ELECTRONICS Australia

HiFi, Radio & Computers

MARCH, 1979

AUST. $1.40* NZ $1.40

CHRYSLER'S LEAN BURN SYSTEM: HOW IT WORKS

UNIQUE $60 TEACHING TOY HAS COMPUTER SPEECH!

QUARTZ DIGITAL CLOCK, MODEL TRAIN SOUND UNIT

TRY THE MARANTZ PIVOT TEST. YOUR EARS WILL NEVER KNOW OUR LOUDSPEAKERS MOVED.

In actual test, speakers should be placed the same distance apart as you are away from them.

Here's the test. First, visit your Marantz dealer and listen to a pair of Marantz floor standing speakers placed in a normal listening position. Then, with your eyes closed, have the speakers turned until they're facing each other. We're betting you won't be able to hear even a slight change in the sound ...because there won't be any! Unlike conventional speakers that tend to beam certain frequencies in a narrow corridor (so you have to be directly in front of them to hear all the sound), the Marantz speakers disperse all the frequencies over a 180 degree listening pattern. Result: You'll hear the entire sound wherever you are in the room. Take the test at your Marantz dealer now.

25th Anniversary marantz.

DISTRIBUTED BY: SUPERSCOPE (A'ASIA) PTY. LTD. P.O. BOX 604, BROOKVALE, N.S.W. 2100 TELEPHONE: SYDNEY (02) 939 1900, MELBOURNE (03) 329 7655, ADELAIDE (08) 336 2029, BRISBANE (07) 397 2066, PERTH (09) 328 3874, MORNINGTON (002) 44 4077

ELECTRONICS Australia

VOL. 40 No. 12 MARCH, 1979

Australia's largest selling electronics & hi-fi magazine

Digital car clock

This new crystal-controlled clock features a 6-digit LED display, is easy to build, and can be used in cars or in the home. Turn to p40 for the details.

Don't miss our April issue!

Our April issue will contain a special bonus insert — a big "Super-Catalog", from Dick Smith Electronics, listing products, prices, data and circuits. Don't miss out on your copy!

On the cover

Attractive Jacki Williams, of Sydney's North Shore Chrysler, displays the Spark Control Computer which is the heart of the Chrysler Lean Burn System. Shown inset is a closer view inside the computer. Read about this system, and its contribution to clean air and fuel conversation, on page 8. (Photograph by staff photographer David Raffan.)

FEATURES

HI-FI TOPICS AND REVIEWS

PROJECTS AND CIRCUITS

AMATEUR RADIO, CB SCENE, DX

COLUMNS

DEPARTMENTS

ACTION ORIENTED

(BUT BUDGET CONSCIOUS)

CAPTURE THE IMPORTANT SOUNDS IN YOUR LIFE

SUPERSCOPE by Marantz

C-205

PROFESSIONAL CASSETTE RECORDER

Replaces the SUPERSCOPE C 105 Professional Portable Cassette Recorder

HOW IT'S DONE

1. Half-track broadcast quality, DC servo-controlled motor and dual flywheel mechanism – a rare breed of portable.
2. Three-head – hear exactly what's going on tape
3. Select auto record level, limiter or manual
4. Built-in condenser MIC plus external MIC jack
5. Built-in ambient noise control circuitry
6. Vari-speed pitch control ± 20%
7. Bias and equalisation for STD., CRO2 and FeCr tapes
8. Memory repeat and auto total mechanism shut-off
9. Built-in 10 cm (4 inch) speaker
10. AC/DC/Opt. Ni-cad/Opt. car battery adaptor

A QUARTER-TRACK STEREO VERSION WITH SIMILAR FEATURES (SUPERSCOPE MODEL CD-330) AND A RANGE OF SUPERSCOPE CONDENSER MICROPHONES ARE ALSO AVAILABLE.

FULL SPECIFICATION INFORMATION AVAILABLE ON REQUEST

Distributed by:

SUPERSCOPE®

(A'ASIA) PTY LTD PO BOX 604 BROOKVALE NSW 2100

TELE: Sydney (02) 939 1900
Adelaide (08) 336 2029
Perth (09) 328 3874
• Melbourne (03) 329 7655
• Brisbane (07) 397 2066
• Mornington (002) 44 4077

SUPERSCOPE (A'ASIA) PTY. LTD. is the distributor of MARANTZ stereo high fidelity components, SUPERSCOPE and IMPERIAL home entertainment products, the PIANOCORDER Reproducing System and D.B.X.

Editorial Viewpoint

Cooperation or chaos?

In "Forum", elsewhere in this issue, I lamented the lack of standardisation in the video cassette systems currently on sale, and the quandary in which this has placed prospective purchasers. The uncertainty can only hinder the marketing of what is, after all, a new and expensive range of equipment.

I ended "Forum" with a brief observation about the impending introduction of high resolution audio/video discs and expressed the hope that manufacturers would sink their differences and settle on a common standard before it was, again, too late. In writing this, I was unaware that a similar plea had been entered by a number of overseas magazines still enroute to our office, or waiting to be read.

The writers seem to be resigned to the diversity of video tape standards, with typically four options and talk of more. However, they draw some comfort from the fact that the owner of a VCR is not entirely dependant on pre-recorded material. As long as he can buy blank cassettes and obtain maintenance on his machine, he can use it privately for its prime purpose: to record TV shows for later viewing, build his own library of (supposedly) non-copyright material, and make home movies using his own camera. The ability to swap tapes and a source of pre-recorded features are handy extras but they are not essential to the basic use of whatever VCR he ends up with.

But a disc system is a very different proposition in that the user is likely to be totally dependant on a continuous supply of new releases to validate his investment — be they video, or wide-range sound recordings or both. Pity the purchaser who finds that he has backed a loser, with software for it of second rate or in danger of drying up altogether.

What has triggered this concern are the signs on every hand of a re-awakened interest in pre-recorded video discs. For a time they seem to have been swamped by cassettes but, ironically, the VCR marketing exercise has served to highlight the potential attraction of the disc format. Adding to this is the possibility that the one style of player, with appropriate discs, could feed two vital markets: colour video with stereo sound and multi-track super hifi audio.

Responding to the hint, major electronics companies have re-invoked, or stepped up development of, disc systems. Prototypes have been shown and test marketings planned — all with the aim of getting the jump on a potentially huge audio/video market. Unfortunately, if the end result of this new haste is a multiplicity of systems and software, the commercial casualties and consumer disillusionment to follow will dwarf anything that has gone before.

— 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
Postal Address: PO Box 163, Beaconsfield 2014.

Advertising Offices
Sydney — 57 Regent St, Sydney 2008.
Phone (02) 699 3622
Representative: Narcisco Pimental.

Melbourne — 392 Little Collins St, Melbourne 3000. Phone (03) 602 3033
Representative: Keith Watts

Adelaide — Charles F. Brown & Associates Ltd, 254 Melbourne St, North Adelaide 5006
Representative: Tom Duffy, (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.

*Recommended and maximum price only.

News Highlights

Lasers could extract energy from uranium waste

Executives for an affiliate of Exxon, the world's largest oil company, have been quietly lobbying government agencies to approve a revolutionary process that could turn uranium wastes into a vast new energy source. The process, proved technically possible seven years ago, relies on carefully tuned bursts of laser light to separate two almost identical isotopes of uranium.

Like many other "revolutionary" developments in energy research, however, there may be a serious catch: laser technology is also suspected of being a new and potentially easier pathway toward the production of atomic bombs.

The basic proof of the process occurred July 14, 1971, when scientists working with a laser at Avco-Everett research laboratory in Everett, Massachusetts, were able to remove the volatile uranium isotope U-235 from its much less interesting brother, U-238. U-235 is the metal that gave birth to the nuclear age. Only 0.7 per cent of it is found in natural uranium, which is mostly U-238, an inert, lead-like substance.

When uranium is "enriched" with about 3 per cent U-235 it can make heat in the fuel assemblies of nuclear power plants. When it is enriched to 90 per cent U-235, it can be exploded in the form of an atomic bomb.

In economic terms, the laser separation technology probably means many billions of dollars for the people who can master it, because the way to separate the two uranium isotopes that was invented in the haste of the World War II Manhattan project to develop the first atomic bomb is extremely cumbersome and consumes enormous amounts of energy. It is called "gaseous diffusion" and it consists of turning uranium into a gas and pumping it through millions of tiny screens in a mile-long facility that removes only about 65 per cent of the U-235 present, and leaves the rest to be stored in uranium "tails" that have continued to pile up over the years.

Energy Department scientists say a device which could get at the remaining U-235 in the tails would suddenly expand the world's supply of usable uranium by 20 per cent, giving the United States a huge new, easily accessible "uranium mine."

The exact details of Exxon's process and similar processes have been classified.

The general physical characteristics, however, are known. Lasers are machines that focus their energy in disciplined pulses. When a laser beam is tuned to a certain frequency it can enter the structure of a complex substance and cause a given chemical isotope within it to vibrate so hard that it changes its nature, combining with other substances in a way that allows it to be easily removed.

(This item is an abridged version of an article written by John J. Fialka of the "Washington Star" and published in the "Australian Financial Review".)

Ceramic car engines: how close?

When Britain's nuclear scientists found a way of shaping ceramic for cladding nuclear fuel in reactors they may also have speeded the day when "china" aircraft and car engines will save fuel by running at temperatures higher than are possible with present-day metal power units.

Ordinary ceramic is not only hard but brittle, and this has long been a barrier to successfully moulding it into the intricate shapes needed for new engineering applications. Then, several years ago, scientists at Britain's Nuclear Power Development Laboratories at Springfields, Preston, in north-west England, developed a high quality silicon carbide ceramic called Refel.

Silicon carbide ceramic is four times lighter than steel and able to withstand very high temperatures that would soften the metals now used in engines.

Although produced as a cladding for nuclear fuel in high-temperature gas-cooled reactors, its excellent wear and high-temperature properties made it ripe for much wider industrial application. Its potential has been boosted by recent success in developing a fabrication method that allows Refel to be used in components of complex shapes.

Silicon carbide ceramic produced at low cost by this method is now being shipped from Springfields to the Ford Motor Company in America which is planning to produce a commercial ceramic gas-turbine car engine. Ford has already run a ceramic rotor in an experimental ceramic gas-turbine at 1,370°C.

Ford is interested in the use of ceramic for its engine of the future because the ability of this material to withstand high temperatures means present-day levels of fuel consumption could be slashed.

NS announces record profits

National Semiconductor Corporation has announced record second quarter revenues and earnings for financial year 1978-79. Revenues totalled $US168.2 million, up 42% over the same period for the previous year, while net earnings were $US8.1 million or 45% more. Total revenue for the first half of this financial year was $US353 million (up from $US249.8 million for the previous year), and net earnings were $US16.8 million (up from $US11 million).

New magazine on solar cells

The arrival of the so-called "energy crisis" has prompted a great deal of international research into various energy alternatives. Electricity produced from solar cells is one area that holds a great deal of promise, and is a field that is rapidly expanding as funds are pumped into research.

This has prompted the publication of a new journal called "Solar Cells" whose purpose, say the publishers, is to provide an international forum in which specialists in the field can publish their work, and at the same time have ready access to the papers of other authors with similar interests.

The editorial scope of the new journal will cover all aspects related to the improvement of device efficiency, reduction of cost, testing and applications, economic aspects, production technology, reliability and social implications. The journal will be published in English.

For information on subscription rates, contact Elsevier Sequoia SA, PO Box 851, CH-1001 Lausanne 1, Switzerland.

Superconducting power generator

The Electric Power Research Institute (EPRI), research arm of the US electric utility industry, has chosen Westinghouse Electric Corporation to design and build the world's first commercial superconducting generator.

The energy-saving generators, which could begin replacing conventional electric generators in both nuclear and fossil-fuelled power plants by the early 1990s, are smaller and more efficient than today's generators and should also prove to be more reliable. They are expected to cost as much as 20 per cent less to build and to yield significant fuel savings.

New IC drives TV channel display

A monolithic integrated circuit that supplies 1½-digit TV channel display information has been released by National Semiconductor Corporation. Known as the LM1017, the device decodes 4-bit binary inputs to drive a 7-segment common cathode LED display with up to 25mA of current.

The LM1017 decoder/driver accepts TTL inputs with a high level of input voltage immunity and displays channels 1-16. The device can be driven directly from an MOS output, and can be operated from power supplies ranging from 5 to 12 volts. In addition, a continuously variable brightness control capability is included on the device.

ELECTRONIC CALCULATOR FEATURES CALENDAR & STOPWATCH

NOT MUCH BIGGER than a credit card, this mini electronic calculator also doubles as a digital watch with calendar, stop watch, alarm and lap timer functions. It's called the model LC-853WA, is only 3.5mm thick, features a bright 8-digit liquid crystal display, and is accurate to within 1.5 seconds per day. The easily set piezoelectric alarm serves as a wake-up call, a parking-time warning or an appointment reminder. Enquiries to Toshiba Australia Pty Ltd, 16 Mars Rd, Lane Cove 2066.

Computer designs golf clubs

Computers are intruding more into everyday life. Shown in the accompanying photograph is British golf professional Hugh Lewis, "wired" to a complex of recording instruments to record what happens to a golf club when a stroke is made. It is part of a series of tests being carried out by a British golf shaft manufacturer to help in the design of improved shafts and clubs.

The program involves connecting strain gauges and accelerometers on the shaft to the instruments by cables running up the player's arm, so as not to impede his swing. The golfer then uses the clubs in the normal way, so that the complex nature of the forces imposed on the shaft during swing, impact with the ball and follow-through can be measured and recorded. Plots of stress (bending moment against time from beginning to end of the swing) are

thus obtained, giving maximum stress levels induced on different parts of the golf shaft.

The data will be used in a computer programmed to aid the efficient design of new shafts, indicating the most effective physical properties and metal distribution.

Space station on a truck

A new transportable station for use with space satellites has been developed in Britain by the Independent Broadcasting Authority.

The station is capable of transmitting live or recorded pictures via Europe's experimental Orbital Test Satellite (OTS), launched last May, from virtually any location in Europe. It opens the way to the use of space satellites for instant electronic news gathering (ENG) at distances too great or too difficult to permit the use of conventional terrestrial microwave links.

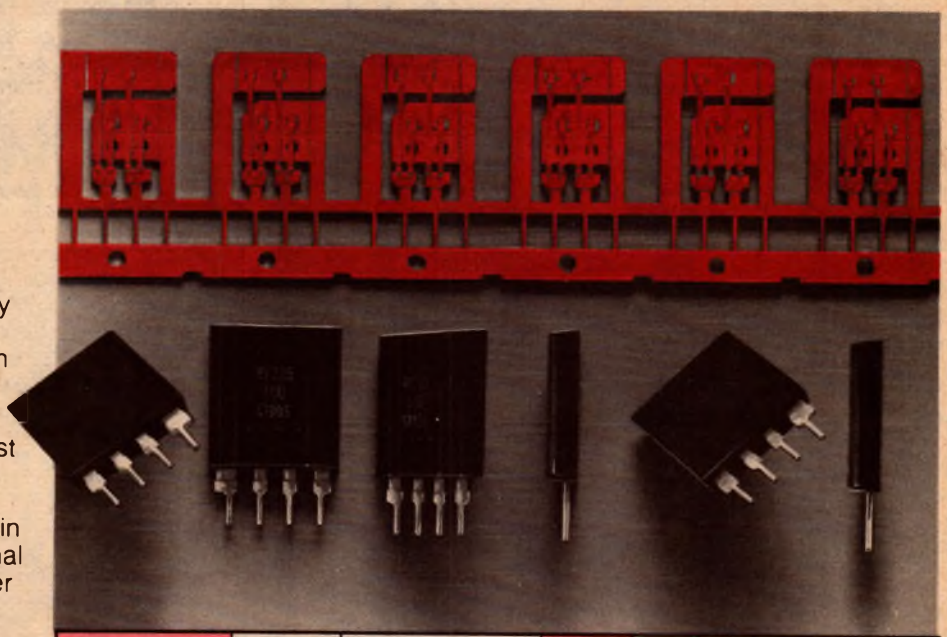
The new self-contained earth station is built in a transportable container carried on a conventional medium-sized lorry together with a 1 tonne trailer on which is mounted the 2.5-metre diameter parabolic dish aerial. The high-power (2kW) 14GHz klystron amplifier and associated transmitter units are in the container. In the absence of mains supplies, an additional mobile diesel generator unit is required.

The complete unit forms the "up-link" to the OTS satellite and the returned signals can be received either at a large earth station (typically with 19-metre diameter dish aerial) or, in most locations, at compact fixed stations having a 3-metre dish aerial.

New SLIM series of rectifier bridges to reduce PCB size.

Electronic Components and Materials

PHILIPS



The new BY224 and BY225-series of full wave silicon bridge rectifiers have a thickness of only 5.5mm. This means *your* new equipment designs can cut down on PCB space needed for the older type bridges.

These bridge rectifiers consist of four double-diffused diode crystals assembled on a copper comb, and plastic encapsulated in a SOT-112 package. Their internal construction, in which the copper comb is in close proximity to the back of the device, makes them suitable for operation with a heatsink (using clip 56366).

The smaller Philips bridges BY164 and BY179 and the Mullard BWY44 to 47 series complement the BY224 and BY225 series to provide an extensive range of bridge rectifiers for both PCB and bolt-down mounting.

For older equipment the Mullard OSH series remains available.

	Type No.	OSH* type superseded	Encapsulation	Input voltage $V_{I(RMS)}$ max.	Repetitive peak input voltage V_{IRM} max.	Non-repetitive peak current I_{SM} max.	Average output current $I_{O(AV)}$ max.
PCB MOUNTED TYPES	BY179	–	All-plastic module (SOD-28)	280V	800V	25A	1A
	BY164	–	All-plastic module (SOD-28)	60V	120V	25A	1.4A
	BY224-400 -600	–	Plastic module with heat-sink face (SOT-112)	280V	400V 600V	85A	5.5A
	BY225-100 -200	–	Plastic module with heat-sink face (SOT-112)	50V 80V	100V 200V	100A	4.2A
BOLT-DOWN TYPES	BYW44-200 -400 -600 -800	OSH03-200 -400 -600 -800	Plastic single-hole fitting	140V 280V 420V 560V	200V 400V 600V 800V	40A	4A
	BYW45-200 -400 -600 -800	OSH05-200 -400 -600 -800	Plastic module two-hole fitting	140V 280V 420V 560V	300V 600V 900V 1200V	75A	6A
	BYW46-200 -400 -600 -800	OSH07-200 -400 -600 -800	Plastic module two-hole fitting	140V 280V 420V 560V	300V 600V 900V 1200V	75A	8A
	BYW47-200 -400 -600 -800	OSH10A-200 -400 -600 -800	Plastic module two-hole fitting	140V 280V 420V 560V	300V 600V 900V 1200V	180A	12.5A

Philips Electronic Components and Materials,
P.O. Box 50, Lane Cove, N.S.W. 2066
Ph: (02) 427.0888

AVAILABLE THROUGHOUT AUSTRALIA FROM

CEMA AND SOANAR

PHILIPS

153-0252

NEWS HIGHLIGHTS

Compact electronic language translator

The question keyed in by Lexicon Corporation's marketing vice president was an urgent one: "Where is the bathroom". The calculator-size electronic gadget in his hand was not fazed in the least as it converted the English into Spanish. "Donde esta el bano" soon appeared across its red LED display.

