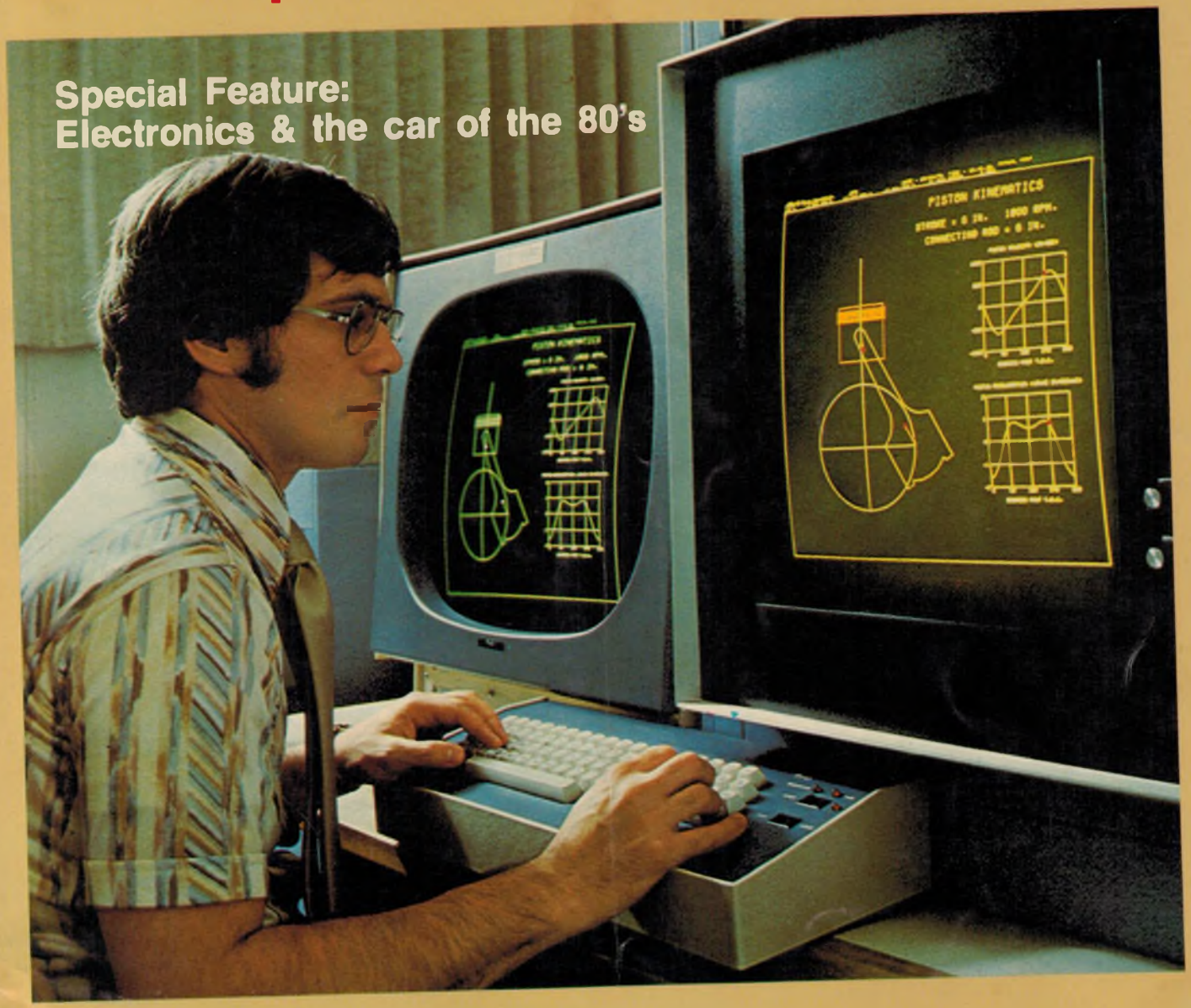
ELECTRONICS Australia

HiFi, Radio & Computers

FEBRUARY 1980

AUST $1.40* NZ $1.50

Car Computers: Electronic Know-It-Alls



- Playmaster Stereo Graphic Analyser
- Signal Injector for Audio & RF Servicing
- Super Bass Filter
- Hall Effect Devices

Up to now you had to choose between the turntable you wanted and the turntable you could afford.

You'll choose Technics D Series turntables for the same reasons as radio stations and discos use our professional turntables: the performance of Technics direct drive.

Yet perhaps the best part about all this performance is the price you can have it for.

And with the Technics SL-D3 automatic and SL-D2 semi-auto models the price includes the B.F.G servo-speed control which constantly monitors and constantly corrects turntable speed. So even if the power fluctuates your Technics direct-drive performance won't.

Your Technics dealer can best demonstrate all the other features of the D Series turntables. He can also surprise you with their cost.

So if you thought poor performance was the price you had to pay for an inexpensive turntable, then you hadn't thought about Technics.

Technics

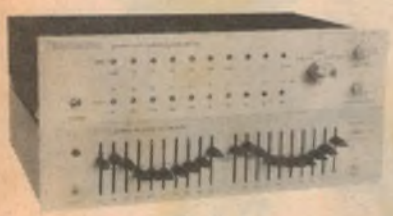
T.79.33

Technics Advisory Service, P.O. Box 319, North Ryde N.S.W. 2113

ELECTRONICS Australia

Volume 41 No. 11 February, 1980

Australia's largest selling electronics magazine



Designed around 13 low-cost ICs our new Playmaster Graphic Analyser matches any equaliser and has a built-in pink-noise generator and microphone for monitoring loudspeaker and room response. It can also function as dynamic display of amplifier power output or signal level. Full details on p50.

Combine this super-bass filter with a separate amplifier and super-woofer loudspeaker and you'll get bass that you can feel. Details on p42.

COMING NEXT MONTH! — Find out what's coming by turning to p34.

On the cover

A Chrysler engineer in Detroit uses a colour graphics terminal to analyse piston performance. Computers will play an extremely important role in designing and controlling the new generation cars of the 80s (see p14). Photo courtesy Control Data Corporation, Minneapolis, USA.

FEATURES

HIFI TOPICS AND REVIEWS

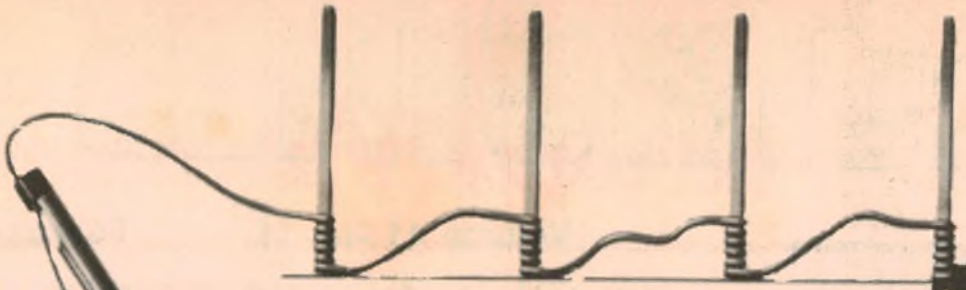
PROJECTS AND CIRCUITS

MICROCOMPUTERS

AMATEUR RADIO, CB SCENE, DX

COLUMNS

DEPARTMENTS



WHY CUT? WHY STRIP? WHY SLIT?
WHY NOT...

NEW

JUST WRAP™

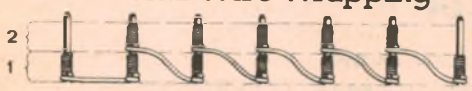
WIRE WRAPPING TOOL

- AWG 30 Wire
- .025" Square Posts
- Daisy Chain or Point To Point
- No Stripping or Slitting Required

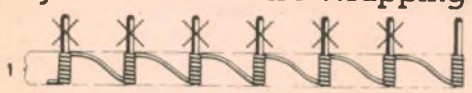
...JUST WRAP™...

- Built In Cut Off
- Easy Loading of Wire
- Available Wire Colors: Blue, White, Red & Yellow

traditional Wire-Wrapping



JUST WRAP Wire-Wrapping



U.S.A., FOREIGN PATENTS PENDING

JUST WRAP TOOL WITH ONE 50 FT. ROLL OF WIRE		
COLOR	PART NO.	LIST PRICE
BLUE	JW-1-B	$19.30
WHITE	JW-1-W	19.30
YELLOW	JW-1-Y	19.30
RED	JW-1-R	19.30
REPLACEMENT ROLL OF WIRE 50 FT.		
BLUE	R-JW-B	$3.84
WHITE	R-JW-W	3.84
YELLOW	R-JW-Y	3.84
RED	R-JW-R	3.84
JUST WRAP-UNWRAPPING TOOL		
	JUW-1	$4.50

AMPEC ENGINEERING CO PTY LTD
1 WELLINGTON ST, ROZELLE

Available from:
NSW: RADIO DESPATCH; G. BROWN; M. DE LAUNAY; DAVID REID. ELECTRONIC DISTRIBUTORS
VIC: ELLISTRONICS; ARLIN; TECH SCIENTIFIC.
SA: PROTRONICS.
WA: RESERVE
QLD: [illegible]

Editorial Viewpoint

A fascinating future, but . . .

Seen from the editorial chair, each new decade has had its own special interest.

The 40's were dominated by World War II, with its tensions and its tragedies. But it was also a period of tremendous technical development, judged on the standards of the day.

The 50's brought peace and the exciting prospect of applying wartime technology to more personal ends. While amateurs and experimenters picked their way through a mountain of disposals gear, industry turned its attention to a new generation of radio receivers, to television and to electronics in the broader sense.

With the 60's came the full challenge of solid-state technology, and the opportunity — indeed the necessity — to re-think and up-date virtually everything electronic, from portable radios to elaborate commercial and professional equipment.

That process continued into the 70's with ever-increasing momentum. But this last decade will surely be remembered as the one which saw the emergence of the computer, the calculator, the microprocessor, and a whole range of digital technology to threaten the analog way of doing things.

What lies ahead for the 80's is nothing short of breathtaking: multi-channel, superquality digital discs and players, long-playing video discs and video cassettes, highly sophisticated communications equipment, satellite and cable television, personal and domestic computers, and so on, without even mentioning educational, commercial and professional products.

But, exciting as it may seem, the 80's may become notable as the decade in which technological achievement outstripped human need — or inclination. How much music can we really cope with, no matter how "perfect" the system? How much time can we really devote to video, no matter how wide the choice of subjects? What real use can we make of a parlour full of TV games, or communications devices, or computer-like gadgetry? Surely we're in danger of becoming a nation of adult children, oversupplied with sophisticated toys — most of them imported.

For sure, entrepreneurs, advertising people and sales reps. will have truckloads of "goodies" in the 80's but they may well discover a new kind of sales resistance, having much in common with the environmental movement. When you've had your fill of gadgets, it's amazing how much satisfaction you can rediscover in simply doing your own thing — playing a musical instrument, reading a book, building a rock garden, or just walking in the bush!

Neville Williams

Registered for posting as a publication — Category B.
Printed by Magazine Printers Pty Ltd. of Regent Street, Sydney and Masterprint Pty Ltd of Dubbo, NSW, for Sungravure Pty Ltd. of Regent St, Sydney.

Editorial Office
57 Regent St. Sydney 2008
Phone (02) 699 3622 Telex 25027
Postal Address: PO Box 163, Beaconsfield 2014.

Advertising Offices
Sydney — 57 Regent St. Sydney 2008
Phone (02) 699 3622 Telex 25027
Representative: Narciso Pimentel.

Melbourne — 392 Little Collins St. Melbourne 3000. Phone (03) 602 3033
Representative: Stephen Taylor

Adelaide — Charles F. Brown & Associates Ltd. 254 Melbourne St, North Adelaide 5006
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 Sungravure Pty Ltd, 57 Regent St, Sydney; in Victoria by Sungravure Pty Ltd, 392 Little Collins Street, Melbourne; in South Australia by Sungravure Pty Ltd, 101-105 Weymouth St, Adelaide; in Western Australia by Sungravure Pty Ltd, 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

Voice recognition device controls colour TV set

Sanyo Electric has developed a voice recognition device capable of controlling a domestic colour TV set and other consumer electronic appliances. While existing voice recognition devices have been mostly based on minicomputers, the new device is based on an 8-bit microprocessor.

The recognition performance averages 95% which, according to Sanyo, is good enough for effective control if the applications are selected intelligently.

Control functions include power supply on/off, volume adjustment and channel selection. The command is composed of two words. For example, "television power" switches the power supply on or off, and "channel 8" selects channel 8.

The volume is controlled by selecting one of 10 levels and issuing the appropriate command, eg "volume 4".

Sanyo has yet to indicate the likely cost and whether the system will be marketed commercially.

RAAF tests laser bomb guidance kits

The RAAF recently conducted a series of tests to evaluate the effectiveness of laser bomb guidance kits. The kits are manufactured by Texas Instruments for the US air force.

Specially wired Mirage III test aircraft of the Aircraft Research and Development Unit (ARDU), based at the Edinburgh AFB, South Australia, conducted a series of carriage and release trials at Woomera to provide the RAAF and specialists from the Defence Research Centre with first hand information on the capabilities of this important area of modern weapon technology.

The laser-guided bomb (LGB) is a highly accurate weapon which homes onto laser energy reflected from a surface target designated by either a soldier on the ground or an airborne FAC (Forward Air Controller).

Although there is no immediate indication of the RAAF acquiring airborne laser designators for FAC aircraft, the Australian Army is already equipped with several laser devices.

The tests to prove the feasibility of fitting LGBs to the Mirage are closely related to the RAAF's intention to maintain the Mirage in its inventory for another decade. Local production of the laser-guidance kits would have significant potential for Australian industry involvement.

COMBINED AM/FM RADIO, CALCULATOR & CLOCK

Sanyo has released a combination AM/FM radio, clock, and calculator, all combined in a package only 161mm high, 65mm wide, and 18mm thick.

The clock has an alarm function, using either a buzzer or the radio. The clock and calculator use LCD readouts, giving low battery consumption and good daylight visibility. Both are powered from two C-13 cells.

The radio delivers 100mW of audio power to a 45mm diameter speaker, and operates from two type AA cells. It is fitted with a small telescopic aerial.

Recommended retail price is $124.00. Further details from Sanyo Australia Pty Ltd, 225 Miller St, North Sydney, NSW.

Power stations in space

Britain is to seek a major role in the plan to establish giant solar power stations in space.

The UK Department of Industry has revealed that it had placed a $200,000 contract with a group of companies to study the idea of using the sun to power the national grid. The group is headed by the British Aerospace Space Centre at Bristol, and includes the Marconi Space and Defence Systems Company.

British Aerospace engineers have already studied plans to develop solar arrays capable of producing up to 500kW of power. It is thought that a series of these could be linked up to produce a space station with an output of up to 2MW.

The solar panels of such stations would cover many square kilometres and be assembled in space from basic units and materials transported from Earth by the Space Shuttle, now being completed in the United States.

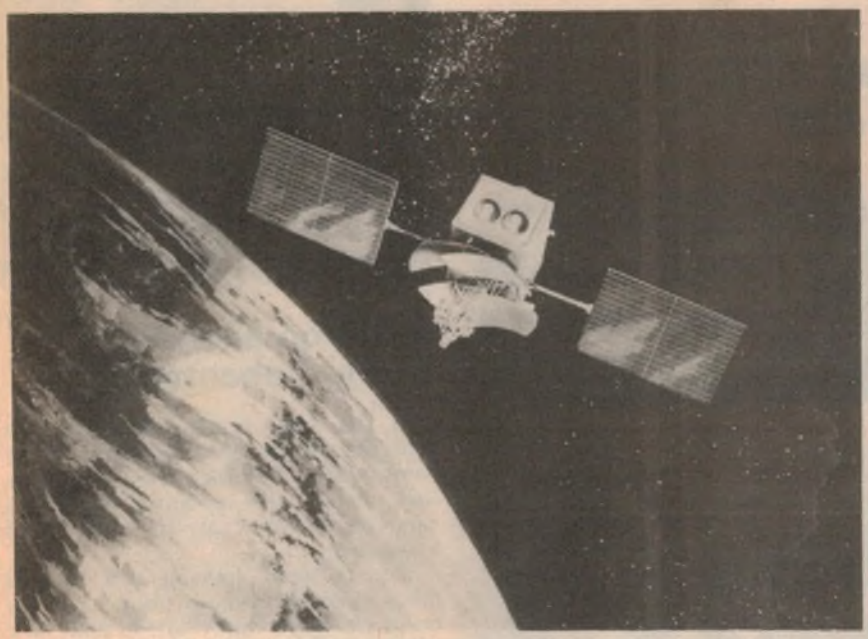
The massive solar power satellites would be put into geostationary orbit some 36,000km above the equator, where they would continually convert the Sun's rays into electrical energy. This energy would then be transmitted to antenna "farms" on Earth by microwave radiation.

RCA to market video disc player

Latest news on the video disc front is that RCA has finally launched its version onto the US market. The RCA system user capacitive pick-up as distinct from the rival Magnavox-Philips system which uses a laser. It remains to be seen which system will ultimately capture the public's attention, or whether the two systems can exist side by side.

RCA plans to back its player with an array of about 300 disc titles, with plans for additional titles to be added at between 10 and 15 per month for the first year. The latest version of the RCA player has been reduced in weight compared with the original concept, but the price has risen from under $US400 to around $US500.

$20 million satellite lost in space!



Artist's concept of RCA's Satcom III, lost in space shortly after its launch from Cape Canaveral on December 6. The $US20 million communications satellite disappeared from tracking screens just 15 seconds after a booster motor was fired and may have exploded according to space officials.

Britain facing TV invasion — Sir Harold warns

Sir Harold Wilson, Britain's former Prime Minister, has warned that the development of satellite relay systems for TV programs poses a threat to the British TV industry — particularly ITA's advertising revenue — by allowing European TV systems easy access to British audiences.

Speaking in an Opposition debate on TV licences, Sir Harold said that this type of viewing was now a real possibility. Continental broadcasters were planning £100m satellites, each of which could earn advertising revenue of £150m in the first year.

A space TV system could be beamed to nearly every home in the land and by 1984 satellites would be a real force. A small dish type aerial in the loft was all that was needed to receive signals.

"We have received evidence showing maps of Europe and the areas which could receive such programs," Sir Harold explained.

"It is clear that programs from Continental satellites will cover the whole of Britain."

Magnetic bubble memories from TI

A new family of physically and electrically interchangeable magnetic bubble memories with the largest capacity device having one-million bits of storage has been introduced by Texas Instruments Incorporated.

Bubble domains for all the new memories are two-microns in diameter. Access time for the megabit bubble memory is 11.2 milliseconds, twice as fast as a previously announced megabit bubble memory.

The first two devices — to be available as board-level systems — are the TIB1000, a binary megabit device organised as 512K x 2, and the TIB0500, a half-megabit device with 512K x 1 organisation. A binary quarter-megabit device, compatible with the two larger devices, will be made available later in 1980. The family approach will alow designers to vary system storage capacity by interchanging the bubble devices.

All members of the new bubble memory family are packaged in a 24-pin 3.3 x 3.56cm package with pins on 2.54mm centres. The devices use the same support circuits, including the TIB0903 monolithic custom controller, TIB0804 coil driver, TIB0953 function timing generator, TIB0833 sense amplifier and TIB0863 and TIB0883 function drivers.

VLSI devices in doubt for space applications

The future of very large scale integrated (VLSI) devices is somewhat uncertain at present, as far as space applications are concerned, due to the likely risk that cosmic radiation could cause both device failure or momentary device malfunction.

The degree of risk is not yet clear, although some researchers are claiming that the devices should not be used until a major breakthrough provides a much higher order of protection. Other authorities claim, however, that the risk of error or total failure is small, and can be allowed for by employing proven error correcting techniques and built-in redundancy.

Steam power set for a comeback

Britain's Overseas Development Administration (ODA) believes a new age of steam could be one answer to the present dependence of developing countries on costly imported fuels and technology.

With this in mind, the UK Intermediate Technology Development Group has joined forces with the Department of Engineering at Reading University, near London, in a 14-month program to design and develop a small-scale steam electricity generating system in the 5-50kW power range.

Under the $60,000 project being funded by ODA, a market survey will be carried out to evaluate the potential use of steam for agricultural duties such as milling and water pumping, and as an electric power source for domestic users and small industries in rural areas. This will be followed by a design study on a steam-driven electricity plant that has low maintenance costs and above all can be built and operated locally in any country.

Interest is also being shown in the possibility of introducing steam trains using a new form of fluidised-bed combustion which is promising to revolutionise coal-fired power stations. This form of pollution-free combustion burns a variety of different fuels on a bed of ash or sand.

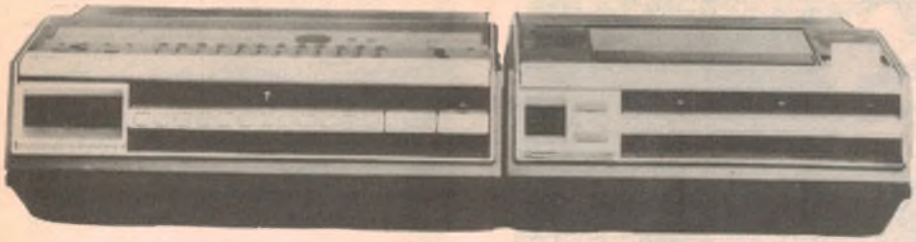
Skid warning system for motor cars

Alfred Teves, Frankfurt, Germany, one of Europe's largest motor car brake manufacturer's, has announced development of a system to warn drivers of the risk of skidding on a wet road. Sensors mounted on the wheels sense changes in rotational speed which indicate that the wheel is about to lose its grip on the road.

The information is directed to a central system, no larger than a cigarette package, which can operate an acoustic or optical warning system to alert the driver. The firm is about to submit samples to various vehicle manufacturers for appraisal.

NEWS HIGHLIGHTS

Single head, high speed VTR — a new concept from BASF



Yet another home video recording system has been added to the market, this time by BASF of West Germany, making a total of five non-compatible systems competing for public approval. Initial marketing is to begin by mid-1980.

Called the Longitudinal Video Recording (LVR) system, it features a single fixed head of relatively simple design. The tape is of chromium dioxide, 8mm wide x 8.5um thick x 600m long, and is housed in the world's smallest video cassette (114 x 106 x 17mm). It moves across the head at a rate of 4m/s.

After each pass, the head steps to the next of 72 tracks recorded on the tape and the tape direction is reversed — all in a period of 100ms. Playing time is three hours.

Among the advantages claimed by the makers are ease of access to any recording on the tape, and ease of tape duplication. Each track lasts for 2.5 minutes so any part of the recording is available in less than this time by selecting the appropriate track. A track number indicator is provided.

Duplication is simplified because all 72 parallel tracks can be copied simultaneously in one pass through the copying system.

For further information contact Mr N. Price, BASF Australia Ltd, 55 Flemington Road, North Melbourne, Vic 3051.

Business Briefs:

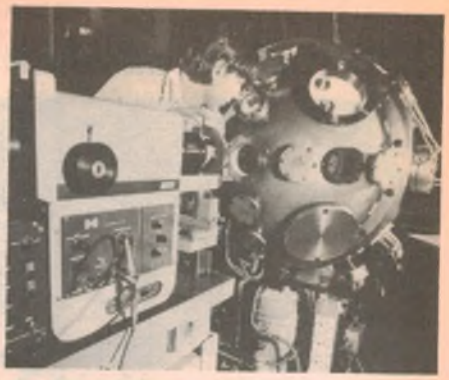
National Semiconductor Corporation and Itel Corporation have signed an agreement transferring Itel's computer marketing and service operations in Australia and New Zealand to National, as from January 1, 1980. Under the agreement, National will market Itel's current range of medium to large IBM compatible computer products.

Multi-Contact Australia has announced the appointment of two new distributors: Halley and Mellowes Pty Ltd, 20 Gault Rd, Belair, SA 5052; and Martin de Launay Pty Ltd, King & Darby Sts, Newcastle, NSW 2300. Multi-Contact handle the range of Tschudin and Held products, as well as high current connectors, laboratory components, switchgear and relays.

A 550 page comprehensive directory of **CSIRO research programs** is now available. The directory contains descriptions of all of CSIRO's 700 research programs and sub-programs and includes details on location, staff and expenditure.

Copies of the book, titled CSIRO Research Programs 1979-80, are available at $10 a copy (postage included) from the CSIRO Editorial and Publications Service, PO Box 89, East Melbourne, Victoria, 3002.

National Semiconductor Corporation, California, has announced a $50 million credit agreement with five American banks and two foreign banks. The loan is for three years, with a further four years option. The loan will be used for working capital and general corporate purposes.



Raindrop analysis on the Concorde!

In the time it takes to read this sentence this British camera could take some 2500 million pictures of the structure change of a specimen inside this vacuum chamber at the Rutherford Laboratory.

The Hadland Imacon 675 camera takes over 600 million frames per second. It is so fast that it will take "streak" photographs that can detect a change over a period of less than five picoseconds.

The camera's speed makes it able to solve a wide range of problems. These include the progressive recording of crack propogation in solid materials such as glass, rock and metals, providing records for ballistic tests, aiding the study of spark discharges and surface flashover on conductors and for work with lasers. A camera similar to this one was first used to study the effects of raindrops on the windscreen materials chosen for the supersonic Concorde airliner.

Further information from John Hadland (Photographic Instrumentation) Ltd, Newhouse Laboratories, Newhouse Rd, Bovingdon, Hemel Hempstead, Hertfordshire HP3 OEL, England.

One-board Teletext & Viewdata decoder

Expansion of the British Teletext and Viewdata systems beyond the current "experimental" stage has been brought a step nearer by the development of a single printed board containing all the necessary circuits to decode these signals. The board is based on a microprocessor and measures just 100 x 150mm.

Make by General Instrument Microelectronics, the system is to be known as Teleview and is described by the company as being sufficiently cost effective to attract manufacturers of add-on equipment, as well as the television set makers, once quantity production levels have been reached. Significant performance advantages over existing dedicated Viewdata or Teletext systems are claimed.

sanwa

...the long term reliable multimeter.

N501 Multimeter The executive choice!

- Measurements similar to a VTVM can be taken as the N501 has a constant IMΩ input impedance on the ACV ranges.
- Widespread coverage of the principal measurements is available as the N501 has AC + DC Volts to 1.2kV, AC and DC Amps to 12 Amps and 6 resistance ranges to 200 MΩs.
- Attractive, 9mm thick walnut sideboards help protect the multimeter from accidental damage.

NEW

T-55 THD Multimeter (T-55D c/w optional temperature probe)

The latest lightweight with heavyweight features!

- Adds a temperature capability (-50°C to 200°C) to the newest thin-dimension multimeter. Lets you measure the temperature of industrial and commercial appliances or individual component heat.
- Offers a multi-role multimeter to cover normal requirements plus AC Amps, battery test, LED test and temperature selections.

U-60D UNIVERSAL MULTITESTER

- 44μA movement–quality performance, diode protected
- Stable ACV measurement – solid-state rectifier & enlarged frequency coverage.
- Linear scale characteristic –common scale reading for DCV and ACV
- Semiconductor test –simultaneous reading of load current & voltage with Ω
- Temperature measurement of –30°C to +150°C with extra probe

PDM500C INSULATION TESTER

- Easy push button operation.
- Large easily read scale.
- No wearing parts (transistorized for long trouble-free life).
- One-man operation–no handle to crank.

Specifications
Rated Voltage 500V.
Resistance 100 Megohm.
Effective scale reading: 0.1–100–200 Megohm.
Continuity Scale: 0–100 ohms.
Including vinyl-leather case with lead pouch, shoulder strap and insulated test leads.

460-ED MULTITESTER THE BEST BUY IN MULTIMETERS

100,000 ohms per volt with ± 2% accuracy for DC ranges with only 10 microamperes loss at full scale. H.F. current blocking when making DC measurements.

- 10μA movement–100kΩ/V, varistor protected
- Polarity reversal switch–negative measurements
- Equalising transformer–common shunts & jacks for 1.2A & 12A DC/AC

BX-505 MULTITESTER

- Fast-response, 24μA movement–fuse & diode protected with high resolution factor (0.4μA/scale division)
- Revised scale marking–intermediate readings readily determined
- Polarity reversal switching–negative measurements
- Series capacitor terminal (OUTPUT+)–AF output level check

RANGES: AC & DCV to 1.2kV (30kVDC with optional probe). AC & DCA to 12 amps

WARBURTON FRANKI

• ADELAIDE 356-7333 • BRISBANE 52-7255 • HOBART 23-1841
• MELBOURNE 699-4999 • PERTH 277-7000 • SYDNEY 648-1711
• AUCKLAND N.Z. 77-0924 • WELLINGTON N.Z. 698-272

WF623/78

JOHN F. ROSE COMPUTER SERVICES PTY LIMITED
JOHN F. ROSE GRAPHICS COMPANY PTY LIMITED

are

Suppliers of complete systems from **Cromemco, Altos, Vector Graphics and Micromation,** as well as manufacturers of the **OMEGA 8000 and 5000** series computers (which can have comprehensive colour graphics including video input!), S-100 boards, peripherals, languages and utilities.

Micromation double density 8"/5" disk controller with CP/M **$570.00**

SORCERERS and S-100's
Micromation Megabox 1.1Mb capacity, with power supply, case, disk controller CP/M & cabling
$2869.00

2xSiemens 8" drives with case, power supply, S-100 controller, CP/M, cabling 8 slot S-100 motherboard
$3100.00

30 A. S-100 power supplies can drive 4, 8" drives etc.
Siemens 8" D/D disk drives
$650.00

Micropolis 5" Quad density disk drives
$650.00

SOLE AUSTRALIAN AGENTS FOR:

$3,500.00

2xMicropolis disk drives with power supply, case, cabling & controller with CP/M.
$1890.00

A selection of boards that we stock is:

Vector Graphics Z80a CPU
Flashwriter II Video Board
Cromemco Z80a CPU
Cromemco Super Dazzler
Matrox 2480 Video
Cromemco D+7a
Micromation Z64 board (64K RAM with Z80a CPU on one S-100 Board)
48k Dynamic RAM Board
Bitstreamer I/O
16K & 32K Bytesaver Cromemco
Matrox ALT 256** (256x256)
Matrox ALT 512** (512x256)
Cromemco 3k control Basic

Software includes WORDSTAR (comprehensive wordprocessor) and Selector III-C2 (a powerful database management package).

Send for our brochures (include a 20c stamp):

SHOWROOM: 33-35 Atchison Street, St. Leonards 2065 N.S.W.
TELEPHONE: (02) 439-1220.

POSTAL: P.O. Box 745 Crows Nest 2065 N.S.W.
TELEX: AA27901.

NEWS HIGHLIGHTS

The menace of gasoline!

We came across this gem in a recent copy of "Atom" (published by the UK Atomic Energy Authority). It's from the "US Congressional Record" for 1875:

"A new source of power, which burns a distillate of kerosene called gasoline, has been produced by a Boston engineer. Instead of burning the fuel under a boiler, it is exploded inside the cylinder of an engine. This so-called internal combustion engine may be used under certain conditions to supplement steam engines. Experiments are under way to use an engine to propel a vehicle.

"This discovery begins a new era in the history of civilisation. It may some day prove to be more revolutionary in the development of human society than the invention of the wheel, the use of metals, or the steam engine. Never in history has society been confronted with a power so full of potential danger and at the same time so full of promise for the future of man and for the peace of the world.

"The dangers are obvious. Stores of gasoline in the hands of the people interested primarily in profit would constitute a fire and explosive hazard of the first rank. Horseless carriages propelled by gasoline engines might attain speeds of 14 or even 20 miles per hour. The menace to our people of vehicles of this type hurtling through our streets and along our roads and poisoning the atmosphere would call for prompt legislative action even if the military and economic implications were not so overwhelming. The Secretary of War has testified before us and has pointed out the destructive effects of the use of such vehicles in battle. Furthermore, the supplies of petroleum, from which gasoline can be extracted only in limited quantities, make it imperative that the defence forces should have first call on the limited supply. Furthermore, the cost of producing it is far beyond the financial capacity of private industry, yet the safety of the nation demands that an adequate supply should be produced. In addition, the development of this new power may displace the use of horses, which would wreck our agriculture.

". . . The discovery with which we are dealing involves forces of a nature too dangerous to fit into any of our usual concepts."

Automatic radio telephone system

The British Post Office has announced plans to introduce an improved radio telephone system for private vehicles in the London area. Installation is expected to commence in May 1980 and to be completed by mid-1981.

The new system will supplement, rather than replace, the present manual operator system. This currently provides for 3500 subscribers and suffers from the disadvantage that calls must be booked with the operator, who then directs the caller to a vacant channel.

By comparison, the new system is completely automatic. The mobile telephone is equipped with a push-button type dial with which the subscriber simply dials the number he wants — to any of Britain's 25 million telephones. Also, the new system provides a full duplex circuit; it will no longer be necessary to use the press-to-talk technique.

New microscope 'sees' atoms

A new 600kV high-resolution electron microscope (HREM), built by scientists and engineers at Britain's Cambridge University, will enable researchers to see individual atoms for the first time.

The microscope has already produced some outstanding results including an image of a gold crystal magnified seven million times . . . at the same degree of magnification a man would look as big as the earth. The image clearly shows rows of gold atoms — some of the smallest objects yet shown on an electron microscope image.

The microscope will be used to examine a wide range of materials to gain a better insight into their structure and, more importantly, their defects. This will help scientists to understand their behaviour as materials.

At present the researchers have mainly inorganic samples in mind, although the microscope could be used to study the structure of organic molecules. To do this it would be necessary to solve the problem of the barrage of electrons that illuminate the sample breaking the weak bond that holds organic atoms together.

VW to purchase Hall-effect sensors for ignition timing

Honeywell's Micro Switch division in Freeport, UDS, has signed an agreement with Robert Bosch GmbH, West Germany, to supply 1980 Volkswagen cars with Hall-effect ignition timing sensors. Similar Hall-effect sensors, which replace the mechanical breaker points, have been supplied by Micro Switch for use in Chrysler's Omni and Horizon cars since 1977.

Britain plans major television expansion

Britain's Independent Broadcasting Authority (IBA) has announced major expansion plans for the country's television network. The IBA aims to have 30 high-power transmitting stations for the new "Fourth Channel" colour television network completed and ready for simultaneous launch in all ITV regions (except the Channel Islands) by November 1982.

From the outset, the Fourth Channel will be available to over 80% of the population of the United Kingdom — more than 40 million potential viewers. An additional 18 stations will join the network during 1983 and 1984.

Contracts totalling more than £16 million have already been awarded by IBA to Marconi Communication Systems Ltd and Pye TVT Ltd for supply and installation of the 48 new UHF transmitters.

Information at the press of a button

Car computers

— new electronic know-it-alls

by BILL HAWKINS

These new car computers give instant readouts of fuel consumption, distance to go, time of arrival, and more — all at the push of a button.

You've been on the road for hours. The clock says you're running late, the gas gauge says you're running low. And there's a desolate stretch of highway ahead between you and your destination. Should you take the extra time to look for a gas station or do you continue, hoping the lonely roadway is shorter than your fuel supply?

Messy situation? Not for an onboard computer. Just push some buttons and digital readouts will tell you how many miles you've got to go, how long it will take and how much fuel you'll have — if any — when you get there. And it's accurate. The answers are based on information from electronic sensors placed under your hood that monitor your speed, gas consumption, mileage, and more.

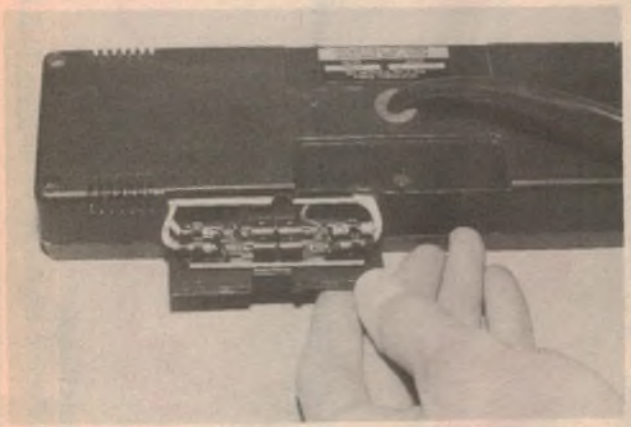
If this sounds like something out of the 1980s, you're dead right — these add-on black boxes are available in the US now and you can install one yourself. Prices vary — from $US160 to $US350, depending upon what the unit will do and the features it has. One, the Compucruise, does everything but steer; you push a button and it automatically brings you up to the right legal speed to arrive at your destination on time. Another, the Prince, is CB-oriented: punch in mile markers along the highway and it alerts you to an accident, detour, or Smokey (police, in CB language) a mile before you get there. Still a third unit, Avantar, doesn't really "compute" at all. It's designed for the car buff who wants to know precise information such as rpm and oil temperature. Using the data it supplies, however, you can accurately figure out your ETA (estimated time of arrival) yourself.

The idea of a car computer isn't new. A year ago, Cadillac began to offer a true digital (on-off pulses) computer as an option. But at $US875 — attached to a $US16,000 car — the gadget was only for big spenders.

Not so for the new generation of car computers. Their lower cost, ease of installation, and dependable accuracy could make them the hula hoop of the add-on industry for autos and vans.

How they work

As you drive, things are happening under the hood that relate to your exact position. When you step on the gas, fuel flows, increasing with engine rpm. The engine turns the transmission, and the transmission turns the wheels under you. You begin to move and, through it all, time is passing by. Just how far you move — distance — will depend on your speed — rate — and how long you've been travelling — time. The old equation — Distance =



Installation is not difficult, but usually takes several hours. Plug-in cables run from dash, through fire wall, to sensors mounted throughout the engine block. These systems are virtually maintenance-free except, possibly, for changing one of the bulbs used to backlight keyboard panel.

Rate x Time — holds for new computers, too. The trick, however, is in measuring these numbers.

These systems use microprocessors, tiny computers on a single integrated circuit chip that can be programmed to step through any sequence of commands: add, subtract, save data, display the results. But digital computers require single pieces of on-off pulses (bits) to work. A spinning crankshaft hardly conforms to this requirement, so transducers (sensors) are used to convert the mechanical motion into a usable electric signal.

The most important sensor is called the speed transducer (although its output is used to represent distance, not speed). It's basically a coil of wire and a magnet. In the Compucruise system, four magnets glued and taped to the driveshaft are used; the coil mounts nearby on the underside of the car. The Prince system puts the magnet and coil in one package, which splices into the speedometer cable. The idea and results are the same: As you move, the cable or crankshaft turns, allowing a magnet to pass in front of the coil. When it does, a small voltage pulse is induced in the coil, representing a full or partial turn. Since the crankshaft and odometer cable revolve in proportion to the movement of your car, a specific number of pulses will represent a specific distance.

How much distance? That depends on such things as the rear-axle ratio and tyre size. But that's where the computing power of the microprocessor comes in: before using any of these systems, you make a simple calibration. At the beginning of a measured mile, you push a button. That tells the computer to begin at zero. Then, as you travel the mile stretch, the computer counts the pulses. At the end of the mile, push the button again. The number of accumulated pulses are then stored as a reference base. If, for example, the computer counted 800 pulses for the measured mile, it knows that 400 represent one-half mile, 1600 mean two miles, and so on, for any distance you travel. And all this will automatically take tyre size and other variables into account, since they were part of the original calibration. (And this, of course, means that you must recalibrate the system if you change your tyres.)

Okay, the computer now knows how far you've gone, but it must also know your speed to do any useful work. To determine it accurately, the system computes it. Since the speed — or rate — is equal to how long it took you to go a certain distance, and the distance is known from the calibration, all that's needed to calculate the speed is the time ($R = D \div T$).

For that, a digital clock is used, basically the same type as the digital clock on your desk. The clock circuitry starts with a quartz-crystal-controlled oscillator — merely a circuit that switches on and off at a precise rate, thousands of times a second. Other digital circuits within the clock divide this time down into thousandths, hundredths, tenths, and finally single pulses per second.

The computer can use any of these time bases as a "window" — a single moment in time to count distance pulses from the transducer. If, for instance, it counts four pulses during a 1/10-second window, that's equal to 40 pulses per second; 2400 pulses per minute; 144,000 pulses per hour. And, from the original distance calibration, if each pulse represented one foot of movement, then you would be moving at 144,000 feet per hour or 27.3 miles per hour.

If all that has you confused, don't worry. Fortunately, the computers do it all automatically — every second — and show the results on a digital display. But that's not all.

More tricks

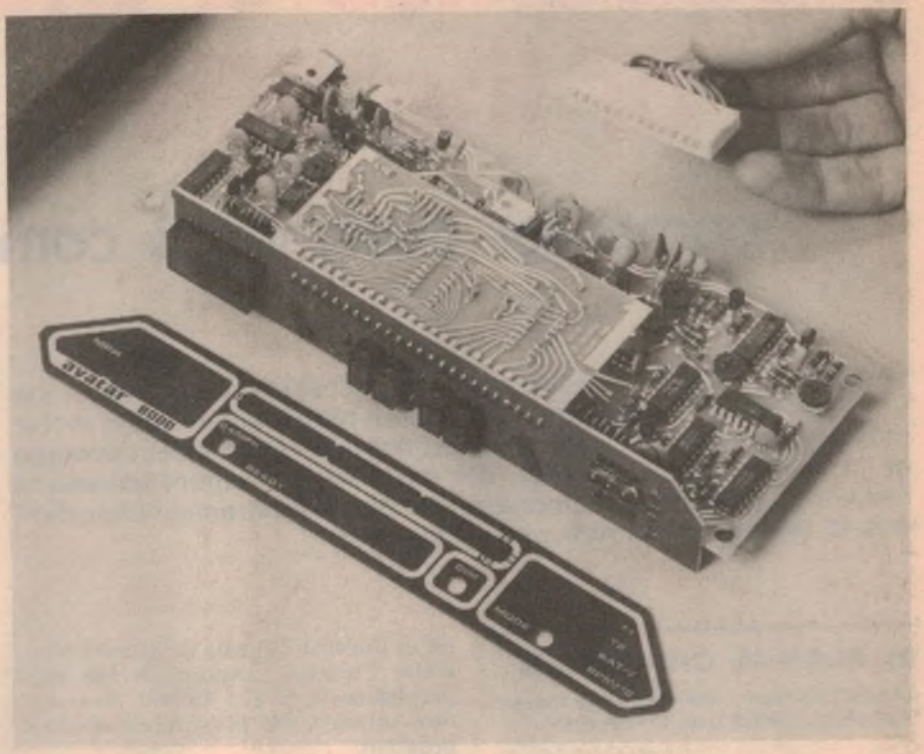
Besides a speed transducer, the Compucruise and Prince units use a flow transducer on the gas line. It, too, uses pulses to indicate the amount of fuel passing through to the carburettor. And once calibrated by entering in the amount of fuel consumed at your next fill-up, along with the capacity of your fuel tank and the cost per gallon of gas,

Car computers: new electronic know-it-alls

Who makes them

Avatar — Grass Valley Instruments, 12555 Loma Rica Dr, Grass Valley CA 95945; Compucruise — Zemco Inc, 1136 Saranap Ave, Walnut Creek CA 94595; Prince — OBC Products Div, 35 Madison St, Holland MI 49423.

The Compucruise is distributed in Australia by Antelope Engineering Pty Ltd, 68 Alfred St, Milsons Point, NSW 2061. Phone 929 4033.



Avatar is the simplest of the three units, gives engine and time information on LED readouts. Unlike Compucruise and Prince, it doesn't contain a microprocessor.

there's no end to what these systems can predict.

"We've got all this information coming into the computer — what we've done is to try and take full advantage of each piece," said Don King, vice president of Compucruise. He's not kidding. The small, 20-button box can perform 44 different functions, including instant mpg, cost per mile, average speed, lap timer, ETA, fuel to empty, present time. Even external temperature sensors can be connected for an inside/outside temperature display. And as a $40 option, the mechanics for a cruise-control system are thrown in, all precisely controlled by the black box on your dash.

Since each key of the Compucruise system performs multiple functions, it's possible to get the correct sequence mixed up when you first start to use it. But the computer out-thinks you there, too: Push the wrong button and the display shows ERROR, and adds an audible alert.

The Prince system is a bit more straightforward in its operation; each button is assigned a specific purpose. The system also contains a programmable memory. Enter in up to five mile markers and the unit reminds you when you're a mile away from a detour, an accident, or other roadway perils. It's assumed this information would come from "Good Buddies" over the CB, but the computer is just as handy for storing mileage markers for directions — at the next beep, you know to look for route 287 on the left, for instance.

The Avatar is the simplest of the three units. It's designed to give precise engine and time information: surface- and fluid-temperature display, digital speedometer, clock, elapsed time, battery voltage, digital tachometer, and a string of LED indicators that light in proportion to rpm, serving as an analog tachometer.

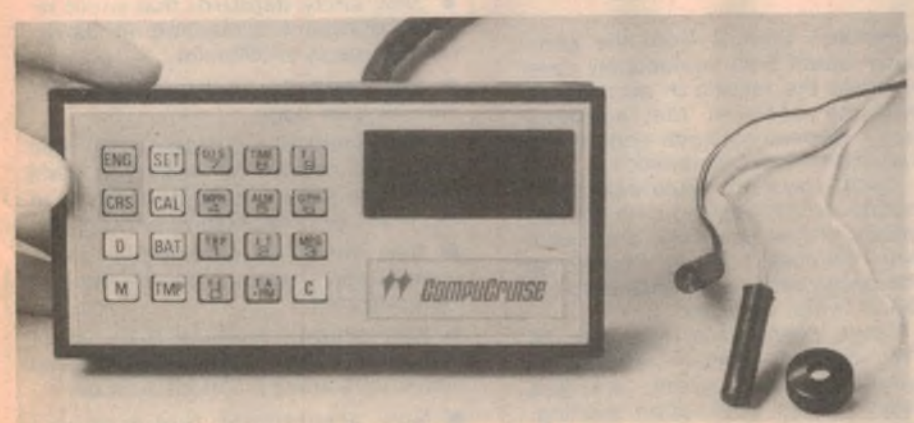
Just three buttons operate the system, but since it does not contain a microprocessor, any computations you do will have to come from your brain.

On the road

As I rode through the streets of New York and onto a parkway system, at the same time pushing buttons and reading digital displays, I was happily alert to one point: A friend was doing the driving.

The myriad of digital displays and pushbuttons are not meant to be the centre of your attention while you're at the wheel. Rather, as the instruction manuals point out, the system should be set up before starting a trip so you can glance at the unit occasionally to see that you're on course.

As we rode, I couldn't help but think this was just the beginning. Under the hood of his car, a microprocessor-based electronic ignition system was controlling our fuel flow for optimum mpg, firing spark plugs for precise engine performance, and advancing timing for instant acceleration when we needed it. Inside the box in front of me, another microprocessor was controlling our speed, indicating our location, displaying how much fuel we had, and telling us when we'd arrive at our destination. All that's left, I thought, is the steering — and that may be just a matter of time.



Compucruise is small, so it may be mounted directly in dash. Two temperature sensors may be placed anywhere. Third component is an audible alarm.

Electronics & the car of the 80's

computer designed & computer controlled

The decision of the US Government to put car manufacturers in the front line of the battle to save oil is about to revolutionise the motor industry. By 1985, US vehicles must not only reach a fleet average of 11.7km/l (around 33mpg), but must meet stringent emissions requirements as well. Computers will play an extremely important role in designing the new generation cars.

by ALAN M. CHRISTMAN

General Manager, Manufacturing Industry Marketing, Control Data Corporation.

An era of revolutionary change is underway for the US automobile industry. An ever-changing series of government fuel-economy, emissions and safety standards has mandated a complete re-design of each manufacturer's automobile product line.

To meet the government-imposed standards, it is estimated that American car manufacturers will spend $US50 to $US70 billion between now and 1985 in massive product re-design programs — more than was expended to place the first astronaut on the Moon.

Ford Motor Company alone expects to spend $US20 billion in its re-design efforts, more than the total profits earned in the first 74 years of its existence, while Chrysler Corporation has embarked on a $US7.5 billion, five-year new product and plant modernisation program.

The regulatory process causing such expensive new product programs in the automobile industry began innocently enough in 1965 when Congress passed the National Highway Traffic Safety Act, and followed it up a year later with the Clean Air Act.

Since then, however, Congress has not only continued to progressively tighten safety and emissions standards, but has also imposed fuel-economy standards that require a fleet average of 11.7km/l (33mpg) by 1985 for each manufacturer.

The regulations are becoming more stringent. Here's what's been proposed or enacted in the last year alone:

Computer-controlled seat adjustment system from Recaro and National Semiconductor. The seat automatically adjusts to one of two pre-programmed positions at the press of a button.

- New emissions standards that will require car makers to cut tailpipe emissions by more than 93% from uncontrolled levels compared to an 83% requirement today. The technological challenge to the industry is to offset possible fuel-economy penalties of up to 12% while meeting the emissions standards.
- New safety standards that could require occupant protection in barrier crash impacts at 80km/hr.
- New passive restraint requirements, including air bags.
- New emissions standards that one day could require car makers to build engines to meet standards, in effect, at the worst possible engine adjustment.
- New service requirements to make engines and emissions control systems "tamperproof".
- New altitude standards that require cars in 1985 to meet the national emissions standards "at all altitudes".
- New accelerated fuel-economy standards, requiring a fleet average of 9.4km/l in 1981, 10.2km/l in 1982, 11km/l in 1983, and 11.5km/l in 1984.

On-board computers by 1981 says GM

US giant General Motors, the world's largest car maker, says that "virtually every GM car will have an on-board computer in 1981, primarily for the control of emissions and for fuel economy".

The company's main emphasis seems to be on central computer control. It believes that given computer control of the ignition, fuel flow and transmission, it would be possible to take the next step and disconnect the throttle from the floor pedal.

The accelerator would then serve only to transmit electrical signals, representing the driver's desired rate of acceleration, directly to the computer. Signals from the computer would then immediately open or close the throttle in accordance with the optimum fuel efficiency curve, depending upon engine and transmission characteristics.

Such a system would essentially modify driver behaviour in the interests of fuel economy, and could even eliminate certain aspects of anti-social behaviour concerning the use of motor vehicles.

Other possibilities foreseen by GM include plug-in automatic diagnostic equipment, keyless doors, coded pushbutton starting, radar braking, and electronic anti-theft devices.

A Chrysler engineer uses a colour graphics terminal to analyse a car body design. Computers will help Chrysler meet stringent new government regulations.

As if these regulations were not tough enough, there are proposals for even higher fleet fuel-economy standards — perhaps up to 17km/l (50mpg), according to Joan Claybrook, National Traffic Safety Administrator.

Meeting any one of these standards requires an immense amount of fast-paced, high-priced technological development over and above the normal requirements for new product development. Meeting them all at the same time requires pushing far beyond the state-of-the-art today, and somehow working around the irrefutable fact that reliable, time-tested solutions to the problems of safety, emissions and fuel economy fight each other when all the regulatory screws are tightened simultaneously.

Computer aided design, or CAD, has become an indispensable tool for the automobile industry in making the "impossible" possible. The plain fact is that government regulations are so stringent, and have been mandated so rapidly, that it would be impossible for humans alone to make the necessary engineering changes fast enough.

Both Ford Motor Company and Chrysler Corporation have installed large-scale Control Data CYBER-class computer systems to help them meet the technological challenges outlined earlier. CAD is allowing Ford and Chrysler to:

- Design, test, re-design and re-test component parts by simulating them on the computer, thus significantly reducing the costly and time-consuming process of testing prototype parts which previously had to be made and re-made until the desired configuration was achieved.
- Compress design time, giving management more time to consider alternative proposals before making final decisions.
- Complete considerably more engineering projects in the same amount of time.
- Relieve design engineers of the tedium of doing drawings by hand, allowing them more time to be creative and to make critical decisions.
- Interface more efficiently with manufacturing and assembly operations on design and engineering issues.

Computer-controlled fuel injection

Robert Bosch GmbH, Germany, has developed a microprocessor-based system that controls both fuel injection and ignition.

Heart of the system is an RCA Cosmac 1802 microprocessor. In operation, sensors under the hood pick up information on engine speed, crankshaft position, throttle position, intake-air temperature, and intake-air flow. The data is fed to the computer which calculates injection and ignition timing, and the amount of fuel to be injected.

The system results in substantial fuel savings, improves engine performance, and reduces engine emissions according to Bosch.

A similar system has been developed by Lucas Electric, the British auto parts manufacturer.

Electronics & the car of the 80's

At the Ford Engineering Center in Dearborn, Michigan, for example, nearly 5,000 computer technicians interact with six general-purpose and more than 100 special-purpose computer systems — the most powerful of which is a Control Data CYBER 176 — on a 24-hour-a-day, 7-day-a-week basis.

Through this extensive computer information system, Ford provides data that can be used by engineers, designers and planners to control and compress the product development process. Among the uses of Ford's extensive computer network are:

- To maintain day-to-day control of Corporate Average Fuel Economy for current and future models to assure compliance with government regulations. The system lists all of the powertrain and vehicle combinations and suggests specific mixes to achieve the standards on a continuing basis.
- To select the optimum mix of weight-reduction actions to achieve specific reductions. The data bank currently has 700 weight-reduction possibilities, and plans are to include cost-reduction, safety and reliability programs.
- To build finite element models for structural analysis of components. Design engineers take digital information from the Design Center, where the design of major parts of the car begins, and refine the lines to ensure that they meet packaging and manufacturing requirements.

By means of computer graphics, a car body is divided into specific panels or sections for closer analysis. Through use of a finite element structural analysis program called NASTRAN, engineers evaluate new designs involving lighter materials, reinforced plastics and other materials.

The computer predicts stresses or vibration characteristics which result when the analytical model is subjected to simulated loads. Graphics displays are used for constructing and interpreting the finite element models.

An indication of what the future holds is a prototype vehicle being built by Ford using graphite components that are stiffer than titanium, as strong as high-strength steel and one-third the weight of steel with equal performance.

This prototype vehicle incorporates a

Crisis for tradesmen — anti-skid braking — anti-collision radar — joystick control

The growing use of electronic and computer technology in modern cars is rapidly overtaking the ability of motor vehicle tradesmen to service and repair them, according to a recent industry report.

The report, published by Australia's National Retail Motor Industry Training Committee (NRMITC), says that the local industry does not understand or appreciate the "staggeringly rapid transformation into computer technology" that is about to revolutionise the motor car.

It says that within the next four years, possibly two years for some makes and models, many new vehicles will have computers controlling the engine, instrumentation and transmission functions. This development is being hastened by emission-control laws which demand exacting monitoring of carburation setting and ignition timing.

The need for manufacturers to improve fuel economy is also an important factor here.

Many other vehicle functions, such as trip meters, self tuning radios, and seat positioning memory devices will also be controlled by computer. Most vehicles will be fitted with anti-skid braking systems, anti-collision radar and other electronically controlled safety equipment such as self-levelling headlights. The various operating functions will be continuously monitored, and dashboard readouts used to indicate faults.

Other major changes forecast by the report include the use of plastics for body, trim, and even engine parts. Dashboard driver information systems — warning of approaching emergency vehicles, and providing traffic flow and speed limit information — will be fitted, and switches will be touch operated.

The steering wheel could even be replaced by a joystick control!

It is not yet clear whether the automobile's various sensing, control and display systems will be all controlled by a central computer or by an automotive version of distributed processing. Both systems may even be used. Either way, the car of the mid-1980's will be a rolling computer centre in which multiplexing will have become a necessity.

number of graphite components — doors, hood, driveshaft, suspension arms, bumper, floor pan, wheels and even the frame. It will be roughly the size of today's intermediate car, but will weigh about 570kg less.

Some part-by-part reductions are impressive: an 18kg steel hood weighs in at 7kg in graphite fibre and a wheel weighs only 4kg compared to 8kg in steel.

Of special significance is the design of hybrid materials that combine graphite and glass for maximum cost effectiveness. Since limited field test data exists for these materials, computer technology plays an important role in evaluation.

CAD also is helping Chrysler Corporation — an industry leader in the use of this advanced technology — make vehicle changes. At Chrysler's Technical Computer and Instrumentation Center in Detroit, four large-scale Control Data CYBER 170 and 70 series computers, supported by a broad range of Control Data peripheral equipment, are linked together to provide computer services 24 hours a day, 7 days a week to engineers in the US and Europe.

In addition, three CDC 1700 series computers support large screen interactive graphics, analog-digital and digital-analog conversion and computational services for Chrysler's vehicle proving grounds.

The Company's extensive computer network, which includes about 100 graphics and 300 teletype terminals, enables users in many locations to share a common data base that is continually updated as engineers and designers create and test new solutions to the government-mandated vehicle changes.

Chrysler engineers also use the NASTRAN finite element structural analysis program extensively in building models on a display screen to evaluate the use of new materials in making vehicles lighter and more fuel efficient. Through use of such lightweight materials as plastics, graphite, composites and high-strength steel, Chrysler expects by 1985 to reduce the average weight of its entire fleet of automobiles by 600kg — a 30% reduction on current models.

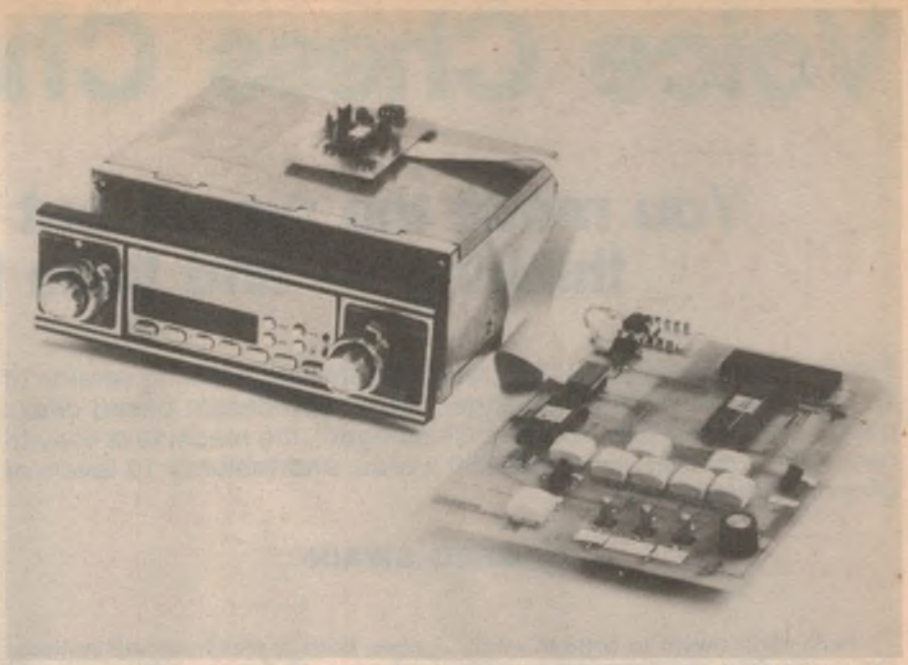
Weight reductions have a snowballing effect. Once weight is taken out of a car, it becomes possible to lighten up other parts. Less overall weight permits the use of smaller, lighter components — including lighter brakes, wheels, tyres, engines and transmissions. Computers also are used to package these components in the smaller car bodies.

Examples of Chrysler products that nearly meet 1985 standards are the basic four-speed manual 1978 Omni and Horizon, which have been certified by the government at 11.5km/l for city driving and 17km/l on the highway — performances that convince Chrysler officials tht the company's $7.5 billion, five-year new product and plant modernisation program will pay off.

An innovative use of computers at Chrysler involves a manikin called "Cyberman". When designers want to evaluate a new seat, armrest or a radio knob location, they call on "Cyberman", a montage of human measurements which they can call onto a display screen or computer printout.

Designers use the manikin to evaluate the packaging of interior features so that drivers of all shapes and sizes can be comfortable behind the wheel and can operate controls conveniently. An operator can program "Cyberman" into a number of preselected positions, displaying the manikin on a graphics terminal as a stick figure or as a complete "wire frame" outline.

The role of computer technology is making the "impossible" possible, as car makers use innovative approaches in designing and building the new generation of automobiles that Americans will be driving in the mid-1980's. That new generation will be radically different from the cars we drive today.



New style AM-FM car radio from National Semiconductor features a microprocessor controlled digital tuning system, keyboard entry of station frequency, pushbutton scanning, a clock, and storage of several stations in memory.

Dashboards will also go electronic

Solid-state electronic instrument displays with bright readouts are likely to be part of the new generation electronic cars. Inaccurate fuel gauges and speedometer cables will be eliminated.

General Instruments Microelectronics (UK), for example, has recently developed a vehicle display system based on one of its single-chip processors. The devices can be masked programmed to user requirements and, depending on dashboard needs, can drive fluorescent display tubes, LED displays, or liquid crystal devices.

Pulses derived from the gearbox output shaft are processed by the chip to drive speed, trip information and fuel displays. Engine parameters can also be displayed using analog or digital electronic readouts.

Another British company, Smiths Industries Ltd, has developed a vehicle display system that uses a laminated glass construction enclosing phosphor patterns. When a direct current is passed through the phosphor, the molecular layer in immediate contact with a conductive pattern etched into the glass emits light.

The most highly developed phosphor is zinc sulphide which emits a predominantly yellow light. This may be filtered to provide green and red displays. Display thickness is just 12mm and, subject to the conductive pattern, the information can be displayed in either digital or analog form, and as horizontal, vertical, curved, circular, expanding or contracting patterns.

Voice Chess Challenger

You move the pieces but it does the thinking — and talks to you!

Fidelity Electronics (USA) has recently released a talking version of its now famous Chess Challenger, a microprocessor based chess game. Called the "Voice Chess Challenger", the machine is easy to use, has a vocabulary of over 50 words, and features 10 levels of playing difficulty.

by GREG SWAIN

I really didn't want to write this article — not after the battering my ego took at the hands of a smart-alec backgammon computer some 18 months back. Well it's happened again! Once more my ego has been trampled on, this time by the "Voice Chess Challenger", a talking chess computer from American manufacturer Fidelity Electronics!

I can't even claim that the computer cheated. Chess is a game of skill, not luck, and there's simply no opportunity for the computer to resort to skulduggery. So I have no excuse — except to say that I was badly out of practice.

Actually, I had a lot of fun playing Fidelity's Voice Chess Challenger. It's a fantastic product, not only because it's a complete chess playing computer, but because it also "talks" using computer synthesised speech. It's almost like playing a human opponent!

Voice Chess Challenger is based on the Zilog Z80A CPU and is said to include the most powerful chess program ever placed in a microprocessor. Backing up the CPU are 8k bytes of ROM which store the game program, another 4k bytes of ROM to store the voice program, and 1k bytes of RAM to store the positions of the pieces as the game progresses.

The unit itself is compact and portable. It comes housed in a solid hardwood case that incorporates all the electronics (except for the plugpack power transformer), a keyboard, a 4-digit 7-segment LED display, and the playing board. It fits neatly into an attractive plastic carrying case, and is supplied complete with chess pieces and instructions.

Approximate dimensions are 31 x 20 x 3cm (L x W x H).

Adding a voice to the Chess Challenger has certainly resulted in a product which is much more interesting than the earlier Chess Challenger 7 and Chess Challenger 10 games, both of which are still available by the way. The machine incorporates a vocabulary of over 50 words. It announces each key as it is pressed, tells you which pieces it has moved and captured, and informs you when your king is in check.

The cold, nasal-sounding computer voice will even remind you to "enter your move" if it thinks you're taking rather a long time to make up your mind. The voice facility may be turned off (or on) at any time without affecting the game in progress.

You approach the Voice Chess Challenger by switching on the power and pressing the reset key. The machine introduces itself with the words "I am Fidelity's Chess Challenger, your computer opponent. Select your level". By then pressing the level (LV) key, the player is able to choose one of 10 levels of playing difficulty, the unit simultaneously announcing and displaying the level each time the key is pressed.

To play the game, the player keys in his move on the keyboard, and moves the piece to its new position. The computer then announces and displays its own move. Keyboard entry is quite logical and straightforward as the following example will illustrate.

Let's say that, at the start of the game, the player wishes to move a knight from position g1 to position F3. The sequence of keystrokes is: g7, A1, F6, C3, EN (enter). That's five keystrokes in all! Simple, isn't it?

The average response time of the computer to the various levels ranges

Comment by Robert Jamieson, Australian Chess Champion

The first question most people will ask about the Voice Chess Challenger is "how well does it play?". I would classify its strength as that of a fair club player, with a rating of about 1100, which places it above 95% of social players who make up the vast majority of the chess playing public.

The computer, like human chess players, has its own strengths and weaknesses. It develops its pieces well, and will take advantage of most tactical errors on your part, ie, if you give it the opportunity to capture an unguarded piece or to win material by a knight fork, etc. However, its depth of calculation appears to be short so that it plays less well in endgames, where one must calculate a longer series of moves, and when it is being attacked it may miss some threats which are beyond its vision.

As a teaching instrument for inexperienced players the Voice Chess Challenger should be rather effective. It develops its pieces along classical lines, tells you if you make an illegal move and can let you know what it thinks is the best move for you to make, as well as having a repertoire of 40 "book" openings for you to follow if you like. Regrettably these openings are poorly classified on the instruction sheet, which makes it a little difficult to look up the line that you want.

Stronger players will be interested in the Voice Chess Challenger, not only because they want an opponent that can give them a good game, but because it is intriguing to try to work out how the computer "thinks" and to test its reaction to different types of play.

from just five seconds for level 1 up to 11 minutes for level 9. If level 10, the most difficult level, has been selected however, the response may take many hours — or even days. The player can ask the computer which move it is considering at any time, and can even halt the search effort and make the computer enter its next move.

Essentially, what happens is this: When set to level 1, the computer examines only a few of the more obvious move and countermove combinations, thus making it an easier opponent and taking no more than five seconds to respond. But, beginning with level 2, the search levels are progressively expanded, with increasing numbers of move combinations considered and corresponding increases in the response time.

Illegal moves are met with "- - - -" on the display and the announcement "illegal move". This situation is corrected by pressing the clear (CL) key and re-entering the move, making sure that the error has been corrected. The CL key can also be used to clear an unwanted move, provided it has not been entered.

At the conclusion of the game, the computer announces the winner with the words "I lose" or "I win" and, if it loses, displays the number of moves played. In the higher levels of play (above level 1), the Voice Chess Challenger may start to flash a victory and announce "mate in two", even before the actual checkmate. This feature tells you that it has set up a "mate in two" situation from which you cannot escape.

If all that sounds impressive enough, consider the following:

- the position of every piece on the board can be audibly listed (and displayed) on demand;
- the player can choose to play either white or black, and can change sides during the game;
- the computer will recognise and play En Passant manoeuvres, and can be made to play against itself;
- it's possible to set up and solve chess problems, to alter the position of pieces during the game, and to "resurrect" pieces which have been captured;
- there are over 40 book opening variations, either randomly selected or chosen by the player; and
- versions of the Voice Chess Challenger are available in German, French and Spanish!

So what's it like to play against? Well, it's certainly no pushover, even when set to the easiest level. It tries to control the centre of the board, and develops its knights, bishops and centre pawns early in the game. The king is usually "castled" into safety as soon as possible.

The machine is also very quick to take advantage of human blunders, such as leaving the queen or some other valuable piece unguarded. And once it's got you by the throat, it doesn't let go!

In case you're wondering, I did manage to beat the Challenger — eventually. The game took just on 1½ hours to complete, this with the machine set to the easiest level. It's very sporting about losing too — no temper tantrums or sulking here. It announces the result without emotion, and sits there waiting to take its revenge in the next game.

The only sad note is the price, which, at $495, seems likely to be beyond the means of many people. Still, the price is not unreasonable, especially when one considers what the unit does. Perhaps I could console myself with one of the lower priced non-talking models!

You can buy the Voice Chess Challenger from large department stores (Grace Bros, Myers, etc), and from specialty games shops. Further inquiries to the importers Futuretronics Pty Ltd, 79-81 Levanswell Rd, Moorabbin 3189.

The Voice Chess Challenger has a vocabulary of 50 words and 10 levels of playing difficulty.

Solid state magnetic switches . . .

The Hall Effect

what it is and how it works

Ever heard of the Hall Effect? You haven't?!! Well read on. Hall Effect devices are now available at quite a moderate cost, making it possible for the electronics enthusiast to experiment with these fascinating devices. Imagine being able to measure the flux intensity of a permanent magnet, or use magnets in all sorts of control applications.

by GERALD COHN

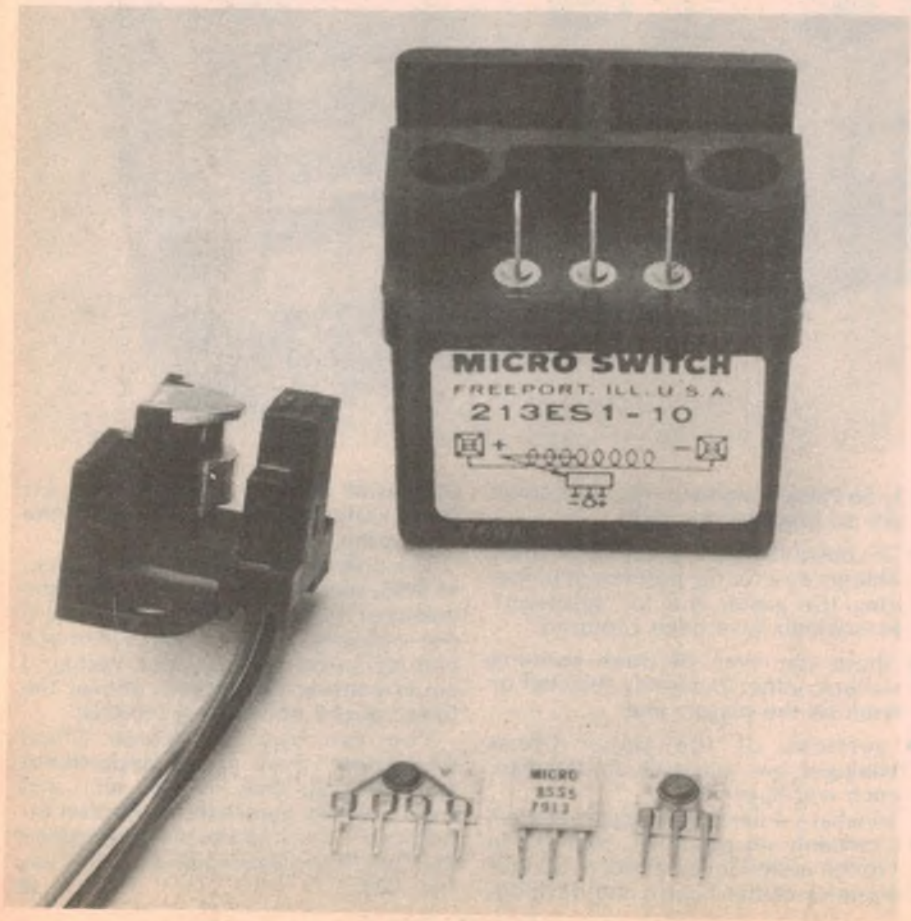
The Hall effect was discovered in 1879 by Edward H. Hall, at the John Hopkins University. Mr Hall found that when a magnet was placed in a position where its field was perpendicular to one face of a thin rectangle of gold through which current was flowing, a difference in potential appeared at the opposite edges. He found that this voltage was in turn proportional to the current flowing in the conductor and the flux density or magnetic induction perpendicular to the conductor.

