs of Chinese operas on old-time shellacs — with their piercingly nasal voices and strange percussion. Rather, you are in for a surprise at the Western influence that makes most of it sound very tonic.

Yet there is still something recognisably Chinese about it; as Chinese as the exquisite paintings on each side of the cover. This sound, I think, is due to the unusual timbre of the instruments used rather than what they play. They are all traditional and as expertly played as they probably were by their makers in the distant past.

"... plenty of surprises on this exquisitely presented disc."

Yet, unusual as these instruments are, and sometimes few in number, they can, in some combinations, swell in volume almost to symphonic proportions. Their suggestion of Westernisation comes from insistence on the melodic line, not always modal, rather than harmonic accompaniment so important in our own music.

Although there has been a growing interest in Asian music during this century, I am convinced their music and ours is irreconcilable in style and technique. I base this opinion on the disc made a few years ago by the famous sitar player, Ravi Shankar, and equally famous violinist Yehudi Menuhin, whose broad mind always responds generously to experimentation.

The essence of Shankar's playing of Indian music is his genius for extemporisation. On this disc, he would play a typical Indian phrase to which Menuhin would reply with a few bars on his violin, in which he tried to imitate Shankar's style — with lamentable lack of success. The absence of rapport between the two styles was instantly apparent with the usually nimble-minded Menuhin struggling after Shankar like a brewery horse after a racer.

Yet despite the overall tonality of the music on the record under review, in what could be our modern manner, you will still find plenty of surprises on this exquisitely presented disc recorded by the China Record Company for CBS.

The exercise was designed and executed by Earl Price who, in his really informative annotations, warns us against

MORTON GOULD:

"Don't be afraid of a forte"

SHOSTAKOVICH — Festive Overture; RAVEL — Bolero; GINASTERA — Estancia Ballet Suite; WEINBERGER — Polka and Fugue from "Schwanda". Morton Gould conducting the London Symphony Orchestra. Digital stereo, Chalfont SDG-301. From P. C. Stereo, PO Box 272, Mt Gravatt, Qld. Phone (07) 343 1612.

In the February issue, we published an interview with Morton Gould, in which he referred to recording with the London Symphony Orchestra, using digital equipment. He remarked:

"I had to first tell the percussion players to play out; not be afraid of a sforzando or a forte. At first they looked at me as if I had two heads."

I would judge that this is one of the recordings referred to, the more so because it carries the same action picture of Morton Gould as made available with the interview.

There is plenty of sonic action in the Festive Overture (5':53") but it is in the much longer Bolero (16':32") that Morton Gould encourages the musicians to let go. The level builds all the way, with no sign of a self-concious plateau anywhere. With the amplifier set for the merest whisper of sound at the first notes (how fortunate!) both channels were topping 50W at the end.

The "Estancia" ballet suite (11':57") is a mix of gentle flute sound and boisterous full orchestra, with a strong South American flavour.

And, finally, the "Polka and Fugue from "Schwanda" (8':23") really fills the grooves with sound expecially, as here, with the assistance of the grand organ, called for in the score.

Jacket notes on the music are provided by Malcolm Walker, Editor of "Gramophone" magazine.

Technically, the recording is well up to standard but its attraction for the individual will really depend on their attitude to "Bolero", which occupies more than a third of the playing time. If you have a good version of the work — and there are enough of them around, goodness knows — then the attraction of owning another one may not be all that urgent. But, if you want a good one, this one will fill the bill and bring with it three other shorter but interesting items. (W.N.W.)

---

being deceived into thinking that there is lack of authenticity because an occasional phrase reminds you of something solidly Western.

He writes: "China is a huge country with a complex history and it includes national minorities with strong cultural identities. Surprising variations in musical ideas are natural." He goes on at length to explain the phenomenon of a sound you thought you heard before because of the geographical closeness of one nation's music which influences the Chinese neighbour's mind.

As the title suggests, most of the pieces are nocturnal in character although not all are by any means "murmured" for that reason. All I can say is that the items were so sagely chosen by Price as to present much variety while preserving a general identity. Strongly recommended as a novelty, for its charm. (J.R.)

☆ ☆ ☆

AUSTRALIA AND ALL THAT JAZZ, Vol 1 and 2 Cherry Pie L 70197/8. Festival release.

When these records were originally released some time ago, they created quite a deal of interest with their fresh, innovative approach to portraying a musical picture of the unique Australian wildlife and landscape. Eleven years later, in the case of Volume 1, the music of John Sangster is still as fresh and exciting as the countryside it describes.

The list of musicians reads like a Who's Who of Australian Jazz, with names like, Errol Buddle, Don Burrows, George Golla, Tony Buchanan, Graeme Lyall, Derek Fairbrass, Ed Gaston, Terry Walker, Greg Lyon and D'Arcey Wright, who is also well known as a composer of percussion.

There is a subtle blending of bush sounds, recorded by Howard Hughes of The Sydney Museum, with the work of the musicians, that gives a finish to the music.

There is a total of 22 tracks to enjoy, with such titles as: First Light — The Birds — Possum —.Man The Destroyer — The Desert — Rain — The Knob-Tailed Gecko — Bush Walk With Curlew — Mini Mouse — Two Wombats — Maxi-Mouse.

The cover photography by Howard Hughes is the best I've seen on an album cover for a long time, with its scenes of wild life and the great outdoors.

Festival have remastered this album with the half speed process, where the master tape and the recording lathe are run at half speed to diminish various problems inherent in the recording process. The result is enhanced dynamic and frequency range, as well as reduced distortion. If the music is new to you, you'll enjoy it. But there will be many people, with the originals somewhat worn, who will find this release worth-while purchasing. (N.J.M.)

☆ ☆ ☆

ROBERT AND ELIZABETH. Original cast recording with Keith Michelle, John Clements and June Bronhill. Stereo, World Record Club R-09096.

From the portraits of the Principals on the cover, this had to be a fairly old recording and, sure enough, inspection of the small print on the label yielded the information "Copyright 1964". Relative to that date, the jacket notes refer to the "new musical" with lyrics by Ronald Millar and music by Ron Grainer.

In fact, the musical is based on the theatrical production the "The Barretts of Wimpole Street" which, in turn, explores the romance between the two poets Robert Browning and Elizabeth Barrett.

On this album — an original cast recording — there are 18 tracks which, helpfully, appear to follow the story line from overture to finale. The jacket notes take advantage of this by explaining the sequence of events and setting the scene for each number.

The tracks, involving various solos, duets and group numbers include such titles as: The World Outside — Moon In My Pocket — I Said Love — The Real Thing — You Only To Love Me — I Know Now — Soliloquy — Pass The Eau de Cologne — I'm The Master Here — Escape Me Never — Hate Me, Please — The Girls That Boys Dream About — Woman And Man — Frustration.

Despite the age of the recording, the sound quality is entirely acceptable and therefore of potential enjoyment to anyone with an interest in the original cast recording of the musical, or in the principals themselves. (W.N.W.)

☆ ☆ ☆

THE BEAUTIFUL MUSIC COLLECTION. The Stardust Orchestra, conducted by Alyn Ainsworth. Stereo, Stardust SRLP-1001. Distributed by RCA.

If you like melodic middle-of-the-road sound, as broadcast by "Beautiful Music" radio, then you'll almost certainly enjoy this "Beautiful Music" album. With 10 orchestral tracks on each side, it plays for about an hour, providing a background which will not intrude into other activities.

Here are the tracks on side one, by way of a guide: To Love The Lord — Theme

A.C.E. RADIO

136 VICTORIA RD, MARRICKVILLE, NSW 2204
PHONE 51 3845

PROUD TO BE AUSTRALIAN

ELECTRONICS CENTRE

BARGAIN PRICES ● PERSONAL ATTENTION ● SLICK MAIL ORDER SERVICE ● SATISFACTION

BRAND NEW GUARANTEED 240 VAC 50Hz

*BELT DRIVE STEREO PLAYER

WITH MAGNETIC CARTRIDGE AND DIAMOND STYLUS

$66.

P-P NSW $4.50. Q, V, T, SA $5.50. WA, NT $6.50

Made for famous Aust Co by leading Jap manufacturer. Features — big aluminium turntable ● 2 speeds 33-45rpm ● Cue lever ● Calibrated adjustable counterweight ● Calibrated anti-skate ● Auto return-stop ● Switch click suppressor ● Power cable, RCA connectors ●
OUR BEST PRICE EVER. BE QUICK.

BSR. 240 VAC 50Hz MANUAL OPERATION STEREO RECORD PLAYER

LATEST DESIGN MODEL P-207 ● S SHAPE TONE ARM WITH COUNTERWEIGHT ● CERAMIC CARTRIDGE — DIAMOND STYLUS ● AUTO RETURN AND STOP ● 33-45 RPM ● PLAYS 7", 10" 12" RECORDS ● CUT-OUT TEMPLATE, INSTRUCTIONS ●

$39.95 P-P NSW $4.50. Q, V, T, SA $5.50. WA, NT $6.50

PASSIVE RADIATOR HI FI SPEAKER SYSTEM.

½ PRICE SCOOP

Excellent frequency response from the 8 ohm 10W RMS (8") woofer and tweeter with cross-over ● modern styling sturdy walnut cabinet ● 445H 280 W 178 DMM

Pack and Post NSW $2.75
V. Q. SA. T $3.75
WA. NT. $5.50

● LIMITED STOCK ●

$69.95 Pair

● AWA CARPHONE ● TRANSCEIVER

76MHz 3 CHANNEL ● LOW BAND ● FM ●
6 12 VDC SOLID STATE POWER SUPPLY ● (INBUILT)
22 MINI TUBES, 7 AND 9 PIN, PLUS TYPE 6146 IN FINAL ●
N.B. CRYSTALS ARE NOT SUPPLIED, NOR ARE THE SETS AIR TESTED ● INTERCONNECTING CABLE AND CABINET IS SUPPLIED ● CONVERSION TO 6 METRE BAND IS EASY ● DATA AVAILABLE ● WE GUARANTEE THE SETS TO BE COMPLETE AND IN EXCELLENT CONDITION ●

EX AMBULANCE **$35** P-P NSW $4.50. V. Q. SA. T. $7.50. WA. NT. $11.50.

STC ● 20 BRAND NEW LEVER SWITCHES ●

On slim line panel 40 x 500mm for 19in rack mounting.
PROFESSIONAL QUALITY GEAR
IDEAL FOR AUDIO CONSOLE, MODEL TRAINS, ETC.

$17.95

ALSO — 24 WAY JACK FIELD
FOR 6.5MM PHONE PLUGS — ON SLIM LINE PANEL FOR RACK MT

$25 P-P NSW $3.50 INTERSTATE $4.50

555 TIMERS

10 FOR $2.50 P-P 80c

* SUPER SCOOP *

$28 OR $49
EACH. PAIR.

PIONEER Hi - Fi SPEAKER SYSTEM.

35 WATTS MAX. 25 WATTS NOM. 8 OHMS.
MODEL A20-EP 70-01F. EXTENDED FREQUENCY RANGE. LATEST DESIGN SATIN SILVER VINYL COVERED CABINET 48H.28W. 19D. CM
P-P NSW $4. V. Q. SA. T. $5. WA. NT. $7.50.

240/250V 150W

FLOODLIGHT

PAR 38 SEALED BEAM REFLECTOR LAMP
NORMAL PRICE $6-$7

$3.75 P-P 75c

GENUINE FACTORY PRICES ETONE 12" SPEAKER SPECIALS

GUARANTEED TOP QUALITY BRAND NEW BARGAINS
Rugged diecast frame. 8 and 15 ohms available
12" Woofer. 30 watts RMS. Reson 65Hz freq 50-8000Hz

$26.50 each **OR** 2 for **$46.50.** P-P for 1 NSW $2 Interstate $3

12" Twin Cone 30WRMS. Reson 65Hz Freq 50-15,000Hz

$27.50 each **OR** 2 for **$48.** P-P for 2 NSW $3. Interstate $4

EXTRA SPECIAL — LAST OFFER

12" 60 WATT RMS. 8 OHM Hi-Fi WOOFER.
HEAVYDUTY DIECAST FRAME. FOAM SURROUND. FREQ 30-4000Hz. RESON. 30Hz.

$32.95 EACH. **OR 2** FOR **$59.75** P-POST AS ABOVE.

Red Rotating Distress Beacon
For car, boat, Disco. 12VDC 2A
$9.95 P-P 75c.