Released in the US last November, the LK-3000 language conversion computer (or translator) was developed by Lexicon Corporation, a small electronics company in Miami. Lexicon was organised five years ago with the idea of developing a small electronic device that could translate from one language to another. But it was only at the end of last year that a translator could be made to sell at an attractive price — $US225.

That price includes one plug-in module that translates back and forth between English and another language! Additional modules for other languages can be purchased for around $US65 each.

What makes the LK-3000 now possible is the availability of two integrated circuits: the 3870 8-bit microcomputer from Mostek Corporation (Texas), and a 64K read-only memory, also from Mostek. The job of the microcomputer is to interpret what is entered in on the 33-key keyboard, and to search and retrieve words stored in memory for display.

The memory IC, or ROM, stores some 1,500 words or phrases in both English and the language it is to translate.

Currently available modules are capable of translating English into Spanish, French, German and Portuguese, and vice versa. By next June, it is expected that modules will be available for Hebrew, Japanese, Chinese and Russian.

Both the microcomputer and the ROM are housed in the plug-in module, which simply slots into the back of the keyboard and display assembly. Lexicon says it so far has orders worth around $3.6 million for the LK-3000.

Ferranti to develop laser gyroscope

Ferranti has received a contract from the UK Ministry of Defence to design and develop a laser gyro and incorporate it in an experimental inertial navigation system.

The laser gyro Ferranti is developing is triangular in plan. It comprises a single block of vitreous ceramic material in which three cavities of circular cross-section have been drilled. The three cavities form a triangle in one plane. A mirror is positioned at the junction between each pair of cavities.

The cavities are filled with a helium neon gas mixture to produce the laser effect. A cathode is situated midway along the length of one cavity and anodes are positioned towards the furthermost ends of the two remaining cavities. The helium-neon mixture is excited to lase by electrical discharges between the cathode and the two anodes.

As a result, two independent coherent light beams are generated — one travelling round the triangular resonating cavity in a clockwise direction, the other counter-clockwise.

If this assembly is spun about an axis perpendicular to the plane of the cavities, the effective path around which one beam is travelling will appear to shorten, and the other to lengthen. To a detector placed at one of the reflecting mirrors, the frequency of the beam propagated in one direction will appear to increase while that of the other beam will decrease.

The detector thus produces output pulses at a rate proportional to this difference in frequency, and hence proportional to the rate of rotation.

Gunning for rust

A diver uses a new British "gun" that is able to monitor the condition of submerged offshore metal structures — among them oil rigs — in order to assess the degree of corrosion and to predict the future life of the structure.

Suitable for diver use down to 150 metres and more, the "gun" has a hardened steel tip that is pushed through the coating of marine growth and rust to make contact with the structure. In this way a silver electrode is uniformly positioned 100mm from the structure's surface. It is surrounded by a shroud that ensures a well defined and constant sensing area. The relevant information is then displayed on a bright digital readout on the rear end of the gun.

Further information is available from Morgan Berkely and Co Ltd, Ember House, Moorside Rd, Winchester, Hampshire, England.

News Briefs:

Ampex appoints Klarion as SA agent

Ampex Australia Pty Ltd has appointed Klarion Enterprises Pty Ltd as distributor in South Australia of the company's "Industrial Magnetic Tape" products. Ampex is a leading tape manufacturer and markets a complete range of professional audio-visual tapes for broadcasters, studios, education and business use.

New components store in Melbourne

Melbourne electronics enthusiasts now have a new source of components and hobby parts. Formed in June last year, Vesco Electronic Supplies started by retailing and distributing components to the hobbyist and to industry. Since then, the company has diversified into hifi, security systems and computer components, as well as becoming Victorian distributors for Utilux and Panduit cable ties. Semiconductor components stocked include brands such as Fairchild, Motorola, Signetics, National Semiconductor, and Texas Instruments.

The address of the company is 318 Huntingdale Rd, Huntingdale 3166.

". . . a contribution towards energy conservation"

Chrysler's Electronic Lean Burn System

by J. de C. GRANDIN A.S.A.E. (Aust.)*

The twin problems of atmospheric pollution and dwindling fuel supplies present a serious challenge to automotive engineers, the solutions to them often being in conflict. This article tells how Chrysler engineers have used electronics to avoid the conflict and to improve both factors at the one time.

In July 1976, a new Australian design rule (no. 27A) was issued covering all new motor vehicles. It required that no petrol engined vehicle should emit more than a specified level of hydrocarbons, carbon monoxide, or oxides of nitrogen. Manufacturers were further warned that the limits would become progressively more stringent.

The aim of the new regulations was to alleviate the all too familiar problem of "smog" — caused when sunlight acts upon hydrocarbon and nitrogen oxides in the atmosphere to produce a complex photochemical reaction.

Manufacturers' response to the regulations was to modify existing engines by various means and to rethink the design requirements for future engines. They also had to consider the problem of raw fuel vapour from the petrol tank and carburettor, plus blow-by gases from the crankcase, which all add to pollution.

These secondary problems have been solved fairly easily, but the exhaust gas pollutants — hydrocarbons, carbon monoxide, and nitrogen oxides — present a major challenge to automotive engineers.

Two of the pollutants, the hydrocarbons and the carbon monoxide, are basically the result of too rich a mixture; in short, not enough oxygen to ensure complete combustion.

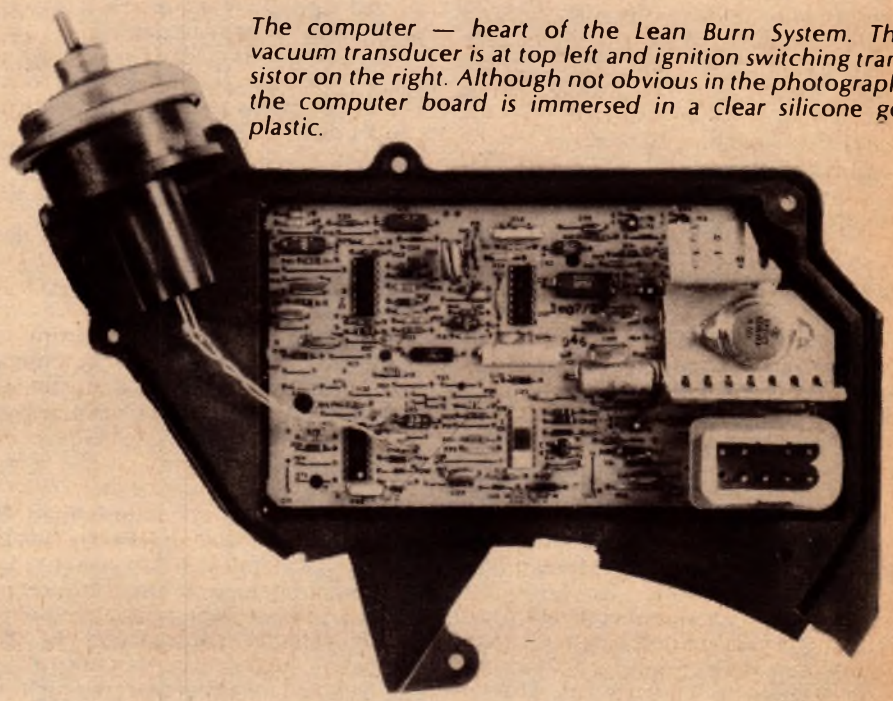
Unfortunately, there is more to it than merely increasing the air/fuel mixture ratio. While this will reduce the hydrocarbon and carbon monoxide pollution dramatically, it also has the effect of increasing sharply the output of nitrogen oxides, commonly referred to in automotive literature as the "NOx" content of pollution.

It happens because of a rise in peak temperatures in the combustion chamber — the result of better combustion. This, combined with the pressures involved, can cause nitrogen in the air/fuel mixture to combine with residual oxygen, to form the unwanted oxides.

Thus while typical air fuel mixtures used to date — about 15/1 — give commendably low hydrocarbon and carbon monoxide pollution, with good engine performance, the NOx pollution peaks at about this figure. Faced with the need to bring down the oxide pollution the engineer has, broadly, two choices: get rid of the oxides before they can be released to the atmosphere, or prevent them from being generated in the first place.

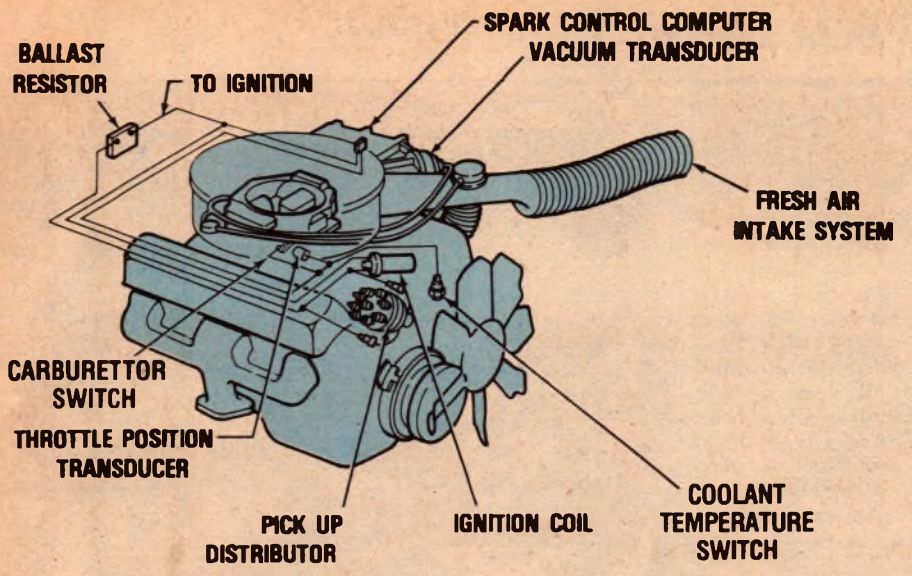
While the first choice is probably the easier one, certainly on a short term basis, the second choice is undoubtedly the better — but the more difficult to implement.

Increasing the air/fuel ratio into the "lean" region beyond about 15/1 results in a rapid fall in nitrogen oxide pollution, without any appreciable increase in hydrocarbons or carbon



The computer — heart of the Lean Burn System. The vacuum transducer is at top left and ignition switching transistor on the right. Although not obvious in the photograph, the computer board is immersed in a clear silicone gel plastic.

*155 The Boulevarde, Strathfield 2135.



The essential parts of the Lean Burn System, shown fitted to a V8 engine. The set-up is virtually identical for the six cylinder engine, the main differences being in the programming of the computer.

monoxide. At 18/1 the oxide is much lower than for a 15/1 mixture and, at 20/1, is comparable with the hydrocarbon and carbon monoxide levels, which are still low.

In the Chrysler "Lean Burn" System the carburettor is adjusted to give an 18/1 ratio for middle and high speed ranges, and 15/1 for idling. The 15/1 mixture does not produce significant oxide pollution under idling conditions, due to the lower combustion chamber temperature.

The challenge which Chrysler had to face was to produce an engine which would run reliably and smoothly on such mixtures, and without any significant loss of performance.

This may not be such a task for an engine intended to operate at a constant speed, into a constant load and, ideally, under constant ambient conditions. But it is a formidable assignment for a car engine, which has to operate over a speed range in excess of 10/1, with wide load variations, and in ambient temperatures ranging from the depths of winter to the extremes of summer.

Basically it involved a detailed study of the links between pollution levels, mixtures, engine parameters and the ignition system. It clearly pointed towards a more intelligent and critical control of ignition timing, and Chrysler engineers were in the happy position of having a background of experience with their breakerless electronic ignition system.

For Chrysler, their most urgent problems had to do with their current V8 engine and it was on this that they developed their "Electronic Lean Burn System".

The Hemi Six was investigated next and the results are best summed up in a quote by Mr T. J. Anderson, Chairman and Managing Director of Chrysler Australia, in a bulletin dated 26 September, 1978.

"We believe that the Hemi Six equipped with E.L.B. is undoubtedly the most fuel efficient six cylinder engine built in Australia. Furthermore, the E.L.B. system means that we no longer need the 'hang on' components originally needed to meet ADR27A emissions regulations.

"All in all, we have eliminated all the disadvantages associated with the emissions laws and come up with an easy starting, better behaved, cleaner, and more responsive six cylinder engine which uses a lot less fuel.

"We are also proud of the fact that Chrysler Australia has scored a world 'first' with the adaption of the ELB system to a six cylinder car."

The writer is indebted to Chrysler Australia for the following description of their Electronic Lean Burn System. Much of the information has been taken from Chrysler manuals.

Although there is considerable emphasis on the "electronic" aspect of the lean burn system, justified by the important part it plays, other factors are involved:

(1) Mixture turbulence within the combustion chamber;

(2) Air temperature at the input to the carburettor;

(3) Engine (coolant) temperature.

The mixture turbulence is critical because the lean mixture does not ignite as readily as a richer mixture and an optimum degree of turbulence minimises this problem; at the same time, excessive turbulence may actually quench the spark! The requirement involves careful head design, including the "Hemi" head concept.

Air temperature at the carburettor input is another important factor in ensuring reliable combustion. In the Chrysler system the air input is regulated by means of a heated inlet air system to prevent stalls or misfiring during engine warm-up. The system is designed to maintain carburettor air inlet temperature between 21°C and 27°C at ambient temperatures below 27°C.

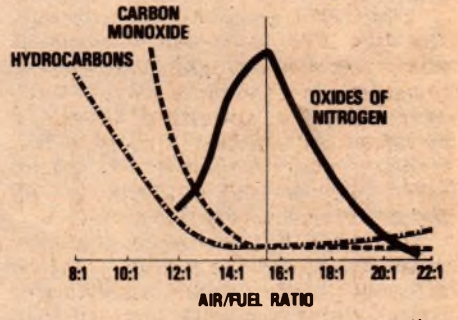
Cold air is drawn in from the front of the engine compartment and hot air from the vicinity of the exhaust pipe. These are mixed in the correct proportion by means of a bi-metal sensor which operates a control vane via a vacuum motor.

At inlet temperatures above 27°C all air to the carburettor comes directly from the exterior of the vehicle via the fresh air intake system. Part of the incoming air is circulated through the computer to provide cooling.

In addition to this the fresh (cool) air intake system — as distinct from underbonnet air intake systems — provides improved fuel economy and power due to greater intake air density.

The third factor, engine temperature, is also carefully controlled. It uses a conventional thermostat system to ensure rapid warm-up and then to maintain the temperature at a minimum of 91°C.

With these factors controlled, one major requirement needs to be satisfied; to fire the spark at precisely the right instant to ensure the most



The effect of air/fuel ratios on pollution. NOx pollution peaks at about 15/1 — a ratio at which conventional engines give best performance. Note the drop in NOx at the 18/1 ratio used in the Lean Burn System.

complete combustion. The "right instant" is subject to continuous change, depending on engine speed, manifold vacuum, throttle position, and throttle rate-of-change.

This is where the computer comes into the picture, since only a computer can digest all these factors and make the necessary timing adjustments with the rapidity required.

The ignition system is based on the breakerless system already well established on Chrysler vehicles. In this, the ignition is triggered by an impulse from a pickup coil mounted in close proximity (.15mm) to a toothed wheel, called a reluctor, driven by the distributor shaft. The wheel has one tooth for each cylinder.

In the lean burn system the distributor is extremely simple. There is no mechanical advance mechanism, no vacuum advance mechanism, and (ob-

viously) no breaker points. There are, therefore, no adjustments and the ignition timing will retain its setting virtually indefinitely. Maintenance should be virtually nil.

The ignition coil is controlled by a power transistor which switches off the primary current to provide a magnetic collapse and a resulting high tension pulse in the normal Kettering fashion. The circuitry is arranged to switch the primary current back on again immediately the spark is extinguished, thus providing maximum time for coil magnetic build up. (This was also a feature of the original breakerless ignition system.)

The exact moment at which the transistor initiates the spark is determined by the computer, which currently is an analog type but is soon to be replaced by a digital type. It will do the same job, but can provide even more precise control if needed.

The computer is fed with the following information:

(1) Pulses from the pickup coil in the distributor. From these it derives both engine speed and crankshaft position, the latter serving as a reference against which the actual timing is calculated.

(2) Throttle position. Two sensors provide this information. One is a switch on the carburettor which simply senses whether the throttle linkage has come back against the idling stop, ie, the driver's foot is off the throttle.

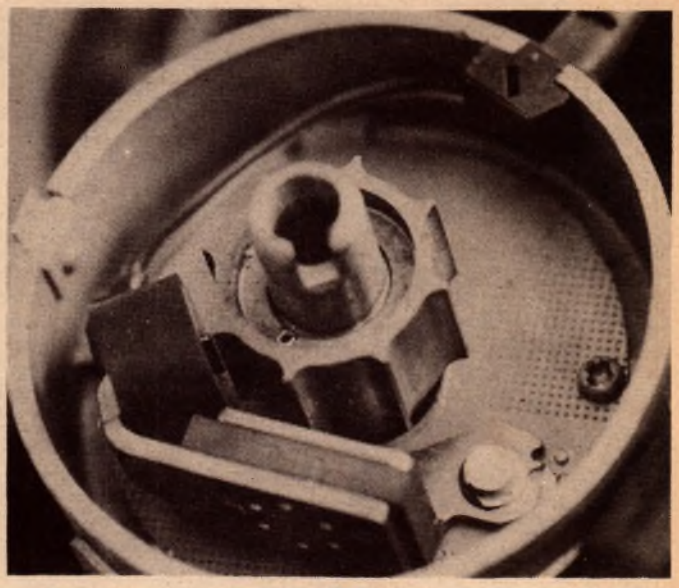
The second sensor is more elaborate and senses two functions. It is a solenoid with a movable core, the latter being connected to the throttle linkage. As the throttle position changes, so does the inductance of the solenoid. The solenoid forms part of an AC circuit, the output of which is fed to the computer. From this is derived both the throttle position and the rate at which the throttle is being opened.

(3) Engine temperature. This sensor is a simple coolant operated switch. It indicates to the computer when the engine has warmed up to at least 65°C.