Today, semiconductors are used rather than gold for the Hall element. The Hall voltages obtained are much higher using semiconductors.

Fig. 1 illustrates the Hall principle. Shown is a thin strip of semiconductor material (Hall generator) through which a constant control current is passed. When a magnet is brought near, such that its field is directed at right angles to the face of the semiconductor, a small voltage appears at the contacts placed across the narrow dimension of the strip. As the magnet is removed the voltage drops to zero.

The Hall voltage is dependent on the presence of the magnetic field and on the current flowing in the element. If either input is zero, the Hall voltage is zero. If the current flow through the Hall element is held constant, the Hall voltage is proportional to the magnetic field, and conversely, if the magnetic field is held constant, Hall voltage is proportional to the control current.

In typical Hall effect devices the control current is held essentially constant and the flux density is changed by the



Left: Typical Hall effect sensors. Shown are a vane sensor, a current sensor and three general purpose devices.

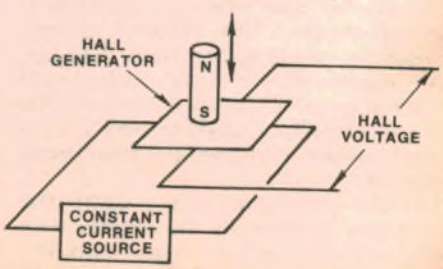


FIG. 1: HALL EFFECT PRINCIPLE

movement of a permanent magnet.

Fig. 2 illustrates the concept behind a practical Hall device. The output voltage of the Hall element, as a function of magnetic flux, is linear and therefore the device cannot be considered as a switch. Rather, the function of the element is to sense the presence of a magnetic field and provide an electrical output which is proportional to the flux density.

Fig. 3 shows the linear relationship between the magnetic flux density and a typical Hall element's output voltage is millivolts. As the magnetic field is increased, the output voltage increases in a predictable fashion. For example, if the output of the Hall element is 9.5mV on a meter, then we would know that the magnet was producing 150 gauss. Moving the magnet closer to the element increases the output reading on the voltmeter. When the meter reads 28.5mV, the magnetic field would be 750 gauss (or .075 Tesla).

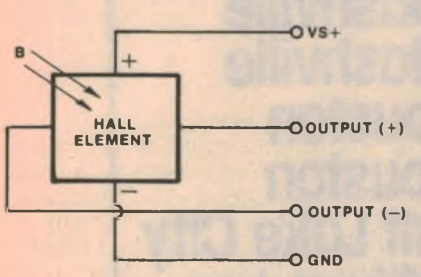


FIG. 2: SIMPLIFIED HALL ELEMENT SCHEMATIC

Another important feature of the Hall element is the differential output. In other words, as the voltage at out output rises, the voltage at the other output falls. This only occurs when the element is subjected to a magnetic field. Another important feature of the Hall element is its ability to determine the magnetic polarity of the applied field. This is a particularly useful feature if the poles of a magnet are unmarked, and need to be identified.

Specially calibrated elements are available that have a known output voltage for given quantity of applied magnetic flux. These devices are primarily intended for the measurement of magnetic field strengths and for other instrumentation purposes where a known characteristic is of prime importance. As would be expected, these devices are considerably more expensive than standard production types which are designed to operate between known limits.

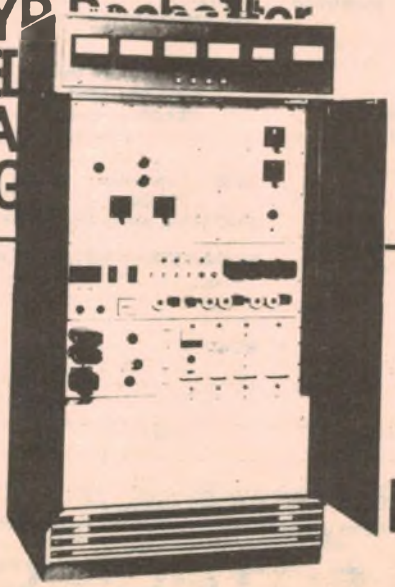
Linear output Hall effect devices are somewhat limited in application, however. For this reason, digital output devices have been developed, and these find a much greater range of application due to the ease with which they can be interfaced with digital circuitry.

Essentially, the digital output device uses the linear element as a detector,

Over 1300 CCA transmitters are in use world wide. The CCA FM range covers everything from a modest 10W. to 80KW. Why do so many broadcasters rely on CCA? Because all CCA transmitters are designed to cut operating costs.
By using proven grounded-grid design. Grounded-grid design cuts the expense of frequent replacement which is inherent in designs using HF tetrodes for FM transmission. In a recent survey, WFPG-FM achieved continuous running of 55,586 hours from a final amplifier tube. That's CCA efficiency and economy in action.
CCA make a full line of FM transmitters, antennas and accessories.
When you want to make great sounding savings on your new installation, call us for the full CCA story.

What do 34 leading North American broadcasters and VICOM have in common?

WFPG Atlantic City
KFOX Long Beach
KOSI Denver
KVOD Denver
KAAT Denver
WMOD Washington
WEBH Chicago
WEFM Chicago
WGRT Chicago
KADI St. Louis
KCFM St. Louis
WNYP Rochester
WEEI
WDA
WMG

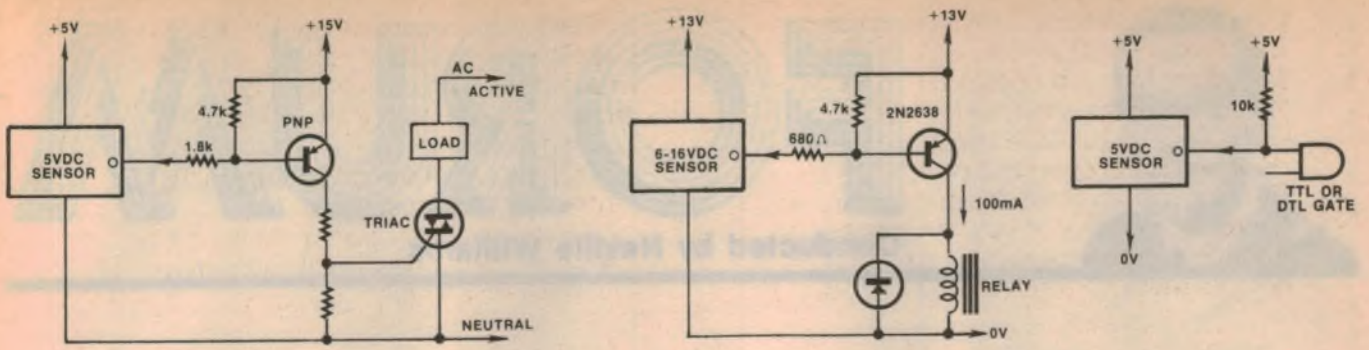


WFCN Nashville
WAMB Nashville
KRBG Houston
KHCB Houston
KRSP Salt Lake City
WQFM Milwaukee
WFMR Milwaukee
CBC Toronto
CBC Calgary
CBC Winnipeg
CBC Peace River
CBC Kitimat
CBC St. Johns
CBC Halifax
CBC Ottawa

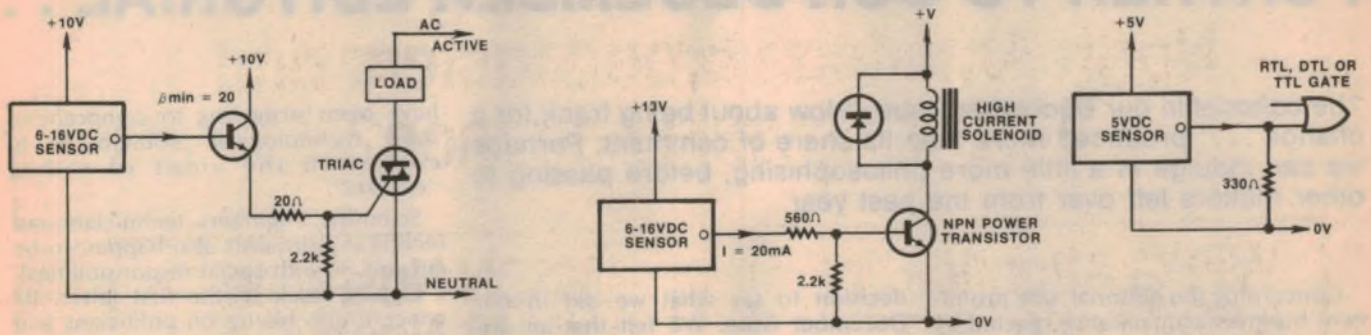
CCA-FM transmitters are available with ratings from 10, 40, 100, 250, 1000, 2500, 3000, 4000, 5000, 8000, 12000, 20000, 25000, 27500, 40000, 55000 and 80000 watts. CCA also offers a full line of AM, FM, HF, UHF and VHF transmitters and TV translators. Accessories include limiters, auto switchers, auto power controls, studio equipment and consoles.

VICOM

Vicom International Pty Ltd
68 Eastern Road, Sth Melbourne
Phone (03) 699 6700.



CURRENT SINKING SENSORS



CURRENT SOURCING SENSORS

FIG. 4: DIGITAL/HALL EFFECT INTERFACE

the output of which is then amplified and fed to a trigger circuit. This, in turn, drives an output transistor to provide the digital output.

The digital devices are available with two types of outputs: current sinking and current sourcing. The current sinking output consists of an open collector that is capable of sinking in the region of 10mA. The emitter of the transistor is internally connected to the ground rail of the chip. The current sourcing type has an open emitter output, capable of sourcing 10mA. The collector of this transistor is internally connected to the supply line of the Hall element.

The digital devices can be interfaced to external circuitry in quite a number of different ways, some examples of which are shown in Fig. 4.

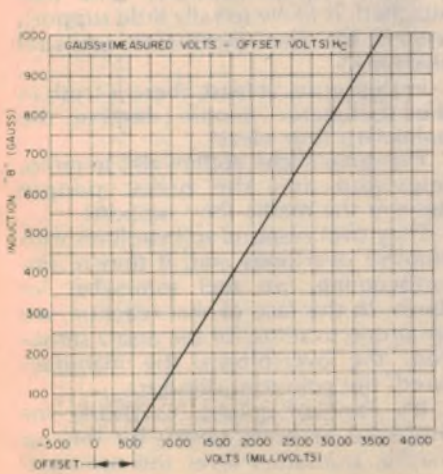


Fig. 3: Hall element characteristic.

Hall effect devices have several big advantages over their electro-mechanical counterparts. These include longer life, greater reliability, and the elimination of contact bounce (since there is no mechanical switching action). This latter advantage has been exploited by such companies as Honeywell and IBM (to name just two) for a range of computer and typewriter keyboards.

The basic scheme is quite simple. Small magnets are attached to the various keys, and activate Hall effect devices whenever the keys are depressed. By eliminating the contact bounce problem of mechanical keyswitches, the interfacing circuitry to the keyboard is considerably simplified.

Another commercial application for Hall effect devices, and one that is increasing in popularity, is in auto ignition systems. Here a cup-shaped vane, with as many teeth as there are engine cylinders, rotates through a Hall effect vane sensor mounted in the engine distributor. The resultant logic pulses are used to trigger an electronic ignition system without the use of points.

Hall effect devices can also be used in flow meters and computer peripherals, and as current and position sensors in a wide range of industrial machinery and home appliances. They can, for example, be used to control the commutation of field current in brushless DC motors, to sense tone arm position in record players, and to control conveyor belts on production lines.

Electronic sewing machines, coin operated machines, office machines, telephone systems, electronic keyboards on musical instruments, and utility meters with remote reading capabilities can all make use of Hall effect devices.

Typical applications in which the hobbyist could use Hall effect devices include burglar alarm installations (instead of reed switches, for example), or as detectors in model railway layouts. The Hall device could be mounted in the middle of the railway track, at the point where it is desired to detect the presence of a train, and activated by a magnet fastened to the underside of the locomotive or one of the carriages. The output of the device could be used to switch points or signals, or even provide signals to a computer that is controlling the layout.

Well, that's at least a basic introduction to the Hall effect and the way in which it can be applied. It's now up to you to find your own applications for these interesting devices.

This article has been prepared from information supplied by Micro Switch, division of Honeywell Pty Ltd. Micro Switch manufactures a wide range of Hall effect devices and sensor packages, including vane sensors, proximity sensors, current sensors and plunger operated sensors. Further information on these may be obtained from Honeywell Pty Ltd, 863-871 Bourke St, Waterloo, NSW 2017. Telephone (02) 699 0155.

FORUM

Conducted by Neville Williams

FURTHER TO OUR DECEMBER EDITORIAL . .

The editorial in our December issue, "How about being frank for a change . . ." produced more than its share of comment. Perhaps we can indulge in a little more philosophising, before passing to other matters left over from the past year.

Concerning the editorial, one prominent business acquaintance reacted by describing it as "one of the best you have ever run". Spare our blushes, but it did have the advantage of expressing something that we feel quite strongly about. Evidently, others in the technical community share those feelings.

By way of example, I quote a further message to hand, on the letterhead of an old and well known company:

Dear Neville,

Just a line to tell you how pleased I was to read your editorial in the December EA.

I believe there are many who wish that politicians would learn statesmanship and get on with the job for which they are paid.

There are many who wish reporters would stop manufacturing news. How sick one feels when reporters, who have not yet mastered their native language, subject eminent interviewees to a series of questions intended to establish a preconceived viewpoint.

What has happened to the self-regulatory bodies that pretend to uphold honesty and objectivity in the media?

BS (North Ryde, NSW).

But not everyone saw it that way. A NSW country reader had this to say:

Dear Sir,

Whilst I agree 100% with what you say in your editorial in the December 1979 edition, I still feel we (your readers) must object to our (your readers') magazine entering into the political arena.

Be frank, but stay in electronics!

Reader from 1951.

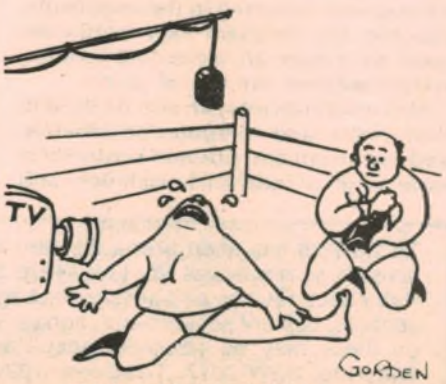
RP (Orange, NSW).

Let me assure RP and his friends that politics, as such, played no part in our decision to say what we did in our December issue. We felt that an unremarkable situation at the Lucas Heights reactor had been sensationalised by the media, and compounded by a statement attributed to the NSW Premier. Our criticism would have been the same, had the Premier been aligned with one of the other parties — or no party!

The overwhelming reaction we received was not political either — or should we say not party-politica. It was simply concern that politicians of all hues are responding to expedience rather than to fact. "What was said in the December editorial needed to be said" was the most frequent observation.

We would not like to see this magazine, or any other technical medium or body assume a permanent political bias, but we don't like the other extreme, either: where informed opinion is withheld just because it might seem to support the current stance of one or other political faction.

We have often felt that our learned societies have been guilty in this respect. They have remained virtuously aloof while politicians, press and public have been struggling to comprehend some technological problem, or to cope with the views of ratbag "experts".



"Ugh ! Ah ! Ugh ! Ugh !

Scientists, engineers, technicians and technical journalists also happen to be citizens — with social responsibilities!

Getting back to the first letter, BS concentrates his ire on politicians and the media but, like my original editorial, omits any reference to the third group in an unfortunate triangle: the public at large including you (perhaps) and me.

We also lack objectivity and we contribute to the emotionally based environment in which we live.

As a general rule, it is not necessary to go beyond one's immediate acquaintances to discover a whole array of strongly held opinions — based, not on objective assessment, but on readily perceived attachments and preconceptions. Challenge those ideas and the usual response is one of passionate defense, rather than a readiness to rethink and re-evaluate.

We all tend to discount opinions which differ from our own and to relish those which coincide.

When we go to the ballot box, we vote for people who hold to our particular viewpoint. A candidate who presents himself as an objective thinker, open-minded, and unattached, is likely to rally little support, unless he also possesses unusual charisma.

In this sense, at least, there is truth in the sentiment: people deserve the politicians they elect!

The same cliche applies also to radio, television and the press: people deserve the media they support!

They (we) respond to headlines with emotive overtones and, if they're not forthcoming, we feel somewhat let down. In the face of that reaction, we are prone to settle for the ersatz sensation; the over-blown, the manufactured, the colourful rumour.

It's easy, of course, to blame the broadcast or press barons for this; or maybe, at another level, the commentators, the reporters and the sub-editors. But we delude ourselves.

The fact is that it would be a lot easier for all these people to be matter-of-fact (objective, if you like) and to report events as they happened — rather than to be everlastingly turning over rocks in an effort to find today's sensation. Unfortunately, experience has taught them that it doesn't work.

The public rejects it as unspeakably dull!

Hence our earlier reference to an unfortunate triangle, a feedback loop if you like, in which public, politicians and media each affect, sustain and control the other.

Short of changing the entire system (Socialism? Communism? Otherism? Dictatorship?), our only recourse seems to be to education and enlightenment in the hope of modifying one or more of the factors in the loop.

Where technical matters are involved, technically minded people have a clear duty to seek out and promulgate the best available information, as distinct from rumour and emotion. That was the thinking behind our December editorial.

Oh yes; if you're wondering what the wrestling cartoon has to do with all this, it did seem to have something in common with the posturing and the agonising of our political leaders, of all shades of opinion.

ENERGY SOURCES

Changing the subject completely, 1979 saw a lot of discussion about energy and energy sources, ranging from nuclear, through fossil fuel systems to "natural" sources such as wind, tidal, hydro-electric and solar.

One of the important truisms that seems gradually to be seeping into public consciousness, is that environmental problems and hazards are not unique to nuclear technology. If the World's growing population and changing life-style demands the tapping and harnessing of large amounts of energy, then there are going to be large-scale environmental implications — some obvious, some less so.

Scars on the countryside and oil spillage at sea are very apparent, as also is smog, smoke and fumes. Increased radioactivity, loss of ozone and acid-rain occur with less fuss. Extinction of fauna and flora by flooding and damming may be appreciated only in retrospect, but it is all happening.

Windmills — wind turbines in modern terminology — have been promoted as a promising "clean" source of energy.

They have also been seen as potential visual blots on the landscape, as subject to structural failure, and as likely sources of interference to radio and TV signals, radio links and aircraft communication and guidance systems.

According to a recent issue of "Electronics" magazine, the possibility of interference to television reception, at least, has now become a reality to residents of Block Island (adjacent to Rhode Island, USA) who live within 1½km of NASA's developmental wind turbine. Operated by the Block Island Power Company, its whirling metal blades modulate the incoming television signals, causing severe picture flutter. It is in clear contravention of Federal Government laws relating to the environment.

Rather than dismantle the turbine, the US Government has reportedly opted for an alternative measure: to spend $600,000 on a community coaxial cable system which will supply clean signals to each one of the affected homes.

There has to be a lesson there.

Also on the subject of energy, the December 1979 issue of "Scientific American" carried a major article on Energy Storage Systems.

The writer points out that it is becoming progressively less practical for supply authorities to meet peak daily demands by cycling supplementary (and often ageing) fossil-fuelled stations and gas turbines. Low efficiency, rising fuel costs and environmental considerations all present mounting difficulties.

It is becoming vital for the power generating industry to maximise the use of modern base generating equipment, and to supplement it with energy storage and release facilities to cope with peak demand. Such storage facilities would also be valid for energy gained ultimately from natural sources which may be cyclic (solar, tidal), spasmodic (wind) or even seasonal (hydro-electric).

PUMPED WATER STORAGE

The article carries a photograph of the World's largest pumped-storage hydroelectric plant at Ludington, on the shores of Lake Michigan, USA. It involves an artificial lake 10km long which can be filled by pump-turbines to a water height averaging 75 metres above that of the lake itself. When discharging back through the turbines, it has the potential to produce a short-term peak output of about 2000 megawatts, equivalent to two large power stations. The efficiency is about 66%, which means that two-thirds of the energy absorbed in raising the water level is recovered during the discharge/generate cycle.

These figures notwithstanding, the writer, Fritz R. Kalhammer, says that the scope for similar projects is very limited. They need a special kind of topography but, in any case, large artificial lakes are seen by many as a threat to the natural environment.

Much more promising, according to the writer, is the idea of large underground caverns, or reservoirs, which can be smaller in size than surface installations but compensated by much greater vertical displacement —

LOW COST PORTABLE OSCILLOSCOPES THAT DON'T COMPROMISE ON PERFORMANCE!

TTM303
15MHz
Battery Operated

TTM303

The TTM Dual Trace Portable Scope Model 303 offers a high sensitivity of 5mV/DIV with DC to 15MHz bandwidth. The 3-inch CRT with 1.5kV regulated accelerating voltage gives a clear bright display.

This Portable Scope operates from standard line voltage (90 to 260V) or from the internal rechargeable Ni-Cad battery, that provides 2 hrs operation before recharging is required. It also operates from any external DC voltages of 11 to 30V, e.g. car batteries, standard 'C' size cells, etc.

SPECIFICATIONS:

SENSITIVITY - 5mV to 10V/DIV 1-2-5 step with fine control. BANDWIDTH - DC: DC to 15MHz (-3dB). RISETIME - 24nS. OPERATING MODES - CH-A, CH-B and Dual Trace. TIME BASE - 1μsec to 500 mS/DIV with fine control. EXPANSION - x5 at all ranges. X-Y OPERATION - X-Y mode is selected by SWEEP TIME/DIV switch. CH-A Y axis, CH-B X axis. POWER REQUIREMENTS - AC: 115/240V DC: 11-30V, 7.2VA. Battery: Ni-Cad Battery (up to 2 hour operation). SIZE: 113 (H) x 223 (W) x 298 (D) mm approx. WEIGHT - 4.5kgs.

BS310
2mV Sensitivity
Add/Subtract Feature

APPLICATION BS310S

The dual trace Model BS-310 employs a high brightness 95mm CRT and offers a high sensitivity of 2mV/DIV from DC to 15MHz.

The ADD/SUB feature makes this model ideal for measurement and maintenance of computers and peripherals. This scope is recommended for FLOATING Measurements and FREQUENCY/PHASE Measurement (X-Y mode). Rechargeable battery operation makes it ideal for repairing TVs and other consumer and industrial equipment.

Now with 95mm rectangular tube

SPECIFICATIONS:

SENSITIVITY - 2mV to 10V/DIV on 12 ranges in 1-2-5 step with fine control. BANDWIDTH - DC: DC to 15MHz (-3dB). RISETIME - 24nS. OPERATING MODES - CH-A, CH-B, DUAL, ADD and CHOP. TIME BASE - 0.5μsec to 0.5sec/DIV in 19 ranges and X-Y in 1-2-5 step with fine control. MAGNIFIER - x5 at all ranges. X-Y OPERATION - X-Y mode is selected by SWEEP TIME/DIV switch. CH-A Y axis, CH-B X axis. POWER REQUIREMENTS - AC: 115/240V DC: 11-30V, 7.2VA. Battery: Ni-Cad Battery (up to 2 hour operation). SIZE - 113 (H) x 223 (W) x 298 (D)mm. WEIGHT - 4.5kgs (5.5kgs including battery).

BS610
140mm
No Parallax Display

APPLICATION BS610

The BS-610 employs a high brightness 140mm Rectangular CRT with internal graticule assuring easy and accurate observation of waveforms without any parallax.

External DC-Powered operation expands the versatility of this oscilloscope to FLOATING Measurements as well as field operation.

Other features including TV SYNC and HF REJ. make this scope ideal for research and development, production lines or in-the-field service applications from computers to electrical appliances.

SPECIFICATIONS:

SENSITIVITY - 5mV to 10V/DIV on 11 ranges in 1-2-5 step with fine control. BANDWIDTH - DC: DC to 15MHz (-3dB). RISETIME - 24nS. OPERATING MODES: CH-A, CH-B, DUAL, ADD and CHOP. TIME BASE - 0.5μsec to 0.5sec/DIV in 19 ranges and X-Y in 1-2-5 step with fine control. MAGNIFIER - x5 at all ranges. X-Y OPERATION - X-Y mode is selected by SWEEP TIME/DIV switch. CH-A Y axis, CH-B X axis. POWER REQUIREMENTS - AC: 115/240V DC: 11-30V, 7.2VA. SIZE — 145 (H) x 280 (W) x 369 (D)mm. WEIGHT - 6.7kgs.

We STOCK PROBES and ACCESSORIES to suit most makes of oscilloscopes to 150MHz. Contact us for competitive prices.

Available from selected stockists or from:-

P.O. Box 30, Concord, NSW. 2137
13-15 McDonald St., Mortlake, NSW. 2137
Phone: (02) 736-2888, Telex: 25887

P.O. Box 107, Mt. Waverley, Vic. 3149
21-23 Anthony Drive, Mt. Waverley, Vic. 3149
Phone: (03) 233-4044. Telex: 36206

ELMEASCO
Instruments Pty. Ltd.

Adelaide: 51 3521, Brisbane: 229 3161, Perth: 398 3362

eg. 300 metres. This is the technology that will probably have to be exploited if pumped storage systems, in the USA at least, are to rise much above the present level of about 2.5% of all generating capacity.

Once beneath the ground, an alternative is to use large caverns to store air, which is compressed when there is surplus power available to the grid, and released through cascaded turbines when additional power is required.

A pilot plant in Huntorf, near Bremen, in West Germany, can compress air to 70 atmospheres in a 300,000 cubic metre twin chamber leached out of salt deposits deep underground. The system can contribute up to 290,000 kilowatts for 2 hours during periods of peak demand. A problem which has to be faced with such a system is the need to cool the air during compression, to protect the cavern walls, and to add substantial heat during the expansion cycle, to prevent freezing. Energy has to be expended for both purposes, affecting overall efficiency.

Other possibilities are being investigated by power authorities — flywheels, hydrogen generation and storage, and superconductive magnets — but the other area being given major attention is that of storage batteries.

JUMBO BATTERIES . . .

While the scale required dwarfs anything to date, in terms of battery technology, such facilities could be dispersed as necessary in large or small modules, the stored power being immediately accessible at any time. Power authorities are re-assessing batteries of various types, on the basis that the performance and economics of large cells for fixed installations may be quite different from those of small batteries required for powering vehicles. One project, under the auspices of the US Department of Energy, calls for a 30,000 kilowatt/hour lead-acid battery installation by 1984, coupled to a 10,000 kilowatt AC/DC converter. The aim is to gain first-hand experience with battery-stored energy.

AND JUMBO INVERTERS

Which brings me to another matter flowing over from our August and November issues. In the last-named, I was gently chided for being less than aware of the scale and useage of present-day static inverters.

Spokesmen for Telecom and STC indicated that locally produced 415V 3-phase inverters, rated to about 100kW were in everyday use to ensure uninterrupted power to Telecom exchange equipment, etc. They are normally powered by DC derived from the AC power mains but can switch instantly to a large battery bank if the mains supply is interrupted.

A rating of 100kW is tiny compared with the power levels in a grid but, if authorities are looking seriously at jumbo battery banks for energy storage, it is reasonable to assume that jumbo inverter banks are also in view.

Another company which is active in the field of inverters is Topaz Electronics, of San Diego, California. They are represented in Australia by Marine and Aerospace Engineering Pty Ltd, of Suite 501A, 220 Pacific Highway, Crows Nest NSW 2065. Tel (02) 929 5377. (I give the details purely to save ourselves from a sequence of "How do I get in touch?" calls).

From the literature to hand, their equipments appears to be slanted to US requirment and to smaller applications — but they are very necessary applications in these days of electronic whatnots. Not only do these involve computers, as such, with volatile memories, but other devices like cash registers, where a power droput can have serious consequences.

No less intriguing, in the literature, is a whole array of power line regulators, isolators and conditioners, intended to protect equipment from voltage variations, surges, spikes, noise pulses and what-have-you. If our concept of DC/AC inverters was limited — as expressed last August — the Topaz equipment is likewise way ahead of traditional ideas about line filters, etc.

Technology certainly breeds technology and my guess is that the rate of propagation will continue to climb through the 80's.

The National Research Council of Canada:

"The problem is not that we are running out of oil — there is more untapped oil in the Canadian tar sands than in all the Middle East — but that the cost of getting it out of the ground is soaring. Ten years ago, it cost about $200 to find and tap a unit flow of oil of one barrel per day in the Middle East. That figure jumped to about $10,000 for the North Sea. The pilot plant at the tar sands in Alberta cost $16,000 per barrel-a-day unit of capacity, and future plants will cost more. Getting a flow of oil of one barrel per day from the ocean floor off Labrador is projected to cost at least $20,000." (From "Science Dimension" Vol. 11, No 4, 1979).

NEW KITS
(and new kit components)

Remember: parts for most kits in most of the electronic magazines are normal stock lines. So even if a kit isn't listed, we may be able to help you anyway. Call in and ask us!

EA ANALYSER/LEVEL METER (See EA February)

Complete kit, including instructions	Cat K-3510	$99.50
Printed circuit boards (set of two)	Cat H-8313	$8.50

SUPERBASS FILTER (See EA February)

Printed Circuit Board	Cat H-8370	$2.40

FLASH EXPOSURE METER (See EA January)

Printed Circuit Board	Cat H-8371	$2.10
Solar Cell	Cat Z-4820	$2.50

GUITAR PRACTICE AMPLIFIER (See ETI January)

Printed Circuit Board	Cat H-8625	$4.60

PLAYMATE AMPLIFIER (See EA January)

Printed Circuit Board	Cat H-8369	$4.60

TRANSISTOR ASSISTED IGNITION (See EA December)

Complete kit including instructions	Cat K-3300	$32.50
Printed circuit board	Cat H-8367	$2.20
BUX80 power transistor	Cat Z-2150	$10.95

FAN SPEED CONTROL (See EA December)

Short form kit (PCB, components; no h'ware)	Cat K-3090	$11.50
Printed Circuit Board	Cat H-8368	$2.50
SC141D Triac	Cat Z-4510	$1.28

(zippy box, etc, normal stock lines – or build it in to appliance.)

NEW METAL LOCATOR (See EA November)

Complete kit (excluding dowel & former)	Cat K-3504	$19.50
Printed Circuit Board	Cat H-8366	$2.40

INFRA-RED REMOTE CONTROLLER (See EA October)

CQY89A Infra red diodes	Cat Z-3235	$1.50
BPW34 photo transistors	Cat Z-1954	$3.50
Printed circuit boards (pair)	Cat H-8365	$5.95

PROCESS TIMER (See ETI October)

Printed circuit board	Cat H-8623	$3.95

DISCO STROBE Mk 11 (see ETI September)

Complete kit, including instructions	Cat K-3152	$34.50
Printed circuit board	Cat H-8572	$1.95
Flashtube	Cat S-3882	$2.95
Trigger transformer	Cat M-0104	90c
Discharge capacitors (each)	Cat R-2856	$3.75
Reflector	Cat K-6016	$4.50

WINDSCREEN WIPER DELAY (See EA September)

Printed circuit board	Cat H-8364	$2.50

Other components for this project are normal stock lines.

AUTO CHIME (See EA September)

Complete kit	Cat K-3502	$29.75
Printed circuit board	Cat H-8363	$3.70
TMS-1000 Integrated Circuit	Cat Z-6825	$16.50

INDUCTION BALANCE METAL DETECTOR (See ETI)

Short form kit (not inc. dowell or former)	Cat K-3100	$35.50
Printed circuit board	Cat H-8578	$1.50

JUST RELEASED!

Our brand new up-dated colour kit catalogue is now available

Send for your copy NOW – it is

FREE!

MAJOR DICK SMITH RESELLERS

Listed below are re-sellers who stock a large range of our products. However, we cannot guarantee that they will have all items in stock or at the prices we advertise.

A&M Electronics
78 High Street, Wodonga, Vic. Ph 244 588
Advanced Electronics
5a The Quadrant, Launceston Tas. Ph 317 075
Aero Electronics
123a Bathurst Street, Hobart Tas. Ph 348 232
Peter Brown Electronics
9 Doveton Street North, Ballarat Vic. Ph 323 035
Crystal TV Rentals Pty Ltd
66 Crystal Street, Broken Hill NSW. Ph 6897
Decro Electric
Cnr Magellan St & Bruxner Hwy, Lismore NSW. Ph 214 137
Elektron 2000
181 Wharf Road, Newcastle. Ph 262 644
Hitel Hi Fi
Shop 12, Venture Arcade, High St Penrith. (Also at St Marys)
Hutchesson's Communications
5 Elizabeth Street, Mt Gambier SA. Ph 256 404
Keller Electronics
218 Adelaide Street, Maryborough, Qld. Ph 214 559
M & W Electronics
48 McNamara Street, Orange NSW. Ph 626 491
Mellor Enterprises
Shop 2/15 Forsythe St, Whyalla Norrie, SA. Ph 454 131
Power & Sound
147 Argyle Street, Traralgon, Vic. Ph 743 638
Purely Electronics
15 East Street, Rockhampton, Qld. Ph 21058
Stevens Electrical
42 Victoria Street, Mackay, Qld. Ph 511 723
Sumner Electronics
95 Mitchell Street, Bendigo, Vic. Ph 431 977
Sound Components
78 Brisbane Street, Tamworth NSW. Ph 661 363
Trilogy Wholesale Electronics
40 Princes Hwy, Fairy Meadow, Wollongong, NSW. Ph 831 219
Tropical TV Services
249 Fulham Rd, Vincent, Townsville Qld. Ph 791 421
Variety Discounts
113 Horton Street, Port Macquarie NSW. Ph 835 486
Viking Electronics
3108 Gold Coast Hwy, Surfers Paradise, Qld.
Wagga Wholesale Electronics Sales
82 Forsyth Street, Wagga NSW.
Wellington Electrical Services
110 Lee Street, Wellington NSW. Ph 325

IT'S ALARMING!

Were you one of the hundreds who were 'ripped off' over the holiday break? Don't take chances with burglars: fit a Dick Smith alarm system and protect your property!

NEW! Home Alarm

It's an alarm module that doesn't look like an alarm module! Handsome wood-grain finish, looks like a small speaker. Inside is the complete 'works' for a professional quality home or office alarm system. Link it to sensors (see below) and you can turn your home into a veritable Fort Knox! Installation is easy, any handyman can do it!

Every purchaser of this alarm module will receive a copy of our exclusive book 'How to install your own burglar alarm'.

How to install your own burglar alarm

$49.50 Cat L-5102

BONUS!

INFRA-RED BEAM ALARM

Great for hallways, doorways (shop doors especially!) Easy installation, just connects to master alarm system. Complete with infra red reflector.

$89 Cat L-5050

ACCESSORIES

REED SWITCHES: Twin set of magnet and reed switch. Wire them into windows and doors for protection.
Cat L-5210 **$1.95**

HORN SPEAKER: Highly efficient horn plugs into alarm module. Mount under eaves for distant warning.
Cat C-2705 **$9.50**

PRESSURE MAT: Hide under carpets, mat etc. Pressure of person walking sets it off.
Cat L-5270 **$14.95**

CAR PROTECTION

WINDOW TAPE: Metallic tape sticks to window glass; sets off alarm if window is broken. Cheap, but great deterrent value. Cat L-5200
Termination blocks for above. Cat L-5205
30c each

INSTALLATION WIRE: Because of its small size and flexibility, our mini speaker twin flex is ideal for installing alarms. Marked with a tracer for easy polarisation if required.
Cat W-2010 per metre **15c**

100m roll: $13

GLASS BREAKAGE DETECTOR: Sticks to glass, responds only to sound of glass actually breaking. Easy to install.
Cat L-5230 **$29.50**

Fully integrated car protection with alarm & horn unit in one. Current sensing system: no external switches. Cat L-5090
$49.50

Here it is! TI's superb TI58C prog.

Up to 480 program steps or up to 60 memories! Complete program editing features: up to 6 levels of sub-routine. And it has the constant memory™ feature. Retains information when turned off – you don't lose valuable information. Incredibly versatile instrument – call in and check it out!
Cat Q-3705
ONLY... **$165.00**

$18.00 WORTH OF SOFTWARE FREE!!

With each TI58C sold by Dick Smith Electronics, Texas Instruments will send, free of charge, two software "Pakettes" of your choice (see list). Normally $9.00 each, yours FREE! (Coupon included with each TI58C)

THE PAKETTES AVAILABLE (only from Texas Instruments!): Electronic Engineering; Civil Engineering; Mathematics; Marketing/Sales; Fluid Dynamics; Statistical Testing; Securities; Oil/Gas/Energy; Blackbody; Astrology; 3D graphics; Production Planning.

DICKTRACER Mk11 – NOW BETTER VALUE!

The improved Dicktracer Mk11 was superb value at $49.50. Internal batteries so there are no trailing wires; re-charges overnight from car cigarette lighter. Now it is even better value: we're practically giving them away! New only

$39.50! (was $49.50)

Cat A-8500

NEW! 5 WATT, 6 CHAN. HAND-HELD.

P&T APPROVED

For the weekend boating set: take along a bit of security – this handy marine transceiver. Huge 5 watts output (maximum legal power), with 6 channel capacity (comes with one channel fitted on the 27.88MHz boating safety channel). Comes with illustrated case – attractive and durable. Easy to use – and it's handy to find out where the fish are biting!

Cat D-1120 **$89.50**

Approved by the P&T Dept for operation on the 27MHz marine band.

SOLAR KIT: 25-IN-1 EXPERIMENTS

Top value for a gift for the budding scientists in your family. 25 experiments in electronics using solar power. Up-to-the-minute technology. Solar power!

$16.95 Cat K-2032

FOR THE HANDYMAN.

Waterproofing or sealing jobs made easy. One part silicone sealant for jobs around the home, car etc. Fixes fish tanks, too!

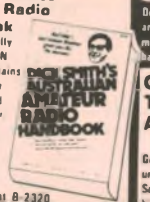
Huge 75g tube: $3.95 Cat N-1225

AMATEURS:

DON'T FORGET: DICK SMITH WILL MATCH ANY OR BETTER ANY GENUINE PRICE (ADVT. IN AUST.) ON YAESU AMATEUR RADIO EQUIPMENT.

DICK'S OWN Amateur Radio Handbook

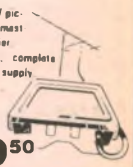
Written especially for AUSTRALIAN conditions, contains loads of info for the amateur and budding amateur.



$6.95 Cat B-2320

HOW'S YOUR TV PIC?

Fix crook TV pictures with a mast head amplifier. Easy to fit, complete with power supply (cable extra).



Cat L-4200 **$39.50**

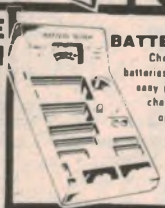
Don't forget we have a full range of TV and antenna accessories: brackets, mounts, stand-offs, cable, splitters, baluns, plugs & sockets, etc etc etc!

PLUG-IN TIME SWITCH

Incredible! Up to 3 on/off actions per 24 hours, fully settable, auto and manual control. Contacts rated at 2400 watts (same rating as your power point); appliances simply plug in! Pool filters, security lights, battery chargers, electric blankets, etc etc etc. Auto or manual control, too.

24.50 Cat X-1120

UNIVERSAL BATTERY CHECKER



Checks virtually all common batteries, lamps, fuses, etc. with easy go/no go check. Also re-charges mcad batteries with optional pluggack adaptor.

Cat Q-1525 **$9.95**

GO-ANYWHERE TV ANTENNA

Great for vans, units, flats, etc. Small in size but big performer. Covers all Aust. channels.

$23.95 Cat L-4026

DIGITAL LCD ALARM WATCH UNDER $50!

Yes! Full alarm watch with stopwatch function too, night light and attractive strap at an unbelievable price!

$49.50 Cat X-1044

IDEAL FOR THE EXPERIMENTER

How many times have you been working on a circuit and needed a specific resistor? Our new resistance wheel dials up the value you want! The handiest thing in your workshop or toolbox!

5 ohms to 1 megohm in 38 steps.

Cat Q-1410 **$5.95**

LOGIC PROBE.

Superb instrument, compatible with TTL and CMOS, shows high and low states, pulses, etc. Easy to use, handy for the experimenter's work shop. Twin alligator clip leads for power, separate earth clip and probe. Handy!

$27.50 Cat Q-1272

BUDGET SWITCH PACK

Pack of 4 push button switches, col tops for easy identification. Four colours available.

(Pack of 4) **$2.50** Cat S-1200

PROJECT BUILDING?

$2.00 Cat S-7120

Here's the best value in a relay around: on-board mounting, wide operating range (7 to 15 volts) so they're ideal for a variety of circuits, and 200mA contact rating. Great for the junk box: you never know when a relay is going to be needed!

SPECIAL NOTICE TO OUR ADELAIDE CUSTOMERS

Thank you for your overwhelming support. Because of our tremendous success that you, our customers, have made, we are moving to larger premises – double the size, to provide you with even better service.

We'll be closer to the heart of the city, near public transport – and for our customers who arrive by vehicle, we'll be able to provide you with the convenience of on-site parking for 21 cars.

Watch for our opening date in your local papers (approximately mid February). Our new address will be 60 Wright Street – up the street from our present store.

Dick Smith and staff.

300W INTO 4 OHMS! –FOR LESS THAN $70!

THE ETI 466 POWER AMPLIFIER

SEE ARTICLE THIS MONTH'S ETI

Kit includes all parts to build the module. Add a transformer, heatsink and case and you have a complete mono power amplifier capable of 300W output!

NOTE: If you plan to use the amplifier at full output you will need two of the heatsinks and a cooling fan.

Cat. K-3444	Kit for amplifier module	$69.00
Cat. M-0150	Transformer to suit	$32.50
Cat. H-3428	Heatsink to suit	$8.50
Cat. D-2865	Cooling fan	$39.00

SPECIAL PARTS FOR THE KIT:

Cat. Z-1810	MJ15003/4 Output pair	$9.95
Cat. H-8626	Fibreglass printed circuit board	$7.50
Cat. R-4572	2500uF 80V RB electro	$3.95

THESE ITEMS ARE EXPECTED IN STOCK MID FEBRUARY
PLEASE CALL YOUR NEAREST STORE TO CHECK AVAILABILITY

BUYING BY MAIL?

It's so easy! Simply list the items you want, with their catalogue numbers, and post it off with your cheque to our mail order centre (address at right). Don't forget to include post & packing (charges apply to total order value as per table at right).

Then watch your letterbox!

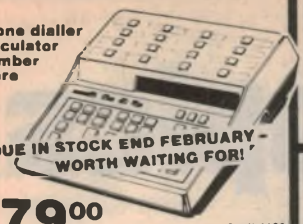
ORDER VALUE:	P&P
$5 (min) to $9.99	$1.00
$10.00 to $24.99	$2.00
$25.00 to $49.99	$3.00
$50.00 to $99.99	$4.00
$100 or more	$5.50

NOTE: These charges apply to goods sent by post in Australia only. Large and bulky items cannot be sent by post.

If you prefer, we will despatch your order by Comet Road Freight to anywhere in Australia for only $8.00 – that's below what it costs us! Large and bulky items are normally sent by Comet unless you specify differently (eg by rail or air – you pay freight on delivery).

COMPUTER PHONE DIALLER with 32 number memory!

- Phone dialler
- Calculator
- Number store



$179.00 Cat X-1170

It offers all the features of a conventional desk-top calculator – and then some! It's also a push button phone dialler which remembers up to 32 most-used numbers. Very simple installation; operates from a plug-pack adaptor (Cat M-9514 @ $5.90). Has battery standby. (Note: although this unit works perfectly with Australian phones, present regulations do not allow them to be used for this purpose)

Don't need a computer dialler?

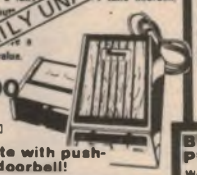
Try this one – our push-button phone dial that fits easily into standard phones (replaces rotary dial). Simple four-wire installation; it remembers the last number dialled for a short period for re-call. Note: this unit has been tested and approved by Telecom Engineering Dept. for OEM's.

$49.50 Cat X-1175

BIG SAVING ON AUTO 24 TUNE BELL!

TEMPORARILY UNAVAILABLE

Remember the Chromachime? We ... kits for $49.50. Here's a fully ... tune doorbell, complete with push but... for $17.00 less! ... the same ... have a fortune ... value.



$35.00 Cat X-1130

Complete with push-button doorbell!

NEW!

LCD CLOCK/TIMER/ ALARM/STOP WATCH MODULE WITH HUGE 8mm LCD DIGITS!

Incredible sophistication! This composite 7 channel digital clock and timer module operates from a single 1.5 volt penlite cell; can be used for a huge range of time and timer projects. Complete on one pcb, data supplied with unit. Cat X-1050

$17.50

FIND A FORTUNE!

INCREDIBLE BREAKTHROUGH!

Microprocessor technology! Never before at this price!

A true T-R discriminator type metal detector for under $250.00? Yes! The Dick Smith Tracker must be the best value going!

$125.00 Cat X-1065

IS THIS THE ULTIMATE?

The Dick Smith D-tex Scanner I with twin search heads. Incredibly sophisticated circuitry for maximum depth and discrimination. Others have found a fortune with a metal detector, it could be your turn next!

Cat X-1075

$480.00

NEW!

GOLD: THE FOSSIKER'S FIELD GUIDE Includes pages of actual treasure maps and lots of useful data.

$13.50 Cat B-4530

THE AUSTRALIAN GOLD FINDER Handy size, full of information. Take it along on your next trip. Cat B-4625

$1.95

METAL DETECTING IN AUSTRALIA Written by a treasure hunting expert, you'll find this one highly useful, too! Cat B-4520

$4.50

HOW ARE YOUR MAGS?

Magazines are getting pretty expensive – and you'll probably want to refer to them in the future. Protect them with a binder. Easy to insert, stiff covers so your magazines won't warp. Holds up to 12 magazines (size of EA/ETI, amateur & motoring mags, etc.)

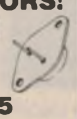
Cat B-4045 **$4.99**

TERMS?

Our pleasure. To approved customers we offer easy terms on any items priced at $111 or more. Or use your Bankcard – it's welcome at a Dick Smith store!

JUST ARRIVED! 5 VOLT, 5 AMP REGULATORS!

You asked for them; here they are. TO-3 package, a massive 5 amp rating. Great for computer power supplies, etc etc etc.



Cat Z-0570 **$6.95**

SPECIAL! 1979 ARRL H'BOOK NOW ONLY $9.95

Yes! Save $4.00 on the 1979 handbook. We're clearing stocks to make way for the new 1980 edition (which will be at a much higher price!) so you save. Loads of data and handy information for all hobbyists – not just amateurs! **LIMITED STOCKS ONLY!...** Cat B-2218

DEAR CUSTOMERS

Quite often, products we advertise are completely sold out within a few days. Or problems may hold up delivery of promised goods so they are not in the stores when the advert appears. Please don't blame the store manager or staff: they are powerless to do anything about it! What we are trying to say is that, if you are about to drive across town to pick up a particular line, give the store a ring first ... just in case!

Dick Smith and Staff

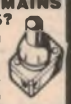
QUALITY TAPE!

Try it; you'll be surprised at the high quality for the low price!

C-60LN Cat C-3356 **$1.50 ea** (10 up $1.00)
C-90LN Cat C-3352 **$2.00 ea** (10 up $1.20)
C-90EDR Cat C-3354 **$2.75 ea** 10 up $1.80

SPECIAL: Buy 10 tapes, mixed if you wish, and get our bonus book, Inside Story on Cassettes as well as discount prices above!

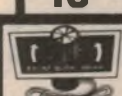
BUILDING MAINS PROJECTS?



We're now stocking these handy momentary push button switches – ideal for small projects. Also great for replacing bedlamp switches etc. 1 amp 250 volt rated. Cat S-1205

95¢

SPEAKER FADER



High power (25W) control for fading between front and rear speakers. Easy to fit, a delight to use! Cat A-7834

$9.95

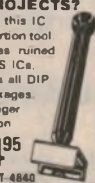
MORE OF DICK'S BONZA BULK BUY BARGAINS – BEWDY!

Now's this one: over 1 metre of 3-core mains cable complete with moulded 3-pin plug, ready for wiring into all types of mains projects. Colour coded wire so you can't go wrong. Cat W-2058

was $1.40; NOW **90¢!!!**

BUILDING IC PROJECTS?

Use this IC insertion tool. Saves ruined MOS ICs. Suits all DIP packages. Plunger action.



$4.95 Cat T-4840

HOW GOOD ARE YOU?

Here's one that will check your intelligence! The Codemaster – a game of mind. It challenges the player's intelligence in solving riddles by comprehensive thinking and logical deduction. It gives hints to make the game interesting. Ideal for all ages. Size approximately that of an 8-track cartridge.

Cat X-1150
DUE IN STOCK END FEBRUARY.
WORTH WAITING FOR!

$29.50

STILL TIME FOR THAT PARTY . . .

Ready to hook up and go; not a kit. This colour organ gives a vibrant, colourful disco display in time with music. Great for adding a little life to a party! Just plugs in to your amplifier, won't harm it in any way.

$79.00 Cat A-4950

NEW! INCREDIBLY LOUD AUDIO ALARM

You've got to hear this to believe it! It's ear shattering! Nominally rated at 9 volts, operates from around 5 to 25 volts. They're due in stock late this month – check them out when they arrive! Cat L-7024

$4.95

DIMN IT!

Create the mode you want with a dimmer. Easy to install; they simply replace existing light switch. Comes with two types of architrave plate, a large and small, to suit all locations.

Cat X-1112 **$6.90**

DISCO KITS:

MUSICOLOR 111: Easy to build; easy to use. A hit with any party. Complete kit, with comprehensive assembly/instruction manual. Cat K-3140

$65.00

Coloured lights & holders

Four colours in PAR 38 pressed glass lamps (internal reflectors) 100W globes. Yellow (S-3850) Red (S-3852) Blue (S-3854) Green (S-3856)

$7.95 each

Edison Screw bases to suit Cat P-5020 **$3.50 ea**

DISCO STROBE KIT

Up-dated version of our popular strobe kit, way under equivalent commercial units. Now even more reliable; smart case labels, too. Full easy instructions provided.

$34.50 Cat K-3152

BOOKS, BOOKS AND MORE BOOKS!

Just a few of the hundreds of popular titles in stock. Call in and have a browse!

'Building Speaker Systems' (Cat B-1215) Plenty of background information. Only **$3.40**

Electronics – a practical introduction (Cat B-3005) Ideal for the student or beginner. Theory made easy! **$5.95**

The Ham Exam Cram Book (Cat B-2314) Great for that last minute brush up or for slower learning. **$2.95**

The ARRL Antenna Anthology (Cat B-2206) Another of the highly successful ARRL series. Recommended. **$6.25**

500 Questions for AOCP candidates (Cat B-2318) Another boon for the amateur exam student. (PS: It also has the answers!) **$3.50**

Microprocessor Cook Book (Cat B-1870) A chip by chip comparison of today's modern microprocessors. **$7.50**

Z-80 Programming for logic design (Cat B-2353) Just what it says! **$9.95**

Zilog Z-80 Assembly language programming (Cat B-2362) All the info. to identify Z-80 addresses & memory locations. **$9.95**

Sorcerer Software Manual (Cat B-8108) Everything you wanted to know but were afraid to ask. **$39.95**

Now reduced to only $14.95 – save!

Introduction to Microcomputers, Volumes 0, 1, 2 & 3. Yes, we have stocks of these popular and world-famous reference books by Osborne.

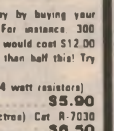
Volume 0	(Cat B-2339)	$9.50
Volume 1	(Cat B-2340)	$9.95
Volume 2	(Cat B-2342)	$27.50
Volume 3	(Cat B-2343)	$17.50

COMING SOON: Dick Smith's Fun Way Into Electronics Volume 2. At your nearest Dick Smith Store or Newsagent – SOON!

HIDE IT!

SPEAKER COVER

This one's for the tradesman and hobbyist. Installing intercoms, PA, background music, etc – use these flush-mounting speaker grilles. Great value, makes a neat job!



Cat C-2846 **$2.75**

FIRST EDITION SOLD OUT!

Yes – the first edition sold out within a few weeks. Now into its second printing this incredibly popular book gives an ideal introduction to electronics for all ages. There are twenty easy projects to build – even a beer powered radio. If you know nothing about electronics and would like to learn, here is the book for you. Cat B-2600

ONLY $4.95

Special offer: examine the book for 14 days and if you are not completely happy, return it to us in original condition for a full refund!

FUN WAY KITS

Two kits of components especially assembled for making the projects in the Fun Way Into Electronic book. The first kit is for projects one through ten; the second kit contains the additional components needed with those of kit 1 for projects 11 through twenty.

Kit 1 Cat K-2800 **$6.90**
Kit 2 Cat K-2810 **$7.50**

BRAND NEW, PRIME SPEC COMPONENTS – at significant savings for the hobbyist and the large volume user.

Whether you're a manufacturer using thousands of components per day, or a hobbyist using a few components per week, you'll save money buy buying your components from Dick Smith Electronics. Our business is basically components – and we offer huge savings when you compare our prices to many other suppliers. If you want quality components at the right price, it pays to come to us!

NEW! METAL FILM RESISTORS

For accuracy, dependability and life its hard to go past metal film resistors. Trouble has been the price! Now look again. Top grade 1/4 watt metal film resistors in values from 10 ohms to one megohm. Outstanding value at only:

6¢ ea
(or 5¢ each 100 – and 4¢ each 1000 –
DUE IN STOCK END FEBRUARY

5 YEAR GUARANTEE ON THESE POPULAR TRANSISTORS!

Yes! Our incredibly useful and popular signal transistor range is backed by an EXCLUSIVE 5 year guarantee. What other supplier is prepared to give that assurance? And even better, our prices are incredibly low – and you don't have to buy a pack of five or ten to get these prices! Single units only!

DS547 (Cat Z-1300) equiv. to BC107/547/182/207 ..... **14¢ each**
DS548 (Cat Z-1308) equiv. BC108/548/183/208 ..... **14¢ each**
DS549 (Cat Z-1319) equiv. BC109/549/184/209 ..... **14¢ each**
DS557 (Cat Z-1340) equiv. BC177/212/557/307 ..... **17¢ each**
DS558 (Cat Z-1348) equiv. BC158/178/213/558 ..... **17¢ each**

TRIED OUR BULK PACKS?

Hobbyists: Save money by buying your components in bulk. For instance: 300 resistors bought singly would cost $12.00. Our pack price is less than half this! Try these packs for value:

Resistor Pack (300 1/4 watt resistors) Cat R-7010 ..... **$5.90**
Electro Pack (55 electros) Cat R-7030 ..... **$6.50**
Greencap capacitor pack (60 100V types) Cat R-7040 ..... **$6.50**
Ceramic Pack (60 capacitors not less than 50VW) Cat R-7050 ..... **$4.50**

DICK SMITH ELECTRONICS

NSW	125 York Street	SYDNEY	Ph 290 3377	**VIC**	399 Lonsdale St.	MELBOURNE	Ph 67 9834
	147 Hume Hwy.	CHULLORA	Ph 642 8922		656 Bridge Road	RICHMOND	Ph 428 1614
	162 Pacific Hwy.	GORE HILL	Ph 439 5311	**QLD**	166 Logan Road	BURANDA	Ph 391 6233
	30 Grose Street	PARRAMATTA	Ph 683 1133	**SA**	203 Wright St.	ADELAIDE	Ph 212 1962
	263 Keira Street	WOLLONGONG	Ph 28 3800	**WA**	414 William St.	PERTH	Ph 328 6944
ACT	96 Gladstone St.	FYSHWICK	Ph 80 4944				

EXCEPT WHERE NOTED, ALL ITEMS SHOWN IN STOCK AT PRICES GIVEN AT TIME OF GOING TO PRESS.

MAIL ORDER CENTRE: PO Box 321, NORTH RYDE NSW 2113 Ph 888 3200. PACK & POST EXTRA.

bankcard welcome here

SHOPS OPEN 9AM to 5.30PM (Saturday: 9am till 12 noon)
BRISBANE: Half hour earlier.
ANY TERMS OFFERED ARE TO APPROVED APPLICANTS ONLY
RE-SELLERS OF DICK SMITH PRODUCTS IN MOST AREAS OF AUSTRALIA.

Hi Fi Topics

Microphones, music, reverb. and all that!

During a recent lecture-demonstration in Sydney, Dr Fritz Sippl of AKG dealt at considerable length with psychoacoustics, or subjective reactions to sound. Implicit in the lecture was a conviction that AKG has a firm grasp of the field in which they are active — undoubtedly the message AKG wanted to get across!

by NEVILLE WILLIAMS

Dipl. Ing. Fritz Sippl, MAES, Director (Market Development) for AKG Acoustics, Austria, represented in Australia by AWA.

A notable feature of Dr Sippl's presentation was its low key efficiency and the complete absence of the bull-dust and ear-cruching sound levels which commonly characterise audio/hifi demonstrations.

Although surrounded by quality microphones (AKG, of course), a multi-channel mixer and an array of other gear, the lecturer quickly realised that sound reinforcement was not really necessary in the excellent acoustics of the Sydney Science Centre. He turned the mics right off and addressed the audience face-to-face from the floor of the lecture hall.

And when the time came to demonstrate mics and reverb units, the sound pressure levels were adjusted to what one would expect from an orchestra in a concert hall, or a grand organ in a cathedral. Perhaps the values of AKG's home city of Vienna were showing through!

There was a moment of confusion to do with the audio-visual presentation. The sound came through very clean but was also rather loud. It didn't stay that way for long.

Dr Sippl went over to the amplifier and actually turned it down!

As a member of the audience, I couldn't escape the feeling that there was a message on the day for promoters of other audio/hifi products, in respect both to the presentation and the venue.

Speaking first about microphones, Dr Sippl emphasised that they can no longer be regarded as devices — good, bad or indifferent — intended merely to pick up sound. They now have a very active role in producing the kind of sound that a musician wants and must therefore be regarded as one of his/her tools of trade, along with an ever increasing array of other electronic aids.

Time was when microphones could be divided roughly into three groups: (1) "Cheapie" types intended for non-professional applications, tape recorders, communications, pageing etc; (2) Public address, platform and stage microphones with the emphasis as much on ruggedness as on audio quality; and (3) studio microphones with the emphasis on quality and on the assumption that they would be treated always as delicate, precision instruments.

The distinctions between the three classes are now less distinct. Cheapie microphones generally are capable of much better quality, while AKG in particular are effectively bridging the "impossible" gap between ruggedness and quality, and offering microphones which meet both requirements.

According to Dr Sippl, pressure to achieve the impossible can be traced to the ever-changing pop music scene. By and large, the reputation and the "sound" of individual groups is established by their recordings, made under studio conditions.

But groups also have to perform live on stage and, if their sound is not clearly recognisable to the fans, concert appearances can become an embarrassing anti-climax. They simply have to go on stage with full electronic paraphenalia and top quality mics — even though those same mics are subjected to brutal treatment during the course of a performance.

AKG's latest answer to this problem is their 300-series "musicians" dynamics: the D310, the D320B and the top-of-the line D330BT. While credited with studio-quality sound, the new microphones are built to withstand very rough treatment. While using a D330BT, Dr Sippl gave the audience repeated jitters by deliberately throwing it on the floor, sideways, end-on, etc, then picking it up and carrying on with the demonstration. It appeared to be completely unaffected, either physically or electrically.

The reason for this ruggedness was revealed when he unscrewed the stainless steel outer grille to reveal a washable anti-pop cushion and, beneath it, a shock absorbent plastic basket designed to have a progressive resistance to mechanical distortion. Inside that again is the plug-in electroacoustic element, fully cushioned within the main zinc alloy die-cast housing.

As the demonstration showed, it is a very simple matter, even for a non-technical person, to dismantle a 300-series microphone and insert a new

---

Operators of radio, TV and recording studios should address inquiries about AKG products to Bill Bolton, AWA Engineering Products Division, 422 Lane Cove Rd, Nth Ryde, NSW 2113; phone (02) 888 8111. Otherwise to Adrian Wackwitz, National Product Manager Audio, AWA, 554 Parramatta Rd, Ashfield NSW 2131; phone (02) 797 5757.

acoustic element in the event that something does fail.

The carefully designed suspension obviates much of the noise that might otherwise be produced by handling — an important characteristic in any microphone that is likely to be hand-held. In addition, potentially explosive transients due to bumping or dropping are curtailed, thereby safeguarding also the loudspeakers in the P.A. system and the ears of the audience!

All three in the 300 "Musicians" series mics have an inherent "presence" characteristic: a gentle prominence extending from about 2kHz to 12kHz and reaching about 6dB at 5kHz. A miniature 3-position switch in the D330BT provides the option of varying the "presence", while another similar switch allows the bass response to be rolled off quite severely. Bass roll-off only is available on the D-320B.

Dr Sippl stressed that these characteristics are what musicians, and particularly vocalists, currently demand. For the most part, they simply do not want a microphone with a completely flat top response. In fact, the slightly undulating top response of the D310 is a deliberate provision for one of their often stated preferences.

Said he: "Don't ask me why; we only know that musical fashions change with the period."

At the bass end, the curves may not be what they seem, because a bass boost effect operates when the microphone is very close to the sound source. Thus a microphone which exhibits a built-in bass roll-off when measured at one metre, may seem flat or even bass boosted when used close-up due to the so-called "proximity" effect.

Vocalists rely on this fact when they wish to project an intimate, sensual mood.

But if they want to emphasise to the audience that "I hate you", full sensual bass would be all wrong. For that number, bass cut would be preferred. Similarly, bass cut could also be used if the venue presents problems with building rumble, acoustic feedback and so on.

Microphone directivity is another vitally important quality. Omni-directional or bi-directional microphones have an important place in studio situations where the acoustic environment has been carefully designed and controlled. However, for general use, so-called cardioid pattern microphones are much more practical, with a response which is (hopefully) confined to the hemisphere in front of the diaphragm.

With such a pattern, microphones can be positioned so that they favour sound from the performer (or stage), while attenuating sound from the audience, or from the public address loudspeakers. The higher the front/back ratio, and the greater the freedom from response peaks, the less likely the problem of acoustic feedback.

Dr Sippl pointed out that the cardioid pattern is normally obtained by admitting sound arriving from the back of the microphone to the rear surface of the diaphragm. By balancing the amount of sound so admitted against what would reach the front of the diaphragm from the rearward source, a substantial degree of cancellation can be achieved.

Unfortunately, it is difficult to achieve good cancellation over a wide range of frequencies. It often transpires that a microphone having a good cardioid pattern and a good front/back ratio at 1000-2000Hz, may have quite poor directivity at lower and higher frequencies. In their 300 series, AKG employ a twin access system for rearward sound to extend the cancellation and produce a more uniform cardioid pattern.

Where directivity is a paramount consideration, AKG can offer their 200 series which, in fact, use two complete transducer systems in tandem, one covering the range from 800-20,000Hz and the other from 800Hz down to

WHATEVER YOUR CASSETTE NEEDS — SONY CAN MEET THEM!

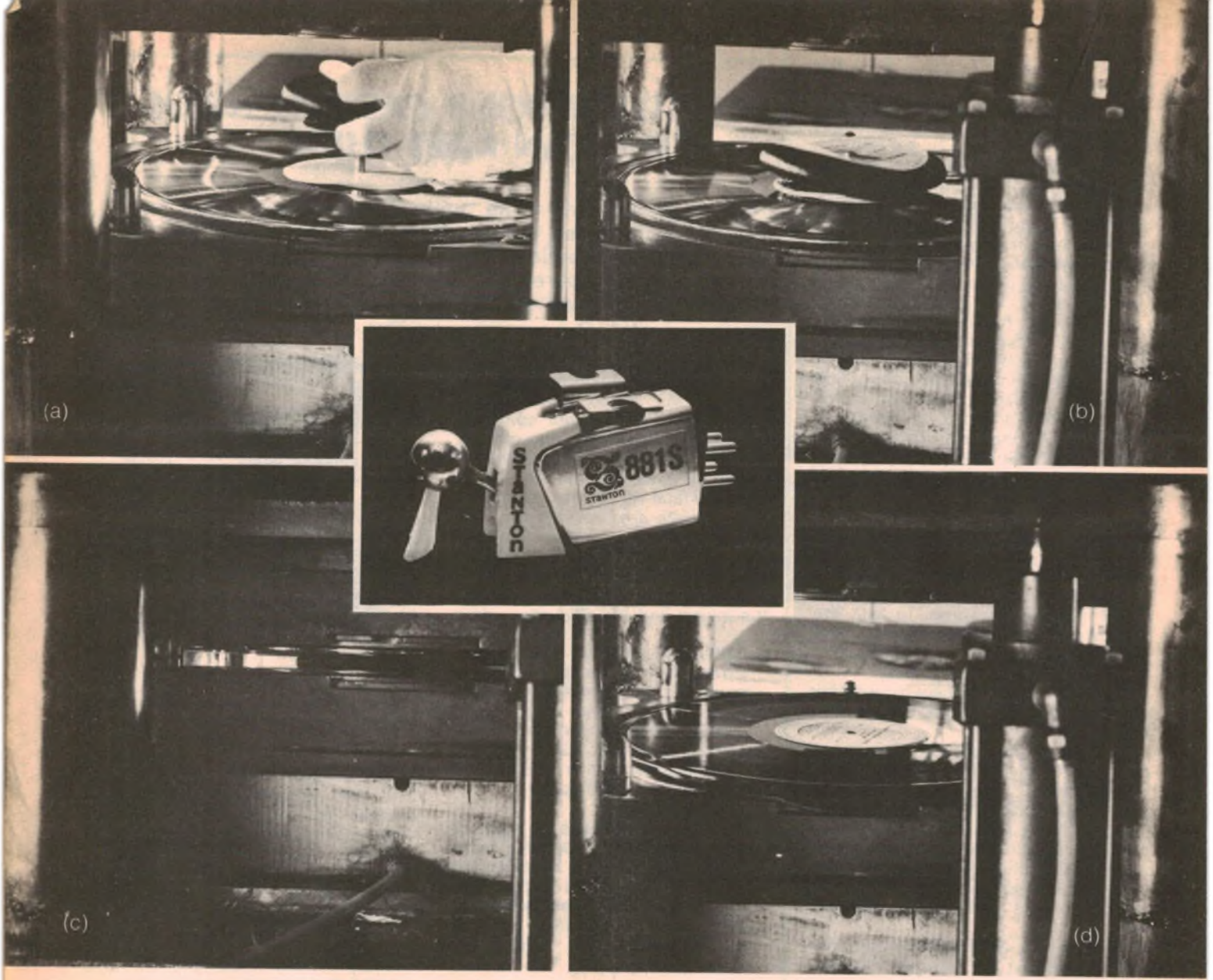
Already prominent in the audio cassette field, Sony have recently rationalised and up-dated their range, with the obvious intent of providing a tape for every need — from general purpose ferric to pure metal particle. All you need to understand the range is an eye for colour or an ear for initials!

First off, all the new tapes use the Sony "SP" cassette body, the initials standing for "Super Performance" mechanism. Of screwed construction, the body contains guides, stepped hubs, and ribbed liners, all aimed at ensuring the smoothest possible tape run during actual use. Sensor slots are provided for Cr02 tapes and generous viewing ports so that the tape remaining on the spools can readily be seen.

Now for the individual cassettes, the initials and the colours:

- CHF — Orange: A general purpose ferric tape, broadly equivalent to the earlier low-noise type. Normal bias and normal (120uS) compensation. Available as C30, C46, C60, C90 and C120. The cheapest tape in the range, at the old "low noise" price.
- BHF — Green: New to the range. A somewhat more expensive ferric tape, still requiring normal bias and equalisation but with slightly higher output and extended top response. Suitable for all applications. C46, C60, C90, C120.
- AHF — Blue: Similar to, and priced the same as the earlier HF tape. A top grade ferric tape, for normal bias and equalisation, but with improved output, dynamic range and treble response. C46, C60, C90.
- CD —Alpha — Silver: A top quality chromium — dioxide tape, requiring Cr02 bias and equalisation. Intended for top quality recording. C46, C60, C90.
- FeCr — Gold: Regarded by Sony as their Top-of-the-line conventional tape. Double layer, similar in specifications and price to the earlier Ferrichrome tape and suitable for top quality applications. Normal bias but equalisation the same as for Cr02 (70uS). C46, C60, C90.
- Metal: A recent addition to the range is a pure iron particle tape for use with decks having "metal tape" facilities. A C46 cassette is currently available for $12.50 retail, but C60 and C90 cassettes will be available shortly.

Further information is available from Sony outlets or direct from Sony (Australia) Pty Ltd, 453 Kent St, Sydney, 2000.



Stanton-The Professional in The Recording Industry

Application—Stanton monitors the quality of the pressing

Record pressing is one step in the process that delivers sound to you. The process begins when a premeasured amount of pure poly vinyl chloride preheated to 300 degrees is dispensed in the form of a vinyl biscuit (a) which is sandwiched between the two record labels (b). The biscuit is then squeezed between two nickel plated stampers by a hydraulic press (c) spreading the vinyl to form the record, (d) which is then trimmed and stacked for testing and packaging. The average press turns out 8500 records daily. Last year's largest single pressing of a particular album was over 14,000,000 copies.