EX — AWA CHASSIS. COVER

AND DETACHABLE CRADLE.
HEAVY DUTY ALUMINIUM
PROFESSIONAL FINISH
SIZE OA 145 W 110 D 90 H. MM
CHASSIS SIZE 145 W 110 D. 33 H MM

$4.50 P-P $1.50

MINI MOTORS.

1½-3VDC
SIZE 34x24MM
SHAFT 1.5x8MM

4 FOR $6. P-P 75c.
$1.75 EACH.

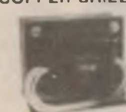
ETONE

100W 2" DOME MID — RANGE.
FREQ. RESPON. 1000-10,000 Hz 89dB PER WATT/METRE. WITH L.C.XOVER. 1200 Hz. 12dB. WITH 4.7 UF CAP. XOVER 2400 Hz MAGNET DIA 120MM

$14.95 P-P NSW $2.50. INTERSTATE $4.50.

● POWER TRANSFORMER SALE ● 50% OFF ● BRAND NEW AKAI SPARES ●

A1 PROFESSIONAL QUALITY ● MULTI-TAPPED PRIMARY, 100V THROU 240 VAC 50HZ ● COVER PLATES ● 90% HAVE COPPER SHIELD ●



GROUP A

AS1080	19VCT 3A 34VCT 3A 0-32 64 70V 3A 5V 3A
AA1050T	34VCT 2.5A 40VCT 2.5A 14V2A
AA920T	20VCT 3A 0 44V2A 6.3V2A
AA5510T-1	0-40V3A 6.3V3A
AM2800	42VCT 3A 0-44V3A 8V1A
AM2600T-1	36VCT 2A 0-42V2A 8V1A
AA5810	39VCT 2A 34VCT 2A 6.3V2A

GROUP B.

AM2200	24VCT 2A
MRT 3	18.5VCT 1.5A 31VCT 1.5A 6.3V2A
AS960T1	0-30V2A. 0 36V2A 6.3V2A
AS970	0 15V2A 0 30V2A 0 44V2A 8V1A
AS960	0-34V2A 0 38V2A 6.3V2A
AA910	32VCT2A 8V1A
AA940T	0-34, 70, 76V1A 0-42V2A 0-6.3V, 8V1A
CCVT1	0 15.5V 2A 0-17V 2A
AA6600	33VCT2A 0-48V1A 7.6V1A
AM5800	30VCT2A 0 33V2A 6.3V1A
35900081	18VCT2A 6.3V2A
AA6100T	14VCT2A 26V1A 5.6V1A
10RT1	16VCT2A 29VCT1A 5.4VIA
AA8030	21VCT2A 8V1A

GROUP C.

LET-1	29VCT1A 6V1A
LST 1	0-17.5V2A
BST 1	0 25V 1.5A 6.3V2A
CST 1	0 23V 1.5A 6.31A
PXT 3	0 19.5V1.5A 17.5V1.5A
AA8000	0-12.5V2A 21.5V2A 0 60V1A 6.3V1A
AA8500	0-13V2A 0-23V1A 0 57V1A 6.6V1A
AA810	30VCT 1.5A 8V1A
AA5500	0 24V2A 0 44V1A 6.3V1A
AA5200	0-26V 1.5A 0-36V1.5A 6.3 V1A
AA5210	0 36V1.5A 0 40V 1.5A 7V1A
TC2	30VCT 12A 15VCT 1.4A 0-28V1A 6.3V 4A
AA8100	0 15V1A 0 24V1A 0-33V1A 6.3V1A
CA5	0-56TAP 52V1A 0-30V1A 6.3V1A

GROUP D

EZ1	26VCT 5A 0 14V.5A 6.3V1A
LFT1	29VCT 1A 0 21V1A 5.5V1A
LET18	31VCT 5A 6.2V1A
RST 1	29VCT1A 0 23V 5A 5.5V1A
RCT 2	19VCT 85A 0-33V 15A 6.3V 5A
RDT3	23VCT1A
RST 2	27.5VCT1A 5.4V1A
CDT 3	32VCT1A 6.3V1A
MCT 1	21VCT 5A 30VCT 5A 6.3V1A
MRT 1	29VCT 1A 5.6V1A
BST 2	27.5VCT1A 6V 5A
RP401C	0 54V 5A 0 9V1A 8V1A
RDT1	0-53V 5A 2 X 9V1A
AA1010	0 38 52 75V 75A
CGT 3A	0 25V1A 6.3V1A
CBT 1	0 105V 1A 30V1A 5.6V1A
AAT 1	0-17V1A 6.3V1A
EDT5	0 22V1A 6.3V1A
CGT 1T	0 23V.5A 43V.5A 6.3V1A
CZ10	0 26V1A 6.3V1A

GROUP E.

AT2200	0-9, 28 50V.5A
AT2600T	0 25, 34, 50V 5A
CGT40	0 25V 5A 6.8V1A
PT269	0 13.5V1A 0-9, 22V 5A
MUT5	0 28V1A
CWT2	0 25V1A 6.3V1A
CWT3	0 26.5V1A 6.3V1A
CIT 1	0 90V 25A 30V 5A 7.5V1A
TS1600	0 21V 5A 6.8V1A
MUT 1	0 29.5V1A 5.6V1A
CPT10	0 28.5V.5A 5.8V1A
EGT3	0 23V.5A 6.2V1A
CA 1	0 31V.5A 6.2V1A
EGT 4	0 24V1A 6.3VIA
CWT 1	0 26V 5A 110V 1A, 6V 5A
CJS 2	0-17, 0-19, 0-24V 5A 6.3V.5A
CDT 2	30VCT 25A
EZT 11	0 7V 0 11.5V 0 19.5V 5A
EZT 16	0 6.3V 0 25V, 0 36V 5A
TDT 4	0 5.2V 0 25V 5A 8V1A

PRICES GROUP

A. $19.95 P-P NSW. $4. V. Q. SA. T. $4.50 WA. NT. $5.

B. $12.95 P-P NSW. $3.50 V. Q. SA. T. $4. WA. NT. $4.50

C. $8.95 P-P NSW. $2.50 V. Q. SA. T. $3. WA. NT. $3.50

D. $6.50 P-P NSW. $2. V. Q. SA. T. $2.50 WA. NT. $3.

E. $4.00 P-P NSW. $1.50 V. Q. SA. T. $2. WA. NT. $2.50

JAMES VINCENT. Enter In. Sparrow SPR 1032 [From Spotlight Music, 262 Pitt St, Sydney. Phone (02) 264 7922]

James Vincent has a very direct jazz vocal style that suits the lyrics and the music of this interesting album.

All told, there are 10 titles: You'll Be Right There — Don't Trust Your Feelings — In You I'm Free — Take My Life — Spiritual Israel — Make A Joyful Noise — Come Follow Me — Enter In — What's Goin' On? — Walkin' In The Light.

In fact, some of the words have been derived from old time hymns that will be familiar to anyone who reads the lyrics on the sleeve; the others leave no doubt as to their Scriptural origin.

The vocal backing group includes James Vincent's wife and son, together with Michael and Tamara Conlan. Instrumental backing comprises Bob Wilson on drums, Kenny Wilde on bass, Pat Murphy on percussion and John Rosasco on keyboards, the overall quality being excellent.

James Vincent's somewhat unusual vocal style certainly provides a welcome change from some of the more commercial sounding Gospel singers that abound today. (N.J.M.)

☆ ☆ ☆

THE PAINTER. John Michael Talbot and Terry Talbot. Sparrow Records SPR 1037. [From Spotlight Music, 262 Pitt St, Sydney. Phone (02) 264 7922]

I was delighted to receive this record from the Talbot brothers for review, their work being much in demand for its fresh approach and Scriptural directness. Indeed, each track is almost a prayer.

The backing from the London Chamber Orchestra is unobtrusive, but it achieves just the right balance except, of course, where the singers are unaccompanied, as in "Create In Me A Clean Heart".

Other tracks are: The Mystery — Jesus Has Come — The Empty Canvas Greeting — Wonderful Counsellor — Advent Suite — Behold Now The Kingdom — Paint My Life.

The voices of the brothers are different but they complement each other with excellent harmony throughout, imparting real meaning to the lyrics, as printed on a sheet inside the sleeve.

The quality throughout is excellent making this an album to enjoy and think about on many occasions. I hope we can hear more of the musical skills of these brothers. (N.J.M.)

"Beautiful Music" — continued

From M*A*S*H — Crying — Cavatina — Fantasy — Do That To Me One More Time — Sailing — After The Love Has Gone — Waterfalls — You've Lost That Lovin' Feeling.

As you might imagine, with that many tracks on each side, there's not much room for fancy dynamics but it's not that kind of record anyway. Otherwise, the sound is quite pleasant and well balanced. (W.N.W.)

Third article in our series

How to program in machine language

The third article in our series on programming the DREAM 6800 in machine language looks in more detail at the uses of the Index register and stack pointer, explains what subroutines are all about and examines interrupts (no, we don't mean meal-times or noisy neighbours).

by TONY HAIG

In the previous two articles on MC6800 machine language programming, we looked at the Index and Stack Pointer registers only very briefly; noting only the instructions used to compare, load or store these two 16-bit registers. However they perform much more useful tasks than simple 16-bit data storage – few machine language programs cannot be shortened or made faster with intelligent use of these registers and the powerful computing techniques associated with them.

Recall from last month the programming trick of altering the program while it was running by storing new program bytes or adding to the old ones. This is usually used on the operands of extended addressing mode instructions, and is particularly useful in changing long repetitive program sections into short loops which are repeated many times. (This was illustrated in last month's sample program where a short three byte instruction loop was able to clear the entire 256 byte display buffer.) However the technique has its drawbacks, most noticably that it cannot be used in any ROM devices, since their important function is that they cannot be altered once programmed. Thus someone with a program in ROM would have to use 256 instructions to clear a section of 256 bytes of RAM if only extended or direct addressing instructions were available. Similarly it would take long programs to transfer "bulk" data (a large number of bytes devoted only to data) to a new set of locations, or to search through bulk data for a specific value. What is required then is some way to vary the address of memory operations without having to alter any operands as the program is running. This can be done through the operations associated with the Index and Stack registers.

First we'll look at how indexed addressing mode instructions use the Index register. The Index register is 16 bits long and since each memory address is also 16 bits long, the value in the Index can be considered as storing a memory address. Indexed addressing mode instructions all have one operand, which is an unsigned offset (remember that the Relative mode offsets were signed) which is added to the value in the Index to give the required memory address used by the instruction. For instance if the Index register has 0300 (hex) in it and a LDAA instruction is performed in Indexed mode with an offset of 9E, then Acc A will be loaded from memory address 039E. (Note that the new address is not put back into the Index register, so the Index remains unaltered by indexed addressing mode instructions.)

Indexed addressing mode mnemonics are usually written like LDAA 30,X or CMPB 27,X (the number before the comma is the offset), to distinguish them from Immediate or Direct mode instructions like LDAA#30, LDAA$30, CMPB#27, CMPB$27. All 40 of the instructions available in extended mode are also available in indexed mode. The simplest use of indexed addressing is as an abbreviation of Extended instructions since each indexed instruction is a byte shorter than the corresponding extended instruction. However since it takes three bytes to set the Index to a specific value, only if the memory location is accessed more than three times can program length be reduced. This saving is increased if there are other data locations nearby.

As an example, see Fig. 1 (which is part of the CHIPOS program in the DREAM 6800 EPROM) in which the use of the index has shortened the program by a byte. Saving a few bytes might not seem like much, but if the memory locations are involved in ten or twenty operations, the saving is more substantial. When the memory space is limited and the program becomes long, any shortening can be helpful.

The Index can also be used to create a scratchpad in any 256 bytes of available memory rather than just 000-00FF as in Direct addressing, simply by making the Index equal to the lowest memory address in the scratchpad. (For instance, if the Index equals 0300 then memory locations 0300-0400 can be referred to by the two-byte Indexed operations.)

C287	C6F0	LDAB#F0
C287	CE 8010	LDX#8010
C28C	6F 01	CLR 01,X
C28E	E7 00	STAB 00,X
C290	C6 06	LDAB#06
C292	F7 01	STAB 01,X
C294	6F 00	CLR 00,X

Fig. 1

0080	CE0100	LDX#0100
0083	6FEE	CLR 00,X
0085	08	INX
0086	8C0200	CMPX#0200
0089	26F8	BNE F8
0080	CE 0200	LDX#0200
0083	09	DEX
0084	6F 00	CLR 00,X
0086	8C 0100	CPX#0100
0089	26F8	BNE F8

Fig. 2

The Index is also a convenient way to address a memory location that has to be calculated (perhaps from a pair of X, Y coordinates) or to refer to one variable in a table.