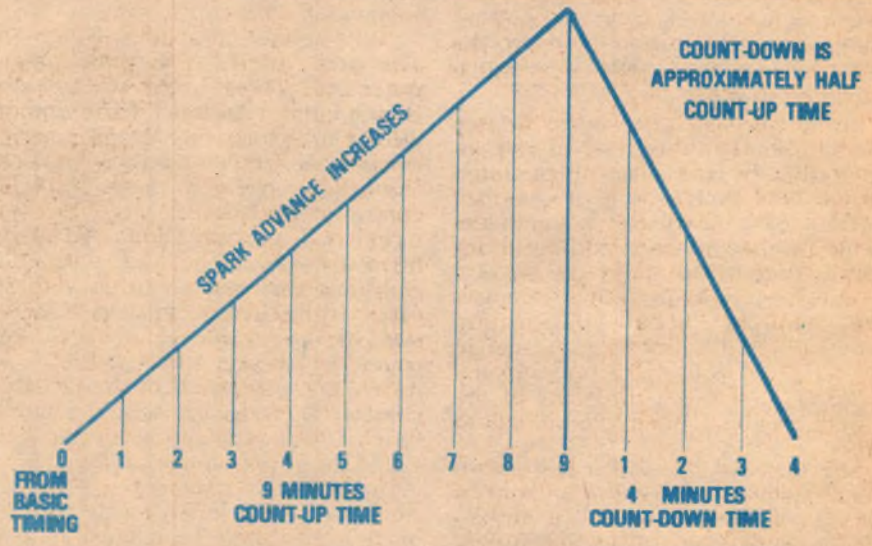
(4) Manifold vacuum. This is provided by another solenoid and circuit similar to the throttle sensor, the solenoid being operated by a diaphragm.

Having provided the computer with all these data, let us see how it uses them, commencing with the starting procedure:

For cranking and starting, the pickup in the distributor feeds the timing signal directly to the ignition control function. In this mode, the computer program is bypassed and has no effect on the ignition timing. Therefore during the time the engine is being cranked, spark timing is determined by the fixed physical position of the pickup coil in the distributor.



The breakerless ignition reluctor and pickup coil used in the Lean Burn System. The coil is energised by a permanent magnet, seen at the bottom of the picture. There is no mechanical advance, no vacuum advance, and no contacts.



This graph shows how the computer "counts up" the permissible maximum vacuum advance, while ever the throttle is open and the manifold vacuum reaches at least 300mm Hg. The system "counts down" when the throttle is closed.

The moment the engine begins to run, the spark control computer senses the increasing speed, overrides the start circuit and instantaneously transfers to the run circuit. With the engine running, but still cold, extra advance helps to stabilise cold engine operation and to reduce the chance of engine die-out during the warm-up period.

For example, taking 10° as the basic timing setting, the program may add as much as 9°, or a total of 19° BTDC (before top dead centre) of the crankshaft.

During the next 90 seconds this extra advance will be gradually cancelled, depending on two factors. One is a timing circuit in the computer which, alone, will cancel it completely over a 90 seconds period.

The other is an engine speed sensing circuit. This is to protect the engine from excessive advance should high engine speed occur immediately after starting. This circuit degenerates the extra (start-up) advance as engine speed is increased.

If the throttle is now part opened to start the car moving, the throttle position transducer signals the computer to produce additional advance due to both the speed of throttle opening and the position of the throttle. After about one second the advance due to speed of throttle opening will be cancelled.

Now assume that the throttle is moved quickly from part open to full open. Again, the throttle transducer senses both the new throttle setting, and speed of throttle opening. Within milliseconds the computer will signal

the ignition control to provide instant extra advance in response to the rapid throttle movement. This condition is held for about one second, after which the setting comes back to a value determined by the throttle position and engine speed.

The brief advance produced by the speed of throttle opening is designed to provide quicker engine response to the demand for acceleration. In spite of the refinements of modern carburettor design, including a throttle operated pump to provide an extra squirt of fuel, a rapidly opening throttle does not result in instantaneous fuel flow to match the new setting.

On the other hand, it does produce virtually instantaneous air flow increase, resulting in an ultra lean mixture for a very brief period. This produces what is variously called "stumble", "hesitation" or "flat spot"; a failure of the engine to respond immediately to the throttle opening. The extra advance, for about one second, is designed to offset this.

So far we have ignored the vacuum sensor. In fact, this is rendered inoperative by the coolant operated switch until such time as the coolant reaches 65°C. Once this happens the computer can provide additional advance based on manifold vacuum.

However, the Lean Burn System uses the manifold vacuum information rather differently from the manner in which it is used in conventional systems. As a result, this part of the system may be a little more difficult to follow.

In one sense it is similar to conventional systems, in that the amount of vacuum is used to sense the instantaneous variations in load and throttle setting, and to produce additional advance over and above that due to engine speed. (Heavier loads and wider throttle openings result in lower vacuum and less vacuum advance.)

In the case of the six cylinder car, the Lean Burn vacuum sensor operates over the range from zero vacuum to 300mm Hg of vacuum. This is not the maximum vacuum the engine will generate, but the maximum to which the sensor will respond. So, as far as the computer is concerned, maximum vacuum is 300mm Hg.

When the coolant switch opens, only a minimum of extra (vacuum) advance is initially applied, even if the vacuum sensor is fully extended to the 300mm Hg — or more — position. This is because the computer is programmed so that it will take approximately nine minutes (seven minutes for the eight cylinder engine) under these conditions before the maximum advance due to vacuum is applied.

To understand the reason for this deliberate delay, it is necessary to look at the difference between suburban and highway driving.

A major portion of vehicle exhaust emissions occurs during urban driving, which consists of light loads at both low and moderate speeds, with occasional moderate accelerations and decelerations.

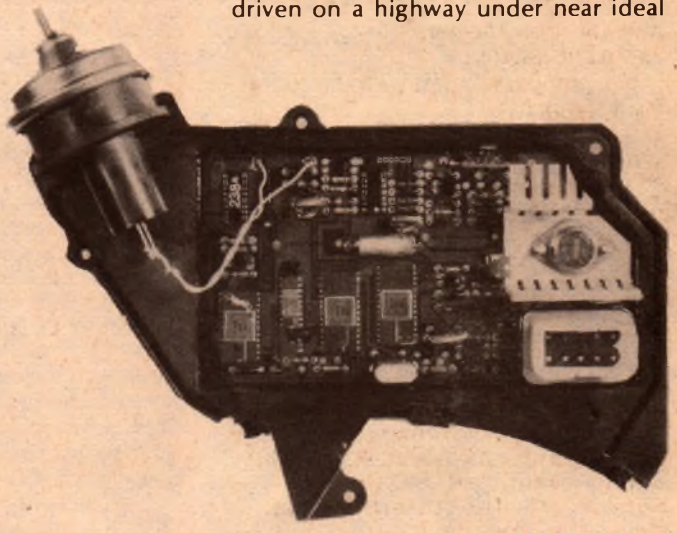
This is one set of conditions for which the Lean Burn System was specifically developed. Lean air/fuel ratios and lower ignition advance levels result in low emissions. By measuring the length of time spent at idle and also the length of time spent off-idle, the computer can detect an urban driving situation and adjust the total load-derived (vacuum) ignition advance to ensure low levels of exhaust emissions.

At steady speeds and higher loads, the ignition timing requirement changes. Under these conditions the engine produces lower amounts of all three pollutants. Additional ignition advance can be used to improve fuel economy.

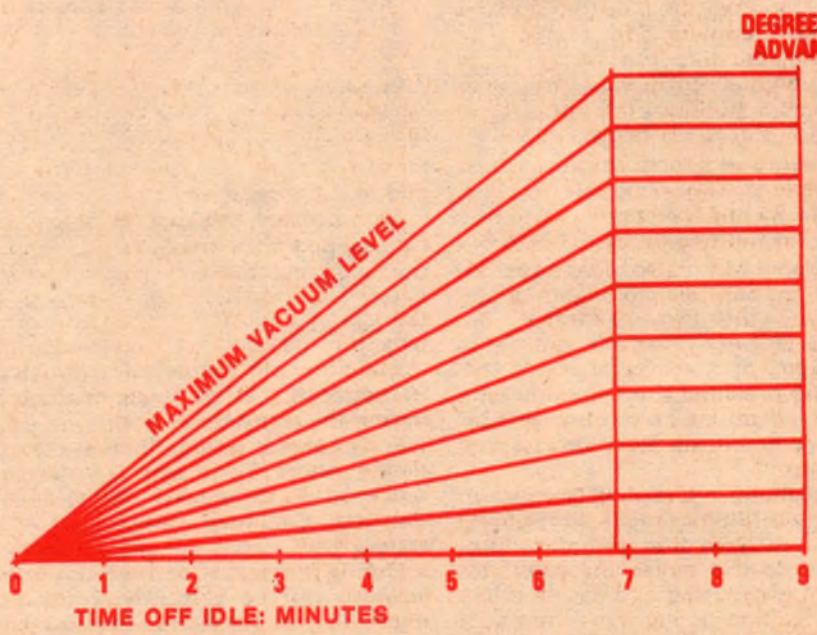
The computer senses this latter condition by noting that the throttle remains open for relatively longer periods. The vacuum advance is allowed to gradually increase — reaching a maximum value after about nine minutes. Under these conditions, best possible fuel economy is achieved.

Any value reached at any particular time is stored by the computer and, while this value will increase, if subsequent driving conditions warrant it, it will not normally decrease, EXCEPT when the throttle comes back to the idle position. When this happens the stored setting begins to decrease, or "count down", at a rate approximately twice as fast as the "count up" rate.

Let us assume that the car is being driven on a highway under near ideal



The latest computer, shown here, is a digital type which will ultimately replace the analog type currently in use. It uses the same hardware and case, but the circuit is quite different and can provide much more accurate control if required.



This graph, for the eight cylinder engine, shows the effect of varying values of vacuum on the maximum advance available after seven minutes. For the six cylinder engine, maximum advance is not achieved until after about nine minutes.

conditions of load, speed, and throttle setting, such as to produce a vacuum of at least 300mm Hg for nine minutes or longer. In these circumstances the extra advance due to vacuum will have reached its maximum setting.

If the driver now takes his foot off the throttle, to slow down or stop, the carburettor switch closes and two things happen. First, the degree of advance reverts immediately to the basic timing plus that due to engine speed, all "vacuum" advance being switched out.

The second thing that happens is that the vacuum advance setting, while still stored in the computer, will commence to count down. Since it counts down at approximately twice the rate at which it counts up, it would be cancelled completely in a little over four minutes if the driver did not reactivate the throttle.

In the event that the driver released the throttle only momentarily and reverted immediately to the previous driving condition (300mm Hg) the previous maximum advance due to vacuum would be restored immediately. If the zero throttle condition was more prolonged, say one minute, then some of the vacuum advance setting would be lost (to allow for the thermal disturbance to the engine) and, on resuming the ideal driving condition, partial vacuum advance would be applied immediately, building up to full advance after about two minutes.

Another possibility is that, while running at 300mm Hg of vacuum (which would involve a partially open throttle) the driver presses the throttle to full open. Under these conditions the vacuum will decrease and this will retard the spark to suit the new conditions. Again, the previous setting will be stored in the computer — without count down this time, since the carburettor switch has not been activated — and this setting will be restored immediately the driver reverts to the previous driving condition.

Fairly obviously, there can be an infinite variety of load, speed, and throttle settings, plus consistency or otherwise of driving conditions, far removed from the simple examples given. The important point is that the computer will assess all the relevant data and produce an optimum ignition timing for whatever combination prevails.

The Australian Design Rule (ADR) 27a sets out the maximum permissible exhaust emissions from July 1976 and then upgraded from January 1978.

DATE	HC g/km	CO g/km	NOx g/km
July 1976	2.1	24.2	1.9
January 1978	1.91	22.0	1.73

The grams per kilometre (g/km) figures are for a specific quantity of air drawn in by the engine, thus allowing for the varying capacity of different engines.

Chrysler engines fitted with the Lean Burn System meet all the 1978 emission level requirements "... with room to spare", to quote the Chrysler engineers.

As can be seen from the photographs, the computer is built on a printed board and, along with the coil switching transistor, is housed in a stout plastic container mounted on the air cleaner. This also houses the vacuum operated diaphragm and associated sensor. The whole of the computer board is encapsulated in a clear resilient silicone gel, designed to protect it from the harsh environment of the engine compartment.

And what happens if the computer fails? Those who fear being caught beyond the black stump with a flashed over transistor, leaky capacitor, or a resistor which has gone high, can be reassured. In the unlikely event that the computer does fail, the system simply reverts to basic timing and, while the engine will not perform very efficiently, it will continue to run.

While each engine type — eight cylinder, six cylinder, and of varying capacities — requires its own specific program, the same basic computer circuit and hardware can be used. The individual engine designs are catered for by relatively simple changes in component values.

For a long time electronics and automotive engineers have gone their separate ways, the latter being suspicious — perhaps justifiably — of the reliability of electronic equipment in the automotive environment. It is good to see that co-operation between them has now provided answers to some very pressing problems.

LEAN BURN ECONOMY TESTS

Claims such as those made for the Lean Burn System obviously need to be backed with facts. The results of three tests, are given here. All involved "Hemi Six" engines.

(1) Dynamometer test by Chrysler Australia to Australian Standards Association test AS2077/1977. This provides "urban" and "highway" cycles with varying loads and stops and starts to simulate these road conditions.

Comparisons were made with CL series vehicles not equipped with the Lean Burn System. Percentage improvements and actual fuel consumption figures were as follows:

	Urban	Highway	Combined Consumption
4.0 litre auto	+23%	+29%	23.5mpg (12 l/100km)
4.0 litre manual	+26%	+24%	24.5mpg (11.5 l/100km)
4.3 litre auto	+21%	+16%	22.5mpg (12.6 l/100km)
4.3 litre manual	+28%	+20%	24.4mpg (11.6 l/100km)

(2) Road test by eight independent motoring journalists driving three vehicles from Adelaide to Sydney, via Melbourne. The cars were checked by the Royal Automobile Association of South Australia to confirm that they were to standard specifications.

Fuel consumption was strictly supervised by the drivers in each team. Full use was made of speed limits as high as 110km/h, and average speeds ranged up to 91km/h. Figures for the whole trip were:

Valiant GLX 4.3 litre manual, (air conditioning): 26.9mpg.
Valiant 4.0 litre automatic, (power steering): 26.3mpg.
Regal 4.3 litre automatic (power steering): 25.3mpg.

The air conditioning fitted to the GLX was needed for only a small proportion of the trip.

(3) A road test by the NRMA on a CM Valiant 4.0 litre automatic. The writer is indebted to the NRMA organisation and to Mr T. Ward, the test engineer, for the following extracts from the test report.

"Our test of the new CM Valiant 4.0 litre automatic sedan proved that not only does the E.L.B. improve fuel consumption, but it does so without sacrificing engine performance. It is fitted to all Valiant/Regal engines.

"There is a new camshaft, carburettor and split exhaust manifold to go with the E.L.B. system. Much of the external 'plumbing' previously required for emission control has been deleted. Power output has been increased from the CL four litre engine.

"Our previous test of a CL Valiant 4.0 litre was on a manaul transmission version (Open Road, April 1977). Performance figures for the CM auto are almost identical with the CL manual. Fuel consumption of the CL manual was 16.1 mpg, whilst the CM auto returned 20.5 mpg, an improvement in actual figures of 27 per cent. Allowing for some loss because of the CM's automatic, the improvement would be even better in true figures.

"Chrysler have developed, in their E.L.B., a system which does work and also gives the additional side benefits of easy starting and a clean exhaust. It is a contribution towards energy conservation."

At Last A Computer We Can All Afford

CHALLENGER I SERIES

Economical computer systems, ideal for personal use.
Superboard II – a complete system on a board requires a 5 volt supply to be up and running.
Challenger 1P – fully packaged Superboard II with power supply.
Both systems feature a 32 x 32 character display, 4K RAM on the board, Keyboard and ready-to-run BASIC-in-ROM.
Challenger I's are expandable with up to 32K of RAM, dual mini-floppies, and printer.

$459

$367

TV set and cassette recorder not included.

$792

CHALLENGER II SERIES

C2-4P – a high performance BUS oriented modular microprocessor system easily expandable. The back-plane construction allows any of Ohio's 50 boards to be readily added, such as memory expansion options, A/D convertors, Voice I/O, printer, disk controllers and many more.
The **C2-4P** has a software selectable 32 x 32 and 32 x 64 character display, and a programmable keyboard for real time interactive use. The C2 is the choice for the serious computer owner planning on expansion.

All systems include 4K RAM, a typewriter style keyboard, video output suitable for use with an RF convertor (not supplied) to a standard TV set, and the reliable Kansas City standard cassette system. Microsoft's 8K BASIC-in-ROM avoids lengthy loading from cassette and features full string manipulation, floating point and trigonometric capabilities. A machine code monitor in ROM, plus an Assembler allow access to machine code programming. A large range of programs are a available for education and entertainment. Contact us for further details.

OHIO SCIENTIFIC

TCG

Australian Dealer: **Systems Automation Pty. Ltd.**
26 Clarke Street, Crows Nest NSW 2065. Tel: 439 6477

Remarkable new speech-synthesising chip

$60 teaching aid has computer speech!

Beneath the orange-plastic exterior of a new word-teaching device called Speak & Spell, Texas Instruments has hidden an impressive new speech-synthesising chip. The first application of the new chip is impressive, but it's the potential for the future that's really exciting.

by GREG SWAIN

"Spell 'hygiene'," commands the voice inside the orange plastic box. I key in the appropriate letters and they appear instantly on the green fluorescent display, the machine pronouncing each letter in turn: **"h-y-g-i-e-n-e.** Press the enter button and the response is an immediate **"You are correct. Now spell 'anything'."** This new prduct from Texas Instruments is a winner; you can't help but be impressed!

I hope you'll forgive my enthusiasm. You see, I've just spent the last couple of hours playing with an incredible new gadget.

That new gadget, called "Speak & Spell", must surely be one of the most innovative products to come out of Texas Instruments — or from any other electronics company for that matter — in years. Basically, it is a teaching aid, designed to teach young children the alphabet, word spelling and word pronunciation. What's causing all the fuss is that the device can actually speak, without having to resort to anything as crude as a pre-recorded message on a disc or tape.

Essentially a dedicated microcomputer, Speak & Spell stores more than 200 words in its semiconductor memory, and employs a patented one-chip voice synthesiser that many scientists had believed was years off. The device reads out its 200 words randomly for various exercises which are selected by means of a keyboard. These exercises include a spelling quiz with four levels of difficulty, hangman (a spelling game), and various other word games.

The voice inside the orange case spelt instant fascination for Editor Jim Rowe's young children. From left: Anne (11), Penny (5) and Grant (9).

TI says that the words programmed into Speak & Spell are common reading and spelling stumbling blocks. They're words like *anxious, ocean, language, obey* and *learn*. "They're not uncommon words", says TI. "They're problem words."

The device is simple to use. Press the "ON" button, and Speak & Spell turns on in the "Spell A" mode; that is, the least difficult spelling quiz. Three further levels of increasing difficulty of about 50 words each can be selected by punching in the letters B, C and D. Punch the "GO" button, and the unit pronounces the first word to be spelt.

The child, using the keyboard, now attempts to spell the word. The unit pronounces each letter at it is entered, and displays it on the fluorescent readout. A correct spelling is verbally acknowledged by the machine, which then gives the next word to be spelt. An incorrect spelling is met with **"Wrong, try again",** and the word repeated.