Stanton plays a vital role in assuring that only the very finest of recordings will ultimately reach the consumer. Engineers rely on Stanton cartridges for playback of the pressing. Stanton's 881S Professional Calibration Standard Cartridge is the logical choice to evaluate the newly pressed records. The 881S is a low mass pickup that features the patented, expanded contact area Stereohedron® stylus tip for truest fidelity and gentlest possible treatment of the record groove. Each Stanton 881S is individually calibrated with the test results packed in each unit. *From disc cutting to disco to home entertainment your choice should be the choice of the Professionals...Stanton cartridges.*

STANTON © 1979 STANTON MAGNETICS

THE CHOICE OF THE PROFESSIONALS™

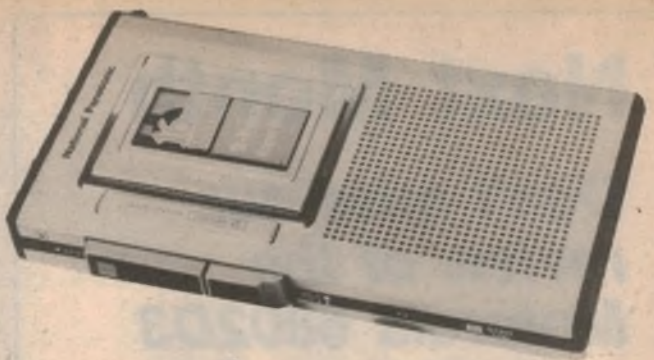
Sole Australian Distributors:
LEROYA INDUSTRIES PTY LTD

Head Office: 156 Railway Pde, Leederville, Western Australia, 6007. Phone 81 2930
NSW Office: 7 Jordan Rd., Wahroonga, 2076. Phone 487-2543

Available at quality conscious Hi-Fi dealers throughout Australia!

A REVOLUTIONARY NEW COBALT TAPE

A practical microcassette music system may be just around the technological corner!



▲ *Above: The National Panasonic 2-speed microcassette recorder RN-Z06. It works well with a conventional microcassette but Angrom tape offers improved high frequency response.*

Hard on the heels of metal-particle tape comes an announcement by Matsushita Electric of "Angrom" — a radical departure in technology which eliminates the binder and results in a thinner tape, with undiminished strength and up to ten times normal data storage capability.

◀ *Measuring 50 x 33 x 8mm, a microcassette pictured left, is tiny by comparison with the normal compact cassette. But it is being considered as the basis for a new miniaturised music system.*

With all conventional tapes — whether oxide or metal particle — the powdered magnetic material is first suspended in a resin-based adhesive binder, and then coated on to the plastic tape base. The coating is usually about 3 microns thick, compared with about 6 microns for the base, so that it adds significantly to the total thickness — and to the bulk when the tape is spooled.

No less to the point, only about 30% of this added thickness (and bulk) is represented by useful magnetic material; all the rest is binder, serving only to keep the particles in place, and to stabilise them chemically in the case of pure iron.

In the new Angrom tape, the magnetic coating is a cobalt derivative and is applied directly to the polyester base film by an "evaporation" process. The technology is apparently related to that involved in the manufacture of metal film capacitors and is therefore well known. The breakthrough by Matsushita has been in extending it to a continuous coating process and in achieving adequate adhesion and wear resistance. It is about five years ahead of what the industry expected, they say.

Having the appearance of a bright, plated surface, the new cobalt coating is only 0.2 microns thick and barely adds to the thickness of the base film. It gives the option of using a thicker film for additional strength, or of retaining the original film and increasing the length and therefore the playing time by about 50%.

The highly homogenous coating offers a much improved high frequency response at low speeds but can operate with normal bias and erase levels.

At present, Matsushita are talking about their Angrom tape only in the context of the microcassette, which, at the moment, is mainly used for verbal note-taking and other voice recording. We tested it in connection with National's new RN-Z06 microcassette two-speed recorder, as pictured.

At the normal speed of 2.4cm/sec and loaded with Angrom tape, the RN-Z06 had high frequency response to spare on voice, with sibilants somewhat exaggerated. At half speed, giving a playing time of 90 minutes per side, the sibilants largely disappeared but voice quality was still eminently satisfactory.

While an Angrom-equipped RN-Z06 would have obvious attractions for an itinerant business executive, the hot tip is that Matsushita (National-Panasonic) are looking beyond it to a microcassette music system. If they can solve the problems of miniaturised deck design, the 10:1 improvement in data storage offered by Angrom should provide the tape they need.

Angrom microcassettes should be on the market in Australia within the next two or three months but microcassette music systems are further back in the pipeline.

HIFI TOPICS: Microphones, music, reverb. — continued.

around 30Hz with switchable bass cut to compensate for possible proximity effect. With this series front/back ratio is maintained in the region 15 to 20dB across the audio spectrum.

For still greater directivity and a narrower frontal lobe, AKG offer a number of "machine gun" microphones, in which the transducer element is mounted at the rear end of a long tube, being in effect an acoustic resistance line. Sound arriving directly from the front passes down the tube to the transducer; sound from the sides and rear are subject to cancellation.

But again the warning was sounded: super-directional qualities are only as good as the basic design and not all microphones with long frontal tubes exhibit good directivity at all frequencies.

Dr Sippl also demonstrated a number of AKG "condenser" microphones, including module kit types, where various transducers, amplifier and fitments can be assembled in different ways to meet particular requirements. Also demonstrated were electret condenser units, which have more recently been introduced into the AKG range.

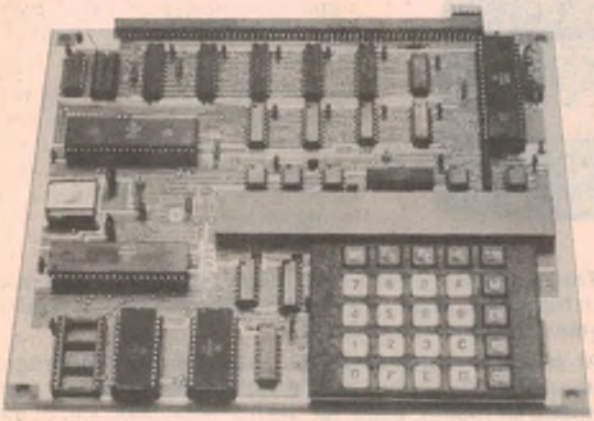
Questioned about the apparent delay, the lecturer said that his company wanted to be satisfied that they could offer such mircophones with the confidence that they would retain their characteristics during a reasonable service life. In no way was AKG prepared to market something that could lose its sensitivity within four or five years, as some electrets had reportedly done.

Dr Sippl said that he tended to avoid the word "electret", because it had acquired an association with inexpensive mass-produced units built into tape recorders, etc. He preferred to think of them as permanently polarised condenser microphones, and legitimate alternatives to the externally polarised types.

The lecturer also drew attention to AKG's current range of phono car-

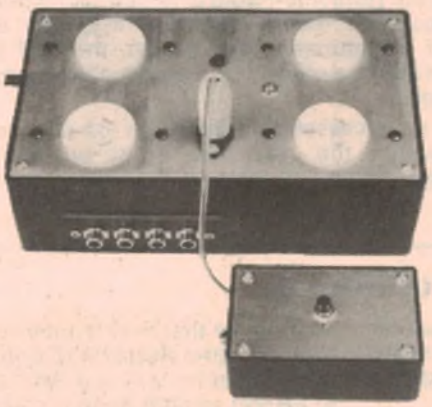
Next Month

Don't miss our review of the Motorola 6802D3 microcomputer



Our March issue features an in-depth review of Motorola's new MEK6802D3 microcomputer, which replaces the old workhorse 6800D2 evaluation kit. The new unit uses 6800 hardware and software and is greatly expandable. Get hold of the March issue for the details.

Automatic Switch for your hifi system



Here's a really neat addition for your hifi system. It monitors the tape output terminals of your stereo amplifier and, if no audio signals are received for a period of 30 seconds, automatically switches off the mains power. As a bonus, the unit acts as a junction box so you can tidy up those unsightly mains cords from all your equipment.

Our planning for this issue is well advanced but circumstances beyond our control may change the final content. However, we will make every attempt to include the articles mentioned above.

HIFI TOPICS — continued

The new National Panasonic model CQ-7600 AM/FM car stereo radio tuner and cassette system, boasts a 5-band graphic equaliser, Dolby noise reduction, auto replay on cassette, tape direction indicator lights and more. It is designed to mate with Panasonic's 4-speaker main amplifier, model CJ-3000 and with recommended dual-cone and coaxial speakers. The cost of the complete in-car hifi system would approximate $730, plus installation charges. (National Panasonic Aust. Pty Ltd, 57-69 Anzac Pde, Kensington NSW 2033.

tridges and headphones, but it was the final demonstration of AKG's artificial reverberation that really stole the show.

Dr Sippl emphasised that a reverberant content is not an optional quality in our sound environment. Subjectively, we need it.

A person confined in an anechoic chamber becomes acoustically disorientated, because the clues are missing by which they normally position themselves. Similarly, confinement in an echo chamber can be emotionally quite disturbing.

It is only to be expected, therefore, that reproduced sound should exhibit the right kind of reverberant quality if it is to be subjectively satisfying and convincing. Cave, cathedral, concert hall and chamber all have their own distinctive kind of reverberation.

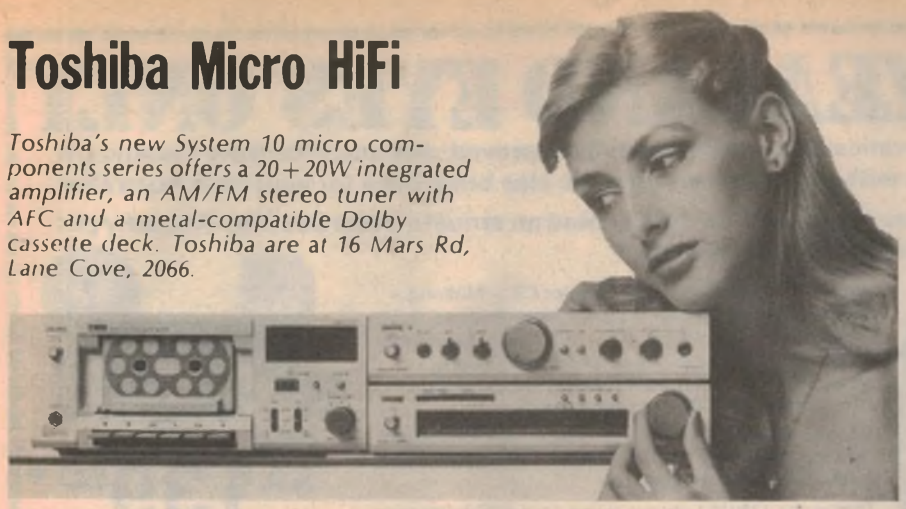
Unfortunately, recording groups do not always have economic access to ideal venues and rather than accept a totally wrong ambience, it is reasonable to seek a method by which reverberation and ambience can be synthesised. Hence the various artificial systems which have been devised, with varying degrees of success.

Echo chambers, echo plates, tape loops and simple Hammond-type spring systems have obvious disadvantages and even the more modern "bucket brigade" systems have proved to be disappointing because of their discrete echoes, their uneven frequency response and their poor signal-to-noise ratio.

Through an unfortunate combination of circumstances, Yamaha missed out in last month's review of cassette decks. Currently, they have four models of which the TC-1000 is currently top of the line. It offers a wow and flutter figure of 0.05%, a response to 18kHz with Cr02 tape and a signal/noise ratio of better than 60dB, even without the in-built Dolby anti-noise circuitry. Facilities include dual line outputs, separate headphone amplifier and full mic-line mixing. Yamaha is represented in Australia by Rose Music in Sydney and Melbourne and retailed by hifi stores around Australia.

Toshiba Micro HiFi

Toshiba's new System 10 micro components series offers a 20+20W integrated amplifier, an AM/FM stereo tuner with AFC and a metal-compatible Dolby cassette deck. Toshiba are at 16 Mars Rd, Lane Cove, 2066.



AKG's answer to the problem is a combination of their own spring system and a digital system involving A/D conversion, digital storage and delay, then D/A conversion and re-mixing. The equipment demonstrated in Sydney was an up-date of equipment that produced quite a sensation in Europe some years ago, and reported in our May 1975 issue (page 9).

The spring system is basically similar to that developed by Hammond for use on electronic organs but the springs have been critically designed and interconnected to ensure a response within a + and -5dB strip over the audio range, with good signal/noise ratio and freedom from electrical and acoustic penetration. Selectable reverberation times from 1.5 to 4.5 seconds are available, depending on the model.

While spring reverberation of this type can be very effective, it lacks an important characteristic of true building reverberation: the discrete bounces which follow the original sound, depending on the major dimensions of the autitorium. A digital system can provide these missing "clues" and can be set up easily to provide the desired number of bounces, their relative delays and relative amplitudes.

To demonstrate the potential of the system, Dr Sippl played an excerpt by as much of an orchestra as could be crowded into an anechoic room. Unprocessed, it was dull indeed.

With purely digital repeat added, it sounded rather like two voices and two orchestras playing slightly out of step in a larger chamber; or three voices and orchestras, or four, and so on.

With only spring reverb, the effect was more natural but still not quite convincing.

But with spring and digital in operation, and set up to give the right mix of bounce(s) and ambient, the anechoic chamber had been transformed into a concert hall. Similarly for recording of an organ in a cathedral and so on.

Dr Sippl capped off the demonstration by revealing that some of the signals we had heard processed were not even stereo to begin with. The Science Centre had been filled with all-pervading sound from a mono original!

The whole point of it was not to convince the audience that all sound should henceforth be reverberated as a matter of course. The intention, rather, was to indicate the resources which now exist to enrich and enhance recordings where the need exists.

If you can't take an orchestra to a concert hall, then you can do it the other way round.

And, if your listening room, by necessity, is of closet-like dimensions, technology is one way to push the walls out — acoustically at least!

Metal particle tape announced by BASF

Well known for their range of conventional oxide tapes, BASF are planning to release their new metal pigment (pure iron particle) cassettes as soon as practicable. They will be marketed as "Metal IV" and be available in two forms: C60 and C90. BASF say that manufacturers have agreed on an equalisation standard of 70uS, as for Cr02 tape, and on a case design which will activate automatic sensing in future decks. However, some of the other characteristics remain to be standardised before BASF — or any other company — can issue a true reference standard tape for the industry. The subject is under constant discussion between involved companies in Germany, the Netherlands, Japan and USA. For further information, contact Mr N. Price, BASF Australia Ltd, 55 Flemington Rd, Nth Melbourne 3051.

FOR NEW ZEALAND EYES ONLY

Did you know that Dick Smith Electronics have available a fully approved, designed-for-New Zealand CB radio that you can legally take back with you (or have someone else bring back for you) from Australia?

YES! Don't take the risk of having non-approved CBs confiscated on arrival in New Zealand. And why put up with exorbitant prices for 'unknown' brands at home?

CB ACTION received a copy of the price list put out by [redacted] in Christchurch and we were surprised by the price of rigs and accessories.

The cheapest 11 channel 2 watt transceiver listed on the brochure was $275 for a Great GT418. The most expensive was $299.50 for a Laser 555. Both rigs have only 11 channels with 2 watts AM output which is the maximum allowed under NZPO rules.

The price list also included some accessories and while antennas were [redacted] slightly "high[redacted]" than Australian supplies and external speakers were very expensive.

For example, a combined power supply and speaker retails for between $64 and $85, according to the list. The supplies probably would not be rated in excess of 1.5 amps continuous unless the transceiver

Reprinted from 'CB ACTION' No. 33

We have the world's most popular CB – Midland – fully tested and approved by the New Zealand Post Office –(approval number RTA 23/1135). This mighty Midland covers the 11 New Zealand channels between 26.425 and 26.675MHz, plus provision for channels 12–14 for approved users.

The set is capable of 6 watts output, but has been internally adjusted to give 2 watts output (maximum legal power in New Zealand).

This is the **ONLY** fully approved phase-locked-loop New Zealand set available: no crystals to buy, plus the incredible frequency accuracy and stability that only phase-locked-loop sets can give you.

ONLY

$A139.50 *

(*Tax-free price only if taken back to New Zealand)
Cat D-1435

Why take risks with inferior sets? You MUST know one of the half million or so New Zealanders who come to Australia each year. Why not ask them to bring you back a fully approved Midland 77A-882NZ CB radio from Dick Smith Electronics?

Yes! We also have a great range of CB radio accessories: at the RIGHT price!

DICK SMITH ELECTRONICS

NSW	125 York Street,	SYDNEY	Phone 290 3377	ACT	96-98 Gladstone Street,	FYSHWICK	Phone 80 4944
	147 Hume Highway,	CHULLORA	Phone 642 8922	VIC	399 Lonsdale Street,	MELBOURNE	Phone 67 9834
	162 Pacific Highway,	GORE HILL	Phone 439 5311		656 Bridge Road,	RICHMOND	Phone 428 1614
	30 Grose Street,	PARRAMATTA	Phone 683 1133	QLD	166 Logan Road,	BURANDA	Phone 391 6233
				SA	203 Wright Street,	ADELAIDE	Phone 212 1962
	263 Keira Street,	WOLLONGONG	Phone 28 3800	WA	414 William Street,	PERTH	Phone 328 6944

EXCEPT WHERE NOTED, ALL ITEMS SHOWN IN STOCK AT PRICES GIVEN AT TIME OF GOING TO PRESS.

MAIL ORDER CENTRE: PO Box 321, NORTH RYDE NSW 2113 Ph 888 3200 PACK & POST EXTRA

POWER SUPPLIES

Fixed Voltage for Battery Operated Equipment

- *Fully protected against sustained short circuits*
- *Rugged, attractive steel case*
- *Suitable for continuous operation in high ambient temperatures*
- *On-off switch with separate L.E.D. indicator*
- *Overload Indicator on ECA143 and ECA144*

	ECA140	ECA143	ECA144
OUTPUT	13.8V 2 A	13.8V 3 A	13.8V 4 A
RIPPLE & NOISE:	0.75mV/Volt at rated output		
PROTECTION:	Fold back current limiting		

Variable Voltage for Bench Use

The "ECA160" series are low cost power supplies designed for laboratory, factory test and systems applications. They are equipped with a front panel mounted 10 turn voltage control, combination ammeter/voltmeter and binding posts. Output is continuously variable from zero to 8% above the maximum rated voltage.

FEATURES:

- Linear series regulator
- Automatic short circuit protection
- Low drift
- Fast transient response
- Electricity authority approved

VOLTAGE CONTROL : 10 turn 5mV resolution
RIPPLE : 2mV RMS
LOAD REGULATION : 0.04% or 10mV

TYPE NO.	VOLTS	AMPS
ECA160–12/3	0–12	3.0
ECA160–24/1.5	0–24	1.5
ECA160–35/1	0–35	1.0

AUSTRALIAN MADE

Made in Australia and Guaranteed by:

FERGUSON

FERGUSON TRANSFORMERS PTY.LTD.
31 HIGH STREET, CHATSWOOD. N.S.W. 2067.

Philips GP-412 II moving-magnet cartridge

The GP 412 II, successor to the outstanding GP 412 VE, is one of the top of the range of Philips Super-M series cartridges. Weighing 6 grams, it has a bi-radial stylus and recommended tracking force of 0.75 to 1.5 grams.

The Philips cartridge is supplied in inexpensive but attractive packaging in the form of a black plastic case. Included with the cartridge are spare mounting screws, some pin connectors and a miniature information booklet.

Operating on the magneto-dynamic (moving magnet) principle, the GP 412 II cartridge uses a very high flux density magnet to make it possible to reduce the moving mass to below 0.1 milligram, while still keeping the sensitivity at a sufficiently high level. Philips claim that with such a low tip mass to enable high compliance, excellent trackability is obtained.

At 6 grams, the GP 412 II is a light cartridge. It has a bi-radial stylus, 7 x 18 microns and the standard (EIA/DIN) vertical tracking angle of 20 degrees. Inductance of the cartridge is 620 millihenries and DC resistance is 1400 ohms. Output voltage at 5cm/sec is 7.5 millivolts.

Integrated with the removable stylus assembly is a flip-down stylus cover which is more useful than detachable covers which are likely to be misplaced. The stylus cover has click stops which are very positive, providing good protection for the stylus when in the down position.

Mounting the cartridge in a standard headshell is a straightforward process. The cartridge has the standard 12.7mm mounting centres and its output terminals are coded with embossed lettering on the cartridge body.

We used the manufacturer's maximum recommended tracking force of 1.5 grams and this gave very good tracking performance. On the CBS STR 110 test disc, the GP 412 handled all the high-level 300Hz tracks without audible distress, although some visible waveform distortion occurred on the + 18dB lateral test track.

On the W&G 25/2434 test/disc, the GP 412 only slightly mistracked on the +16dB drum track. At lower signal levels, distortion was not apparent. With the Shure "Audio Obstacle Course", the cartridge displayed virtually faultless tracking except for some mis-tracking on the "violin level 5" test. Overall then, the cartridge has very good tracking performance.

We tested the cartridge with the recommended load of 47k, shunted by cable and test instrument input capacitance of 180pF. With this loading the frequency response was very smooth and within ±3dB from 20Hz to 20kHz with the exception of a resonant peak of +5dB at 15kHz. Channel balance was within 0.5dB over most of the range.

At right, the Philips GP 412 II moving magnet cartridge shown in its presentation case.

Separation was uniformly wide over the whole audio range. We measured it as 20dB at 1kHz in one direction and 35dB in the other. At 10kHz the respective figures were 20dB and 22dB. Even at 20kHz the figures were 20dB, however, at the region of resonance (15kHz) the separation dropped to -10dB.

Square wave response at 1kHz was very good, with only slight ringing. Response to sinewave signals exhibited only slight sawtooth shape at the 6kHz to 20kHz region which is normal for most cartridges. At lower frequencies the sine wave response was excellent.

On listening tests the GP 412 II performs very well and confirms the high performance indicated by the measurements. There is a smooth response on all types of music ranging from classical to rock. Above all the sound is very clean without muddiness and provides excellent clarity.

In summary, our overall impression of the GP 412 II is very favourable. It performs well with excellent trackability and smooth response. Recommended retail price is $118.88 + 27½% sales tax. Further information on Philips products can be obtained from high fidelity retailers or from Philips Service, 443 Concord Road, Rhodes, NSW 2138, or from branches in your nearest state capital city. (JC)

Play cassettes through your car radio

Although in no sense a piece of hifi equipment, a unit currently being offered by Classic Radio and ACE Radio will certainly appeal to the music enthusiast with a limited budget. For around $20 it can turn an ordinary car radio into a cassette player.

Although intended primarily for use in a car, the BICOH converter illustrated below can be used with any AM radio system.

These days, a great many car radios have the cassette replay facility in-built but there are countless others which are limited to off-air music. In urban areas this may be adequate but, on longer journeys, the ability to relax to a handful of favourite cassettes is an undoubted advantage.

The BICOH cassette converter model CC-007A, currently being offered by the two abovementioned firms, offers a neat solution to the problem. It is essentially a cassette player with an in-built 3-transistor amplifier, which modulates an RF oscillator, preset to the middle of the AM broadcast band. The signal can be tuned on an AM receiver in the same way as a broadcast station, with the receiver volume and tone controls performing their normal function.

Electrically, connection to the receiver is very simple. The normal car radio antenna lead is plugged into the converter and a jumper lead, supplied in the package, completes the connection to the receiver. As far as the radio is concerned, it is a straight-through connection but a small capacitor injects the additional signal, when the converter is in use.

NEGATIVE GROUND

Connection is also required to the +12V supply line in the car and this involves a single lead with its own fuse fitting. It is important to note that the converter is designed only for a negative-ground system, with the return circuit being provided by the mounting arrangements. The current drain is quoted as a modest 200mA, indicating the use of a "battery" style transport mechanism.

The converter is quite small, measuring nominally 110mm wide x 53mm high x 150mm deep. As such, there should be a reasonable chance to find a spot for it in most vehicles. Basically, it is intended to sling beneath the fascia, within reach of the driver, and brackets are provided with this in view. It must protrude far enough to allow the cassette to be inserted into the top of the unit.

Controls are limited to three push buttons: power on/off; eject; and play. There are no spooling or rewind facilities and, of course, no provision for recording. The assumption is that the converter will be used with cassettes which have been pre-recorded and which will be played through and turned over as necessary.

Loading and changing cassettes tends to be a little on the fiddly side, but should not present too much of a difficulty if the unit is strategically placed.

By hifi standards, the specifications are modest indeed with wow and flutter quoted at 0.35% and signal/noise ratio at "more then 30dB". Having in mind that these figures apply only to replay and are not cumulative record/replay figures, they do not impose any significant limitation on the sound, as heard through a normal car radio.

Indeed, signal/noise ratio, distortion and certainly the frequency response would be substantially that of the car and radio system. In practice, it is reasonable to assume that the converter will sound like an ordinary AM transmission — except that you control it yourself!

The converter is set to a nominal 830kHz, suggested by the manufacturers as a normally unused frequency. This would not necessarily be true in all areas of Australia but a trimmer is provided (acessable through the PC board on the underside) to permit a frequency adjustment of plus and minus 50kHz.

The level of RF signal produced is quite small — adequate for a car radio installation but certainly too small to cause any problems with general radiation.

As a matter of curiosity, and to get a better idea of the basic sound, we connected the converter to an AM tuner — part of a normal hifi system. To couple to the ferrite rod antenna, we wound a half-dozen turns around it and took the respective ends to the inner and outer connections of the converter output cable. And although subjected to the normal sideband losses of the AM tuner, cassette quality sounded quite clean, with good bass. Overall, it was eminently listenable.

This would suggest that anyone with an existing AM system, and able to provide the requisite filtered DC (12V at 200-plus milliamps) could add cassette playing facilities in a very cheap and compact form.

The unit, as inspected, was supplied by Classic Radio of 245 Parramatta Rd, Haberfield NSW 2045. Phone (02) 798 7145. Advertised price is $18.50 plus $1.50 post and package. We understand that the converters are available at the same price from ACE Radio, 136 Victorial Rd, Marrickville NSW 2204. Phone (02) 51 3845. (WNW).

The new generation of factory-built or kit-set Peerless loudspeakers

It's true most speakers *look* alike and that price alone never tells the whole story. But now the new generation Danish-built Peerless loudspeakers give you a recognizable difference in sound quality–a difference that has set Peerless a notch above the others for over 50 years.

The range of new generation Peerless loudspeakers includes the fully assembled *PAS series* plus the money-saving *PLK kit-sets*. Both series contain drive units with the following characteristics.

Peerless 'X' Line Woofers

☐ Large ceramic ferrite magnets for high power handling. ☐ Specially coated cones reduce colouration to a minimum. ☐ Cones are supported by a single-roll foam or rubber surround to maintain excellent linear motion. ☐ Bass response is clean and tight at all listening levels.

Peerless Midrange Units

☐ Sealed back units prevent interaction with the woofer. Distortion and colouration are reduced to a minimum. ☐ The rear side of the cone is coated with a special damping material to eliminate colouration. ☐ Specially impregnated polyurethane cone rim provides high degree of linearity.

Peerless Tweeters

☐ Dome tweeters designed for the highest accuracy of reproduction with low distortion flat response and wide dispersion. ☐ The sealed back isolates the tweeter from interference. ☐ Specially developed dome fabric ensures no degradation of performance even after prolonged heavy loading. ☐ Assembly mounted on a precision diecast plate where rigidity ensures permanent alignment.

Peerless Dividing Networks

☐ Peerless crossovers use air-cored chokes for maximum power handling, and special electrolytic capacitors to ensure long term reliability. ☐ All components are mounted on fibreglass printed circuit boards for maximum durability, while coded clip connectors eliminate the need for soldering.

Power handling

The power handling capacity is high and conservatively rated at 100W RMS, however, due to the high efficiency of Peerless speakers, the recommended amplifier power is between 25-100W RMS.

Whether you settle for the smart timber-veneered PAS assembled series or the PLK kit-set, you're getting the same Danish-made Peerless quality–a quality selected by many of the world's most reputable names in loudspeakers, for inclusion in their own speaker systems.

Contact us now, and discover where you can hear Peerless loudspeakers–then let your ears make up your mind.

Danish-built Peerless loudspeakers, Orthodynamic headphones and unique car speakers are imported by the sole Australian agents,

G.R.D. GROUP Pty. Ltd.

698 Burke Road, Camberwell. 3124. Telephone (03)82 1256. Telex 31712

Please send me descriptive literature and dealer list: BO1294

Name .....

Address .....

Postcode .....

AUDIO TALK

by LEO SIMPSON

Transformers and Solid State Amplifiers

In our "Circuit and Design Ideas" pages for this month there is an idea proposed by one of our readers for varying the speed of a turntable which has an induction or synchronous motor. The method involves feeding an audio signal into one channel of a stereo amplifier which drives a step-up transformer to feed variable-frequency 240VAC to the turntable motor.

On the face of it, the idea is worthwhile but a number of objections can be raised. As I thought about the subject, it seemed unfair to try to allude to them all as a notation to the reader's idea, without seeming like the proverbial wet blanket. So, we overcame this without offence to the contributor concerned (I hope) by referring readers to this column.

The fact is that there are quite a few potential problems inherent in connecting transformer loads to solid-state amplifiers. Consider first the transformer problem which is most easily solved: direct current (DC) in the transformer primary.

This problem can readily occur when a direct-coupled amplifier is used to drive a transformer. To give an example, if the DC amplifier has a DC offset voltage at the output of 50 millivolts (positive or negative) and the transformer primary winding has a DC resistance of 100 milli-ohms, then the current flowing in the transformer primary would be 500 milliamps. Yes, half an amp!

Clearly, the amplifier would not survive for very long if this situation was maintained, Again, the transformer would be pushed toward saturation, even if the amplifier could sustain such a load.

It may seem that I have picked a rather extreme example to illustrate the point, but that is not the case. It is quite conceivable for a DC amplifier to have a DC offset voltage at the output of up to 100 millivolts, and that this would not cause problems with a conventional loudspeaker load. It is also quite conceivable for a transformer to have a very low primary resistance, particularly if it is a high quality auto-transformer intended for high fidelity or public address applications.

Fortunately, this problem can be easily circumvented by connecting a large value non-polarised capacitor (or two electrolytic capacitors back-to-back in series with the output of the amplifier. Alternatively, some, if not most, DC amplifiers have a means of offset adjustment which can be set to minimise any offset voltage at the output.

A second problem which may arise when a transistor amplifier is used to drive a transformer is instability. Depending on the characteristics of the transformer and the phase margin of the amplifier, the resulting instability may take the form of supersonic oscillation or low frequency "motorboating".

There is no easy cure for this problem, short of modifying the amplifier. If the amplifier specifications make a claim to "unconditional" stability, then it is fairly safe to assume that it will drive a transformer satisfactorily, but subject to the constraints outlined in the following paragraphs.

The following set of problems may apply to any transistor amplifier driving a transformer, whether or not it has unconditional stability and freedom from DC offset at the output. The first of these problems occurs when the amplifier is subjected to overdrive, ie, it is driven into clipping. Depending on the inductance of the transformer, this may generate excessive voltages across the output transistors which could cause failure.

Amplifiers which are specifically designed to drive inductive loads such as transformers and motors overcome this problem by connecting reverse-biassed power diodes across the output transistors. Thus any "spike" voltages generated by the inductive loads are bypassed safely to the amplifier supply rails.

Two potential problems remain to be discussed and they are both related to "second breakdown" of the amplifier's output transistors. In the first case, just driving the transformer above a certain power level (which may be well short of clipping) may cause the output transistors to exceed their "safe operating areas" and subsequently be damaged by "second breakdown". By way of explanation, "second breakdown" is an effect whereby, at high voltage and high currents, the voltage distribution across the semiconductor chip causes current "crowding" and localised hot spots which can cause failure of the device.

Some amplifier designs take special measures to avoid "second-breakdown" of the output transistors by including "load-line" protection circuitry. This circuitry monitors the voltage and current conditions through the output transistors and switches off the transistor drive should the load line be exceeded. What can happen when this sort of circuit interacts with a transformer or other inductive load is that the voltage spike generated when the output transistor is turned off may cause it to turn on again. The result is a burst of high frequency oscillation on the signal waveform. So the protective circuit can give rise to considerable distortion when used with a highly inductive load.

To some experimenters who have successfully used transistor amplifiers to drive transformers, all the foregoing may sound unnecessarily alarmist. However, their degree of success may have just been a lucky coincidence. Whether or not the match between amplifier and transformer is compatible depends on the parameters of these components.

I can summarise the message of this month's column by stating that if you propose to connect a transformer to an amplifier's output, proceed with caution. Don't just blithely connect the two up and assume that "everything will be apples". It may not; it may be "lemons".

Above all, do not assume that your ruggedly beautiful "professional grade" amplifier with rack mounting handles will drive a transformer. It might not. It might just quietly expire inside a few milliseconds. That would be sad.

At the very least, check to see if the amplifier has a DC offset voltage at the output. Then measure the DC resistance of the transformer primary. If the combination of the two will produce a primary current of more than about 20 milliamps, then you should take the steps outlined above to minimise or circumvent the DC offset.

Make sure that you do not drive the amplifier into clipping. If at all possible, use an oscilloscope to monitor the amplifier output, to check that all is well. If that checks out OK and the amplifier does not fail within the first few minutes due to "second breakdown" problems, then you may be reasonably sure that the amplifier and transformer are compatible.

TANDY ELECTRONICS

6th BIRTHDAY SALE

SAVE $40

89.95

Regular Retail Price 129.95

Printing/Display Calculator with 12 Digits and 4-Key Memory

Your premier Birthday Sale Saving from Tandy! Combine the convenience of a bright fluorescent display with the attraction of a print-out that you can keep. At stunning savings. Features include four-key dual memory, independent add register for fast extensions and invoicing, constant key, percent key and non-add key. Twelve digit display with floating comma and selectable decimal, full floating and add mode. Auto-rounding feature. Item count key. Plus, gives subtotals, totals and grand totals. With roll of thermal paper for instant action. You can choose display or both display and printout on this Birthday Sale Special. It's almost, "calculator features for free"! See this Birthday Sale Special at your Tandy Store now. 65-645

Handy 3-pack of thermal printing paper to fit this Birthday Sale Special! (5.7x27.4m) 65-706

3.95

Sale Ends March 1, 1980

For the lowest musical octave you need a

Super-Bass Filter

for the Bass you can feel!

A most effective method of extending the bass response of a stereo system is to add a super-woofer. Although the associated loudspeaker system may be somewhat bulky it can be disguised as a piece of furniture, such as a coffee table. This article presents a design for a Super Bass Filter, a necessary part of a super-woofer system.

by RON DE JONG

Most run-of-the-mill loudspeaker systems provide a useable bass response down to around 50Hz or so. This is adequate for satisfactory reproduction of most music, including most so-called "heavy rock". Those enclosures that are smaller than average will generally provide a higher "cut-off" frequency or, if they do have an extended bass response, are inefficient, in the sense that they require significantly more drive power.

Even those loudspeaker systems which are larger than average or which purport to have really extended bass rarely provide much in the way of useable response below about 40Hz.

This simply means that the majority of hifi enthusiasts have to make do with loudspeaker systems which lack at least the lowest octave of the audible spectrum. For most music, this is a satisfactory compromise. Most people just do not have the resources necessary to obtain and accommodate loudspeaker systems which cover the whole audio spectrum.

So most people never enjoy the rich sound of a truly wide range loudspeaker system — one which can really come into its own when playing classical organ music or music produced on electronic synthesizers. Sad.

Well there is a way to recover those lost octaves and this is within the reach of even those people with compact bookshelf loudspeakers: Use a separate "super-woofer" which can be housed in an enclosure with does double duty as a coffee table or end table. Powered by a separate amplifier, the super-woofer takes over where the stereo speakers leave off.

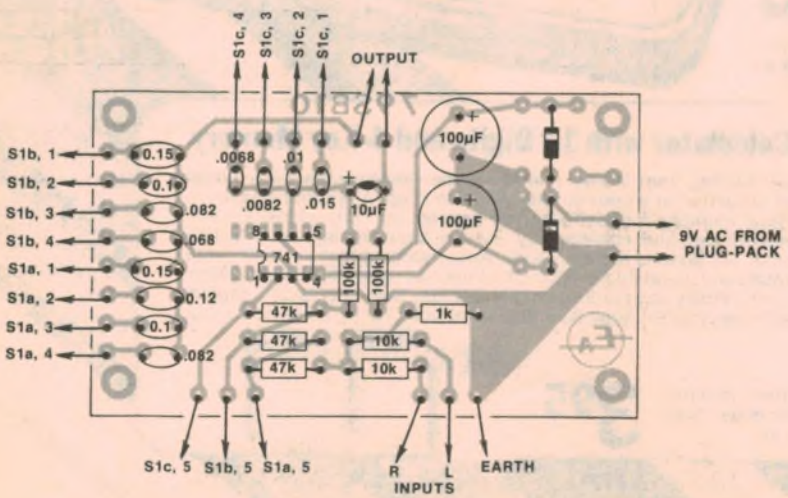
By disguising the necessary bulk of a super-woofer system in a useful piece of furniture, the hifi enthusiast can employ smaller enclosures for the main stereo speakers and yet still obtain very deep bass.

Only one super-woofer is required for a stereo system. This is because there is no directional information provided at signal frequencies below 100Hz. This also means that the super-woofer can be positioned almost anywhere within the listening room.

What is needed to drive the super-woofer is a separate power amplifier with at least as much power as the total of the existing stereo amplifier. This is to take into account that, for a super-woofer to have tolerable enclosure size, it must necessarily be relatively low in efficiency.

The signal for the super-woofer amplifier is derived from the outputs of the existing stereo amplifier. The circuit presented here is designed for this purpose. We call it a Super Bass Filter.

Our Super Bass Filter mixes and



All the components except for the frequency range selector switch are mounted on a small PC board.

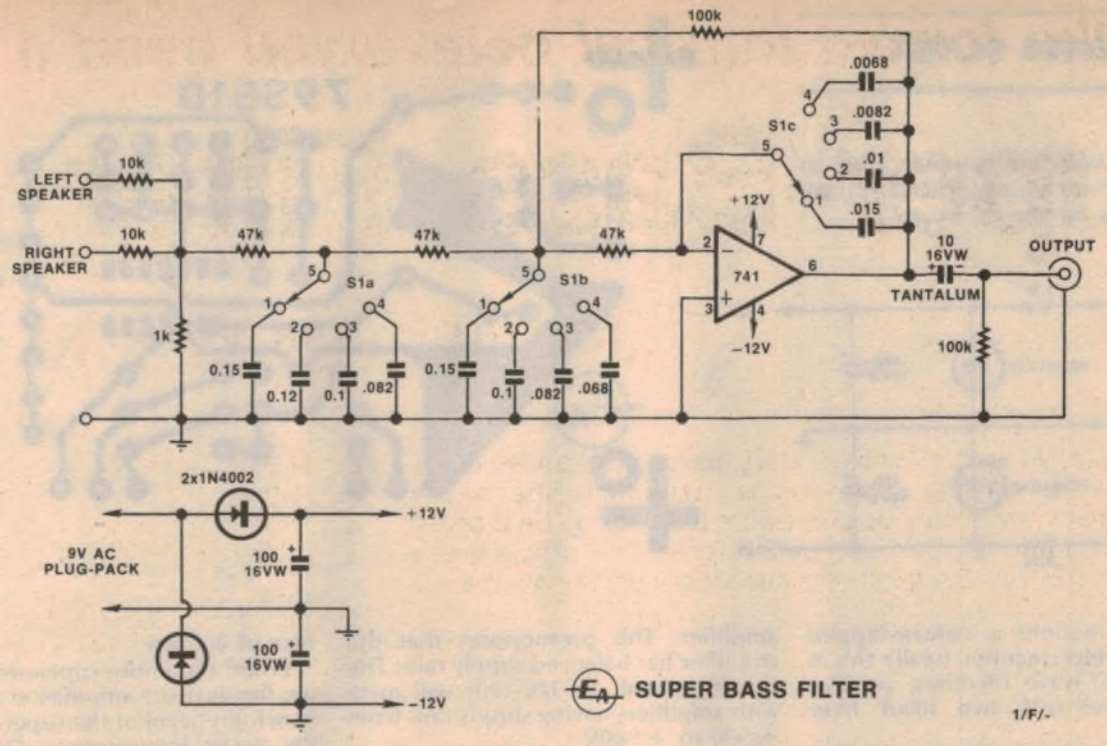
PARTS LIST

1 PC board coded 79SB10, 97mm x 57mm
1 3-pole 4-position rotary switch
1 9 volt plug pack transformer, Ferguson model PPA 9/500
½ Metre of rainbow cable

SEMICONDUCTORS
2 1N4002 diodes
1 741 op amp

CAPACITORS
2 100uF 16VW electrolytics
1 10uF 16VW tantalum
2 0.15uF metallised polyester (greencap)
1 0.12uF metallised polyester
2 0.1uF metallised polyester
2 0.082uF metallised polyester
2 .068uF metallised polyester
1 .015uF metallised polyester
1 .01uF metallised polyester
1 0.0082uF metallised polyester
1 .0068uF metallised polyester

RESISTORS
all ¼ watt: 2 x 100k, 3 x 47k, 2 x 10k, 1 x 1k



Circuit of the super bass filter. It uses only one IC — an inexpensive 741.

attenuates the signals from both channels of the existing stereo amplifier. Frequencies above the cut-off frequency are rolled off at the rate of 18dB/octave. Frequencies below the cut-off point are fed to the super-woofer amplifier. There is a switch to select the cut-off frequencies: nominally 50, 70, 80 and 100Hz.

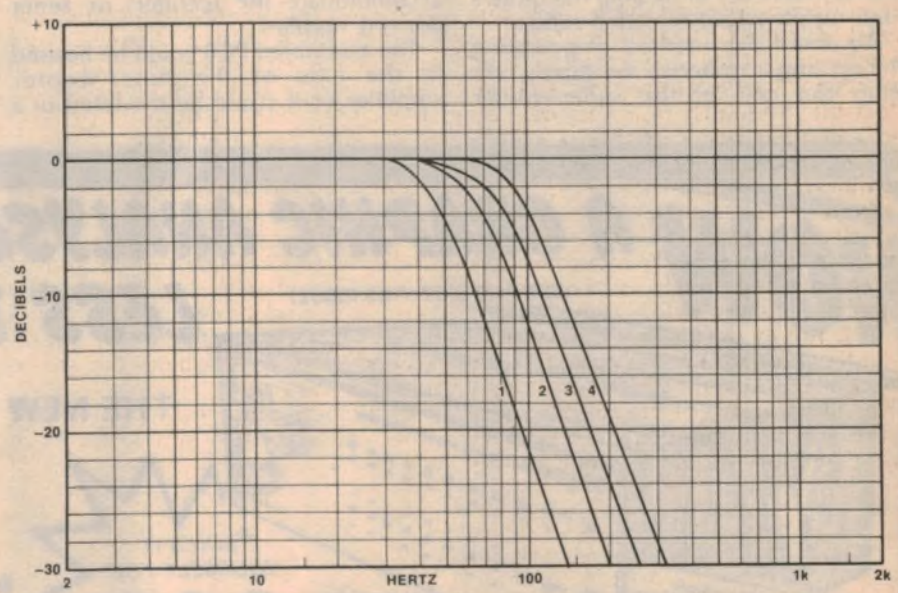
Now refer to the complete circuit of the Super Bass Filter. It uses just one operational amplifier IC, the readily available 741. This op amp is connected in a conventional low-pass filter network which has three RC networks. It is known as a third-order Butterworth filter.

A three-pole, four-position switch is used to switch the capacitors to obtain the four cut-off frequencies.

Apart from the attenuation provided by the input voltage divider, the filter circuit has a gain of unity, below the cut-off frequency. The input voltage divider has been designed to suit the output of most amplifiers. If the filter is fed from the line outputs of the stereo amplifier (or preamplifier), the input network should be changed.

This would involve omitting the 1k resistor, increasing the two 10k resistors to 47k each and substituting a link (on the PCB) for the first 47k resistor following the input mixing resistors. This modification assumes that the source impedance of the line outputs of the amplifier is low, ie, less than about 5k.

Power requirements for the op amp circuit are +/-12V DC at about 3 milliamps or less. This can be provided in two ways. The first involves the use of plugpack transformer, Ferguson



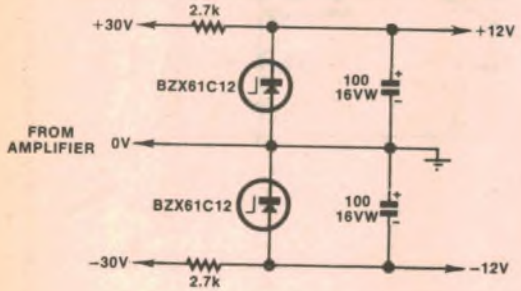
Response curves of our prototype unit for the four different frequency ranges.

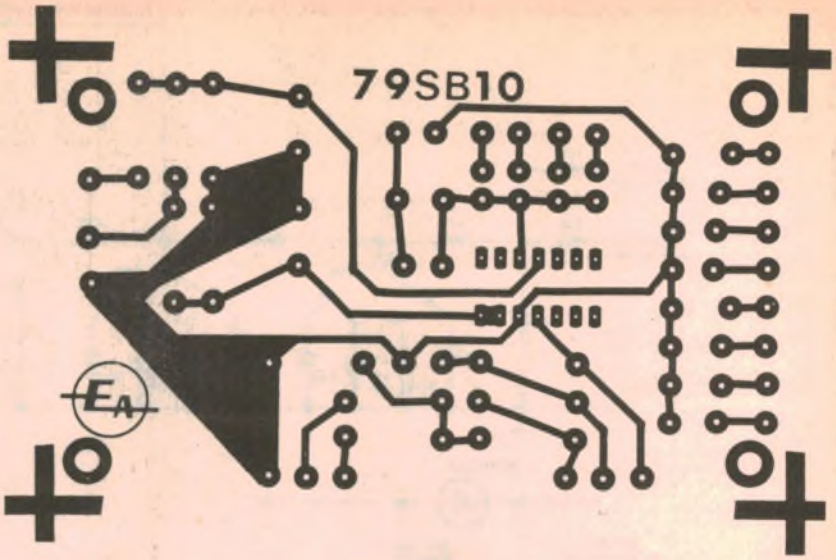
SPECIFICATIONS

HARMONIC DISTORTION:	*Typically .012% at 60Hz with respect to 100mV RMS*
SIGNAL-TO-NOISE RATIO:	*88dB unweighted with respect to 100mV RMS*
MAXIMUM OUTPUT VOLTAGE:	*5V RMS*
INPUT IMPEDANCE:	*10k*
OUTPUT IMPEDANCE:	*less than 1k*
CUT-OFF FREQUENCIES:	*50, 70, 80, 100Hz*
FILTER SLOPE:	*18dB per octave*

SUPER BASS FILTER

BELOW: Circuit to connect filter to amplifier power supply. RIGHT: Actual size artwork for the PC board.





PPA9/500, feeding a centre-tapped voltage doubler rectifier (really this is just two half-wave rectifiers, positive and negative) with two 100uF filter capacitors.

This modest degree of power supply filtering is adequate for the circuit because of the low current drain and the fact that the 741 op amp has quite a high supply ripple rejection ratio.

An alternative method of powering the op amp is to derive the supply rails from the rails of the super-woofer amplifier. This presupposes that the amplifier has balanced supply rails. The zener derived +/-12V rails will mate with amplifiers having supply rails from +/-30 to +/-60V.

All the components for the circuit are mounted on a PCB measuring 57 x 97mm (code 79sb10). This has space to accommodate the rectifiers or zener derived supplies.

The assembled PCB could be housed in the case of the super-woofer amplifier or it could be mounted in a case of its own.

When the entire super-woofer is set up, the auxiliary amplifier is adjusted to match the level of the super-woofer to the stereo loudspeakers. Once this is done, the stereo amplifier volume control is used and the auxiliary amplifier requires no further adjustment.

Just a final point: do not rotate the rotary switch for the filter while the system is powered up otherwise a loud thump will be delivered by the super-woofer.

NOW Build Your Own Printed Circuit Boards Instantly With Unique New E-Z CIRCUIT™ Pressure-Sensitive COPPER Design Products!

Yes, thanks to this revolutionary new E-Z CIRCUIT concept, you can now make quality printed circuit boards in your own home or shop —

. . . without messy chemicals
. . . without artwork
. . .without photography
. . .without screening or etching

Unique E-Z CIRCUIT Technical Manual . . . A "Gold Mine" of Usable, "How To" Techniques, Tips And Illustrations For Building Electronic Circuits At Home!

And the new E-Z CIRCUIT Technical Manual and Catalog leads you through each and every step with large, fully illustrated instructions written in clear, simple-to-understand language that make it easy for you to produce a quality, printed circuit board with electrical and mechanical characteristics that simulate those of etched "production house" PC boards.

Each of its 36 pages is packed with invaluable technical "how to" information that tells you:

- *How to build a PC board using pressure sensitive copper*
- *How to repair existing, damaged circuitry*
- *How to create a PC board artwork*
- *How to solder professionally*
- *How to wire wrap using E-Z CIRCUIT's NC* Drilled & Pre-Shaped General Purpose Plug Boards, Terminal Pins & Wire*

*Automated, Numerically Controlled (NC) drilling

Informative New Technical Manual Shows You How . . . Send Coupon Below Now For Your Copy!

To get your copy of this comprehensive & jam-packed Technical Manual and Catalog full of practical "how to" information on building circuit boards, contact your local E-Z distributor . . . or send only $1.00, plus 50c for postage and handling with the completed coupon below.

E-Z CIRCUIT™ by Bishop Graphics, Inc.

E-Z CIRCUIT™ by Bishop Graphics, Inc.

CIRCUIT COMPONENTS (A/ASIA) PTY. LTD.
P.O. BOX 70, BEXLEY, N.S.W. 2207

Rush my copy of the new E-Z CIRCUIT™ Technical Manual & Catalog on how I can build my own PC board instantly right in my own home. I enclose $1.00, plus 50c to cover postage and handling (no stamps, please).

Name (please print) .....

Address .....

..... Post Code .....

ALL ENQUIRIES TO:

CIRCUIT COMPONENTS (A/ASIA) PTY. LTD. 383 FOREST ROAD, P.O. BOX 70, BEXLEY, N.S.W. 2207, AUSTRALIA.
CABLES: "CIRCOM" SYDNEY. TELEPHONE: (02) 59-3720, 59-6550. TELEX AA 27197

For servicing audio gear & broadcast receivers

A modulated signal injector

This compact piece of test equipment should appeal alike to the beginner, the serious amateur and the professional serviceman. It is easy and economical to build and is small enough to be carried in the pocket and may be used as a source of signals for audio equipment, broadcast receivers and well into the television bands.

by IAN POGSON

Signal injectors have been around for a long time now. We have described a number of them in the past, the last two being presented in February 1964 and more recently, in June 1973. However, some of our younger readers may not have come across this type of instrument before. It may be considered as a very rough type of "signal generator". In its simplest form, it consists of a low frequency audio oscillator designed to produce a waveform as rich in harmonics as possible. As such, it produces a large number of frequencies which are multiples of the fundamental and these appear at the output of the unit.

A signal injector therefore becomes a source of signals across a wide frequency band and which may be used for testing such things as audio amplifiers, broadcast radio receivers, etc.

By limiting the concept to a single audio oscillator, the band of frequencies will also be limited. By adding an extra and similar type of oscillator, this time with its fundamental frequency in the lower RF range, it follows that its harmonics will extend further into the high frequencies and even into the VHF range. The audio frequency oscillator can be made to "modulate" the RF oscillator and we then have an even more useful and versatile instrument. This is the principle on which our new signal injector is designed.

Because many integrated circuit chips are readily available at low cost and include a number of separate circuits which may be combined or used separately, the extended concept of the signal injector becomes very easy to implement.

A diecast metal case was used to house the prototype. The probe was made from a stout piece of tinned-copper wire soldered to the centre lug of a jack plug.

In this particular case, we have made use of the IC type 4069, or 74C04, described as a "hex inverter". With six separate inverters available, we are able to use three of them for an audio oscillator and the other three for an RF oscillator. By adding just a few components around this chip, we are able to produce a versatile signal injector at a very modest cost.

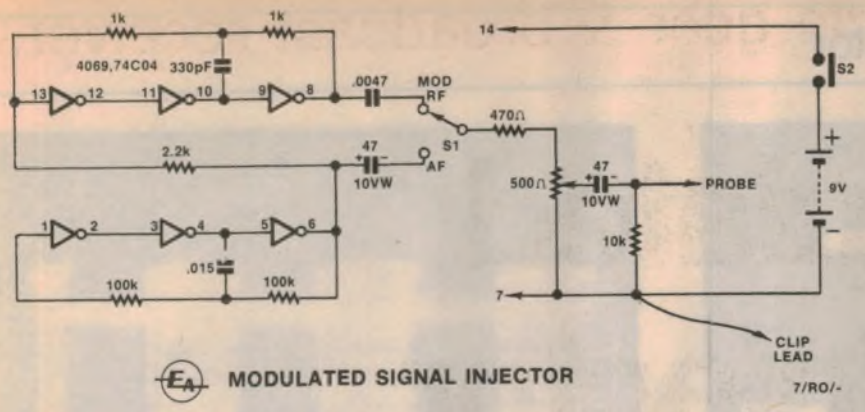
With the component values given, the frequency of the audio oscillator is about 300Hz and the RF oscillator comes out to about 700kHz. This means that the signal injector may be used, not only for audio and broadcast radio tests, but it may also be used for high frequency receivers and even for making some checks on television receivers.

To be a little more specific, perhaps the most basic use for the signal injector is to make stage-by-stage checks on a faulty audio amplifier, similar to the old "finger-on-the-grid" technique used when valves held sway. With many valve amplifiers still in use, the technique still applies, with its extension to what may now be called "finger-on-the-base" method.

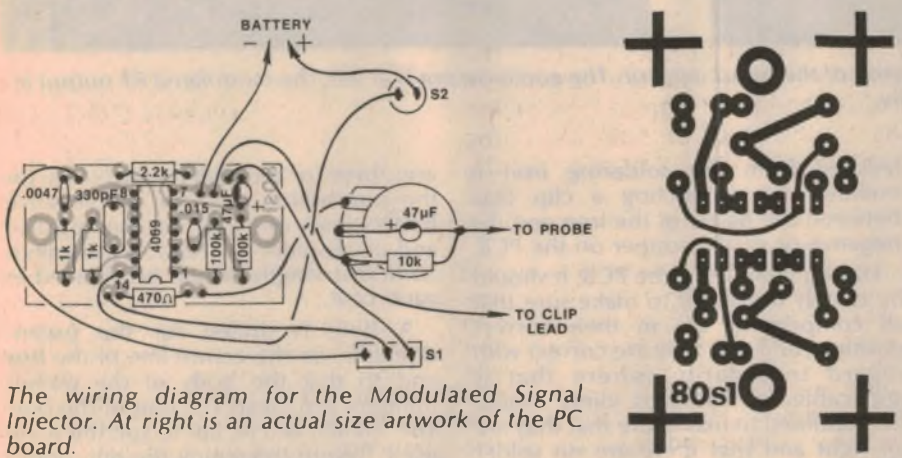
Only a short step away is the application to ordinary broadcast receivers, whether valve or transistor equipped. It is just a matter of probing along, stage-by-stage with the injector, until the faulty stage is isolated.

These tests are possible by using the audio oscillator section. By using the added modulated RF oscillator, we can extend the tests to receivers covering the HF range and well beyond.

Because of the heavy modulation of the RF oscillator by the audio oscillator, a series of "bursts" of RF is produced. This feature and the almost square



Two CMOS oscillators form the basis of the circuit. The audio oscillator has a frequency of about 300Hz; the RF oscillator a frequency of 700-800kHz.



The wiring diagram for the Modulated Signal Injector. At right is an actual size artwork of the PC board.

PARTS LIST

1 Diecast metal box, Eddystone 89mm x 30mm x 35mm
1 Printed circuit board, 48mm x 25mm code 80s1
1 Potentiometer, 500 ohm linear carbon
1 Knob
1 Miniature toggle switch, SPDT
1 Miniature pushbutton switch
1 Battery, 9V No. 216
1 Lead for battery
1 Jack socket, 3.5mm
1 Jack plug, 3.5mm
1 IC, 4069/74C04 14-pin DIL
1 IC socket, 14-pin DIL
1 330pF polystyrene capacitor
1 .0047uF greencap (metallised polyester) capacitor
1 .015uF greencap capacitor
2 47uF/10VW tantalum capacitors

RESISTORS:
1 x 470 ohm
2 x 1k
1 x 2.2k
1 x 10k
2 x 100k

MISCELLANEOUS:
Screws, nuts, solder, hookup wire, 16-gauge tinned copper wire for probe.

NOTE: Ratings are those used on the prototype. Components with higher ratings may generally be used providing they are physically compatible.

waves produced by the RF oscillator make it very useful for testing the signal circuits of television receivers. By applying the probe at appropriate spots along the signal line, a definite pattern of bars is produced on the screen. It should be noted, however, that the upper RF range is limited and we found that the prototype was good up to 100MHz as previously mentioned and so only the first few TV channels may be checked.

A switch has been provided to take the output from the audio oscillator only, to cope with audio amplifiers and broadcast frequencies, or the modulated RF output may be selected when tests are to be made on HF and television receivers.

To increase the versatility of the signal injector even further, we have provided means of controlling the level of the output to the probe. This feature could be used to ascertain whether or not any gain is available over any particular stage. The gain control is a simple potentiometer in the output circuit and it is very effective on the audio output but there is a reasonable amount of leakage at RF by virtue of the "hop-on" effect of the potentiometer. This means that when applied to some aerial inputs, the amount of signal is still quite high but in practice this is not a significant restriction.

Although there is not much to it, let us have a look at the circuit of our signal injector. The heart of the circuit is the hex inverter chip. Three of the inverters are connected in series (input to output) to form an audio oscillator when two resistors and a capacitor are added. As mentioned earlier, the two 100k resistors and the .015uF capacitor set the frequency of oscillation to about 300Hz. The other three inverters are similarly connected and this time, there are two 1k resistors and a 330pF capacitor, giving a frequency of 700 to 800kHz.

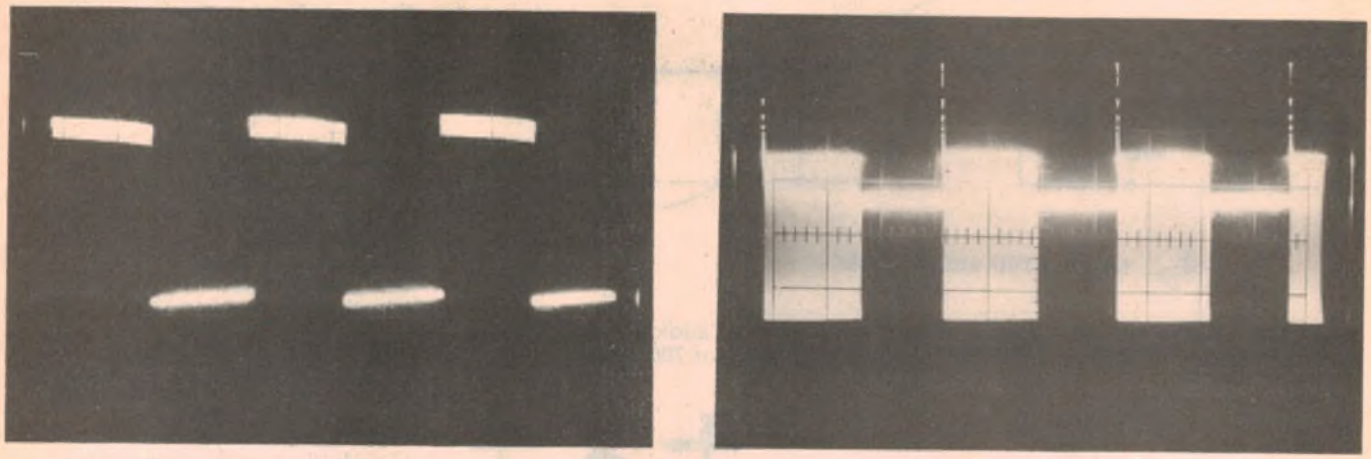
The output of the audio oscillator is connected to the input of the RF oscillator, via a 2.2k resistor, for the modulation process. The output of the audio oscillator is taken off also via a 47uF tantalum capacitor, to one pole of the output selector switch. Similarly, the output of the RF oscillator is taken via a .0047uF capacitor to the output switch.

The output of the switch is fed via a 470 ohm resistor to a 500 ohm carbon track potentiometer, the rotor of which is coupled via a 47uF tantalum capacitor and a 10k resistor, to the probe. The 470 ohm resistor in series with the potentiometer is to prevent the oscillators from being excessively loaded.

A small 9V battery is used as the source of supply for the IC. This is applied via a momentary pushbutton, which ensures that the battery will not be left on unintentionally.

It will be noticed that we have provided two large-value capacitors in the output circuit, each in such a way that they will be charged by any voltage applied to the input side. This was done so that the square wave of the audio oscillator would be passed on to the circuit being checked with a minimum of distortion. However, this feature may not be required and there may be some cases where it may be desired to test circuits with voltages in excess of the ratings of these two components. In such an event, the capacitors could be reduced to .01uF polycarbonates rated at 400V. The 10k resistor could also be omitted.

To give some idea of the waveforms to be expected from the signal injector, we took pictures from the CRO screen and these are reproduced here. The photographic process has resulted in some changes to the detailed appearance of the waveforms. One obvious point is that some of the lines have been somewhat increased in width. This applies particularly to the square wave picture and to the "DC" level of the modulated RF waveform.



These two photos show the output waveforms of the signal injector. The audio output is at left, the modulated RF output at right. CRO settings: 0.5V/div and 1ms/div.

Also, the RF component assumes a solid block, rather than each cycle being visible. Finally, the vertical components of the square wave were so thin that they have been lost completely. However, these points do not detract from the overall impression.

CONSTRUCTION

Because the signal injector has only a few component parts, construction is not difficult. However, it demands a certain amount of care, particularly when it comes to fitting the components into the small diecast box.

Before attempting to fit any components into the box, the printed circuit board should be assembled. It is quite small and should present no problems. In keeping with normal procedure, the smallest items, such as resistors and capacitors should be soldered in first, followed by larger items. Although it is not essential, I favour the use of sockets for ICs, particularly for CMOS devices.

Readers who elect to solder the IC in directly are reminded that it is important to make sure that any possible leakage from the soldering iron is nullified by connecting a clip lead between the barrel of the iron and the negative or earthy copper on the PCB.

Having completed the PCB, it should be closely inspected to make sure that all components are in their correct positions and that they are correct with regard to polarity, where that is applicable. All soldered joints should be examined to make sure that they are all right and that there are no solder bridges.

Reference to the picture will help in the assembly. Two screws are needed to fix the PCB. Two holes should be drilled on the correct centres and such that the PCB just clears the corner buttress of the box. Also, the board should only just clear the bottom of the box. This will ensure that the top edge of the PCB will not foul the lid of the box. The PCB is stood off the side of the box by using two half nuts between the box and the board, making three nuts in all for each screw.

Before finally screwing the PCB into place, seven leads should be soldered to it, for external destinations. These are: three for the toggle switch, one for the pushbutton, one for the negative battery lead, one each for the negative and active sides of the potentiometer. Sufficient length should be allowed in each case.

A hole is drilled for the potentiometer, on the centre line of the box and so that the body of the potentiometer just clears the end of the box. The spindle will be cut to suit the knob used. Before tightening the nut, orientate the potentiometer so that the lugs are nearer to the pushbutton side, with the earthy lug about on the centre line.

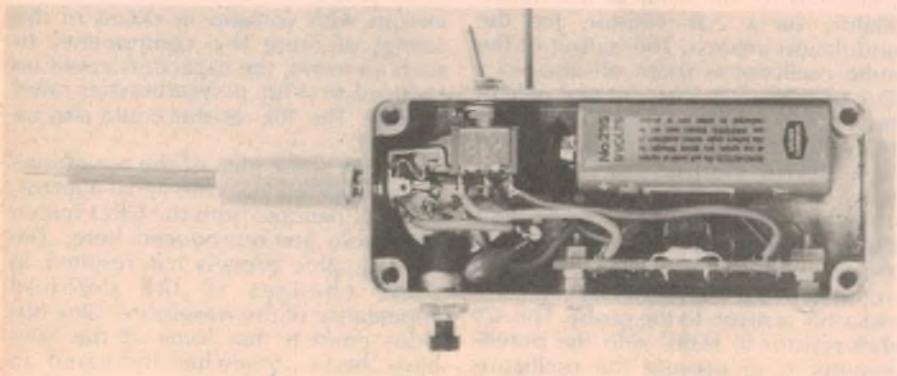
A hole is drilled to take the pushbutton, so that its body just clears the potentiometer and the buttress of the box.

Next, a hole is drilled in the end of the box to take the jack socket for the probe. The socket should be placed so that it just clears the potentiometer and the lugs on the pushbutton. You may find that the position for the socket is off centre, as it was on the prototype.

Now drop the battery in place temporarily, so that it butts against the buttress on the box. It may be necessary to dress some of the leads from the PCB, to allow space for the battery. The toggle switch is mounted on the side of the box, between the battery and the jack socket. The switch should be placed so that it clears the potentiometer, with a gap between the switch and the jack of between one and two millimetres. Care should also be taken to make sure that the lugs of the toggle switch and the pushbutton do not interfere. The pushbutton lugs may be bent if necessary.

Drill another hole, just large enough to clear a piece of hookup wire, on the toggle switch side and opposite the earthy lug on the potentiometer. The earth clip lead passes through this hole.

Most of the wiring from the PCB to



View inside the completed prototype. Assemble the various components into the case as described in the text and take care to avoid inadvertent "shorts".

the other components will be left to the builder but a few comments may be helpful. A convenient common earth point is the lug on the potentiometer. A wire is run from here to the earth lug on the jack socket, to earth the box. Also, the 10k resistor is earthed at the potentiometer lug. The other end is connected to the 47uF tantalum capacitor "in mid air", with the other end of the capacitor going to the rotor lug on the potentiometer.

The probe is made up by a piece of 16-gauge tinned-copper wire, about 55mm long and soldered to the centre lug of the jack plug. A piece of spaghetti tubing, about 45mm long, is slipped over the tinned-copper wire and it is then crimped onto what is normally the earth lug of the plug. The outer case is screwed back into place and the probe is then plugged in.

This almost completes the assembly work. If a socket is used, the IC should be plugged into its socket, taking care that no pins are bent over in the process. It is sometimes necessary to bend the pins inwards slightly, to make them enter the socket. This done, the battery plug is connected to the battery and the unit is ready for checks to see that it is in working order.

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

$12.00

This includes sales tax.

The signal injector is very easy to use and a little practice is all that is necessary to make best use of the device. The normal procedure is to start testing at the high level, working backwards towards the lower level stages. By adopting this method, the offending stage can usually be isolated. If you wish to check whether or not a particular stage is giving any gain, the signal should first be injected at the output of the stage and noting the amount of output. The injector is then moved to the input of the stage and an increase in output should be noted.

When making tests with the signal injector, the level control can often be useful when coping with different signal level requirements. Also, the output may be switched between the audio and the modulated RF sources, depending on the nature of the checks being made. Experimentation during the initial stages could be helpful in getting the best out of the instrument.

Playmaster Stereo Graphic Analyser

Functions as a room analyser or peak level meter with 20 LED display

While graphic equalisers have considerable potential to improve the sound quality of any high fidelity system, they are difficult, if not impossible, to use without supporting equipment such as a graphic analyser. Our new Playmaster Graphic Analyser is the perfect complement to our recent Playmaster stereo graphic equaliser or any commerical equaliser.

by RON de JONG & LEO SIMPSON

When we published our highly successful Playmaster graphic equaliser back in May 1979, we indicated that we would follow it with a companion analyser. We have always been of the opinion that graphic equalisers are merely a source of frustration and confusion for keen audiophiles, unless they have access to a suitable analyser. Now, after some delay, we present the Playmaster Graphic Analyser.

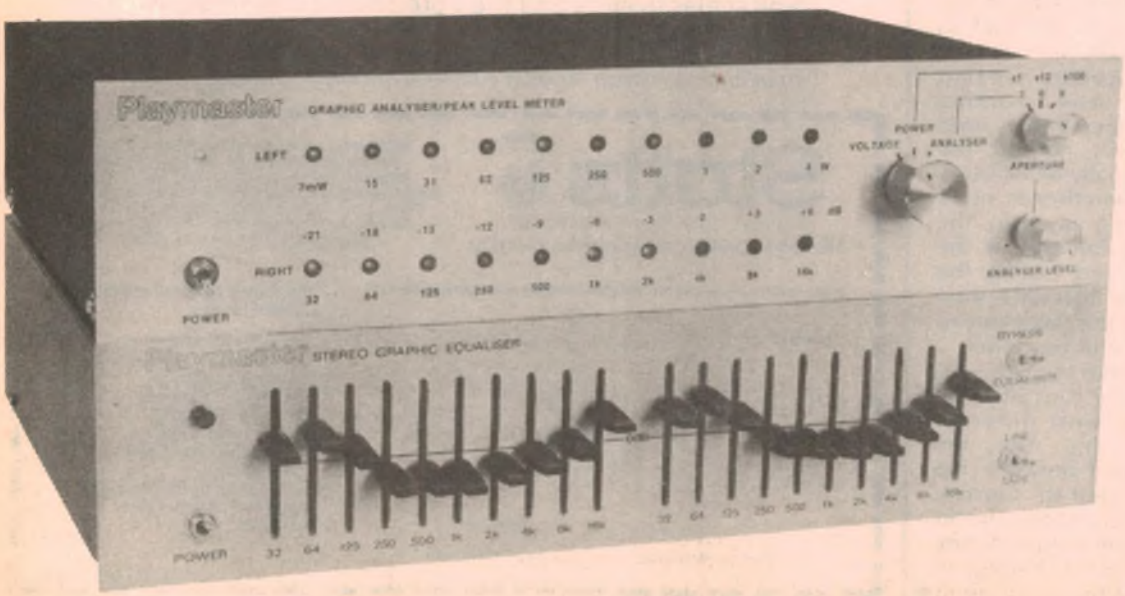
Our new Playmaster Graphic Analyser provides a visual display of frequency response; as with the Playmaster graphic equaliser and the better commercial graphic equalisers it divides the audio spectrum into ten octave bands with the same centre frequencies, ie. 64, 125, 250, 500, 1k, 2k, 4k, 8k and 16kHz.