INX and DEX

And now we come to the instructions that really make the Index register useful – INX and DEX. The INX instruction simply increases the Index register by one, so if originally the Index had perhaps 0369 stored, then after executing the INX instruction it would equal 036A. Note that the INX instruction does not require an operand since just the op code (08) on its own tells the computer everything it needs to know to complete the operation. This is one of the Implied addressing mode operations. They are all one byte operations and all are valid only in this addressing mode.

DEX is another Implied instruction. It orders the computer to subtract one from the Index register. (We'll look at all the other Implied instructions later in this article.) With these instructions the programmer can perform the "bulk" data manipulations discussed earlier. For instance to clear the memory from 0100-0200 either of the program fragments in Fig. 2 may be used. Although they are both three bytes longer than the method used in last month's sample program they certainly are better than having to use 256 Extended mode instructions. Fig. 3 shows some other uses for the Index Register utilising INX or DEX.

Program fragment I moves all the memory 0203-02FF to the addresses three bytes lower (0200-02FC). Fragment II searches through memory 0100-01FF for the value FF. If it finds it the Index has the address stored in it (if not found then it has 0200 stored). Fragment III slows the computer program by executing the DEX and the BNE instructions about 25,000 times. The Index register can be used in many other ways to shorten programs – sometimes drastically while sometimes only a byte is saved. It is good programming practice to use the Index even if it only saves a byte and to try and get the maximum usage out of this versatile register.

PSHA and PULA

There is a frequent need to step byte by byte through memory, incrementing the address being referenced then loading the value into an accumulator and the opposite of this, storing an accumulator in memory then decrementing the address. These two operations are provided for by the push and pull stack pointer operations. The Stack Pointer, like the Index and the Program Counter, is 16 bits long and refers to a memory address. When the computer executes a PSHA instruction it stores the value in accumulator A at the memory location specified by the Stack Pointer. Then the Stack Pointer is decremented in preparation for the next push operation and the instruction has been completed. Obviously it requires no operand so is an Implied addressing mode instruction. PULA is also an Implied instruction, and it is the exact reverse of PSHA; first the Stack Pointer is incremented then accumulator A is loaded from the memory referenced by this new Stack Pointer value. The same principle applies to the PSHB and PULB except it is accumulator B which is loaded or stored. To clarify this consider the area of the memory be referenced as a well with the data stacked in at the various heights. Data "pushed" in falls onto the top of the stack while only the top data can be "pulled" out. The height of the stack is stored in the Stack Pointer. After pushing in data the stack height is increased. Before pulling out data the Stack is first changed to indicate the lower height. This is illustrated in Fig. 5.

In Fig. 4 we see a program fragment in which the Stack Pointer is used to transfer the memory section 0300-03FF to a new set of addresses (0100-01FF). When comparing this to Fig. 3 note that in this program fragment the new location can be anywhere in memory, not just within the range of the offset.

```
0080   CE0100   LDX#0100
0083   8E02FF   LDS#02FF
0086   32       PULA
0087   A700     STAA 00,X
0089   08       INX
008A   8C0200   CPX#0200
008D   26F7     BNE
I

0240   CE0100   LDX#0100
0243   86FF     LDA#FF
0245   A100     CMPA 00,X
0247   2706     BEQ 06
0249   08       INX
024A   8C 0200  CMPX#0200
024D   26F6     BNE F6
II

0292   CE61A8   LDX#61A8
0294   09       DEX
0295   26FD     BNE FD
III
```

Fig. 3

```
0080   CE0200   LDX#0203
0083   A600     LDAA 03,X
0085   A703     STAA 00,X
0087   08       INX
0088   8C0300   CMPX#0300
008B   26F6     BNE F6
```

Fig. 4

Fig. 1 (far left, top) illustrates the use of the Index register (X) to shorten programs. Fig. 2 shows two methods of clearing memory, using INX and DEX. Fig. 3 has three program segments using the Index register. I moves the contents of memory 0203-02FF. II searches a block of memory for a match to the character stored in A. III is a time delay loop, counting down from the value originally stored in X. Fig. 4 is a segment of a program which transfers the data at 0300-03FF to 0100-01FF using the Index and Stack pointers.

Subroutines

Anyone with programming experience has discovered subroutines. A subroutine is basically a section of a program that would normally be repeated a number of times during the program. To reduce program length this subroutine is separated from the main program, then when the program needs to perform the particular section it executes a jump to subroutine (JSR) instruction. This instruction makes the computer jump to the first op code in the subroutine, execute the whole subroutine, then return to the instruction immediately after the JSR instruction. The main program must be able to "call" a number of subroutines, or subroutines call other subroutines (which may then call others – this is called subroutine nesting). Nesting of four, five or six levels is not unusual. A subroutine may even call itself (this is known as a recursive subroutine).

Obviously the computer needs some way to keep track of the address it will return to in the main program or in the various levels of subroutine. There are a number of ways this can, and has, been implemented (can you think of a few possibilities?). The MC6800 uses the commonest, and probably best method, storing the addresses on the stack. When the computer executes a JSR instruction it pushes onto the top of the stack the two bytes of the Program Counter (which will have the address of the next op code to be performed. It then loads the PC with the address of the first subroutine op code, then continues from that new address. Each subroutine must be terminated by an end-of-subroutine instruction. (How else could the microprocessor know it had finished executing the subroutine?) which is usually called return from subroutine (RTS). When the microprocessor encounters this RTS instruction it simply pulls two bytes off the top of the stack and puts it back into the Program Counter. Since the last values dropped onto the stack were the address of the op code after the last JSR instruction, the effect of the RTS instruction is to start the microprocessor off from the address after the JSR instruction. Now provided

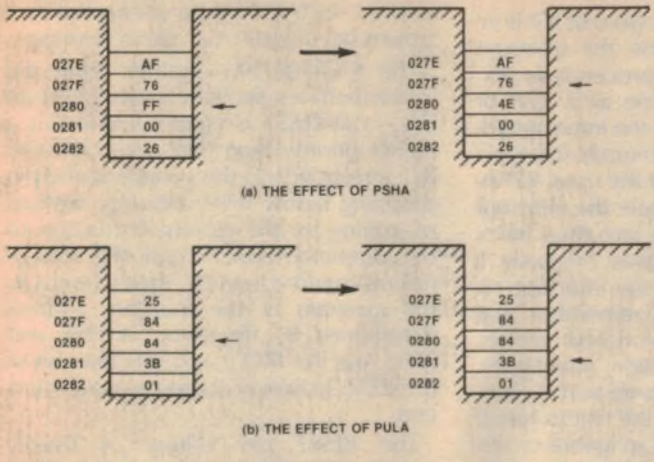


Fig. 5 illustrates the use of the stack. In (a), 4E is pushed.

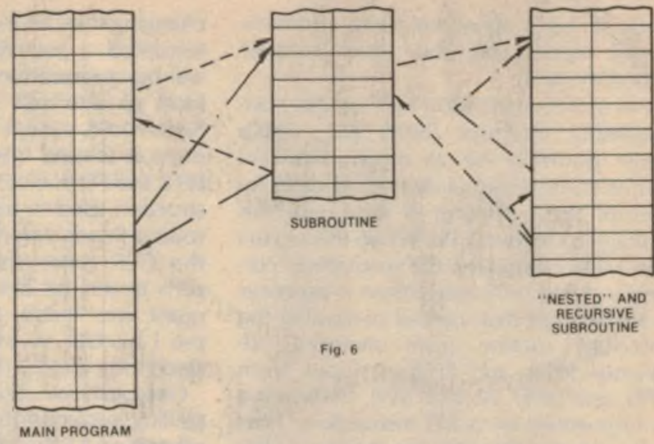


Fig. 6 Nested and recursive subroutines.

that the value of the Stack Pointer or top few values of the stack are not tampered with by the subroutine, then this system will correctly keep a track of almost any number of subroutine levels and recursions (see Fig. 6).

Note that it is "legal" to use the stack during a subroutine but the stack must be in its original condition before another JSR or the RTS instruction is performed. Similarly, if the stack is being used for the bulk memory operations (as discussed earlier) the programmer must avoid corrupting his data with return addresses if he calls a subroutine in the middle of his bulk memory handling.

It turns out that in machine code programming the use of the subroutine is very important, much more important than in some high level languages; in fact often machine language programs become a set of interlocking subroutines linked together by a main program. In the DREAM 6800 the CHIPOS monitor and CHIP-8 interpreter are written in this way. The subroutines used are accessible by using standard JSR instructions. An adequate description of the 24 CHIPOS subroutines has already been published, detailing the functions and start addresses, so there is little point further elaborating or reprinting this work. Also note that the return from subroutine operation (RTS) is only meaningful in implied addressing mode since it requires no operand; the JSR instruction does however require operand/s to provide it with the address to jump to. The JSR operation is meaningful in extended, indexed and relative addressing modes. (The relative JSR instruction is usually called BSR – branch to subroutine). For instance the instruction JSR$C079 (BDC079) causes the subroutine at C079 to be executed (in the DREAM this happens to be the subroutine that erases the screen buffer). If the index has 0200 stored in it, then the instruction JSR C4,X (ADC4) will cause the subroutine at 02C4 to be executed.

Interrupts

The stack is also used to handle interrupt routines in a similar manner to subroutines. An interrupt occurs when the microprocessor is stopped by an interrupt signal. It then "drops" everything, performs an "interrupt routine", and then returns to the next instruction after the last is completed and continues right on as if nothing had happened. In fact when it restarts again it must have exactly the same values in all its registers as before it was interrupted. To make sure of this all the registers are pushed onto the stack, except for the Stack Pointer itself (it is pointless to store the Stack Pointer on the stack). Then when the interrupt routine is terminated by a return from interrupt instruction (RTI) the computer can load all the registers from off the stack top. Thus all registers return to their original state (including the Stack Pointer, since as many bytes were pushed onto the stack as were pulled off). The first interrupt signal we'll look at is generated by the op code 3F; this is a software interrupt (SWI). When the microprocessor comes across this implied addressing mode instruction it pushes the registers onto the stack, then jumps to the interrupt routine. However, instead of jumping to a location specified by operand/s, it loads the value of memory locations FFFA and FFFB, and then jumps to that location, which is assumed to have the desired interrupt routine starting address. For instance in the DREAM 6800 if the computer reads FFFA and FFFB it will always find 00 and 80 (two values stored in EPROM). So whenever the DREAM software interrupt is encountered the program jumps to the address 0080. If the memory locations had been in RAM then this could have been made to change during the program.

We can see a functional similarity between the JSR and SWI instructions in that they both order the microprocessor to execute a routine then return to the main program at the next instruction, and they both use the stack as a temporary store of register/s. However they differ in the method of obtaining the starting address of the routine to be performed and in the total number of registers pushed onto the stack. The SWI instruction is generally not widely used; its main use in programs is as a response to some sort of error condition, where the computer jumps to an error handling routine. It also can be used at the debugging level as a breakpoint in the program which jumps to a debugging routine, or it can be used to simulate a hardware interrupt.

Hardware interrupts are more important than the software interrupt. Consider a computer system which has two MC6800 MPUs working side by side. One may wish to communicate with the other at irregular intervals, perhaps up to ten hours between such transfers of information. This could be achieved by the second computer performing a subroutine every few hundred instructions to check if the other has some information. This is very inefficient in terms of computer time and program length, and the first MPU will not always get immediate attention. What would be helpful in a situation like this is for the first MPU to "interrupt" the second MPU, force it to accept the information and then let it process the information, or respond, etc, then allow the second MPU to continue from where it was interrupted. This is very similar to SWI, except the interrupt signal is not the op code 3F, but a signal put out by some external device (in this case another MC6800 MPU).

Pin 6 of the MC6800 MPU is the non-maskable interrupt (NMI) pin, which must normally be at more than 2V. When some external device needs to interrupt the computer it must pull this voltage to below 0.1V. When this occurs the MPU completes the instruction currently being performed then it executes a SWI except that instead of loading the interrupt routine from memory addresses FFFA and FFFB, it loads from FFFC and FFFD. As with SWI, the routine is terminated by a RTI instruction. Thus we have the situation we desired – being able to stop the MPU, make it perform a routine, then when the routine has been completed the program picks up where it left off. The three most common uses of the NMI are for "catastrophic" problems like power failure, an input from a human operated switch which makes the computer stop until released or restart from a new location in memory (ie, go back to start of program), or to allow one MPU to control another.