If the child fails after two tries, Speak & Spell says **"That is incorrect",** and goes on to spell the word, pronouncing each letter and the entire word. At the end of every 10 words,Speak & Spell announces the score and shows it on the display. The unit praises a perfect score, and announces the score in a "matter-of-fact" way for poor performances.

The word guessing game, or hangman, is one well known to children (and to most adults as well). Dashed lines on the fluorescent display indicate the number of letters in the mystery word selected at random by the machine, and if you key in seven in-

Speak & Spell comes with a 32-page activity book. Unit reads out its 200 words randomly for various spelling exercises selected via the keyboard.

correct letters you lose. A correct letter guess is greeted by musical tones and is shown in its appropriate position on the display.

At the end of the game, the unit declares the winner by announcing "You win", or "I win".

If all that sounds impressive, consider the following:

- the unit varies its response at the end of each correct spelling;
- it can code and decode words and phrases;
- optional plug-in modules allow the vocabulary to be expanded;
- a single word or an entire list of 10 words can be repeated at the touch of a key;
- there is provision for a pronunciation drill. A word is displayed, the unit says **"Say it",** then pauses while the student pronounces the word. It then gives the correct pronunciation;
- the unit can provide random letters for a variety of games; and
- words that sound the same but are spelt differently are defined.

Take the lastpoint, for example. One of the words in the spelling test is "yolk", and the command is **"Spell 'yolk' as in egg".** This is to avoid any possible confusion with the word "yoke", which has quite a different meaning.

The way in which the machine varies it's response at the end of a correct spelling is most intriguing. In fact, it's almost human in this aspect of its behaviour, varying the response from **"That is right,"** to **"That is correct",** or **"You are correct",** or **"You are right".** The command to spell a new word is similarly varied.

Another interesting point is that the letters on the keyboard are arranged in alphabetical order, rather than in typewriter-keyboard fashion. Why? The reason presumably has to do with the fact that this would be an excellent unit for teaching the alphabet to young children. Used in this mode, it is only logical for the letters to be in alphabetical order.

The appearance of the unit is disarmingly simple. A bright orange case of rugged, high impact plastic is used to house the electronics. Colour-coded keys set against a blue, orange and yellow background, together with the fluorescent display, combine to produce a toylike appearance. It is, after all, designed to be used by children.

But the simple appearance of Speak & Spell belies the complex electronic technology hidden inside that bright orange exterior. Heart of the system is the new one-chip voice synthesiser. It reproduces words uttered by a male voice, has a distinct nasal sound and — you've guessed it — has an American accent!

In fact, it sounds like an American male with a bad cold!

The voice synthesiser chip, which TI calls the TMC0280, is a MOS device containing an entire digital signal processor with timing and decoding circuits, a 10-stage digital filter and a D/A converter. Used in conjunction with a pair of 128k ROMs and a special version of the TMS1000 8-bit microcomputer, the silicon chip can produce a total of 200 seconds of sounds for the 200-word vocabulary. However, it is capable of accessing a lot more memory — as much as 2.1 megabytes in fact.

Since the speech generator uses memory at a maximum rate of only 1200 bits per second, it could be designed to speak for as long as 30 minutes.

The data used to make up the spoken words is encoded into the two ROMs by means of a complex mathematical procedure. This procedure, called linear predictive coding (or LPC), divides the analog signal representing each word into a number of slices and digitises the most significant characteristics for storage in ROM.

Speech is first broken down into voiced and unvoiced sounds. Voiced sounds like *l,* o, and *m* have a definitie pitch and include vowels and fricatives that can be represented by low-frequency, high amplitude signals. Unvoices sounds, like *s, f* and *sh,* are represented by low-amplitude, random high-frequency signals similar to white noise.

In use, the new "talking" chip randomly takes data from a ROM every 20ms — from 4 to 49 bits, depending on the complexity of the sound — and uses this data to synthesise an analog waveform with sufficient fidelity for intelligible speech. The characteristics of the vocal tract are simulated by processing the data stored in ROM through what is effectively a variable formant filter.

Impressive, clever, innovative — all these adjectives apply now to Speak &

Speak & Spell is easy to use. Even five-year-old Penny can have fun learning the letters of the alphabet.

Spell. But as impressive as the product is, it's the potential of the basic speech synthesising system for the future that really makes one stop and wonder. In fact, the voice synthesis and semiconductor technology behind Speak & Spell has so much market potential that it has stunned competitors.

Although tight-lipped about future product plans, TI must surely view a near future in which spoken words will replace warning lights in cars and airplanes, or just about any place where recorded message and answering systems are needed. One promising near term application is a machine that could teach foreign languages.

Gazing further into the crystal ball, one sees such products as dictionaries

(Continued on p126)

Imagine a hand-held camera system that you can take anywhere, right into the thick of the action, and still achieve dolly-smooth results. That camera system exists today, and has already made a dramatic impact on some of America's latest feature films.

Steadicam: steady as she goes

by GREG SWAIN

Anyone who has watched television will be familiar with the problem. The action is moving down the street and the news cameraman must run to keep up with it. The result — a film sequence with a bad case of the jitters.

Ask a professional moviemaker what his main problems are and he will most likely point to the contraints imposed by tracks, dollies and heavy camera platforms. He can't always take the camera right into where the action is and still achieve jitter-free sequences — at least not for movies.

That's all about to change thanks to the development of a revolutionary new camera stabilisation system called "Steadicam". Already, the system has made a dramatic impact in numerous video and film productions, including such features as "Bound for Glory", "Marathon Man", "Rocky", "MacArthur", and "Equus". For the first time, professional cinematography is possible using a hand-held camera.

Steadicam (Universal Model) shown with 35mm "studio-silent" Arri 35BL.

What Steadicam effectively does is deliver dolly-smooth, jitter-free film (or videotape) sequences from a hand-held camera. At the same time, the system actually reduces production costs by releasing the moving camera from the constraints of dollies, tracks and heavy camera platforms.

Steadicam was invented by an American filmmaker named Garret Brown, who experimented with the system for several years before turning a rough prototype over to Cinema Products Corporation of California. Cinema Products refined and developed various versions of the new stabilising system, which it now manufactures and distributes.

The remarkable thing about Steadicam is that it is a passive stabilising system. Amazingly, there are no pneumatic or electrical servo systems. Steadicam is completely mechanical, and extremely reliable.

The trick employed here is to let the human body act as the servo-system. In fact, the human body is virtually a perfect servo-system if used properly. Think about it for a moment, and you will soon realise that when we run the scene before our eyes is quite steady! We can also run up and down stairs holding a cup of coffee without spilling a drop. And we can run and point steadily in a specific direction.

This then is the principle behind Steadicam.

By supporting the total weight of the camera system from a body brace, the camera can move with the operator as if it were an extension of his own body — part of his internal servo-system, so to speak. The operator can then easily control and guide the camera in any direction he chooses with a gentle movement of his hand.

In practice, the body brace is a padded harness-like jacket, designed to transfer and distribute the weight of the Steadicam system across the operator's shoulders, back and hips. The vest is fully adjustable to fit the individual camera operator!

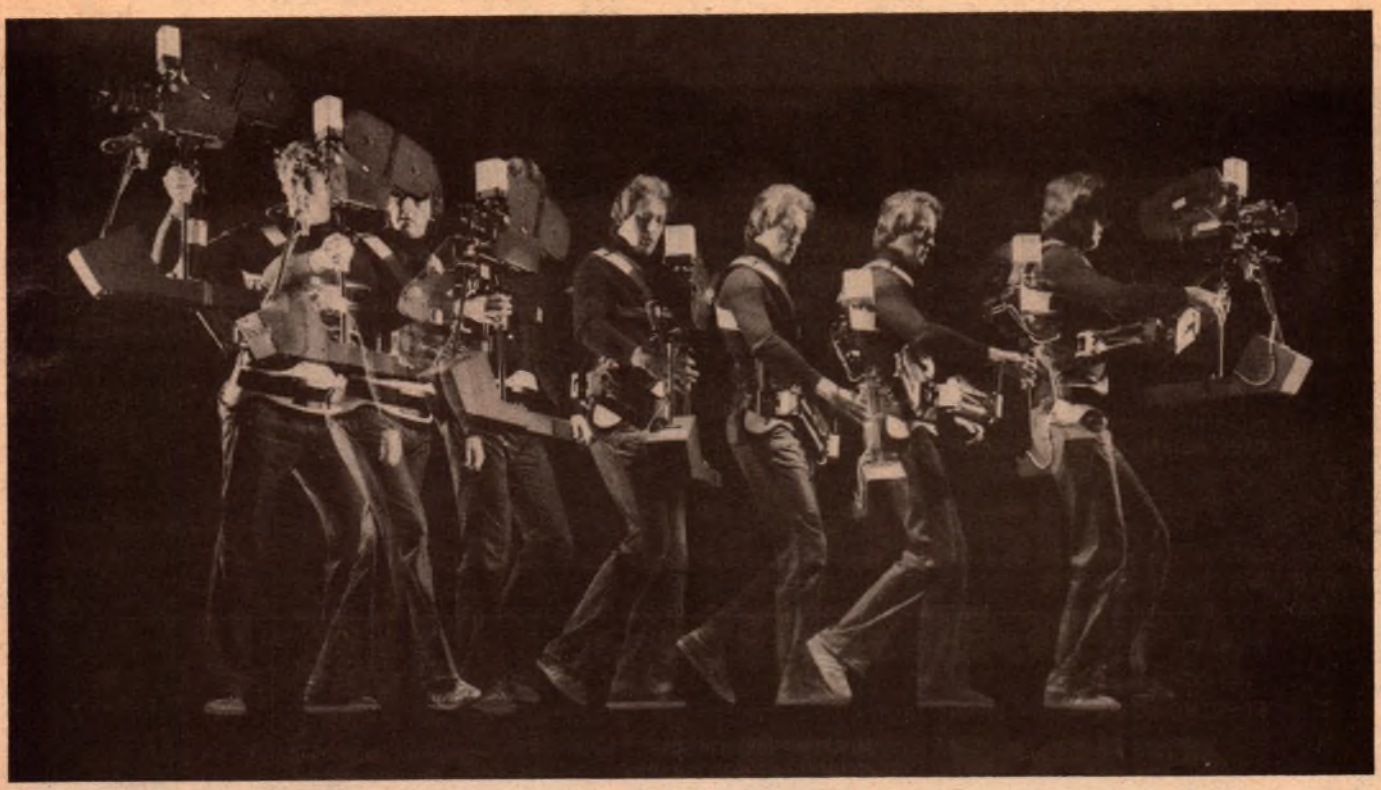
Attached to the breast-plate of the jacket is an exoskeletal-type articulated support arm which parallels the operator's arm in any position, and almost completely counteracts the weight of the camera system with a carefully calibrated spring force. A free-floating gimbal connects the stabilizer support arm to the camera mounting assembly.

The result of all this is an arrangement which, according to Cinema Products Corporation, leaves the camera as though it were free-floating in mid-air!

The flat sled-like lower portion of the camera mounting assembly contains all the electronics for the video viewfinder, and the battery pack for powering both the camera and the viewfinder system. Attached to the "sled" are two vertical members which support the camera mounting platform.

The total mechanism is such that the camera operator is able to pan or tilt the camera at will, or move it up or down or from side to side. He can, for example, boom up or down nearly one metre, he can pan a full 360° or tilt up or down 60° — all this while the camera operator is himself in motion, walking or running. He can even run forwards and shoot backwards!

By the very nature of the system, a remote viewfinder is necessary. If the cameraman were to put his eye to a conventional viewfinder, this would introduce unwanted mechanical coupling between his body and the camera,



Inventor Garrett Brown demonstrates the maneuverability of the Steadicam system.

and the basic concept of the system would be destroyed. In any case, the cameraman can hardly run up and down stairs, or otherwise move about, with his eye stuck to a viewfinder.

The viewfinder system developed consists of a remote high-resolution TV monitor employing a high-intensity kinescope. A special filter coated with multiple-layer anti-reflection coatings virtually eliminates reflections on the face of the tube from ambient light sources, including sunlight.

What are the main advantages of Steadicam?

That a great deal of track laying for dollies in location shooting can be eliminated is obvious. What is even more exciting is that Steadicam greatly enhances the creative latitude of the cinematographer.

Released from the constraints of dollies, tracks, and heavy camera platforms, both camera and operator are now free to go anywhere, recording new kinds of moving shots previously considered impossible!

The system permits the camera operator to run at top speed over rough terrain, or run up and down staircases while shooting, and still deliver smooth, jitter-free sequences. Indoor scenes, with their tight, confining movements, are made easy, and even crane shots can be easily simulated by means of a ramp or temporary stairs.

In "The Marathon Man" which starred Dustin Hoffman, for example, Steadicam was used to get some spectacular fast-action shots right in New York city. In that picture, Hoffman had to do a lot of fast movement through the streets of New York — and New Yorkers are not known for being very co-operative when someone is pointing a camera in their direction. With no crew around at all, Hoffman would take off down the street with the cameraman ahead of or behind him and, because the cameraman was not looking directly through the camera, people didn't know exactly where he was shooting!

For the Chartoff-Winkler feature production "Rocky", Steadicam was taken into the ring to film a visually stunning boxing sequence. Because his movements were unrestricted, the cameraman was able to move around the ring with the two boxers to achieve the best visual effects.

Garrett Brown, inventor of the system, has already demonstrated the uses to which Steadicam can be put in a helicopter. With appropriate wind screening, Brown was able to achieve better quality results than could be achieved with a conventional helicopter camera mount, because he had much greater flexibility and mobility inside the aircraft. A further advantage here is that vibrations from the aircraft are also filtered out.

"Virtually any vehicle can serve as a perfect camera platform," says Ed DiGiulio, President of Cinema Products Corporation. It is even "conceivable" that an experienced Steadicam operator may be able to gallop on horseback and still shoot extremely smooth and steady shots."

These features together make Steadicam ideal for taping or filming

The Steadicam system features a specially designed high-intensity monitor which permits viewing in all ambient light conditions.

motion picture features, documentaties, television specials and commercials, live concerts, on-the-spot interviews and theatrical and sports events. In fact, Steadicam could well find wide application throughout the television industry, particularly for outdoors news gathering.

Cameras presently available for use with the Steadicam system include Arri 35BL and CP-modified Arri IIC 35mm cameras; CP-16R reflex 16mm cameras; the TK-76 video camera; and the all-new MNC-71CP video camera.

Any Australian company wishing to find out more about Steadicam should contact Cinema Products' Australian agent: John Barry Group, 105 Reserve Road, Artarmon, NSW 2064.

Forum

Conducted by Neville Williams

Domestic video recorders — Has the industry blown it again?

Having, a few years back, thoroughly ruined their own market for 4-channel sound, one would have thought that leaders of the world electronics industry would have learned a once-and-for-all lesson. But no! It would seem that the same destructive forces are operating again on a grand scale — this time in relation to home video equipment.

For as long as I can remember, the electronics industry has been variously praised and cursed for its efforts — or lack of them — to rationalise electronic components and practices. There have been notable examples of cooperation and notable examples of insular pig-headedness!

One could write a book about valves alone: the many new series that were started and the noble, tongue-in-cheek sentiments that accompanied their birth; the stout but eroding efforts of the Radio Manufacturers Association of America to maintain a standard range; the curious British response of bringing out their own octal series with a base that didn't quite fit the American socket!

And so on . . . and so on . . .

But, while most people in the industry have been frustrated and annoyed at times by lack of standardisation, most of the situations we traditionally lament have been primarily internal industry problems. The public has been involved only indirectly in terms of reliability and service.

After all, if the man in the street buys a radio receiver or a record player, his prime requirement is met, if it tunes the stations he wants to hear, or plays his favourite records. He is not concerned that the designer may have agonised over the choice of valves or transistors or ICs, or of other components in the "works".

The quadraphonic situation referred to earlier was much more than an "in" problem for the industry; it concerned and involved the buying public directly, in that they were expected to decide between expensive but ostensibly incompatible items of equipment.

As you may recall, major companies, having committed themselves to a particular 4-channel system, proceeded to tout loudly for that system and to ridicule everyone else's. Customers were faced with a dilemma and the need for a decision that they were not qualified to make. After all, if Sony, Sansui, EMI, RCA and others all seemed to be saying different things, which one was a potential buyer supposed to believe?

The result was inevitable: the public was enticed, intrigued and confused, finally becoming thoroughly suspicious of the whole proposition. They ended up putting their money back into their pockets, leaving the contenders high and dry.

After all, music fans had their existing stereo systems, and plenty of records to go with them. Few had felt any special need to double the number of amplifiers and loudspeakers — that is, until the industry planted the idea in their minds. But, having done so, it then provided them with a ready excuse to defer their decision to buy — perhaps indefinitely.

Within little more than twelve months, manufacturers who had been so vocal about the merits of "discrete", QX, SQ, QS, RM and so on, had backed off and reverted to selling — or trying to sell — the straight stereo systems they had so recently talked down.

In retrospect, few in the industry questioned that confusion was a large factor in the public rejection of surround sound, and that there was a lesson to be learned from it.

But, looking at the current home video situation, I really doubt that industry leaders have learned a thing. They're doing it all again!

For many years, the public has been fed with the idea that, one of these days, we would all be able to make our own video tape recordings. We'd be able to see the shows we would otherwise have missed; we'd be able to build our own library of movies off-air; we'd have our own cameras and be able to record original material.

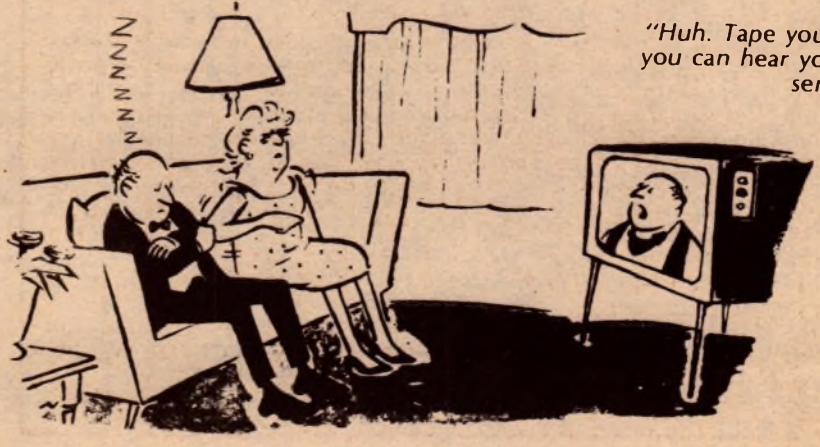
Personally, I've never been all that excited about the prospect of being able to do these things, as a purely personal domestic exercise. If one has a specific need for a video facility, that's fine; but why aspire to something that will simply put further pressure on our already overcrowded leisure time?

I suspect that many other people have been indifferent for the same reason!