Each octave band has a vertical display consisting of two LEDs. If the amplitude of the input signal within one of these frequency bands exceeds a certain limit the lower LED for that band will turn on; if the amplitude increases further, the top LED in the band will turn on as well.

The difference in signal level between the top and bottom LEDs in a band is set by what is termed the "aperture" control. We have provided three aperture settings: 3dB, 6dB and 9dB. The idea of having two LEDs per octave band is to display the frequency response within narrow limits, as defined by the aperture control.

When equalisation is performed with a graphic equaliser and our companion analyser, a pink noise signal is fed to the amplifier and speakers. The signal is monitored by a microphone and then displayed on the graphic analyser. The equaliser slider controls are then adjusted to obtain an optimum flat frequency response as displayed by the two LEDs in each octave band.

Pink noise is similar to white noise except that it is "pink", ie. the energy content decreases as the frequency increases. To define it more precisely,



Teamed with our Playmaster Graphic Equaliser or just about any commercial equaliser, our new Playmaster Graphic Analyser enables loudspeaker systems and the rooms in which they are used to be accurately analysed. At other times, the Analyser functions a as dynamic display for power output or signal level.

pink noise is random noise with an equal energy distribution for each octave bandwidth. This means that it has the same energy content for the octave centred on 64Hz as it does for the octave centred on 16kHz, or any other frequency.

Normally, pink noise is produced by passing the signal from a white noise generator through a filter which rolls off the high frequency response at the rate of 3dB/octave. The inbuilt pink noise generator in our analyser is provided in the same way. A preamplifier is also incorporated to enable a microphone to be connected.

With pink noise fed through a system, flat frequency response is indicated when only the bottom row of LEDs in the front panel display are on. If the aperture control was set to 3dB then this would mean that the frequency response between bands was equalised within at least 3dB. Aperture settings of 6dB and 9dB would likewise imply equalisation to within 6dB and 9dB respectively.

Naturally, when you begin to equalise your system, the overall frequency response of the system/room combination will probably be anything but flat and so not all the LEDs on the analyser panel will be alight. You may have to first make some changes in the positions of loudspeakers and perhaps the positions of some pieces of furniture. A guide to this process is given in our article entitled "Locating Peaks and Troughs with an Equalisation Analyser" published in the February 1978 issue of "Electronics Australia".

Assuming that this initial procedure has been carried out, then adjustment of the equaliser controls can begin. The level of the pink noise signal is adjusted so that it is high enough to mask out any ambient noise in the system or room. Then the analyser level (sensitivity) control is adjusted so that about half the LEDs are alight.

Now if both LEDs for a particular octave band are both out, then the response for this band is too low. Similarly, if both LEDs for a particular band are alight, then the response for that band is too high. The slider controls on the graphic equaliser should then be adjusted accordingly.

Besides this most important function of system or room equalisation, our new Analyser provides a bonus. When not displaying room or system response, it can provide a dynamic horizontal "bar-graph" display of the signal levels in both channels of a stereo system. Thus, it may be used to monitor signal levels during tape recording or the power delivered by an amplifier.

When measuring power, the analyser can indicate powers up to 400 watts (referred to an 8-ohm load). When measuring signal level, the display may be calibrated to agree with 0VU of the tape recorder being used, by adjusting the rear-mounted "peak level" control.

SPECIFICATIONS OF THE THREE FUNCTIONS

GRAPHIC ANALYSER

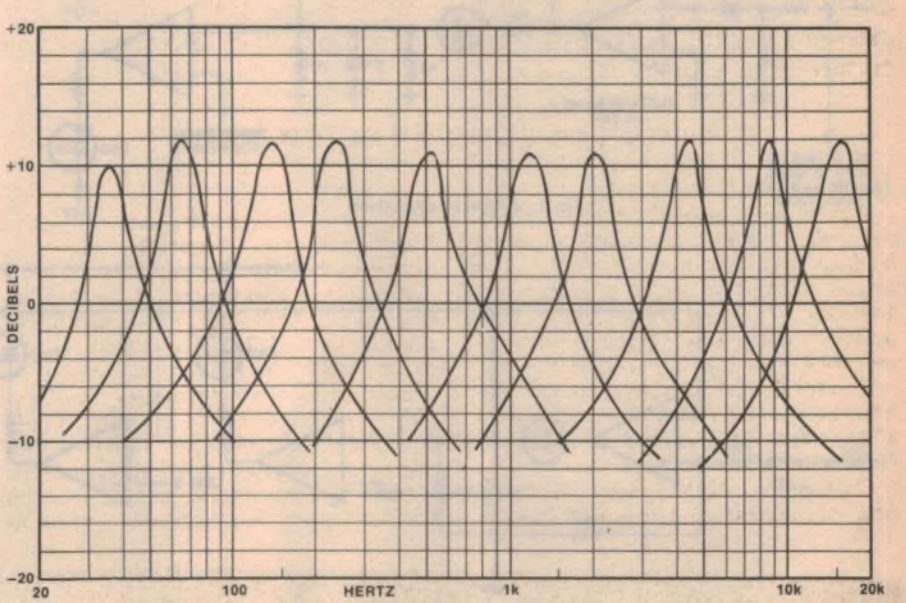
Display: 10 frequency bands, 2 LEDs per band
Centre frequencies of bands: 32, 64, 125, 250, 500, 1k, 2k 4k, 8k, 16kHz
Q factor of filters: 5
Aperture: 3dB, 6dB, 9dB
Line input sensitivity: 15mV RMS with 50k input impedance
Microphone input sensitivity: 80uV RMS with 10k input impedance
Averaging period: 4 seconds

PEAK LEVEL METER

Display: Left and right channels, 10 LEDs per channel
Scale: 3dB per step from -21dB to +6dB
Accuracy: ±0.5dB with respect to 0dB indication
Response decay time: 50ms
Line input sensitivity for 0dB indication: 75mV

PEAK POWER METER

Display: Left and right channels, 10 LEDs per channel
Scale: 7mW, 15, 31, 62, 125, 250, 500, 1W, 2, 4
Range: x1, x10, x100
Maximum power indication: 400 watts
Calibration: with respect to an 8 ohm load.



The shape of these filter curves in the Analyser complements the filters in our Playmaster graphic equaliser. Because of the shape of these filters it may be found that a high boost setting on one slider control will cause more than one Analyser LED to light.

In total, our new Playmaster Graphic Analyser/Peak Level Meter, to give it its full name, can be regarded as a real bargain. At around $95 in kit form it is a mere fraction of the cost of equivalent commercial equipment. It is also easy to build and uses readily available parts.

CIRCUIT DESCRIPTION

The circuit of our Analyser is pretty daunting to look at, especially if you consider that nine op amps have not been shown, to simplify it. In all, there are 39 operational amplifiers in the circuit but these are actually in the form of uA4136 quad op amps, so the number of IC packages is relatively small. One op amp, IC 9d, is not used.

Beside the 39 op amps, there are two three-terminal regulator ICs and a noise generator IC, plus, incidentally, a lot of resistors and capacitors.

As can be seen on the upper half of the circuit diagram, there are two rows of LEDs, each driven by an op amp. The LEDs are depicted in rows in the same order as they appear on the analyser front panel. In the peak level meter mode, the top row of LEDs displays the signal in the left channel of the amplifier while the bottom row displays the signal from the right channel.

Whereas the peak level meter mode

results in a horizontal display, the analyser mode results in a vertical display, ie. ten columns with two LEDs each. This may seem complicated but it turns out to be quite easy to arrange the op amps to provide either mode quite simply.

The mode in which the display works is set by the function selector switch, S1. We shall discuss the analyser mode first.

Input signals to the analyser are fed from the Mic/Line switch S3 to op amp IC7c which is a non-inverting amplifier. IC7c drives ten octave-band-filters which correspond to the ten centre frequencies listed above. Each filter is followed by a half-wave rectifier and filter.

Each rectifier output is fed to a pair of op amps which are each connected as comparators and drive a LED. The comparators are referenced to one of two voltages to set their thresholds. The basic circuit concept is shown in Fig. 1. Later we shall explain the differences between Fig. 1 and the main circuit diagram.

Almost the entire circuit of the graphic analyser is reconfigured to provide the peak level metering mode. The basic circuit arrangement is shown in Fig. 2. This shows the circuit for the left channel display only.

IC10d operates a negative peak level detector which is referenced to +6V. If the input has a peak value of 150mV, for example, then the capacitor at the output of IC10d will be charged to 150mV below +6V. As a further example, if the input signal has a peak value of 4V then the capacitor at the output of IC10d will be charged to 4V below +6V, ie +2V.

Each of the 10 op amp comparators following IC10d has a reference input voltage which ranges from 100mV to 2.7V below +6V. If the input signal exceeds 100mV peak, then the first LED will be turned on. If the input signal exceeds 2.7V peak, then all LEDs will be turned on. The ten comparators thus provide a signal display range of close to 27dB total.

While the analyser and peak level functions depicted in Figs. 1 and 2 are both relatively simple in themselves, the whole circuit has to be virtually turned upside down to provide either function.

For example, while IC10d drives the non-inverting inputs of the ten comparators in the peak level mode, it (IC10d) is used to hold those comparator inputs at a fixed reference when in the analyser mode.

Notice also, that while IC10d drives the non-inverting inputs of its associated ten comparators, IC10c, for the left channel, drives the inverting inputs (not the non-inverting inputs) of its associated ten comparators. The latter set of comparators would not work in the correct "sense" were it not for the fact that their associated LEDs are driven from the -12V line rather than the +12V line.

For the same reason, there is a fundamental difference between the complete circuit and Fig. 1 in that the inputs to the lower comparator are reversed.

The need to drive the top set of LEDs from the positive 12V line while the lower set of LEDs is driven from the negative 12V line really has nothing to do with the operation of the circuit. It was done merely to simplify the layout of the printed circuit board.

About the only major point left to be explained about the circuit operation is how the reference voltages for the two strings of ten comparators are provided. These are actually provided by voltage dividers made up from R2 and R3 on the output of each octave band filter. Since the octave band filters are not operating when in the peak level mode, their output is zero and so R2 and R3 can provide a fixed voltage reference from the +6V output from IC9c.

The pink noise generator is a standard circuit which we have published before. It uses a National Semiconductor IC, type MM5873. This generates white noise digitally, using a "pseudo-random bit sequence" (PRBS). The white noise is then passed through a filter network which provides a piecewise approximation to a 3dB/octave slope. The output of the filter is buffered and amplified by IC6d.

The microphone preamplifier consists of two high gain amplifiers in series, IC6c and IC7d. These provide the high gain necessary for an electret or low impedance microphone. Input impedance is 10k. This may be increased to 47k by increasing the input resistor to this value. This will also reduce the preamplifier gain by five

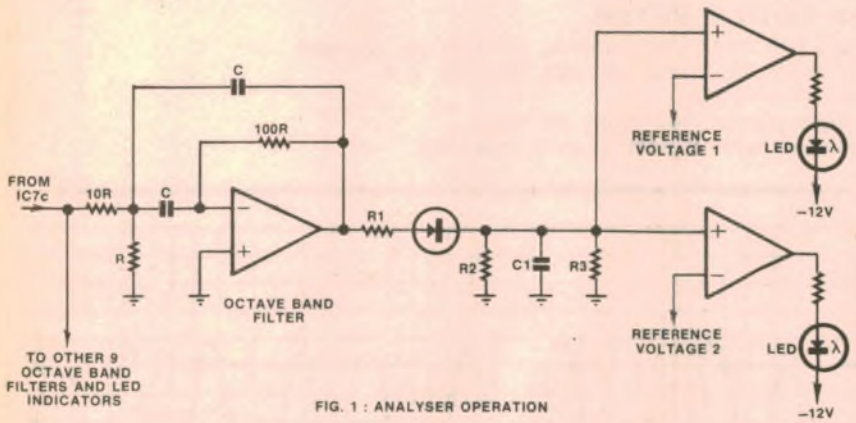


FIG. 1 : ANALYSER OPERATION

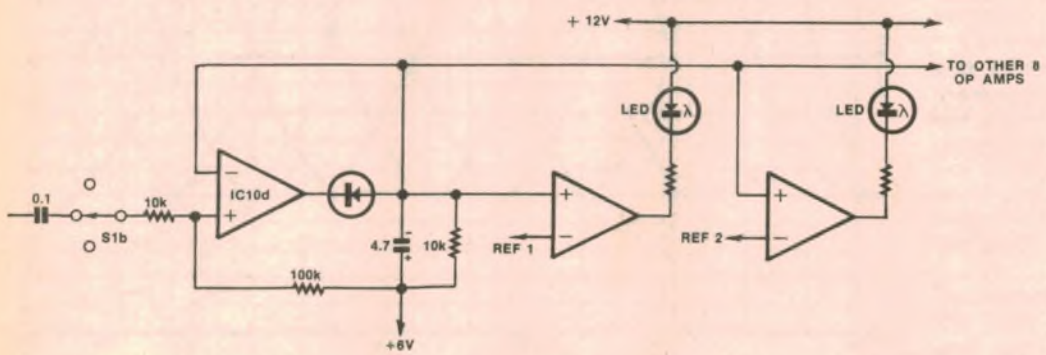
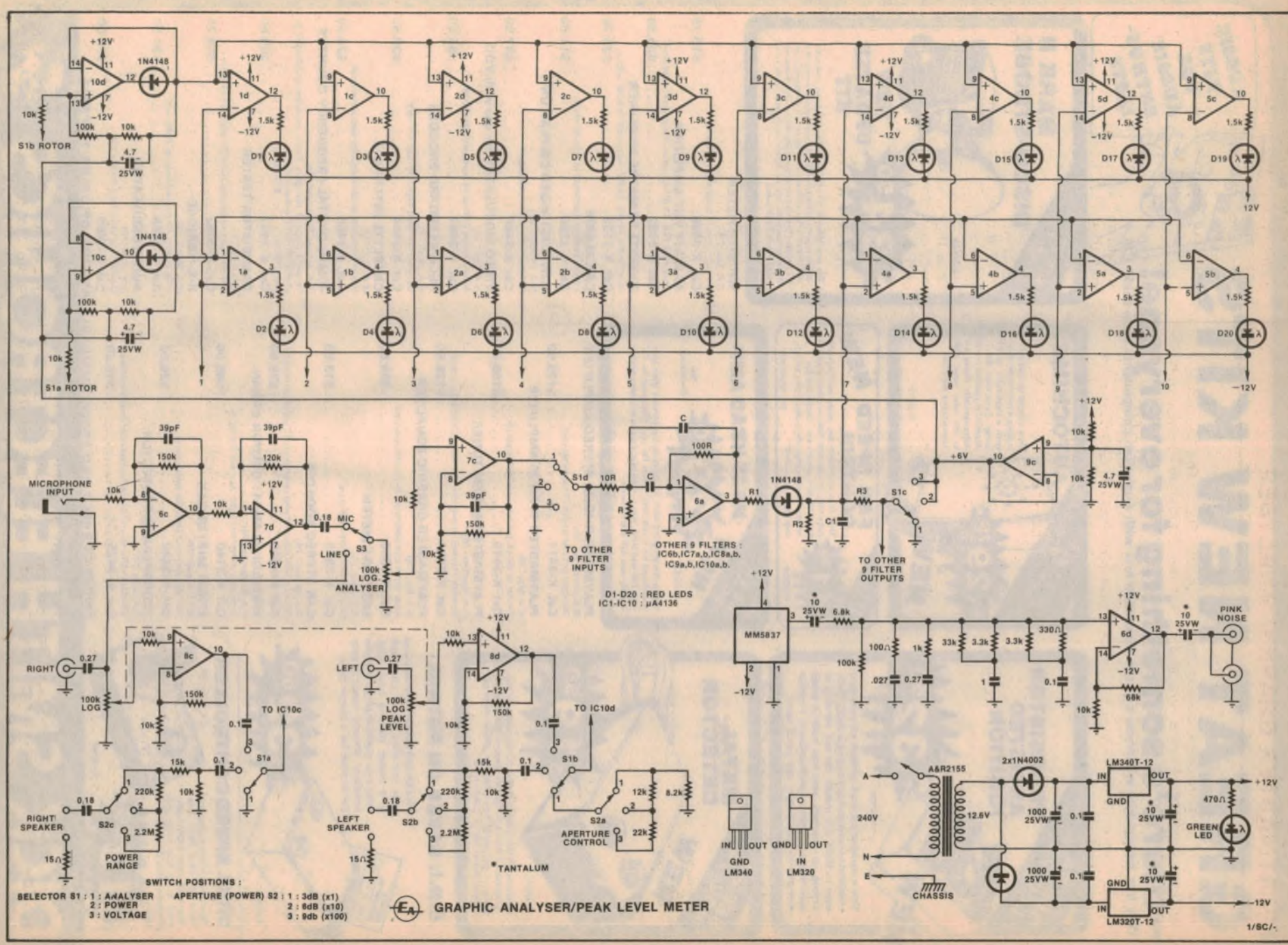


FIG. 2 : PEAK LEVEL METER OPERATION

Figs 1 and 2 illustrate the operation of the Analyser and Peak Level Meter functions, respectively. Opposite page: the full circuit diagram. Only one filter is shown. The component values for the ten filters are tabulated on page 55.


S1b ROTOR
S1a ROTOR
1N4148
4.7 25VW
MICROPHONE INPUT
39pF
150k
120k
0.18 MIC
LINE
S3
100k LOG. ANALYSER
TO OTHER 9 FILTER INPUTS
OTHER 9 FILTERS : IC6b,IC7a,b,IC8a,b, IC9a,b,IC10a,b.
TO OTHER 9 FILTER OUTPUTS
D1-D20 : RED LEDS
IC1-IC10 : µA4136
MM5837
6.8k
PINK NOISE
RIGHT
LEFT
100k LOG
100k LOG PEAK LEVEL
TO IC10c
TO IC10d
RIGHT SPEAKER
LEFT SPEAKER
APERTURE CONTROL
POWER RANGE
15Ω
2.2M
220k
15k
12k
8.2k
22k
*TANTALUM
SWITCH POSITIONS :
SELECTOR S1 : 1 : Analyser
2 : Power
3 : Voltage
APERTURE (POWER) S2 : 1 : 3dB (x1)
2 : 6dB (x10)
3 : 9db (x100)
GRAPHIC ANALYSER/PEAK LEVEL METER
A&R2155
240V
12.6V
2x1N4002
LM340T-12
LM320T-12
GREEN LED
CHASSIS
1/SC/-

GREAT NEW KITS

– there's something for everyone!

Why buy foreign kits when you can get Australian kits with Australian components from Dick?

AUSSIE KITS FOR AUSSIE ENTHUS-IASTS

SEE EA DEC '79

TRANSISTOR ASSISTED IGNITION

NEW

$32.50

K-3300

This transistor assisted ignition kit uses your standard car coil and points and is delightfully easy to build and install. No coil winding or setting up required; also has built-in dwell extension for optimum performance. Your car will stay in tune longer and you'll save!

SEE EA SEPT '79

AUTOCHIME

$29.75

NEW

This simple to build kit utilizes a microprocessor with a repertoire of 24 tunes. Each time the doorbell is pushed it will automatically move on to the next tune! Full instructions supplied.

K-3502

SEE EA DEC '79

FAN SPEED CONTROL

NEW

$11.50

K-3090

This is a shortform kit (does not include case etc) for use with fans or other 'squirrel type' motors which are unsuitable for normal speed controllers. Build this kit into the appliance itself!

Not Illustrated

SEE ETI SEPT '79

MARK II DISCO-STROBE

K-3152

$34.50

NEW UPDATED KIT

The ever popular ETI Disco Strobe has been updated - improvements in the electronics necessitated a new PCB and this plus the all new case makes this an essential kit for parties. The kit comes complete with instructions and these instructions include details on extending the kit to include two flash tubes.

SEE EA NOV '79

METAL DETECTOR

NEW

$19.50

K-3504

Economy PLUS! Latest digital IC circuitry for top performance from a budget kit. Easy to make and get going — you could find a fortune. (Note: does not include dowel rod or coil former).

SEE EA AUG '79

MAST HEAD AMP

NEW

$29.50

K-3232

Not Illustrated

If you are plagued with TV reception problems then this masthead kit could solve them for you! Designed for TV plus FM and UHF, it is simple to build and includes power supply and full instructions.

C.D.I. SAVES ON PETROL

This kit will pay for itself over and over. Installed in your car, it will give easier starting from cold, keep your points & plugs in better condition thereby keeping your car in tune for a longer time.

$32.50

K-3280

DRILL SPEED CONTROLLER

Thousands of these simple to build kits have been sold. Use with your 240V 'universal' brush type motor drill to give speeds down to near zero.

E.A. July '76

$13.50

K-3080

PLAYMASTER 40/40 STEREO AMPLIFIER
(E.A. December '76)
Our most popular kit ever. Thousands sold.
Cat. K-3411 ..... **$129.50**

PLAYMASTER TWIN 25 AMPLIFIER
(E.A. May '76)
Similar to above, but less power. A great kit.
Cat. K-3410 ..... **$105.00**

PLAYMASTER AM/FM TUNER
(E.A. Nov/Dec '78)
Matches Playmaster amplifiers — with in-built digital clock.
Cat. K-3494 ..... **$129.50**

PLAYMASTER GRAPHIC EQUALIZER
(E.A. May '79)
Adds depth and dimension to your Hi Fi system.
Cat. K-3500 ..... **$99.50**

LED LEVEL METER
(E.A. June '76)
Easy to make, fully solid state.
Cat. K-3370 ..... **$13.50**

CAR STEREO BOOSTER
(E.A. January '79)
Boosts power output of your car stereo to 12 watts per channel.
Cat. K-3493 ..... **$29.50**

MUSICOLOR Mk111 COLOUR ORGAN
(E.A. September '76)
Turns your music into light! Just add the lights.
Cat. K-3140 ..... **$65.00**

ETI601 MINI ORGAN
(E.T.I. August '76)
YOU can play your favourite tune in style.
Cat. K-3430 ..... **$26.50**

LOUDSPEAKER PROTECTOR
(E.A. June '76)
Eliminates turn-on and turn-off surges from most amplifiers.
Cat. K-3425 ..... **$13.50**

WHISTLE FILTER
(E.A. Feb '79)
Rid your tuner of heterodyne whistles.
Cat. K-3496 ..... **$19.75**

45 WATT VHF AMPLIFIER
Fibreglass PCB, 13.8V operation. Requires 8-12W drive.
Cat. K-3132 ..... **$29.50**

30 WATT 80 METRE AMPLIFIER
Ideal for the novice. 13.8V. Adaptable to 50W output.
Cat. K-3133 ..... **$35.75**

CAR ALARM
Easy to build and protects your investment.
Cat. K-3250 ..... **$11.50**

LOW COST VIDEO DISPLAY UNIT
(E.A. February '78)
Communicate with a computer.
Cat. K-3460 ..... **$97.50**

VIDEO MODULATOR for use with VDU
(E.A. April '78)
Allows above VDU to be used with any TV set.
Cat. K-3462 ..... **$4.50**

ASCII KEYBOARD ENCODER
(E.A. April '78)
Uses our standard keyboard (Cat. X-1180)
Cat. K-3464 ..... **$39.50**

CASSETTE INTERFACE
(E.A. April '77)
Use any cassette to communicate with a computer.
Cat. K-3465 ..... **$24.50**

40MHz DIGITAL FREQUENCY COUNTER
(E.A. August/September '78)
Versatile piece of test gear. Easily upgraded to 200MHz by adding 95H90 Pre-scaler IC.
(Cat. Z-5360 ..... $12.50)
Cat. K-3437 ..... **$99.50**

TRANSISTOR TESTER
(E.A. July '78)
Checks most transistors and FETs quickly and easily.
Cat. K-3052 ..... **$19.75**

R-C-L BRIDGE
(E.A. March '78)
Ideal project for the beginner or enthusiast.
Cat. K-3468 ..... **$34.50**

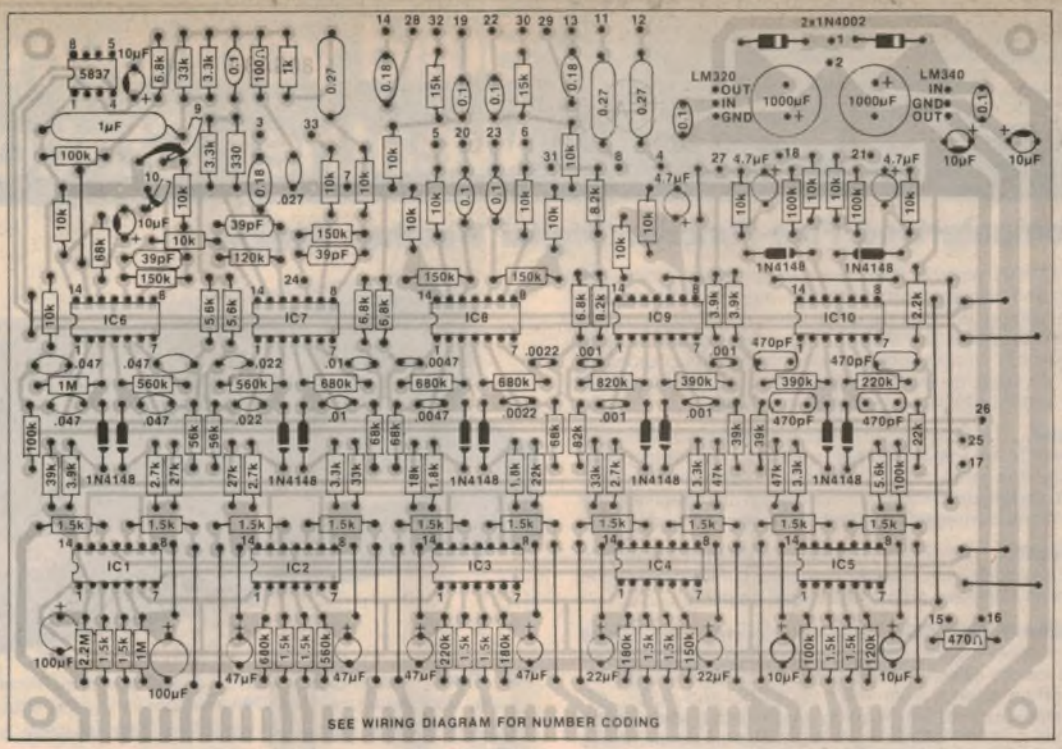
AUDIO OSCILLATOR
(E.A. June '78)
Outstanding value for a service aid.
Cat. K-3469 ..... **$32.00**

PRICES CORRECT AND STOCK AVAILABLE AT TIME OF GOING TO PRESS

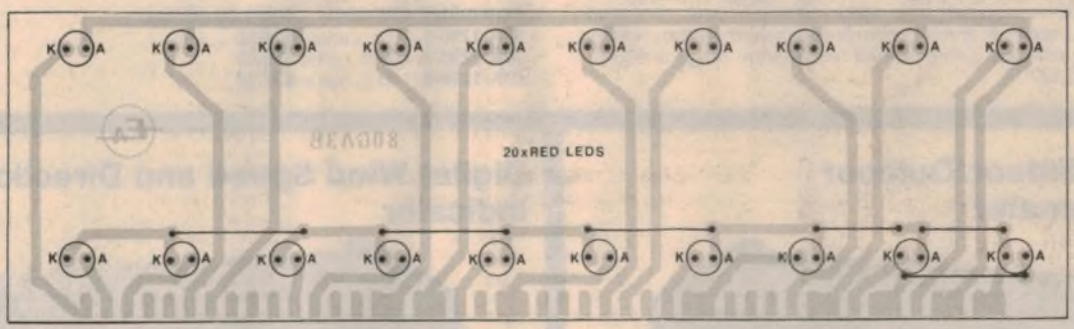
DICK SMITH ELECTRONICS

SEE OUR OTHER ADVERTS IN THIS MAGAZINE FOR OUR STORE ADDRESSES AND RESELLERS

DSE652



Follow these diagrams carefully when assembling the two PC boards. The two boards are connected together by soldering the edge-connector patterns at right angles.



	1	2	3	4	5	6	7	8	9	10
R	10k	5.6k	5.6k	6.8k	6.8k	6.8k	8.2k	3.9k	3.9k	2.2k
C	0.47uF	.047uF	.022uF	.01uF	.0047uF	.0022uF	.001uF	.001uF	470pF	470pF
R1	3.9k	2.7k	2.7k	3.3k	1.8k	1.8k	2.7k	3.3k	3.3k	5.6k
R2	2.2M	1M	680k	560k	220k	180k	180k	150k	100k	120k
R3	39k	27k	27k	33k	18k	22k	33k	47k	47k	100k
C1	100uF	100uF	47uF	47uF	47uF	47uF	22uF	22uF	10uF	10uF

This table gives the component values of the 10 octave-band filters.

times, which is desirable for a high impedance microphone.

A transformer with 12.6V secondary powers the unit. It needs two half-wave rectifiers which develop about plus and minus 18 volts, which is further filtered and regulated down to ±12V DC by the three-terminal regulators.

CONSTRUCTION

The front panel and case dimensions match those of other units in the Playmaster series such as the Playmaster Twin 25 and the Playmaster Graphic Equaliser. As such, the new Playmaster is easy to build. All the circuitry is accommodated on two printed circuit boards which are attached to each other, at 90°. In spite of the relatively complex circuit functions, wiring has been kept to a minimum.

Assemble all the hardware into the chassis first. There is a good reason for this, so don't "roar off" into the PCB assembly just yet. Go ahead and mount all the hardware, including the decorative front panel. It is attached and held with the nuts of the potentiometer and switches.

The rear panel for our prototype was made from adhesive Scotchcal. We assume that kitset suppliers will supply this as well as the front panel.

The 6.5mm microphone socket mounted on the rear chassis must be insulated from chassis. This can be acheived using two insulating fibre washers (or you can make your own from the thick transparent plastic used for packaging shirts). Wrap insulating tape around the bush of the socket to ensure insulation from chassis. Alternatively, a rubber grommet of suitable

HEATHKIT

Build your own Weather Station

Fully Computerised Five-Function Digital Weather Station

The Heathkit ID-4001 Weather Station is microprocessor controlled and computes and displays weather data on easy-reading LED's — stores data in memory for instantaneous retrieval! Monitors indoor and outdoor temperatures and wind chill, barometric pressure, wind speed and direction, and time/data — all with electronic accuracy and reliability. It's ideal for home or office, boat clubs etc, anywhere accurate and instant weather information is needed.

1. Wind Speed. Two significant digits are displayed with your choice of average or instantaneous readings. Indicators show whether display is in miles-per-hour, knots or kilometres-per-hour. Date, time and magnitude of maximum wind gusts are retained in the memory and recalled whenever needed. Accuracy ±5% or better.

2. Wind Direction. Current wind direction is displayed by one of 16 indicators arranged in a circular compass configuration, and identified by both compass points and radial degrees.

3. Temperature & Wind Chill. Displays include a 2½-digit readout with + and − signs, alternately displayed indoor/outdoor readings and switch-selected Fahrenheit and Celsius readouts. Temperature range extends from −40° to +70°C and from −40° to +158°F. Computes wind chill reading automatically at the touch of a button. Date and time of maximum and minimum temperatures are stored in memory for future retrieval. Accuracy ±1°C.

4. Barometric Pressure. A 4-digit readout is displayed, with indicators to show whether pressure is rising or falling, and whether display is in inches of mercury or millibars. Range of pressure is 28.00 to 32.00 in. Hg (981.9 to 1050 millibars). Date, time and magnitude of maximum and minimum pressure are stored in memory and instantly recalled. Compensated temperature range is 0°C to 50°C (32°F to 122°F).

5. Time. 6-digit display with 12 or 24-hour format time readout, 4-digit date readout and AM/PM indicator in 12-hour format.

Includes outdoor transducer assembly. Optional cable below. For 120/240 VAC.

Kit ID-4001 $680.00 inc. tax
Assembled IDW-4001 $800.00 inc. tax
IDA-1290-1, 50 ft. cable **$16.00**
IDA-1290-2, 100 ft. cable **$28.00**
IDA-1290-3, 150 ft. cable **$37.50**

Digital Indoor/Outdoor Thermometer

You'll never have to "gauge-guess" again! This fun-to-build kit monitors indoor/outdoor (or any two temperatures) with a big, bright ½" high digital readout. The readout includes plus and minus signs as well as indoor and outdoor indicator lights, so you know at a glance which temperature is being monitored.

ID-1390AE SPECIFICATIONS: Temperature Range: Fahrenheit −40 to +120°, Celsius −40 to +50°.

KIT ID-1390AE $103.50

Digital Wind Speed and Direction Indicator

Outstanding accuracy and easy-to-read digital display make this kit a "must" for pilots, boaters, and anyone whose activities are affected by the wind.

ID-1590E SPECIFICATIONS:
Wind Speed 0-99 in miles per hour, knots or kilometres per hour.

KIT ID-1590E $125.50

ORDER BY COUPON NOW OR COME TO OUR SHOWROOM

Please rush me the Heathkit of my choice. My cheque for $ . . . . . is enclosed plus $7.00 for package and post.

☐ *Kit ID-1590E* ☐ *Kit ID-4001* ☐ *Assembled IDW-4001*
☐ *Kit ID-1390 AE*
IDW-4001 indicate either:—
☐ *IDA-1290-2, 100ft cable*
For Kits ID-1590E, ID-4001 & IDW-4001
☐ *IDA-1290-1, 50ft cable*
☐ *IDA-1290-3, 150ft cable*

Name .....
Address .....
..... **P/Code**.....

Send to: W. F. Heathkit Centre
220 Park St., South Melb. 3205. Phone: 699-4999

size can be used to isolate the socket from chassis.

With all the hardware mounted in the chassis you can install the mains wiring and some of the other wiring which does not involve the PCB. With that complete, you can turn attention to the PCBs. The display PCB is relatively straightforward as it accomodates only the twenty LEDs. It measures 203 x 59mm and is coded 80ga3b.

Each LED should be mounted so that it is spaced about 8mm from the PCB surface. Solder only one lead of each LED so that it can be adjusted later.

The main PCB measures 203 x 143mm and is coded 80ga3a. Mount all the links and small components first. We recommend that PC pins be installed for external connection. Take particular care to install the diodes and electrolytic capacitors with correct polarity. A similar comment applies to the orientation of the IC packages. Leave the MM5837 IC till last as it is a MOS device and requires precaution to prevent damage from static charges.

When you are ready to solder in the MM5837, connect the barrel of the soldering iron to the 0V line of the PCB, using a clip lead. Now solder pins 1, 2, 3 and 4 of the MM5837. The other pins may now be soldered although they have no internal connections.

The three terminal regulator ICs require heatsinks. We made those for the prototype from 16-gauge aluminium, each measuring approximately 20 x 30mm.

With both PCBs complete, they can be soldered together. Position the display PCB exactly at 90° to the main PCB so that the top of the edge-connector pattern on the display PCB is just visible above the component side of the main PCB. Now tack the two edge connector patterns together in several places and then temporarily mount the assembly in the chassis to check that the LEDs will pass through the front panel holes. If not, adjust the two PCBs and solder all the connectors together. Now all the wiring can be connected to the PCB assembly. Use rainbow cable as much as possible, to give a neat appearance.

When all wiring is complete, make a thorough check of all your work and then apply power. Measure the voltages marked and then you should be ready to switch on and check the analyser functions. Connect the unit to your amplifier. Feed the pink noise into the amplifier and check that it works.

Now connect a good quality microphone and check that the LEDs in each octave band respond as the ap-

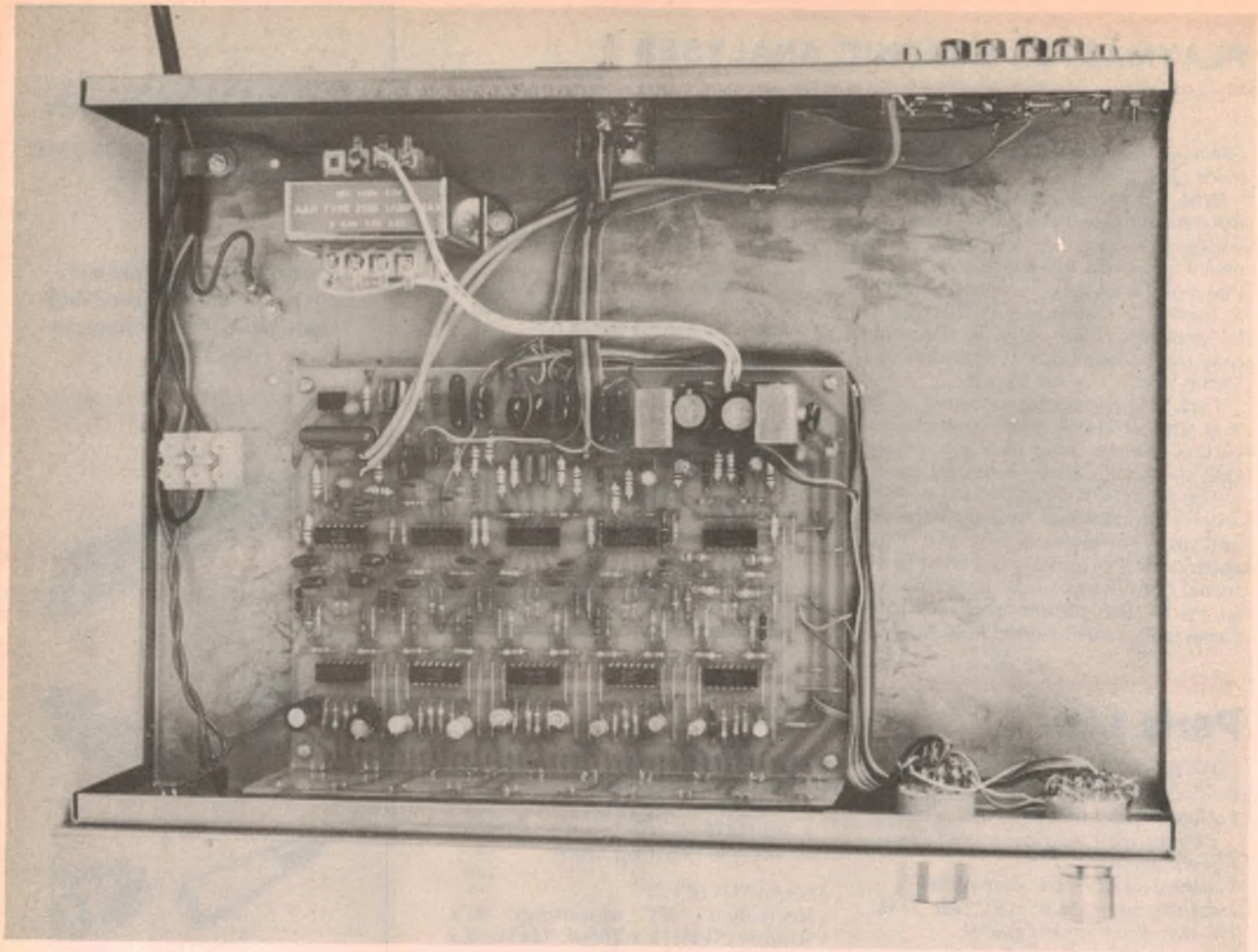
Parts List

1 PC board, 203 x 143mm, 80ga3a
1 PC board, 203 x 59mm, 80ga3b
1 plated steel chassis, 370 x 80 x 245mm with wrapover steel cover
1 front panel
1 adhesive label for rear panel
1 transformer, A&R 2155, DSE 2155
1 6-way RCA socket panel
1 4-way spring-loaded speaker terminal panel
1 100k rotary (log) potentiometer
1 100k dual ganged rotary (log) potentiometer
2 4-pole 3-position rotary switches
2 SPDT miniature toggle switches
1 6.5mm jack socket
4 adhesive rubber feet
4 brass spacers, 10mm long
1 3-pin mains plug and cord
1 3-way mains terminal strip
1 rubber grommet and cord clamp
32 PC stakes
Plus: hookup wire, solder lug, screws, nuts, washers, tinned copper wire, shielded audio cable.

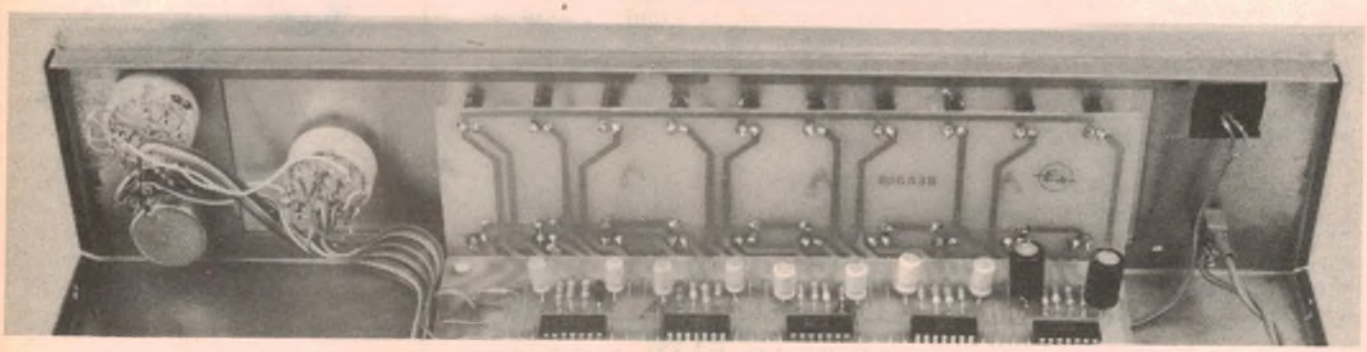
SEMICONDUCTORS
2 1N4002 power diodes
12 1N4148 silicon signal diodes
20 large red LEDs
1 small green LED
1 LM340T-12 regulator
1 LM320T-12 regulator
1 MM5837 IC
10 uA4136 quad op amps

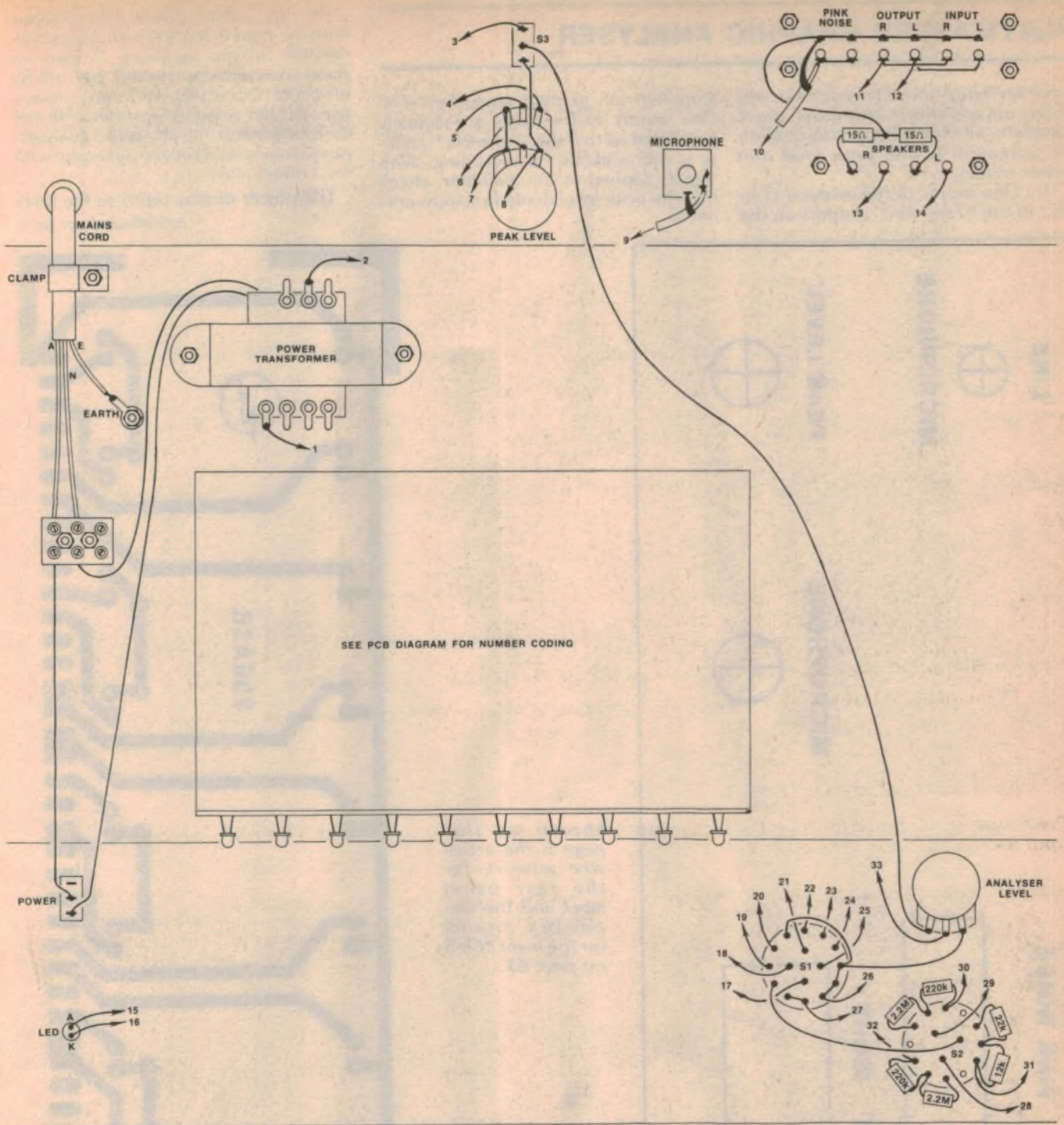
CAPACITORS
Electrolytics (PC mounting): 2 x 1000uF/25VW, 2 x 100uF/16VW, 4 x 47uF/16VW, 2 x 22uF/16VW, 2 x 10uF/16VW, 3 x 4.7uF/25VW.
Tantalum: 4 x 10uF/25VW
Metallised polyester (greencap): 1 x 1uF, 3 x 0.27uF, 3 x 0.18uF, 7 x 0.1uF, 4 x 0.47uF, 1 x 0.27uF, 2 x .022uF, 2 x .01uF, 2 x .0047uF, 2 x .0022uF, 4 x .001uF.
Polystyrene or Ceramic: 4 x 470pF, 3 x 39pF.

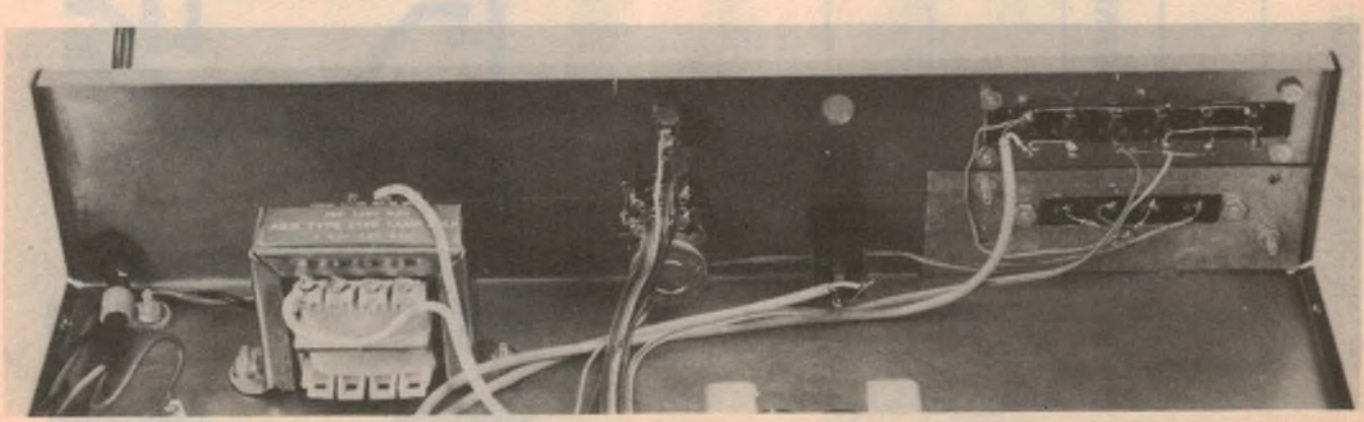
RESISTORS
3 x 2.2M, 2 x 1M, 1 x 820k, 4 x 680k, 3 x 560k, 2 x 390k, 4 x 220k, 2 x 180k, 5 x 150k, 2 x 120k, 6 x 100k, 1 x 82k, 4 x 68k, 2 x 56k, 2 x 47k, 3 x 39k, 3 x 33k, 2 x 27k, 3 x 22k, 1 x 18k, 2 x 15k, 1 x 12k, 18 x 10k, 2 x 8.2k, 4 x 6.8k, 3 x 5.6k, 2 x 3.9k, 5 x 3.3k, 5 x 3.3k, 3 x 2.7k, 1 x 2.2k, 2 x 1.8k, 20 x 1.5k, 1 x 1k, 1 x 470 ohm, 1 x 330 ohm, 1 x 100 ohm, 2 x 15 ohm.



These views of our prototype show the simplicity of construction. At bottom of the page is the rear view showing the input sockets and peak level control.




PINK NOISE
OUTPUT R L
INPUT R L
11
12
10
15Ω
15Ω
SPEAKERS
R
L
13
14
MICROPHONE
9
3
S3
4
5
6
7
8
PEAK LEVEL
MAINS CORD
CLAMP
A
E
N
EARTH
2
POWER TRANSFORMER
1
SEE PCB DIAGRAM FOR NUMBER CODING
POWER
LED
A
K
15
16
33
ANALYSER LEVEL
21
22
23
24
25
20
19
18
17
S1
26
27
30
29
220k
2.2M
22k
32
S2
12k
31
220k
2.2M
28



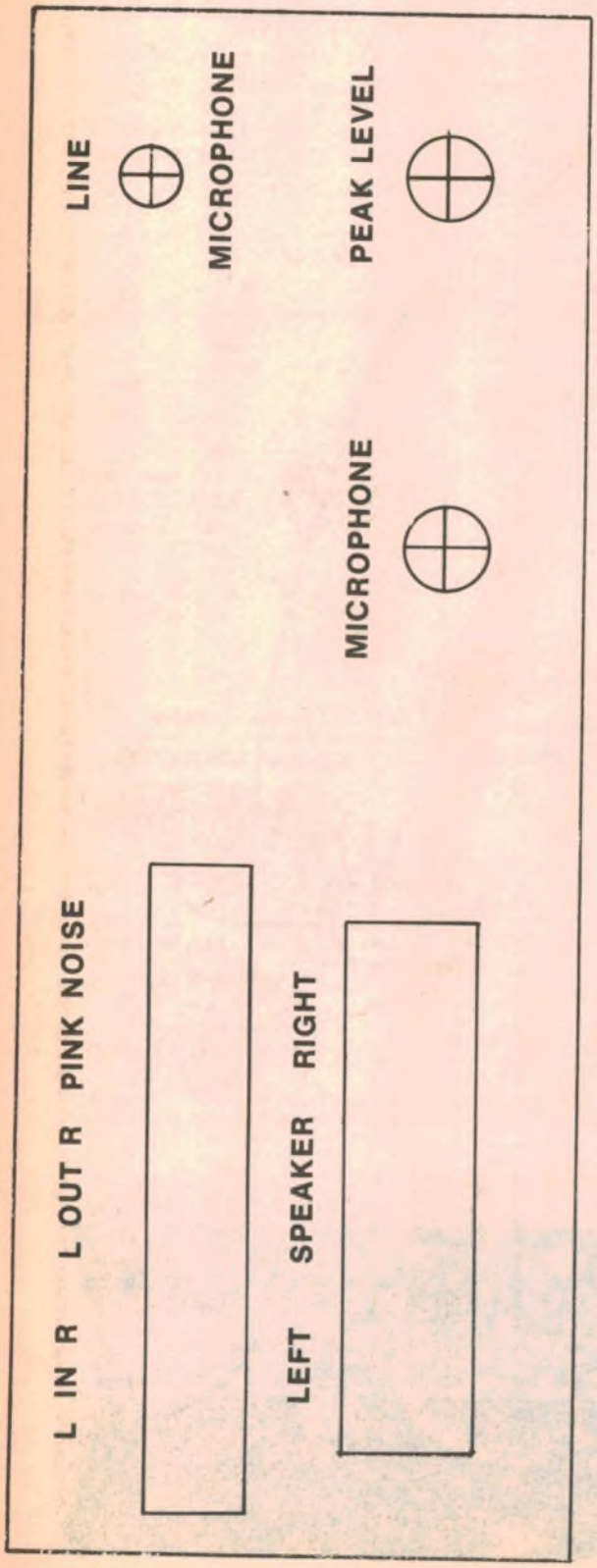
propriate equaliser slider control is adjusted up and down. With that check complete, all that remains is to confirm the operation of the peak level and power modes.

The Line inputs of the analyser connect to the "Tape Rec" outputs on the amplifier (or graphic equaliser). The Line inputs and outputs are actually paralleled so that the "Tape Rec" facility is still available for recording. With signals applied to the amplifier, check that the peak level mode functions correctly.

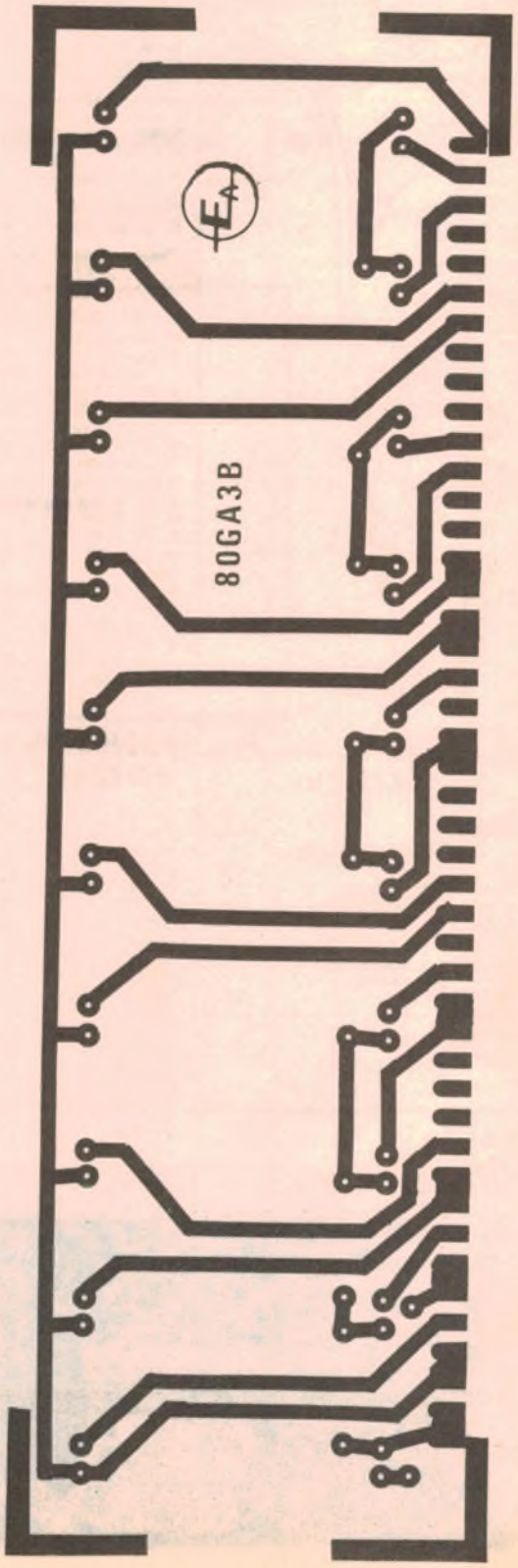
For the power mode, the analyser must be connected to the loudspeaker outputs on the amplifier. Polarity of these connections should be strictly observed. Note that there are protective 15 ohm resistors in series with the 0V loudspeaker inputs to the analyser, just in case you do make a mistake with the connections.

The power display refers to the RMS

(continued on p63)



Shown on this page is the actual size artwork for the rear panel label and the display PCB. Artwork for the main PCB is on page 63.



ROD IRVING ELECTRONICS

499 HIGH STREET, NORTHCOTE 3070, MELBOURNE VICTORIA. Ph. (03) 489 8131.

NEW PRODUCTS

RIE are now distributors for 3M products including Scotchcal range

8016 blue on white plastic	$4.10
8018 green on white plastic	$4.10
8011 red on white plastic	$4.60
8012 black on transparent plastic	$4.10
8013 black on yellow plastic	$4.10
8015 black on white plastic	$4.10
8009 light blue on aluminium	$4.10
8001 red on aluminium	$4.10
8005 black on aluminium	$4.60
8007 reversing film	$3.75
*Note — all above sheets 10in x 12in	
8500 Photosensitive developer	$4.40
3900 clear coating (glossy finish)	$9.30
3930 clear coating (matte finish)	$9.30
ML-3 Applicator block	$3.90
ML-4 developer pads 10 for 8002KA evaluation kit	$8.90

SOAR corporation

Digital hand-held multimeter **$77**

EA METAL DETECTOR

EA 79md 9	$2.60
As A Kit (without H/phones)	19.90
ET576	4.90
Dream 6800	9.90
ETI 472	2.90
ETI 471	9.90
ETI 470	2.75
ETI Series 4000 Kit	179.00
ETI 585 Rx ultrasonic Rx	15.95
ETI 585 Tx ultrasonic Tx	8.95

INTERSIL ICL7106 LCD EVALUATION KIT

$32.50

INTERSIL LCD 3½ DIGIT PANEL METER KITS

Build a working DPM in ½-hour with these complete evaluation kits.

Test these new parts for yourself with intersil's low cost prototyping kits complete with A/D converter and LCD display (for the 7106) or LED display (for the 7107). Kits provide all matrials including PC board for a functioning panel meter ICL7106EV (LCD).

COMPONENTS

2114 RAMS	$6.25
2708 EPROM	8.50
741 s 10 up	2.50
555 s 10 up	2.90
BD139 10 up	4.00
BD140 10 up	4.00
SC141D 10 up	11.00
SC151D 10 up	21.10
RED LEDS 10 up	1.40
RED LEDS 100 up	11.00
YELLOW LEDS 10 up	2.90
8 PIN I/C SKTS 10 up	2.00
BC547 10 up	1.00
BC548	0.15 ea
BC549	0.19 ea
MJ802	3.60
6,800/50V CAPS (LUG)	4.50
5,600/40V CAPS (PCB)	1.90

KITS & CIRCUIT BOARDS

ETI SERIES 4000 AMP

- **Complte Kit $175.00**
- Quality front panel to suit above $7.99
- ETI 470 kit of parts 19.90
- ETI 480 kit of parts 100w (incl. bracket) 19.75
- ETI 470 PS kit of parts (includes relay, not transformer) 19.50
- Transformer to suit 22.90
- ETI 471 pre-amp 45.50
- ETI 585R ultra sonic RX 15.95
- ETI 585T ultra sonic TX 8.95
- EA 79 SF9 sound flash trigger 15.00
- All parts available for DREAM computer project
- P.C.B.'s (all quality fibreglass boards)
  - ETI 574 disco strobe 2.80
  - ETI 549A metal detector 2.75
  - DREAM circuit board 9.90

PROJECT BOARDS (FIBREGLASS)

ETI 043	1.40	ETI 481M	2.00
ETI 044	1.30	ETI 481PS	3.50
ETI 047	1.50	ETI 483	2.20
ETI 061	1.40	ETI 484	3.90
ETI 062	1.80	ETI 485	2.90
ETI 063	1.70	ETI 486	2.90
ETI 064	1.70	ETI 489A	2.50
ETI 065	1.70	ETI 499	1.99
ETI 067	1.80	ETI 528	2.20
ETI 068	1.40	ETI 541	2.20
ETI 071	1.40	ETI 547	2.20
ETI 072	1.80	ETI 581	2.20
ETI 081	1.50	ETI 583	2.20
ETI 083	1.80	ETI 585R	1.60
ETI 084	1.70	ETI 585T	1.40
ETI 085	1.30	ETI 586	2.30
ETI 130	1.90	ETI 603	2.50
ETI 134	1.90	ETI 604	1.60
ETI 135	1.90	ETI 635	2.90
ETI 136	1.80	ETI 638A	3.90
ETI 137A	2.90	ETI 708	1.90
ETI 137B	2.90	ETI 713	3.90
ETI 139	1.90	ETI 714	1.90
ETI 245	1.60	ETI 717	2.90
ETI 417	1.80	EA 78A0B	2.90
ETI 445	1.50	EA 78TM8	2.00
ETI 446	1.90	EA 78N6	3.20
ETI 449	1.50	EA 78NG4	2.50
ETI 450A	1.90	EA 78UT4	3.90
ETI 450B	1.90	EA 78T3	4.20
ETI 480	2.40	EA 78C5	3.90
ETI 480PS	2.40		

COMPUTER COMPONENTS

Attention Sorcerer & TRS 80 owners. Memory expansion kits available. We also offer full service on the popular computer projects and systems.

SPECIAL 4116RAM OFFER
80FF PRIME SPEC 4116 I/Cs $88.00
STATIC RAM KIT 16K S-100

KIT FORM $269.00
ASS & TESTED $299.00

All front panels available for ETI & EA projects in scotchcal. Phone for details.

DIP PLUGS

Ideal for use with flat ribbon cable or to mount components on

14 pin $0.56	24 pin $0.94
16 pin $0.58	40 pin $2.00

POWER TRANSFORMERS

SPECIALLY DESIGNED FOR MICROCOMPUTERS

- See Feb 1979 EA for full details
- Good regulation electrostatic shield
- SE 805 8V @ 5A 2x15V @ 1A $18.50
- SE 810 8V @ 10A 2x15V @ 1A $20.50
- SE 820 8V @ 20A 15V @ 1A 15V @ 3A $30.50

20 TURN CERMET TRIM POT

SPECTROL 43P ACTUAL SIZE

STOCK RESISTANCE VALUES
10R, 20R, 50R, 100R, 200R, 500R, 1K, 2K, 5K, 10K, 20K, 50K, 100K, 200K, 500K, 1M, 2M.

1—9	$1.20
10—99	0.95
100	0.90

Values may be mixed.

Hexadecimal ~~Keypad~~

$19.50/each

19-key pad includes 1-10 keys ABCDEF and 2 optional keys and a shift key.

Ideal for dream project

MULTIDIALS

Dials to suit 10 T Pots

Model 21 1.8" dia	$9.90
Model 16 .9" dia	$9.50
Model 18 1" x 1.75" dia	$17.50

COMPUTER COOLING FANS

Muffin fan 4⅝" square	
110V	$26.50
240V	$24.50
Sprite fan 3⅛" square	
110V	$26.50
240V	$24.50

Range of larger fans available. Send for details.

cermet single TURN TRIM POT

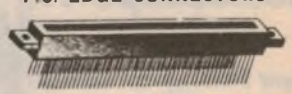
Spectrol model 63P ACTUAL SIZE

STOCK VALUES
10R, 20R, 50R, 100R, 200R, 500R, 1K, 2K, 5K, 10K, 20K, 50K, 200K, 500K, 1M, 2M.

1—9	0.95
10—99	0.85
100	0.75

Values may be mixed.

P.C. EDGE CONNECTORS



S100 gold plated wire wrap	$6.50
S100 solder tail	$6.90
D2 Motorola bus	
43/86 solder tail	$6.34
43/86 gold plated wire wrap	$7.40

DREAM

ELECTRONIC AUSTRALIA MICROCOMPUTER PROJECT

Kit for main board (including programme 2708) **$109.00**

PCB (fibre glass) only	$9.90
2708 programmed	$15.60
Key Pad 19 keys	$17.50
Kit (less key pad)	$90.00
PCB for power supply	$3.50

10 TURN POTENTIOMETERS

Stock resistance values

50R, 100R, 200R, 500R, 1K, 2K, 5K, 10K, 20K, 50K, 100k.

Spectrol model 534 ¼" shaft

Price 1—9	$6.25
10 + values may be mixed	$5.75

HEAVIER ITEMS ADD ADDITIONAL POSTAGE. EXTRA HEAVY ITEMS SENT COMET FREIGHT ON. PRICES SUBJECT TO CHANGE WITHOUT NOTICE. SEND 40c & S.A.E. FOR FREE CATALOGUE.

MAIL ORDERS: PO BOX 135, NORTHCOTE, VIC 3070.
MIN PACK & POST $1.00

TEST IT!

PROFESSIONAL TEST GEAR AT AMATEUR PRICES — FROM DICK SMITH

Q-1140

See the review in February Electronics Today Intl.

LOOK AT THESE HANDY RANGES:

DC Volts: 0.25, 2.5, 10, 50, 250, 1000 (100k/V)
AC Volts: 5, 10, 50, 250, 1000
DC Current: 10uA, 25uA, 0.5mA, 5mA, 50mA, 500mA, & 10A. AC current: 10A.
Resistance: 20, 200, 20k & 200k centre scale
Decibels: –10 to–62
Transistor: h_{FE} 0–500; I_{co} 0–50uA
Capacitance: 50pF to 3uF; 0.01uF to 50uF

ONLY $69.50

More than a multimeter. More than a transistor checker. This one measures capacitance, too!!!

Incredible value! This superb 100,000 ohm per volt multimeter is probably the handiest instrument you will ever own. For with its 36 ranges, you can not only measure voltages, currents, resistances, etc like most other multimeters, you can actually check transistors and capacitors!
And with the optional RF probe, you can extend the range of your meter up to 30MHz – ideal for trouble-shooting RF circuits too!
Whether you're a hobbyist, amateur, service technician, or engineer you'll find this meter will give years of accurate, reliable service. It's fully protected (internal fuse protection); has large, mirrored scale for accurate reading and even has a polarity reversal switch. Supplied complete with instruction manual, test leads and transistor connection leads.

YES! We have many other feature-packed multimeters in stock, from a low $12.50. Call in and see our superb range soon – along with a host of other test gear!

COMING SOON:

Dick's new lab. oscilloscope...

A bargain! 5MHz bandwidth; 10mV/div (vert) and under $200.00!!
That's right – it's the new Dick Smith Laboratory Oscilloscope; just right for the amateur, hobbyist or service desk. Why pay up to $100.00 more for a CRO and do no better?

Cat Q-1280

$199.00

DUE IN STOCK LATE THIS MONTH!

WANT TO GO DIGITAL?

For accuracy and speed you can't go past a digital multimeter. This budget priced 3½ digit model offers better accuracy than others in similar price range, plus huge digits for high visibility.
Battery operated, or mains operation with optional 'plug-pack' adaptor (M-9525 @ $6.90).
High impedance input – 10Mohm AC & DC; ranges 200mV – 1kV DC, 200mV – 700V AC, 200uA – 2A AC & DC, 2k to 20M ohms. Better than 0.1% accuracy on DC!

Cat Q-1440

$145.00

IS SERVICING YOUR GAME?

Make some money out of CB! Yes, there are a lot of opportunities for CB repairers: if your forte is servicing, why not cash in on it?
This deluxe CB test set, in conjunction with your other test gear (cro, dmm, etc) is all you really need. Checks power, modulation, oscillators, antenna SWR, xtal activity, etc.

Ideal for the test bench or service vehicle.

Cat Q-1380

$49.50

THE DIPPER...

Ask an amateur how handy his 'dipper' is! He'll tell you he wouldn't be without one. For circuit checking, signal generation, as an absorption wavemeter, modulation checker . . . the list of uses for this incredible instrument goes on and on. There are a lot of 'cheapie' dippers on the market: this is one of the top models available. Recommended.

Cat Q-1322

$99.50

INCREDIBLY HANDY...

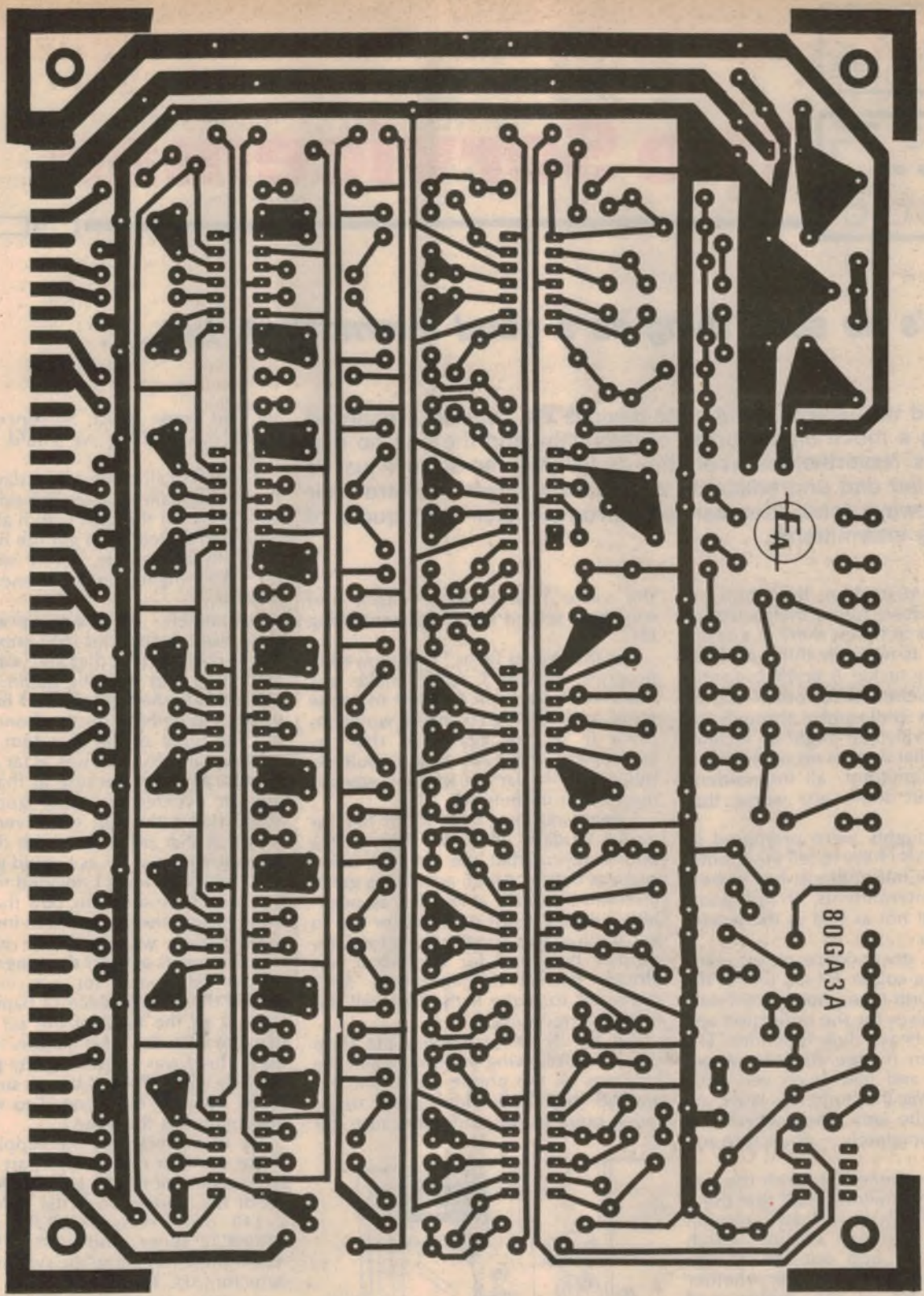
Think of how many times you've wondered if a battery is ok! You've probably just measured it with a meter for a voltage check. Wrong! You need to properly load batteries when checking them – this checker does that, with virtually every type of battery. Gives a go/maybe/no go reading. Also checks lamps and fuses.