The main flaw of the NMI is that it always forces the computer to respond. In each of the above examples it is essential that it responds; however other devices which we might like to connect into the system could sometimes be ignored. Many microcomputers incorporate a "heartbeat". Part of the system regularly interrupts the MPU; this occurs in the DREAM 6800, for example, every 20ms. The idea of the heartbeat is it greatly simplifies programs where accurate timing is necessary. Usually the heartbeat interrupt routine decrements a register or data location so it only takes the computer 30 to 50 μs. However, since many programs would not require the heart beat it would be helpful if we could sometimes ignore this signal. Also note the problem that an external device might interrupt the MPU a second time before it has finished the first routine, which could produce errors.

To overcome these problems a second interrupt signal is provided for, called the maskable interrupt (abbreviated IRQ). The main difference between this and the NMI is that the MPU may choose to ignore this signal. The C, Z, N, V and H bits of the Condition Code Register have already been discussed in detail but the I bit, bit 4, hasn't yet been dealt with. It is the "interrupt mask" which determines whether the computer will ignore an IRQ request. When pin 4, the IRQ pin, of the MC6800 is lowered below 0.1V by a device the computer will ignore it if the I bit of the CCR is set. If however the I bit is zero then the computer responds by changing the I bit to one (so that if it is interrupted a second time the interrupt will be ignored) then it proceeds to perform an interrupt routine as a SWI or NMI would, except that the interrupt adress is loaded from memory locations FFF8 and FFF9. Note that the usual RTI instruction used to terminate the interrupt routine loads zero back into the I bit of the CCR, since there was originally a zero in this bit before the interrupt request was made. Also remember that the I bit has no effect on NMI signals, since they are, by definition, mandatory.

Obviously we need some sort of controlling instruction over the I bit to turn it off and on so the MPU can ignore or respond to the IRQ signals. The two instructions are CLI and SEI which clear or set respectively the interrupt bit. They obviously require no operands as the op code completely specifies the operation. (Similar implied mode operations change the other Condition Code bits – CLC and SEC clears or sets the carry bit, CLV and SEV clears or sets the overflow bit).

Most systems have a number of devices capable of interrupting the MPU. The usual method of combining these signals is to OR them together and feed the result into the required MPU pin (see Fig. 7). Note that usually the 3.3kΩ resistor is recommended but may not be necessary; it only makes sure the voltage is usually high; however the devices can easily reduce this voltage to near zero. When the computer is interrupted by a device it has no idea which device is actually requiring the interrupt. If the devices require different interrupt routines then when interrupted the MPU must first check each device until it finds which one is requesting the interrupt (a process called "polling"), then it jumps to the section of program which the interrupting device wants performed. If more than one device is requesting an interrupt of the same type, the program must also determine which device has priority.

If an NMI and an IRQ are requested simultaneously, the NMI routine is performed first as it is considered higher priority since it may be connected to a power fail device or a "panic" switch.

The MC6800 has another input pin which behaves similarly to an interrupt pin – the RESET pin (pin 40), which is a higher priority than NMI. Like NMI and INT it responds to the voltage at the pin dropping below 0.1V, although instead of waiting for the current instruction to be completed it waits until the voltage returns to more than 2V, then it jumps to the program at the memory address determined by the value at FFFE and FFFF. And like IRQ it also sets the I bit of the CCR. However there the similarities end.

The RESET pin voltage is usually lowered to initiate the system, either after power-up, or by some distraught programmer whose program has failed. It does not want to execute a routine then return to the same place in a failing or nonexistent program so there is no point pushing anything onto the Stack. So the effect of the RESET signal is to make the computer jump to a new location from which it will start running. The accumulators, Index and Stack Pointer are unaltered by this although usually they will be initialised in some way in the next few bytes of program. Note however that the RESET pin on the MC6800 is usually connected to RESET pins on other devices in the systems such as a MC6821 or MC6850, and that the RESET pulse clears the registers in these devices. A summary and comparison of the three interrupts and RESET is given in Fig. 8 the "time delay" being the time between the end of the last main program instruction and the start of the next instruction.

While on the general topic of MPU interrupts there are three other ways external devices can control the MPU. Firstly the DBE (Data Bus Enable) and TSC (Tristate Control) pins of the MC6800 make the computer "float" (virtually disconnect) the data or address lines

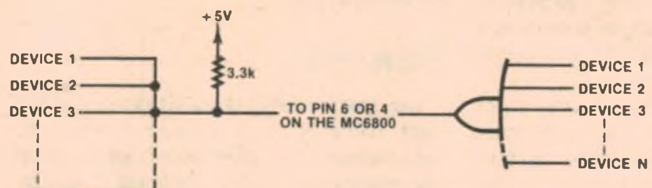


Fig. 7

Fig. 7 Two circuits for combining interrupt signals from a number of devices.

	Next Address	Pin	Priority	Sets I Mask	Time Delay
RESET	FFFE, FFFF	40	1	Yes	10μs
NMI	FFFC, FFFD	6	2	Unchanged	12μs
IRQ	FFF8, FFF9	4	3	Yes	12μs
SWI	FFFA, FFFB	–	–	Unchanged	21μs

Fig. 8 Summary of 6800 interrupt and RESET signals.

OPEN MON — SAT, 9am — 6pm

AED'S SUPERCOMPUTER

* AUTOMATIC MEMORY TESTING
* PASSWORD KEYBOARD LOCK
* KEYBOARD INTELLIGENCE
* PROGRAM DRIVEN CP/M CONSOLE COMMANDS
* UN-CORRUPTED CP/M 2.2
* SUPERFAST MEMORY MAPPED DISPLAY
* RELIABLE STATIC RAM
* 4 MHz Z80 OR 8085 & 8088 CPU's
* IEEE 696 S100 CONSTRUCTION

The most powerful S100 Turnkey Computer in the world!

CONTACT US TODAY FOR MORE INFORMATION OR A DEMONSTRATION OR CONSULTATION BY APPOINTMENT

AED MICROCOMPUTER PRODUCTS

PHONE (02) 681 4966 TELEX AA70664
130 MILITARY RD GUILDFORD, NSW

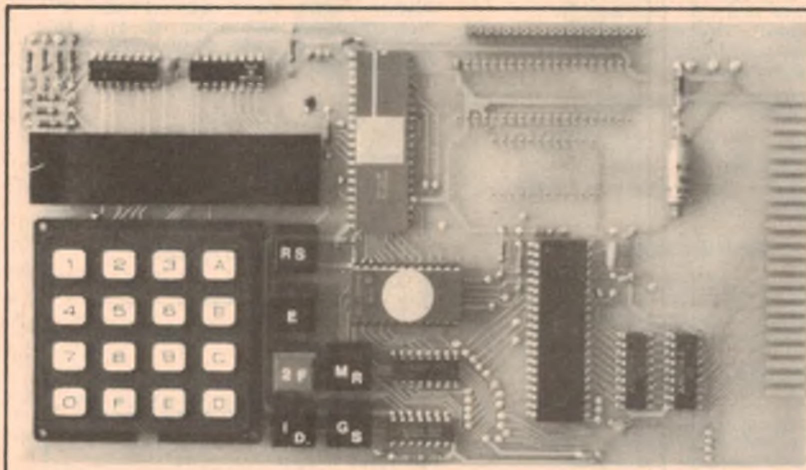
AED FOR —

— COMPLETE COMPUTERS, S100 & SORCERER
— DISK SYSTEMS
— PRINTERS & PLOTTERS
— MEMORY & ALL OTHER S100 CARDS
— KEYBOARDS, VIDEO MONITORS, CASES, POWER SUPPLIES & PARTS
— PROTOTYPING CARDS
— COMPLETE RANGE OF CP/M BASED SOFTWARE

AUSTRALIAS LARGEST SPECIALIST IN S100 PRODUCTS

BUILDING YOUR OWN SYSTEM? THEN YOU MUST SEE OUR MAGNIFICENT NEW S100 CASE, DESIGNED SPECIFICALLY TO BE MORE RIGID, ATTRACTIVE AND VERSATILE THAN ANY OF THE USA OR LOCAL ALTERNATIVES. ALSO SEE OUR ATTRACTIVE RANGE OF VIDEO AND KEYBOARD HOUSINGS AS ADVERTISED IN JANUARY ETI.

SEND NOW FOR OUR 1982 CATALOGUE
WE WELCOME DEALER AND OEM INQUIRIES



from GAMMATRON "DATUM"

the true starting point

COMPUTER KIT

for $97.00 (inc S.T.).
Postage and handling $3.00
when assembled kit.
READY TO USE

Developed by the S.A. Institute of Technology as a teaching aid for those who wish to learn about microprocessors at minimal cost. The kit uses a MC6802 microprocessor which is complete and ready to assemble with full instructions. Power source is either a reg. 5V Supply or 6V lantern battery provided by the user.

Kit includes P.C. board, all IC's and components, pre-programmed 2716 ROM, key pad.

Send SAE for further information or
send money order, cheque, Bankcard and we will post haste a kit.

For Bankcard users:

Bankcard No. ....
Expiry date ....
Name .... Signature ....

Available only from

GAMMATRON

ELECTRONIC SYSTEMS MANUFACTURERS
UNIT 1, WEEN RD, POORAKA, SA 5095
PHONE: (08) 262 6555

respectively, when raised above 2V, then pause until the voltage returns to below 0.1V. This can be done for up to 5μs and causes the program to pause in the middle of whatever instruction is being performed. This is usually only used when slower (cheaper) memory devices, which need the extra time to respond, are being used with the system.

The second method is to take the HALT pin (pin 2) below 0.1V. In this case the MPU completes the instruction being performed, then makes pin 7 (Bus Available) more than 2.4V to acknowledge the signal and indicate that it has floated all its outputs, except this pin. It remains in this state until the HALT pin returns to a voltage greater than 2V, when it continues with the next instruction. This is often used as it allows other devices (eg, a VDU or another MPU or a disk drive unit) to manipulate the memory without the MPU interfering.

Thirdly, the program can make the MPU float the address and data lines by executing a WAI instruction. This instruction is performed when the computer has nothing to do except wait for an interrupt signal to occur. So it pushes all the registers onto stack in preparation then floats all the output lines as it waits for an interrupt to occur. It is therefore in a similar state to the HALT pin being low so the external devices can then use these lines then interrupt the MPU when it has finished. This would cause the computer to execute a (short?) interrupt routine then continue from the next instruction after the WAI instruction.

Note that if the I bit of the CCR was set then a maskable interrupt cannot be used to restart the computer. Also note that the time delay of an interrupt signal is reduced to 4μs if the WAI instruction has been performed since the registers have been pushed onto the stack already. The particular importance to the machine language programmer of these external controls is their effect on timing. For instance, in the DREAM 6800 the VDU "steals" 8192μs every 19968μs and the heartbeat uses 40μs every 19968μs. This could cause programs to malfunction if not taken into consideration or turned off.

Implied addressing

Let's now return to the Implied addressing mode. As stated earlier, these operations require no operand — they are completely specified by their op code. So far we have looked at 16 implied instructions, so let's look at the other 35. Many of these simply perform on the accumulators operations previously discussed for memory only. ASLA, ASRA, CLRA, COMA, DECA, INCA, LSRA, NEGA, ROLA, RORA, and TSTA simply perform the operation of left or right shifting, clearing, complementing, decrementing, incrementing, left logical shifting, negating, left or right rotating, or testing accumulator A. Another 11 implied instructions perform the same functions on Acc B. Obviously they require no operand (what could CLRA//7E possibly mean?) and in many cases are abbreviations of immediate mode instructions (ie, CLRA is a byte shorter but has the same effect as LDAA//00, similarly compare DECB to SUBB//01).

Some of the other instructions are also fairly straightforward — ABA, adds Acc B to Acc B (result in Acc A); CBA, compares Acc B to Acc A; SBA, subtracts B from A (result in Acc A); TAB, transfers Acc A into Acc B (ie, it stores the value in Acc A in Acc B also); TBA, transfers Acc B into Acc A; DES, decrements the Stack Pointer; INS, increments the Stack Pointer; TAP, transfers Acc A into the Condition Code Register; TPA, transfers the CCR into Acc A. However the others deserve a short mention. TSX transfers the Stack Pointer into the Index Register, usually the Index will then be used to reference the value stored at the top of the stack.