Be that as it may, until recently, I/we have not had to worry all that much. The development of home video has lagged sufficiently for it to remain in the role of "the big thing for next year". Manufacturers, meanwhile, have been struggling to get the cost down and the performance up.

But "next year" is now with us and, on every quarter, we are being offered the equipment that really will do all the things that we're supposed to have dreamed about — and do them very well!

Whereas, a few years ago, prototype home video recorders provided an acceptable picture, considering . . . there is now no need for the qualification. The pictures available now give little hint as to whether they're coming



"Huh. Tape yourself so you can hear your own sermons!"

direct off air, or from the black box yonder.

Nor can it be said that the current price level is unreasonable. Having in mind the problems that have had to be solved and the amount of technology built into a modern home video recorder, a $1000 bench mark is about what one would expect, with the prospect of a gradual reduction as development costs are amortised.

Having thus said, one may not be too inclined to question publicity which would suggest that home video recorders are pouring, in an ever-mounting flood, out of electronic factories and into the homes of eager buyers. Japan and America lead the way, with Europe allegedly not all that far behind. In West Germany, Grundig has opened a factory with an output of 400-500 video recorders per day, all of them spoken for as they come off the lines. The plant is to be scaled to well over 1000 a day, but a new Philips factory in Vienna will reportedly top this again.

If that's happening overseas, then it must surely be mirrored in Australia — a country which made history by the speed with which it took up colour television.

In the face of such "bonanza" thinking, it was sobering to come across the leader in the January issue of the long-established British technical magazine "Television". It put the scene into an entirely different perspective.

The leader writer recalled the early and abortive attempts by big-name American companies to develop their own home video systems: holographic recording, EVR, cartravision and sundry disc formats. In the face of those failures there seemed to be a willingness to consult and commiserate, and to come up and with a common system that would be universally accepted.

But the talks led to nowhere in particular and, in the shake-out which ultimately followed, marketing forces aligned themselves behind two basic but non-compatible Japanese systems: Betamax fathered by Sony and VHS fathered by JVC. European-sourced recorders scarcely figured in the US, their manufacturers being presumably content to exploit markets nearer home.

But now the rub: according to "Television" magazine, the US market has settled down to about one sixth of what the optimists had predicted; a useful, supportive market but not the expected money-spinner.

As such, there is no way that the demand can match the huge potential of the Japanese-dominated consumer electronics industry, and take up the slack left in the wake of colour television or, before that, hifi, tape recorders and radios.

To make good the shortfall, Japanese manufacturers moved quickly into the European market with PAL versions of their respective recorders, thereby multiplying the choice of systems already offered in Europe by firms like Philips and Grundig.

Despite the professed optimism of the last-named companies, "Television" sees no reason to believe that the European market will be any more responsive than the US market. In fact, it may turn out to be less so, with European buyers having to cope with a wider range of highly touted and non-compatible options.

To quote from the editorial:

"... but all that advertising in the national press and on TV, what exactly

Deafness: seek specialist advice first

Dear Sir,

"Electronics Australia" has contained interesting material, recently, on the subject of hearing aids. For 55 years I have suffered a very common hearing problem (stapes immobilisation) and have worn a hearing aid for 30 years.

Your material and that of H.C. (Footscray, Vic) seem to suggest that anyone with a hearing problem should consult a hearing aid specialist, I believe this should be the last step, not the first.

I believe that a hearing aid should be called a "noise generator" but, in some respects, it is more like a drug with side effects

The side effect is that, as soon as a hearing aid is used, it will slowly damage the hearing nerve by unavoidable high noise levels, and so jepoardise possible future medical procedures. I agree that, without a hearing aid, there is the problem of low sound level but this may be the preferable alternative if the intervening time is spent having the problem investigated thoroughly.

With a hearing aid, if you miss a word, or have tinnitis, or if your high frequency response is poor, you will try to compensate by turning up the volume, and cause overload. H.C. specifically states that tinnitis is very loud at times and he increases the level above this.

I also disagree with his method of using the hearing aid for 16 hours a day. I would use it only as required and wear out the on-off switch, rather than the hearing nerve!

I would advise anyone aged 10 to 50 years, with a hearing problem, to consult an ear specialist with a view to possible medical/surgical treatment, and leave electronic aids until later, as appropriate.

A.F. (Pennant Hiils, NSW).

FORUM — continued

is it after? A market that can't possibly be large enough now or in the forseeable future to support the systems on offer — all four of them, Philips, the Sony Betamax, VHS and Grundig's SV system."

Again:

"The video world must stand accused of a massive bungle — for which it is likely to pay dearly."

Would-be Australian buyers are faced with the same multiple choice.

As yet, advertising and publicity does not seem to have evoked an urgent "I must have one" response from many people in the Australian community. They're rather off-handed about television, anyway, and open to any excuse not to outlay another $1000-odd.

And what better argument than an uncertainty about systems.

As I remarked at the outset, the whole thing looks alarmingly like a replay of the 4-channel situation, on a grander scale, with a large segment of the buying public retreating from a decision that should have been taken at an industry level.

And it's a continuing saga. While still one of the contenders in the current struggle with their N-1500 through N-1700 series, Philips are reportedly readying an entirely new VCR design for unveiling at the Berlin Radio Show. Designated at present as the V-2000, it is said to use an oversize version of the audio compact cassette, offering just over four hours of recording and replay on a ½-inch tape. But, at the end of that time, you flip it over and have access to another four hours!

Many people will see that as an even better reason to pass up what is currently on offer. Maybe it's the very reaction that Philips are counting on!

Competition is undoubtedly an important and integral part of our free enterprise system and it is inevitable that major industry groups will find themselves working simultaneously towards certain technological and marketing goals. The rewards can be considerable for the company that gains a breakthrough ahead of its rivals and an effort to that end is understandable.

But there is something intrinsically ludicrous about a degree of single-mindedness that produces a whole array of end products that could and should be compatible, but aren't. They fragment the market,confuse would-be buyers and contribute to a situation in which everyone is disadvantaged.

Undoubtedly, Australians will buy a lot of video tape recorders during 1979 and have a lot of fun with them. What I am saying is that they would have bought a lot more VCRs—and had a lot more fun — if there had been just one basic format and standard cassettes to match, with the unlimited option to buy and lend and swap at will.

It may be already too late to lament the VCR situation but, somewhere out ahead, is a new and revolutionary product: the high resolution disc which can carry TV-style signals or wide-range multi-track sound.

Right now is the time for major international combines to sink differences, merge technologies, and trade patents. Otherwise, there'll be yet another battle for supremacy fought out in the marketplace.

ADDRESSES: Australian Deafness Council

Dear Mr Williams,

I have had my attention drawn to your January edition in which "H.C." outlines in his letter the help he has received from his hearing aids. The Australian Deafness Council was formed in 1974 and there are Councils in each mainland State. To provide a complete list of the various organisations would take up too much room in your columns, so I am listing hereunder the name and address of the Hon. Secretary of the Australian Association for Better Hearing in each capital city. The Association is a voluntary organisation which is active in helping people who have a hearing impairment.

Qld: Mrs R. Collier, 127 Eagle Street, Brisbane, Telephone: 221 8597.

NSW: Mrs B. Brooks, 1st Floor, RAN House, Grosvenor Street, Sydney. Telephone: 525 5554.

Vic: Mrs E. Bing, 28 High Street, Windsor. Telephone: 51 3499.

Tas: Mrs B. Burgess, 58 Melville Street, Hobart. Telephone: 43 9318.

SA: Miss L. McKay, 139 Franklin Street, Adelaide. Telephone: 51 2996.

WA: Mr J. Gourdis, 141 Newcastle Street, Perth. Telephone: 328 4832.

"H.C." mentions "Tinnitus" (head noises) and his amazement that so many people suffer from it. This Council has been partly responsible for a special Clinic being set up at the Royal Victorian Eye and Ear Hospital, East Melbourne, and Dr Quentin Bailey has recently carried out a survey of approximately 2000 people who suffer from Tinnitus.

H.F. Powell (Hon. Sec.)
Australian Deafness Council,
597 St. Kilda Rd, Melbourne 3004.
Phone (03) 51 9961

WE'LL GET YOU INTO ELECTRONICS. ONE WAY OR ANOTHER.

At International Correspondence Schools, we have at least 15 career courses you can take in electronics and other inter-related fields, like computers and television. These are the fields of the future that you *should* progress in now. And they are all ideally suited to home study. And ICS, being the largest institution of its kind in the world, has access to the latest world-wide developments and among the best teachers Australia has to offer. So, if you're interested in one or more of the courses below, mail the coupon to ICS, and we'll send back everything you need to begin a more successful career.

1 Basic Electronics course for a sound knowledge of radio theory and the industrial applications of electronics.

2 Electronic Technician course, with specialist courses in Audio, Radio, Hi-Fi; Communications/Broadcasting; Electronic Computer Servicing; Industrial Electronics.

3 Electronic Instrumentation and Control Systems course for electronics technicians interested in industrial instrumentation and control.

4 Electronic Technology, a program that will fit the ambitious technician for wide variety of jobs.

5 Electronics Maintenance for basic principles and electronic theory, followed by a practical section of maintenance procedures and techniques.

6 Radio Electronic Telemetry covers electrical and electronic aspects of telemetering. Employment opportunities abound in this very modern field.

7 Amateur Radio Operator's Certificate of Proficiency prepares you for the examination leading to the Certificate of Proficiency issued by the Postal and Telecommunications Department.

8 Data Processing, various courses including Electronic Computer Servicing.

9 TV Servicing courses, in black and white, and PAL colour.

10 TV Principles course for basic television technology. And TV engineering course for complete practical coverage of television engineering.

11 Basic Electrical Engineering is especially for those who want to make a start in the industry or want a broad technical knowledge.

12 Electrical and Electronic Drafting is designed for experienced draftsmen wishing to enter this specialised field.

13 Automobile Electrician gives you the basics of servicing the automobile's electrical system.

14 Industrial Electrician course gives comprehensive training on all aspects of the electrician's work.

15 Electrical Mechanic course prepares you for external examinations.

Please send me, without cost or obligation, information about the ICS courses in Electronics.

Mr/Ms .....

Address .....

Postcode ..... Occupation ..... Age ..... Tick here if currently full time student ☐

Write to your nearest ICS city:

ICS

International Correspondence Schools
Sydney: 400 Pacific Highway, Crows Nest, N.S.W. 2065. Tel.: (02) 43 2121.
Melbourne: 18-20 Collins Street, Melbourne, Vic. 3000. Tel.: (03) 63 7327.
Perth: G.P.O. Box D157, Perth, W.A. 6001. Tel.: (09) 32 1850.
New Zealand: 182 Wakefield Street, Wellington.

224010C Bankcard

ICS1700EA

MIDLAND IS QUALITY CB

But don't take our word for it..

"Comparisons on-air with our regular rig brought comments like: 'B . . . . . great', 'It's the better by far'; 'Fabulous rig.' We feel that these comments are accurate and we had no option but to rate this rig as excellent for both transmit and receive."

"Generally, the rig behaved so well on air that we were left a little flabbergasted. We had become a little sceptical of AM rigs of late, but the **MIDLAND 886** certainly changed that."

Other specifications were also quite good and the excellent noise suppression highlighted the attention to detail that has made **MIDLAND** a well respected name in CB."

CB ACTION No. 22 Page 30.

D-1438

WAS $249.50 -

MIDLAND 76A-886 **NOW $199.50**

★★★★★★★★★★★★★★★★★★★★★★★★★★★★

WHAT'S NEW?

★★★★★★★★★★★★★★★★★★★★★★★★★★★★

REAR WINDOW WIPER

This is the NEW Dick Smith Wiper Kit - for the average car handyman this unit is easy to install. Has spacers to allow for different types of cars and comes complete with full scale permanent pattern and all instructions. 12V DC operation. Has automatic stop. Also ideal for marine uses.

$39.95

Comes complete with switches, wiring etc.

A-8505

★★★★★★★★★★★★★★★★★★★★★★★★★★★★

PROJECT CASE

Great for mounting switches, pilot lights, displays etc in your car. Complete with brackets, fixing screws, 88 x 70 x 34mm

H-2500

$1.50

KIT BUILDERS & HOBBYISTS

Ask for our FREE 16 page colour kit catalogue next time you're in a Dick Smith Store - or drop us a line and we'll send you one.

SOMETHING TO BUILD

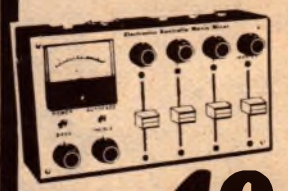
LED LEVEL METER

Easy to build, just as easy to add on to your amplifier for a striking visual display of relative power output. Get two — one for each channel!

K-3370 **$13.50**

MOVIE MIXER

All the features you'd ever want to add pro sound to your movies. Auto fade, tone controls too. Also ideal as a conventional audio mixer.



K-3492 **$49.50**

ARE YOU GAME?

X-1200

Be the first on your street to own a home computer that enables you to use your own colour TV to play dozens of educational and exciting games. Play educational games (children can improve their maths), exciting games like Blackjack, Spitfire, Dragrace and many more. **17 game cartridges to choose from at $24.50 each. Easy terms available to approved applicants. $29.00 deposit — $2.90 per week.**

$259.00

BEST VALUE IN A HOME COMPUTER

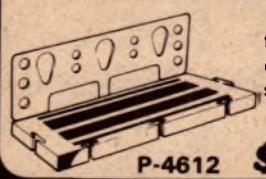
You've seen the rest, now here's the best. The Sorcerer 8k (basic) or 16k ($1,250). Space doesn't allow us to give full details. . . call into a Dick Smith store for a demonstration. You'll agree it was worth the wait!

$995.00 X-1190

MONITOR X-1196

Add this video monitor to your home computer. Yes, works with the Sorcerer, Tandy's TRS-80 (Save a bundle buying our monitor!) Exclusive to Dick! **$149.50**

DESIGNING CIRCUITS?



Here's the handiest breadboard you'll ever find. Components plug into positive connections, major components such as pots, switches, etc mount on a front panel. Get rid of birds nests and costly mistakes.

P-4612 **$22.50**

HERE IT COMES!

DICK'S NEW JUMBO CATALOGUE IS IN THE APRIL ISSUE OF ELECTRONICS AUSTRALIA — FREE

NOVELTY RADIOS

Just the gift for someone special! Or leave it around — you're sure to have a great conversation piece! Twist to change stations - or adjust the volume by the knob. A real laugh!

215mm long

A-4305 **$9.95**

Know any male chauvinist pigs? Give him a MCP radio. Twist the tail for volume, tuning on his back. Earphones supplied.

$9.50 A-4310

FREE POWER!

Yes, it operates on solar power! Plus in-built batteries for night operation. Watch has LCD (Liquid Crystal Display) with 5 functions - hours, minutes, seconds, day and AM/PM. Complete with band, makes an ideal gift - or buy one for yourself.

X-1040 **$39.50**

NEW RESISTOR PACK

FANTASTIC BARGAIN Guaranteed over 200 resistors, all preferred values within range 1 ohm - 10 Megs, ¼ watt - all brand new and fully guaranteed. **Hurry! Limited Quantity.**

$3.00

R-7015

QUICK! VERY FEW LEFT

We thought we'd run out – but found a few more. Very few! Don't miss out. 1.2V, 900mAH - less than half the normal price.

S-3302 **$1.75**

VISITING THE EAST?

Dick's new Hong Kong store is NOW OPEN!

DUTY FREE PRICES — PLUS AUSTRALIAN GUARANTEE'S

Shop in confidence at Dick Smith Hong Kong!

WATCH THIS SPACE

AND FIND OUT WHAT YOU MISSED

Each month all of our stores feature an outstanding special which is actually BELOW COST! N.B. Specials are strictly while store stocks last. Don't miss out!

LAST MONTH:

FREEZE IT - REFRIGERANT FOR $1.17 - NORMALLY $3.00

SAVING $1.83

STACK 'EM NEAT

You know how much magazines cost these days. Protect your valuable investment with our deluxe vinyl binders. Hold up to 12 issues each, takes most standard size magazines. (Even PLAYBOY!)

$4.50

B-4045

PARTS FOR NEW KITS

6 DIGIT CLOCK (See Feb. EA)	
Complete kit, including instructions	Cat. K-3495 $19.75
Case with mounting bracket and bezel	Cat. H-3194 $3.60
AC Mains adaptor	Cat. M-9514 $5.95
PLAYMASTER AM/FM TUNER (See Nov/Dec EA)	
Complete kit, including instructions	Cat. K-3494 $158.50
SEPARATE PARTS	
Pre-wired and aligned tuner module	Cat. F-4610 $59.00
Set of 4 PC boards	Cat. H-8357 $9.75
Signal strength meter	Cat. Q-2100 $4.95
Tuning meter - centre zero	Cat. Q-2095 $4.95
Most other electronic parts for this project in stock.	
MODEL TRAIN CONTROLLER (See Oct EA)	
Not produced as a kit - all parts available from stock:	
PCB only	Cat. H-8355 $3.75
Zippy box	Cat. H-2752 $3.75
2N3055 transistor	Cat. Z-2145 $0.95
2N3053 transistor	Cat. Z-2130 $0.80
FET INPUT AC-DC VOLTMETER (See Sept EA)	
Not produced as a kit - all parts available from stock:	
PC board only	Cat. H-8353 $2.75
1mA MRA-65B panel meter	Cat. Q-2060 $12.50
Fabricate your own meter scale using the Scotchcal process:	
8005 black Scotchcal photo-sensitive aluminium	Cat. H-5894 $6.00
CA-3140 FET op-amp	Cat. Z-5417 $2.50
VARI WIPER Mk 2 (See Sept EA)	
Not produced as a kit - most parts available from stock	
Relay	Cat. S-7125 $4.80
C106Y1 SCR	Cat. Z-4315 $1.00
2N2646 (DS2646) unijunction	Cat. Z-1786 $1.20
UPGRADED 40/200MHz FREQ. COUNTER (See Aug EA)	
Same style as previous kit, but new circuitry means it is easier to build, set up and is more sensitive. Basic counter is 40MHz - by adding a single 95H90 IC the range is extended to 200MHz.	
Complete kit for 40MHz, inc. instructions	Cat. K-3437 $99.50
95H90 IC to extend range to 200MHz	Cat. Z-5360 $12.50
SEPARATE PARTS:	
PC boards (set of two high quality boards)	Cat. H-8346 $8.50
MC10116 IC (triple differential amplifier)	Cat. Z-5415 $1.95
MM-5369M IC (oscillator - divider)	Cat. Z-5781 $2.50
74C928 IC (4 digit counter)	Cat. Z-5414 $6.50
3.579545MHz crystal (new low price)	Cat. K-6031 $3.00
LT-303 7 segment display	Cat. Z-4103 $1.50
All other components are normal stock lines at all of our stores.	
PHOTO TACHOMETER (See Aug EA)	
Although we do not produce a full kit for this project, all parts are normal stock lines at all of our stores	
PCB (only)	Cat. H-8352 $1.80
FPT 100 phototransistor	Cat. Z-1950 $2.00
NEW 10 GAME TV GAME KIT (See July EA)	
Complete kit, including instructions	Cat. K-3491 $49.50
SEPARATE PARTS:	
PCB (only)	Cat. H-8344 $3.95
Fully built RF modulator	Cat. K-6040 $3.00
Fully built audio modulator	Cat. K-6042 $4.50
AY-3-8600 IC	Cat. Z-6852 $15.00

Many other PC boards for current magazine projects in stock.