Cat Q-1525

$9.95

DICK SMITH ELECTRONICS

SEE OUR OTHER ADVERTS IN THIS MAGAZINE FOR OUR STORE ADDRESSES AND RESELLERS



sinewave power into a resistive 8 ohm load. You can refer the power into 4 ohm loads or 16 ohm loads by changing the circuit slightly. For 4 ohm loads, the 10k resistor in the input voltage divider (associated withe S1b and S1a) should be changed to 4.7k. For 16 ohm loads, change it to 22k.

If both the analyser level and line level controls are wound up to maximum, and there are no connections to the line inputs supersonic oscillation may result and some of the LEDs will turn on. This is not a fault and is a natural consequence of the high input impedance and large gains used. The condition will disappear immediately when normal connections are made to the line inputs, whether or not there is an input signal.

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

$95

This includes sales tax but does not include a microphone or connecting cables.

The Serviceman

There's no such thing as a good intermittent, but . . .

Compared with valves, solid state devices are generally regarded as having a much higher order of reliability, and there is no disputing this. Nevertheless, when they do fail they can do so in just as many varied and unpredictable ways as did valves. Nor are their failures always total; they can also produce their own quota of tantalising intermittents.

Among Australian bushmen, or others who have found themselves on short rations at times, there is a saying that "there is no such thing as crook tucker." Any tucker is good, but some tucker is better than other tucker! Shifting this philosophy through 180 degrees, servicemen might be inclined to observe that there is no such thing as a good intermittent; all intermittents are bad, but some are worse than others!

These thoughts were prompted by the two stories I have to tell this month; both involve intermittents but in both cases the intermittents, if not good, were at least not as bad as the worst I have known.

The first story concerns an early model Decca colour TV set, one of the 33 series hybrid type; mostly solid state but using valves for the deflection and some other heavy duty functions. The set had been in operation for about three years and had given very little trouble during that time. But now, according to the lady who owned it, it had failed completely — no picture and no sound.

When she phoned me with the bad news I immediately recalled that these sets have a thermal overload cut-out in the mains primary circuit which sometimes will pop out for no apparent reason. So I asked her whether she was aware of this button and whether she had checked it. She was not aware of it but, following my instructions, she checked it while I waited on the phone. She returned in a minute or so and reported that this had made no difference.

When I made the service call the set started out exactly as the lady had described it; no picture and no sound. But when I removed the back I realised that it was not completely dead, in that the valve heaters were alight and somehow sensed that it was generating EHT.

But that was as far as I was allowed to progress. Before I could make any more tests, the set decided to come good, and nothing I could do would induce it to fail again. In the circumstances, there was little I could do but advise the lady to call me when it decided to misbehave.

I heard nothing more from her for about 10 days; then she was on the phone saying that the set had failed again as before. Much as I like to get at intermittent faults as quickly as possible, it was just not practical for me to get at it that day. For one thing I was extremely busy and for another it was already late in the afternoon. So I promised to make it the first call the following morning.

But hardly had I opened the shop doors the following morning when the lady was on the phone again. She explained that there didn't seem to be much point in my calling because the set had come good. So, once more, there was nothing we could do but wait.

"There's no time like the present when you're up against an intermittent!" (From "Radio-Electronics").

The next call came a few days later; the set had failed again. This time I was able to be on the spot within about an hour and I decided to get the back off, as gently as possible, before switching on — keeping my fingers crossed in the process.

Fortunately, the fault decided to show itself, at least for long enough for me to confirm that that EHT was being generated and that the audio section was alive. In the light of this I began to suspect something up the front of the set; the tuner or the IF system.

Unfortunately, that was as far as I was able to progress because at that point the set decided to come good. I'm afraid that I thought some very rude words at that point but, with the lady present, that was far as I could go. At a more practical level I decided to make the best of the situation, now that I had some idea of the general area involved.

The idea was to take voltage measurements around the tuner and IF circuits while the set was working, record these on a piece of paper, and leave it in the back of the set in anticipation of the next failure. Having done this I was explaining my plan to the lady when, Presto! the set suddenly failed again. (I didn't need to restrain my comments this time.)

My first check was the supply rails. There are two rails in this part of the set; a main rail of 25V and a secondary rail of 12V, derived from the 25V rail via a 110 ohm resistor (R29) and a BZX61C12 zener diode (D2). This rail supplies the tuner and the synchronous detector/AFC IC chip TCA 270.

The 25V rail read normal but I knew I was getting close when the 12V rail read only about 3V. Well, at least that was something, even if I still had to find the exact cause. I felt that the most likely possibility was excessive current drain due to a failure of some component fed by this rail, so I began progressively disconnecting everything connected to it.

I finished up with virtually everything disconnected, including some electrolytics immediately adjacent to the

zener, and still had only 3V. This left only the 110 ohm resistor and the zener and I quickly cleared the resistor of suspicion. This left the zener and, doubtful though I was, I disconnected it also.

The voltage shot up immediately to something over 12 and I knew I had found it. I fitted a new zener, restored the other connections, and switched on. The voltage pegged immediately at 12 and, as the valves warmed up, up came the picture and sound.

So there it was, a zener diode with an intermittent breakdown; something which I certainly have not struck before and which I confess I still find rather puzzling. An intermittent open circuit is not hard to visualise, but I always imagined that once a junction in any solid state device had broken down that it was broken down completely and for good. Now I know better.

ANOTHER ONE!

My next story also involves an intermittent fault but, once again, it was in a less vicious form than these things can sometimes be. There was also some similarity in the cause, as will become apparent.

The set was a Rank Arena 22in, model 2201. The initial fault was complete failure and the owner, who had some electronic background, had established that the tripler had failed. However, in the light of what I subsequently found, it is obvious that there was a lot more to the history of the set than I was told about. In fact, I strongly suspect that the failed EHT tripler may well have been caused by a clumsy effort to locate an earlier fault.

But, not knowing this, I simply took the owner's word for it and ordered a replacement tripler. The only other comment by the owner was a somewhat garbled comment about the set losing colour on occasions, but there was little I could do about this until the tripler was replaced and I had a picture to look at.

When the tripler arrived and was fitted the EHT came good, but this only served to reveal another fault; complete lack of vertical deflection. This, I suspect, was what the owner was trying to fix when he damaged the tripler.

At this point I realised that I was lacking some essential data for this set. I had a copy of the circuit, but no manual. This would have not been so bad, had the circuit featured the various waveforms, but it didn't. These were presented separately in the complete manual. So the first thing to do was contact the makers and order a manual.

At the same time I had the opportunity to talk to one of the company technicians, and he suggested several components which would be most suspect for this fault, in this model. Armed with this information and a few other points, I went back to the set and began checking waveforms from the vertical oscillator onwards. Even without the exact waveforms, I reckoned I could pick the point of total failure.

In this set the vertical oscillator and a couple of following amplifier stages are located on the "deflection board", while additional amplifier stages and the output stage are on a separate board, the "deflection output board." It was easiest to check the waveform at the input to the output board and here I found what seemed to be a reasonable shape and amplitude. (When the manual subsequently arrived, it was shown to be spot on.)

The first stage on the output board is the third vertical amplifier (TR410), followed by the vertical drive stage (TR411), and the vertical output stage (TR409). As already stated, the waveform into the third amplifier stage was normal, but the output from it was anything but. My first reaction was to blame this stage, except that the manufacturer's technician had warned me that the next stage, the driver, was the more likely culprit.

In addition to the transistor in this stage there are three diodes in what appears to be some kind of wave shaping network, and he had warned that any of these four components should be suspect and that, in some circumstances, the fault could load the previous stage.

The easiest way to check this possibility was simply to replace the transistor and three diodes, which I did. This proved to be the right thing to do, even though it did not effect a complete cure. I now had vertical scan, but limited to about one third of the screen height.

So what now? Was the third amplifier stage also faulty? In the light of the checks I had made so far it seemed very likely, so out came that transistor and in went a new one. And that was the answer. Up came the vertical scan to full height and, after a few routine adjustments, the set was delivering a first class picture.

A LINGERING DOUBT

At that stage I could easily have regarded the job as finished, except for two things. One was the hint of a possible intermittent colour fault, the other was the fact that the owner was on holidays and I could not have returned the set to him anyway.

In fact, in the vague description of the colour fault a comment had been made which suggested that the symptom was not loss of colour in the total sense, but rather loss of chroma lock. It is fairly easy to adjust the reference oscillator APC loop in this set. The stage is provided with a small slide switch (SW751) which allows the oscillator to run free while the APC adjustment pot (VR706) is adjusted to give the best approach to a locked colour pattern.

I went through this routine, and everything seemed normal except that the pot needed to be set fairly close to one end of its travel. I didn't take a great deal of notice of this at the time, but simply moved the set into "intermittent corner" and let it run while I went on with other jobs.

All went well for a couple of days, when I happened to look up from another job and realised that the frame had partially collapsed by about two inches at the top and bottom. And a little while later — I could not attend to it immediately — it suddenly went out of chroma lock. Then, to cap it all, it developed intermittent flashes on screen, seemingly not related to anything.

It is times like these that one is sorely tempted to give the whole game away and buy a chicken farm. While I had been half expecting the chroma lock fault, the reappearance of vertical scan problems, which I thought I had solved, was a cruel blow — with the flashes thrown in just to make it harder!

I went through the chroma lock routine again and it came good, but with the difference that VR706 was now set at about its mid position — more or less where I imagined it should be. At the same time I re-set the height, mainly to see how the scan responded, and again everything seemed to come up normally. But, needless to say, I wasn't convinced.

The set ran like this for several days then just as suddenly as before, it dropped out of chroma lock. And, very significantly, I realised that it was now overscanning vertically, and that the flashing had returned. It was too much of a coincidence to suggest that all three faults could all pop up at the same time without there being some common cause, widely separated as the vertical scan and chroma lock circuits might be.

A VITAL CLUE

As it turned out, it was this wide separation of the circuits which gave me a clue. About the only thing they had in common was the supply rail, so I decided to check that first. There are two main supply rails in this set, one regulated at 120V and the other, also regulated, at 19V.

It was the latter one I suspected, since it supplies the vertical oscillator and amplifier circuits, plus the chroma board, among others. The voltage is derived from a small winding on the EHT transformer, via a diode (D554) a filter capacitor (C562) and a regulator transistor (TR505). The latter derives its base voltage from the 120V rail via an 8.2k resistor (R561) and a zener diode network.

The zener diode network delivers 19.7V, and consists of the zener diode itself, plus two ordinary diodes in series. I am not exactly sure as to the purpose of these diodes, but I suspect that it is to pad the voltage up slightly, above that available from a standard zener. Anyway, the end result is that the transistor develops 19V at its emitter after allowing for its own losses.

At least, it was supposed to develop 19V. When I measured it in what I regarded as the fault condition, it was closer to 25V. I knew then that I was on the right track. My first reaction was to blame the regulator transistor which, if it had shorted internally, could produce excessive voltage. On the other hand, and in spite of my experience related in the previous story, I hesitated to accept the idea of an intermittent short circuit.

An intermittent open circuit was a more likely possibility, and this suggested the zener diode as the likely culprit. A meter between base and chassis showed 25V plus, thereby confirming that the transistor was doing its job and narrowing the search to the zener network.

A measurement across the zener showed about 15V, which didn't make much sense in itself. Next I measured across the diode nearest the chassis and found about 0.3V — about what one would expect — but it was a different story across the other diode. This had about 9V across it; a quite ridiculous figure.

Replacing it pulled everything back into line. The rail supply came up spot on 19V, the chroma lock pot settled into its mid position, and the vertical overscan vanished. And, for good measure, there was no immediate sign of the intermittent flashes. Nor have any of the symptoms shown up since, and it has now been running in the workshop for two weeks. The owner is due back shortly and by that time I imagine that I will be able to return it to him with complete confidence.

But what a sequence of events. And what potential for misunderstanding and recrimination. If it hadn't been for the casual mention, almost as an afterthought, of the colour problem, I could easily have imagined that I had finished the job after replacing the vertical amplifier and driver stages. After all, I had already found two faults which nobody had mentioned and which I didn't expect.

Had this happened the owner would, at best, have been thumping my counter and complaining that I had not done the job properly. At worst he wouldn't even have bothered to tell me — but he would have told everybody else!

As I said at the beginning, there is no such thing s a good intermittent.

Another Chapter in the History of Wireless —

Stanley Mullard 1883-1979

A significant chapter in British (and Australian) electronics history came to a close with the death of Stanley Mullard in September last. He left behind a brand-name which will not easily be forgotton by those who have grown up with the industry.

Born in 1883, Stanley Mullard attended Sussex Polytechnic and took a position with an electric lamp manufacturer. Continuing his studies at the Northampton Institute, he became a director of the Company at 24, but left it to join Ediswan in 1915.

Even though a member of the R. N. Reserve, he continued with Ediswan during the war, involved in the production of valves for the British Admiralty. He later took charge of a special laboratory at Imperial College, London.

In 1920, he established the Mullard Valve Company and, with production exceeding two million valves per year in 1924, he became one of the fathers of Britain's radio industry.

At about that time, he also established links with Philips in Holland, who acquired all the shares in the company over the next few years. Stanley Mullard resigned as Managing Director in 1929 but remained active in the company affairs until 1970. During that period Philips in England was — Mullard!

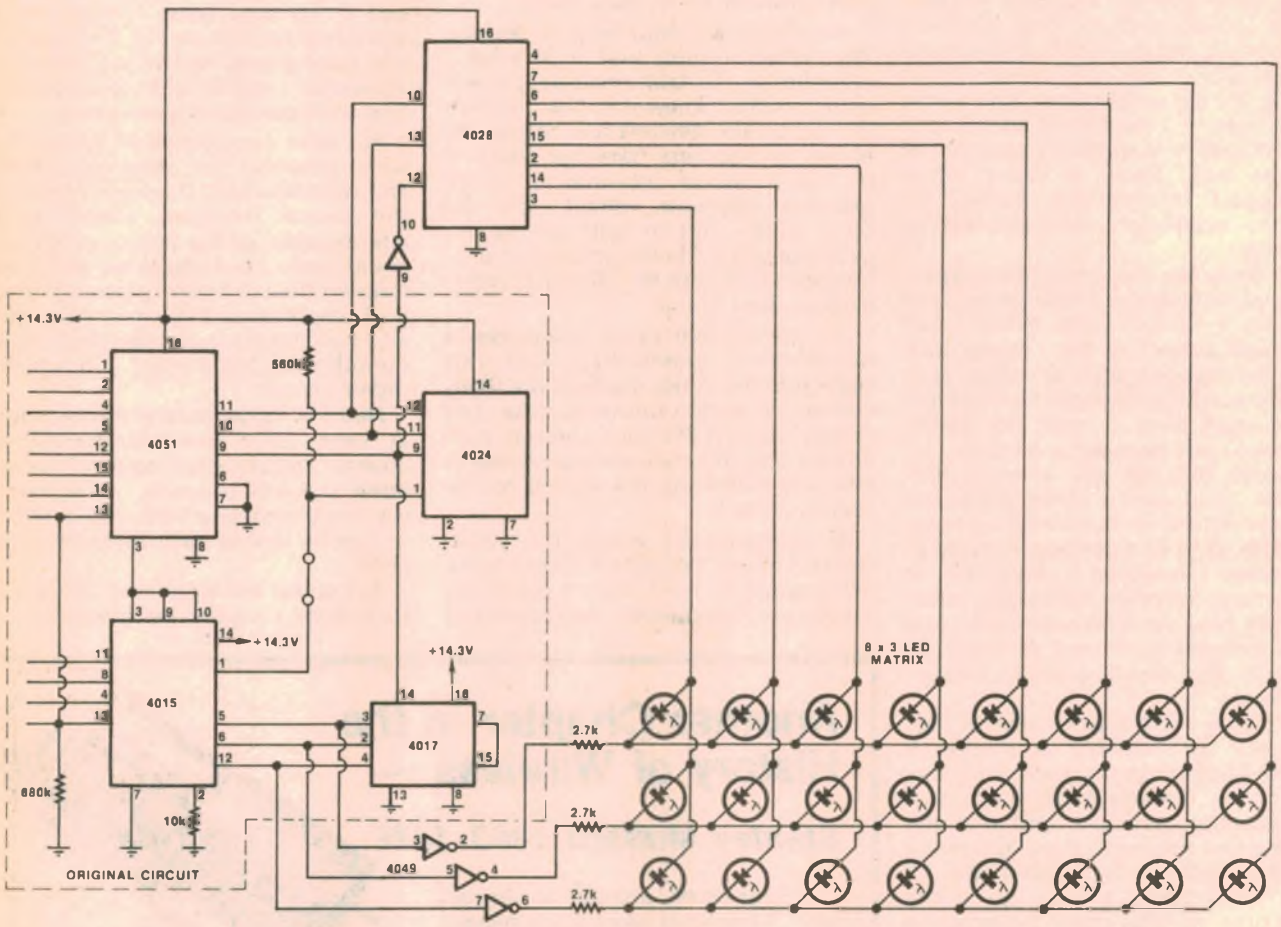
And in Australia, during that period, Mullard competed vigorously in its own right, even against its parent company, under the guidance of the late Eric Dare and, subsequently, the late Maurice Brown. More recently, when Philips reorganised in Australia, Mullard was officially absorbed.

CIRCUIT & DESIGN IDEAS

Interesting circuit ideas and design notes selected from technical literature, reader contributions and staff jottings. As they have not necessarily been tested in our laboratory, responsibility cannot be accepted. Contributions to this section are always welcome, and will be paid for if used.

Conducted by Ian Pogson

Auto-chime — which tune is next?



I have added some additional circuitry to the Auto-Chime which was described in September, 1979. The additions are arranged to give an indication as to which tune is to be played next. It is quite simple to add, I used a piece of Veroboard to carry the two extra ICs.

I chose LEDs for the indicators in preference to a 7-segment readout because I think that it has a better appearance and it is a simpler approach. I built the LEDs around a square box but they may be arranged as each individual constructor wishes. The repertoire list may also be added to the LEDs and the next tune may then be read off.

The added circuitry has proved to be very satisfactory and it cost me about $7.00, including the LEDs.

(By Mr R. Gareb, 17/37-39 O'Donnell Street, Bondi, NSW 2026.)

Novel way to play your old 78s

I built a Wien bridge audio oscillator and I have found it to be a very useful piece of equipment in enabling me to play my old 78 recordings on my two-speed synchronous motor turntable.

Rather than build a separate power amplifier for it, I fed the output of the audio oscillator into the right channel of my existing stereo amplifier. The left channel carries the signal from the pickup as usual. I wired in a 12V to 240V power transformer between the right channel speaker terminals and the turntable motor, with the 240V winding connected to the motor. This arrangement gives the necessary speed of 78rpm when the turntable is set to 45rpm and the audio oscillator set to 86.6Hz.

I have found this arrangement to be a satisfactory one and I thought that other readers in a similar position may be interested to try it.

(By Mr M. R. Lewis, 26 Waterdale Road Ivanhoe, Victoria 3079.)

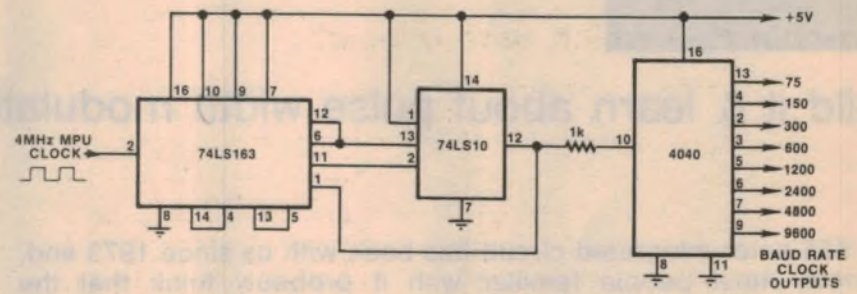
Editorial note: This idea is a good one but readers should be alerted to the possible dangers involved. Some amplifiers may not like being connected to a transformer as described, for a number of reasons. Unless readers are familiar with the ramifications and able to adjust for the right amount of drive etc, it would be wise to avoid taking any risks. (See "Audio Talk" P40).

Direct derivation of baud rate clock signals from a 4MHz clock signal

The specific ICs designed to provide these signals are generally rather expensive and tend to use a separate non-standard quartz crystal. This generally results in a system costing of the order of $30 merely to generate those I/O clock signals.

After some thought and the use of a calculator, it became clear that another far less expensive method of obtaining these important signals was possible. The result is a circuit which produces 16x baud rate clock signals only +0.16% above the nominal values and which is in a constant timing and phase relationship with the MPU clock signals.

In operation, the 74LS163 (any 4 bit resettable counter may be used) is driven by the 4MHz clock signal, derived in the author's system from a 6875 clock generator. The 74LS10 is used to decode a count of 13 (decimal), hence



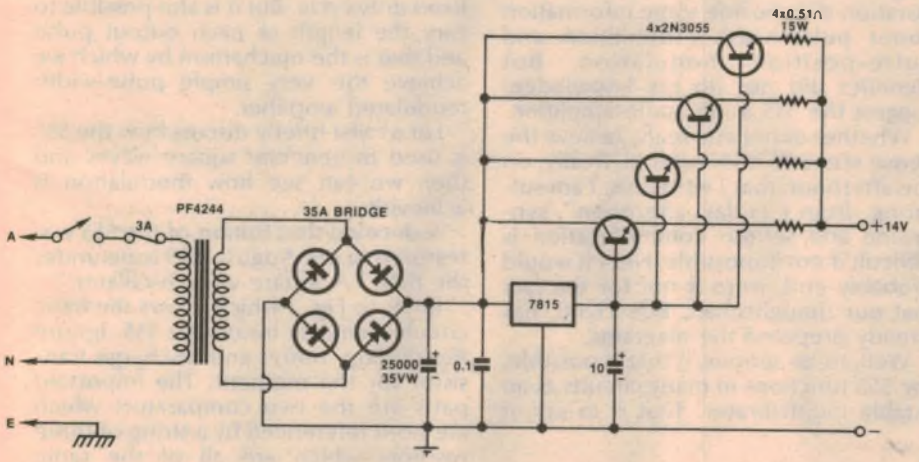
we have a modulo 13 counter. The resulting signal has a repetition rate equivalent to 307.692kHz, as against the nominal 307.2kHz.

This is further divided by the 4040 12-stage binary counter to give appropriate output frequencies for 9600 baud, 4800 baud, 2400 baud, 1200 baud, 600 baud, 300 baud, 150 baud and 75 baud. Since the author's system does not include a TTY it was thought an unnecessary refinement to generate a 110 signal.

The outputs of the 4040 may be buffered as required to suit the system in use. I hope that this information may be of use to other interested readers.

(By Mr C. C. Wright, Architecture Laboratory, The University of Auckland, Private Bag, Auckland, New Zealand.)

Simple high current regulated power supply



The need arose for a simple high current regulated power supply and the circuit shows how that need was met. The circuit delivers approximately 14V up to about 18A.

A Ferguson type PF4244 transformer is used. It is rated at 300VA and the two secondary windings, rated at 16V and 9A are connected in parallel. The rectifier unit is a diode bridge rated at 35A. Filtering is by a 25000uF 35VW electrolytic capacitor.

A series regulator consists of four 2N3055 power transistors in parallel. These are supplied with 15V from a type 7815 regulator IC. This gives an output voltage very close to 14V. A 7812 IC may be used but this would only give an output of about 11V, which is not really sufficient for mobile use.

In the prototype, the output voltage dropped less than 0.5V at a load of 10A. It is most important to provide adequate heat sinking for the diode bridge and the 2N3055s.

(By Mr K. Taylor, VK3YOS, 48 Albert Street, Warragul, Victoria 3820.)

Basic Electronics

An unusual audio amplifier

Build it & learn about pulse width modulation

The 555 timer integrated circuit has been with us since 1973 and, by now, most people familiar with it probably think that the applications for it have been exhausted. But did you know the 555 can be used as an audio amplifier? Well it can! It may not be really practical but it can be done.

by LEO SIMPSON

The main application for the 555 integrated circuit is in timing and oscillator circuits. It is not a linear device and cannot be used to amplify audio signals in the usual way. But it can be used to provide the basis for a simple "pulse width modulation" amplifier. As such, it is not a practical amplifier — it is not likely that you would use it in preference to a more conventional amplifier. But it can be demonstrated.

The idea for this article came to the author on an otherwise uneventful day when he was staring into the middle-distance during postprandial depression. This latter remark means that I had had quite a lot to eat and I wasn't sure whether it was for the best.

But in spite of its inauspicious origins (it must have been the garlic prawns), the idea has a certain compelling quality about it. After all, the 555 has apparently been used in just about every thinkable application (and probably a few that are unthinkable) except as an audio amplifier. Now that is a challenge that no self-respecting designer could possibly overlook.

Here I must confess that the idea is not completely original. After all, the original literature from Signetics Corporation did provide some information about pulse-width modulation and pulse-position modulation. But Signetics did not (to my knowledge) suggest the 555 as an audio amplifier.

Whether or not you really believe the above scenario is immaterial. Really, on the afternoon that I write this, I am suffering from "Friday afternoon" syndrome and serious communication is difficult if not impossible. Here it would probably end, were it not for the fact that our draughtsman, Bob Flynn, has already prepared the diagrams.

Well, to be serious, if that is possible, the 555 functions in many circuits as an astable multivibrator. That is to say, it can be a source of square waves with a fixed duty cycle. But it is also possible to vary the length of each output pulse and that is the mechanism by which we achieve this very simple pulse-width modulated amplifier.

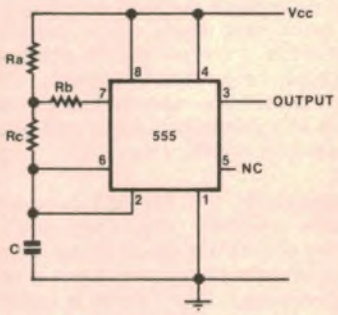


FIG. 2 : THE 555 AS AN ASTABLE

Let us first briefly discuss how the 555 is used to generate square waves and then we can see how modulation is achieved.

A detailed description of the 555 was featured in our August 1979 issue under the title, "A square wave oscillator".

Refer to Fig. 1 which shows the basic circuit elements inside the 555. Ignore the flipflop, buffer and discharge transistor for the moment. The important parts are the two comparators which are both referenced by a string of three resistors which are all of the same value, 5k. Thus, comparator A is referenced to 2/3 Vcc while comparator B is referenced to 1/3 Vcc. Vcc is the supply rail.

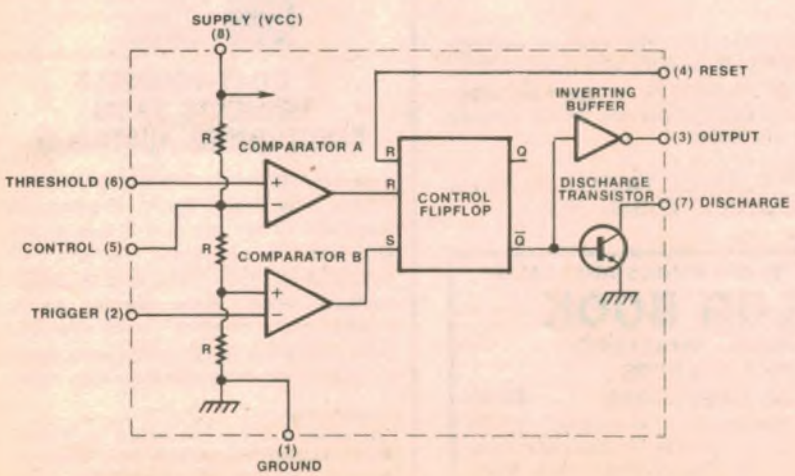


FIG. 1 : INSIDE THE 555

ASTABLE MULTIVIBRATOR

Now refer to Fig. 2 which shows how the 555 is connected in a typical astable multivibrator circuit. Pins six and two of the 555 are connected together, which means that the non-inverting input of comparator A connects to the inverting input of comparator B. In this way, the comparators monitor the voltage across capacitor C which is charged from Vcc via resistors Ra and Rc.

When power is first applied to the circuit, there is no voltage across the capacitor and thus the inputs of both comparators are held low. This means

that the output at pin three is high and the discharge transistor at pin seven is held off. The capacitor now charges up towards 2/3 Vcc. When it reaches this point, the output of comparator A toggles the flipflop and the output at pin three goes low. At the same time the discharge transistor at pin seven turns on.

Capacitor C now discharges towards 1/3 Vcc via resistors Rb and Rc. When the capacitor voltage drops to 1/3 Vcc, the output of comparator B toggles the flipflop again so that the output at pin three goes high and the discharge transistor at pin seven turns off. Capacitor C then begins to charge up again.

This cycle continues indefinitely, or until you turn the power off! The result is a pulse waveform at pin three and a sawtooth waveform across capacitor C. By suitable selection of resistors Ra, Rb and Rc we can arrange for the output at pin 3 to be an almost exact square wave.

MARK/SPACE RATIO

There is another method whereby we can change the mark/space ratio of the output waveform. This uses pin five which is labelled "control" or "FM" in some manufacturers' data. Pin five is connected to the string of 5k resistors which set the thresholds for comparators A and B. It is possible to change these comparator thresholds merely by connecting external resistors from Vcc or Ground to pin five, or by feeding an external voltage into this point.

Normally, pin five is set at 2/3 Vcc by the internal voltage divider of 5k resistors, referred to earlier. If pin five is held higher than 2/3 Vcc by external means, capacitor C will take longer to reach the new threshold for comparator A and longer for the capacitor to discharge to the threshold for comparator B. The net effect of this is to lower the repetition rate of the output square wave.

Similarly, if pin five is held lower than normal by external means, the repetition rate of the output square wave will be increased. But if the voltage at pin five is continuously changed by an audio signal the net effect will be to change the mark/space ratio of the output waveform.This is shown in Fig.4.

Reference to the complete circuit of Fig. 3 shows just how this modulation is performed. An NPN transistor Q1 is connected as a common-emitter amplifier with its collector connected to pin five of the 555. Q1 provides a higher input impedance than is available at pin five and also gives a modest order of gain, about 3.5 times.

Feeding an audio signal into the base of Q1 produces an amplified version of the signal at pin five. Pin five then continuously changes the thresholds of the two internal comparators in the 555 to produce an output square wave with a continuously changing mark/space ratio. This waveform is coupled to a loudspeaker via a 1000uF capacitor.

With no signal applied to Q1, the output square wave is roughly 66kHz. Naturally, the loudspeaker does not respond directly to this high frequency. Instead the loudspeaker responds to the average DC value of the modulated square wave. Referring again to Fig. 4 it can be seen that the average DC value of the output square wave roughly follows the input sinewave.

In effect, the loudspeaker functions as a mechanical low-pass filter, removing the high frequency "carrier" and reproducing only the modulating signal.

This amplifier really does work and gives quite good results although the effective power output is low, of the order of a few milliwatts at maximum. Any signal source such as a cassette deck or tuner, will drive it to full output. Why not give it a try?

FOOTNOTE

Some readers may not be fully satisfied with the explanation of this amplifier. While it does demonstrate the principle of pulse-width modulation, it is, strictly-speaking not a pulse-width modulation amplifier. More correctly speaking, the circuit produces "pulse-position modulation" or, more simply, frequency modulation. Literature supplied by Signetics Corporation gives a more complicated circuit employing the 555 which does result in pulse-width modulation. We preferred the circuit presented here as it is simple and self-contained.

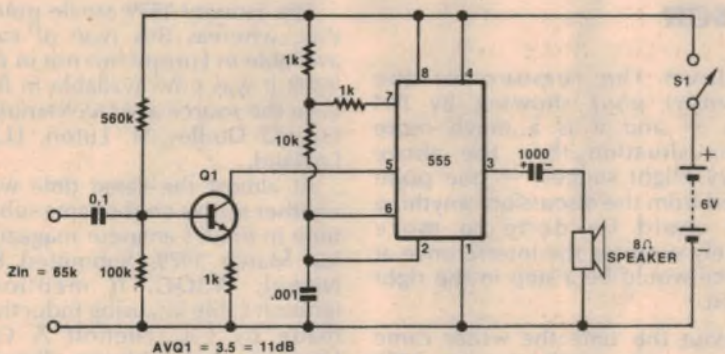


FIG. 3

This unconventional circuit will function as an audio amplifier when fed with a signal of up to several hundred millivolts RMS. Why not try it just for fun?

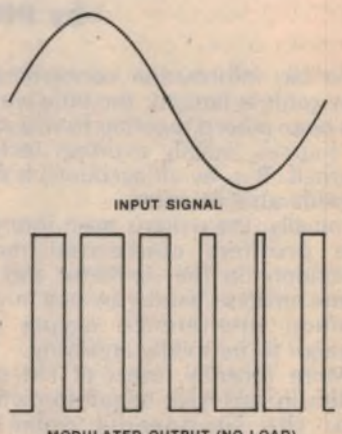


FIG. 4 : PULSE-WIDTH MODULATION

The loudspeaker functions as a mechanical low-pass filter and so responds to the average value of the output waveform.

Ignition interference — is this the answer?

Inductive ignition cable

Ignition interference in mobile radio equipment has always been a problem, and the increasing popularity of FM car radios has highlighted it in a new context. This article discusses a special type of ignition cable, claimed to have superior suppression characteristics, which is being used overseas.

by PHILIP WATSON

So far, information concerning the new cable is limited; the little we have has been pieced together from a variety of sources, mainly overseas technical journals. But, by all accounts, it shows considerable promise.

Initially, the writer's main interest in the problem concerned mobile operation on the six-metre and two-metre amateur bands; an area in which ignition interference occurs often enough to be mildly annoying.

More recently, users of FM stereo radios in cars have begun to complain that the supposedly noise-free characteristics of FM don't seem to be working out in practice; ignition interference is making itself evident in an area where they were led to believe they would receive beautiful music against a quiet background.

The problem was highlighted when a reader (J.R. of Wahroonga, NSW) wrote to our "Forum" column (September 1978) complaining about ignition and other noises in his domestic FM system and querying why the FM system appeared not to be living up to the claims made for it.

This brought a letter from N.H. of North Carlton, Victoria (December 1978), drawing attention to the much more serious situation involving FM radios in cars. A professional car radio installation mechanic, he claimed that it was almost impossible to eliminate ignition interference from FM car radios by any economical means.

This prompted a comment from T.B. of St Ives, NSW (February 1979), who pointed out that effective noise cancelling systems were available and that he was surprised that N.H. was not aware of these.

Back came a reply from N.H. (May 1979) saying that he was well aware of these devices but that they had a number of drawbacks. They were fairly expensive to buy and, in some cases, even more expensive to fit. In addition, they introduced some distortion and also reduced the stereo separation.

It seemed we were back to square one!

Whatever the reasons for the (apparently) poor showing by FM systems — and it is a much more complex situation than the above summary might suggest — one point emerged from the discussion; anything which could be done to more effectively suppress the interference at its source would be a step in the right direction.

At about this time the writer came across an article in the January 1979 issue of "Radio Communication", the British amateur journal published by the Radio Society of Great Britain. It referred to an article in their May 1976 issue, by Dennis Morris, G3AYJ, of Lucas Electrical Ltd, dealing with vehicle interference suppression in general, and mentioning inductive ignition cable. (Apart from this, this article is a very good one in its own right.)

The January 1979 article pointed out that, whereas this type of cable was available in Europe but not in Britain in 1976, it was now available in Britain. It gave the source as MAS Manufacturing Ltd, 43 Dudley St, Luton, LU2 ONP, England.

At almost the same time we found another article on the same subject, this time in the US amateur magazine, "73" for March 1979. Submitted by Larry Nickel, W3QG, it mentioned an ignition cable kit, using inductive cable, made by C.E. Niehoff & Co, 4925 Lawrence Ave, Chicago, Illinois 60630, USA. The author went on to give a glowing account of how this cable virtually wiped ignition interference in his own car on the 2-metre band.

Resistive plugs may also help

Another weapon in the fight against ignition interference, and one which is already used extensively both overseas and in Australia, is the resistive spark plug. While its use to date has been mainly limited to professionally installed two-way radio systems, particularly marine systems, the current interest in entertainment FM systems may result in it becoming more widely accepted.

Resistive spark plugs look the same as conventional plugs, but have a resistor inside the porclain insulator, between the terminal and the centre electrode, joining the latter at about the level of the outer metal shell. The resistance is about 4000 ohms.

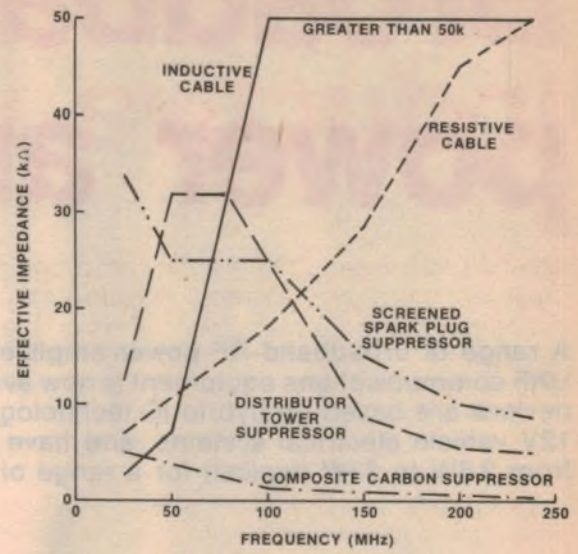
These plugs are intended for use with conventional resistive suppressor cable, but probably would be just as valuable if added to inductive ignition cable. They may also be used with lumped resistance inserted in wire ignition cables, although this approach is generally regarded as less effective than that using resistive cable.

Resistive spark plugs are handled in Australia by the Champion Spark Plug Co, who stock them in all popular types. While they are not generally available from service stations, they are stocked by the larger distributors. They carry the letter "R" in the type number, e.g., RBL-11Y.

Champion also have available an informative booklet entitled "Giving Two-Way Radio its Voice" (No. 7R) which contains a lot of useful advice concerning vehicle noise suppression in general, as well as descriptions of the resistive plugs.

This booklet is available for the asking from Champion Spark Plug Co, (Aust) Pty Ltd, PO Box 165, Alexandria, NSW, 2015.

Comparison of ignition suppression devices



This graph gives a good indication as to the effectiveness of the different suppression methods. The inductive cable has by far the best characteristic, with an effective impedance greater than 50k for frequencies above 75MHz.

These were not the first references to inductive cable we had encountered. We first heard of it at an RF interference workshop conducted by the IREE and the University of NSW, at the University, in February 1970 — nearly 10 years ago. At that time it was mentioned by J. M. Waldron, of the Army Design Establishment, in a paper on interference suppression of military vehicles. The reference stated that it was "somewhat better" than distributed resistance cable, but that it was relatively costly.

When the more recent references appeared the writer was inspired to try to find out more about it and, particularly, whether it was available in Australia. We also wrote to MAS Manufacturing Ltd, requesting any technical information they could supply.

At the same time we approached a number of local cable distributors and manufacturers, in an effort to find a local source, if one existed. In the latter respect the exercise served only to confirm what we feared; no one had even heard of the product, let alone being able to nominate a source!

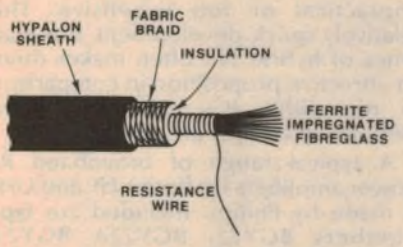
The only bright spot was that one firm, Beale Prichett Pty Ltd, 2b Northcote St, St Leonards, NSW, showed sufficient interest as to contact their principals in the US and enquire whether such cable was available, and the likely cost structure in Australia.

Several months later, at the time of writing, both steps have paid dividends. MAS Manufacturing have replied with some limited, but useful, technical literature, while Beale Prichett have located a source of the cable and are negotiating price structures, order quantities etc. Hopefully, they may find it a proposition to import it.

What is the idea behind inductive ignition cable, what does it consist of, and how good is it?

The idea behind the cable appears to be fairly basic. While resistance in a cable can provide a certain order of suppression, there is a limit to the resistance value beyond which engine performance is likely to be impaired. We cannot go beyond this.

Inductance on the other hand can more easily discriminate between the wanted current, across the plug gap, and the unwanted currents, resulting from it, which occur at a much higher frequency. On this basis suppression should be more effective as the frequency increases, and this seems to be borne out in practice.



Construction of the inductive ignition cable. The core is very much finer and consists of many more strands than can be shown in a simple drawing.

A sample of the cable we have seen consists of a central core of very fine fibreglass filaments, impregnated with ferrite, over which is wound a coil of fine resistance wire. (About .09mm or 39B&S.) Over this is the main insulating material, then a layer of fabric braid, and an outer covering of Hyperlon.

The resistance is low, at about 1700 ohms per metre, compared with carbon track leads at between 10,000 and 20,000 ohms per metre, but it still reinforces the inductive effect.

Mechanically, it would appear to be superior to the carbon resistance type cable, which can be damaged by careless handling, and is also less likely to deteriorate with age, as some authorities claim can happen to carbon leads.

How good is it? Unfortunately, we have not had the opportunity to make as many tests as we would like, due mainly to very limited supplies of sample cable available at the moment. Most of our assessment is therefore based on overseas reports.

It appears to be popular in Europe, where it is fitted as standard to many locally manufactured cars. In fact, according to MAS Manufacturing, a total of 27 car manufacturers, world-wide, are using it.

It is generally regarded as being most effective in the VHF band (30 to 300MHz). Indeed, it is considered to be less effective at HF than the conventional resistive cable. Where both VHF and HF suppression are required, it is recommended that additional resistive suppression be added, to bring the resistance up to conventional values.

This limited HF performance may be responsible for a couple of reports, including the one from the Army Design Establishment, which suggested only a limited improvement. On the other hand, the European car manufacturers appear to have adopted it to meet legislative requirements, in some countries, covering interference to TV signals.

In addition, there was the previously mentioned report from the American amateur who found it the only solution to a particularly stubborn case of interference on the two-metre band, which had defied most of the accepted suppression methods.

Our own tests were made using a few metres of sample cable which Beale Prichett had obtained from the US. They were conducted on a four cylinder Torana fitted with conventional resistive cable, using an Icom 22S 2-metre transceiver.

Unfortunately, the tests proved inconclusive. The level of ignition interference was not high anyway, but our reaction was that the new cable gave exactly the same results as the original resistive cable.

We hesitate to condemn the cable on the basis of only one test, particularly in view of the favourable reports from overseas. Beale Prichett are still negotiating with their US principals for more technical information and a more useful amount of sample cable, with which to conduct additional tests.

And that, at the moment, is about all we can tell you. If we have an opportunity to make more tests, and the results are worth reporting, we will certainly do so.

In the meantime we suggest you keep your eyes open for any other references and, particularly, for any local source.

We still think it would be worth trying when all else fails.

Broadband RF power amplifiers

A range of broadband RF power amplifier modules for VHF and UHF communications equipment is now available from Philips. The devices are based on hybrid IC technology, operate directly from 12V vehicle electrical systems, and have power outputs ranging from 2.5W to 23W (typical) for a range of frequencies.

by GREG SWAIN

Until recently, if you wanted a few watts of RF power you had to employ an RF amplifier based on discrete components. The circuit had to be carefully designed, built and adjusted in order to obtain optimum performance, and special protection circuitry had to be incorporated to protect the circuit against wide variations in load impedance.

This made RF amplifiers quite expensive when compared to other electronic circuits of similar complexity. In addition, they tended to be fairly bulky, a definite drawback where mobile communications equipment is involved.

In recent years, these drawbacks have been largely overcome. Thanks to modern hybrid IC technology, the design engineer can now choose from a range of broadband VHF and UHF power amplifier modules to suit his particular requirement. These hybrid IC modules have several advantages over their discrete component counterparts including lower cost, more compact size, greater reliability, and reduced assembly and troubleshooting time.

The hybrid IC modules have better performance too. The tuned circuits are etched directly onto a ceramic or PC substrate and are accurately tuned during manufacture. The tuning is effectively locked in — there are no coil slugs to adjust or to drift out of tolerance.

Let's back up a little and find out what a hybrid IC is.

A hybrid integrated circuit is a small encapsulated module containing a substrate of integrated conductors, designed to accept a variety of semiconductor chips and miniature components. A variety of substrates, encapsulations and pin-formats are possible. The added components can be capacitors, diodes, transistors in SOT packages, MOS and bipolar monolithics in SO packages, or MOS and bipolar naked chips.

The components themselves are automatically positioned and fixed into place during the manufacturing process. Electrical connections to the substrate conductors are made either by reflow soldering or wire bonding, the method depending upon the type of component and the product specification.

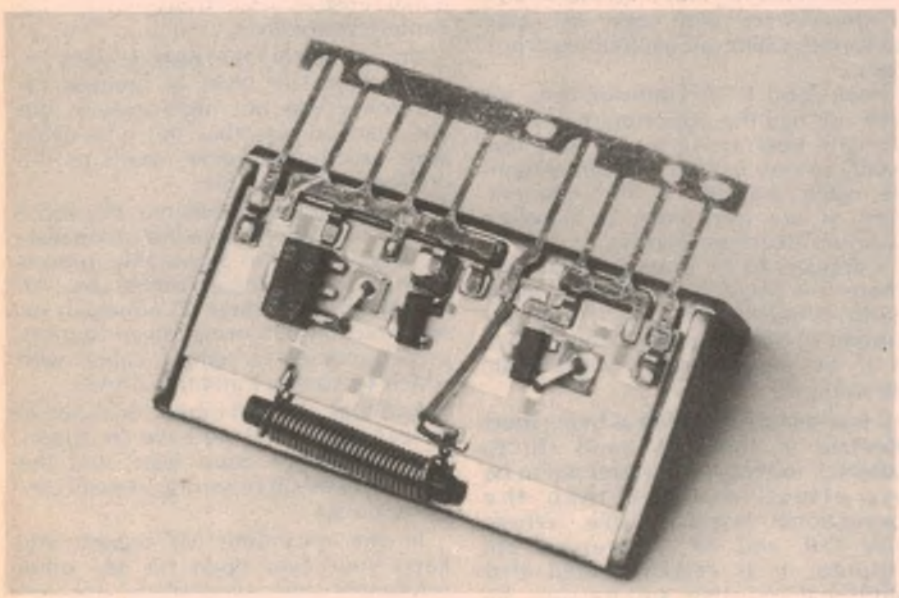
Reflow soldering or parallel-gap soldering is also used to attach the leadframe to the substrate. The completed IC is then encapsulated in some suitable material, either resin, plastic, metal or ceramic.

A number of technologies are possible in a single package. The speed of bipolar, the low power of MOS and the high impedance of FETs can be brought together, for example. In short, hybrids give the flexibility of discrete components while approaching the small size and reliability of monolithic ICs.

When is a hybrid IC used? The answer is when a discrete component circuit would be too bulky or too unreliable, and a monolithic IC would be impractical or too expensive. The relatively quick development and lead times of hybrid ICs often makes them an attractive proposition in comparison to monolithic ICs, especially when medium quantities are required.

A typical range of broadband RF power amplifiers for both VHF and UHF is made by Philips. Included are type numbers BGY22, BGY22A BGY23, BGY23A, BGY32, BGY33, BGY35, BGY36, BGY38 and BGY41. The latter is designed for UHF work; the other types are all for VHF.

A range of wide-band VHF/UH



OM337 hybrid IC amplifier module. This three-stage design covers frequencies from 40-860MHz, and is designed for use in MATV systems and as a general purpose VHF/UHF receiving amplifier. Gain is typically around 26dB.

receiving amplifiers using similar hybrid IC technology is also offered. These are usually designated by an "OM" type number and are mainly intended for use in mast-head booster amplifiers and as preamplifiers for MATV systems. Typical type numbers are OM320, OM321, OM322, OM335 and OM337.

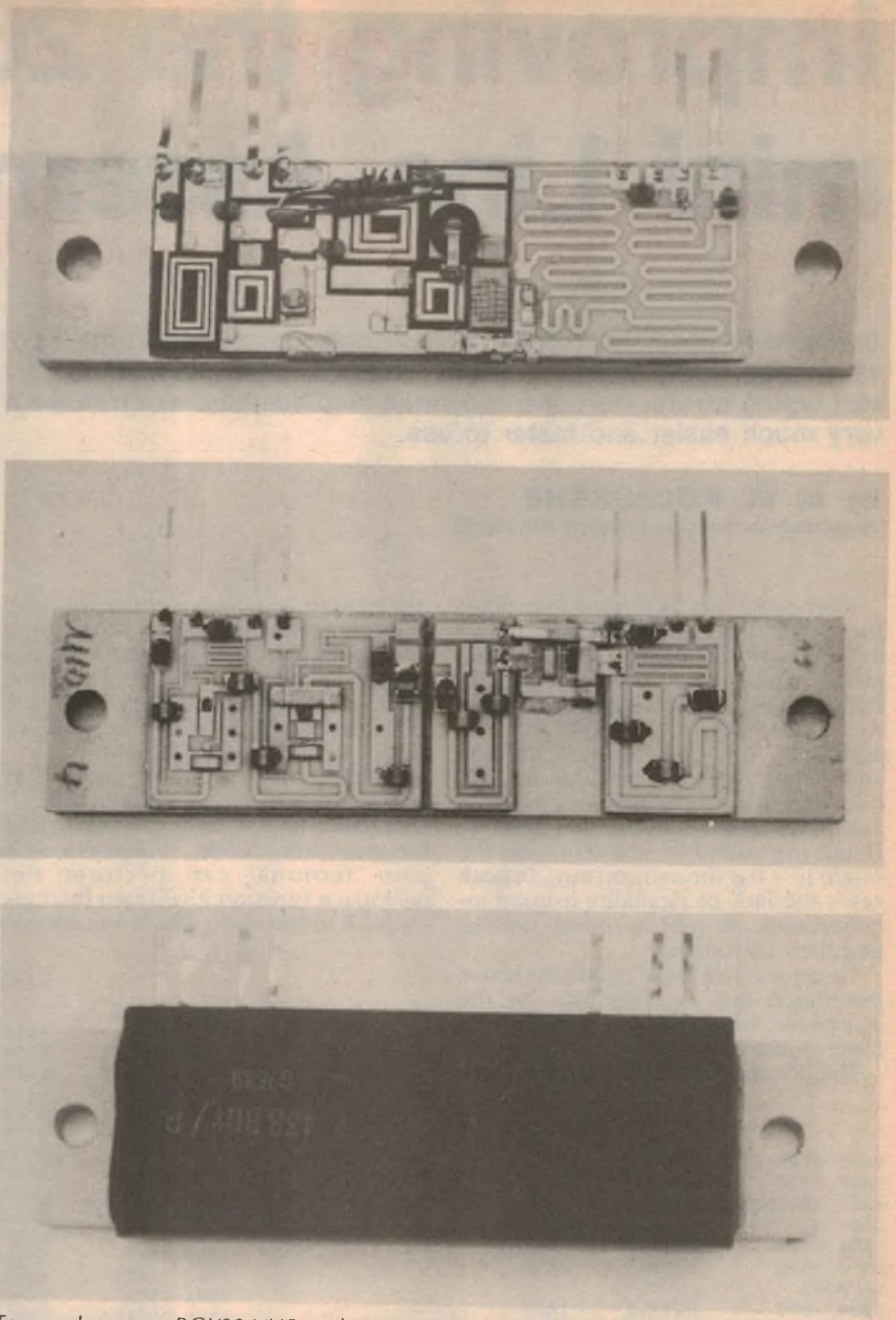
Specifications for the BGY series devices are set out in the accompanying table. All are designed for class C operation and offer typical power outputs ranging from 2.5W up to about 23W. Drive powers are in the range 100-150mW for type numbers BGY32-36. Types BGY22(A) and BGY23(A) are designed for cascaded operation; i.e. the 2.5W output of the BGY22(A) can be coupled directly into the BGY23(A) for an output of 7W.

Physically, the BGY32-36 series and the BGY41 are made up of one or more rectangular substrate modules mounted on a metal flange. This flange measures 68 x 17mm, is about 3.5mm thick, and provides good heatsinking capability and mechanical rigidity. It is made of gold plated copper. A hole is drilled at either end of the flange to allow convenient mounting.

As for the electronics, this consists of a two stage RF amplifier using NPN transistors, together with lumped-element matching components. An interesting point here is that the driver and output transistors are run off separate supply lines. By varying the driver supply voltage, the designer can provide both high and low power capability from the same module.

The completed modules are capable of withstanding load mismatches of up to 50 VSWR for short periods, provided the matched RF output power rating is not exceeded. To ensure good thermal transfer, the module should be mounted onto a heatsink, with heat conducting compound between the module and the heatsink.

So there you have it — a range of rugged RF power amplifiers to suit a variety of design situations. For further information, contact Philips Electronic Components and Materials, 67 Mars Rd, Lane Cove, NSW 2066.



Top and centre: BGY38 VHF and BGY41 UHF power amplifier modules before encapsulation. The photo immediately above shows how the modules look after encapsulation.

Type number	Mode of operation	Frequency MHz	Supply voltage	Drive power (mW)	Load power (W)	Load impedance
BGY22	c.w.	380-512	13.5	50	2.5	50
BGY22A	c.w.	420-480	12.5	50	2.5	50
BGY23	c.w.	380-480	13.5	2.5W	7	50
BGY23A	c.w.	420-480	12.5	2.5W	7	50
BGY32	c.w.	68-88	12.5	100	23	50
BGY33	c.w.	80-108	12.5	100	22	50
BGY35	c.w.	132-156	12.5	150	22	50
BGY36	c.w.	148-174	12.5	150	21	50
BGY38	c.w.	156-163	13.5	250	31	50
BGY41	c.w.	400-512	13.5	150	13	50

Improving the 2650 mini Line Assembler

If you have used the 2650 Mini Assembler described in the April 1979 issue, you'll know it is a little inflexible when you want to correct typing errors. Here are two small modifications which make it very much easier and faster to use.

by A. M. KOLLOSCHE
Higginbotham Avenue, Armidale NSW 2350

After using the 2650 Mini Assembler for a while, I became a little irritated by its lack of any facility to let you correct minor typing errors as soon as you notice them, before the end of the line. As you'll know if you've used the assembler, you have to finish the line and either reset the original to step back and re-type the line (assuming the assembler doesn't throw you out), or restart the assembler and also reset the origin (if it *has* thrown you out). In both cases the lack of flexibility is quite inconvenient, as well as being tedious and time consuming.

To get around these problems I have developed two modifications for the assembler, which make it considerably faster and more convenient to use.

The first modification is to the line input routine. Its effect is to let you step back along the line input buffer, using "delete" (rubout) characters. So if you spot a typing error before you have finished a line, you can step back to it and then type the rest of the line again before typing a carriage return.

Actually the modified routine is arranged to echo "backspace" characters to the terminal, instead of the incoming "delete" characters, so if your terminal can perform the backspace function it will step the cursor back to show you where you are going. With terminals which don't perform backspacing you'll have to count back yourself, but this is usually no problem.

A disassembler listing of the modified input routine is shown below. It is one byte longer than the existing routine, ending at X'1AFF instead of 1AFE.

The second modification is a little more elaborate. It involves an additional error handling routine, a modified starting sequence and a couple of subroutines, together with changes to all the error throwout addresses.

The idea of this modification is that instead of throwing you right back to PIPBUG when it finds an error, the assembler now prints a curt "? ERROR" message, and reprints the address of the line concerned so you can re-type it correctly.

The disassembler listing for this modification is also shown below. I think you'll find it worthwhile.

```
                    *MODIFIED LINE INPUT ROUTINE
1ACD 0700       LODI,R3   00
1ACF E73C       COMI,R3   3C
1AD1 1C15B0     BCTA,Z    15B0
1AD4 3F0236     BSTA,UN   0236
1AD7 E47F       COMI,R0   7F
1AD9 9303       BCFR,Z    1AE6
1ADB 03         LODZ,R3
1ADC 1871       BCTR,Z    1ACF
1ADE 0408       LODI,R0   08      MOD BEGINS HERE
1AE0 BBA0       ZBSR      *0022   PRINT BACKSPACE
1AE2 A701       SUBI,R3   01      DECREMENT BUFF PTR
1AE4 1B69       BCTR,UN   1ACF    & LOOP BACK
1AE6 0503       LODI,R1   03
1AE8 ED7AC9     COMA,R1   1AC9#
1AEB 1809       BCTR,Z    1AF6
1AED F979       BDRR,P    1AE8
1AEF CF7A02     STRA,R3   1A02#
1AF2 BBA0       ZBSR      *0020
1AF4 DB59       BIRR,UN   1ACF
1AF6 CF0429     STRA,R3   0429
1AF9 CD042A     STRA,R1   042A
1AFC 0700       LODI,R3   00
1AFE 9BA5       ZBRR      *0025
```

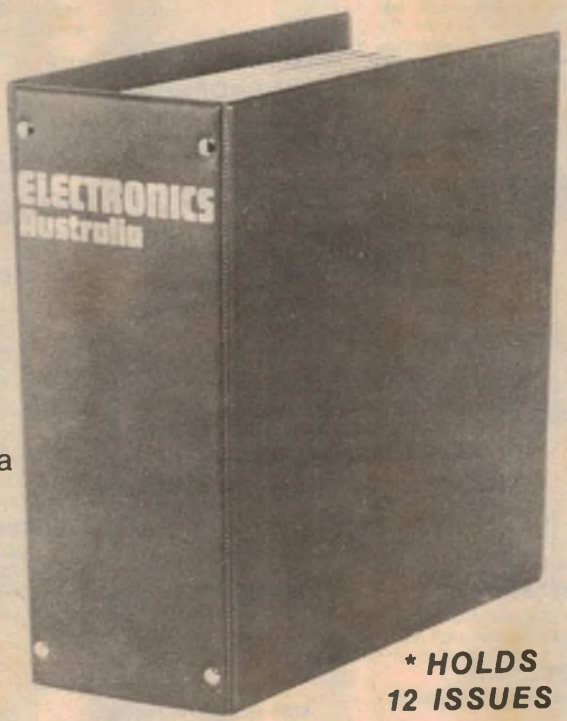
ABOVE: A disassembler listing of the modified line input routine, which lets you step back to correct typing errors.

RIGHT: A similar listing of the modifications to allow you to re-type lines that are thrown out by the assembler. It now types "?ERROR", and repeats the address.

```
                    *MODIFICATION FOR IMPROVED ERROR HANDLING
159E 00 00
                    *LOAD & STORE SUBR
15A0 0D040D     LODA,R1   040D
15A3 0E040E     LODA,R2   040E
15A6 C976       STRR,R1   159E
15A8 CA75       STRR,R2   159F
15AA 17         RETC,UN
                    *LOAD ADDR SUBR
15AB 0971       LODR,R1   159E
15AD 0A70       LODR,R2   159F
15AF 17         RETC,UN
                    *NEW ERROR HANDLING ROUTINE
15B0 75FF       CPSL      FF
15B2 740F       CPSU      0F
15B4 0503       LODI,R1   03
15B6 0D75C3     LODA,R1   15C3#
15B9 BBA0       ZBSR      *0020
15BB F979       BDRR,P    15B6
15BD BBA5       ZBSR      *0025
15BF 3B6A       BSTR,UN   15AB
15C1 1F160C     BCTA,UN   160C
                    *ERROR MESSAGE
15C4 524F52     ROR
15C7 524520     RE
15CA 203F        ?

                    *MODIFIED START SEQUENCE
160C 3BF0       BSTR,UN   *15FE
160E 3F15A0     BSTA,UN   15A0   GO TO NEW SUBR
1611 3BDC       BSTR,UN   *15EF
1613 02         LODZ,R2
1614 C1         STRZ,R1
1615 3BD8       BSTR,UN   *15EF
1617 042E       LODI,R0   2E
1619 3F02B4     BSTA,UN   02B4
161C 3BD3       BSTR,UN   *15F1

MODIFY THE ERROR THROWOUT ADDRESS TO X'15B0
AT THE FOLLOWING LOCATIONS:

162F-30  16BA-BB  1704-05  1745--46
17B0-B1  1A93-94  1AD2-D3
```

Don't let your valuable issues go astray

ELECTRONICS AUSTRALIA BINDERS



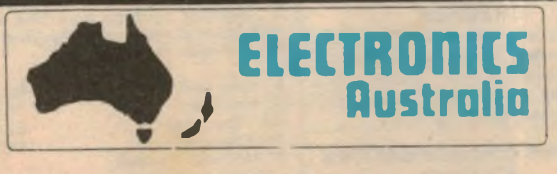
These attractive binders finished in brown plastic with gold lettering will keep your back issues of Electronics Australia neat and tidy.

*** HOLDS 12 ISSUES**

Available from
Electronics Australia,
57 Regent St, Sydney. PRICE: **$4.50**
or by mail order from Electronics Australia, P.O. Box 163, Beaconsfield 2014.
PRICE **$5.50** NSW: **$6.50** other states;
or 6 for: **$28.00** NSW; **$30** other states.

*Magazines prior to April 1971 will need to be trimmed to fit binder

SUBSCRIPTION SERVICE



Subscription Rates
$18.00 per year within Australia.
$A21.00 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

BRASS SHIPS CLOCKS SMITHS 8 DAY 7 INCH DIAMETER $110

Post A $1.75; B $3.00; C $3.60

GENUINE EX ARMY WRIST WATCHES

Complete with nylon band $19.50
Post $1.10

P.M.G. TYPE TELEPHONES

Standard desk type with magneto bell calling device. Range 30 miles. Uses standard batteries at each phone. Any number can be connected together on single line **$39.50**

(2 TELEPHONE SETS)

$2 Cartage to Rail. Freight payable at nearest attended Railway Station.

RECEIVER No. 210

2-16 M/cs **$75**
Transmitter No. 11 suits 210 **$35**.
24 volt Power supply to suit above **$15**.
Or complete station with Headphones, Mic **$110**

EX ABC MAGNETIC RECORDING TAPES ¼"

PROFESSIONAL QUALITY

5" x 600' **$1.50**
7" x 1200' **$2.75**
P + P $1.30
10½" x 2400' $7.95
P + P A $1.65 B $2.75 C $3.10

COLLINS INDEPENDENT SIDEBAND TRANSCEIVER TRC/75

Fully synthesised transceiver with am, upper, lower and independent sideband operation. 1KHz steps from 2MHz to 29.999MHz. 1 microvolt sensitivity. 2.5KHz bandwidth ssb. 6KHz bandwidth AM. 1 RW. PEP max. output. Fully automatic tuning of both transmitter and receiver from remote control unit. Complete with automatic aerial coupling unit, mic, headset, etc. 400Hz supply.

Ideal for amateur use

PRICE $750

COLLINS SYNTHESISED SB RECEIVER

TRC/75 receiver section of transceiver specification as above.

PRICE $400

TELEPHONE WIRE

1 mile twin (2 miles) genuine ex-Army Don. 8 perfect condition **$45.00** per drum. **$5.00** cartage to rail, freight payable at destination.

20X to 60X ZOOM TELESCOPE

With Tripod. **$115.50**
Post **A$2.25, B$4.10, C$6.10**.

RCA 44BX MICROPHONES

PROFESSIONAL QUALITY $75
P&P A $1.80, B $3.50, C $4.55, D $4.55

AERIAL CAMERAS

WITH 8" FL 3" DIAM. LENS F24 MARK IV 2.9 LENS STOPS 11, 8, 5.6, 4, 2.9 — **$75**
$2 cartage to rail freight. Payable to nearest attended railway station.

PENTAC LENSES

3" DIAM. 8" FL WITH DIAPHRAGM STOPS 11, 8, 5.6, 4, 2.9 MOUNTED IN METAL HOUSING — **$65**
POST A $1.85, B $3.25, C $4.10

PRISMS

4" SQUARE FACED RIGHT ANGLE PRISMS TOP QUALITY EX AIR FORCE — **$65**; OR LENS & PRISM FOR **$120**
POST A $1.75, B $3.00, C $3.60

SOLENOIDS

200 MA 24 volt. ⅛in push movement. **$2.50** P+P 80c

NIFE CELLS

1.2 volt, fully charged, 4in x 3in x 1in 4 AH
$1.50 each P&P 80c

CENTRE DRILLS

15/64 x 15/64
Carbon steel **$4.00** doz, Post 60c

ARTILLERY DIAL SIGHTS MK2

Can also be adapted as a Dumpy Level or as base for a telescope has full 360° 5" diam. gunmetal rotating circle. Adjustable elevation and depression. Has top grade ¾" diam. object lens F.L. 10" with cross hairs, eyepiece, ½" right angle prism — height 10" — weight 3½kgs. With leather carrying case. Original cost $300
Our Special only **$27.50**
P&P A $2.25 B $4.00 C $6.00

POSTAGE KEY:

A: NSW
B: Vic, Qld, SA
C: NT, Tas
D: WA

VALVES

BRAND NEW

6SN7	$1.95	6BM8	$1.95
5U4	$1.95	6GV8	$1.95
EF50	$1.50	6AK5	$1.95
		1H6	$1.50
2x2	$1.50	832	$5.00
	P+P 80c		
6x4			$1.95
VR65			$1.50

STC HIGH IMPEDANCE HEADPHONES

3400 ohms, brand new, only **$5.95** pair.
P&P A $1.65, B $2.75, C $3.10

WRIST WATCHES SWISS JAEGER

Le Coultre ex RAAF rated one of the world's best in smart chrome case with black dial. Original cost $250

SPECIAL **$49.50**
Post **$1.30**

PRISMATIC TELESCOPES

15 x 50 Ex RAN — black enamelled brass. Length 16", weight 5kg. Price **$39.50**.

$2 cartage to rail, freight payable at nearest attended railway station.

ZOOM FOCUSING MICROSCOPES

Zoom focusing microscopes, 750X battery and mirror illuminated $31.75. Zoom 1200X similar to above $47.95.
P&P A $1.65, B $2.75, C $3.10

DIRECTOR LEVELS

Ex Army No 9 with azimuth horizontal circle and vertical adjustment suits all types of levelling. In leather case **$90**.

P + P A**$1.75** B$3 C$3.60.

ZOOM SPOTTING SCOPES

30 x 30
LENGTH 12½", HEIGHT 10"
WEIGHT 1¾ lb
$32.50

45 x 40
Length 16in
Height 10in
Weight 2lb
$49.50

High grade coated lenses ideal for pistol and rifle ranges or general viewing. Zooms in from very low to high powers. Complete with tripods.
POST A $1.75, B $3.00, C $3.60

TELESCOPES

25 x 30 $13.50
P&P A $1.30

SPY TELESCOPES

8 x 17 mag size of a rifle cartridge extends to 8". Only **$8.95** each, post 60c.

BINOCULARS

PRISMATIC Coated Lenses. Brand new. Complete with case.

8 x 30	$42.00		
7 x 50	$48.95	P&P	
10 x 50	51.00	A	$1.75
12 x 50	53.00	B	$3.00
20 x 50	65.00	C	$3.10

SMALL CLIP-ON POCKET TELESCOPE

15X **$7.00**, P+P 80c

THEODOLITES

Made by Wilds Microptic with tripod. Model T2 reads down to one second of ARC **$1000** (Usual Price **$3200**)

Freight payable at nearest attended R'way Stn.

C42 set 36 to 60M/Hz with 24 volt power supply headphone mic leads etc. **$95**.
Or 42 set separate **$65**.

AIRCRAFT INSTRUMENTS

Directional Gyros
AN5735-1 Air Operated
$35
Sperry Artificial Horizon
AN5736-1 Air Operated
$45.
Slip and Turn Indicators
$17.50.
P&P
A $1.65, B $2.75, C $3.10

MAGNESIUM DRY CELL BATTERIES Suits PRC25 and dozens of other uses. 15 volts long life.
Only **$1.50** each. P & P A **$1.35**, B **$2.75**, C **$3.60**.

ANEROID BAROMETERS

In brass case, made in London, **$39.50**
P&P A **$1.65**
B **$2.75**
C **$3.10**

CONDENSER LENS

2" diam. 2" F.L. **$1.50** each or **$2.50** per pair. P&P 80c

IMPELLER PUMPS

New gunmetal body. Stainless Steel Shaft. Neoprene Impeller. Up to 15ft Lift, suitable for almost any type of liquid. Self priming. Ideal boat bilge pump, sullage drains, etc. Approx. size 8" x 5".
⅜" **$35.75**, ½" **$51.00**, ¾" **$56.50**.
P+P: A $1.95, B $3.50, C $4.60

Liquid filled compass

With magnified lens sight and degree reader.
Only **$7.95** each. Post $1.30

POLARITY & CURRENT CHECKER

3 volt to 400 volt. Simple leads and prods quickly determines positive or negative with illuminated indicators, also checks AC current and intensity, fully insulated only **$4.95**, pp $1.30

COLLINS COMMUNICATIONS RECEIVER

Type SIJ-4
500kHz to 30mHz
$350.00

MARCONI SIGNAL GENERATOR

Brand new type TF801A-1 Range 10 to 310MHz Continuous. Complete in original case — with instruction book, power leads, spare valves, etc.

$600 value!
only **$195**

$2.00 cartage to rail. Freight payable at nearest attended railway station.

16MM SOUND PROJECTORS IN GOOD WORKING ORDER

240 volts operated complete with Speaker and Amplifier.

SIEMENS **$375**
BELL & HOWELL **$195**.
$1 Cartage to Rail. Freight payable at nearest attended Railway Station.