However, remember that the address stored in the Stack Pointer is the address of the byte one address lower in memory it would be necessary to add one to the Index before it could be used to refer to the Stack's top. For convenience the addition of one takes place during the transfer from the Stack Pointer to the Index. Conversely the address transferred into the Stack Pointer from the Index has one subtracted from it during the TXS operation. The NOP instruction is a fairly frequently used instruction, which as its name states, performs nothing (no operation); all it does is add one to the Program Counter as it moves to the address of the next instruction, a process which takes 2μs.

Binary coded decimal

In some applications of the MC6800 it is desirable to connect the MPU into devices that use data in BCD (Binary Coded Decimal) format, such as BCD to 7-segment display chips, or BCD digital voltmeters or clocks. (Remember that in a BCD byte each 4 bit nibble represents a decimal digit. Since there are 10 decimal digits and 16 ways of arranging the nibble, the last six are undefined. Thus in BCD 82 [hex] = 82 and 64 [hex] = 64 are "legal" while AF [hex] and 2E [hex] are not.) Such applications then may call for arithmetic manipulation in BCD. Binary arithmetic will not work on BCD data. (Consider the addition of 33 to 38. In binary 33 + 38 = 6B which is an "illegal" result in BCD — not the desired BCD answer — 71.)

The machine language programmer can handle this problem in two ways — he can do all his calculations in binary and devote part of his program and computer time converting from BCD to binary and binary to BCD. Or he can wish he had instructions which would do this for him or instructions for performing BCD arithmetic. In fact this wish has partially been granted in the form of the DAA instruction. This instruction is used straight after a BCD addition has been performed with a result in ACC A, basically it corrects any illegal or incorrect results by adjusting this accumulator to the correct result. And it also sets the carry bit of the CCR if the result is greater than 99, so that in multibyte BCD addition the carry is correctly set for ADCA instructions.

To perform the DAA instruction the MPU adds 06 (hex) to Acc A if the half carry bit was set or if the low digit was illegal, and it adds 60 (hex) if the high digit was illegal or if the (full) carry bit was set. If any of these additions set the carry bit, or it was originally set, it remains set. Try a few additions yourself with pencil and paper and you'll see that this actually works for all BCD additions, although obviously you must perform this operation straight after the ADDA or ADCA or ABA instruction which adds the two BCD bytes, otherwise the carry bits might be corrupted by a subsequent operation.

The conversion turns out to be easily implemented within the MPU so it takes only 2μs to complete this instruction. However this system works only for BCD addition, other BCD arithmetic functions must be built up using a number of steps; however, in many applications, like the DREAM 6800, BCD arithmetic is not very useful. Also note that the sole use of the H bit of the CCR is in this instruction.

Now we have been through all the instructions, interrupts and addressing modes of the MC6800 MPU chip. The best way to become truly "conversant" in the 6800 machine programming language is to use it and write programs. Only through experimenting and exploring will you get really confident. If you don't feel you understand an instruction or addressing mode try writing a little program to test it out. The CHIP-8/CHIPOS EPROM in the DREAM 6800 is written entirely in machine language; try working out how it operates and see if you can rewrite sections of it. Try also rewriting last month's sample program; if you use the Index or Stack Pointer you can slash the program length by up to 30%.

OVER 6,000 SOLD!

Australia's most popular computer DICK SMITH SYSTEM 80 now even better!

New Model — New Features!

WAS $750 NOW ONLY

NEW LOW PRICE

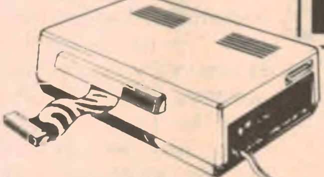
$690

All new Expansion Unit — you save!

A brand new model — now with extra value! The first row of 16K RAM is fitted as standard in this unit, with provision for an extra 16K (which gives the System 80/Expansion Unit 48K total memory). And it's $100 cheaper than the previous model! It provides as standard, a floppy disk controller capable of controlling up to 4 single density disk drives. Although the exterior of the unit is similar to the previous model, there are significant changes internally; the Centronics printer port is still standard, but the RS 232C interface and connector are now only available as an option. The S-100 motherboard has been removed, and is available as a second option for those who require S-100 expansion capability.

$100 less than previous model!

Cat. X-4020



$399

Colour Graphics

Cat. X-3275

Now you can have colour with your System 80 computer! This kit gives you 8 different colours AND it has a PAL encoded modulated RF output which allows it to be used with any standard colour TV receiver.

Only experienced hobbyists or technicians should install this kit. ***$129.00***

NEW LOW PRICES ON PRINTERS!

UNDER $500 PRINTER!

Superb dot-matrix printer that uses ordinary fan-fold sprocketed paper up to 204mm wide. Its most unusual feature is the single hammer print-head — this means very few moving parts for increased reliability. Fitted with a standard Centronics type parallel data interface making it compatible with most modern computers.

Cat. X-3252

WAS $495!

$399

DAISY WHEEL WORD PROCESSOR PRINTER

The Dick Smith Daisy Wheel printer delivers ultra sharp copy which is a definite prerequisite for word processing. It will accept standard office stationery or continuous stationery up to 400mm wide, if required. The cartridge ribbon and economical Diablo fonts are freely available making this a very versatile printer.

Cat. X-3265

$1845 WAS $1,995!

ITOH 8300P DOT MATRIX PRINTER

The Itoh 8300P features high speed, bi-directional printing (125 characters per second), with full upper and lower case character set. It accepts standard fan-fold sprocketed paper up to 240mm wide. This means you can do 80, 40 or 132 column printing. Fitted with standard Centronics type parallel port. A great seller with great features.

Cat. X-3255

$799

WAS $920!

NEW Full upper and lower case video display capability

NEW Flashing cursor

NEW Screen print facility (obtain a print-out of any 'page' appearing on the screen)

NEW Built-in speaker

NEW Monitor program (suitable for the hobbyist to program in machine language)

Cat. X-4005

and look at this great new software!

KILLER BEETLES

Pit your skills against the killer beetles. You dig traps and when the beetle falls in you bury him. Problem, they don't stay buried! Cassette based, req. 16K.
Cat. X-3598 ***$19.95***

GALAXY INVASION

Real time graphics and sound, the idea is to destroy the invaders and save Earth, but beware of the Flagships!
Cat. X-3693 ***$19.50***

GHOST HUNTER

The aim is to eat the energy dots in the maze before the ghost can get you. Random 'power pills' will assist you in chasing them.
Cassette based, req. 16K.
Cat. X-3597 ***$19.95***

SUPERMAZE

The maze game to end all maze games. It can generate mazes up to 100 x 100 elements — it can take you many hours to find the way out!
Cassette based, req. 16K.
Cat. X-3672 ***$17.95***

DEPTH CHARGE

The latest version of the arcade favourite. Your mission is to destroy the enemy submarine pack. Good graphics and includes sound
Cassette based, req. 16K.
Cat. X-3686 ***$14.95***

RAIN ANALYZER

A most useful program for the man on the land, the geography student, etc. By keying rain patterns for your area in the past (these figures normally available at your local post office, etc.) you can predict rain fall patterns, volumes, etc.
Cat. X-3767 ***$19.95***

TREK 78

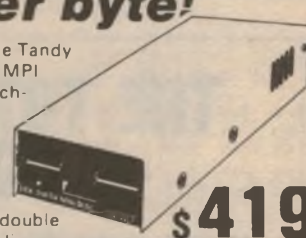
The classic computer game based on the ever popular TV series 'Star Trek'. This game utilises good graphics and provides continuous 'status' reports. Your aim is to destroy the enemy and save the Galaxy.
Cassette based.
Cat. X-3644 ***$12.95***

New! A high resolution Monitor at a low price!

With this monitor added to your computer system, you'll be able to use it for almost limitless applications: for accounts, statistics, education, medical, amusement and for any purpose data and video display. The anti-glare screen with its jitter and ghost free image makes viewing much easier and sharper and allows 80 characters with 24 lines. A must for the serious computer hobbyist or professional.
Cat. X-1200

$349

Still cheapest per byte!



These superb disk drives cost so much less than the Tandy disk drives and they incorporate a high-quality MPI B51 drive mechanism together with matching inbuilt 240V power supply! Each drive has high storage capacity — 40 tracks and is suitable for both single and double density recording. With double density recording, you can store more than 180K bytes per diskette! The disk drives are suitable for use with most computers and disk controllers using the standard 34-way connection bus — such as the System 80 and TRS-80 (Don't pay their prices for disk storage!)

$419

Drive 0
Cat. X-4060
Drive 1
Cat. X-4061

WIN A DATSUN STANZA

When you purchase a VIC-20, System 80 or Sorcerer computer from Dick Smith Electronics you become eligible to win this superb

DATSUN STANZA
GL four door sedan.
So hurry in for your fabulous System 80 NOW!

HURRY IN NOW!

Not valid in states where this contest may contravene state laws.

Permit No. TC82/278
Issued under the Lotteries and Art Unions Act

Have you got your copy of our 1982 Catalogue yet? It's crammed full of new products and includes 33 pages of data information. ONLY 75¢

DICK SMITH ELECTRONICS

See our Address Page for address details

DSE/A230/LM

Microcomputer News & Products

Computerama '82 — "hands-on" experience for thousands

Tandy Electronics' Computerama '82 was held in capital cities around Australia in February and March. We saw the show at Sydney's Centrepoint, and very impressive it was too.

Where can you see 45 TRS-80 Model IIIs working in a single room – an array of computing power that would have staggered the researchers who worked on ENIAC? Tandy's "hands-on" demonstrations at the Computerama exhibition, that's where. You could even try them out for yourself, if you could get through the crowds of kids (and their parents!) waiting to do just that. Still, there were plenty to go around, and plenty to do elsewhere at the display.

How about a run through the galaxy on "Project Nebula" or perhaps a game of chess on a brand new Colour Computer? Or a comprehensive test run of the Visicalc financial modelling program, or the Scriptsit word processor on a Model II TRS-80 with a fast daisywheel printer?

Tandy Electronics, sales leader in the microcomputer marketplace, demonstrated its determination to stay that way at the Computerama exhibitions. The shows brought home strongly the fact that Tandy has something for everyone interested in computers, from the compact Pocket Computer to the 64K TRS-80 Model II business system with four 20cm floppy disk drives, and perhaps, a Winchester type hard disk, storing 8.4 million characters (soon to be released).

The "computer classroom" at the exhibition made use of another Tandy product, their TRS-80 network controller, which allows up to 16 Tandy computers to be linked together, slaved to an instructor's computer for lessons or freed to operate independently.

Education was the strong point of Computerama in fact. Perhaps for the first time many thousands of people of all ages were able to get acquainted with a computer in an unhurried, "no obligation" atmosphere. Demonstrations were available on the hour for the length of the exhibition. In addition, each person attending Computerama received a certificate entitling them to a free introductory course at one of Tandy's computer centres (normally around $40).

Judging by the reaction of the crowds, Tandy's computer classrooms were greatly appreciated. The invitation to "take a computer" for an introduction to programming was eagerly accepted. Indeed, the eagerness of some young enthusiasts surprised even Tandy officials, who had to shepherd them out of the exhibition at closing time. One staff member spoke of his surprise in discovering a computer the next morning, still running an elegant little program that printed out "I hate school" over and over in eye catching patterns!

On Sunday alone, when the exhibition's opening in Sydney was late in the morning, 11,000 people saw and took part in the show. Final attendance figures were around 25,000 for the Sydney show.

A commonplace scene at Computerama '82, where thousands of people had the opportunity to try Tandy's latest computers for themselves.