PLEASE NOTE:

Because of supply problems with the IC in the TANK GAME kit, we have had to discontinue this kit from our range.

DICK SMITH ELECTRONICS

bankcard welcome here

SHOPS OPEN 9AM to 5.30PM Saturday 9AM – 12 noon BRISBANE 9.12 Noon

ANY TERMS OFFERED ARE TO APPROVED APPLICANTS ONLY

Many items available from the Dick Smith Electronics Centre at

GRACE BROS

Broadway, Bridge, Chatswood, Liverpool, Miranda, Mt. Druitt, Parramatta, Hurstville and Gosford Mall.

SYDNEY	125 York Street, SYDNEY	Ph 290 3377
	147 Hume Hwy, CHULLORA	Ph 642 8922
	162 Pacific Hwy, GORE HILL	Ph 439 5311
	30 Grose Street, PARRAMATTA	Ph 683 1133
MELBOURNE	399 Lonsdale Street, MELBOURNE	Ph 67 9834
	656 Bridge Road, RICHMOND	Ph 42 1614
BRISBANE	166 Logan Road, BURANDA	Ph 391 6233
ADELAIDE	203 Wright Street, ADELAIDE	Ph 212 1962

MAIL ORDERS P.O. Box 747, Crows Nest, N.S.W. 2065 Post and packing extra Dealers across Australia

MAJOR DICK SMITH DEALERS Listed below are the names and addresses of dealers who stock a large range of our products however we cannot guarantee that the dealers listed will have all items in stock and at the prices advertised

Brian Bambach Electronics	68 William St, Gosford NSW Ph 24 7246
Sound Components	78 Brisbane St, Tamworth NSW Ph 66 1363
Elektron 2000	44 Brown Road, Newcastle NSW Ph 691 222
GM Electronics	99 Fitzmaurice St, Wagga NSW Ph 21 3044
Trilogy Elec. Supplies	40 Princes Hwy, Fairy Meadow NSW Ph 83 1219
Crystal TV Rentals Pty Ltd	66 Crystal St, Broken Hill NSW Ph 6897
Lismore Kitronics	Magellan St & Bruxner Hwy, Lismore NSW Ph 878 361
Langman's Sound Centre	Shop 15, Treasure Island, Coffs Harbour Jetty NSW Ph 521 570
Sumner Electronics	95 Mitchell Street, Bendigo VIC Ph 43 1977
Citcom Electronics	Hopkins Arcade, West St, Mt Isa QLD Ph 43 791
ADS Electronics	312 Oxley Ave, Margate QLD Ph 204 1276
Advanced Electronics	5a The Quadrant, Launceston TAS Ph 31 2075
Aero Electronics	123a Bathurst St, Hobart TAS Ph 34 8232
Hutchesson's Comm. Centre	5 Elizabeth St, Mt Gambier SA Ph 256 404
Gawler CB Centre	51 Hillier Road, Evanston SA Ph 222 149
Altronics	105 Stirling St, Perth WA Ph 328 1599
Hocks TV Rentals	87 Hannan St, Kalgoorlie WA Ph 21 1906

NOTE: Prices & stock availability could change between publication deadline & on-sale date due to circumstances beyond our control. Please check with our stores for latest availability & prices.

PROFESSIONAL

WUHY-FM, Philadelphia, rates Stanton's 881S superior in every aspect!

Disc Jockey, Stephen Brooks at the mike.

Scanning Electron Beam Microscope photo of Stereohedron® stylus, 2000 times magnification; brackets point out wider contact area.

The Stanton 881S cartridge has been rated, worldwide, as the outstanding stereo cartridge of its time. So, it ought to be a rather delicate pick-up. Not so, says WUHY . . . outstanding National Public Radio FM Station which says:

1) The 881S is rugged . . . we back cue with no damage to the stylus.
2) It has excellent flat frequency response.
3) It handles high level complex music passages with complete freedom from mis-tracking.
4) The 881S has the highest output compared to average high quality magnetic cartridges, plus it gives superior signal-to-noise ratio from the phono preamp.

We are in total agreement with all of the above except, honestly, the 881S was not designed for back cueing.

Stanton guarantees each 881S to meet its specifications within exacting limits. Whether your usage involves recording, broadcasting or home entertainment, your choice should be the choice of the professionals . . . the Stanton 881S.

STANTON!

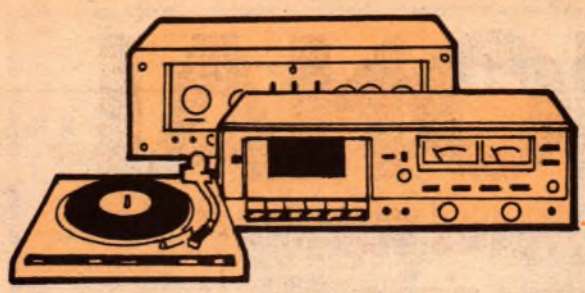
And remember, you can't get the best out of your Stanton Cartridge unless you use a genuine Stanton Stylus.

Sole Australian Distributors

LEROYA INDUSTRIES PTY LTD

W.A. Head Office: 156 Railway Pde., Leederville 6007. Phone 381 2930.
N.S.W. Office: 7 Jordan Rd., Wahroongah 2076. Phone 487 2543.

LER 212



Hi Fi Topics

TEAC/TASCAM LAYS STRONG EMPHASIS ON MULTI-TRACK RECORDING

With the doors closed, it's just another big Dodge van somewhere in Canada. But open the doors and you're looking right into a compact and heavily soundproofed mobile recording facility, capable of producing a complete, high quality multi-track master tape. In a special way, it dramatises TEAC's interest in the professional field.

by NEVILLE WILLIAMS

The project had its beginning when the Tascam Sales Division of White Electronic Development Corporation Ltd of Canada faced the need for a facility which would allow its staff to gain hands-on experience with professional level TEAC and TASCAM multi-track recording equipment.

It was one thing to have a drawer full of brochures and specifications. It was quite another to co-operate in a meaningful way with prospective professional customers. "You can't show what you don't know," they reasoned.

Accordingly, White Electronic Development sought suitable space in their existing Head Office facility and, in due course, set aside funds to cover the conversion of a warehouse area into a recording studio of the conventional kind.

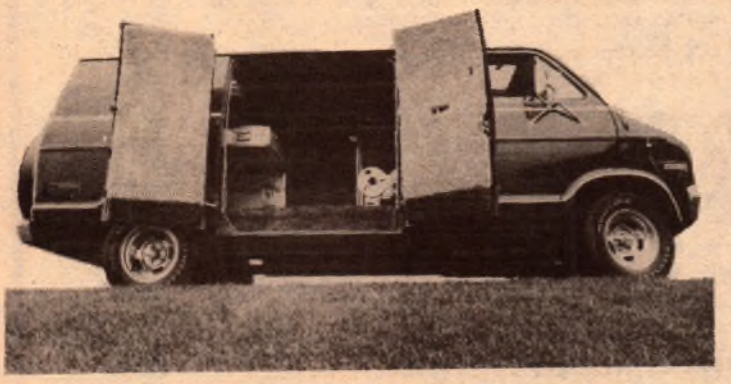
However, before work actually had begun on the scheme, its inadequacies for the Company's requirements had become evident. Artists and sales-technical personnel would have to be transported to a fixed studio and the situation that resulted would not have been the best for training purposes. It would be better to take the training facility to where the personnel were and to use it to record actual musical events in the local area.

Accordingly, Van Masters Inc of Mississauga was commissioned to fit out a Dodge van as a mobile recording facility, working to specifications supplied by White Electronic. Generous sound insulation involved fixing a 2-inch layer of fibreglass to the ceiling and a 4-inch layer to the walls, with an inner floor made up of ½-inch particle board covered with 2 inches of dense polyfoam. All this was surfaced, in turn, with naugahyde and velvet on the ceiling, and high quality nylon shag carpet on walls and floor.

As part of the exercise, equipment mounts were fixed in the required positions and interconnecting cables run behind the insulation. As well, adjustable overhead aircraft style lights were installed, to provide illumination where it was needed.

As shown in the photographs, an operator's console occupies the centre of the floor space just inside the doors.

Looking from the driver's end bulkhead, the Tascam/TEAC van would be sufficient to make any aspiring on-location recordist drool in envy!



Outwardly, a conservative, black painted Dodge van, it is fitted out inside with thousands of dollars worth of professional quality Tascam/TEAC recording equipment. A special multi-way cable enables it to operate up to 250ft from the actual performance.

Ten Reasons Why Memorex Cassettes Are Superior . . .

1 Welded cassette halves add strength and dimensional stability compared to screw-joined cassettes.

2 The special Memorex wafer resists static electricity and reduces friction.

3 Memorex cassette halves are constructed of high impact, heat resistant polyestyrene plastic which will not warp in temperatures up to 56°C. (132°F.).

4 Precise molding of the hub provides a true circumference in the tape pack. There is no bump to cause wow or flutter.

5 The memorex large window (an exclusive Memorex feature) makes it easier to determine position and when it's time to change sides.

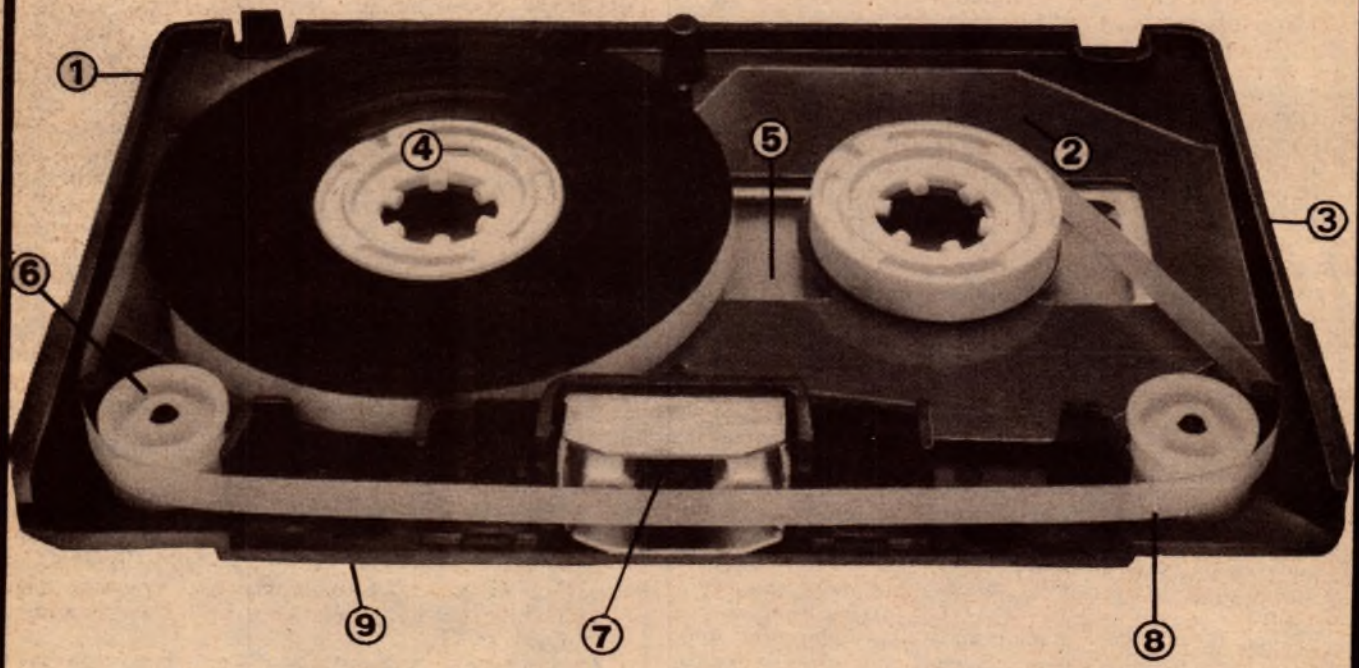
6 Large flanged rollers add extra surface contact for guiding tape. This minimizes jamming, tape wow and flutter during play, record and rewind.

7 An extra-large pressure pad provides optimum tape-to-head contact and lasts longer than smaller pads.

8 No stationary cassette parts come in contact with the tape oxide during recording or rewind. This prevents oxide damage from abrasion.

9 There is no seam along the tape path in the front, as in other cassettes. This minimizes the possibility of tape oxide wear and prevents the tape from slipping out of the cassette or snagging.

10 Each Memorex cassette comes with a written warranty. If you find a Memorex cassette defective in materials or workmanship, return the cassette prepaid to Memorex and it will be replaced without charge.



MEMOREX NEW MRX3

AVAILABLE IN C45 C60 C90 AND THE NEW C120 SIZES

Sole Australian Distributor for Audio-Technica Products

MAURICE CHAPMAN AUSTRALIA PTY LTD

44 Dickson Avenue,
Artarmon, NSW 2064
Phone: 438-3111

150 Burwood Road,
Hawthorn, VIC. 3122
Phone: 818-1730

29 Kooringal Drive,
Jindalee, QLD 4074
Phone: 376-3931

BURMAC ENTERPRISES PTY LTD

114 Railway Pde, West Perth, W.A. 6005. Phone: 3218-346

VISUAL DISPLAY SYSTEM FROM CHROMATEC VIDEO

A novel and effective video display system currently being manufactured in Australia solves, for the recording engineer, the impossible problem of having to watch simultaneously a couple of dozen VU meters. The system would appear to have other important potential applications outside the audio field.

In fact, the Chromatec display was referred to on page 33 of our November issue, in connection with the new sound studios currently being commissioned by EMI. On the cover of the same issue, it was visible in two of the pictures, at one end of the main mix-down console.

The particular unit is one of a range which the manufacturers describe as "Multichannel Peak Program Meters and Real Time Spectrum Analysers". They are finding ready application in the local recording industry but, because they are performance and price-competitive, they may well attract overseas buyers, especially from the UK.

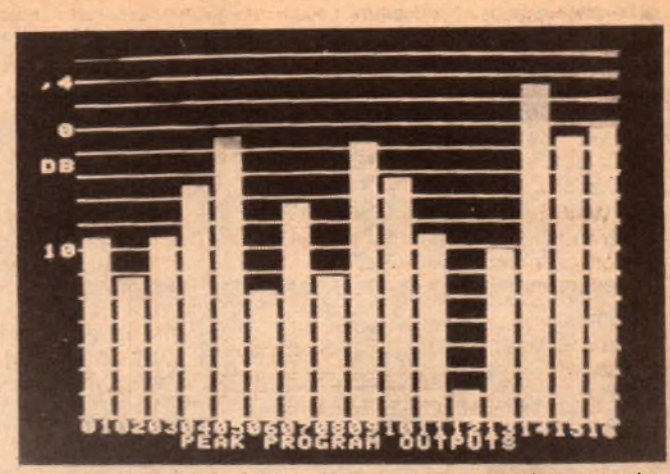
Chromatec's concept is to generate a series of vertical bars, with appropriate colouring, on the screen of a colour TV monitor. The height of each bar is made to vary in proportion to the input signal it is intended to display. The bars can be made to change colour at particular levels corresponding, for example, to permissible amplitude limits.

For audio applications, the relationship is normally made logarithmic to achieve a linear decibel display. Up to 32 channels can be presented simultaneously, allowing the operator to see immediately whether overload is occurring in any channel of even a very large mixing console. Such a display is pictured, albeit in monochrome, with one channel clearly peaking to +3dB.

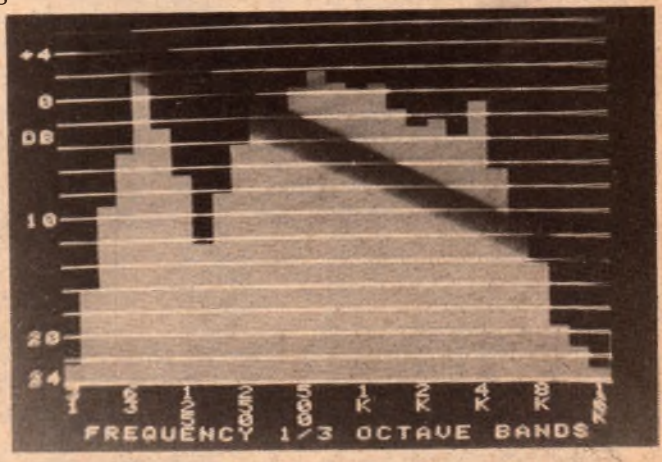
The horizontal white lines across the display, and the alphanumeric characters are generated electronically, indicating the dB levels and the number of the channels being observed.

A further function, which can be supplied as a separate "dedicated" instrument, or in combination with the peak program metering, is that of a real time spectrum analyser. The spectral content of an audio signal, over the range 31Hz to 16kHz is displayed in the form of a bar graph on the basis of third-octave break-up. In the combined instrument, changeover of the display and associated alphanumeric characters involves only the flick of a single switch.

So equipped, a recording engineer can very quickly observe, not only the channel(s) on which overload is occurring, but the band of frequencies most likely to be causing the problem.



A display of 16 channels in peak program mode. Note that channel 14 is showing +3dB. The slight change in density above 0dB is where the display changes spontaneously from green to red.



The spectral display, showing peaks around 80-90Hz, 600-700Hz and 4kHz. The oblique shadow is an accidental strobing effect between the TV display and the camera shutter.

Outside the audio field, the manufacturers see a likely application in hospitals for multiple pulse rate monitoring. In industrial situations, they could be used for multi-channel monitoring of temperature, mixture, pressure, flow rate, etc — in fact, in any situation where one operator might otherwise be required to keep an eye on a whole array of conventional meters.

For further information: Chromatec Video Products Pty Ltd, 3 Withers Ave, Mulgrave, Vic 3170. In the UK: World Procurement Service, 10 Barley Mow Passage, Chiswick, London W4 4PH.

TEAC MULTI-TRACK RECORDING — continued

This is one of the Tascam series by TEAC, model 5. It is basically an 8-in 4-out console but, with a model 5EX expander board will handle 20 inputs and 4 outputs, with talk-back facilities.

In the normal way, this feeds a Tascam/TEAC series 80-8 8-channel recorder, with the option of invoking a Tascam/TEAC DX-8 8-channel dbx noise reduction unit.

But that is only the beginning. Other on-board equipment includes a Tascam/TEAC 25-2 stereo recorder with in-built dbx, and either ¼-track or ½-track facility. There is a model 1 audio mixer, three PB-64 patch bays, and an MB-20 meter bridge for extra metering facilities. All these are Tascam by TEAC.