SELSYN MOTORS MAGSLIP

TRANSMITTER 3" MK2 $20.00

Post Packing A $1.75, B $3.00, C $3.10

MAGNIFYING GLASSES

4" Magnifier suspends from neck and rests on chest, leaves hands free ideal for mum or gran, sewing, etc **$6.30**

4" Hand held	$5.95
3" Hand held	$3.80
2½" Hand held	$2.65
3¼" Rectangular	$4.25
4" Magnifier on stand leaves hands free	$10.75
Illuminated 10 x power magnifier	$6.60

Postages $1.30 extra

Deitch Bros.

70 OXFORD STREET, SYDNEY 2010

SORRY NO C.O.D.

MARKETPLACE

DISPLAY ADVERTS IN MARKETPLACE are available in sizes from a minimum of 2cm x 1 col rated at $11 per col cm.

Please state classification: For Sale, Wanted, Reader Service, Position Vacant, Position Wanted, etc.

CLASSIFIED RATES $2 per line per insertion payable in advance. Minimum two lines.

CLOSING DATE is six weeks prior to the on-sale date. Issues are on sale the first Monday of each month.

ADDRESS all classified orders, copy, enquiries, etc. to: The Advertising Manager, **ELECTRONICS AUSTRALIA**, Box 162, Beaconsfield 2014.

FOR SALE

COMPUTER CASSETTES: QUALITY PECOS C 10 BLANKS $4.50 for package of four or $10.95 (leaderless) plus 90c postage & packaging. Quantity discounts available on request. Please make Cheque/Money Order payable to PECOS, PO Box 382 Royal Exchange, Sydney 2000.

MICROCOMPUTER: Processor Technology SOL System including 8080 processor and S100 bus, 48k RAM, dual single density North Star drives and controller, monitor — as new top quality equipment. Phone (03) 568 4022, 10am—6pm Monday to Friday.

COMPUTERIZE your club, society or association's membership mailing list. Address changes made easier. Adhesive labels & printouts available at short notice. Moderate charges. Write: PO Box 9, Crows Nest, NSW 2065. Phone: (02) 437 6681.

RESISTOR SALE

Top quality ½W carbon film resistors. 10 ohm — 10 Megohm 3c ea; or $2.50 per 100. No minimum quantity. Will mix any values. Get some of these now & avoid paying top dollar for these common components.

If you are a beginner, seasoned hobbyist or just want to stock up, we have available packs of 100 most commonly used resistors at $2.50.

First 100 purchases of $10 & above will receive a free veroboard pin insertion tool. One PP charge of $1.00.

R & C Electronics,
PO Box 68, O'Halloran Hill, SA 5158.

APOLOGY

SHERIDAN ELECTRONICS OF 164 REGENT ST, REDFERN 2016 HEREBY OFFER THEIR APOLOGIES TO DICK SMITH ELECTRONICS FOR THE USE OF THEIR DRAWING WITHOUT APPROVAL OF THE RUBYCON 3,300uF 50V ELECTROLYTIC CAPACITOR, AND AS ADVERTISED BY US IN THE AUG 79 ISSUE OF "ELECTRONICS AUSTRALIA".

Japanese Transistors & IC's

Catalogue — Send 40c (Aust) stamp

CTV Transistor prices:

2SC 1106	$3.10	2SC 1325	$5.60
2SC 1114	$6.00	2SC 1413	$6.50

Min Order $10 plus $1.50 post. Bank Cheques, money orders in Australian dollars.

N. NAKAGAMI
457-22 Hasama-cho
Kasugai, Aichi-ken JAPAN 487

JAPANESE SEMICONDUCTORS for CBs, Car Radios & Televisions, etc. 2SD350 $8.00; 2SC710 $0.39; 2SC1061 $2.63; 2SC1306 $1.80; 2SC1307 $4.80; 2SC1969 $5.48; 2SC2166 $2.80; AN214Q $3.80; BA521 $3.80; uPC575C2 $2.80; uPD858C $9.52; uPC1001H $3.53; uPC1020H $3.60; uPC1025 $3.10; HA1322 $4.80; HA1339 $4.80; HA1342 $4.80; LA440 $4.80; LA4430 $4.20; AN7150 $4.25; TA7204P $3.60; TA7205P $3.25; uPD40013 $13.65; LA4420 $4.20; MM5316 $6.00; MM5387 $6.00.

Special for February (expires 29th) PLL-02AG (normally $8.60) $6.50; limit of one per order at special price.

Many other types stocked. Minimum post & pack $1.00, add extra for large orders. 24 hour return service. Trade Enquiries welcome.

ZL VK Electronic Services, (Mail Order Division), PO Box 221, Summer Hill 2130.

ELECTRONIC ORGANS — Build your own! Send 45c stamp for full details of the SCHOBER (USA) organ kits. Schober Organs (Aust), PO Box 22, Guildford NSW 2161. (Established 21 years.)

TRS 80 — 16k memory upgrade for sale — 8 x 4116s plus switches for $110. Installation $25 extra. P. Stephenson, 34 Maple St, Blackburn, 3130. (03) 878 2628.

READER SERVICE

AUSTRALIAN TAPE MAKERS SOCIETY invites you to join others in this new club. Enter a whole new world through your tape/cassette recorder. Information and membership application form from the Secretary, PO Box 74, Umina Beach, NSW 2257.

Z80 — 8080 AND SC/MP Programs Disassembled from listing $20 per K (Hex or Octal) or from E Proms 2708-2716 or 5204 $10 per K. TRS 80 Basic or machine code programs to your requirements. Also machine code programs for above processors. Write to Micro-Assistance, PO Box 49, Sandy Bay, Tas 7005.

AN INTRODUCTION TO DIGITAL ELECTRONICS

You don't need any previous knowledge of digital electronics — the book starts you right from scratch, and covers all of the basic concepts you need.

Available from "Electronics Australia", 57 Regent St, Sydney. **PRICE $3.50** OR by mail order from "Electronics Australia", PO Box 163, Beaconsfield, 2014. **PRICE $4.10.**

"ELECTRONICS AUSTRALIA" PROJECTS & CIRCUITS NO. 2

Available from "Electronics Australia", 57 Regent St, Sydney **PRICE $3.00.** OR by mail order from "Electronics Australia", P.O. Box 163, Beaconsfield, 2014. **PRICE $3.60.**

BOOMERANG TAPE RECORDING CLUB — full details, 9 x 4 SAE PO Box 118, Wellington, NSW 2820.

COMPUTER PROGRAMMER: Do you have a level II TRS-80 with Disc System and wish to make money programming part-time? Telephone Ken Chandler (03) 428 1831.

Buy your copy now of the "ELECTRONICS Australia"

LOG BOOK

Designed for use by licensed amateurs, DX listeners and CB operators.

More than 50 pre-ruled log pages on high quality paper, plus Australian & New Zealand radio and TV stations, FM Data, Frequency Spectrum Chart, Amateur Repeaters, Commonwealth Prefixes, CB Operating Data and more . . .

Direct from "Electronics Australia", PO Box 163, Beaconsfield 2014.

$2.95 (post free)

don't exactly know what this does technically as I am only an amateur. I found out only by accident about this because without it I have no control over it and it goes haywire (LEDs flickering here there and everywhere). I have no IR filter on the unit yet, maybe that would make a difference. This filter is very hard to obtain in Melbourne.

As regards to the remote control, an employee of Dick Smith's in Melbourne told me that a friend of his said that the photodiode (BPW34) is in fact not a diode but a photovoltaic cell. Apparently this chap is into this sort of thing and also says that by using this (photocell) the best you can hope for is a range of about 1m because IR has very little effect on it. Could you please advise me. (F.S., Boronia Vic.).

● Starting with point (b) we find it difficult to believe it worked at all with the 100k resistors mentioned removed. The 100k resistors are simply in series with the RCA inputs; if they were removed there would be no output. We can only suggest that you may have the unit incorrectly connected to your stereo.

As far as points (a) and (c) are concerned, they are related. The low range is a direct result of the 50k trimpot which you inserted in the circuit. This also has the effect of reducing the gain of the receiver, not to mention altering the bandwidth.

The flickering of the LEDs is to be expected if an infra-red filter is not used; in fact the filter is extremely important for proper operation. If you cannot obtain the filter material from a photographic store then we suggest that you replace the BPW34 with a BP104 which has an integral infra red filter, as mentioned in the original article.

Finally the information you were given about the BPW34 not being a photodiode, and that it is insensitive to infra-red is incorrect. It most certainly is a photodiode and one that is specifically intended for infra-red applications — it has a peak spectral response of 850nm which is well into the infra-red region of the spectrum.

LF & VLF RECEPTION: Some time ago I built the LF and VLF Converter (March 1976, File No 3/CV/3). With a 15m wire antenna, I fed the converter into my Drake SSR-1 receiver and I received a number of LF stations, both local and interstate with reasonable clarity. However, during evening hours reception was generally unsatisfactory because of noise and interference from local MF stations. I decided to try the RF Preselector (April 1979, File No 2/SW/76) by adapting it to the LF band.

Instead of the ferrite rod antenna I used a coil consisting of 230T of 30B&S enamel wire close wound on a former made from a 100mm length of 50mm OD PVC electrical conduit. An antenna primary winding of 45T was wound over the earthy end of the large winding, with a strip of paper insulating the two windings. The input winding for the gate of the FET is 30T spaced about 5mm from the other windings. Tuned with a 415pF variable capacitor, the main winding covered about 200-400kHz. The 30pF trimmer was deleted and a low pass filter consiting of a 2.5mH RF choke and a .0015uF capacitor was placed between the antenna and the coil winding.

The RF preselector, the LF converter and the receiver were coupled together with 50 ohm coaxial cable. With this set up and using the same wire antenna as before, many LF stations, local and interstate were received satisfactorily.

Using the LF converter down to the VLF band, I have been able to tune NWC (North West Cape) on 22.3kHz, the Naval station in Canberra on 44kHz and NAA (Cutler, Maine, USA) on 17.8kHz. In the future I intend to experiment further with the RF preselector for use on this band as well. (A.A. Lindisfarne, Tas).

● Thank you for your interesting letter A.A. As you can see, we have had to reduce the length of your letter but we have given enough information so that interested readers could duplicate your arrangement. Incidentally, there are a number of other VLF stations which you should be able to receive. In addition to the American VLF stations, NWC and NAA, they have several others. Try listening on 17.4kHz, 18.6kHz, 21.4kHz, 23.4kHz and 24.0kHz, as well as GBR in Rugby, England, on 16.0kHz. Oh yes, there is Omega too!

ELECTRONIC BONGOS: Back in 1970 I made a suggestion regarding the bongos published in the April, 1970 issue. This suggestion was the fitting of a third plate between the two existing touch plates so as to eliminate the need for a separate hand-held wire.

The same set-up can be used again with the bongos published in the Dec. '79 issue.

The etched PCB could be divided into three separate plates with the centre plate connected to the +9V line. In use, two or more fingers are made to bridge the gap between the centre and either of the two outer plates using skin resistance. (K. Y. Nunawading, Vic.).

● This idea was tried when the bongos were first designed but was considered to be impractical since we found hand movement is restricted. We leave it up to the reader to decide.

Electronics Australia Reader Services

If you are unable to complete an "Electronics Australia" project because you missed out on your regular issue, we can usually provide emergency assistance on the following basis:

PHOTOSTAT COPIES: $2 per project, or $2 per part where a project spreads over multiple issues. Requests can be handled more speedily if projects are positively identified, and if not accompanied by technical queries.

METALWORK DYELINES: Available for most projects at $2 each, showing dimensions, holes, cutouts, etc., but no wiring details.

PRINTED BOARD PATTERNS: Dyeline transparencies, actual size but of limited contrast: $2. Specify positive or negative. We do not sell PC boards.

PROJECT QUERIES: Members of our technical staff are NOT available to discuss individual projects, either in person at our office or by telephone.

REPLIES BY POST: Limited to advice concerning projects published within the past two years. Charge $2. We cannot provide lengthy answers, undertake special research or discuss design changes.

BACK NUMBERS: Available only until our stocks are exhausted. Within three months of publication, face value. Four months and older, if available, $2 (includes storage fee). Post and packing 60c per issue extra.

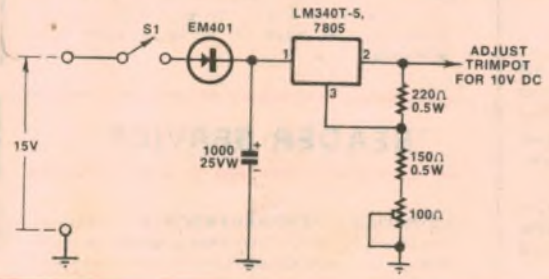
OTHER QUERIES: Technical queries outside the scope of "Replies by Post" may be submitted without fee, for reply in the magazine, at the discretion of the Editor.

COMMERCIAL, SURPLUS EQUIPMENT: No information can be supplied.

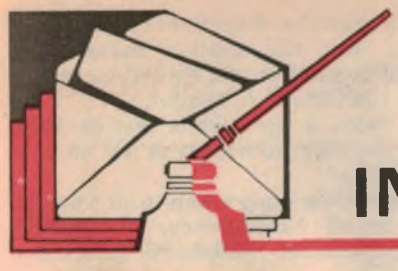
COMPONENTS: We do not deal in electronic components. Prices, specifications, etc., should be sought from advertisers or agents.

REMITTANCES: Must be negotiable in Australia and made payable to "Electronics Australia". Where the exact charge may be in doubt, we recommend submitting an open cheque endorsed with a suitable limitation.

ADDRESS: All requests to the Assistant Editor, "Electronics Australia", Box 163, Beaconsfield, 2014.



For those readers who have been unable to obtain a 10V regulator for the Sound Effects Synthesizer described in September 1979, we suggest this modified circuit which uses a 5V regulator instead. Note that it will be necessary to cut the PCB pattern.



INFORMATION CENTRE

DREAM 6800: Since your articles on the "Dream 6800" I have built the power supply from details published in the June 1979 issue. I have found that 470-ohm resistor and LED overheated and blew up the 12V 100mA regulator. I solved this problem by replacing the regulator with a 1-amp type and removing the LED from the circuit.

This solved the regulator problem but I feel that the power supply is now unsafe due to the lack of a power on indicator. Could you supply any information that would help me to overcome this problem. Also, thank you for the Dream 6800 series, and I hope that more software will be printed in future issues. (D.H. Nth Caulfield, Vic.)

● Your problem with the regulator is one that could be expected if you are using a 100mA type. The specified worst case current drawn from this regulator is stated as being 100mA, and this is not allowing for the 22.6mA drawn by the LED. Now that you have replaced this with a 1-amp type we suggest that you try replacing the LED in to the circuit. You should not experience any further problems due to the larger current handling capability of the new regulator.

As for your question regarding further software for the Dream, we do have plans to publish more during 1980.

CAR ALARM PROBLEMS: I constructed the Car Burglar Alarm as published in the April 1979 issue. I have spent quite some time checking the alarm but am unable to get it to work. I have had quite a problem in trying to obtain the BC148B and BC212B transistors and have had to accept what are claimed to be alternative part numbers. I have substituted a BC549 for the BC148B and a BC557 for the BC212B. Are these substitutions suitable?

In your parts list you specify a 1N4001 diode but this is shown as a 1N4006 diode in the circuit diagram. On page 47 you refer to the 0.05uF capacitor and this is shown to be 0.047 in the circuit. Which is the right value? Have there been any errata published to the article? If not I would be pleased if you could give me some answers to these questions. There is also the question of transistor lead orientation. I cannot make out your drawings. Can you please advise? (J.H.T. Bilunga, Qld).

● The problem regarding the availability of the specified transistors should not pose a problem as the BC549 will substitute for the BC148B, and the BC557 will substitute for the BC212B. As far as the diodes are concerned, almost any general purpose rectifier diode will do the job, and both the IN4001 and the 4006 are suitable.

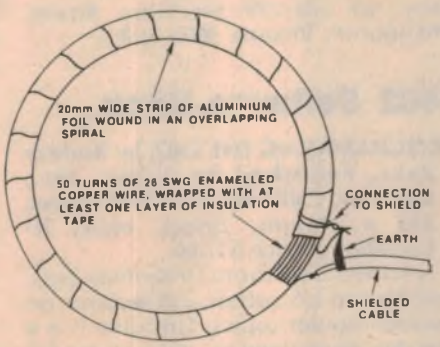
In the case of the capacitor, the difference beween .05uF and .047uF can be considered negligible when tolerances are taken into account. The diagrams of the transistors are shown with the leads facing up. In the case of the UJT you will find that there is a small tag on the case body. The lead nearest to this tag is B2. We hope that this clears up any problems that you have experienced.

METAL LOCATOR: I have been interested in your article on the "Prospector" metal locator in the November edition of your magazine. However, since I am not too conversant in the art of coil winding I find it difficult to wind same. Would it be critical for instance to wind the coil in layers, or should it consist of one single winding only? It would be very much appreciated if you could enlighten me on the above. (W.B., Caloundra, Qld).

● Your letter is typical of many we have received, either enquiring about construction of the coil or the Faraday screen. In an attempt to clear up any confusion about these problems we will try to expand on the description given in the original article.

The Faraday screen is made up from a long strip of aluminium of about 20mm width. Starting from one end of the coil near where the two coil leads come out, wrap the foil tightly around the coil with the foil edges overlapping to ensure the whole coil is covered. When you get back to the beginning, make sure there is a gap of no more than about 10mm between the two ends so that the foil does not form a shorted turn.

The screen has to be connected to



earth as shown on the circuit diagram. This is accomplished by connecting to the earth side of the shielded cable which connects the search coil. To facilitate connection to the aluminium foil we recommend that a few turns of copper wire be wrapped around one end of the foil as shown in the diagram. It should be emphasised that the coil and Faraday screen should be tightly constructed and fixed rigidly to the base of the locator. Naturally even slight deformations of the coil or screen will change the capacitance or inductance of the coil with a consequent change in the pitch.

Note also that the number of turns and gauge of wire used in the search coil is not critical.

SQUELCH: I recently built a converter to receive the 108-136MHz aircraft band. The converter is fed into my FRG-7 communications receiver. It works very well but there is a problem with an excessive amount of hiss in between stations. What I need is a simple squelch arrangement to fit to my receiver. Could you please supply me with a circuit for a suitable squelch. (H.D. West Ulverstone, Tas.)

● We understand the problem which you have H.D. but we regret that we have not described a circuit which would help. In the meantime, perhaps it would be a good idea to keep the volume control on the receiver set well back when no signals are being received. The volume could be increased when a signal is tuned in.

REMOTE CONTROL: I recently built the remote control for a hifi that you published and have some problems with it. (a) I only have a range of approximately 2 metres, (b) my unit (stereo) will only operate if I remove the 100k resistors that form the voltage dividers on IC7&8, otherwise I get no sound from the speakers. Also (c) I placed a 50k trimpot across the 470pF capacitor for some sort of adjustment. I

Books & Literature

devices in the home. Other chapters cover non-transmitter interference sources, noise in vehicular installation, and problems arising from the operation of CB transceivers.

The author's approach is logical and systematic and he suggests most of the standard things that one tries in trying to cure interference. It is not his fault that line filters only help sometimes, or that domestic light dimmers can rarely be silenced completely.

A couple of points puzzled me: page 5, his definition of cross modulation; page 43 diagrams that show the null of a DF loop in line with its edges. Also, somewhat unfortunately, much of the material in the appendices is more appropriate to the USA than to Australia. However, if interference is driving you round the bend, Larry Kahaner may just happen to have the answer.

Our review copy came from Butterworths, 586 Pacific Highway Chatswood, NSW 2067. (W.N.W.)

Digital Electronics

BEGINNERS GUIDE TO DIGITAL TECHNIQUES, by G. T. Rubaroe. Bernard Babani (publishing) Ltd, London, 1979. Soft covers, 108 x 181mm, 62pp, with illustrations.

As a book supposedly written for the beginner, I feel that this one leaves a lot to be desired. In the opening chapter the author makes no reference to the basic concepts of digital electronics, but starts off whith analog to digital conversion, hardly the right starting point.

In the chapters that follow, the author discusses number systems, codes, combinational logic, A-to-D converter circuits, and finally touches on the subject of digital computers. The level at which the text is written makes the assumption that the reader has at least a basic familiarity with the subject, although the title of the book suggests otherwise.

In short, the beginner that wishes to learn more about the subject of digital electronics is advised to look elsewhere for more instructive material as this book does not fall into the category of recommended reading.

The review copy came direct from the publisher. (G.C.)

Building a Computer

HOW TO BUILD A MICROCOMPUTER, by Sam Creason K6EW. Published by 73 Inc., Peterborough, New Hampshire 1979. Soft covers, 218 x 282mm, 112pp, many illustrations. Price $13.30.

The full title of this book is "How to Build a Microcomputer . . . and Really Understand It". Although it may sound unduly harsh, I must comment that to my mind it neither gives an adequate description of the construction of a microcomputer, nor gives sufficient information for even a rough understanding of its operation.

From what one can glean from the book, the microcomputer design developed by the author was fairly appropriate as a small teaching system. It does seem a little clumsy, using a "do-it-yourself ROM" with lots of plug-in diode modules to provide a "monitor" program, but this is perhaps acceptable in a system for this type of application.

The real shortcoming is in terms of the book itself. There just isn't anywhere near enough information given, either for the construction of the microcomputer or for understanding its operation. In fact, some of the chapters are so brief and superficial that they scarcely scratch the surface — for example the chapter introducing microprocessor systems consists of ONE page of text, spread over two pages! Similarly the chapter on the microcomputer's processor board has slightly over two pages of text, and doesn't even give a block diagram of the registers inside the 6502.

In short, very disappointing indeed.

The review copy came from Technical Book and Magazine Company, of 289-299 Swanston Street, Melbourne, Victoria 3000. (J.R.)

6502 Software Book

PROGRAMMING THE 6502, by Rodnay Zaks. Published by Sybex, Inc., Berkeley, California 1978. Soft covers, 138 x 216mm, 305pp, many illustrations. Price $17.60.

A further book from Dr Rodnay Zaks, well known US author and lecturer on microcomputer topics. This time it is a text on programming, with particular emphasis on the 6502 processor. And as we have come to expect from Zaks, it is well planned and executed.

There are a number of chapters offering basic introductory material on programming in general: basic concepts and programming techniques, addressing techniques, data structures and generalised program development. These are augmented with chapters treating the specifics of the 6502 processor and its programming: its hardware organisation, its instruction set, its addressing modes, input-output techniques, system configurations and so on. And there are also a good many explanatory examples, together with tuitional exercises.

The text is clearly and concisely written, although a little on the dry side; it even borders on the pedantic at times. But the subject material is smoothly graded, and should be found both readable and helpful.

In short, a worthwhile text on 6502 programming, although at $17.60 it is not cheap.

The review copy came from McGills Authorised Newsagency, of 187-193 Elizabeth Street, Melbourne 3000. (J.R.)

Computer Game

SCELBI'S 8080 GALAXY GAME, by Raymond Edwards. Published by Scelbi Computer Consulting, Inc, Milford, Connecticut 1978. Soft covers, 210 x 280mm, approx 8mm thick, some illustrations. Price $13.50.

This is not so much a book but a comprehensive document on a space-war type game written in 8080 assembly language and suitable for running on most 8080-based microcomputer systems. It is apparently a revised version of an earlier program created by Robert Findley.

The documentation is quite thorough. It covers the rationale and operation of the game, system requirements, memory usage, input/output requirements, data tables, messages and subroutines and a sample of the game in operation. Also given are a full commented source listing and a machine code dump in octal. In short, just about everything you would need in order to get the game going on any suitable system. It's quite well written, too.

The review copy came from McGill's Authorised Newsagency, 187-193 Elizabeth Street, Melbourne, Victoria 3000. (J.R.)

BASIC Programming

COMPUTER PROGRAMMING IN BASIC, by Peter Bishop. Published by Thomas Nelson and Sons Ltd, Sunbury-on-Thames, Middlesex, 1978. Soft covers, 190 x 245mm, 140pp, many diagrams. Recommended retail price $8.95.

An introduction to programming in BASIC, intended not so much for the newcomer to personal computing but rather for the student or school pupil doing a course in computer studies. As such it presents the material in a pedagogic fashion rather than an entertaining one, and would not fare well in comparison with books like Dr Lien's TRS 80 Level 1 User's Manual.

Still, it is a methodical and businesslike book, with many tuitional examples for the serious student. It could therefore make worthwhile supplementary study material.

The review copy came from the Australian office of the publisher, who advise that the book is currently available from Thorburn's Technical Bookshop, 114 Castlereagh Street, Sydney. (J.R.)

dicator, mono amp, stereo amp, stabilised power supply.

For each project there is a circuit, a layout on Veroboard, photograph, parts list and notes on construction and use. Good value, if simple audio is your scene!

Our review copy came from Butterworths, 586 Pacific Highway, Chatswood, NSW 2067. (W.N.W.)

ARRL on Antennas

THE ARRL ANTENNA ANTHOLOGY. Edited by Marian S. Anderson, WB1FSB. Stiff paper covers, 151 pages 275mm x 207mm, freely illustrated by photographs and diagrams. Published 1978 by the ARRL, Newington, USA. Price in Australia $6.75.

By way of clarification, this book is subtitled "The best of recent QST HF antenna articles and theory presentations". Perhaps we should add the further remark that it has been compiled primarily for the amateur who is not blessed with acres of space and unlimited funds; it's very much for the amateur who has to do it himself.

The first section on vertical HF antennas includes a dozen or more designs, supplemented by interspersed material to do with feeding, matching, etc.

A second, somewhat shorter section deals with about a half-dozen mainly compact beams and this leads naturally into section 3 dealing with quad arrays of one kind and another.

Section 4 contains a number of odd but interesting antennas, such as a loop, delta loop, half-square, DDRR and installations for caravans.

The book is rounded off by section 5, comprising about 40 pages of assorted articles on comparative gain, matching, instrumentation, etc.

If you're one of the many amateurs who don't quite know what to do about installing an antenna at your place, this anthology may provide just the idea you've been looking for.

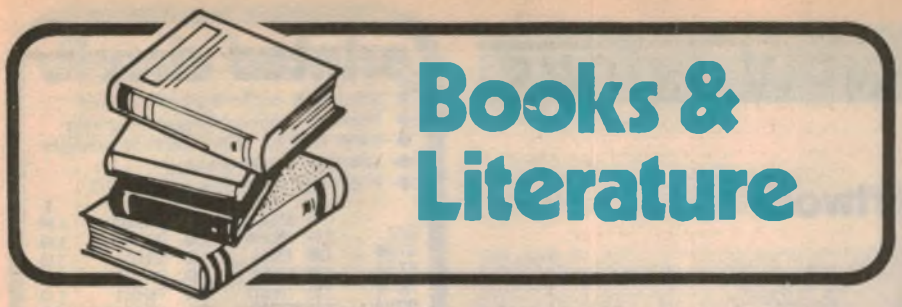
Our review copy came from Technical Book and Magazine Co, 289-299 Swanston St, Melbourne 3000. (W.N.W.)

RF Interference

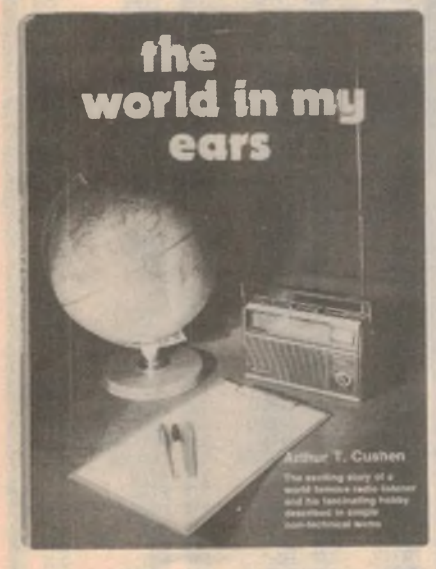
AUDIO AND VIDEO INTERFERENCE CURES, by Larry Kahaner. Stiff paper covers, 114 pages, 209mm x 135mm, illustrated by drawings and circuits. Published 1979 by Hayden Book Co Inc, New Jersey, USA, Price in Australia $7.50.

In this new book, Larry Kahaner has made a valiant effort to solve a problem that, in many cases, defies solution. At least, the reader is encouraged to "have a go" and, in some cases it may help.

In chapter 1, the author talks about transmitters and the ways in which they can cause interference. Chapter 2 deals with TV interference of various kinds, and chapter 3 with hifi and audio



Books & Literature



THE WORLD IN MY EARS by Arthur T. Cushen. Hard covers, 204 pages 212mm x 156mm, freely illustrated. Published 1979 by the Author at 212 Earn St, Invercargill, NZ. Price in Australia $15.95.

Readers of this journal will need no introduction to Arthur Cushen, who conducts our monthly feature "Shortwave Scene". This reviewer has visited Arthur and his wife Ralda in their home and been profoundly impressed by the way in which he has overcome blindness and turned a one-time hobby into a profession.

The first part of the book is personal, and amongst other things, tells how he became deeply involved in short wave listening during World War II, recording prisoner-of-war messages, and following propaganda and news broadcasts from enemy stations. So through to the present.

From page 67 onwards, the Author seeks to introduce the reader to shortwave radio listening with an explanation of what it is all about: receivers, antennas, frequencies, times, conditions and so on. It is all readily readable and avoids off-putting technicalities.

The book can be recommended especially to those who may want to get into DX and shortwave listening, or to old-timers who would like to re-live past experiences. Congratulations, Arthur!

The review copy came direct from the Author/Publisher. Copies can be obtained in hard cover form from the Author/Publisher, or in both hard and soft cover from McGill's Newsagency in Melbourne. (W.N.W.)

Shortwave DX Guide

WORLD DX GUIDE, First Edition, arranged and compiled by Jim Vastenhoud. Published by Billboard Ltd under licence from the Billboard Group. Soft covers, 208 pages 146mm x 228mm, illustrated by diagrams, tables and photographs. Recommended Australian retail price $17.95.

According to the Introduction by Jim Vastenhoud, this book is a compilation of selected articles from previous editions of the "World Radio TV Handbook" and supplemented by several articles written by Jim Vastenhoud. As such, the contents are a mixture of new material and some which has been published before.

The text seems to be pitched mainly towards the beginner in the art of DX listening, along with TV DX viewing, although there is a considerable amount of material which would be of value to the more experienced enthusiast. The book consists of 28 fairly short chapters, the headings of which are too numerous to list here. The text is divided into four sections.

The Section headings are: (1) Getting on your way, (2) Getting ahead further, (3) Some backgrounds, (4) References. Suffice to say that the various sections cover most aspects of shortwave listening, including propagation, sunspots, jamming, SSB reception, MW DXing, etc. The reference section gives information on such items as azimuthal maps, world time charts, standard frequency and time signal stations and other useful information.

While I am of the opinion that this book would be very useful to all interested in the fascinating subject of DXing, at the price I do not consider it good value for money. It would be a good idea to have a look before you buy.

Our review copy came from Thomas C. Lothian Pty Ltd, 4-12 Tattersall's Lane, Melbourne, Victoria 3000. Copies are now available and should be obtainable from technical booksellers. (I.L.P.)

HiFi Speakers

HOW TO SELECT AND INSTALL YOUR OWN SPEAKERS by Norman Crowhurst. Stiff paper covers, 234 pages, 208mm x 130mm, freely illustrated. Published 1979 by TAB Books, USA. Price in Australia $7.50.

From the title, I rather expected a down-to-earth discussion: needs which have to be met — typical speakers to meet those needs — how to choose — how to install.

In fact, the secondary title "Everything you need to know about speakers" would have been more to the point. Norman Crowhurst covers a lot of ground from domestic hifi to indoor public address, but its a meandering mix of practice and theory; of past and present.

Some of it gives evidence of perceptive thought; some of its seems vague, even suspect. For example, buried in a lot of talk about reflex enclosures, etc, is a section about "Designing Your Own". It boils down to copying any suitable commercial design and fiddling until you get it right. That would be turning the clock back a decade or more, to when we didn't know any better!

If you want to browse and pick up a lot of general knowledge about speakers, fair enough. But if you want down-to-earth guidance for a minimum of reading time, I suggest you look for a text which is better organised for the purpose.

Our review copy came from Technical Book & Magazine Company, 289 Swanston St, Melbourne, 3000. (W.N.W.)

Audio Projects

ELECTRONIC PROJECTS IN AUDIO by R.A. Penfold. Published 1979 by Newnes Technical Books. Stiff paper covers, 88 pages 215mm x 135mm, illustrated with diagrams and photographs. Price in Australia $6.00.

First impression of this is a nicely presented small book, with good printing, good paper, and the use of pickout colour to add visual interest and to highlight circuit details. Inspection and sample reading confirms that the material has also been carefully prepared and it should be of interest to anyone who likes to build up and use simple audio gear.

It details 15 projects as follows: Rumble filter, scratch filter, dynamic mic preamp, magnetic cartridge preamp, crystal mic preamp, dynamic noise limiter, miniature power amp, quasi-quad adapter, 3/6 channel mixer, slave amp, audio limiter, stereo peak level in-

Drafting aids for PC artwork

Bishop Graphics of the USA has recently released a range of printed circuit drafting aids onto the hobby market. The range of products is very extensive and covers almost every imaginable item required to produce good quality artwork.

Pictured are the catalog, some sample packs of cut shapes and slit tapes, alphabetical designators and a magnifying glass for checking both artworks and completed PCBs.

One other essential tool for the successful production of a quality artwork is a good sharp knife. Bishop also supplies the range of "X-Acto" knives together with a wide range of replacement blades.

The drafting tapes are made from black opaque crepe which is self adhesive, making application a simple task. Other standard items include a range donut pads of varying internal and external diameters, targets for photographic registration, 90-degree bends, T-junctions and universal curves.

Since these tapes and precut shapes are the same as those used in the preparation of professional artworks, it is possible for the hobbyist to achieve a professional result.

Hints and application notes for the various products are provided as an integral part of the catalog.

Bishop Graphics products are available from the following retail outlets: Radio Despatch Service, Sydney; Ellistronics, Melbourne; and Zero-One Electronics, Brisbane.

For further information contact the importers and distributors: Circuit Components, 383 Forest Road, Bexley, NSW 2207. Phone: 59 6550.

Controlled temperature soldering station

Royel Electronics has released a new soldering/desoldering station. The unit features precise temperature control, achieved through the use of "feedback" soldering tools. SCR switching at guaranteed zero potential eliminates the risk of damage to voltage sensitive components and also eliminates RF interference.

Also provided is an auxiliary earth terminal for grouding PC boards containing CMOS ICs.

The control unit also features a vacuum pump for desoldering components. A special 100 watt desoldering tool is connected to the unit and controlled independently of the soldering iron. The solder removed from the joint is collected in the handle of the tool.

Two types of soldering iron can be fitted to the solder station, either the 40 watt CT6 or the 80 watt CT7. These irons are both easy to handle due to their size and weight.

For further information contact Royston Electronics Pty Ltd, Unit 15, 59 Moxon Rd, Punchbowl, NSW 2196. Telephone (02) 709 5293.

SPECIAL PURCHASES

NEW B.S.R. RECORD CHANGERS-PLAYERS

MODEL C197
$47.50

This is a new model just released and is fitted with a ceramic cartridge & diamond stylus. Auto or manual operation. Three speed 33, 45 & 78rpm. Cueing control and bias compensation. Changer & player spindles supplied. 11" turntable. **Post & packing extra.** NSW $2.75. Vic. Qld $3.75. WA, NT & Tas $4.75.

SPEAKER GRILLE FABRIC AT ½ PRICE

AVAILABLE IN BLACK, BLACK WITH GOLD FLECK, LIGHT & MID BROWNS. WIDTH 54"

$4.80 Per YARD. Post & Pack $1.75.

Send two 20c stamps for samples.

GARRARD CC10A RECORD CHANGER
$15.75

Fitted with a Sonatone Garrard Ceramic Cartridge Sapphire Stylus supplied with template & instructions. Posts & Packing: NSW $2.50. Inter. $3.50.

MODEL C142R

HI-FI UNIT WITH ADC MAGNETIC CART & DIAMOND STYLES

$55.00

A precision automatic and manual record-playing unit fitted with 4 pole motor to provide constant speed conditions for the 11½ inch turntable. The low resonance tubular pickup arm is counter-balanced with a resiliently mounted weight to permit light sensitive tracking, and the slide-in cartridge carrier enables styles inspection and the interchange of replacement of cartridges to be carried out simply and quickly. Fine stylus force adjustment and bias compensation are both calibrated for accurately setting the arm to given optimum playing conditions for the chosen cartridge.

The fluid-damped level-type cue and pause control ensures gentle lowering of the pickup to the surface of the record. A short spindle is supplied for single record play records. Precision engineering is reflected in the styling of the 142R which is elegantly finished in black and silver.

POST AND PACKING EXTRA

NSW $3.75
Vic, SA & Qld $5.75
Tas, WA & NT $7.00
(Reg. post $2.00 extra)

NEW RANK-ARENA F.M.-A.M. TUNER AMPLIFIER

Freight Extra

MODEL RA402. Output 24 watts RMS (12+12). Response 50HZ to 50KHZ. Mag or ceramic inputs. High & low filters. Loudness control. Provision for 4 speakers.

$147.00

NEW E.M.I. AND HITACHI RECORDING TAPE AT BARGAIN PRICES

HI-DYNAMIC EMITAPE — HIGH OUTPUT — LOW NOISE — HI-FIDELITY

HLP18 7" reel 1800ft. long play $5.95
HDP12 5" reel 1200ft. double play $3.95
P & P $1.00

NEW E.M.I. SUPE C90 CASSETTES, 5 FOR $10.00. *P&P $1.00*
NEW EMI HI-FI C90 CASSETTES 5 for $12.50.
Hitachi LN 8-track 90 minute cartridge. 5 for $10. *P & pack $1.50.*

NEW AWA HI-FI SPEAKER KITS 8" 2 WAY 3 SPEAKER SYSTEMS

AT LESS THAN ½ LIST PRICE

POWER RATING 20 WATTS R.M.S.
IMPEDANCE 8 OHMS
FREQUENCY RANGE 46 TO 18000 CYCLES

Supplied in kit form (less cabinet) each kit comprises: One AWA 8WAC 8in. bass unit, two AWA 4MBC 4in. tweeters with ceramic magnets & curve-linear cones, crossover components, grille cloth, innabond lining and cabinet plans.

CABINETS AVAILABLE
Post & packing extra. NSW $2.50. Interstate $3.50

$18.50 Per Kit

NEW GOODMAN-FOSTER 3-WAY 4-SPEAKER HI-FI SYSTEM

$39.00 PER KIT

Frequency Range 45 to 22 000 cycles. Power rating 25 watts RMS Imp 8ohms. Supplied in kit form (less cabinet) each kit comprises two English Goodman 8" bass units, Foster 5" mid range, Foster 1" dome tweeter crossover components, Ocodensers and inductance innabond, speaker fabric and plans of cabinet. Cabinet dimensions 23" x 13" x 10". **CABINETS AVAILABLE**

Post & packing extra: NSW $2.70, VIC, SA, QLD $4.70, WA $5.70. (REGISTERED POST $2.00 EXTRA IF REQUIRED) cabinets available.

RANK-ARENA 2 WAY SPEAKER

$42.00 PER PAIR

- 10 Watts RMS
- 8 ohm impedance
- 8" woofer with tweeter
- Supplied with lead and plug
- Teak finish

Dimensions 18"H, 11"W, 9½"D
Freight extra per rail, air or road transport.

NEW HOKUTONE HI-FI SPEAKER KITS AT A FRACTION OF LIST PRICE

NEW THREE WAY HIGH FIDELITY SPEAKER SYSTEM WITH A FREQUENCY RANGE OF 35 TO 20,000 CYCLES. POWER RATING 50 WATTS.

Supplied in Kit form (less cabinet) Woofer HFW-302, 12". Mid range HM-24 dome. Tweeter HT-60 dome. Three way crossover with separate controls for mid range & tweeter. Innabond lining, grill fabric & cabinet plans supplied. Cabinet dimensions 668 high, 435 wide, 310 deep.

$69.00 per kit

Freight extra by rail, air or road transport.

NEW HOKUTONE 12" HI-FI SPEAKERS

Model 300F W09YL 12" power rating 20 watts, 8OHM IMP cone resence 30 cycles. Manufactured by Hokutone Onkyo Co Japan.

$14.50 *POST & PACK $2.50*

NEW GARRARD 6-200 CP RECORD PLAYERS

Fully automatic turntable automatically or manually as required. 11" turntable. Cue & pause control. Record speeds 33 1/3, 45 and 78 rev/min. Finished in black with silver trim. Fitted with ceramic cartridge. Post & packaging extra. NSW $2.70, Vic, Qld, SA $3.70, WA $4.70 (registered post $2 extra if required).

$34.00

NEW CAR CASSETTE CONVERTERS BICOH MODEL NA100/CC-007A AT APPROX. ½ LIST PRICE

By connecting this model with your existing AM car radio, you can enjoy the music of any cassette that has been pre-recorded.

Connection requires no alteration to the car radio. Plug your car aerial into the cassette recorder and using the patch cord supplied, connect the recorder to the aerial connection of your car radio. By following the instructions, installation is a **simple procedure. All cords & brackets are supplied. Can be used in any car with a 12-volt neg. earth** system can also be used with any AM radio by using a 12V supply.

Dimensions: 150 x 110 x 53mm.

$18.50
post & pack
$1.50 extra

CLASSIC RADIO

245 PARRAMATTA RD, HABERFIELD 2045. PHONES 798-7145, 798-6507.

New Products

2-metre amateur transceiver

Icom has released a new 2-metre all-mode amateur radio transceiver, the IC251A.

Following the tradition of the earlier IC211 2-metre multimode transceiver, the IC251A has improved performance and facilities, apart from introducing new power supply technology. A pulse type (50kHz) power supply is used on AC, allowing a reduction in weight and heat.

Using microcomputer control, a multi-purpose scanning facility allows monitoring of three different memory channels, a program scan giving scanning between two programmed frequencies. The scanning speed is adjustable and automatically stops when a signal is received.

Continuous coverage is provided over the 2-metre band with either 1kHz steps on FM or 100Hz steps on SSB, with a fast tuning facility also provided.

Further information from Vicom International Pty Ltd, 68 Eastern Rd, South Melbourne, Vic 3205.

Low-cost 1.2V voltage reference

A new, low cost 1.2V reference is available from Analog Devices Semiconductor. The AD589 will operate from 50uA to 5mA, dissipating only 60uW at 50uA, and is free from oscillations when shunted by capacitive loads over 1,000pF. The temperature compensated, two-terminal bandgap device is an exact replacement for other 1.2V references.

The low output impedance, — 0.6 ohm typical, 2 ohm maximum — is a factor of ten lower than typical zener diodes and allows operation with no external components required to maintain full accuracy under changing loads. No frequency compensation is required; RMS noise voltage is 5uV at 500uA from 10Hz to 10kHz. The output voltage is rated at 1.200V minimum, 1.235V typical, and 1.250V maximum.

The AD589 is available in seven grades; J, K, L and M grades for operation over the 0° to +70°C temperature range, and S, T and U grades for the -55°C to +125°C range. All S, T and U devices are available fully processed to MIL-STD 883B. Temperature coefficients are 10ppm/°C for M grades, 25ppm/°C for L and U grades, 50ppm/°C for J and S grades.

Further information from Parameters Pty Ltd, 68 Alexander St, Crows Nest, NSW 2065 (phone 439 3288).

A.C.E. RADIO

136 VICTORIA RD, MARRICKVILLE, NSW 2204 PHONE 51-3845

ELECTRONICS CENTRE

BARGAIN PRICES ● PERSONAL ATTENTION ● SLICK MAIL ORDER SERVICE ● SATISFACTION ●

NEW BSR STEREO CHANGER/PLAYERS MODELS

C198 (ILLUSTRATED)
S SHAPE TONE ARM
4 POLE MOTOR
WITH CERAMIC CART
$55.00
WITH MAGNETIC CART
$65.00

C197
STRAIGHT TONE ARM
2 POLE MOTOR
CERAMIC CART
$47.50

PACK & POST: NSW **$2.75**, V/SA/Q **$3.76**, TAS/WA/NT **$4.75**

With all the wanted facilities ● Auto or manual operation ● Cueing lever ● Bias compensator ● Adjustable stylus pressure ● 33, 45, 78rpm ● Plays 7", 10", 12" records ● Separate changer and player spindles ● Operating instructions ● Template for cut-out ● Big 28cm turntable ● Diamond stylus ● 240V AC 50Hz.

● BSR BELT DRIVE RECORD PLAYER ●

ABSOLUTE
LATEST MODEL P-200
$95.00
P&P NSW $3.50
INTERSTATE $4.50

STYLISH S SHAPE PICK-UP ARM ● ADC MAGNETIC CARTRIDGE DIAMOND STYLUS INCLUDED ●

ALSO AVAILABLE WITH WALNUT BASE AND PERSPEX COVER WITH HINGES **$119** P&P NSW $5.00 INTERSTATE $7.50

Specs: 240VAC 50Hz, auto or manual operation ● Plays 17, 25, 30cm (7, 10, 12in) records ● 33 and 45 rpm, adjustable counter weight and stylus pressure ● cueing lever ● Bias compensator and anti skate control ● Die-cast platter with mat ● RCA audio plugs and cable, 3-core power cable and plug ●

C-CORE TRANSFORMERS

LOW NOISE ● HIGH EFFICIENCY ● PRIMARY 240V 50Hz CONT. RATING

MODEL	SEC V.	AMPS	PRICE	PACK AND POST NSW	V Q SA T	WA NT
JT 266	0-18V	8A	$25.95	$2.95	$3.75	$5.50
JT 235	260-26V	2A	$24.95	$2.95	$3.75	$5.50
JT 248	0-10V	10A	$25.95	$2.95	$3.75	$5.50
JT 249	8.5-0-8.5V	4A	$26.50	$2.95	$3.75	$5.50
	15VCT	1A				
JT 274	0-10V	10A				
	2x0-12V	1A	$26.50	$2.95	$3.75	$5.50
JT 253A	0-18V	12.5A				
		30A				
		PEAK	$45.95	$3.50	$5.50	$7.00

SUPER SCOOP

PASSIVE RADIATOR HI FI SPEAKER SYSTEM

Excellent frequency response from the 8 ohm 15 watt 200 mm (8") woofer and 200 mm 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

$65
PAIR

STEREO CASSETTE DECK FRONT LOAD

SUPER SCOOP ● TOP BRAND ●

Pack and Post NSW $2.50 V. Q. SA. T $3.50 WA. NT $4.50 **$99.95**

240V AC 50Hz ● HiFi Freq. Response ● Twin illuminated V-U meters ● recording indicator ● Tape Counter ● Auto stop ● Pause ● Headphone Jack ● 2 mic inputs ● Bias/Equalizer switch for normal, FeCr, Cr 02 ● Line in/out jacks ● woodgrain cabinet 380 w x 240d x 135 h mm.

PLESSEY ROLA SPEAKER SPECIAL

GUARANTEED TOP QUALITY BRAND NEW BARGAIN

Model C12PX, 15 ohms, 31cm (12in) twin cone. Specs: 30W rms. Reson. Freq. 40Hz Freq. respon. 35-13,000Hz.

$19.95 ea. P&P: NSW $2.00 INTERSTATE $2.75
2 for $37.00 P&P: NSW $2.75 INTERSTATE $3.75

12V SIREN ALARM

WARBLER TONE ● 100dB AT 1 Metre ● 8 WATTS OUTPUT

INDOOR
$15.50
OUTDOOR

P&P NSW $1.50 Interstate $2.50

PA REFLEX HORN SPEAKERS

A1 Quality, Weatherproof.
8 Ohms, 150Hz — 13Khz

6"	10 WATT	$21.95	8"	15 WATT	$25.50
8" x 5"	15 WATT	$26.50	12"	25 WATT	$39.95

Pack and Post NSW $1.50. Interstate $2.50

HIGH EX PMG POWER SILICONE DIODES 200PIV. 100AMP

Good order and condition guaranteed.
$4.75 ea P&P 75c
4 for $16 P&P $2.50
HEAT SINK TO SUIT **$1.75** P&P 75c

HEAVY DUTY NI-CAD RECHARGEABLE BATTERIES

1.2v

Top quality guaranteed.
Used by many Govt. Depts.

SIZE D 4AH **$6.25** ea P&P 75c
4 for $23 P&P NSW $1.50 INTERSTATE $2.50
SIZE C 1.8AH **$3.75** ea P&P 75c
4 for $14 P&P NSW $1.50 INTERSTATE $2.50

GEARED MOTOR 240VAC 50Hz 3W

$2.50
P&P 50c

5 RPM. Plenty of torque. With Cam and N/O N/C microswitch. 15 switch contacts per min. OA size 65 x 60 x 35mm.

FAMOUS IMPORTED EMI CASSETTES

SUPER FERRIC ● COMPARABLE TO CHROME ● TOP QUALITY PERFORMANCE ● LOW NOISE ● HIGH OUTPUT

C60 — 5 for $7.50 P&P $1.50
C90 — 5 for $10.00 P&P $1.50

LIGHT DIMMER

240VAC 1.8A Aust. made approved. Complete with cover plates. The latest trend in home lighting.

ADDS THAT LITTLE EXTRA ATMOSPHERE

Only **$4.50**, P&P 90c.

TO CLEAR PANEL METERS

Top quality clear plastic front. Type MRA85, 118 x 112mm, Bar. dia. 85mm
30ADC 1ADC 500VDC **$9.50** ea.
Type MRA70, 85 x 77mm, Bar. Dia. 70mm
1ADC 500MA 100MA **$7.50** ea.
P&P NSW 75c. Interstate $1.25

FIBREGLASS P-C BOARD

1.5mm SINGLE SIDED A1 QUALITY

350 x 82mm 5 for **$3.50**
P&P NSW $1.50 INTERSTATE $2.75
365 x 330mm 5 for **$7.50**
P&P NSW $2.00 INTERSTATE $3.00

PUSH BUTTON PHONE DIAL — WITH MEMORY

TELECOM APPROVED

$43.95
PACK & POST $1.25

EASY TO INSTALL

If wanted number is engaged (including std and isd) unit will re-dial with the push of a single button. Dial dia. 100mm. Compatible with telecom type phones.

SOLID STATE FAN - MOTOR SPEED CONTROLLER

240VAC 2.8A. Fully sealed, complete with pot and knob. **$4.50** P&P 75c

50V DC 2AMP POWER SUPPLY

240VAC 50Hz input. Ex Ferguson and Hallam factory surplus. Transformer can be used for 240-110V 1A stepdown.

Only **$15.00** P&P $2.50

BUTTERFLY VARIABLE CONDENSOR

1000PF IDEAL FOR A.T.U. BALL BEARINGS, BRASS PLATES
70 x 65 x 30mm OA
$3.50 P&P 90c

SERVICE

Moderate charges — Repairs guaranteed. Radios, Tape Recorders, Cassettes, Amps.

Calculator or computer? — the latest from HP

Hewlett-Packard has released a hand-held calculator package, the HP-41C, that functions very much like a small computer. It has expandable memory, alphanumerics, card reader, printer and application program modules.

The HP-41C is the most advanced and versatile hand-held calculator HP has ever developed. In addition to preprogrammed scientific and mathematical functions, the continuous memory, RPN logic machine can be tailored to perform any number of other calculations through programs written by the user or through plug-in applications software available from HP.

These plug-in application "pacs" provide the user with programs to solve problems in real estate, aviation, physics, engineering, small business, surveying, personal finance, and dozens of other dedicated applications.

The calculator's alphanumeric capability enables the user to label programs in English. Word messages alert the user to errors in calculations and programs and report on the status of programs and the calculator itself. The "alpha" feature also allows "prompt" messages to be built into programs. The display is a high-resolution LCD that minimises power consumption.

More than 130 of the most commonly used scientific and mathematical functions are programmed into the machine. The calculator keyboard identifies 58 of these functions. Upon user demand, the calculator will provide a "catalogue" of the other available functions which can be easily accessed from the keyboard. The catalogue can also list user-defined functions.

A versatile feature of the HP-41C is that nearly any function the calculator can perform — either those built into the machine or programmed into it — can be assigned to most key locations on the keyboard. This enables the user to personalise the calculator by positioning functions on the keyboard where they are most convenient. Two keyboard overlays and a set of labels enable the user to change the keyboard markings to reflect the functions assigned to each key.

The basic machine becomes a powerful, personal calculating system with the addition of a series of options:

- Up to four memory modules can be plugged into the calculator, raising program memory from a base 400 lines, or 63 data storage registers, to as many as 2000 lines or 319 registers.
- A plug-in card reader allows the user to enter programs from recorded magnetic cards or to record programs on blank cards.
- A portable thermal printer provides hardcopy records of calculations, high-resolution plots, and complete alphanumeric output.
- An optical wand (available early 1980) reads and enters programs or data from printed bar codes.
- Sixteen plug-in application modules offer 4000 program steps each of preprogrammed solutions to problems in specific areas.

The basic HP-41C comes preprogrammed with 130 mathematic functions and features continuous memory and alphanumeric liquid crystal display.

The HP-41C can be connected to any of these devices through four ports built into the calculator.

In addition to its built-in functions, the HP-41C is keystroke programmable by the user to perform any number of calculations. The user assigns the program a name and then presses keys on the calculator in the same order that would be used to solve a problem or perform an operation. To use the program, the user can key in the name of the program, and the entire series of keystrokes is executed automatically.

A continuous memory feature permits retention of user programs and data, even after the power has been turned off.

As with any small computer, the HP-41C also has decision-making power. A program can automatically compare data, constants, or results, and then alter execution based on the outcome of the comparison. It can also test two alphabetic strings for equality.

Recommended retail prices are as follows: HP-41C $315; Card Reader (82104A) $209; Printer (82143A) $375; Memory Modules $48. These prices do not include sales tax.

Further information on the HP-41C from Hewlett-Packard Australia Pty Ltd, 31-41 Joseph St, Blackburn, Victoria 3130.

The addition of memory modules, printer, card reader, applications modules and optical wand make the HP-41C as powerful as some small computers, according to Hewlett-Packard.

New Products

Hitachi V-152 dual trace 15MHz oscilloscope

A range of Hitachi oscilloscopes have been released onto the competitive Australian market. We tested the Hitachi V-152 which is a dual trace model with 15MHz bandwidth and maximum sensitivity of 1mV/cm. Circuitry is all solid-state with a power consumption of 40 watts.

Overall dimensions of the Hitachi V-152 are 275 x 190 x 400mm (W x H x D) including knobs, feet and rear projections. Mass is 8.5kg. The screen is an attractive blue which is a change from the usual green of most oscilloscopes.

Vertical deflection sensitivity is variable in 10 ranges from 5mV/cm to 5V/cm, with continuous variation in each range available from a knob located next to the range switch. The sensitivity can be increased to 1mV/cm with the use of the x5 gain knob.

Nineteen ranges in a 1-2-5 sequence are provided for the timebase, with continuous adjustment available from the "SWP VAR" knob to the side of the range switch. In addition, the horizontal trace position control can be pulled out to provide a 10x magnification of the sweep signal. This will give a maximum sweep speed of 100ns/division.

An attractive feature of the timebase switch is the ability to turn the switch to X-Y operation, with the second channel displaying the horizontal component. This makes Lissajous figure operation for comparison of two signals an easy matter. The full gain of the second channel (5mV/cm) can be used, making this feature very attractive.

Two switches and a knob provide comprehensive trigger selection facilities. The TV line and TV frame sync pulse triggering facility is incorporated into the timebase switch and is automatically selected depending on the timebase range. Similarly, selection of chopped or alternate trace operation is incorporated into the range switch.

Five display modes are available: CH1, CH2, CH1 and CH2 (dual), Add and Difference. Input signals to the vertical inputs can be AC or DC coupled or grounded. Input impedance is 1M shunted by 30pF. AC bandwidth is 10Hz to 15.2MHz (—3dB points).

Additional features of this CRO are the blanking facility located at the rear of the CRO and the trace rotation adjustment at the front panel. No graticule lighting is provided. We did not miss the graticule lighting but would have preferred the V-152 with a tilting bail to enable a more convenient viewing angle.

The Hitachi V-152 oscilloscope is one of a range of four models distributed by Standard Components Pty Ltd.

Internal layout of the V-152 is clean and uncluttered. One very large PC board containing the vertical amp, power supply and high voltage circuitry covers the entire base of the CRO. Two smaller PC boards accommodate the sweep generator, horizontal and vertical output amplifiers. The calibration circuitry is located on another, small PC board.

All switches and controls are wired directly to the PC boards and all connections between boards are made via quickly disconnectable plugs and connectors. All the boards can be quickly removed from the chassis.

We counted eleven integrated circuits. Eight of these are 7400 series TTL ICs. There should be no problem here with replacements if they are ever needed.

Shielding is provided for the high voltage supply by way of a brass shield. Most of the heatsinks for the transistors were made from copper rather than aluminium. The Cathode Ray Tube is screened with a steel plate protecting it from stray magnetic fields.

We found the V-152 a delight to operate. The simplicity of the controls belies its performance. It has the full 15MHz bandwidth available at deflections up to 8cm and a maximum sensitivity of 1mV/cm. The traces are sharp and waveforms with fast risetimes are easily viewed. We can recommend this CRO for laboratory or hobbyist use.

A comprehensive operation manual is supplied with the oscilloscope, but probes are extra. The distributors, Standard Components, however, advise that they have a range of probes available. The prices range from $20 + tax for a 1:1 probe to $35 + tax for 10:1 probes.

Price of the V-152 dual trace oscilloscope is $540 plus sales tax if applicable. This includes the operation manual mentioned above. This is good value considering the price of similar performance oscilloscopes.

Further information can be obtained from the distributors, Standard Components Pty Ltd, 10 Hill Street, Leichhardt, NSW 2040. (J.C.)

11655kHz, which is transmitted over the long path, while the short path service continues on 21500kHz, the signal coming across Asia to Australia. The broadcast at 1200GMT is now on 17560, a move from 17565. The power on all transmitters on the lower frequencies is 300kW. Other transmissions in English are at 2000 and can be heard on 9425, 11655 and 15425kHz.

VOICE OF AMERICA FACILITIES

The Voice of America has established relay bases in several countries and in recent months there has been a move by these countries to request time on the VOA facility. In the past the Greek radio has been relayed on the VOA transmitters and the powerful million watt transmitter in Thailand has also been used by that Government for relays of its domestic program. The Voice of America relay base in Morocco, 20km south of Tangier, is now being used by the Moroccan Government to relay some of its domestic programs. The 21735kHz channel was formerly used by the Rabat transmitters of the Moroccan radio to relay its programs in Arabic but this frequency is now operated from VOA Tangier 1100-2200 GMT. The program is also carried on the Tangier transmitters at various times on 6090, 6170, 9540, 15155, 15160, 15335 and 15360kHz.

RADIO VERITAS ASIA

The latest schedule from Radio Veritas Asia indicates that they have made some frequency changes and are generally operating three frequencies in parallel. The broadcast for our morning reception, indicates they open at 2155GMT in Chinese on 9740, 11725 and 15285kHz. English is broadcast at 0030-0100 on 15135, 15285 and 17790kHz. A further transmission in English at 0300-0330 can be heard on 15285, 15320 and 17790kHz.

The evening broadcasts open at 0955GMT on 9615, 11775 and 15215kHz. English programs are at 1130-1200 on the same frequencies, while the last English program for the day, at 1430-1500, is on 9605, 11955 and 15215kHz.

The programs are of a gospel nature and in most of the Asian languages. Radio Veritas Asia welcomes reception reports to P.O. Box 939, Manila, Philippines.

SWAZILAND BOOSTS POWER

Trans World Radio in Swaziland has recently installed a new 100kW transmitter which is now in regular operation and, according to the schedule received from the station, is using 11840kHz at 1530-1930 to Central and East Africa and this transmission should be one of the best received here.

Trans World Radio has been broadcasting for more than five years from Swaziland and over that period used 25kW transmitters. The new 100kW transmitter has a frequency range of 3-26MHz and can be preset to cover 10 frequencies. The higher power will boost TWR signals: into Central Africa as they are fed into a 4 x 4 curtain antenna directed to the north. The aerial is capable of being slewed by 30° either side of centre, providing even more focusing of the signal onto specific target areas. The new 100kW transmitter is housed with the four 25kW transmitters. The mailing address is PO Box 64, Manzini, Swaziland.

LISTENING BRIEFS

EUROPE

FINLAND: Helsinki has been heard on 9575kHz with a transmission closing at 0730GMT. The broadcast was in Finnish but at 0725GMT suffered interference from Trans World Radio at Bonaire, which opens at that time with a gospel program in Portuguese.

FRANCE: "Paris Calling Africa" is the only English language service broadcast from Paris and is now heard 1700-1800GMT. Many frequencies carry the transmission and these include 11845, 15300, 15360, 15425, 17795, 17850, 17860, 21580, 21620 and 21675kHz.

AUSTRIA: Vienna is widely reported with its 13-metre band signals by Z. Hayder of Mt. Isa, Queensland, who notes signals on all frequencies being used. The transmission, in English, at 0830-0900 is best received on 21640 and 21735kHz. On Sunday Austrian Shortwave Panorama is broadcast at 0900 and can be heard on 21585kHz.

EAST GERMANY: Radio Berlin International has revised its English broadcasts and is now heard at 1415-1500GMT on 9730, 11700, 15240 and 15285kHz. Broadcasts to Australia in English at 0645 are now on 15110, 17700 and 21465, while at 1200 the transmissions are on 15115, 17880, 21465 and 21540kHz.

AFRICA

ALGIERS: Since the retiming the English broadcasts by Radio Algiers, which are now heard at 2100-2130GMT, a further out-of-band frequency has been noted. Leigh Morris of Palmerston North, NZ reports reception on 10935kHz while, at the same time, we have been hearing the signals on 11615 and 11810kHz. The schedule change also means that the Spanish broadcast is now heard 2130-2200GMT.

UGANDA: Leigh Morris also reports Uganda Broadcasting Corporation at Kampala being heard on 15250kHz at 1835GMT with an English commentary but with interference from another station. Kampala continues to be well received in its transmission to Australia at 0300-0400GMT on 15325kHz. This frequency provides good reception, but the schedule is such that transmission is always running a little late.

ASIA

NEPAL: According to the BBC Monitoring Service, Radio Nepal's External service program in English to India is currently observed from 1435-1520 on 7174kHz instead of 3245 and 5008kHz. Victor Goonetilleke of Sri Lanka reports that test transmissions have been heard from a 100kW transmitter on 9590 at 1150-1720GMT. He also comments that other frequencies are available, including 7165, 11970, 15200 and 17800kHz.

UZBEKISTAN USSR: Radio Tashkent has two English broadcasts daily at 1200 and 1400GMT. The signals are now received on three frequencies; 6025, 9540 and 11875kHz. The best reception is on 6025kHz and Tom Chisnali, of Nelson, NZ reports interference on the other two frequencies.

SHORTWAVE SCENE

by Arthur Cushen, MBE

Short-wave stations experiment at high end of HF band as sunspot count increases

The current increase in sunspot activity has encouraged several short-wave stations to experiment with relatively low power stations at higher than normal frequencies, notably in the 26MHz band. One of these, HCJB in Quito, Ecuador, is using a 100W transmitter and has been heard at our listening post.

The tests transmissions from HCJB are on the air 24 hours a day and in the South Pacific are best around 0800GMT to past 1000GMT, but have also been noted at 1900GMT. The frequency is 26000kHz and is blocked by the Voice of America in the Philippines on this frequency from 2200GMT, but the channel is free from other interference. The fact that this very low powered signal has also been reported from North America indicates the long distances possible on the 11-metre band during these high sunspot conditions.

It is interesting to recall that in 1958 the Radio Norway engineers also tested a 100W transmitter in this band on 25900kHz with the call sign LLA. This transmission was also heard well in New Zealand and proved to be one of the best catches of that period when one takes into consideration the low power and the higher frequency. The broadcasts from HCJB are not mentioned on station announcements, no reference is made to 26000kHz, and the program material broadcast can be taken from any of those being transmitted by HCJB. Thus, it is necessary to get fairly good reception of this low powered signal to be able to compile your reception report. We have noticed that, on the whole, English programs are used and this will make identification easier for listeners world wide.

THE VOICE OF CHILE

The latest information from the Voice of Chile (Santiago) indicates a new schedule is in operation up to March 1, 1980. The transmission covers broadcasts in Spanish, English, and French and the best times for the English broadcasts are 1000, 1100 and 1230GMT on 17790kHz. Morning reception at 2100GMT is on 17715 and 17790kHz; 2200 on 15150, 17790 and 17800kHz. The afternoon transmissions include one at 0330GMT on 11720kHz.

The latest schedule shows 13 broadcasts in English during the daily transmission and the station confirms reception with a verification card and schedule, though it is about eight months before a reply is received. The address is the Voice of Chile, Casilla 244-V, Santiago, Chile.

BANGLADESH BROADCASTS

Radio Bangladesh at Dacca is using three frequencies for their English broadcasts at 0445-0515GMT. These are 15400, 17890 and 21685kHz; 21685kHz giving the best reception. There is some interference from Radio Australia on 21680, but the program of news, commentary, and music can be followed throughout the transmission. The other two frequencies suffer interference; 15400kHz from the BBC World Service and 17890kHz from Radio Australia on the same channel.

Other English transmissions are at 1230-1300GMT on 15285 and 21670kHz: 1815-1900 on 11765 and 15285kHz.

AFRTVS CHANGES

The American Armed Forces Radio and Television Service has changed frequency for its Bethany transmission 0900-1100GMT. This is now on 9660kHz (replacing 9575) but in this area suffers interference from ABC Brisbane. The transmission is actually beamed to Europe and Africa. The Greenville transmitter on 9585 is using the same schedule.

Broadcasts to the Pacific and Far East are on 9700kHz at 0900-1600GMT: 11805, 0900-1800: 15330, 0430-0700: 17765, 0200-0700 and 1600-2200: 21570, 1800-0430: 25615, 2200-0200. The AFRTVS does not issue a regular program schedule but these are sent on request to AFRTVS, 1117 North 19th Street, Arlington Virginia 22209, U.S.A.

RADIO MOSCOW DX PROGRAM

Radio Moscow World Service has recently retimed some of its broadcasts and the DX Program is now heard on Saturday at 0810GMT. The 20 minute session includes information on new schedules, replies to listeners' technical questions, and information about a Soviet Union station.

The World Service is broadcast at 0400-1400 and 1900-2300GMT to Australia and New Zealand. At 0800GMT the DX Program can be heard on 9780, 15130, 15380, 17800, 17820 and 21530kHz.

Moscow Mailbag is broadcast on Sunday at 0610 and Monday at 1010 on 9780 and 17820kHz.

ISRAEL CHANGES

The Israel Broadcasting Authority has moved to 29720kHz at 0530GMT in Russian. This transmission is on Saturday and Sunday only and replaces 29705kHz. The broadcast continues to 0600GMT and is carried on several other frequencies which are generally jammed.

The changes to listeners in Australia from Israel include the English broadcast at 0500GMT, 11637 replacing

Notes from readers should be sent to Arthur Cushen, 212 Earn Street, Invercargill, NZ. All times are GMT. Add eight hous for WAST, 10 hours for EAST and 12 hours for NZT. In areas observing Daylight Saving Time add a further hour.

The Australian CB SCENE

FIGHT NOW — OR FACE A DEBACLE IN '82

Will CBers be banned from using 27MHz in 1982? The NCRA says now is the time for all who want that band retained to stand up and be counted!

by JAN CHRISTENSEN*

As all CB operators are aware, or at least should be aware, the Government has decreed that Citizens' Band operations on the 27MHz band will cease in 1982. This was stated categorically in the original RB 14, but in the new RB 14, it says that "Current policy anticipates that the HF band will cease to be available to the CBers on June 30, 1982. Hence any licence for HF equipment renewed after July 1, 1981, shall expire on June 30, 1982."

This, I feel, is where we should fight. Neither the operators nor the Industry know where they stand, and the Government's indecision is killing the Service.

We have all paid our $25 a year licence fees, and with 35,000 licenced operators in Queensland alone, that amounts to around $875,000 per year. If you add to that the fees collected from the thousands of other operators in the remaining State and Territories, you have the Government with a multi-million dollar a year revenue raiser, for which it gives very little in return.

The Citizens' Band Radio Service is costing the Government very little to administer, simply because so little is being done. In fact, if the CB operators were shareholders in a company called the CBRS, and the Government (or the Department) was the Board of Management of our business, they would have been sacked a long time ago!

One of the reasons that the Government's present stance on the 1982 question is so ridiculous is that they are earning big money for next to no outlay, and yet are talking about:

(1) Doing away with the HF side of the CBRS and the money it brings in, and

(2) The need for cutbacks in Government spending!

CB has opened so many new horizons for the citizens of Australia that I firmly believe that it would be nothing short of criminal for the Government to take the most popular band away from the people.

There are two types of equipment available to us to use on the CBRS at this time; HF and UHF. If a person is looking for reliable short distance communications, with no background noise or overcrowded channels, then UHF is for them. On the other hand, if an operator is seeking longer distance communications, remembering that now it is legal to work any licenced station within the geographic boundaries of Australia and its Territories, then HF is the logical choice.

Unfortunately, the 27MHz band is severely overcrowded. Ironically the Government realises this and unofficially says that, if the NCRA can win the battle to keep 27MHz, extra frequencies will be allocated to the band.

CB operators are faced with the farcical situation of the Government saying that, after 1982, CB will be permitted only on UHF. But it also admits that operations will continue on HF after that date, with next to no-one paying licence fees, because they will be pirating again! This means that the Department won't be collecting the revenue out of which its officers are paid so that the restrictions can be policed! The position would be reminiscent of the pre-legalisation days, with the exception that there would be many thousands more operators for the Department to contend with.

The National Citizens' Radio Association of Australia (NCRA) has lobbied the Government since 1977 for the retention of the 27MHz band within the CBRS. We can see no reason why there can't be a dual HF-UHF Service. We have also lobbied for the betterment of conditions on the CBRS, and will continue to do so, hopefully with the support of CBers right across Australia.

We fail to see why Australians should pay out hundreds of dollars for HF equipment, plus $25 dollars a year for the right to use it, and then be forced to throw the lot on the rubbish heap.