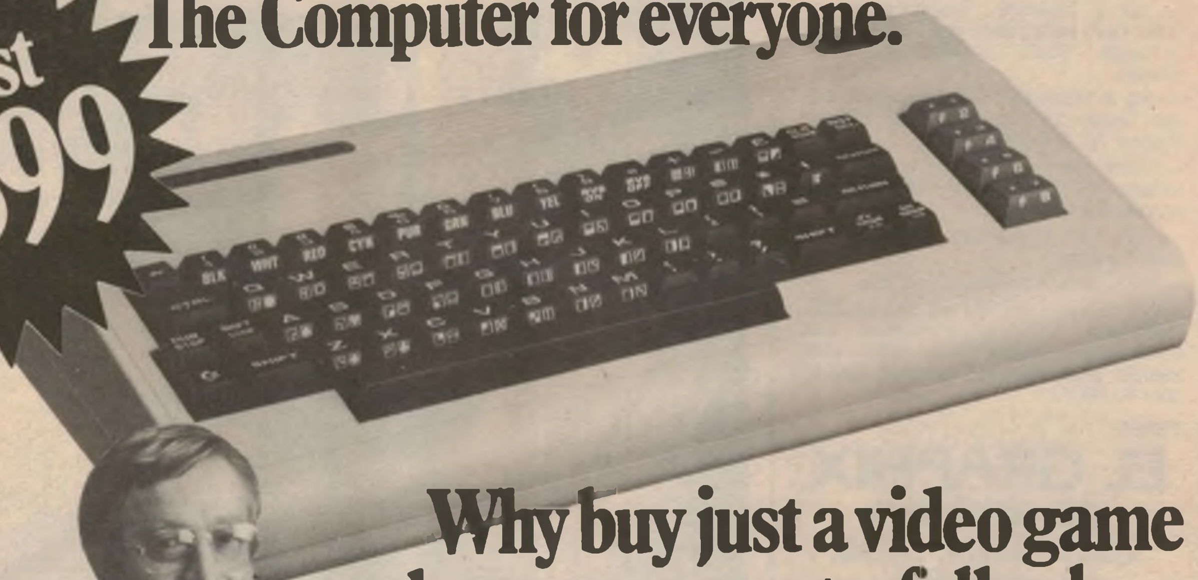
Micronews cont'd ►

commodore

VIC-20

The Computer for everyone.

Just $399



Why buy just a video game when you can get a full colour computer for this price.

A computer like this would have been fiction a few years ago. Now it's a reality. It's the new Commodore VIC-20, a full-fledged, expandable colour computer that costs little more than the video games.

Everybody loves video games and the VIC-20 has some of the best. But the Commodore VIC-20 can also help the kids with their homework and mum with her home budgeting. Dad can even take the light, portable VIC-20 to the office for financial and business applications. And Commodore has many more applications on the way. With full capability for:

- Education programmes
- Recreational programmes
- Personal computing
- Includes Microsoft, PET BASIC
- Connects to any TV set
- 4 sound generators • 16 colours
- 66 graphic characters
- Full-size typewriter-style keyboard
- Easy-to-follow instruction manual
- 25K total memory • 5K RAM
- Memory expansion to 32K RAM

The VIC-20 is the friendliest way we know to learn computing. It has a full computer keyboard even a small child can operate. It plays music, has exciting graphics and lets you create pictures. It even tells you when you've made a mistake and how to correct it. The VIC-20 can take your children from pre-school through post-graduate studies.

Why get just another game that could end up in the closet? Get an honest-to-goodness computer for just $399. Get the Commodore VIC-20

So much brain for so little.

commodore COMPUTER

Microcomputer News & Products

Winner of EA/DSE Super-80 competition

Winner of our Super-80 programming competition was Mr R. W. Muchamore of Elizabeth South, SA. He is shown above (right) receiving his prize, a GP80 printer, from Robert Nicholson, manager of the Adelaide store of Dick Smith Electronics. Note that there were no entries in the "school" category of the competition and no prize was awarded.

Wide range of software for 6809

Paris Radio Electronics has perhaps the biggest range of 6809 software available in Ausatralia. Designed to run on any SS-50 bus 6809 system, the range includes operating systems and languages from Microware Systems Corporation, Technical Systems Consultants, Frank Hogg Laboratory Inc, Washington Computer Services, Universal Data Research Inc and Talbot Microstystems, to name but a few.

Two new releases, one from Frank Hogg Laboratory Inc and one from Computer Systems Consultants Inc are particularly interesting. "CRASMB" from Frank Hogg is a cross assembler for the 6809, running under the Flex (TM) operating system.

Using special assembler commands a "CPU Personality Module" can be loaded into memory to handle the translation from the standard source code of a particular processor to object code (machine language). At the moment modules are available to allow the assembler to produce code for the 6809 (of course), the 8080-8085, Z80, CDP1802, 6502, 6800 and 6805 microprocessors. In most cases the source code required by the cross assembler is exactly the same as that of the processor standard.

Other programs from Paris Radio Electronics include "Tabula Rasa", a financial "spread-sheet" system for analysing tables of data for accounting, planning and reporting purposes, and the Bill Payer system, both from Frank Hogg. The Bill Payer keeps track of accounts payable, and is designed for house-hold and small business use. Tabula Rasa on the other hand is a business oriented program, with extensive capabilities, depending on the size of your computer system.

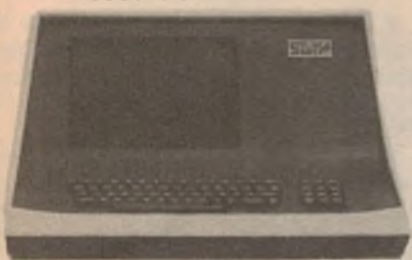
In addition to applications programs, there are also operating systems software and languages available, including the Microware OS-9 (TM) Level 2 multiuser operating system, UniFlex, Basic and Pascal in several versions, a compiler for the "C" programming language and a range of Forth interpreters for the 6809.

Paris Radio Electronics is at 7A Burton St, Darlinghurst, NSW 2010, phone (02) 357 5111. In Melbourne contact J. H. Macgrath & Co, 208 Little Lonsdale St, Melbourne, Vic 3000, telephone (03) 663 3731.

SWTPC OF AUSTRALIA

DISCOVER THE WORLD OF THE 6809 MICROPROCESSOR

6809 COMPUTER

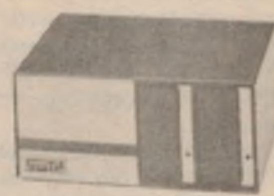


8212 TERMINAL
(ASS. IN AUSTRALIA)

HARDWARE DESCRIPTION

S/09 6809 Computer w/128K Memory
/09 6809 Computer w/64K Memory
8212 12" Terminal w/monitor
DMF 2 Disk System w/2.5m Capacity
CDS-1 Winchester Hard Disk System
MP-09A 6809 Process/Board (assem)
D5-2 double side/double density 720KB
3809 128K Memory Expansion for S/09
MP-LA Parallel Interface
MP-L2 Dual Parallel Interface
MP-N Calculator Interface
MP-R Eprom Programmer
MP-S Serial Interface
MP-64 Memory board 64K
MP-S2 Dual Serial Interface
MP-SX Serial Interface Expansion
MP-T Interrupt Timer
S-32 Universal Static Memory Card
NEW PRODUCTS SOON

DMF DISK
SYSTEM 2.5M



D-5 720k
DT-5 1.3M

SOFTWARE SPECIALIST FOR THE 68XX SERIES

MICROWARE SYSTEM CORP

OS-9 Level 1 Operating System	$195.00
OS-9 Level 2 Operating System	$495.00
Basic 09 Programming Language	$195.00
Pascal OS-9	$440.00
Macro Text Editor	$ 95.00
Assembler	$ 95.00
Debugger	$ 35.00
Stylograph Word Processor	$175.00
Cobol Programming Language	$995.00
C Programming Language	$440.00

TECHNICAL SYSTEMS CONSULTANTS

UNIFlex Operating System	$550.00
UNIFlex Basic	$200.00
UNIFlex Pascal	$250.00
UNIFlex Fortran 77	$350.00
UNIFlex Relocating Assembler & Language Editor	$175.00
General Purpose Flex 6809	$165.00
General Purpose Flex 6800	$165.00
Exorcisor Flex 6809	$165.00
SWTPC Flex 6809	$ 45.00
GIMIX Flex 6809	$ 99.00
TRS80C Colour Flex	$ POA
Extended Basic	$110.00
Utilities	$ 82.50
Pascal for Flex	$220.00
6800 Cross Assembler for Flex	$275.00
Sort Merge Package	$ 82.50
Text Editor	$ 55.00
Assembler	$ 55.00
Debug Package	$ 82.00
Diagnostics	$ 82.50
Text Processor	$ 82.50

FRANK HOGG LABORATORY, INC

XForth	$165.00
Basic Programmer Tool Kit	$ 77.00
Extended Use Utilities Pack	$ 77.00
Password Protection Pack	$ 99.00
Dynasoft Pascal Flex	$ 99.00
Bill Payer System	$185.00
Spell Test	$220.00
Super Sleuth	$110.00
Stylograph 2:0	$315.00
Stylograph 3:0	$215.00
Dynastar Full Screen Editor OS-9, Flex	$ 99.00
CRASMB Cross Assembler, Flex, 6809, 6800, Z80, 8080, 6502	$149.00
Dataman + DBM	$220.00
Plot	$ 49.00
Tabula Rasa	$110.00
Job Control Program	$ 99.00

WASHINGTON COMPUTER SERVICES

6809RMS DBM for Flex	$220.00
6809 RMS DBM for UNIFlex	$330.00
6809 RMS DBM for OS-9	$275.00

UNIVERSAL DATA RESEARCH INC

DBM 2 Flex	$450.00
DBM 2 UNIFlex	$550.00
Payroll	$495.00
Accts Receivable	$495.00
Accts Payable	$495.00
General Ledger	$495.00
Inventory	$495.00

TALBOT MICROSYSTEMS

tForth	$ 99.00
tForth+	$275.00

COMPUTER SYSTEM CENTRE

DYNAMITE Dissassembler	$ 66.00

DUGGERS GROWING SYSTEMS

6809 C Compiler ver 2:0	$130.00

OMEGASOFT PRODUCTS

PCS2 Pascal Compiler Flex, OS-9, MDOS	$490.00
Rall1 Relocatable Assembler & Linking Loader	$150.00

SWTPC

EDIT Word Processing Editor Flex	$110.00
C Compiler for UNIFlex	$ POA

* Prices subject to alteration without notice, p&p $3.00.

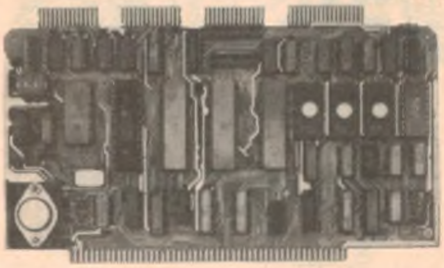
AVAILABLE FROM

PARIS RADIO ELECTRONICS
7A Burton Street, DARLINGHURST, NSW 2010
TEL: (02) 357 5111

J. H. MAGRATH & CO
208 Little Lonsdale Street, MELBOURNE, VIC 3000
TEL: (03) 663 3731

Microcomputer News & Products

Powerful S-100 Z-80 board from SME



SME Systems of Melbourne has announced the release of a single board S100 CPU using the Z80A processor, said to be "of unprecedented power". The new board, which can be used either alone or as the central processor of a complete computer system, will retail for under $500 according to the manufacturers.

SME Managing Director Mike Pratt says the SBC-800 presents "an impressive array of hardware". Included as standard are two RS232C or 20mA current loop serial ports, three programmable parallel ports, a Centronics compatible printer port, software baud rate selection, vectored interrupt handling and a four channel timer. Power-on reset, power failure detection and power-on jump features are also included.

Intended for OEMs and engineers wishing to build their own computer systems, the SBC-800 is completely designed and manufactured in Australia.

For further information on the SBC-800 contact SME Systems at 22 Queen St, Mitcham, Victoria, 3132. Phone (03) 874 3666.

Club notes

● The Super-80 Users Group of Melbourne will hold its inaugural meeting in the front hall of the Heathmont Uniting Church, Canterbury Road, Heathmont, on June 11th at 8pm. For more information write to PO Box 57, Glenhuntly, Vic, 3163.

● The Sorcerer User's Group of South Australia has a new address. The group now meets on the 1st floor of the Commodities Exchange Building, 123 Pirie St, Adelaide, on the second Wednesday of each month. For further information write to the Secretary, Jeremy Webber, at 22 Delange Ave, Banksia Park, South Australia, 5091.

Phono preamplifier

cont'd from p59

3300μF pigtail electrolytic or three 1000μF PC electrolytics, so you can use whatever is available. The 2% capacitors are not available as over-the-counter items so you will have to purchase and select your own, using a capacitance meter. We hope that parts suppliers will make this service available. One per cent resistors are readily available from a number of suppliers.

The wiring diagram for the preamplifier should be closely followed, in conjunction with the main circuit diagram.