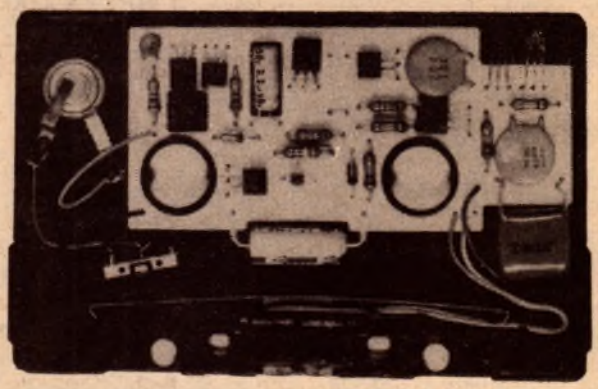
Two other dbx units permit processing of individual channels, or processing of stereo signal pairs. Power amplifiers, graphic equalisers and peak level indicators are by Luxman, as also is the amplifier for the headphone/cue system. Monitor loudspeakers are by Visionik-Dahl and the operator's headphones are KOSS Pro 4 AA. More than a dozen microphones by Sennheiser round off the list.

Most of this equipment is mounted in standard equipment racks, each 42 inches high and positioned respectively towards the front and back of the vehicle.

Last but not least is the "snake" — an apt name for the custom-built 250-feet cable which allows the van to operate at up to that distance from the event which it is recording. It contains 16 balanced circuits for inputs (to the van) and three balanced return output circuits.

While the mobile unit will have an obvious place at trade shows and exhibitions, for most of the time it is planned simply to take to the road, bringing a training situation to those who need it around the country. In so

TDK's Revolutionary New Product — The HD-01 Head Demagnetizer Built into a Cassette Shell.

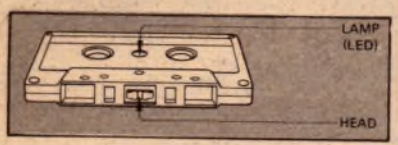


Simply load the HD-01 into any cassette recorder as you would a standard audio cassette and depress the 'play' button.

The HD-01 Head Demagnetizer was designed by TDK for easy, convenient head demagnetization of any cassette deck, insuring crystal-clear, perfect recordings every time.

The TDK HD-01 Head Demagnetizer features:

- A unique cassette format, designed to insure complete compatibility with any cassette deck.
- Powerful de-gaussing circuit instantly demagnetizes recorder heads the moment the play button is depressed. The above diagram depicts the oscillating waveform applied to the recorder heads, removing every trace of residual magnetism in only one second!
- A red LED (Light Emitting Diode) built into the HD-01 cassette shell will light up the moment your recorder heads have been completely demagnetized.



The TDK HD-01 Head Demagnetizer ends forever the fuss and mystique surrounding the demagnetization process and is much easier to use than conventional wand-type tools. Anyone can use the HD-01 and get perfect results every time.

The TDK HD-01 Head Demagnetizer is completely self-contained, battery operated and portable. It can be taken anywhere and stored with your present audio cassettes. The TDK HD-01 is ideal for all types of cassette decks especially those with heads located in hard to get at places such as:

- recorders with heads positioned in the front of the unit but which point to the rear.
- those with 'pop up' loading mechanisms which can not be detached, thus making the heads almost inaccessible.
- cassette decks with heads positioned laterally with respect to cassette loading (car decks are good example of this type).
- automatic loading machines.

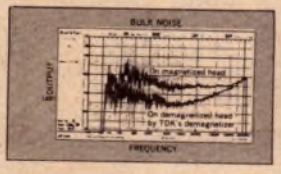
WHY IS DEMAGNETIZING SO IMPORTANT?

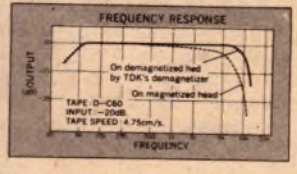
TDK, in conjunction with many cassette deck manufacturers, recommend that cassette decks be maintained on a regular basis. Cleaning the heads, capstan and pinch rollers is one important aspect of that maintenance program. — Periodic demagnetizing, about every thirty hours of use, is the other. Failure to do so will cause a build-up residual magnetism on the heads, which can seriously affect tape and machine performance in the following critical areas:

1. The noise level in the low and midrange frequencies is increased by 5 to 7dB, thereby reducing the overall signal-to-noise ratio.
2. Pre-recorded tapes can also be affected with midrange and high frequency distortion, as well as attenuation by as much as 2 to 6 dB, virtually eliminating any hopes for clear sound reproduction.

The interaction of these factors will not only prevent both the tape deck and tape from displaying their true performance capabilities, but will severely limit the Dynamic Range properties of both, rendering pure sound reproduction an impossibility.

The following comparison data clearly demonstrates the effect of residual magnetism on recorder heads in the areas of both Noise Level and Frequency Response.





TECHNICAL DATA

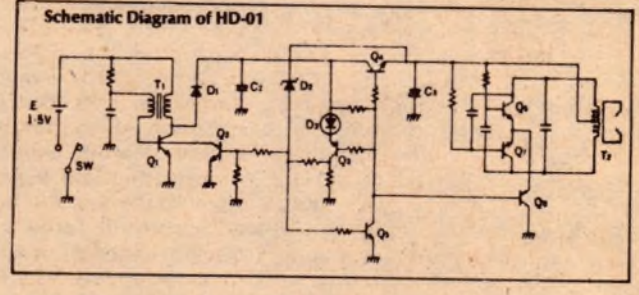
Major Components:
Transistors (8)
Diodes (2)
LED (Light Emitting Diode)

Power Supply – Control Section – Oscillation Section – Head Section

Specifications:

Maximum Magnetic Flux Density	200 Gauss
Oscillation Frequency	630 Hz
Shape	(External Dimensions) Conform to IEC Standards
Battery for Power Supply	G-13 1.5 volt, Silver Oxide Battery (option)

Schematic Diagram of HD-01



For additional information, direct all inquiries to:

CONVOY INTERNATIONAL PTY. LTD.
4 Dowling Street, Woolloomooloo, N.S.W. 2011
Telephone: (02) 358-2088. Telex: AA23111

TDK®

doing, it will provide the company with a mobile on-location recorder that will both do a job — and publicise the fact that Tascam can!

BOOKLET AVAILABLE

Meanwhile, for those who are keen to delve deeper into the recording art, TEAC are offering a free brochure entitled "Are You Ready For Multitrack?".

Written in a helpful, practical style, it points out the limitations of ordinary mono and stereo recording, particularly in ambient or noisy situations. It stresses the advantage of having available a greater number of microphones and channels and thus being able to capture a better recording of individual instruments or groups of instruments, before mixing down to ordinary mono or stereo.

This leads into a discussion of "Multitrack", intended here to signify, not just the use of multiple tracks, but the assembly of a total performance by recording vocals and/or different instruments at different times.

It suggests reasons why individual recordists should consider this approach.

The brochure raises and discusses matters like what kind of equipment; how many tracks; what mixing facilities; what other facilities; cueing and talk-back; recording levels. Finally: how to go about making your first 8-track multi recording. It makes interesting and helpful reading.

For your free copy of the brochure, write to TEAC (Australia) Pty Ltd, 165 Gladstone St, South Melbourne, Vic 3205.

Sennheiser phones

Release of two new models brings to six the number of headphone sets currently being marketed by Sennheiser through R.H. Cunningham Pty Ltd. The HD-420 phones, pictured, employ the "open air" principle and offer an impedance of 600 ohms. Rates frequency response is 18 to 20,000Hz, sound pressure level 94dB and weight 127 grams. The HD-430 phones have much the same electrical specifications but are fitted with full muffs and are somewhat heavier at 190 grams. Both have 3 metre detachable cables.

NEW TELEFUNKEN PRO. SPEAKERS FEATURE MAGNETO-FLUID

Three new professional quality loudspeaker systems announced recently by Telefunken use the latest magneto-fluid technology to ensure peak performance from the tweeter and (where used) the mid-range driver.

The idea behind magneto-fluid is fairly new, especially in relation to loudspeakers. It involves a special fluid containing, in permanent suspension, a heavy concentration of microscopically small iron-oxide particles. When introduced into the magnetic airgap of a dynamic loudspeaker, the fluid will distribute itself and be retained, purely by magnetic attraction.

Telefunken point to three distinct advantages of the technique. The first is that it eases the conflict which faces the designer of any moving coil driver: to provide a wide airgap in the interest of mechanical reliability or a narrow airgap to ensure the greatest possible magnetic flux. By introducing a magneto-fluid with a hundred times the magnetic conductivity of air, the designer can satisfy both requirements: adequate mechanical clearance and high magnetic efficiency!

A further problem has to do with voice coil temperature rise. Tweeters in particular need to have a small and light voice coil assembly if they are to reproduce the highest frequencies efficiently. However, with modern amplifiers and present-day program material, tweeters may need to absorb a lot of power, leading to voice coil overheating and even burn-out. If the space between the voice coil and the adjacent pole faces is occupied by a liquid instead of air, heat is transferred more effectively — and harmlessly — to the main structure.

Finally, there is the matter of voice coil damping. A voice coil assembly which is restrained by a viscous fluid is less likely to vibrate spontaneously, and to move only in direct response to the signal drive current. Cleaner sound can thus be expected.

Telefunken are using the magneto-fluid system for both tweeters and mid-range drivers.

There are actually three models in the new Telefunken professional range, all showing a strong family likeness, and all being of sealed construction with an "air suspension" woofer.

Telefunken state that the drivers are all manufactured and tested in their own factories and that their design, plus that of the enclosure, inhibits resonances.

The TLX1 is a two-way system, crossing over at 1500Hz. Power rating is 50W RMS or 75W "music"; claimed frequency response is 40-25000Hz, and impedance 4 ohms. Dimensions are 230 x 357 x 196mm.

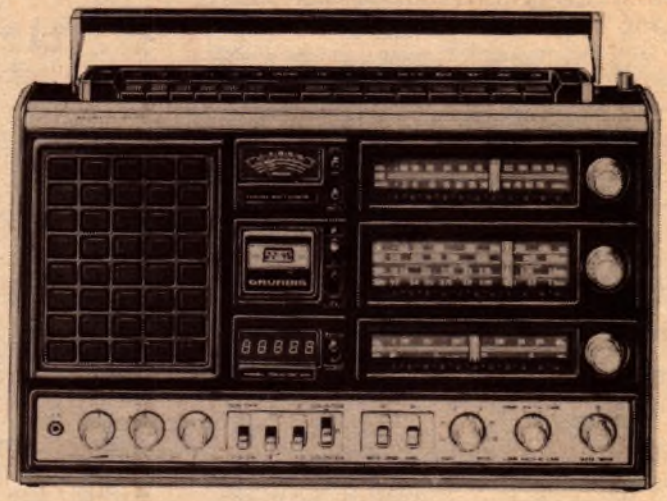
The TLX2 (pictured) is a two-way system, rated at 70W RMS or 120W "music", frequency response 30-25,000Hz, and impedance 8 ohms. Dimensions are 292 x 451 x 232mm.

The TLX3 is a four-way system, somewhat larger again, with a similar frequency and impedance rating but with power handling boosted to 120W RMS or 200W "music".

All three systems have a facility to adjust top-end response, LED indicators to warn against peak overload and circuitry to protect the drivers against long term overload. They can be supplied as pictured, or complete with a black cloth fret.

For further information: Brewo Electronics Pty Ltd, 104 Bathurst St, Sydney 2000. Phone (02) 61 2867 or (02) 233 3206.

HIFI TOPICS — continued



Adding to the number of receivers currently available to those especially interested in radio reception, the Grundig Satellite 3000 offers coverage of no less than 32 bands : 18 short-wave bands, plus VHF, MW and LW, and 88-108FM. The short-wave bands provide complete coverage from 1.6 to 30MHz, with digital readout available above 5MHz. Features include provision for SSB reception, noise limiter, signal strength meter, push-button tuning and band change, quartz clock, provision for a variety of antennas, phones and external loudspeaker. Measuring 50 x 32 x 13cm, the Satellite 3000 weighs 8.9kg without batteries. It is distributed in Victoria by Olmic Pty Ltd, who quote the price as $995, recommended retail. (Refer John O'Keefe, Melbourne, phone 03 527 5153.)

Surround sound in Britain

It would appear that British Broadcasting interests have grown cool towards the whole gamut of 4-channel matrix systems as a means of broadcasting surround sound from their FM radio stations. Included in this would be the variants derived from British "ambisonic" thinking.

One can only guess that, unlike their American counterparts, British broadcasting interests have been discouraged by audience reaction to 4-channel FM transmissions using the various matrix systems. Any advantage they may have offered in 4-channel mode has been offset by listener complaints that stereo or mono compatibility has been compromised. Hence the continued efforts by British and European broadcasters to come up with a system that would not suffer this disadvantage.

Ambisonic thinking, backed by the National Research Development Corporation, is still being accepted as a starting point but attention is now being directed towards use of a 3-channel signal, but with the third channel "fully recoverable". The thinking seems to be that such a method represents the best way to add dimension to a 2-channel system, without prejudicing compatibility of the signal as heard on existing stereo and mono receivers.

What they are doing, according to a recent IBA (Independent Broadcasting Authority) release, is to assemble the additional information required for correct surround sound, restrict its bandwidth to a manageable figure and quadrature modulate it on to the 38kHz subcarrier already present in an FM/stereo transmission.

In fact, because the third channel is bandwidth restricted, the concept could well qualify for description as a 2½-channel system.

The important thing is that the extra ½-channel is capable of being fully recovered and utilised unambiguously by receivers designed to take advantage of it. Equally, it will be completely ignored by existing stereo and mono

receivers, so that there is no residual "surround" information to complicate the basic "stereo" signal, as provided. This clear demarcation is just not possible with any conventional matrix system.

IBA claims that, if the method works out as well as they hope, it will have financial advantages as well. There is good reason to believe that a receiver capable of adequately decoding a 2½-channel transmission would be cheaper than one designed for a conventional 4-to-2 matrixed system and including complex (and costly) variable matrix or logic circuitry.

The IBA tests of the new system, extending from late '78 into the current year, are actually part of a study being conducted by the European Broadcasting Union.

British listeners to a variety of test programs over a variety of stations are being invited to comment on the quality of the transmissions as heard on their existing mono and stereo receivers — to confirm or otherwise basic mono or stereo compatability. This has obviously been a sensitive area in Europe, and the one which has tended to put the knocker on ordinary matrix methods.

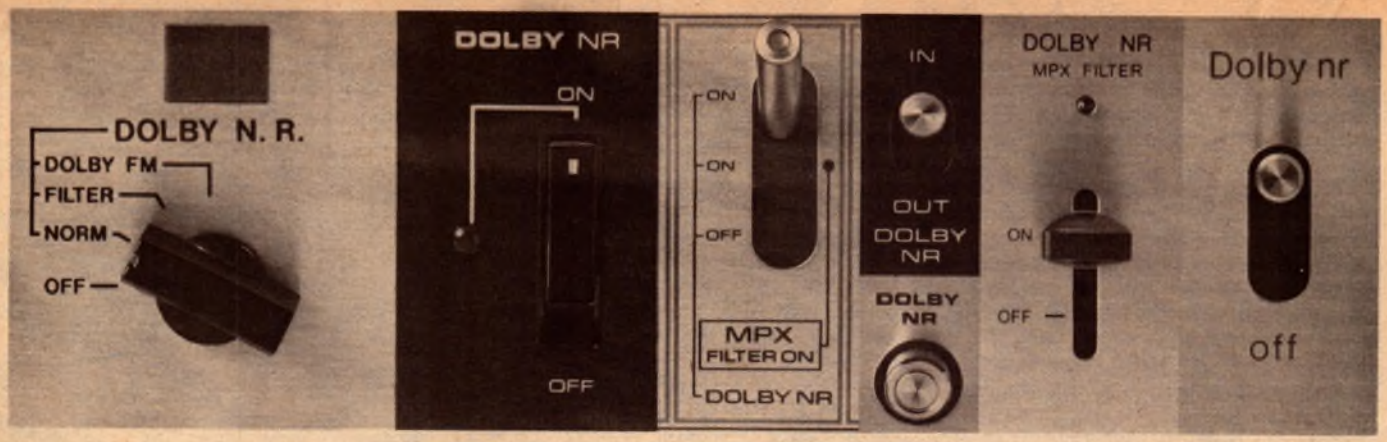
One interesting statement in the IBA release is a prediction that a 2½-channel decoder for an FM-stereo receiver could as easily decode 2½-channel material recorded on disc or tape. Presumably, they have in mind recording a 38kHz carrier, quadrature modulated with the extra "surround" information.

This would indeed be a strange twist, if anything came of it: first, matrix displaces the JVC/RCA "discrete" carrier system because the latter is too difficult; second, a carrier system is preferred to matrix, because the latter is not sufficiently "discrete"!

A victim of last year's CB market collapse, Hy-Gain Electronics have reopened as a subsidiary of Telex Communications. As a result, they are now represented in Australia by Audio Telex Communications Pty Ltd, according to a note from General Manager Rod Craig. Some Telex microphones and headsets such as the CM-1320 series pictured are eminently suitable for the amateur radio market and are being sold in the context alongside the well known Hy-Gain range of amateur antennas. (For further information: Audio Telex Communications Pty Ltd, 54 Alfred St, Milson's Point, NSW. Phone 02 929 9848. Also in Melbourne).

PHASE LINEAR, not a technical phrase but a company by that name, first made its presence felt in 1971 with the release of a 350W power amplifier for domestic use — more than twice the power currently being offered by any other company. Since then, Phase Linear, based in Washington, USA, has added to its range preamplifiers, tuners, loudspeakers and signal processors all, for the most part, intended for audiophiles. Ownership of the Company has now passed to the New Jersey based US Pioneer Electronics Corp, a subsidiary of Pioneer Electronics Corp of Tokyo. Present intention is that Phase Linear will operate as a separate entity and that present distribution arrangements in Australia will be maintained.

NATIONAL PANASONIC (AUST) PTY LTD advise that stocks are now available of the Technics EPC-300MC moving coil cartridge and the SU-300MC moving coil cartridge preamplifier, both of which were previewed in our July 1978 issue. The recommended retail prices are respectively $75 and $90. The company address: 57-69 Anzac Parade, Kensington 2033.



When what's built-in is not enough.

Still hearing some "SSSSSSSS," even though you're using good tape and the noise reduction system in your deck? Don't blame the tape. Chances are, that noise reduction system doesn't have what it takes to give you totally noise-free recordings.

The answer: a dbx II tape noise reduction unit. All of our models give you 30 dB of noise reduction at all frequencies, plus 10 dB extra recording level headroom. Without altering the sound of your music, either. The best that Dolby* B can offer is 7-10 dB of noise reduction. Besides, Dolby and other typical systems operate only at high frequencies, allowing low frequency noises to remain. And as experts know, they require level matching. dbx II doesn't require any level matching whatsoever, because its true mirror image compression/expansion operates linearly on all frequencies and your music's entire dynamic range.