We also fail to see why the Government should wish to deprive itself of millions of dollars every year in licence fees, import and sales taxes and the untold amounts collected through the personal taxation on the wages of the people who earn their living through the Industry. If there is a valid reason for this, then I'm afraid that we can't see it.

Will CBers be allowed to keep 27MHz, or must we be forced back to being pirates once more?

If every CB operator in Australia, whether affiliated with the NCRA or not, whether a casual or constant user of CB, wrote now to his local MP in protest against the elimination of the HF band; if every operator thought deeply and acted; if we could all join together as a united force and demand our rights, then I would say that we will win. But until that day arrives, the future of the 27MHz CB band is in grave danger. And once it is gone, it is too late then to say what should have been done! NOW is the time! Stand up and be counted . . . if you care.

Anyone wishing information on CB in general, on the NCRA or wishing to find out how to join the NCRA either as an Individual Member or through a club, please contact me either through this magazine or direct at PO Box 406, Fortitude Valley, Qld 4006.

*** Jan Christensen is National Liaison Officer of NCRA, the National Citizens' Radio Association of Australia.**

ANNOUNCING A NEW COMMUNICATIONS COMPUTER!

TONO

THETA 7000E

NEW IMPROVED MODEL FEATURING STACKS OF EXTRA TRICKS!

The new Theta 7000E has all the features of the popular 0-7000, plus a lot more! Now every Amateur can enjoy the visual display of CW, RTTY, and ASC11 in both transmit and receive modes. Just connect the TONO to any TV set via the antenna terminals or to a page printer from the parallel port provided. Bring up your CW speed in receiving or sending by either watching receiver-sent or from recorded cassettes.

SOME OF THE OUTSTANDING FEATURES:

THETA 7000E COMMUNICATIONS COMPUTER

Due to the most up-to-date computer technology, just one piece of equipment can now handle both transmitting and receiving in CW, RTTY and ASC11.

VHF and Composite video output provided:
Both home TV set and video monitor outputs are provided for display purposes.

Printer interface.
Centronics Compatible interface enables easy connection of a low-cost dot printer for hard copies.

Wide range of transmitting and receiving speeds.
10 communication speeds for transmitting (with automatic CW speed adjustment on receive) and 8 communication speeds for transmitting and receiving in RTTY and ASC11. The multiple speed feature makes the Theta-7000E ideal for Amateur, business and commercial use.

Built-in demodulator for high performance.
Three-step shift (either 170Hz, 425Hz, 850Hz) can be obtained in High Tone and Low Tone by the switch. Manual adjustment is available by FINE TUNING control.

Crystal controlled modulator.
A transceiver without AFSK function can transmit in RTTY mode by utilising the high stability crystal-controlled modulator controlled by the computer.

Convenient ASC11 key arrangement.
The keyboard layout is the same as a regular typewriter and automatic insertion of LTR/FIG code makes operation a breeze.

Large capacity display memory.
The two-page display memory contains 32 characters x 16 lines per page. Page selection is operated via the keyboard.

Split-screen.
With a keyboard command, the same page can be divided in two: the upper half for transmit and the lower half for receive. Sentences can be edited whilst receiving.

Automatic Transmit/Receive switch.
The transmit/receive switch is controlled by the microprocessor. (Manual operation is also available). Built-in remote control key function controls the transmit/receive switch of the transceiver.

Anti-noise circuit.
A new anti-noise circuit prevents garbled messages when there is no signal.

Battery backed-up memory.
Data in the battery backed-up memory is retained when the external power source is removed. The Theta-7000E has provision for 64 characters x 7 channels in the non-volatile memory. Data in this memory can be repeated 1-9 times from a keyboard instruction. Every channel can read out continuously. The channel number in use is displayed on the screen.

SEND function.
The SEND function sends the whole data displayed on the screen, including the stored data in channels, with an instruction from the keyboard. The message can be stopped and easily restarted.

Buffer memory.
A 53-character-buffer-memory is displayed on the 17th and 18th lines on the screen. The characters move to the left erasing one by one as soon as they are transmitted. Data in the channels can be displayed in the buffer.

Rub out function.
Mistakes can be erased whilst the information is still in the buffer memory. If the mistake has already been sent correcting code will be transmitted.

Simultaneous access of the memory.
Whilst receiving, it is possible to write into the channel memory and the buffer memory from the keyboard. When sending from the channel memory or the screen it is possible to write into the buffer memory.

Pre-loading function.
The buffer memory can momentarily store data and release it on an instruction from the keyboard.

Channel No., Page No., and Case No.
Channel No., Page No., and Case (FIG/LTR) in RTTY are displayed in the 17th line of the screen.

CR (Carriage return)/LF (line feed) cancel function.
When receiving CR or LF, they are replaced by = (equal) and (underline) respectively for effective use of the screen.

Cursor control function.
Full cursor control (up/down — left/right) is available from the keyboard.

WORD MODE operation.
Characters can be transmitted by word groupings.

Automatic CR/LF.
While sending, CR/LF are automatically inserted once every 72 (60 or 80) characters.

Echo function.
With a keyboard instruction, received data can be read and sent out at the same time. A cassette tape can be used as the source data.

WORD-WRAP-AROUND function.
In receive mode word-wrap-around prevents the last word of line from splitting in two.

Transmit/receive in ASCII mode in RTTY.
On instruction from the keyboard, the same AFSK signals as used in RTTY are transmitted in ASC11 mode.

CW identification function.
Keyboard controlled CW identification is available if required.

MARK-AND-BREAK (SPACE-AND-BREAK) system.
Either mark or space tone can be used to copy RTTY.

Monitor circuit.
A built-in monitor circuit with an automatic transmit/receive switch enables checking of the transmitting and receiving state. In receive mode it is possible to check the output of the mark filter, the space filter and AGC amplifier prior to the filters.

CW practice function.
The Theta-7000E reads data from the key and displays the characters on the screen.

Variable CW weights.
For CW transmission, weights (ratio of dot to dash) can be changed within the limits of 1:3-1:6.

Cross-pattern checking output terminal.
Provision has been made for attachment of an oscilloscope to aid tuning. This supplements the tuning LED and audio monitor provided in the system.

Log-computer output provided.
The Theta-7000E has an output terminal for connection to a log-keeping computer.

Test message function.
"RY" and "QBF" test messages can be repeated with this function.

VICOM Back-up.
Supported by VICOM 90 day warranty and technical service.

$899 incl. S. Tax

Distributed by:

VICOM

Available from VICOM dealers throughout Australia

□ Melb: 68 Eastern Rd, Sth. Melb. Ph. 699 6700
□ Syd. 339 Pacific Hwy, Crows Nest Ph. 436 2766
□ Bris. 48 6601
□ Perth 321 3407
□ Adel. 43 7981

KENWOOD R-1000

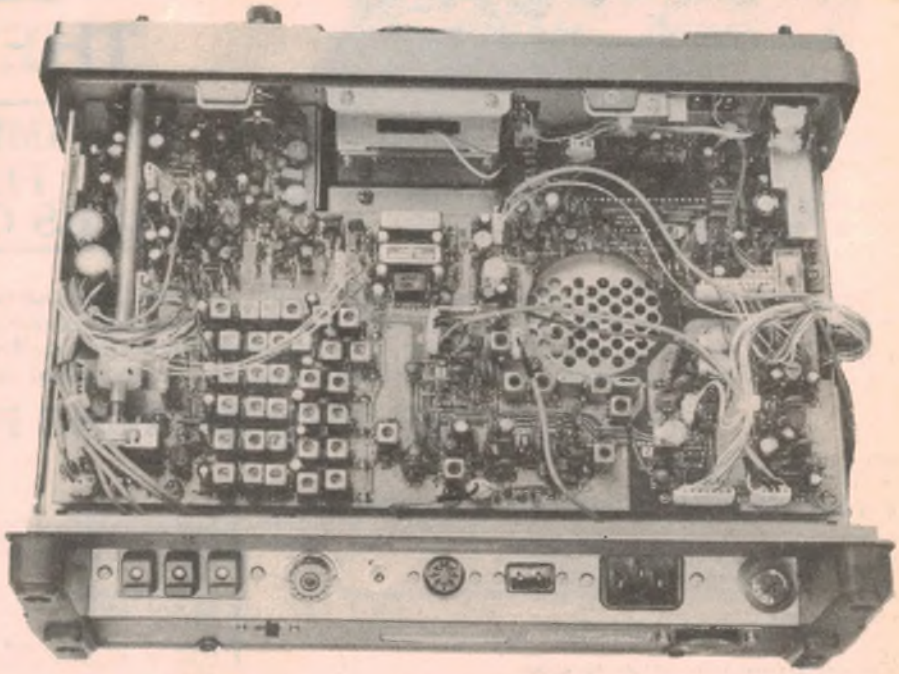
2MHz, and 0.5uV and 5uV for SSB and AM respectively, from 2MHz to 30MHz. These figures are for a signal plus noise to noise ratio of 10dB minimum. Measurements showed that the actual sensitivity was comfortably within these figures and in many cases, very much better.

The AGC performance was equally impressive. The generator input at 10MHz to give about S1 reading on the meter was well below 1uV and an increase of 100dB in signal level resulted in less than 2dB increase in audio output. The noise blanker also works very well, so much so that under noisy conditions, many weak signals which are below the noise level can be copied when the noise blanker is switched on.

A couple of points which attracted my attention relate to the loudspeaker and the AGC release characteristic. While I have no strong feelings about it, I prefer to have the inbuilt loudspeaker mounted on the front panel if possible, or underneath. The AGC release time is quite long and this is good for SSB reception. However, when tuning from a very strong signal, to look for an adjacent weak one, the sensitivity is reduced by the AGC and one has to wait for a few seconds before the weak signal is tunable.

Apart from the above minor points, my overall impression of the R-1000 is that it is an excellent piece of equipment. It should be a strong competitor in its field and it offers very good value for money at under $500. A well illustrated manual is provided, which includes a circuit diagram.

At the time of writing, the importers have a large number of back orders to fill but supplies should become available in March, 1980. The unit for review was supplied by Trio-Kenwood (Australia) Pty Ltd, 31 Whiting Street, Artarmon, NSW 2064. Telephone (02) 438 1277. (I.L.P.)



A single PCB accommodates all the circuitry of the Kenwood R-1000 receiver.

AMATEUR RADIO

Kenwood R-1000 receiver

The Kenwood Model R-1000 communications receiver has recently been released by Trio-Kenwood (Australia) Pty Ltd. It uses a phase-locked loop and covers the frequency range of 200kHz to 30MHz. Capable of reception in AM, SSB and CW modes and featuring digital readout, the receiver appeals as an excellent unit for use by short-wave listeners and amateurs, as well as being useful for some commercial applications.

Since the introduction of the principle of tuning across the RF range in discrete 1MHz steps, it has virtually become the norm with receivers of recent design. The now well known Wadley loop has been used on many receivers but the R-1000 uses instead the phase locked loop principle to provide stable internal frequencies.

The RF amplifier is rather unique in that it is not tuned to the incoming signal frequency in the normal way. Rather, there is a number of discrete bandpass filters, covering the range 200kHz to 30MHz. The appropriate filter is switched into circuit automatically, using diode switching, so that the need to continually peak up the RF stage tuning has been eliminated.

The signal is passed through an RF amplifier to the first mixer, consisting of a balanced pair of dual gate FETs, where it is upconverted to 48.055MHz. The first IF is a band-pass filter with a bandwidth of 17kHz. A second mixer follows, similar to the first, where conversion to a second IF of 455kHz takes place. Injection for the second mixer is from a 47.6MHz crystal oscillator associated with the PLL. Injection for the first mixer (48.055-78.055MHz) is synthesised in the PLL together with the VFO (4.545-4.545MHz) to produce the first IF of 48.055MHz from the incoming signal.

The VFO constitutes the main tuning in kHz for the receiver. MHz selection is by a 30 position switch (calibrated 0-29MHz) which actuates the PLL and, in addition, selects the appropriate RF band-pass filter.

Immediately following the second mixer is a noise blanker. Then there are three band-pass filters, one each to give wide band or narrow band for AM and a third for SSB and CW. There are two stages of IF amplification and separate detectors for AM and SSB. Two carrier insertion oscillators are provided for SSB, one each for upper and lower sideband resolution. Audio amplification is provided for a tape recorder as well as for the usual headphones and built-in or external loudspeaker.

In addition to the circuit of the receiver proper, there is the circuitry to do with facilities such as a clock and ON and OFF timer and the counting and display circuitry for digital readout for the receiver tuning, clock and timer.

The R-1000 is housed in a dark grey metal cabinet, 300mm wide x 115mm high x 218mm deep. The front panel is diecast and the overall finish provides an attractive professional appearance.

Controls on the front panel are well placed and give an uncluttered appearance.

Tuning signals on this receiver is about as easy as it could be. The main tuning knob has a fast tuning recess for a finger and, although there is no flywheel effect, it has a good smooth feel to it; so much so that SSB signals can be tuned without effort and fast changes across the range may also be made with ease. Readout for tuning is by a five digit LED display, giving an accuracy to the nearest kHz. There is also an analog scale which is calibrated in 10kHz steps.

The digital readout also performs the added functions for the clock and for setting the timer operations.

A signal strength meter is calibrated in "S" points and up to 40dB above S9. The analog dial scale and the meter are illuminated and a push-button is provided to dim the light level.

Other controls on the front panel include the 30-position MHz selector switch, a four-position antenna attenuator switch, tone and volume controls, four mode push-buttons, switches for the clock and timer functions, power switch, phones and record outlets.

There are also extra facilities on the back panel: a coaxial socket takes an antenna lead-in of 50 ohms for HF use. Also, there are terminals, one for an earth wire, one for a random wire for HF and one for a random wire for use below 2MHz. A switch selects either the 50 ohm or random wire input for HF use. Sockets are provided for mains input (with fuse and voltage selector), 13.8V DC input, remote control for use with a transmitter and an external speaker.

The built-in loudspeaker is on the top panel of the cabinet. A carrying handle with a series of detents may be used as a prop to raise the front panel for easier access to the controls. Also, although the receiver is not intended as a portable, it may be used as such by virtue of the handle and the facility to operate from an external 13.8V DC supply.

Some measurements which I made on the R-1000 were quite impressive. A drift check taken at 10MHz, from one minute after switch-on, to 60 minutes showed a drift of 530Hz and another 140Hz in the next 30 minutes. This is well within the specification which quotes 2kHz maximum for the first 60 minutes and 300Hz maximum in any subsequent 30 minutes.

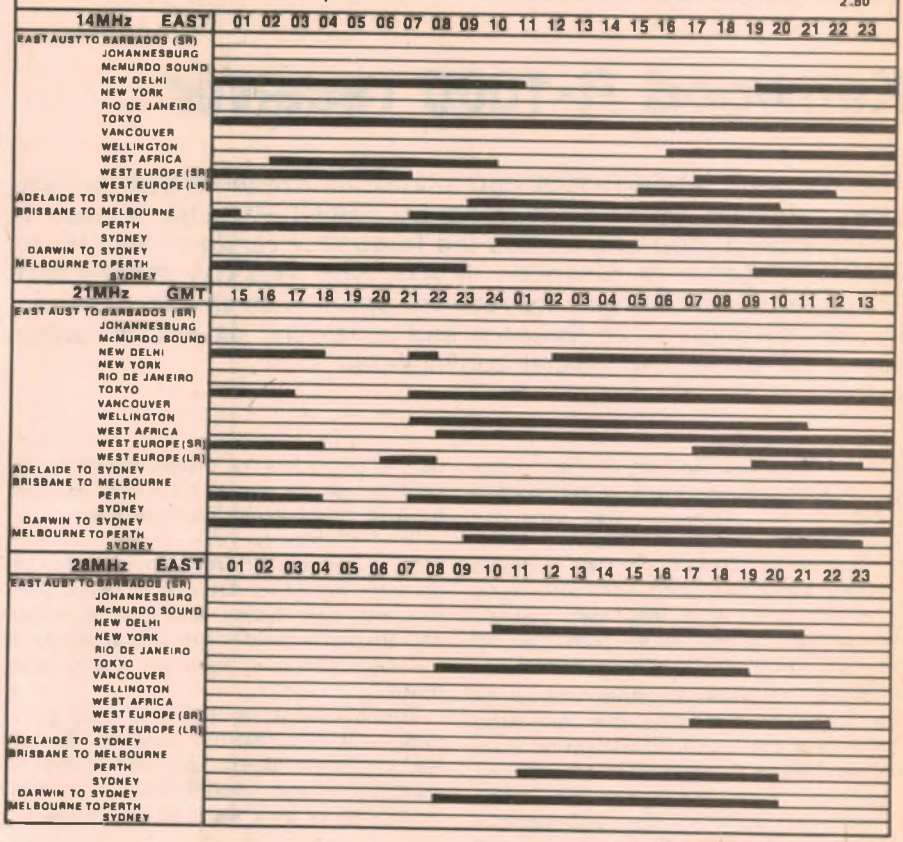
Sensitivity figures given in the specification are: 5uV and 50uV for SSB and AM respectively, from 200kHz to

AMATEUR RADIO

IONOSPHERIC PREDICTIONS FOR FEBRUARY

Reproduced below are radio propagation graphs based on information supplied by the Ionospheric Prediction Service Division of the Department of Science. The graphs are based on the limits set by the MUF (Maximum Usable Frequency) and the ALF (Absorption Limiting Frequency). Black bands indicate periods when circuit is open.

2.80



struction, and practical construction projects.

Full details may be obtained from Jim Harper, VK2VFC on telephone (02) 457 9158.

RADIO CLUB NEWS

CENTRAL COAST AMATEUR RADIO CLUB: A final reminder that the annual field day will be held at the Gosford Showground on Sunday 17th February, 1980. An invitation has been extended to all amateurs, their families, and friends to attend. Full details were given in last month's notes.

LIVERPOOL AND DISTRICT AMATEUR RADIO CLUB: The club will hold a field day on Sunday 23rd March, 1980, at Catherine Fields Hall, Cnr Catherine Fields and Chisolm Roads, Catherine Fields (opposite Post Office).

There will be something for everybody. The whole family will be catered for with equipment displays, disposal sales, hidden transmitter hunts, quiz competitions and novel events.

Registrations commence at 8.30am and activities will continue until 4.00pm with prize presentation.

Registration fees: Children under 16 years and pensioners $2.00; Adults $4.00 per person; Families $6.00.

Catherine Fields is 16km west of Liverpool on the old Hume Highway. Map references are: UBD 106, E3; Gregory's 143 D6.

For further information or accommodation booking inquiries ring (02) 72 1107 or (02) 605 4461 or write to Llyod Anderson, 105 Willan Drive, Cartwright, 2168.

CANADIAN S-W-L INTERNATIONAL: Founded on 21st May, 1977, it aims to promote all activities associated with short-wave listening.

Membership is open to anyone in the world. Annual dues outside Canada or USA $US12.00 which includes airmail delivery of club bulletin "CANDX" containing 40 pages of SWL news and information.

For further information contact Kelvin Hudson, 39 Warwick Avenue, Kurralta Park, South Australia 5037, who is honorary publicity officer for Australasia, the Far East, and Seychelle Islands.

COFFS HARBOUR AND DISTRICT AMATEUR RADIO CLUB: Thirty members attended the second annual meeting of the club and elected Max Francis, VK2BMK president; Paul Ireland, VK2VQI, secretary; Norm Napper, VK2VMP treasurer, plus a committee of five licensed members.

The club conducts classes for the novice licence and, each Monday night, conducts a club net and news session commencing at 8.00pm on 3610kHz.

Preparations are being made for the 1980 Urunga Radio Convention planned to commence at 8.00pm Good Friday 4th April. Registration fee will be $5.00.

Program will include all the popular events.

For further details contact Paul Ireland, PO Box 655, Coffs Harbour, NSW 2450 or telephone (066) 52 4389.

ILLAWARRA AMATEUR RADIO SOCIETY: The society's monthly newletter, "The Propagator", advises that The School of General Studies at the Wollongong Technical College will be running its course in electronics again in 1980.

The course offers an excellent opportunity to obtain the necessary qualification to gain the novice licence or to upgrade to a full licence.

Class times are from 6.00pm — 9.00pm each Friday night, commencing 15th February, 1980. Enrolment is on the first night of the course in Room 213, Mathews Building, Wollongong Technical College at 6.00pm.

Further information from Brian Wade, VK2AXI. Phone after hours (042) 84 1381.

Radio clubs and other organisations, as well as individual amateur operators, are cordially 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 2200.

AMATEUR RADIO

frequency allocations between 4.000MHz and 27.000MHz: "The amateur service has been allocated additional bands at 10100 — 1015kHz on a secondary basis; 18068 — 18163kHz, including amateur satellite, on an exclusive basis, and at 24890 — 24990kHz, also including amateur satellite on an exclusive basis. The availability of the latter two bands to the amateur service is dependent upon the completion of the satisfactory transfer of all assignments operating in these bands and recorded in the Master Register."

In the sections dealing with the bands 960MHz to 40GHZ and 40GHz to 400GHz the following statement appears:

"Extensive allocations have been made jointly to the amateur-satellite and the amateur services, both on an exclusive basis and sharing with other services on a secondary basis."

Standard frequency and time signal services have been added to the table, for Region III, on 8000kHz and 16000kHz.

ANOTHER SAFARI

From time to time your correspondent has reported on unusual VHF contacts made during a holiday safari. Here is another one.

During the first week in December, 1979, a week was spent at Cooma, in southern New South Wales. As has become a habit, the ICOM 215 VHF packset transceiver was included in the baggage.

At the motel in Cooma not a signal was heard. This was probably due, in part, to being off the usual interstate route and in part to the distance of the nearest repeater. This was VK1RGI (channel 7) at Mt Ginini, ACT, over 81km away and shielded by some of the most rugged country in the Snowy Mountains. However, we hoped to make contacts during two trips through the mountains.

The first was to Threadbo and the Mount Kosciusko winter resorts which, in December, are sprinkled with wild flowers and have an entirely different beauty. The second was to Cabramurra, the highest town in Australia at 1122m asl.

At Threadbo village is Australia's longest chairlift; it is 2km long and rises 600 metres above the valley. From its summit it was hoped that a contact through VK1RGI on Mount Ginini might be possible.

However, a more unusual contact was to be made. About halfway up the chairlift I unexpectedly recognised a fellow amateur, Lyle Patison, VK2ALU, on the downward side of the chairlift returning to the valley. The eyeball QSO as we passed was one of surprise and a vocal inquiry revealed that Lyle had two metre equipment with him in his car at the bottom.

At the top of the chairlift time did not allow me to walk higher up the mountain to where contact through VK1RGI may have been possible. However, returning on the chairlift an unusual contact — VK2ALU/M and VK2APQ/chairlift mobile — took place during the 15 minute descent. In the discussion which followed the handshake to seal the unexpected meeting it was agreed that the contact, although unexpected and unusual, was not in quite the same category as Lyle's moon-bounce contacts from VK2AMW at Dapto.

Later on the same trip, a call was made from a Charlotte pass lookout which is within sight of Mount Kosciusko and 107km from Mount Ginini. No difficulty was experienced working through VK1RGI and joining a group which included VK2DO at Yass, VK1AOP/M in Canberra and several others.

On the trip to Cabramurra contact was made through VK1RGI with VK1ZAS/M and VK1AOP/M, both in Canberra.

Later in the evening, after return to Cooma, a check was made from the hill overlooking Cooma railway station and contact was made through VK1RGI with VK2ZWQ at Bundanoon.

From Cabramurra to Mount Ginini is 55km and from Cooma 81km.

Next morning a further check was made from the hill in Cooma and contact through VK1RGI was made with VK1AOP/M Canberra, VK2DO/M Yass, and later, with VK5OZ/M between Goulburn and Yass.

So, once again, amateur radio added to the pleasure of a holiday, not only by reason of the contacts made through a normally remote repeater, but particularly by the unexpected meeting of a friend and fellow amateur, and the unusual contact it provided. If you have portable gear take it with you on holidays; it can provide many pleasant surprises, as well as increasing your knowledge of repeater performance and serving as a valuable aid in case of emergency.

NOVICE LICENCE COURSE

The Novice Amateur Radio Group of New South Wales will hold a course to prepare candidates for the May 1980 P&T Dept novice licence exam. Classes will be held at the Wireless Institute Centre, 14 Atchison Street, Crows Nest, each Saturday afternoon at 1.00pm, commencing Saturday 2nd February, 1980.

The course will include lectures on theory and regulations, Morse Code in-

AMATEUR RADIO

by Pierce Healy, VK2APQ

Finish of WARC 79 — how the amateurs fared and the likely scene for the 1980's

WARC 79 has come and gone and, while many of the details have yet to be worked out, and may take some time, the overall picture should be one of optimism. Several new HF channels have been tentatively allocated, there appear to be no serious losses, and there has been some rationalisation of the Morse code requirements.

Although there have been some authorative statements up to the time these notes were being compiled (mid December 1979), there is still a lot of work to be done by delegation members on behalf of their national administrations. The impact of footnotes to various regulations in the final document, inserted to meet requirements of individual nations, will need careful study. The full implementation of the decisions may be a continuing process for some years.

In general, it appears that amateur radio has retained its status as an international communication service, and will continue to be available to those who have the necessary technical qualifications.

One of the major decisions was to retain the Morse code requirements for amateur licenses in the HF band. However, the regulation has been brought into line with the technical demarcation point between HF and VHF at 30MHz; instead of 144MHz as previously.

A report from the federal president of the Wireless Institute of Australia, Dr David Wardlaw, VK3ADW, (an accredited member of the Australian delegation at Geneva) was broadcast over WIA stations in New South Wales. It contained these points.

- There were no losses to existing frequency allocations in the HF bands.
- Three new HF bands have been created: 10.100MHz to 10.150MHz, with amateur as secondary to fixed commercial primary service; 18.068MHz to 18.168MHz and 24.890MHz to 24.990MHz, as amateur and amateur satellite primary service.
- 50.00MHz to 54.00MHz remains as an exclusive amateur band in regions II and III. However, there are many footnotes for countries in region III which refer to broadcasting.
- 144MHz to 146MHz remains an international amateur and amateur satellite allocation. In region III 146MHz to 148MHz is shared with commercial fixed and mobile services on an equal basis. In effect this means the band was retained by accepting sharing, despite extreme pressures. This does not mean that sharing will be introduced into Australia, although other countries will.
- Although there was pressure on the 70cm UHF band, footnotes resulted in no losses to Australian amateurs in the 420MHz to 450MHz band.
- The 1215MHz to 1240MHz band was lost to make way for a global radio navigation service. However, there is a footnote for 1260MHz to 1270MHz for earth to amateur satellite communication.
- In the GHz range several additional bands have been made available for amateur satellite communication.
- There are also other favourable changes to the amateur satellite service.

It is beyond doubt that the amateur service was admirably represented by the International Amateur Radio Union delegation, which co-ordinated the views of amateurs expressed through their national amateur radio societies. Also by amateurs representing national societies who were accredited members of their countries' official delegation.

ITU NEWS

From the International Telecommunication Union in Geneva it is reported that WARC 79 completed 74 days of work on 6th December, 1979. The new Radio Regulations will come into force on 1st Janauary, 1982.

No less than 894 plenary meetings or meetings of committees and working groups were held, without counting the large number of smaller meetings.

One point of interest is that the conference recommended that the administrative council should consider, from 1990, whether it is necessary to convene a World Administrative Radio Conference for the general or partial revision of the Radio Regulations.

A number of other points were noted, several of which are expansions on the points made in Dr David Wardlaw's summary.

The conference allocated frequency bands on the basis of the three regions defined in the existing Radio Regulations. However, it considered that the present divisions, dated back to 1947, no longer fully met the requirements of all countries. It therefore requested the CCIR to study a possible revision of the division of the world, for frequency allocation.

Fifty three radio services have been allocated frequency bands between 10kHz and 275GHz, which gives some idea of the need for world-wide coordination if these services are to function satisfactorily.

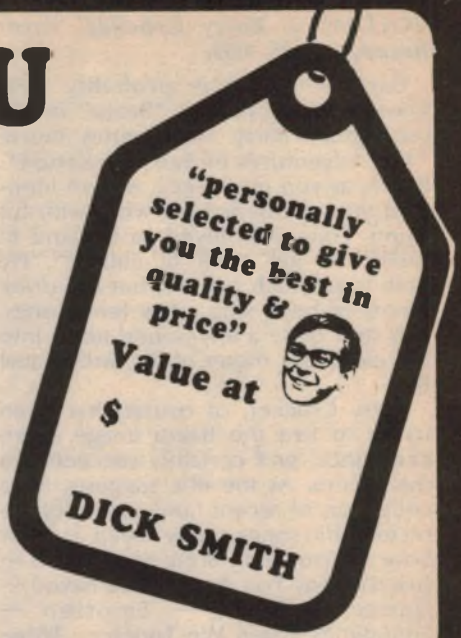
A new band has been allocated exclusively to the amateur service between 1810kHz and 1850kHz in Region I, and between 1800kHz and 1850kHz in Region II.

A new footnote (details not given) was added to the table covering the use of bands allocated to the amateur service between 3.5MHz and 144MHz in the event of a natural disaster. The amateur service was given an exclusive allocation between 3500kHz and 3750kHz in Region II.

In the section dealing with amateur

THIS IS A YAESU PRICE TICKET.

Notice the price?



There isn't one! Or if there is, it represents only the **maximum** you will have to pay. If anyone advertises, in Australia, a lower price than we show, we will guarantee to beat it! Our list prices are very competitive as they are – but we will guarantee to lower them if our prices are undercut!

Please take these prices with a grain of salt . . .

WHY TAKE CHANCES? BUY YOUR YAESU GEAR FROM THE AUTHORISED AUSTRALIAN YAESU AGENTS!

HF TRANSCEIVERS:

FT-901D: Superb all-mode HF transceiver with digital readout. 6146B finals; 180 watts. The ham's dream! CatD-2854 **$1266.00**

FT-101Z: Up-graded version of the famous FT-101E. Suits the FT-901 accessories, same smart styling CatD-2862 **$849.00**

FT-7B: Mobile or base, all HF bands. AM/SSB/CW. 12 volt operation. Easy controls for safer mobiling, too CatD-2868 **$649.00**

LINEAR AMPLIFIERS:

FL-2100B: 1.2kW of muscle (drive it at 400 and it's coasting!) Tunes all HF bands; 240 volt operated CatD-2546 **$599.00**

VHF TRANSCEIVERS:

FT-625R: The new all mode 6m rig for DX chasers CatD-2886 **$795.00**

FT-207R: The 21st century microprocessor-controlled hand held for 2 metre operation. Complete with NiCads CatD-2888 **$358.00**

CPU-2500RK: 800 channels from 144-148; 25 watts CatD-2889 **$549.00**

FT-227RB: 2 metre mobile, dual power out, built-in memorizer CatD-2891 **$399.00**

RECEIVERS:

FRG-7: Probably the most popular receiver in the world!) 0.5 to 30MHz, famous Wadley Loop circuit. Mains or 12V CatD-2850 **$395.00**

FRG-7000: Up-graded FRG-7, with digital readout, dual clocks & timer, etc. A superb receiver for the serious listener CatD-2848 **$625.00**

ACCESSORIES:

FC-901 Antenna tuner: Suits most transceivers; tunes into virtually any load (almost a wet piece of string) CatD-2855 **$265.00**

DC/DC Converter: Suits both the 901 & 101Z CatD-2856 **$75.00**

MEMORY UNIT: For both the 901 & 101Z CatD-2858 **$149.50**

YE7A Mic: 500 ohms imp; with p.t.t. Suits most transceivers CatD-2863 **$14.50**

Cooling Fan: For the 101Z (or replacement on 901) CatD-2865 **$39.00**

TEST EQUIPMENT:

YC-500S Digital Frequency Counter: 1ppm accuracy, 500MHz CatD-2892 **$475.00**

WE OFFER EASY TERMS THROUGH BFC FINANCE *

For us to better any price, simply show us the advertisement from an Australian company. After checking that they have stocks available at that price, we will sell it for a lower price. Offer open while stocks last.

DICK SMITH ELECTRONICS

NSW	125 York Street,	SYDNEY	Phone 290 3377	**ACT**	96-98 Gladstone Street,	FYSHWICK	Phone 80 4944
	147 Hume Highway,	CHULLORA	Phone 642 8922	**VIC**	399 Lonsdale Street,	MELBOURNE	Phone 67 9834
	162 Pacific Highway,	GORE HILL	Phone 439 5311		656 Bridge Road,	RICHMOND	Phone 428 1614
	30 Grose Street,	PARRAMATTA	Phone 683 1133	**QLD**	166 Logan Road,	BURANDA	Phone 391 6233
	263 Keira Street,	WOLLONGONG	Phone 28 3800	**SA**	203 Wright Street,	ADELAIDE	Phone 212 1962
				WA	414 William Street,	PERTH	Phone 328 8944

EXCEPT WHERE NOTED, ALL ITEMS SHOWN IN STOCK AT PRICES GIVEN AT TIME OF GOING TO PRESS

MAIL ORDER CENTRE: PO Box 321, NORTH RYDE NSW 2113. Ph 888 3200. PACK & POST EXTRA.

bankcard welcome here

SHOPS OPEN 9AM to 5.30PM (Saturday: 9am till 12 noon) BRISBANE: Half hour earlier.

ANY TERMS OFFERED ARE TO APPROVED APPLICANTS ONLY

RE-SELLERS OF DICK SMITH PRODUCTS IN MOST AREAS OF AUSTRALIA.

BARRY CROCKER SINGS THE HITS — VOLUME 2. Barry Crocker. Astor Records. ALPS 1059.

Barry Crocker is probably best known for his role as "Bazza" in the outrageous Barry Humpheries movie "The Adventures of Barry McKenzie". Bazza, as you may recall, was an innocent young colonial lad who, with his Aunty Edna, journeyed to England in order "to get a bit of culture". He didn't get much culture, but did drink plenty of beer, sing a few lewd songs, and stuff quite a few pound notes into the electricity meter of his Earl's Court flat.

Barry Crocker, of course, has been trying to live the Bazza image down ever since, and certainly succeeds on this album. As the title suggests, it's a collection of recent (and some not-so-recent) hit songs: How Deep is Your Love — You Don't Bring Me Flowers — Just the Way You Are — Blue Bayou — Dance With Me — Emotion — Sometimes When We Touch — Three Times A Lady — Too Much Heaven — Kiss You All Over — MacArthur Park — Can't Smile Without You — You Needed Me — Higher and Higher.

In summary, an album that Barry Crocker fans definately should not miss. Recording quality is good, with negligible surface noise. (G.S.)

GUITAR SPECTRUM. Guitar Spectrum. Astor Records Pty Ltd. SPLP 1570.

Maybe I've missed something but, as far as I'm concerned, the treatment of the titles on this album is rather heavy handed. Even those titles that are familiar are difficult to recognise at times, although one doesn't doubt that the musicians making the sounds are all very clever. The best advice I can offer is to listen before buying.

The titles: Don't Cry for Me Argentina — Fields — Fascinating Rhythm — Etoile — Norwegian Wood — Scarborough Fair — Heigh Ho — Nauges — Lisbeth — Jesus Christ Superstar.

Recording quality is generally quite okay but with some surface noise on side two. (G.S.)

☆ ☆ ☆

KEVIN BORICH EXPRESS ... LIVE. Kevin Borich. Avenue Records L 37139. Festival release.

This live album was recorded at Bombay Rock, Melbourne; Mount Pleasant Leagues Club, Wollongong and Parramatta Jail.

Seven of the nine tracks were composed by Kevin Borich, including a new version of the La De Das classic, "Gonna See My Baby Tonight".

The nine tracks on the album are: Not Fade Away — The Place — Going Down Town — Little Red Rooster — Gonna See My Baby Tonight — Bellhop Blues — K.B.'s Boogie — Good To See You Again — Going Somewhere. (D.H.)

☆ ☆ ☆

DANCIN' IS MAKING LOVE. Gap Mangione. A&M L 36965. Festival release.

If Disco is your scene, this disc will no doubt find favour with your ears with six lengthy tracks, mainly in that idiom.

Dancin' is Makin' Love — Girl Goodbye — Takin' It Back — You're The One — Dreamflow — I'm Home.

The quality is what one has come to expect from A&R records, bright, clean and with a good stereo image. If you are planning a dance party this would be a good starter. (N.J.M.)

RECORDS & TAPES — continued

of two discs, one by a veteran of the local theatre circuit, the other by one of the younger generation of Australian organists.

Playing his own electronic Conn organ, Reubert Hayes offers: Beyond The Blue Horizon — Spanish Eyes — Kismet Selections — Stranger On The Shore — Swanee — Old Comrades March — Estrellita — Begin The Beguine — My Way — I Don't Know How To Love Him — We'll Meet Again. It's pleasant organ, all in the traditional theatre organ style.

The second album was originally reviewed in June 1976 and, on that occasion, I rated it as a most entertaining performance of wide potential appeal. Ray Thornley relies heavily on over-recording and arrangement to produce a one-man orchestral effect quite distinct from the Reubert Hayes style. The program: That's Entertainment — Great Race Selection — Tara's Theme — In The Mood — Brother Sun, Sister Moon — The Old Piano Roll Blues — The Holy City — Duelling Banjos — March Militaire — Killing Me Softly With His Song — Anchors Aweigh.

In summary, "Blue Horizon" has mainly nostalgic appeal; Ray Thornley offers a more up-to-date style and treatment. The albums are priced at $4.00 each including pack and post, or $7.00 posted for the two. Only from Parker Recordings, 9 Carmel Place, Winston Hills NSW 2153. (W.N.W.)

HOW GOOD IS YOUR HIFI SYSTEM?

— and what about your ears?

STEREO TEST RECORD, "Stereo Review" Model SRT-14, for home and laboratory use. (From M.R. Acoustics, PO Box 165, Annerley, Qld 4103).

When I set about to review this record, I immediately gained the impression of "having been there before". Checking back, I realised it was an up-date of an earlier test record also sponsored by the American "Stereo Review" magazine, model SR12. It was reviewed in these columns in March 1978.

As in the earlier disc, side one is occupied by tracks which will allow an enthusiast to assess his hifi system overall, by careful listening and without resort to test equipment.

As before, bands one and two provide half-octave warble tones between 20Hz and 20,480Hz, which allow the listener to judge the extent and balance of frequencies which are getting through the system and through his/her ears — the last named being a likely problem for the over 40s!

Succeeding tracks on side one permit a subjective evaluation of channel separation, cartridge tracking across the spectrum, channel balance using wide-band noise, speaker phasing, hum and rumble content, and turntable wow and flutter. A booklet explains what to do and what to look for.

Side two is intended more for the laboratory and includes a 40kHz separation test for CD-4 characteristics, L&R response sweep from 500-20,000Hz, a 500Hz square wave, tone burst, intermodulation check, anti-skating adjustment signal, 1000Hz reference tone at four stated levels, 3120Hz flutter and speed test signal, and gunshots to test stereo spread.

As before, a handy disc to have around. (W.N.W.)

Brightly Shines the Morning Star, and J. S. Bach's 9-part Chorale Partita on O God, Thou Faithful God. Then on the second side there is Buxtehude's Trauermusik, composed for the funeral of his father in 1674, and finally a five-part chorale partita on the plainsong hymn Veni Creator, by Nicolas de Grigny.

Peter Hurford's playing of these pieces is first rate; both accurate and sensitive, and with excellent registration. And the organ has been recorded extremely well. The end result sends shivers up my spine — what more can I say? (J.R.)

☆ ☆ ☆

BEYOND THE BLUE HORIZON. Reubert Hayes, the Conn theatre organ. Stereo, Parker PKS-008.
RAY THORNLEY ENTERTAINS. Vol 1. The Lowrey Theatre organ. Stereo, Parker PKS-012.

Devotees of the theatre organ may well be interested in a special offer by Parker Recordings "while stocks last"

Christmas is past but . . .

CHRISTMAS WITH RAY THORNLEY in Yamaha Music-Land. Stereo, AMCO, IMA 7916. (From Soundbank Pty Ltd, PO Box 248, Gladesville, NSW 2111.)

Having been very favourably impressed by a couple of earlier Ray Thornley albums, I was not surprised to find this one also to my liking. Ray Thornley is strong on orchestral sound and arrangement and, with the aid of double recording, can simulate an orchestra as well as anyone I know.

And the Yamaha E70 is certainly equal to the task, with a whole range of instrumental sounds expertly woven together. I think you'll enjoy it the year round, even though it concentrates on the Christmas theme:

It Came Upon A Midnight Clear — Mary's Boy Child — Angels From The Realms Of Glory — The First Noel — We Three Kings — Away In A Manger — O Come All Ye Faithful — The Silver Stars Are In The Skies — The Coventry Carol — Silent Night — The Drummer Boy — O Holy Night.

Technically the sound is very clean and a credit to producer/engineer Malcom Able. Recommended. (W.N.W.)

DEVOTIONAL: Choral — brass & organ — rock beat

THE PSALMS OF DAVID. VOL 3. The Kings College Choir, Cambridge. World Record Club Wrc QR 03476 Quadraphonic.

This is part of a series of Liturgical music in the best Anglican tradition, released over a period by the World Record Club, and featuring one of the world's best known and best disciplined Church choirs. The record has been recorded in Quadraphonic technique but, played on stereo equipment, it provides a delightful reproduction of the ambience of a big church. The psalms, in the order they are sung, are: 93-94-49-107-45-37-53-130-131. The cover notes give an interesting account of how the uses of the Psalms has changed and evolved over the centuries, plus biographical notes of the arrangers. (N.J.M.)

☆ ☆ ☆

NUTSHELL, "BEGIN AGAIN". Myrrh records MSB-6513. (From Ward Records Aust, 18-26 Canterbury Rd, Heathmont, Vic 3135.)

A very fresh "now" sound would be the best description of this collection of 10 gospel songs with a decided rock accent. The three singers, Mo McCafferty, Annie McCaig and Paul Field have somewhat "mid Atlantic" accents but their treatment of the following titles leaves no doubt as to where their hearts lie: Love With No Limit — Don't Let Me Fall — Caroline — In The Father's Hand — Starry Eyed And Laughing — First Snow — Take Me Down — Stay Close — The Dancer — Heaven In Your

Heart.

A liner sheet with the record carries the thought provoking lyrics and photos of the three singers. The sound quality is really excellent. (N.J.M.)

☆ ☆ ☆

HYMNS FOR BRASS AND ORGAN. Harry Mortimer and the Cathedral Brass; Michael Austin, organ. Stereo, World Record Club WRC-R-02982.

In terms of content, there is quite a feast here for those who like traditional hymn tunes, identified both by the theme title and by the tune: "Crimond", "Horsley", etc.

There are 15 in all: Praise My Soul — The Lord's My Shepherd — Mine Eyes Have Seen The Glory — There Is A Green Hill — Alleluia, Sing To Jesus — Silent Night — And Did Those Feet — Ye Holy Angels Bright — Once In Royal David's City — Thou Whose Almighty Word — Abide With Me — The Day Thou Gavest — O Thou Who Camest — Rock Of Ages — Who Would True Valour See.

Recorded in the De Montfort Hall, Leicester, England, the brass is much more evident that the organ. For all practical purposes it could as well be titled "Hymns For Brass".

From a Polydor original, I would judge it to be a fairly old recording that "gets by" — without being notable either for sonic definition or musical enterprise. Still, its presence in the WRC catalog indicates a continuing appeal as a collection of time-honoured hymn tunes. (W.N.W.)

FOU TS'ONG PLAYS CHOPIN — continued

Fou Ts'ong stands revealed as possibly the most lyrical of Chopin's current followers.

The Chinese pianist's approach can best be observed by direct comparison with some of his predecessors; in the sonata, I have chosen Malcuzynski, generally acclaimed in recent decades, to serve: from the very start, it is clear that Fou Ts'ong employs a much lighter touch, eschews solid drama and manages to imbue even the sombre Marche Funebre with considerable lyricism. His musicianship is firm and reasoned, nowhere more so than in the eerie Finale which he invests with a fluttering of bats' wings.

For the Fantasy and Etudes, I chose Arrau's recordings for comparison. There is, in the Fantasy, little to choose between the two versions; Arrau is a little more dramatic and employs a more relaxed rhythm here and there, but the differences are not very marked ones. The Nouvelles Etudes are another matter, though; where Arrau is a little perfunctory and seems to regard the D flat major Etude, with its simultaneous use of staccato and legato as a bit of a bore, Fou Ts'ong reveals even these works to be quite lovely music, delightful to the listener and, presumably, to this pianist. The rarely-heard C minor march is beautifully played, with delicacy and a feeling of gentle resignation. The recorded sound is, on the whole, very good and the disc is highly commended. (P.F.)

☆ ☆ ☆

CHORALE VARIATIONS: Peter Hurford at the organ of Our Lady of Sorrows Church, Toronto, Canada. World Record Club stereo, R 05871.

Lovers of baroque organ music won't want to miss this one. A WRC re-release of a recording made in 1976 by Decca, it features well-known organist Peter Hurford at the delightful neo-classical two manual Casavant Freres organ at Our Lady of Sorrows Church in Toronto. Not only that, but he plays some really enjoyable baroque music.

The first piece is John Bull's Revenant, a set of chorale variations on the old German drinking song More Palatino. Then follows Buxtehude's Chorale Fantasia on the hymn How

Dowd) has not a single first-rate mature tenor of Australian provenance. This, then, is a disc to enjoy, but I suggest you do not send it to discriminating opera-lovers abroad. (P.F.)

☆ ☆ ☆

BEETHOVEN: Piano Concerto No. 3 in C minor, op. 37. Maurizio Pollini, piano; Vienna Philharmonic Orchestra; conductor Karl Bohm. DG Stereo disc 2531 057.

There is a pretty general consensus among the world's music-lovers that Pollini is one of the great pianists and musicians of our time; I have heard him on disc and live and, although I had some reservations earlier in his meteoric career, I now wholeheartedly subscribe to the above consensus. As might be expected, his interpretation of this Beethoven concerto is authoritative, sensitive and very beautiful.

Despite the obviously first-rate performance, first listening to this record left me a little dissatisfied. I recalled some rather strange occasions of recent years when Bohm, noticeably ageing, had adopted uncommonly slow tempi; I listened again, compared the performance with older, excellent ones, by Solomon and by Schnabel, employing tried and reliable conductors and found that there's nothing sluggish about Bohm's tempi: total performance times are almost identical for Pollini and Schnabel while Solomon (with conductor Menges) took about 1½ minutes longer.

After repeated checks, I have concluded that there is some slight, but consistent, lack of communication between soloist and conductor — they simply did not take the same view of many little details; also, the recorded orchestral sound, while good, is not as clear and precise as I might have wished.

To me, then, this disc is just a bit short of what it ought to be: the conductor not entirely fair to the soloist and the recording technicians not quite fair to what is still one of the world's best orchestras. (P.F.)

☆ ☆ ☆

ISADOR GOODMAN PLAYS CHOPIN. Etudes in E major, op 10 No. 3, C minor, op 10 No. 12, A flat major, op 25 No. 1; Mazurka in B flat minor, op 24 No. 4; Nocturne in F major, op 15 No. 1; Polonaise No. 6, A flat major, op 53; Waltz in E flat major, op 18; Ballade No. 3, A flat major, op 47; Berceuse in D flat major, op 57; Scherzo No. 3, C sharp minor, op 39. Philips stereo disc 6508 004. (Also available on cassette.)

This Chopin recital was recorded to mark Goodman's 70th birthday and it is a fitting tribute to a musician who, over many decades, has contributed a great deal to Australia's cultural life. The periods during which he was most widely known were the pre-war years, when he appeared regularly in Sydney's major movie theatres, giving audiences far better music than they were used to; and, later, touring army camps all over the place, introducing many a soldier and airman to the delights of Chopin, Liszt and Schumann.

Available also on cassette

In terms of today's virtuosi, Isador Goodman is, of course, a very minor figure; no amount of affection can blind us to that. All the same, even at 70 he can still produce a seductively enchanting sound and his sure touch seldom deserts him. As in earlier days, Goodman shows at his best in music of a strongly romantic cast: on this occasion, the "Aeolian Harp" Etude from opus 25 receives a fine and delicate reading, as good as I've yet heard. The same goes for the Berceuse, even though he is easily tempted into tempi that are just a trifle too fast for the most thorough enjoyment of the music. Again, in the Nocturne and the slow sections of the Ballade, I find Goodman thoughtful and quietly sensitive, playing with a lovely sense of contemplation that Chopin is rarely accorded.

In fairness to those who may not be familiar with Goodman's work, some shortcomings cannot be glossed over; the Mazurka is decidedly bumpy, the Waltz is, to my taste, too fast and full of oompapah and there are, here and there, signs of flurry in the faster runs. They are blemishes, but not of a major kind and not such as would spoil one's enjoyment of the record. The quality of the sound, recorded in an ABC studio, is very good and the record surfaces are quiet. (P.F.)

☆ ☆ ☆

FOU TS'ONG PLAYS CHOPIN: Sonata No. 2, B flat minor, op. 35; Fantasy F minor, op. 49; Trois Nouvelles Etudes, op. posth.; Funeral March in C minor, op. 72 No. 2. Odyssey stereo disc ODA 5134.

As I indicated in my review of the Chopin Nocturnes, Fou Ts'ong has suddenly emerged as an authoritative interpreter of this composer's music; this is the more surprising as this pianist, by no means a newcomer, was previously known almost exclusively for his playing of Mozart. Just as he played Mozart's music with the cleanest of classical attention, so now

A NEW "1812" — Telarc cuts loose with the guns!

TCHAIKOVSKY: 1812 Overture; Cappricio Italien; Cossack Dance from Mazeppa. Cincinnati Symphony Orchestra conducted by Eric Kunzel. Stereo, Telarc DG-10041. (From P. C. Stereo, PO Box 272, Mt Gravatt, Qld 4122.)

With this album comes a leaflet advising caution during the first playing, in case the extreme groove excursions should upset the cartridge, the amplifier, or the loudspeaker system. Look at the grooves carrying the cannon shots and you'll see why.

By all means follow the advice but don't be surprised if a first cautious playing robs the performance of its vitality. It will almost certainly drop the level of the soft passages down into the ambient noise of an average suburban on-street dwelling — such is the dynamic range.

A second playing, with the gain turned up to the safe limit should correct any such reservation, although I still felt that the microphone placement could have captured a little more ambience and a little more spread.

But the recording is nevertheless very quiet and very clean and, when the bells and particularly the cannon shots are heard — the result of a computer controlled digital mix — that is where the quality really stands out. What tends to degenerate into noise-on-noise in some other versions emerges here as a series of incredibly clean and gutsy transients, that literally shake the house.

On side 2 "Cappricio Italien" is an appropriate and familiar coupling, with Cossack Dance from "Mazeppa" providing, between them, another 20 minutes of clean, vibrant sound.

Mastered on a Soundstream digital system and processed in Germany, the disc comes in a double-fold album with notes on the system, the music and the conductor and orchestra. This is another superb album. (W.N.W.)

REVIEWS OF RECENT

Records & Tapes

CLASSICAL ● POPULAR ● SPECIAL INTEREST

John Mack, oboe: "utterly musical"

SCHUMANN: Three Romances, op. 94; BRITTEN: Six Metamorphoses after Ovid, op. 49; SAINT-SAENS: Sonata op. 166; PALADILHE: Solo de Concert. John Mack, oboe; Eunice Podis, piano. Telarc (US) stereo disc 5028 (From PC Stereo, PO Box 272, Mt Gravatt, Qld, 4122).

John Mack's name was familiar to me — the leading oboist in the Cleveland Orchestra and the most widely acclaimed of Tabuteau's students ought to be worth hearing. In the event, his playing far exceeded my expectations; it is no small matter for the oboe never to appear excessively penetrating and utterly musical in every phrase: yet, these are Mr Mack's achievements.

Schumann's op. 94 was certainly composed for the oboe and sounds delicious when played on it; I had not heard it on disc since the days of Leon Goossens. Too often, live or on disc, it is played by flute, violin, even clarinet — good to have the real thing for once. Britten's Six Metamorphoses, written in 1951, is one of the composer's most successful essays with an unaccompanied voice; far from sounding thin or obsessive. Britten's musical line is ideally realised in one of the happiest of his works.

The sonata by Saint-Saens, written in 1921, is another piece which shows a composer at his most skilful and best. The three concise movements are utterly delightful; this is remarkably fine chamber music, quite unjustly neglected. If Emile Paladilhe's name seems unfamiliar, don't worry: although he appears to have been quite a prolific composer (he died at 82 in 1926), no other work of his graces the catalogue. The piece heard here was written as a virtuoso showpiece and that's what it is — melodic, quite charming, fiendishly difficult and brilliantly played.

Special mention must be made of the outstanding quality of recorded sound on this record from Cleveland — sound worthy of the magnificent playing and, on the whole, very fine and unusual music. (P.F.)

Australian Opera: A disc to enjoy — but . .

STARS OF AUSTRALIAN OPERA SING VERDI. Joan Carden, soprano; Lauris Elms, contralto; Robert Allman, baritone; Neil Warren-Smith, bass; The Sydney Symphony Orchestra; conductor Eric Clapham. ABC stereo disc AA 9059.

This disc should have been one any of us would be proud to send abroad as a Xmas gift and as proof of the Australian Opera's high standards. To be sure, there are some glorious sounds on the record and there is quite a lot to be proud of — including first-rate recording technique, decent acoustics and a well-compiled set of notes in a sleeve which shows John Coburn's "Curtain of the Sun' for the Opera Theatre stage. Alas, the disappointments almost outweigh all these fine things!

The music, nine tracks, is taken from seven Verdi operas: two items each from Traviata and Rigoletto, one each from Nabucco, Otello, La Forza del Destino, Il Trovatore and Don Carlo; the bass and the contralto are heard twice each, the soprano gets three showings and the baritone — overworked as is usual — is heard on four tracks. Of the four artists, Lauris Elms is probably the only one whose experience in the concert hall and recording studio is as extensive as her operatic stage work; this may well be the reason why she, alone of the four, performs here as freely and unembarassedly as if she was in a full operatic performance.

As far as singing goes, all four artists are excellent, even though Mr Allman shows some slight strain at the top of his range. The singing is fine, but it simply is NOT opera. The artists are hampered by the absence of familiar coprotagonists as well as by an unfamiliar conductor and orchestra; worst, they seem, each one of them, to be struggling against uncommonly slow tempi which tend to negate every genuine dramatic effort.

Of the pieces included, I was mystified by the Rigoletto scene described as a Duet between Rigoletto and Sparafucile — it does seem a bit odd! The things that are wrong can most strongly be observed in the Willow Song: Miss Carden sounds quite glorious in the gentle and tender sections, but of real drama there is no trace.

The members of the SSO, wherever there is something to get their teeth into, perform quite splendidly and, as I said, there is a great deal to enjoy on the record. That such a disc should be made without the participation of a tenor is, of course, rather ridiculous. However, as anyone who subscribed this season will know, the company presently (and since getting rid of Ron

Reviews in this section are by Paul Frolich (P.F.), Neville Williams (W.N.W.), Jamieson Rowe (J.R.), Leo Simpson (L.D.S.), Norman Marks (N.J.M.), Greg Swain (G.S.), and Danny Hooper (D.H.).

Letters to the editor

Cigarette advertisements

I wrote to you on August 16 protesting at the inclusion in that month's issue of a "foreign matter" advertisement in a publication I had purchased as a specialist journal since its inception (as Radio and Hobbies) in 1939.

I feared I was a lone voice crying in the wilderness but was heartened by the reply I received from the then editor Jamieson Rowe.

I was saddened to read his farewell leader in the November issue and to note the inclusion in that issue, and that of December, of the offensive (to me) advertisement.

As this now seems to be confirmed policy, I have no option but to express my disapproval in the only manner now open to me — the transfer of my subscription to your competitor. Their December issue, at least, does not carry any such extraneous advertisements — something I would have thought axiomatic in such a journal.

In closing I must say that I find it incredible that I was the only one to protest in writing (at least no other letters were published).

Chas Fletcher,
Toongabbie West, NSW.

COMMENT: We were naturally very sorry to see Jim go, but wish him well in his new position. We too, would be happier without "extraneous" adverts but they are legal and the result of an overall space booking involving the parent companies.

Politicians & the press

I wish to congratulate you on your Editorial in the December 1979 issue of EA. Your comments are so accurate and so necessary that the item should be made compulsory reading for all media personnel and for all politicians.

To show my reaction to the present situation, and to support your statements, I would point out that I no longer buy any of the daily newspapers and only subscribe to those technical or semi-technical publications which are reasonably factual in approach. My own experience over the years, whenever I have been involved in a newsworthy matter, is that the press is incapable of accuracy, even when an accurate report might be stimulating to sales. The record was one item which had 23 fundamental incorrect statements in one short report.

Your comments regarding the political scene are also valid. During periods of regular car driving I used to listen to the broadcast of our national Parliament, not to become well informed, but as a form of amusement akin to Amos and Andy.

With rare exceptions, the utterances of our representatives would have brought scorn on a third form debating team at school.

Perhaps if enough citizens indicate to the news media that dramatic, inaccurate and misleading reports are not what is desired by thinking people, and perhaps if enough politicans are made aware of the low level of esteem in which they are generally held, we may have some improvement. If you have sufficient response to your Editorial, perhaps circulation of that copy and the supporting letters should be made to those whom we have criticised.

J. M. Swan,
Girraween, NSW.

Nuclear power & the December editorial

I found your editorial in the December issue of "Electronics Australia" somewhat disturbing.

You state that "truth itself is being sacrificed to personal and political point scoring" and quote examples of pressmen asking for guarantees of safety from a Lucas Heights' spokesman. Perhaps their questions and the scepticism of government agencies can be condoned in the light of the following:

(1) At the 1972 AEC hearings on emergency core cooling in US reactors, interventionists Cherry and Ford were continually misled and misinformed by the AEC as to the recommendations of a scientific group, included in a manuscript known as the Brockett report.

The Brockett report showed that emergency core cooling has not been developed to a level where it would work reliably; but the AEC was being pressured by the manufacturers — and hence fought to have the report excluded from evidence, claiming that emergency core cooling was a reliable and well developed technology.

Cherry and Ford subsequently exposed this deceipt and reactor orders fell from 1000 to 200.

(2) In Australia, Queensland Mines' submission on water management in the proposed Northern Territory uranium mines used rainfall figures from 1962-69 — inordinately dry years. The figures from 1970-77 indicated that leaching of tailings could be a very real problem indeed.

The Queensland Mines submission was accepted as proof of safety by government agencies.

(3) At the site of the Shippingport nuclear plant in Pennsylvania, a survey of local health was undertaken by the National Utilities Corporation. The figures that emerged showed that the child mortality rate was more than double the state average. They showed that there is more than twice as much leukaemia, and that in 1970 — the year of highest infant mortality — the level of Strontium 90 in milk at local dairies reached an all time high.

When considering these findings, frightening enough in their own right, one must take into account that, in the opinion of the AEC, the Shippingport complex was one of the industry's safest and that all the radition levels recorded and encountered during the health survey were within the recommended levels set by the Australian AEC.

(4) The "no-one has ever been killed by a nuclear power plant" argument is one of the greatest dupes.

After the recent death from leukaemia of one of the Lucas Heights workers due to a sudden and accidental blast of radiation, the AAEC quietly settled out of court with the widow. This takes a little of the sting out of the "white as snow" front of the industry.

Furthermore, death from radiation overexposure is a very slow process, and information about the long term health of workers in the industry is difficult to obtain. This is mainly due to the fact that medical records of employees have not been kept for any significant time (15-20 years) in any nuclear institution in the world.

The "spirit of honest enquiry" is indeed a casualty of our present era, but I would suggest that, in the light of the foregoing, this spirit has been quashed by the protagonists of nuclear power; not, as your editorial suggests, by those who oppose it.

When the lure of the dollar is subtracted and when people recognise the fact that waste disposal, reactor integrity and other critical issues have not been solved, perhaps then the humbug will be allayed.

Martin Levins,
Wahroonga, NSW.

COMMENT; The December editorial was neither pro nor anti-nuclear. Its thrust was aginst emotional, sensational and political verbage, as distinct from reasoned debate and consensus.

THE TOP TEAM OF TESTERS

The Professional Choice.

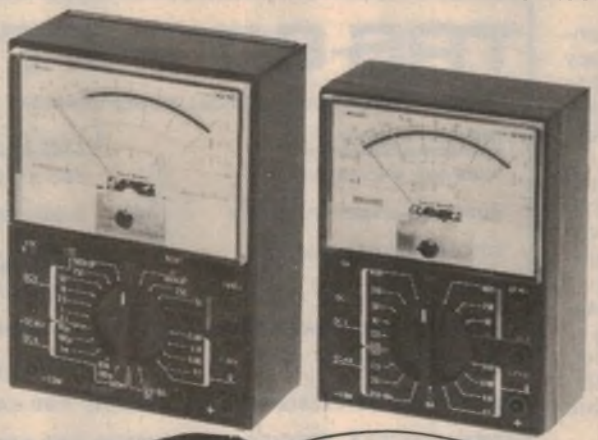
Make your choice of the tester to suit the job — knowing that your selection is backed by two great reputations. The reputation of Hioki, world-famous for their innovations in electrical measuring instruments for forty-five years, and H. Rowe who have close to 80 years of experience in the electrical industry. H. Rowe are the sole agents for Hioki in Australia.

These outstanding testers meet the most exacting standards of professionals — which is why they are chosen by the majority of electricity authorities. We believe Hioki are unequalled for reliability in their field.

Before you choose any tester, look into this Hioki range. You will be pleased and perhaps surprised at their advanced technology.

3010 An ultra sensitive meter – 100,000Ω/V (Max). Includes D.C. polarity selector switch, relay and fuse protection, a taut band movement plus an output terminal for dB readings.

D.C. VOLTAGE
Full Scale Value 0.1/1/2.5/10/50/250/1000V
Accuracy ± 3% of rated value
Internal Resistance 100,000Ω/V
D.C. AMPERAGE
Full Scale Value 10μ/100μ/1/10/100/500 mA /10A
Accuracy ± 3% of rated value
Voltage Drop 100 mV 250 mV
A.C. VOLTAGE
Full Scale Value 10/50/250/500/1000V
Accuracy ± 3% of rated value
Internal Resistance 10,000Ω/V
A.C. AMPERAGE
Full Scale Value 10A
Accuracy ± 4% of rated value
RESISTANCE (OHMS)
Full Scale Value 2k/200k/2m/20mΩ (Rc 20Ω)
Accuracy ± 3% of scale length
LOW FREQUENCY OUTPUT (DECIBELS)
20 - 36 dB

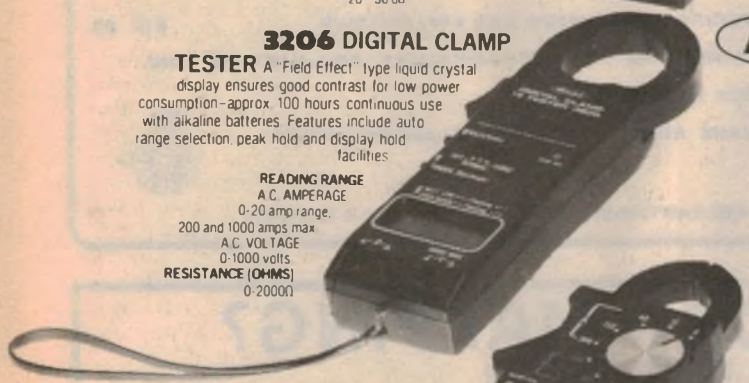


3003 A high sensitivity meter with fuse protection, taut band movement and mirror scale. A.C. current measurement up to 10A, and output terminal for dB readings.

D.C. VOLTAGE
Full Scale Value 0.25/2.5/10/50/250/1000V
Accuracy ± 3% of rated value
Internal Resistance 30,000Ω/V
D.C. AMPERAGE
Full Scale Value 50μA/2.5/25/250mA/10A
Accuracy ± 3% of rated value
A.C. VOLTAGE
Full Scale Value 10/50/250/1000V
Accuracy ± 3% of rated value
Internal Resistance 13,500Ω/V
A.C. AMPERAGE
Full Scale Value 10A
Accuracy ± 4% of rated value
RESISTANCE (OHMS)
Full Scale Value 5k/50k/500k/5mΩ (Rc50Ω)
Accuracy ± 3% of scale length
LOW FREQUENCY OUTPUT (DECIBELS)
Full Scale Value -20 - 36 dB
Accuracy ± 4% of rated value

3206 DIGITAL CLAMP TESTER A "Field Effect" type liquid crystal display ensures good contrast for low power consumption – approx. 100 hours continuous use with alkaline batteries. Features include auto range selection, peak hold and display hold facilities.

READING RANGE
A.C. AMPERAGE
0-20 amp range,
200 and 1000 amps max.
A.C. VOLTAGE
0-1000 volts.
RESISTANCE (OHMS)
0-2000Ω



3101 Dustproof case, circuit protection fuse and convenient meter lock. Incorporates the advanced, shock-resisting core magnet taut band movement.

A.C. AMPERAGE
6/15/60/150/300A
Accuracy ± 3% of rated value
A.C. VOLTAGE
150/300/600 V
Accuracy ± 3% of rated value
RESISTANCE (OHMS)
0-1 kΩ (Centre 30Ω)
Accuracy ± 3% of scale length

3205 DIGITAL MULTIMETER A "Field Effect" liquid crystal display ensures good contrast. Approx. 40 hours continuous use with alkaline batteries. Features include – automatic and fuse overload protection and semi automatic range selection.

D.C. VOLTAGE 5 ranges. With auto facility.
200 & 2000 mV ranges: acc. ± 0.3%rdg ± 0.1%f.s. ± 1dgt
20-200 Volts range: acc. ± 0.5%rdg ± 0.1%f.s. ± 1dgt
200 & 1000 V ranges: acc. ± 1.5%rdg ± 0.1%f.s. ± 1dgt
D.C. AMPERAGE 4 ranges. With auto facility.
200 & 2000 μA ranges: acc. ± 1.0%rdg ± 0.1%f.s. ± 1dgt
20 & 200 mA ranges: acc. ± 1.0%rdg ± 0.1%f.s. ± 1dgt
A.C. VOLTAGE 5 ranges. With auto facility.
2000 mV range: acc. ± 0.3%rdg ± 0.2%f.s. ± 1dgt
20-200 Volts range: acc. ± 0.8%rdg ± 0.7%f.s. ± 1dgt
200 Volts range: acc. ± 1.7%rdg ± 0.8%f.s. ± 1dgt
1000 Volts range: acc. ± 1.7%rdg ± 0.3%f.s. ± 1dgt
A.C. AMPERAGE 4 ranges. With auto facility.
200 μA: acc. ± 1.3%rdg ± 1.0%f.s. ± 1dgt
2000 μA: acc. ± 1.3%rdg ± 0.2%f.s. ± 1dgt
20 & 200 mA ranges: acc. ± 1.3%rdg ± 0.7%f.s. ± 1dgt
RESISTANCE (OHMS) 6 ranges. With auto facility.
200 & 2000Ω ranges: acc. ± 0.5%rdg ± 0.1%f.s. ± 1dgt
20 & 2000kΩ ranges: acc. ± 0.5%rdg ± 0.1%f.s. ± 1dgt
2-20mΩ: acc. ± 0.7%rdg ± 0.2%f.s. ± 1dgt

A wide range of optional accessories also available

Phone now — we'll be pleased to arrange a demonstration or supply further details.

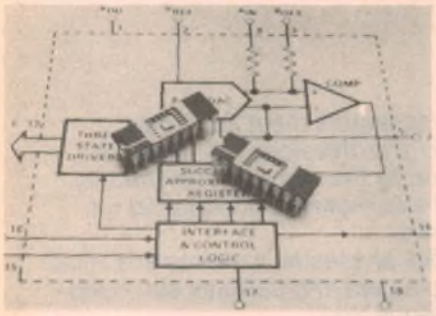
• SYDNEY 6016600 • MELBOURNE 3296511 •
• BRISBANE 525231 • ADELAIDE 466411 • PERTH 4466622 •

H. ROWE & CO. PTY. LTD.

SOLE AUSTRALIAN AGENTS

Microcomputer News & Products

NEW LOW-COST A to D CONVERTER



A new 8-bit analog to digital converter which performs full accuracy conversion in 15us and is connected to a microprocessor bus as a memory-mapped peripheral is now available from Analog Devices.

The AD7574 acts as a memory-mapped peripheral and is interfaced in the same way as RAM or ROM. For example, in the static RAM mode, a conversion is started by executing a memory-write to the AD7574. A data-read is performed by executing a memory-read to the AD7574. The chip uses control input signals CS-bar, RD-bar and BUSY-bar which are available in all microcomputer systems.

Several different versions are available, the differences between the different types being conversion accuracy and operating temperature ranges.

Further information on these devices is available from Parameters Pty Ltd, 68 Alexander Street, Crows Nest, NSW 2065. Phone (02) 439 3288.

NEW LOGIC DEVELOPMENT SYSTEM FROM HEWLETT-PACKARD

Microprocessor products can now be moved rapidly from project definition to production with this new Logic Development system.

Called the model 64000, the system is hard-disk based with multi-station architecture for a flexible, high-performance operating system. It helps hardware and software designers in design, debugging and troubleshooting of microprocessor-based products.

The system will currently support four microprocessors with relocating macro-assemblers and real-time emulation at processor speed. The micro's that are currently supported are the Intel 8080, 8085, the Motorola 6800 and the Zilog Z80.

Emulation modules for all of these microprocessors free the user from designing around a particular chip from a single source.

For further information contact Hewlett-Packard Australia Pty Ltd, 31-41 Joseph Street, Blackburn, Victoria 3130. Phone (03) 89 6351.

NORTH STAR USERS GROUP

A group of North Star computer users has been formed in Melbourne, and they are now interested in hearing from other users in Australia. Write to P.O. Box 156 Carnegie, Vic. 3163 enclosing $2 for reply.

DON'T MISS OUT

27 DO-IT-YOURSELF PROJECTS FROM ELECTRONICS AUSTRALIA

If you like building electronic projects in your spare time, this exciting new book of popular projects is a must. There's a tacho, a dwell meter and a CDI unit for your car; a Doppler burglar alarm; a digital clock; a loudspeaker protector; a variable power supply; plus much more. Order your copy now!

Use this handy order form

ONLY $3.00* + 60c pack & post

To: Electronics Australia, PO Box 163, Beaconsfield 2014.