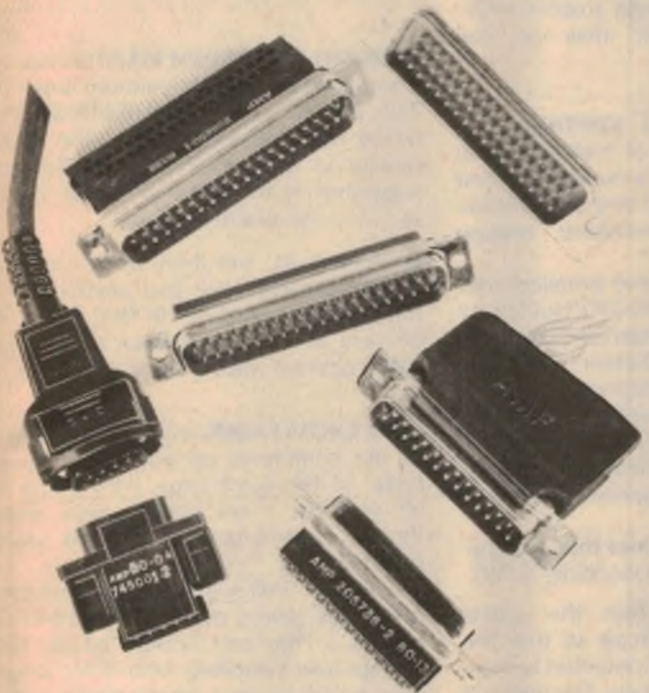
If 5W dropping resistors have to be used for the supplies to the preamplifier, they should be mounted on separate tagstrips to avoid heat damage to the PC board.

When all construction is complete, check your work very carefully for errors. Then connect a suitable power supply and check all voltages marked on the circuit diagram. They should all be within 0.5V of the values shown. Similarly, the DC voltage at the output of each op amp should be within about 10-30mV of 0V.

AUSTRALIAN

AMP

AMPLIMITE CONNECTORS



FOR ROUND CONDUCTORS OR FLEXIBLE FLAT CABLES

- Wide choice of sizes — 9, 15, 25, 37 and 50 contact positions
- Conforms to latest amendments MIL-C-24308
- Connectors employ integral plastic retention tines to eliminate need for spring clips
- Optional mounting — standard or with floating bushings

Technical information available on request.

soanar

Soanar Electronics Pty Ltd

30-32 Lexton Road, Box Hill, Vic., 3128, Australia.

VICTORIA: 840 1222	QUEENSLAND: 52 1131
N.S.W. 789 6733	WEST. AUST. 381 9522
STH. AUST: 42 8918	TASMANIA: 31 6533

REACH FOR RALMAR...

WHEN IS A MIC NOT ONLY A MIC?

WHEN IT IS ALSO A

- 7.5 watt P.A. amplifier with volume control.
- Built-in siren.
- LED indicator.

Simple connection to a horn speaker and 12 volt (neg) supply is all that is required. (Horn speaker is extra). Ideal for sporting events, crowd control, emergency services and mobile electioneering.
The possibilities are up to you.

DECIBEL METER

HOW LOUD IS THAT HI FI?

HOW NOISY IS THAT TRAIL BIKE?

This handy dB meter will give you the necessary information. Covers 40 – 110dB in six steps. Easy read dial covers ± 10dB. Sensitive electret microphone. Battery check. Ear phone listening if required. Ideal in fact for anyone who has to measure noise levels or sound pressure, dynamid range, insulation levels, frequency characteristics or general environmental noises.

RALMAR®

TRADE ENQUIRIES...

N.S.W. Ralmar Agencies P/Ltd (02) 439 6566
Vic. Ralmar Agencies P/Ltd (03) 267 3028
S.A. Charles Harwood P/Ltd (07) 264 1118
QLD. Olbertz International P/Ltd (07) 261 1513
W.A. Bruce Ingram & Assoc. P/Ltd (09) 381 7777
TAS. George Harvey P/Ltd (003) 331 6533

INFORMATION CENTRE

PLAYMASTER AM/FM TUNER: I am presently constructing the Playmaster AM/FM Stereo Tuner-Clock which was designed by Leo Simpson. I am having problems getting FM reception, although the clock and AM reception works. I have checked voltages against another kit and these are OK. Can you send me some fault-finding ideas for the tuner module, which I think is faulty? (S. J., Sutherland, NSW).

● Unfortunately, you have not provided sufficient detail for us to be of much help. Do you get any indication on the signal strength and tuning meters? If so, then it is quite possible that the module is OK and the fault lies in the wiring to switch S1.

If there is no indication on the signal strength meter and the wiring checks OK, then the module is probably faulty and should be returned to the kit supplier. Of course, we assume that you are using an adequate FM antenna.

LEDS & LADDERS: I recently constructed your LEDs and Ladders project (August, 1980) and have encountered some problems. When the batteries are connected, nothing happens until the climb button is pressed five or six times, upon which LEDs 8, 9 and 16 begin flashing. This continues until either the batteries are disconnected or the electrolytic is discharged. Also, occasionally, the bottom LED begins flashing and no amount of pushing the climb button will make it climb the ladder. I've done numerous voltage tests, but to no avail. (B. C., Blackburn, Vic.)

● To troubleshoot your LEDs and Ladders game, temporarily connect the D1/10kΩ resistor side of the climb switch to the positive supply and check that the voltage across the 470μF capacitor rises to +12V. The LEDs should light in sequence as the capacitor charges. Pins 10, 12 and 13 of the UAA-170 should be at +12V, 1.2V and 5V respectively.

If the LEDs do not light in sequence, the most likely cause of your trouble in incorrect wiring. Either that or the UAA-170 is a dud!.

TRANSISTOR-ASSISTED IGNITION: The September 1981 issue of "Elektor" has an article which answers a number of their readers' queries concerning the publication of a transistor-assisted ignition circuit.

Having constructed and installed your own TAI project on my HQ Holden 12 months go, it is with interest that I refer to the article from "Elektor" regarding the value of the capacitance across the contact breaker. According to "Elektor" the capacitor must be retained for electronic ignition, but its value must not exceed 0.1μF otherwise ignition timing will be affected.

The question arises, does this also apply to your TAI? (T. A., Doonside, NSW).

● We recommend that the points capacitor be left in circuit so that the vehicle can be quickly converted to standard ignition if the TAI fails. The effect of this capacitor on ignition timing is negligible, since its value is quite small (about 0.22μF).

Assuming a value of 0.22μF, the time taken for the capacitor to charge up is only about 10μs, and a 10μs repetition rate theoretically represents 1,500,000rpm for an 8-cylinder engine! Thus, for a 1° timing error, the engine would have to run at 1/360th of this speed, or 4166rpm! At lower engine speeds, the timing error will be even less.

It should also be realised that the effect will be exactly the same for conventional Kettering ignition systems.

INFRARED LIGHT BEAM RELAY: I require a burglar alarm with a minimum range of 21m, preferably 29m. Will this be achieved by reducing the value of the 680Ω resistor in the transmitter to 150Ω, as suggested in the article in April 1981? (A.G M., Templestowe, Vic.)

● Sorry A. M., but there is no way our simple unit can give you anything like the range you require. In fact, it would be very difficult to produce a unit that could operate reliably over this range.

SLIDE CROSS FADER: After reading some of the comments on your Slide Cross Fader in the March issue, let me first of all say that I am tickled pink, even though I can't get my unit to work properly.

Whilst my unit works almost perfectly once it is going, my main problem is related to the best feature of all, the change over switching. With the change over switch in one certain position the unit works fine. On switching over, the projector lamps change, but on activating the change button the slide change takes place in the projector that has just come on and keeps doing that from one projector to the other until switched back; ie the slide change is taking its signal from the opposite ramp.

Problems with the Tacho/Dwell Meter

TACHO/DWELL METER: In the October 1980 issue, Ron de Jong had a circuit for a Tacho/Dwell Meter for engine tuning, etc. I recently built this project, but all I can get to function correctly is the battery voltage readout.

When first turned on to Tacho a reading of 0320 is obtained but will only alter by adjusting VR1 and then only to 0220. On the Dwell side a reading of perhaps 40, 30 and 20 is obtained. Both these functions happen with or without a half-wave rectified signal applied.

Modifications include substituting TIL322A 7-segment readouts for the FND500 (which were not available) – these are pin for pin compatible and all light. Also, I was not able to purchase 49.9kΩ resistors, 50kΩ resistors being used instead. Other than that, all is made to the drawing. Could you help in any way with more information? (F.J., Papakura, NZ).

● With no signal input, the VCO (IC9) "free runs" and a reading of 0320 is perfectly normal. When an input signal is applied in the tacho mode, the VCO should lock on to produce a valid reading.

The fact that the dwell circuitry is also malfunctioning suggests that the trouble lies with the input buffer circuit IC6d. In particular, check component values around IC6d and check that the 1N4002 diode is not open circuit or incorrectly oriented. Notes and errata for this project were published in March, 1981 and August 1981.

My second problem makes the lack of this facility more acute. On switching the unit on, it spontaneously activates the advance circuitry once, sometimes twice. Subsequently, if the unit and projectors have been set up in advance, it takes agonising minutes to get the correct slides back in the right position.

My third problem is that after the unit has been in operation for about 10 minutes on manual, the change button will not latch on consistently, resulting in missed cues.

I have programed five audio/visuals despite the above problems, one of 28 minutes duration, and am delighted with the performance (no latch problems on auto). I have at present a second unit underway and intend to incorporate the titling facility described in your March issue although I am a little apprehensive. It means partial manual operation and a slip up could mean a false start at showtime. I look forward to receiving your advice. (K. J. F., Cromer, NSW).

● To enable the projector change over switch to simultaneously switch the projector bulb and advance switch, it will be necessary to use a 4-pole 2-way switch for S2. The first two poles would be connected as per the circuit diagram and the remaining poles to transpose the base drive to the BC557 transistors. In other words the output of IC4b, pin 4, should switch to the 1kΩ base resistor of the BC557 transistor of projector 1 and, similarly, IC4a to the 1kΩ resistor of projector 2.

If you intend to use the titling modification suggested from the information column of the March issue, we recommend the use of two independent switches, one for titling and the other for change over.

Regarding the spontaneous activation when the mains is first switched on, perhaps the simplest solution to the problem would be to have the slide change disable switch left open until power is on. Your third problem could possibly be solved by connecting a 1N4148 diode from pin 5 of IC8 to the ground rail, with the anode connected to ground. The diode will block the negative going signal at pin 5 from going below the negative rail by more than 0.6V.

Notes & Errata

TRS-80 SERIAL PRINTER INTERFACE (November 1980, File No. 2/CC/56): The Transmit Data signal line from pin 6 of the 741 IC should connect to pin 2 (and not pin 3) of the 25 pin "D" type female connector. This error occurs both on the circuit diagram and PC board pattern. The track running to pin 3 of the connector should be broken and taken to pin 2 with a short piece of wire. Pin 2, transmitting data, should connect to pin 3 of the printer. The interface will now comply with RS232C standards.

VOICE-OPERATED RELAY: April, 1982, File No. 1/RA/36): The 1 × 10kΩ resistor value listed in the parts list should read 1 × 10Ω. The circuit and wiring diagrams are correct.

DIGITAL THERMOMETER (February 1982, File 3/MS/91): The 100kΩ calibration resistor should be removed after calibration. This was not made clear in the article. Leaving the resistor in circuit will cause the thermometer to read 1% low.

MARKETPLACE

FOR SALE

ELECTRONIC BOOKS FOR BEGINNERS. Wide range of books covering basic concepts to use and design of standard circuitry. Expressly written in simple English for those with little electronic knowledge or experience. Send stamped addressed envelope for catalogue and price list to: Hobby Electronic Books, PO Box 92, East Gosford, NSW 2250.

CB's. We convert old CB's to the new 40ch FT902DM plus $975 FM320 $259 FRG7 $275 40ch SSB/AM CB from $169 CB repairs by mail. Park Disposals, 32 Park St, Sydney (02) 264 7515 or ring Sam from 6pm to 9pm only (02) 407 1066.

AMIDON FERROMAGNETIC CORES — Large range for all receiver and transmitter applications. For data and price list send 105 x 220 SASE to: RJ & US IMPORTS, PO Box 157, Mortdale, NSW 2223.

TRS80 AND SYS80 users l/case with descenders mod, also rom patching. Enable TRS prt address on SYS80, ect, ect. Lowest price in Aust. Send SAE to Den McKenzie, 29 Ellesmere Cres, Tullamarine 3043.