Please send me ..... copies of "PROJECTS & CIRCUITS NO. 2" at $3.60 each. (Price includes packing and postage.)

NAME .....

ADDRESS .....

.....STATE..... POSTCODE.....

I enclose a cheque/postal order to the value of $ .....

"THE S100 BUS STOP" TM

S100 16K STATIC RAM KIT

ETI 642

16K 2114, Low Power 1.2 Amps Typ. for 16K. 300 or 450nS. 4K addressing, 4K write protect switches. Cromemco bank select, wait states, plated thru-holes, solder mask. See FEB. E.T.I. project for details. Assembled and tested $380.00. $5.00 P&P Reg. mail. Kit price $315.00.

UV EPROM ERASERS

New product range. LEE/T 15W tube — 120 min. timer — up to 40 eproms — will erase in 10/15 min. Model MEE/T — 8W tube — 120 min. timer up to 10 eproms — will erase in 20/30 min. Model MEE is the same as MEE/T but with no timer. All erasers have safety cut out switch.
PRICE: LEE/T $105.00. MEE/T $93.50. MEE $74.00. P&P $3.00.

S100/6800 CHASSIS

11 Slot back plane, 15 amp. power supply, fan, key switch, bench mount, rack mount, fully card guided, anodised alum. 5 sockets in basic unit.

S100 Rack Kit	$306.00	Assembled	$406.00
S100 Bench Kit	$345.00	Assembled	$445.00
6800 Rack Kit	$331.00	Assembled	$431.00
6800 Bench Kit	$370.00	Assembled	$470.00

6800 Power Supply 5V at 10 amps. + 12V at 2 amps
S100 Power Supply 8V at 15 amps. + 16V at 2 amps

S100 16K Eprom Board Kit	$98.00
S100 Z80 4 MHz CPU Board Kit	$156.00
S100 Floppy Disc Controller Kit	$165.00
S100 Double Density Disc Controller Kit	$325.00
S100 2708/2716 Programmer Kit	$175.00
S100 2708/2716 Eprom Board kit	$115.00
S100 11 Slot Back Plane	$36.00
Extender Termination Board	$70.00
S100 Sockets	$8.00
S100 Wire Wrap Board	$28.50
S100 Extender Board Kit	$33.00
Number Cruncher Kit (MM57109)	$49.50
SBC 100 Single Board Computer	$260.00
S100 80 x 24 Video	$330.00

DUAL SERIAL PORT BOARD NEW PRODUCTS

9 Parallel Ports (programmable). 2 Serial Ports TTY RS232 or TTL. Baud rate generator 9600 to 75, full address decoded, low power buffers, plated thru holes, solder mask.
KIT PRICE $189.00. P&P $3.00. ASS PRICE $225.
Dual serial port version.

DISC DRIVES

Shugart SA400 Mini	$375.00
Shugart SA801	$650.00
Remex 4001 Double Sided	$750.00
6800 PRODUCTS	
6800 11 Slot Back Plane	$36.00
6800 11 Slot Chassis (Basic Rack)	$175.00
6800 Extender Board Kit	$33.00
2708 EPROMS (ceramic)	
450nS, guaranteed quality	$12.00
2716 Eproms (single supply)	$47.50
2114 RAMS Low Power Hitachi, Super Rams	
450 NS	$7.50
300 NS	$8.50

Send 60c in stamps for computer printout catalogue for full production information and price list.
All products Aust. made and ex-stock (almost).
Dealer enquiries welcome.

SM ELECTRONICS MELBOURNE

bankcard — *Give name, number, expiry date and signature. For mail order sales.*

BUILT AND TESTED P.O.A.
ALL PRICES ADD 15% S.T. IF APPLICABLE

S.M. ELECTRONICS
1096 Doncaster Road, Doncaster East, Vic 3109.
Phone (03) 842 3666, 842 3950.
Telex AA37213
Dealer A.C.T. 81 5011
Dealer SYD. 661 9237

Gimix Inc of the USA have just announced their new System 68 6800-based microcomputer system.

The system is SS-50 bus compatible for both hardware and software. The system is video based, the high speed of the Gimix video board filling the screen instantly. It is limited only to the entire systems software limits, whereas a terminal limits the user to the intelligence of the terminal.

The system also features the Gimix-bug resident operating software. The monitor ROM is installed on the CPU board and features all the standard utility routines found in other MIKBUG compatible systems.

A video board, GMXBUG, a parallel keyboard, and a video monitor give you a complete video based system. No terminal is required.

Further system backup is provided in the form of additional boards that can be fitted to the system by plugging into the mother board. These include — 16K and a 32K static memory boards, 8K PROM boards, and 4K PROM programmer and duplicator boards.

Gimix also offer a range of serial and parallel I/O boards, as well as special relay driver boards for AC mains interface and control.

Further information can be obtained from the Australian distributor, Paradio Electronics, 7a Burton Street, Darlinghurst, NSW 2010. Telephone (02) 31 3273.

MICRONEWS CONTINUED

Microcomputer News & Products

200mm floppy disk systems, and a 16M byte hard-disk system.

Price for the basic 8K system is $560 plus 15% sales tax where applicable. The system is in kit form but can also be purchased as a fully assembled unit for $660 plus 15% sales tax.

The system is available from South West Technical Products Corporation, 7a Burton Street, Darlinghurst, NSW 2010. Phone (02) 31 3273.

STEWART ELECTRONICS MOVE

As from 1st February 1980, Stewart Electronics will be moving from their current Mount Waverley address to much larger premises at 44 Stafford Street, Huntingdale, Vic.

The new phone number is (03) 543 3733 and the telex No. is 36908.

TEXAS FLOPPY-DISK CONTROLLER

Texas Instruments has just announced the release of a new floppy-disk controller that is compatible with their series of TM990 microcomputer board products.

The board, designated TM990/303, supports up to 4 double-sided drives and features programmable stepper-motor rates and data transfer format.

In addition the board also features write precompensation, 125mm or 200mm diskette compatibility, soft sector compatibility, internal phase aquisition and address mark detection.

For further information contact your nearest Texas Instruments distributor.

TROUBLESHOOTING AND DEBUGGING MICROS

Hewlett-Packard have released a specially written application note for designers and users of microcomputer systems.

The 16-page booklet, "Minicomputer Analysis Techniques Using Logic Analysers", includes theory and examples of procedures for software evaluation, code optimisation, performance analysis, and troubleshooting complex digital systems. Listed as Application Note 292 (publication number 5953-2704), the booklet is available from Hewlett-Packard free of charge.

Further information can be obtained from Hewlett-Packard Australia Pty Ltd, 31-41 Joseph Street, Blackburn, Victoria 3130. Phone (03) 89 6351.

NATIONAL MICROCOMPUTER CONFERENCE

MICSIG, the Microprocessor Special Interest Group, are sponsoring a National Microcomputer Conference, the subject of which is "Personal Computing In The Eighties". Interested parties are invited to submit papers which should be pertinent to the Personal Computer scene.

Abstracts should be forwarded to: Microcomputer Conference, Sub-Committee, MICSIG-Canberra, PO Box 446, Canberra City, ACT 2601.

ternal components for interfacing and incorporates 2K bytes of ROM, 128 bytes of RAM, two timer/counters, 5 interrupts, and 32 I/O lines. This complete minimum system dissipates only 100mW.

Other new products announced by National include an ECL 256-bit RAM, the DM10414, with typical access times of only 7 nanoseconds and three new Maxi-ROMs. The three new devices are 16K, 32K and 64K chips that have maximum access times quoted at 450ns. All three chips operate from a single 5V supply and dissipate a maximum of 1 watt.

Also available from National are two new intelligent floppy disk controllers. These have been introduced as part of their Series/80 family of microcomputer products. The boards can interface directly with a variety of standard mini-sized floppy-disk drives and can control up to four single and two double-sided floppy drives.

National's BLC-8201 is a single board replacement for Intel's two-board SBC 201 and requires 71% less power. The BLC-8221 is unique to National, and has buffered data transfer for system efficiency.

Further information of these products can be obtained from: NS Electronics, Cnr. Stud Road and Mountain Highway, PO Box 89, Bayswater Victoria 3153. Phone (03) 729 6333.

LOW COST LINE PRINTER

A low cost matrix printer with innovative features has been released on the Australian market, The Microtek MT80 offers three character widths of 5, 10 and 15 cpi, buffer sizes up to 4K byte and a choice of RS232, parallel and IEEE-488 interfaces. The microprocessor controlled unit has comprehensive self-testing software, and carries a full one year warranty.

Printing speed is 125 characters per second and multiple forms from 11.5cm to 24cm may be used. It has pin-feed drive, and will print an original and three copies.

The unit weighs 10kg and is housed in an attractive moulded plastic case 450mm wide x 376mm deep x 185mm high.

Reliability is quoted as one million hours MTBF.

For further information contact Image 10 Pty Ltd, 27/67, Queens Road, Melbourne 3004. Phone (03) 51 0671.

NEW SWTPC 6809 MICRO COMPUTER SYSTEM

The new system is very similar to the older SWTP 6800 system in appearance but is more powerful due to the greatly enhanced instruction set of the 6809.

The basic system consists of a 6809 CPU plus a 2K monitor ROM that is 2716 EPROM compatible. It provides 8K of memory (expandable to 56K) and features full buffering on all output lines.

The system also has built in multi-user capability, needing only the addition of extra I/O boards to operate a multi-terminal system.

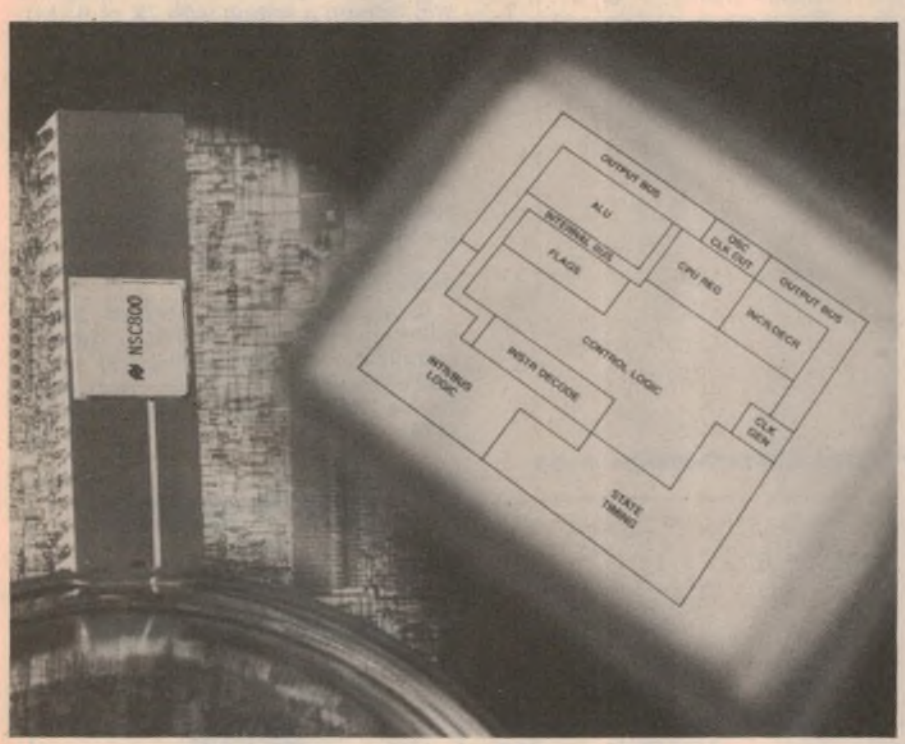
The system is well supported with both software and hardware. Some of the software available for the 6809 includes the FLEX-9 operating system, a Text Editor, Mnemonic Assembler, Debug, Sort-Merge, BASIC, Extended BASIC, Multi-user BASIC and PILOT.

The range of peripherals available for the system includes Dot-Matrix printers, Daisy wheel printers, 125 and

MICRONEWS CONTINUED ➔

Microcomputer News & Products

New microprocessor from National features Z-80 instruction set & Z80/8085 architecture



National Semiconductor have just announced a new range of products including a new microprocessor, the NSC-800. This chip combines the low power requirements of CMOS with the high performance of existing NMOS processors. The chip has a very interesting architecture in that it combines the best architectural features of the 8085 and the Z80.

It uses the address data bus structure of the 8085 and the register structure and instruction set of the Z80.

Two support chips, both dedicated memories (NSC810 and NSC830) incorporate on-chip logic to interface directly with the multiplexed bus. Combining the three devices results in an efficient design that significantly reduces chip count as well as power, without degrading system performance.

A minimum three-chip system using the NSC800, 810 and 830 requires no ex-

MICRONEWS CONTINUED ➔

```
 1 P"ENTER COMMAND" P G35
 2 L4096=Z P"ENTER NEW FILE" S44
 3 AB TZ=8190 G33
 4 MB>Z )Z TB:13 G1<
 5 P"MEMORY LEFT="8190↑Z-,"BYTES" LZ=Q G4<
 6 P"ENTER DATA" P
 7 L4070=C
 8 AD
 9 MD>C )C TD:13 G1<
10 P"SEARCHING" S44
11 P
12 L4096=Z
13 L4070=C TZ=Q G34
14 MB<Z MD<C
15 TB:D )Z TD:13 G2<
16 TD=13 G2>
17 )Z )C G3<
18 (Z
19 MB<Z
20 TB:42 (Z G1<
21 )Z
22 MB<Z
23 OB )Z TB:42 G1<
24 TF=2 G1
25 TF=3 L4070=C P G12<
26 TF=4 P"TYPE NEW LINE" (Z P
27 (Z
28 MB<Z TB:42 G1<
29 )Z MB<Z TB=42 G2>
30 AB MB>Z G1<
31 P"LINE FULL"
32 G1
33 P"MEMORY FULL" G1
34 P"END OF FILE="Z G1
35 L42=K MK>4095 IF
36 TF=1 G2
37 TF=2 G6
38 TF=3 G6
39 TF=4 G6
40 TF=5 LQ=Z P"ADD TO FILE" P"BYTES LEFT="8190↑Z- P G3
41 MB<Z
42 TB:38 )Z G1<
43 LZ=Q G1
44 P"CALLSIGN  NAME   DATE     RST" P R
```

```
 G1
ENTER COMMAND
?5
ADD TO FILE
BYTES LEFT=3939
VK2XYZ    FRED    23/3/89   594 *
MEMORY LEFT=3905 BYTES
ENTER COMMAND
?3
ENTER DATA
VK2XYZ
SEARCHING
CALLSIGN  NAME   DATE     RST

VK2XYZ    FRED   1/2/89    599 *
VK2XYZ    FRED    23/3/89   594 *

END OF FILE=4285
ENTER COMMAND
?
```

Fig. 3 above is the full listing of the amateur log program while Fig. 4, at left, is a sample of its operation.

This is like command 2, except that program will print out all lines in current file containing the data.
Is to allow altering an existing line file. Note that the new line must same length as the original.
add to the current file. Each should be delimited by a n asterisk as before.

If the file in memory is to be saved on cassette, the last character in the file should be an ampersand (&). This is required by the alternative start-up routine, in order to set up the end of file pointer when the file is re-loaded into memory. When a file has been re-loaded from cassette, start the program at line 41 instead of line 1, to ensure that the end of file pointer is set up properly. Otherwise it will be ignored.

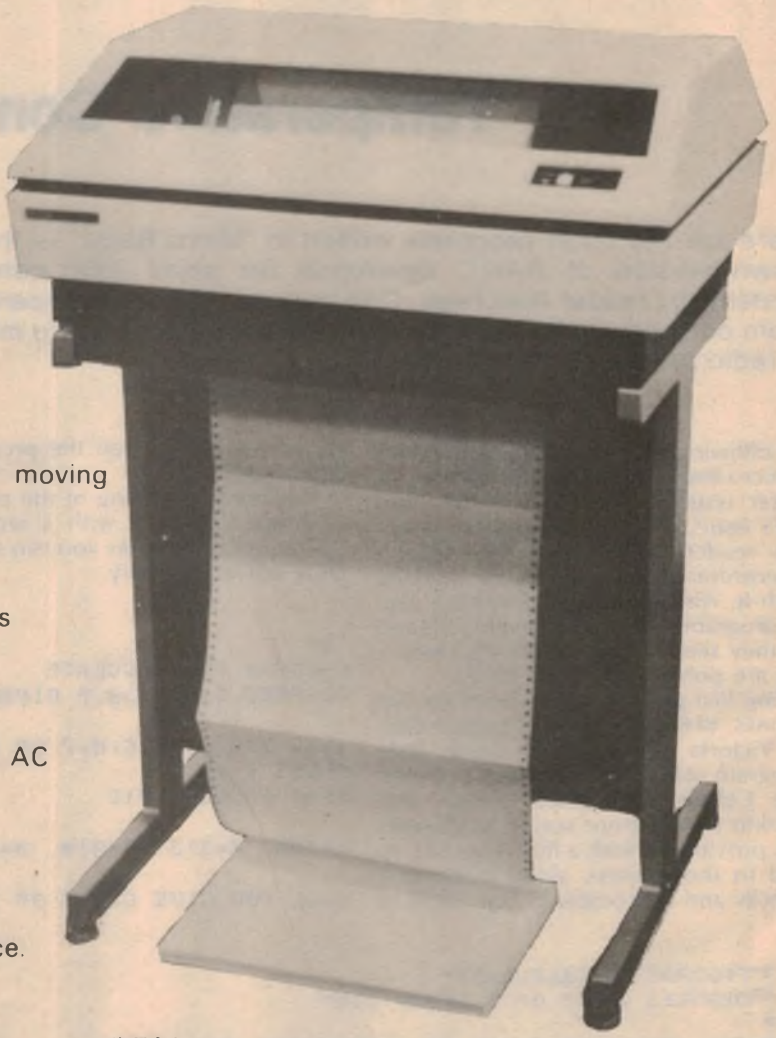
Note that searching a full 4K byte file can take up to four minutes. This is mainly because the Micro Basic interpreter is rather slow in operation — although Mr Leykam notes that his program may well be capable of improvement (it was his first programming effort).

Finally, a note regarding Micro Basic itself for the benefit of those who may not have seen the earlier story. Micro Basic is a tiny version of BASIC, written by Alan Peek for small 2650 microcomputer systems. The editor/interpreter for Micro Basic squeezes into a mere 1.6K bytes of memory, so that it can even run in systems with only 4K of RAM (although Mr Leykam's program will require a system with 7K of RAM).

As you may have deduced from the program listings in this article, Micro Basic achieves this remarkable economy by the use of single-character commands, reverse Polish notation and an efficient way of packing the source program into memory. Its unorthodox approach takes a bit of getting used to, but the ability to program rapidly even in small systems makes it well worth persevering.

A cassette of the Micro Basic editor/interpreter (in PIPBUG format) complete with instructions and a full source listing is available from Alan Peek at 10 Gale Street, Woolwich NSW 2110.

NDK S-2000 SERIAL PRINTER



- 8085 Microprocessor controlled single board electronics
- Quiet operation
- Simplified mechanism with minimal moving parts
- Front or back paper feed
- 170 cps bidirectional printing. 42 ips automatic space skipping
- 4in - 15in paper
- AC voltage selector, 100-240 volts AC
- 10 CPI 11.7 CPI, 5 CPI
- 9 x 7 Dot Matrix
- 6 months warranty
- Stand and interface included in price.

Sole Australian distributor

JOHN F. ROSE
COMPUTER SERVICES PTY. LTD.

OEM enquiries welcome
AMA HOUSE
33-35 Atchison Street
ST LEONARDS 2065

Tel. (02) 439 1220
AH (02) 328 6683
Telex: AA 27901

For the enthusiast looking for value — a stock clearance sale of items in an as-is condition without warranty. All items inclusive of sales tax.

21L02 RAMS	$0.90
1602-B UARTS	$4.25
C-8251 USARTS	$4.50
N8T26	$1.60
6502 CPU CHIP	$8.00
2513 CHR GEN	$5.00
44 PIN PCB EDGE CONNECTORS	$2.70
63 KEY UNCODED KEYBOARDS	$46.00
GEORGE RISK KEYBOARD CASES	$60.00
ITHICA AUDIO S-100 Z-80 CPU CARDS	$100.00
ITHICA AUDIO S-100 VIDEO BOARD (NO DOC)	$80.00
SOLID STATE MUSIC VIDEO Board s-100 64 x 16	$140.00
16K STATIC MEMORY S-100 BOARDS	$200.00
MPI DISK DRIVES 5¼in WORKING CONDITION	$260.00
PRINCESS B/W 12in PORTABLE TV	$50.00
1 ONLY EXIDY SORCERER 32K CASSETTE AND EXPANSION INTERFACE	$1500
1 ONLY OHIO SCIENTIFIC C2-4P COMPUTER IN PIECES	$300.00
MATCHING TIMBER DRIVE AND CPU CASES (NEEDS WORK)	$800.00

Micro Basic Programs for 2650 systems

Temperature Conversion, Radio Log

Here are two short programs written in "Micro Basic" — the cut-down version of BASIC developed for small 2650 computer systems by reader Alan Peek. One program converts temperatures from one scale to another, while the other is a program to manage a radio amateur's contact log.

Following our review of Alan Peek's "Micro Basic" for small 2650 microcomputer systems, published in the April 1979 issue, it would seem that quite a few readers have obtained Mr Peek's interpreter and have been working with it. Already two readers have sent in programs they have developed, and as they seem likely to interest readers we are publishing details here.

The first program came from Mr Syd Brooks, of 6 Edgar Street, Ferntree Gully Victoria 3156. It is a simple little program which can convert between the Celsius, Fahrenheit, Kelvin and Rankin temperature scales. Mr Brooks has provided it with a little humour, to add to the interest, along with some checks and reprompts in the event of an invalid entry when the program is being used.

The complete listing of the program is shown in Fig. 1, with a sample of operation in Fig. 2. As you can see, it is fairly self-explanatory.

```
 G1
PROGRAM TO CALCULATE
DEGREES C,K,F OR R GIVEN ONE

WILL YOU GIVE C,K,F OR R? F
PRESS + OR -+
WHAT IS TEMP?212

C=100   K=373   F=212   R=672

WILL YOU GIVE C,K,F OR R?
```

```
1 P"PROGRAM TO CALCULATE"
2 P"DEGREES C,K,F OR R GIVEN ONE"
3 P
4 P"WILL YOU GIVE C,K,F OR R? " AA
5 TA:70,A:75,A:67,A:82 G1<
6 P"PRESS + OR -" AB TB=43 L1=X G3>
7 TB=45 L1#=X G2>
8 G2<
9 P"WHAT IS TEMP" IE LEX*=E
10 TA=70 G4>
11 TA=82 G4>
12 TA=67 G4>
13 TA=75 G4>
14 LE460+=R,R=E
15 LE460-=F,F32-5*9/=C,C273+=K,E=R G3>
16 LE273+=K,K=E
17 LE273-=C,C9*5/32+=F,F460+=R,E=K
18 TK<0 P"THAT'S IMPOSSIBLE STILL!" G3>
19 TC<400 P"THAT'S COLD!" G2>
20 TC>1999 P"GUESS" G3
21 P
22 P"C="C," K="K," F="F," R="R
23 G3
24 $A=C,F,K OR R  B=SIGN E=TEMP$
25 $C=CELSIUS F=FAHRENHEIT K=KELVIN $
26 $R=RANKIN $
27 E
```

Fig. 1, at left is the full listing of temperature conversion program while Fig. 2 above is a sample of its operation.

The second program came from Mr Horst Leykam, of 165 Victor Street, Dee Why NSW 2099. Mr Leykam is a radio amateur, with the call sign VK2BHF, and explains that he wrote the program in an effort to produce a more elegant and effective way of maintaining and referencing his contact log.

What this program does is maintain a log of contacts, with each contact represented by callsign, the name of the operator contacted, the date and the readability/signal strength details. It allows you to add to the log "file" when each contact is made, and then to have an automatic search made for previous contacts with the same callsign. This lets you "refresh" your memory regarding the name of the operator, and the previous times that you exchanged calls.

A file can be expanded until it fills the allocated memory buffer space (hex 1000—1FFF, or decimal 4096—8191). As each entry is made to a file, the program tells you how many bytes of memory are left — in decimal. This allows you to save a file at any time on cassette tape, using the normal PIPBUG dump command, and then re-load it into the buffer later using the L command.

The program can search for either the first file entry matching the supplied data (typically the callsign), or for all matching entries. It also allows you to alter an existing file entry, providing the change will fit into the same space. This allows you to correct a previous mistake, when it is discovered.

A full listing of the program is shown in Fig. 3, with a sample of its operation shown in Fig. 4. When the program starts up, it immediately asks you for a command. You have five options, each command being represented by a single digit (1-5) terminated by a carriage return.

1 — Is to enter a new file. Each line should be delimited by a space and an asterisk.

2 — Is to accept a data entry (say the callsign), and search through the current file for a match. The first line found to contain the data will be printed out.

ENTER THE WORLD OF COMPUTERS — WHEN YOU ENTER A DICK SMITH STORE!

CASSETTES FOR USE WITH YOUR SORCERER —

GRAPHIC GAMES
(X-3631 - **$14.95**)
The most fantastic games - the ultimate game is to land on the moon with a LEM. Also includes pie lab, nuclear reaction, bounce checkers and dodgem.

SMART ALEC
(X-3632 - **$14.95**)
Over 200 questions on seven subjects. The computer can certify you a genius!

MAGIC MAZE
(X-3620 - **$14.95**)
Ten levels of play - how good are you at getting out?

PLOT
(X-3621 - **$17.95**)
High resolution mode for superior graphics or low resolution mode for ultra fast graphics, all on one cassette.

Z-80 DISASSEMBLER
(X-3622 - **$17.95**)
Decode machine language programs, including the Sorcerer's monitor and ROM PACs. Or use in ASCII mode which converts machine language to ASCII.

SHAPE MAKER
(X-3623 - **$17.95**)
Detailed 12 page book explains how you can construct special characters and fancy shapes with this on-screen editor.

DEBUG
(X-3624 - **$17.95**)
Debug machine language programs by stepping through one instruction at a time - has several display options.

FASTGAMMON
(X-3625 - **$22.95**)
A skillful opponent for backgammon players - includes an 8 page instruction manual with rules.

MICROPOLIS™ FLOPPY DISC DRIVES

Top quality drive systems without the expense!

DUAL DENSITY - SINGLE DRIVE
A massive 143k storage with a transfer rate of ¼ million bits/sec recording density of 5162bpi and improved drive system for accurate location.
X-3200 ..... **$875**

DUAL DENSITY - DUAL DRIVE
The same top quality as the single drive plus 630k storage.
X-3210 ..... **$1950**

Both systems are supplied with S100 controllers, interconnect cable, 2 diskettes, one of the the MICROPOLIS™ BASIC, a compatible DOS, assembler, editor and user's manual.

FOR LESS THAN $1,000! A TOP MODEL PRINTER

C.ITOH Model 8300

This is a superior dot matrix impact printer that uses inexpensive fan fold paper. It has a print speed of 125 characters per sec with a 1 line data buffer. Interface is 8 bit parallel standard and the code is ASCII (96 characters). If you are after a printer then the C.ITOH is an absolute must!
X-3255 ..... **$970**

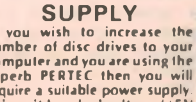
Computers for the enthusiast is an ever expanding hobby. Dick Smith is constantly expanding his range of products so when you are next in a Dick Smith store why not ask about our latest products in this fascinating hobby.

COMPUTER MONITOR

You don't have to spend a fortune on a video monitor. This famous make unit can be used with the Sorcerer, TRS80, Apple etc. It has a large 30cm diagonal screen and gives jitter free characters. Connection to your computer is via an RCA plug and the unit can be used on 240V AC mains or 12V DC.
X-1196 ..... **$149.50**

LIMITED STOCKS VIDEO BRAIN KEYBOARD

Scoop purchase from manufacturer who has gone broke! This is a full function keyboard with 37 keys on a silver plated double sided PCB. Connections are made through a double sided edge connector (0.1"). All keys can be individually accessed by cutting the PCB tracks. Keys contain all alphabet letters, 0-9 numerals, shift, %, etc., etc.
X-1182 ..... **$17.50**



PERTEC POWER SUPPLY

If you wish to increase the number of disc drives to your computer and you are using the superb PERTEC then you will require a suitable power supply. This unit has dual voltage (+5V & +12V) and special connector.
X-3234 ..... **$60.00**

Supply powers TWO disc drives. . .

THE NEW SORCERER II

The BEST is now even BETTER!

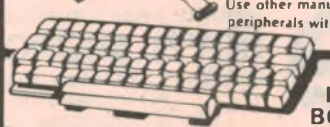
As part of their on-going research and development, Exidy have made some changes giving the Sorcerer on-board capability of up to 48k RAM plus even greater reliability. You still get a complete stand alone computer that only needs a video monitor to be up and running in BASIC. The Sorcerer has built-in flexibility, there are other computers BUT there is only one Sorcerer.
SORCERER II (8k RAM) Cat. X-3000 ..... **$1095.00**
SORCERER II (16k RAM) Cat. X-3001 ..... **$1250.00**

SORCERER S-100 EXPANSION

Opens the way to almost unlimited expansion of your Sorcerer. Use memory modules speech synthesizers etc, etc. Complete with power supply ribbon cable & connector.
X-3010 ..... **$499**

Use other manufacturer's peripherals with your Sorcerer.

ASCII KEY-BOARD



This standard ASCII 63-key keyboard array comes as a one piece unit that can be easily soldered directly to a PCB without the need for subpanels or other additional hardware. Keys have gold alloy inlaid to give long life, low bounce and low contact resistance. If you are considering making up your own keyboard assembly then this is the unit for your project.
X-1180 ..... **$58**

SUPER SPECIAL

16k EXPANSION KIT FOR TRS 80 AND APPLE

Increase your 4k up to 16k and if you have expansion interface you can increase the memory to 32k or even 48k!!

SAVE A MASSIVE $40!!

Limited stocks at only

$109.50

Cat. X-1186

Also available 16k expansion kit for the Sorcerer.
X-1185 ..... **$149.50**

WORD PROCESSOR

By adding the Word Processor PAC™ to your Sorcerer you will get a system that is more powerful than other available systems. It features automatic text wrap, automatic checking of drastic commands, powerful search functions, auto commands and macro programming, single key commands plus, plus. Includes instruction manual.
X-3085 ..... **$199**

Also available: Development PAC™ - X-3090 @ **$139.50** and E-PROM PAC™ - X-3095 @ **$75**

DISKETTES

133mm HARD SECTOR BLANK DISKETTE
Made by a leading US manufacturer for the Micropolis drive systems.
X-3505 1-9 **$5.95 ea**
10 up **$5.00 ea**

133mm SOFT SECTOR BLANK DISKETTE
Made for the Shugart drive systems.
X-3510 1-9 **$5.95 ea**
10 up **$5.00 ea**

SORCERER USER'S GROUP
SYDNEY Meets 1st Friday odd months, 2nd Friday even months at 14 ATCHISON St, ST LEONARDS @ 7.30 pm.
ADELAIDE: Contact Dr. P. Delin c/- Psychology Dept. University of Adelaide for further details.
For information or contacts in local groups in Melbourne Ballarat, Canberra, Brisbane, Manila, Hong Kong, Singapore and Fiji contact the Secretary Australian Sorcerer User's Groups PO Box E162 St. James 2000.

PERTEC DISC DRIVE FOR TRS80 OWNERS

More features for your dollars ● 133.4mm minifloppy ● 40 tracks ● soft sectored ● dual sensors for recording both sides ● recording density (inside track) 2768bpi ● 1 million bits/side/disc ● power harness and power supply available (see this page).
X-3230 ..... **$379**

Don't pay $689!!!

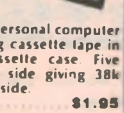
We have limited stocks of this superb disc drive - call in now before we sell out!

NEW "TINY" PASCAL FOR TRS 80

Cassette tape with "Tiny" Pascal for developing, debugging and running programs on your TRS80. Provides powerful subset of standard Pascal statements, including recursive procedure/functions, global & local variables, if-then-else-then, peek & poke, while, for, repeat/until case & complete TRS80 graphics.
X-3670 ..... **$49.50**

Comes complete with comprehensive easy to read manual.

C10 TAPE



High grade personal computer programming cassette tape in standard cassette case. Five minutes per side giving 38k capacity per side.
X-3500 ..... **$1.95**

CONNECTION CABLES

34 way daisy-chain cable for connecting 4 disc drives to your computer - for use with PERTEC drives & TRS80 expansion interface.
X-3232 ..... **$49.50**

Serial interface cable for the Sorcerer - connect 2 cassette recorders to the Sorcerer with motor control for both.
X-3110 ..... **$34.50**

Printer cable for Sorcerer - connects C.ITOH or any Centronics compatible printer to the Sorcerer.
X-3112 ..... **$49.50**

COMPUTER BOOKS

We stock a huge range of books - call in and browse!

INTRODUCTION TO PASCAL

By Welsh & Elder

'Highly recommended' says Jim Rowe. Pascal is the latest 'state of the art' computer language - if you're a computer enthusiast, this 282 page reference will tell you want you want to know.
B-2385 ..... **$13.95**

BASIC AND THE PERSONAL COMPUTER

Dwyer & Critchfield

This book does not require you to have a University degree! It has 438 pages of superb information on BASIC written for the novice or advanced computer man. Covers games, art, graphics business and much more as well. A highly recommended book that not only educates but is a lot of fun as well.
B-2330 ..... **$14.95**

GAMES FOR TRS80

Special absorbing program cassettes for TRS 80 owners.

TIME TREK (X-3650 - **$17.95**)
A version of the popular Star Trek. Level I & II 4k RAM.

STIMULATING SIMULATIONS
(X-3652 - **$17.95**) 10 games on one cassette, all original - art auction, forest fire, monster chase, nautical navigation, lost treasure, business management, gone fishing, rare birds, space flight and diamond thief. Level I & II 4k RAM.

ELECTRIC PAINTBRUSH
(X-3654 - **$17.95**) Paint patterns on your monitor at machine language speeds. Level I & II 4k RAM.

BRIDGE CHALLENGER
(X-3656 - **$17.95**) Practice and improve your play - whether you're expert or novice. Level II 16k RAM.

MICROCHESS (X-3658 - **$22.95**)
Think out your moves because the computer is out to beat you!

LIGHT PEN

X-3645

$29.50

Scoop purchase of incredible light pens, direct from the USA. Now you can 'draw' on your computer monitor - it's fun, it's educational and it's simple to use!

● Uses your cassette recorder as a pre-amp ● Comes complete with cassette containing two application programs: tic-tac-toe and menu display routine ● Give your TRS80 an "eye" ● Only a fraction of the cost of other light pens.

DICK SMITH ELECTRONICS

SEE OUR OTHER ADVERTS IN THIS MAGAZINE FOR OUR STORE ADDRESSES AND RESELLERS

DSE683

"Trace" routine helps debug 2650 programs

When you're trying to debug a tricky program in assembly language, a breakpoint isn't always the answer — you can generally only call it once. Here is a "trace" routine for 2650 systems which can be rather more helpful. You can call it any number of times, and each time it is called it prints out the contents of all processor registers.

by JAMIESON ROWE

Like most small microcomputer systems, the 2650 Mini Computer provides only one debug aid: a pair of breakpoints, which are software implemented by the PIPBUG monitor program. These can be quite handy, but there are many occasions when they just don't help enough.

For a start, each breakpoint can only be used once. When it is executed once, PIPBUG replaces it with the original instruction. So you can't use the breakpoints to track down bugs which are inside loops, for example — the breakpoint disappears first time you go around the loop!

The other main drawback is that the breakpoint "runtime" routine simply saves the processor register contents in RAM, and then transfers control back to the PIPBUG command loop. So if you actually want to examine the registers, you then have to use the PIPBUG "see and set the registers" (S) command. This can be very tedious and time consuming when you have to use the breakpoints over and over.

Most of these disadvantages can be avoided by using the "trace" routine described in this article. It was developed some months ago for this very purpose, and since then it has helped me considerably in tracking down elusive bugs.

Basically it consists of a subroutine which may be called any number of times, by temporarily patching appropriate BSTA or BSTR instructions into the program you are trying to debug. When it is called, it first saves the contents of all of the 2650 registers. Then it prints them all out on the terminal, to provide a "snapshot" of the current processor status. Then it restores all of the registers again, and does a return.

Before it prints out the register contents, it prints three spaces. This is to prevent confusion if the program you are testing already involves printing. After the spaces it prints the registers in the same order that they are provided by PIPBUG: R0, R1, R2, R3, R1', R2', R3', PSU and PSL. Finally it prints a carriage return and line feed, so that each "snapshot" is on a different line.

A full source listing of the trace routine is shown below, together with a sample of its operation. As listed the routine is located from 0440 to 0495, but it may be relocated anywhere in page 0 without changes. Note that it stores the processor registers in locations 0400-0408 — ie, the same locations used by PIPBUG for this purpose.

The sample tracing shown below was produced by patching a call into the author's Disassembler program, at the end of the PRINT MESSAGE subroutine (1D9C). The code at 1D9C was changed to 1B39, to branch to 1DD6 where a patch of 3F0440, 1F1D94 was located. As you can see this gives a "snapshot" after each character is printed from the line buffer.

```
*G1B00 1B0C 1B02
I   001A02000C3100E280
B   001A02010420C0E280
C   001A02020030C0E280
0   001A0203C03000E280
    001A0204002000E280
7   001A0205C03700E280
6   001A02060036C0E280
6   001A02070036C0E280
0   001A0208C03000E280
    001A02090020C0E280
    001A020A002000E280
    001A020B002000E280
    001A020C002000E280
    001A020D002000E280
    001A020E002000E280
P   001A020F005000E280
P   001A02100050C0E280
S   001A02110053C0E280
U   001A02120050C0E280
    001A02130020C0E280
    001A02140020C0E280
    001A02150020C0E280
    001A02160020C0E280
    001A02170020C0E280
    001A02180020C0E280
6   001A02190036C0E280
C   001A021A003000E280
```

RIGHT: A full listing of the trace routine, complete with comments so that you can see how it works.

LEFT: A sample of the routine in operation. Here it was patched into the Disassembler program, so that a "snapshot" of the processor registers is printed after each character from the Disassembler's line buffer.

```
                *DIAGNOSTIC "TRACE" ROUTINE FOR
                *2650 SYSTEMS. J.ROWE MARCH 1979

0440 CC0400     STRA,R0   0400    SAVE R0
0443 12         SPSU              & PSU
0444 CC0407     STRA,R0   0407
0447 7660       PPSU      60      FORCE TO MARK,INHIBIT INT.
0449 13         SPSL              SAVE PSL
044A CC0408     STRA,R0   0408
044D 7710       PPSL      10      FORCE TO BANK 1
044F CD0404     STRA,R1   0404    SAVE BANK 1 REGS
0452 CE0405     STRA,R2   0405
0455 CF0406     STRA,R3   0406
0458 7519       CPSL      19      FORCE TO BANK 0,CLR C & WC
045A CD0401     STRA,R1   0401    SAVE BANK 0 REGS
045D CE0402     STRA,R2   0402
0460 CF0403     STRA,R3   0403
0463 3F035B     BSTA,UN   035B    PRINT 3 SPACES
0466 07FF       LODI,R3   FF      SET R3 AS INDEX
0468 0609       LODI,R2   09      & R2 AS COUNTER
046A 0F2400     LODA,R3   0400+   FETCH SAVED REG
046D C1         STR2,R1           MOVE TO R1
046E 3F0269     BSTA,UN   0269    PRINT VIA BOUT SUBR
0471 FA77       BDRR,N    046A    LOOP BACK TIL DONE 9
0473 3F008A     BSTA,UN   008A    THEN GIVE CRLF
0476 0D0401     LODA,R1   0401    RESTORE ALL REGS
0479 0E0402     LODA,R2   0402
047C 0F0403     LODA,R3   0403
047F 7710       PPSL      10
0481 0D0404     LODA,R1   0404
0484 0E0405     LODA,R2   0405
0487 0F0406     LODA,R3   0406
048A 0C0407     LODA,R0   0407
048D 92         LPSU
048E 0C0408     LODA,R0   0408
0491 93         LPSL
0492 0C0400     LODA,R0   0400
0495 17         RETC,UN           & RETURN
```

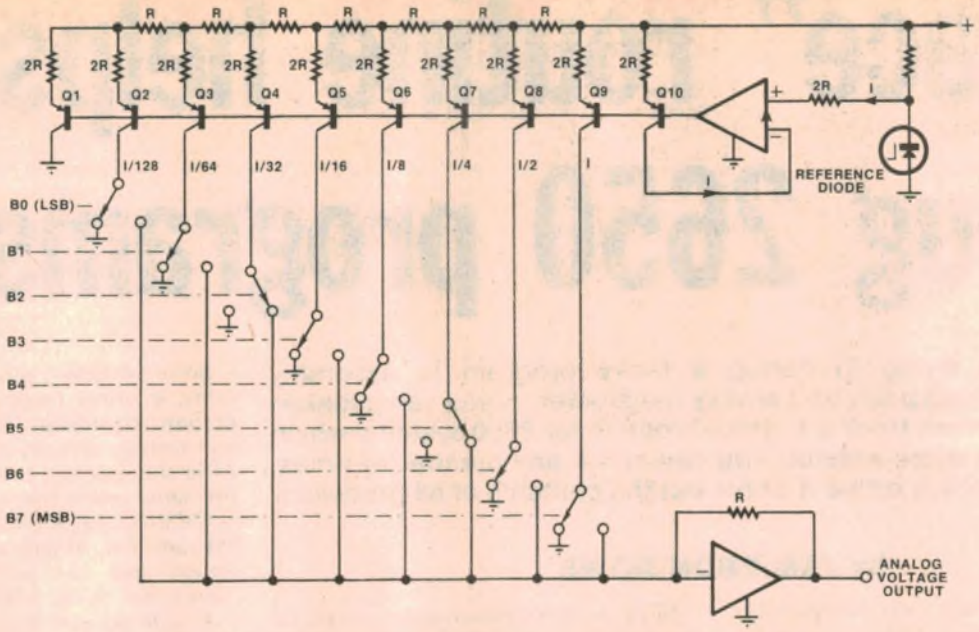


FIG. 4 : MODIFIED LADDER NETWORK DAC (8-BIT)

accurately matched, and to maintain this condition despite supply voltage and loading variations.

Q10's collector current is thus set accurately to equal I. As Q10 is matched to all the other transistors, and its emitter resistor is also matched to the other resistors, this automatically sets the current levels in all of the transistors. Hence Q9's current is set to I, Q8's to I/2, Q7's to I/4 and so on down to Q2 whose current is set to I/128.

Note that there is a tenth transistor, Q1, whose collector is connected directly to earth. This is necessary in order to terminate the ladder correctly, and ensure that the binary sequence of current levels is maintained accurately over a range of supply voltages.

The actual current switching in most modern DACs is performed using MOS transistors. Fig. 5 shows how complementary MOS transistors are used to perform the SPDT switching in a circuit like that of Fig. 4.

A P-channel device is used for the "grounding" function, while an N-channel device is used for the gating function. As the two devices are complementary, the digital input B is simply connected to both gates in parallel. When the input is at logic low level, the N-channel device is cut off while the P-channel device conducts, directing the current increment to ground. Conversely when the input is raised to logic high level the P-channel device cuts off and the N-channel conducts, switching the current increment into the output amplifier.

Before leaving DACs, there are a number of terms used to describe DAC performance with which you should be familiar. These are resolution, non-linearity and settling time.

The **resolution** of a DAC is a measure of the number of discrete voltage or current levels which its output can adopt. Naturally enough, this is directly related to the number of digital input bits. The output of an 8-bit DAC like that of Fig. 4 can adopt any of 256 discrete levels, equal to the number of combinations of 8 bits. Similarly the output of a 12-bit DAC can adopt any of 4096 levels, while that of a 16-bit DAC can adopt 65,536 levels.

The **linearity** of a DAC is a measure of the degree to which its analog output amplitude corresponds to the magnitude of the digital input. Nothing is perfect in the real world, and all DACs have small errors due to things like resistor matching errors and the fact that the electronic switches do not have zero resistance in their "on" state.

Generally, DAC linearity is expressed in terms of either a percentage of the maximum DAC output amplitude, or as a fraction of the LSB output increment. It is sometimes also expressed in terms of the number of input bits required for a DAC with resolution equal to the linearity error concerned.

For example the linearity of an 8-bit DAC might be described as "within 0.1% of full output", or "within $\pm$1/8 LSB", or as being of "10 bits". These all mean much the same thing.

The **settling time** of a DAC is a measure of the time taken for its analog output to re-stabilise when the digital input is changed to a new value. When such a change takes place, one or more current switches must operate, and the output feedback amplifier must readjust its output to the new level. Needless to say the switches take a finite time to operate, while the amplifier has a finite response and output slew rate. These delays collectively form the settling time.

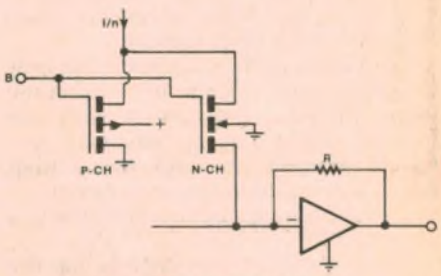


FIG. 5 : SPDT CMOS SWITCHING

A final note. Some modern DACs are designed so that they may be used not only as a digitally programmed voltage or current generator, but alternatively as an attenuator with digitally programmed attenuation. These are known as "multiplying DACs".

Essentially a multiplying DAC is rather like those in Figs. 2 and 3, except that an analog input signal may be fed into the switched weighting resistors or the ladder network, in place of the fixed precision reference voltage. The DAC's output signal amplitude will then depend not only upon the magnitude of the digital input, but also on the analog input amplitude. In effect, the DAC multiplies the digital and analog inputs together.

Some multiplying DAC's are designed to accept bipolar (AC) analog input voltages, and to treat the digital input as a signed binary quantity. The analog output signal is also bipolar, with a polarity depending upon both the sign of the digital input and the polarity of the analog input. DACs of this type are often described as being capable of "4-quadrant" operation, or as a "4-quadrant multiplying DAC". ◆

D-TO-A CONVERTERS

to the weighted resistor type, but in place of the set of weighted resistors there is a "ladder" of resistors controlled by two-position electronic switches. Only two resistor values are required, "R" and "2R", the ladder network itself ensuring that these produce the desired progression of binary weighted currents.

Like the weighted resistor DAC the ladder-network circuit uses a feedback amplifier to provide a very low load resistance and ensure linear conversion.

As you can see from Fig. 2 the resistor values in the weighted resistor DAC reduce in value by a factor of 2. This means that for each additional bit involved in the conversion, the required resistance range doubles. For an 8-bit DAC, the B7 or MSB resistor must have a value 128 times smaller than the B0 or LSB resistor. This tends to make the weighted-resistor DAC relatively difficult to implement in integrated circuit (IC) form.

In contrast, the ladder-network DAC has only two resistor values in the network regardless of the number of bits involved, and the two values have a modest 2:1 ratio. This makes the ladder-network DAC much more suitable for IC implementation, and in one form or another it is now used more often than the weighted-resistor approach.

Fig. 4 shows a modified version of the ladder-network technique, which has been evolved for use in modern DACs implemented in a single monolithic IC. Here the ladder-network is not used alone to set the current increments, but in conjunction with a set of carefully-matched transistors connected in the constant-current configuration.

As you can see the ladder-network itself is connected to the normal supply line, which could not be relied upon to have the accuracy or stability required for the DAC's reference. However, the bases of all the transistors are connected together, and the common base line connected to the output of a current-differencing operational amplifier. This amplifier is used to control the base line potential, to set and maintain accurately all of the transistor collector current levels.

The non-inverting input of the amplifier is connected via a matched resistor to a reference diode, which derives from the supply line a source of accurately stabilised voltage. This produces an accurately maintained input current, I. The inverting input of the amplifier is connected to the collector of one of the current-source transistors, Q10, as shown. The action of the amplifier is thus to adjust the base line potential until the two currents are

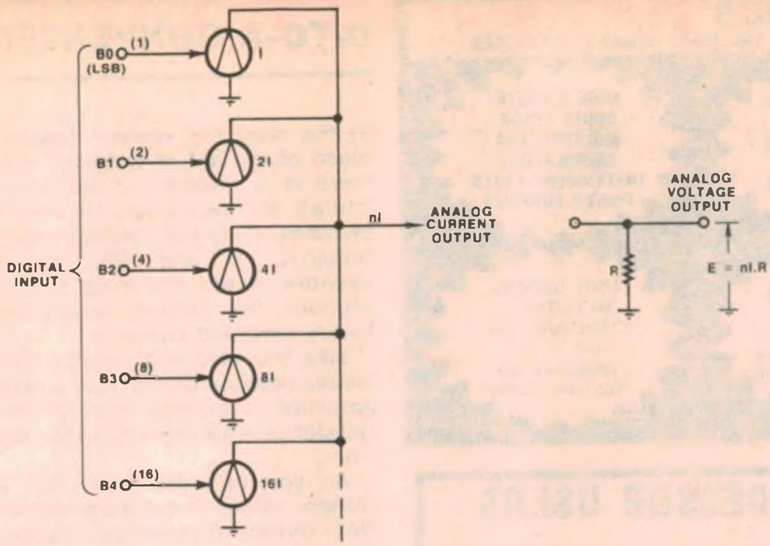
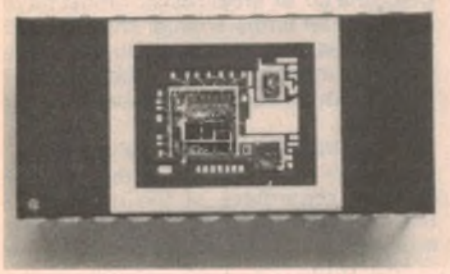


FIG. 1 : BASIC CURRENT-INCREMENT DAC



The Analog Devices AD DAC80, a 12-bit D-to-A converter which uses 3 chips in a 24-pin DIL package. (Parameters)

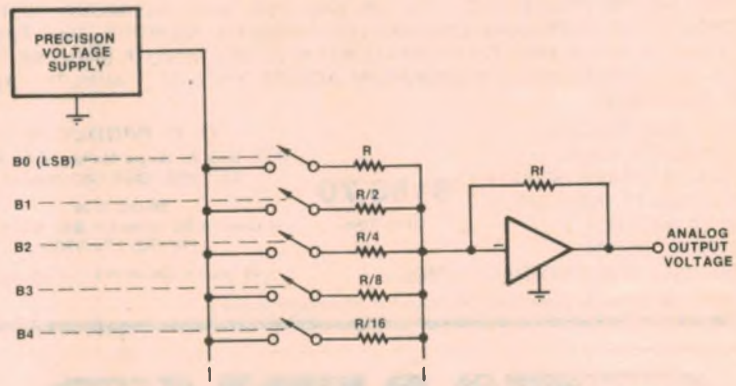


FIG. 2 : WEIGHTED-RESISTOR DAC

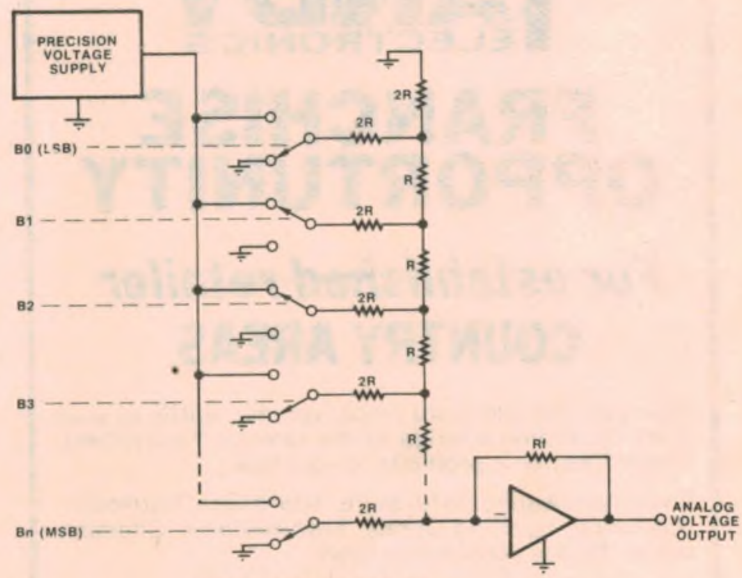


FIG. 3 : LADDER NETWORK DAC

DAC is simply the sum of all the incremental currents from the individual generators. And since the individual generators are controlled by the input bits, this means that the sum will have an amplitude proportional to the overall binary number applied to the DAC inputs: "nI", where n is the binary number.

Essentially all that is needed to produce an analog voltage from this output current is to feed it into a resistor. Ohm's law will then cause the resistor's voltage drop to equal nI.R, where R is the resistor value.

Practical DACs use one of two basic techniques to perform the operation shown in Fig. 1. These are generally known as the "weighted resistor" and "ladder network" techniques, and they are illustrated in Fig. 2 and Fig. 3 respectively.

As its name suggests, the **weighted resistor DAC** involves a set of resistors whose relative values vary in binary weighted fashion. The resistors are connected between a precision regulated voltage supply and the input of a feedback amplifier (inverting), with each resistor in series with an electronic switch controlled by one of the binary input bits.

The feedback amplifier is necessary to ensure that the currents which flow in the weighting resistors are themselves also accurately weighted, and that they add together linearly. Because the circuit uses resistors and a voltage source instead of the ideal current sources shown in Fig. 1, the junction of the resistors cannot be fed to a simple load resistor because the varying voltage drop across the load resistor would upset the currents through the weighting resistors. Instead of remaining fixed, these would vary considerably depending upon the number of other resistors in circuit.

The feedback amplifier consists of a high-gain operational amplifier with heavy negative feedback around it, via resistor Rf. The main effect of the high gain and negative feedback is to reduce the input impedance of the amplifier to a very low value, creating a "virtual earth" condition. This provides a very low load resistance for the weighting resistors, ensuring that the voltage across each resistor is substantially constant regardless of the number of resistors in circuit.

The output of the feedback amplifier forms the output of the DAC, and as the amplifier acts as an impedance converter, the output is in the form of a voltage. Each voltage increment will have an amplitude of (E.Rf/Rw), where E is the voltage of the DAC's precision voltage supply and Rw is the weighting resistor for the bit concerned. Thus the increment corresponding to B0 (the LSB) will be E.Rf/R, that for B1 will be twice this value, and so on.

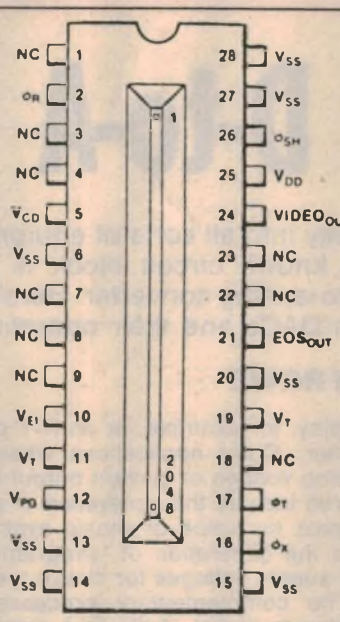
As you can see from Fig. 3 the **ladder-network DAC** is broadly similar

CHARGE-COUPLED DEVICES

MELB: 877-5444
SYD: 439-5911

DESCRIPTION			DEVICE TYPE	PRICE
CCD110F —	256 Element Linear Sensor		CCD110FC	$145
CCD131 —	1024 Element Linear Image Sensor		CCD131DC	$633
CCD121H —	1728 Element Linear Image Sensor		CCD121HC	$950
CCD122 —	1728 Element Linear Image Sensor		CCD122DC	$950
CCD142 —	2048 Element Linear Image Sensor		CCD142DC	$1140
CCD211A —	244x190 Element Area Image Sensor Class "A"		CD211ADC	$2500
CCD211B —	244x190 Element Area Image Sensor Class "B"		CD211BDC	$2300
CCD211C —	244x190 Element Area Image Sensor Class "C"		CD211CDC	$1800
488x380	Element Area Image Sensor	With Cover	SL62925 SL62927	$5000 $3000
		Without Cover	SL62926 SL62928	$5000 $3000
CCD321A-1 —	455/910 Bit Analog Shift Register — Broadcast Quality Video Delay Line		CCD321A1	$150
CCD321A-2 —	455/910 Bit Analog Shift Register — High Quality Video Delay Line		CCD321A2	$60
CCD321A-3 —	455/910 Bit Analog Shift Register — Time Base Compression/Expansion Delay Time		CCD321A3	$90
CCD321A-4 —	455/910 Bit Analog Shift Register — Audio Delay Line		CCD321A4	$25

- Enhanced spectral response (particularly in the blue region)
- Low dark signal
- High responsivity
- On-chip clock drivers
- Dynamic range typical: 2500:1
- Over 1V peak-to-peak output
- Dark and white references contained in a sampled-and-held output
- Single power supply



CCD142

PIN NAMES

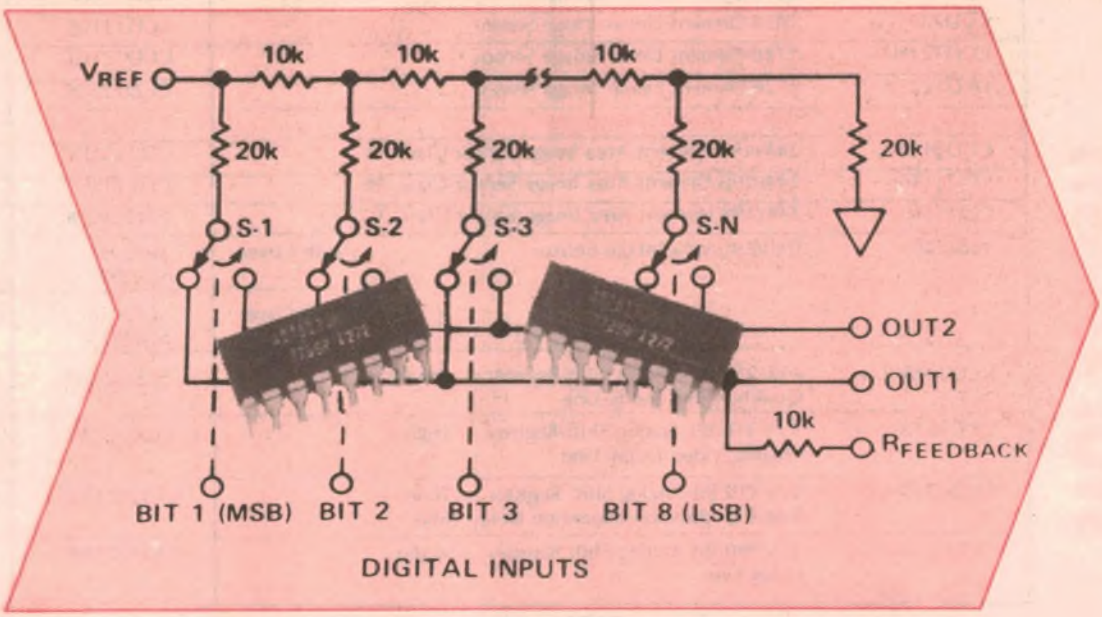
VPG	Photogate
ØX	Transfer Clock
ØT	Transport Clock
VIDEOOUT	Output Amplifier Source
VDD	Output Amplifier Drain
ØR	Reset Clock
VCD	Clock Driver Drain
VEI	Electrical Input Bias
VT	Analog Transport Shift Register DC Electrode
EOSOUT	End-of-Scan Output
ØSH	Sample-and-Hold Clock
VSS	Substrate (GND)
NC	No Connection (Do not Ground)

FAIRCHILD

CCD DESIGN DEVELOPMENT BOARDS AND MODULES

DESCRIPTION	DEVICE TYPE	PRICE
CCD110F Design Development Board	CCD110FB	$500
CCD131 Design Development Board	CCD131DB	$500
CCD121 Design Development Board	CCD121HB	$500
CCD122 Design Development Board	CCD122DB	$750
CCD142 Design Development Board	CCD142DB	$750
CCD211 Design Development Set	CCD211DB	$1500
488x380 Design Development Set	SL62929	$1500
CCD321VM Video Module	CCD321VM	$500

What you need to know...



...about D-to-A Converters

With microprocessors finding their way into all sorts of equipment nowadays, another previously little known circuit block is also coming into prominence: the digital-to-analog converter. Here's an easy to read introduction to modern DACs and their operation.

by JAMIESON ROWE

Inside modern electronic circuits, information is handled most elegantly and reliably in digital form — ie, as numbers. But in the "outside world", the information often either occurs or is wanted in analog form — a varying voltage, or current, or frequency or whatever. So it is often necessary to perform digital-to-analog and analog-to-digital conversion where the information has to pass between a digital system and the outside world.

For example at the input interface of a system, the information may be in the form of a varying analog voltage or current. It could be a voice or music signal, perhaps, which is to be processed or transmitted within the digital system. Understandably the first thing which must be done with such signals is to convert them from analog into digital form.

Similarly at the system's output interface, the output information may be needed in the form of an analog voltage or current in order to use it effectively for the desired purpose. It could be needed as a varying analog voltage or current to operate a high-speed visual display, for example, or an X-Y paper plotter. Other applications where an analog voltage or current output is required include the generation of audio signals for voice or music synthesis, and the generation of "programmed" DC supply voltages for circuit testing.

The complementary processes of analog-to-digital (A/D) and digital-to-analog (D/A) conversion are therefore performed in many digital systems. And with the microprocessor revolution bringing digital systems into almost every sphere of electronics, this means that A/D and D/A converters are becoming very important — so you're going to need some knowledge of how they work.

In this article we're going to look first at D/A converters or "DACs". A following article will deal with A/D converters or "ADCs".

Essentially, D/A conversion is the process of taking a piece of digital information — usually, a binary number — and generating an analog voltage or current whose amplitude is proportional to the number's magnitude. This is done by using each binary bit of the number to control an increment of voltage or current, whose amplitude is proportional to the binary weighting of the bit concerned. The various incremental voltages or currents are then added together to produce the full analog output.

In most practical D/A converters or "DACs" current increments are used, as it is easier to add them together. This gives the basic converter an analog current output, but changing this into an equivalent voltage signal is generally quite straightforward. The basic idea of a current-increment DAC is shown in Fig. 1.

As you can see, each bit of the digital input is effectively used to control a current generator, whose current magnitude is proportional to the binary weighting of the bit concerned. Hence bit 0 (the least significant bit or LSB), with a weighting of 1, is used to control a current generator with an output "I". Bit 1, with a weighting of 2, controls a generator with an output of "2I". Bit 3 controls a generator of output "4I", and so on.

There are as many current generators as the number of input bits that the DAC is designed to accept. Typical DACs are designed to accept either 8, 12 or 16 input bits, and therefore have the same number of controlled current generators.

The analog output current from the

DESIGN GROUP PRINTERS

malibu

MODEL 165

SPECIFICATIONS

Features
- High speed printing: 165 cps full logic bi-directional
- Letter quality printing: 90 cps full logic bi-directional
- Adjustable tractor feed (4" - 15" forms width)
- Paper feeds from front or bottom center
- User adjustable platen
- Forms length from 1 to 99 lines, 15 ips slew rate
- Auto-reversing, re-inking ribbon
- LSI Hydra Ballistic-w printhead, 9 wire, 12 x 9 matrix
- Line spacing: 6 lines per inch
- Power save circuitry turns off the fan and motors shortly after printing stops and re-energizes them as new characters are received, reducing noise and power consumption

Controls
- Lighted "Power On" switch
- FORMS Override allows printing to bottom of last form after the "out of paper" switch has been activated
- ADJUST UP, ADJUST DOWN provides vertical forms positioning
- LINE FEED advances the paper at the slew rate
- FORM FEED advances the paper to next top of form

Functional with optional controller card only
- ON LINE, OFF LINE
- RESET reinitializes the controller card
- SELECT De-Select with LED indicator
- TEST causes the printer to go into a self-test mode printing a rotating character pattern

Software Routines
- Full 96 ASCII character set, lower case with descenders
- Two type fonts, high speed and letter quality, software controlled automatic speed change
- Expanded characters
- Underlining
- Programmable vertical and high speed horizontal tabs
- Selectable left margin
- Complete dot control graphics (60 x 72 dots/inch)
- Easy custom character installation

Physical
- Selectable primary voltage (110-240 VAC, 50-60 Hz)
- Dimensions: 27.5 x 19 x 9.25 inches (60 x 47 x 23 cms); Weight: 48 lbs. (22 kgs.)

Optional Interfaces
- RS-232 serial or ASCII parallel controller
- S-100 buss I/O card
- S-100 buss I/O card with memory
- Apple computer I/O card with HI-RES screen dump

Proudly distributed in Australia by

ASP MICROCOMPUTERS

THE SELECTRIC* APPROACH TO HIGH QUALITY PRINTING

Any model IBM SELECTRIC* typewriter can be interfaced as a computer output printer operating at 13.5 cps. The interface comprises a precision solenoid assembly which fits to the underside of the typewriter without drilling, tapping or permanent modification. Installation takes approximately 4 hours and is extensively documented. If you prefer, ASP or interstate agents will install the solenoids for $75.00 (subject to inspection of your typewriter). Use as a typewriter is unaffected, the keyboard does not feel heavy, or in any way altered.

The electronics provided convert ASCII code into the proper bail select code for the typewriter, control the operation of the typewriter and allow the host computer to communicate on a variety of different interface standards. Available are S100, TRS80 (without Expansion Interface) and Universal Interfaces.

Prices: (including Sales Tax)	S100	$599.00
(10% off for multiple orders)	TRS80	$699.00
	RS232/Parallel	$729.00
	IEEE	$759.00

Dear Ali, I'm convinced I should be more Selectric.* Please reserve the conversion noted below and send me your Order Form.

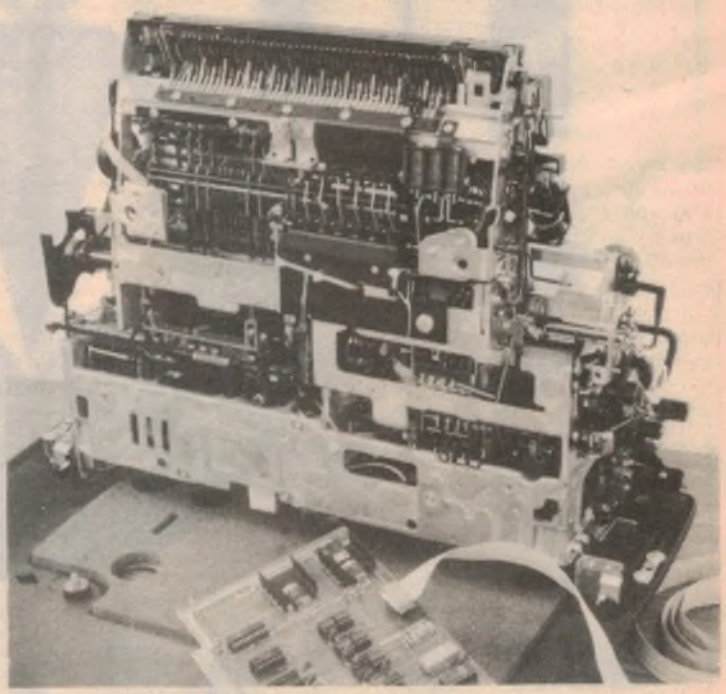
Type of Interface	Quantity	My computer is a

NAME: .....

ADDRESS: .....

PHONE:

* SELECTRIC is a Trade Mark of IBM



ASP MICROCOMPUTERS
799 DANDENONG ROAD
EAST MALVERN 3145.
Telephone 211 8855 211 8344

SOANAR ELECTRONICS PTY. LTD.

A MEMBER OF THE A+R-SOANAR ELECTRONICS GROUP

30 Lexton Road, Box Hill, Vic., 3128, Australia. ☎890661

VICTORIA: 89 0661
N.S.W.: 789 6733
STH. AUST: 51 6981
QUEENSLAND: 52 5421
WEST AUST: 3819522

Color your thinking with Compucolor 11

The Renaissance Machine is a "one-of-a-kind" system for the "one-of-a-kind" person who demands, and will not settle for anything less than, the best.

The color machine with the black and white price

Available from

ANDERSON DIGITAL EQUIPMENT PTY. LTD.

MELBOURNE: 1 Expo Court, Mt. Waverley, (03) 543 2077. SYDNEY: (02) 808 1444.

Your local dealer:
Sydney: Logic Shop (02) 699 4910 • Melbourne: Logic Shop (03) 51 1950
Newcastle: D.G.E. Systems Pty. Ltd. (049) 69 1625 • Canberra: A.D.E. (062) 58 1811
Brisbane: A.D.E. (07) 59 6436 • Adelaide: Applied Data Control Pty. Ltd. (08) 79 9211
Perth: W. J. Moncrieff Pty. Ltd. (09) 325 5722 • Hobart: Management Technology. (002) 34 4522
Darwin: Direct T.V. and Electronic Services (089) 81 9313
NEW ZEALAND:
Wellington: A.D.E. 64 4585 • Auckland: A.D.E. 87 6570 • Christchurch: A.D.E. 79 0210 — 89 7598
NEW GUINEA: Komputel Systems. 42 3924

ADE

DEALER ENQUIRIES WELCOME

REAL HI-FI

AND IT'S ALL IN OUR COLOUR CATALOGUE

The truth is, JVC have always produced real hi-fi components and we believe this current range represents JVC's finest range ever. Here are some real innovations and performance features to whet your appetite:— Quartz locked turntables with uncanny accuracy; Receivers/Amplifiers, some with built-in SEA Graphic Equaliser and DC, class A/B amplification; Cassette deck with JVC automatic computerised tape tuning; Computer designed speaker systems; Separate but matching JVC components designed to compliment one another; perfectly. And all this real hi-fi know-how is yours ...merely for the asking.

If you think they look different, wait till you've heard them!

FREE OFFER
COLOUR HI-FI CATALOGUE

Just fill out this coupon and we'll fill you in on what's available and new in terms of JVC hi-fi entertainment...and it's all FREE!

Name _____

Address _____

_____

_____ Postcode _____

WT1323/EA/79

I am especially interested in...

- ☐ Cassette Decks
- ☐ Matching Systems ☐ Amplifiers
- ☐ Speakers
- ☐ Turntables
- ☐ Receivers

Just address your envelope to...
JVC Hi-Fi Advisory Service,
Post Office Box 307,
North Ryde,
N.S.W. 2113

JVC

the right choice