COMPUTER PRINTER Olivetti 221 electronic typewriter with XYMEC RS232 interface which has full control of all typewriter functions eg auto centring bold print etc. Phone D. Straatman (02) 649 2486.

TP-85 SMART VDU or GP CPU, Card or kit. Details SAE, TP Electronics, 9 Venturi Ave, Paralowie, SA 5108.

IC SOCKETS 16 pin DIL 20 for $3.40, speaker lead twin flex heavy duty 14/0076. No trace 100 yard reel $6.50. Quality electros 3550μf 64v 2 for $7.50, 4500$\mu$f 64v 2 for $9.50. Fuse holders panel mtg, 3AG 8 for $4.00. Feedthru bypass capacitors 0.001μf 40 for $4.00. Prices include P and Post. Scale prices for larger qtys. Cheque or money order to Helen Gerard Trading, PO Box 60 Kallista 3791.

ORGAN Schober Recital, full cons. Latest reverb, circuits $3850. Conn pipes (48) $450. Leslie 122V $250. Sydney (02) 212 2573, Bus hrs.

WANTED

SPECTRUM ANALYZER, low frequency. Melbourne (03) 579 1205.

CLUBS

MEMBERS WANTED for AMECC, Australia's own correspondence micro-computer club. Send $2 for sample monthly newsletter. AMECC, Box 172, Ryde 2122.

READER SERVICE

COMPUTER CLINIC repairs and services Sorcerer, Pet, Apple, System 80, Super 80, Tandy and others. Phone (07) 269 8573.

FOR HIRE

MICRO RENTAL Microcomputer systems of various models and configurations, and peripherals, are available for hire from DORF MICROCOMPUTER. Start-up and reference manuals included. Sydney (02) 922 1644 or (02) 960 1808 (AH).

MICROCOMPUTERS for rental. Commodore Pets (8K) at $25 per week (minimum period 1 week). Software tapes and manuals included, plus Basic instruction course and book. David B. Bates Microcomputer Consultant. Ph (02) 630 8652.

TOUCH SWITCH continued from p78

continued from p78

touch sense input next to IC1. If you prefer not to use stripboard all that is really needed is two adjacent pieces of bare metal — even two stripped wires. Just as long as they will be bridged by the touching hand, foot, nose or other part of the anatomy!

If you intend to use the touch switch as a portable unit that can be changed from one piece of equipment to another, it will be necessary to put it in a permanent housing. A zippy box would be suitable for this purpose.

A word of caution may be in order at this point. Although the touch switch can switch mains powered equipment if it has the appropriate relay, you should not attempt to use it in this way unless you are certain that you know what you are doing. If you are not confident that you can wire up mains equipment safely, play it safe and stick to battery operated equipment.

Probably the most practical application for the touch switch is with a bedside reading lamp. Often, it is dark when you want to turn this lamp on, and it would be much easier to put your hand on a touch plate than to find a switch. Similarly, it could also be used to switch an electric blanket on or off. Remember that the touch plate can be mounted remotely from the PCB and power supply, so you could build it into an attractive panel and mount the control box elsewhere.

There are no-doubt numerous other applications for the touch switch — some practical and some that could only be described as novel. A few areas which have been suggested are door chimes, radios, automotive controls, intruder detection, hand-held torches and as an aid to the disabled. We're sure that you will think of some original applications of your own.

CLASSIFIED ADVERTISERS

To the Advertising Manager, ELECTRONICS Australia, Box 163, Chippendale, 2800

- Please insert the following advertisement in the first available issue.
- Tick the classification required ☐ FOR SALE ☐ WANTED ☐ FOR HIRE ☐ CLUBS ☐ POSITION VACANT ☐ POSITION WANTED ☐ READER SERVICE

Please print in ball-point pen on a separate piece of paper, using capital letters only where necessary.

Signed .... I enclose Cheque/Money Order for $ ....

Address .... being full payment for .... letters at $3.60

.... for 40 letters or part thereof (minimum 80 letters).

EA Magazine Holders

The binders and magazine holders are available over the counter from Electronics Australia, 57 Regent Street, Sydney, NSW — Price: $5.10 binders, $4.50 holders.

Mail orders should be sent to Electronics Australia, PO Box 163, Chippendale, NSW 2008.

Prices including postage are:

Holders: $5.40 NSW; $5.50 other states; or six for $28.30 NSW, $30.40 other states, A$32NZ.

Binders: $6.20 NSW; $7.90 other states; or six for $32 NSW, $34 other sates, A$36.60 NZ.

EA PC BOARDS AND FRONT PANELS

Some readers have problems obtaining PC boards and front panels for projects. Many of our advertisers sell these items and their advertisements should be checked in the first instance. Failing that, below is a list of firms which produce or sell PC boards and front panels.

NSW

Dick Smith Electronics,
125 York Street,
Sydney, 2000.
Telephone 290 3377.
DSE also has branches and resellers throughout Australia.

Electronic Agencies,
115-117 Parramatta Road,
Concord, 2137.
Telephone 745 3077.

Jaycar Pty Ltd,
380 Sussex Street,
Sydney 2000.
Telephone 264 6688.

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.

Rod Irving Electronics,
425 High Street,
Northcote, 3070.
Telephone 489 8131.

Kalextronics,
101 Burgundy Street,
Heidelberg 3084.
Telephone 743 1011.

Sunbury Printed Circuits,
10 Counihan Street,
Sunbury 3429.

SA

James Phototronics,
522 Grange Road,
Fulham Gardens, 5024.

WA

Altronics Distributors,
105 Stirling Street,
Perth 6000.
Telephone 328 1599.

Jemal Products,
8/120 Briggs Street,
Welshpool, 6106.

N.Z.

Marday Services,
PO Box 19 189,
Avondale, Auckland.

Mini Tech Manufacturing Co Ltd,
PO Box 9194,
Newmarket.

Printed Circuits Limited,
PO Box 4248,
Christchurch.

SUBSCRIPTION SERVICE

ELECTRONICS Australia

Subscription Rates

$24.50 per year within Australia
$28.50 per year elsewhere

Make sure you receive every copy of the magazine by ordering it from your newsagent or the publisher. For publisher subscriptions post this coupon, with your remittance to Electronics Australia Subscription Dept, John Fairfax & Sons Ltd, GPO Box 506, Sydney 2001. Subscription will start with first available issue.

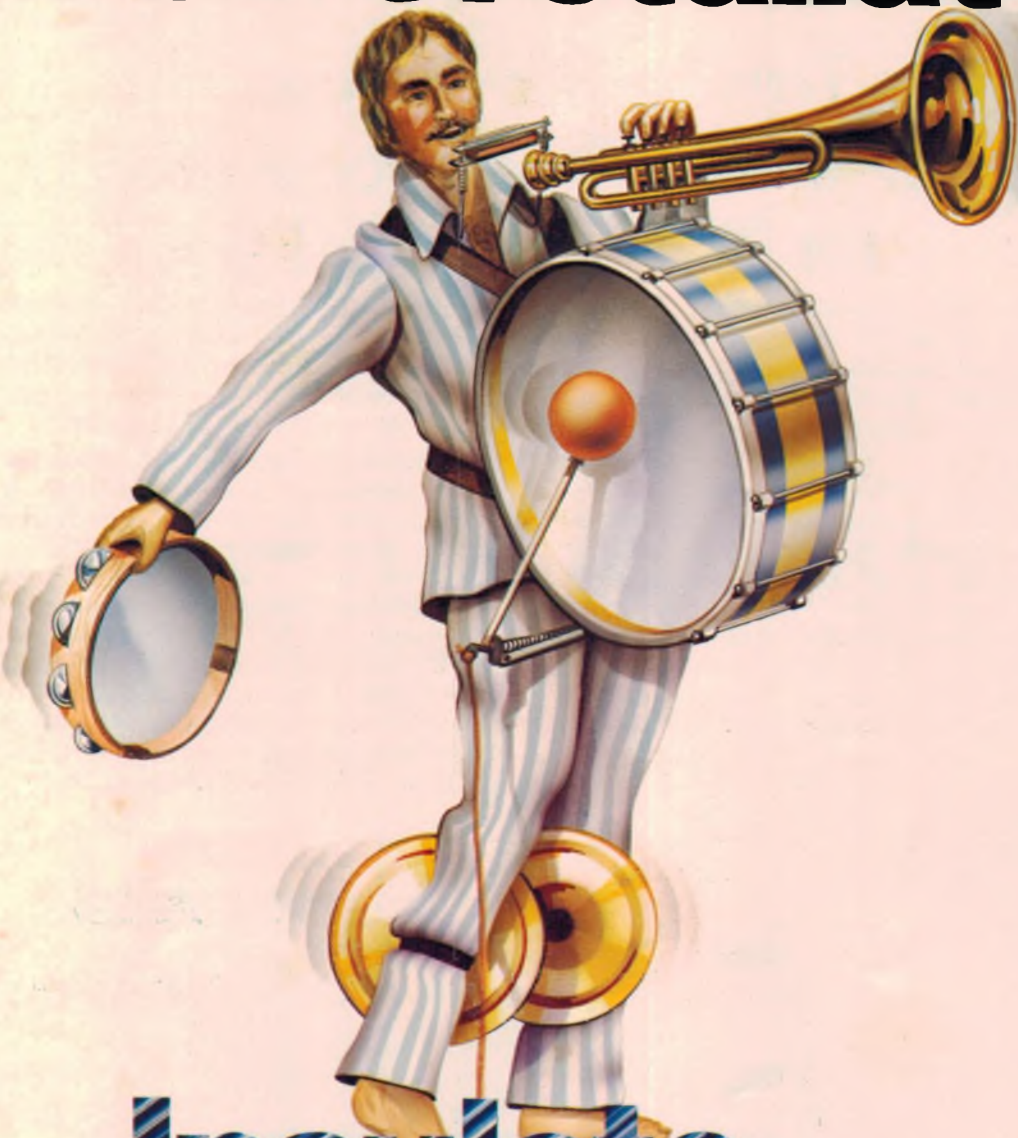
Name ....

Address ....

Postcode .... **Enclosed is** .... **for** .... **years**

ADVERTISING INDEX

Don't retaliate



Insulate
with BHAS Lead

When there's no point in complaining about noise, the only thing to do is insulate yourself from it.

BHAS Lead sheeting is the answer. Lead is an efficient, easy to install, economical insulation material. For free booklet on lead installation techniques, mail the coupon or contact Mr. L. I. Goff, Phone (03) 658 3945. Just quietly, lead is hard to beat.

LEAD
BHAS
ZINC

CONCORD/BHAS/42

Please send me your free booklet "Noise Isolation with Lead Sheet".

EA

Name

Address

Postcode

To: The Broken Hill Associated Smelters Pty Ltd., 55 Collins Street, Melbourne, Australia 3001.

Tandy Introduces Low-Cost Word Processing for TRS-80 Model II

You'll never want to use a typewriter again! Our all-new Model II SCRIPSIT™ program gives you professional word-processing features at a price no one else matches! This system will save you time and money, reduce errors and increase office efficiency. Here's why . . .

It's Easy to Use. SCRIPSIT is user-oriented, with menus and prompts for every important function. An automatically updated information line gives current document status. Automatic centering and justification make tables and special formats easy. Typeover, Insert, Delete, Global Search and other conveniences make editing on the video screen simplicity itself. There's even automatic page numbering, re-numbering and re-ordering!

More Exciting Features. Of course there are full headers and footers, underlining, subscripts, superscripts and boldface. We include a detailed 8-lesson audio instruction course — you can quickly become an expert with SCRIPSIT.

The Computer is Included. With this system, you not only get word processing, you also get our top-of-the-line computer that, with optional software, can run your inventory, ledger, payables and more. And our Daisy Wheel II printer gives you correction-free electric typewriter quality at 500 words per minute. The complete system, including SCRIPSIT, 64K Model II Business Computer, Daisy Wheel II Line Printer (and cable), is only $8717.90*. You can own or lease now, through our 300 dealer stores and Computer Centres. Come in for details. SCRIPSIT software only **$349.95**

Tandy
COMPUTER CENTRE

*Retail prices may vary at individual dealer stores.

Send for your free TRS-80 Computer Catalogue! 320040

Tandy Electronics, Advertising Dept,
PO Box 229, Rydalmere 2116.

☐ Send Catalogue
☐ Have Someone Call Me

Name: ______________________

Company: ______________________

Address: ______________________

City: ______________________ State: __________

P/C: __________ Tel: __________