*Dolby is a registered trademark of Dolby Laboratories, Inc.

This all means that the live performances, FM broadcasts and record albums you tape will have their full dynamic range preserved, with no audible tape noise added. So, if you're unhappy with the noise reduction system in your tape deck, consider a dbx II. We make 3 models: the 122, for two-channel tape noise reduction; the 124 for four-channel tape noise reduction, or simultaneous off-tape monitoring of the noise-reduced signal; and the 128 combination tape noise reduction system/dynamic range expander, which lets you make tape copies of your recordings that sound better than the original.

The dbx difference is the difference between some tape noise and no audible tape noise at all. Hear it at your dbx dealer soon.

dbx

DISTRIBUTED BY SUPERSCOPE (A/ASIA) PTY LTD
PO BOX 604, BROOKVALE, NSW 2100

Telephone:
Sydney: (02) 939 1900
Melbourne: (03) 329 7655
Adelaide: (08) 336 2029
Brisbane: (07) 397 2066
Perth: (09) 328 3874
Hobart: (002) 44 4077

AUDIO TALK

by LEO SIMPSON

Music Power and Dynamic Headroom

Elsewhere in this issue, we have published a design for a toneburst tester entitled "IHF 1kHz Tone Burst Source". The letters IHF stand for the Institute of High Fidelity, an American association which establishes standards for high fidelity equipment sold in the USA. Why have we produced a piece of equipment to perform a test to an American standard?

The answer has more to do with international trade than with the efficacy of IHF standards. In the USA, the major portion of the hifi market is held by Japan and it represents the biggest single market served by Japan outside its own domestic market. Therefore, since Japanese audio companies design their equipment primarily to satisfy the US market, they design to meet the IHF standards. So the IHF standard also tends to serve the world, as far as performance of amplifiers, receivers and tuners is concerned.

There are probably some readers who object to the idea of the performance of equipment sold on the Australian market being determined largely by an American standard. Here we must give the Japanese their full credit. As part of their aggressive marketing approach, no doubt guided by their powerful MITI (Ministry of International Trade and Industry), Japanese companies have shown themselves to be anxious to comply with the standards of every country in which they sell. To give an illustration of this approach, the Technics SA-400 receiver reviewed in the January 1979 issue is manufactured in at least 10 versions to suit different countries and regions. The model for Australia meets our standards for mains power connection and conforms to the intent of Australian Standard AS 3159 (Electronic Sound & Vision Equipment).

Despite this, the fact that the IHF has defined this new "Dynamic Headroom" performance spec does mean that many amplifiers are likely to carry the rating in the future. What does this mean, and is it worth worrying about? A partial answer to the first question can be gained from the article on the toneburst tester elsewhere in this issue. I will elaborate.

"Dynamic Headroom" supersedes the previous IHF rating for "Dynamic Power Output", which in turn superseded "Music Power". So let's start with Music Power. The idea behind this term recognised that most amplifiers can deliver more power on a short term basis, on peaks of program material, than they can when fed with a continuous sinewave tone.

This means that it is possible for two amplifiers to have identical continuous power ratings but for amplifier 1 to be able to deliver substantially more power before the onset of clipping, when fed with actual program signals. The reason for this is that amplifier 1 has a power supply which is not as well regulated as that for amplifier 2.

When each amplifier is delivering full power on continuous tone, the power supply rails may measure +35VDC, for argument's sake. In the "no-signal" condition, the power supply rails of amplifier 1 may rise to +45VDC, whereas the supply rails for amplifier 2 may rise to only +40VDC at no signal. While the difference is only five volts for each supply rail, this can account for a substantial difference in music power output.

On face value, the idea of quoting music power output is a good one as it enables would-be buyers to get a better grasp of the overall performance. If everything else is equal, then the obvious choice is the amplifier with the higher music power output.

The trouble with the music power rating was that it was subject to abuse by the more unscrupulous manufacturers. The recognised method of measurement was to substitute a regulated power supply for the normal amplifier supply rails and measure the power output.

While there is really nothing wrong with the above method of measurement, it led to the production of amplifiers with very poorly regulated power supplies. This meant that the music power rating became wildly optimistic in some cases, when related to actual performance.

In short, the music power rating made it very easy for specifications to be "cooked".

Recognising that the music power rating left much to be desired, in 1966 the IHF defined a new rating. This was "dynamic power", which was measured using a toneburst of 10 milliseconds of sinewave at a low repetition rate. This method at least had the advantage of not using regulated external power supplies.

But the dynamic power rating still could give a substantial advantage to the amplifier with a poorly regulated power supply. And the 10 millisecond toneburst test specified for this measurement bears little relation to the dynamics of normal program signals. In other words, the figures for dynamic power could still be quite unrealistic.

For some time we have been aware of the need for a regular series of articles to provide background to our hifi reviews and audio projects. So this new column will discuss in detail many of the measurements and parameters which characterise audio equipment.

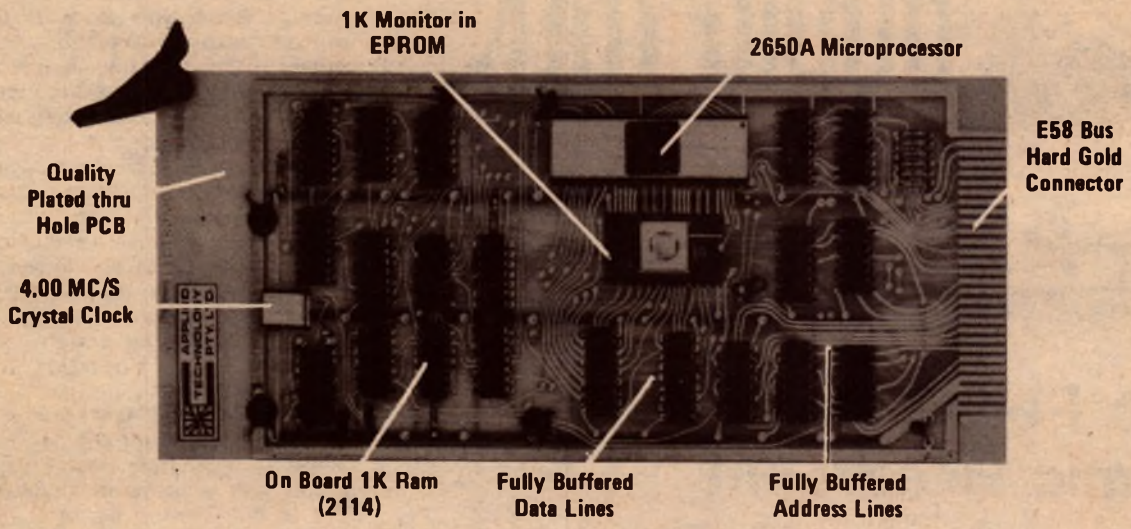
This situation changed rather drastically in 1974, at least in the USA. Up to that time, amplifiers could be advertised with wildly unrealistic ratings and there was no uniform standard of comparison. Then the American Federal Trade Commission stepped in. It has just as many teeth as our own Trade Practices Commission.

The FTC ruled that amplifiers and receivers could only be advertised with a "continuous power rating". Any secondary power rating such as "music power", "peak music power" or "figment of imagination power" had to be printed in the advertising material using type sizes no greater than two-thirds of that used for the continuous power rating.

Consternation reigned. Worse still, the FTC stated that, in testing an amplifier's power rating it had to be "pre-conditioned" by a one-hour soak test running at 33% of its continuous power rating when fed with a 1kHz sinewave. For many manufacturers, particularly those that were not conservative in their ratings, this was an unmitigated disaster.

Some amplifiers could not survive the pre-conditioning without thermal runaway and subsequent breakdown. Others became severely overheated and their thermal overload cut-outs,

Educational, Hobbyist, Business, Industrial, Microcomputer users . . .



. . . EUROCARD 2650: a professional quality, expandible single card computer engineered to meet todays needs.

COMPLETE COMPUTER

The DB1001 is the heart of an incredibly flexible computer system based on the 2650 microprocessor. Designed by BOB ARMSTRONG the DB1001 features; on board 1K RAM, 1K EPROM monitor, serial I/O, 4.00 crystal clock, fully buffered address and data lines.

Memory expansion and extra I/O devices can be readily connected using the E58 BUS which is also Z80 and S–100 compatible. The 1K EPROM can be readily reprogrammed to various operating systems such as 1200 BAUD PIPBUG or BINBUG V3.6.

The DB1001 is available in kit form or assembled and tested. Conversion kit is available to convert the EA2650 starters kit (DB1001 Kit $135.00*)

DATA/BYTE 100: ENORMOUS EXPANDABILITY

DATA/BYTE100 is the system configuration using the DB1001 CPU card. Additional memory and I/O cards readily plug into a mother board to produce an enormously versatile mainframe which can also incorporate floppy disc drives and high speed printer. By selecting from the individual modules you can design a DATA/BYTE 100 system to meet your exact specifications.

NOW AVAILABLE

DB1006; a 6K RAM card which with the 1K RAM and 1K ROM on the DB1001 becomes a full 8K system. (Kit $140.00*)

DB1008; a 8K static RAM card configured as 2 separate 4K byte blocks selected with DIP SWITCHES for each address boundary. (Kit $175.00*)

DB1048; a dual 4/8K ROM and high speed cassette interface card. Accepts 2708 or 2716 EPROMS with your resident software. Also contains 2708 containing the full software to generate the cassette interface and digitally controlled dual cassette system together with full file handling. (Kit $130.00*)

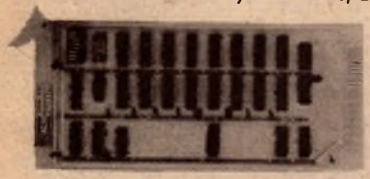
DB1500; a plug in power unit supplying 5V @ 5A regulated, –5V, ±12V 750mA from an external DB1505 transformer and bridge rectifier. (Kit $45.00, transformer $27.00*)

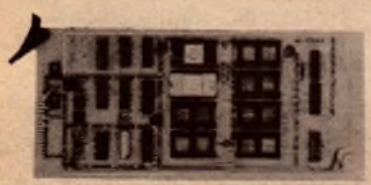
DB1202; a wire wrap card for custom applications. (Kit $25.00)

DB1203; an extender card for trouble shooting the E58 BUS. (Kit $25.00)

EASY TO USE:

No matter what your application, DATA/BYTE 100 system is easy to use and understand. You can select from the extensive software base for the 2650 or use the newly released MICRO-WORLD BASIC which is a powerful MICROSOFT ™ compatible 8K BASIC which will run in ROM or RAM on your system. The soon to be realeased 16K dynamic memory card and floppy disc controller will enable you to build your system to over 100K capacity!

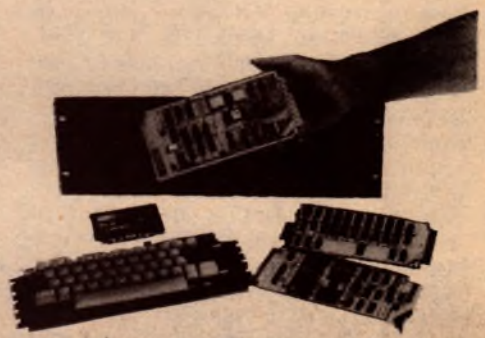




*Prices include sales tax. Please allow $2.00 post and package.

FOR MORE INFORMATION SEND $1.00 FOR OUR 1979 CATALOGUE:

APPLIED TECHNOLOGY PTY. LTD.



bankcard welcome here

APPLIED TECHNOLOGY, 1A PATTISON AVE., WAITARA. (02) 487 2711 (3 lines)
SHOWROOM 9-5 MON TO SATURDAY
MAIL ORDERS P.O. BOX 355, HORNSBY 2077.

where fitted, would trip. Whether it was intentional or not, the FTC had created a very stringent test.

Perhaps the main reason for this is that the maximum power dissipation in a class-B amplifier doesn't occur when the amplifier is delivering full power, but when the amplifier delivers about 40% of its continuous power. This figure is not very far away from the 33% specified by the FTC.

The actual figure for maximum power dissipation in a particular amplifier depends to a large extent on the no-signal voltage of the power supply rails and the effective output resistance of the power supply. What this means is that a poorly regulated power supply is a liability — it results in an amplifier with higher internal power dissipation for a given continuous power rating.

So amplifier manufacturers had to go back to their drawing boards and design a new generation of amplifiers which would pass the pre-conditioning. This meant better regulated power transformers with less internal losses, more rugged rectifiers, and bigger filter capacitors with higher ripple current ratings. And, of course, the power transistors had to be more rugged and their heatsinks more effective.

So the result of the FTC ruling was to make amplifier ratings more conservative. It is now rare for an amplifier or receiver not to meet its continuous power ratings. A further result is that the amplifiers develop less music power than they used to, because their power supplies are better regulated.

Even so, in 1978 the IHF sought to resurrect the music power or dynamic power concept with the new rating "Dynamic Headroom". This is expressed in decibels and represents the ratio between the music power and the continuous power output. Along with the term there was a new toneburst test, more valid than the previous method.

The new toneburst method employs a 1kHz sinewave which increases in amplitude by 20dB over the reference level, for 20 milliseconds at a rate of two bursts per second. This is more realistic than the previous test because the 20dB change in level represents a typical peak-to-average program ratio and the rate of two bursts (peaks) per second is not likely to be exceeded by most program material.

Typical good quality amplifiers will have a dynamic headroom of between 1dB and 2dB. An amplifier with a dynamic headroom of 0dB would have a power supply with perfect regulation. An amplifier with a continuous power output of 30 watts per channel and a dynamic headroom of 1dB would have a music power output of just over 37 watts. The same amplifier with a headroom of 2dB would deliver 47.5 watts music power.

As an interesting paradox, amplifiers with completely separate power supplies for each channel usually have less dynamic headroom than equivalent amplifiers with single power supplies.

In a practical sense, even though Dynamic Headroom has re-established the music power concept, the fact that it is expressed in decibels makes it harder to sell. Thus while a dynamic headroom of 2dB for an amplifier of 30 watts rating means an increase in effective power of 17.5 watts or 58% more, it does not sound impressive. Nor is it impressive, in actual fact. An increase in level of 2dB is barely audible.

There is another problem with Dynamic Headroom and that has to do with accuracy. The toneburst output of the amplifier is displayed on an oscilloscope screen and the signal increased until the amplifier just reaches the onset of clipping. Then the measurement is taken from the oscilloscope display and the calculations made.

Now, under steady-state conditions it is quite difficult to judge the onset of clipping by visual inspection of an oscilloscope waveform. To get around this problem in our tests for continuous power, we judge the onset of clipping by the sudden increase in distortion products. The difference in accuracy of the two methods can easily amount to 0.5dB. This depends to some extent on the visual acuity of the observer, the focussing of the oscilloscope trace and the amount of hum and other noise superimposed on the waveform. But the task of judging the onset of clipping is much more difficult on this toneburst waveform which flicks across the screen at the rate of two per second. So the dynamic headroom cannot be expressed with any great degree of precision.

Some idea of the music power (and dynamic headroom) of amplifiers we have reviewed in the past can be gained by doubling the power delivered by one channel into a 16 ohm load. The resulting figure will give a fair idea of the music power likely with normal 8 ohm loads.

Some sort of conclusion should be drawn from the foregoing. Dynamic headroom is a useful concept, which gives a further parameter for comparison of otherwise similar amplifiers. But because of the American FTC regulations most amplifiers have well regulated power supplies. So the result is that most amplifiers don't have much in the way of dynamic headroom.

Continued on page 124

SCOOP PURCHASE OF WORLD FAMOUS RANK ARENA SPEAKERS.

FANTASTIC VALUE $24.75 EACH

FANTASTIC 2 WAY HI FI SPEAKERS - Ideal as extension speakers in any room of your home.

- ★ Huge 10 watts RMS (20 watts peak).
- ★ 8 ohm input.
- ★ Two way system - 8" woofer with ferrite magnet for ultra smooth bass and mid tones -quality tweeter for brilliant high notes.
- ★ Wood grain finish with attractive brown grille.
- ★ Perfect for main speakers or extension speakers in every room.
- ★ Complete with leads and plugs for fast no fuss connection.

WERE SELLING FOR $75 per pair

SAVE OVER 1/3rd off normal selling price

The most fantastic special EVER 2,000 pairs of top name hi fi speakers

TOP PERFORMANCE ONLY $49.50 per pair

(Can be purchased separately) Cat. A-2466 P&P $5

☆SCOOP☆SCOOP☆SCOOP☆SCOOP☆SCOOP☆SCOOP☆SCOOP☆

GARRARD SP125 SCOOP

Deluxe stereo belt drive turntable

A superb belt drive turn—table with features normally found only on more expensive units! Ready wired for your hi fi, it comes complete with deluxe base and cover and a ready fitted magnetic cartridge. This unit will auto replay a record for you, so if you like a certain record, it will play it all night for you! Buy your new turntable today before inflation forces the price up..... **Not available from Grace Bros.**

Terms available to approved applicants from 10% deposit and low repayments.

$169 Cat. A-3070 P&P $5.50

BSR SCOOP

Deluxe stereo belt drive turntable

A sensational bargain from Dick Smith. The BSR turntable has belt drive for excellent re-production and comes complete with a very modern base and cover. The magnetic cartridge fitted is one of the renowned ADC units. The price on this unit is only possible through Dick Smith and his superb buy-ing powers. Be the first in your street with a BSR turntable for less than $100! **Not available from Grace Bros.**

$99 Cat. A-3074 P&P $4

Prices and availability correct at time of going to press

DICK SMITH ELECTRONICS

bankcard welcome here

SYDNEY 125 York Street, SYDNEY. Ph. 290 3377
147 Hume Hwy, CHULLORA. Ph. 642 8922
162 Pacific Hwy, GORE HILL. Ph. 439-5311
30 Grose Street, PARRAMATTA. Ph. 683 1133

MELBOURNE 399 Lonsdale Street, MELBOURNE. Ph. 67 9834
656 Bridge Road, RICHMOND. Ph. 42 1614

BRISBANE 166 Logan Road, BURANDA. Ph. 391 6233

ADELAIDE 203 Wright Street, ADELAIDE. Ph. 212 1962

MAIL ORDERS P.O. Box 747, Crows Nest, N.S.W. 2065. Post and packing extra.

Dealers across Australia.

SHOPS OPEN 9AM to 5.30PM (Saturday 9AM - 12 noon) BRISBANE 1/2 Hour earlier

* ANY TERMS OFFERED ARE TO APPROVED APPLICANTS ONLY

Many lines available from the Dick Smith Electronics Centres at

GRACE BROS

Broadway . Bondi . Chatswood . Liverpool Miranda . Mt Druitt . Parramatta . Roselands and Warringah Mall

483EA279

Technics RS-673 cassette deck

The Technics RS-673 is a front-loading stereo cassette deck with two heads and two motors, Dolby noise-reduction, solenoid control and adjustable bias. A major innovation featured by the deck is the fluorescent bar graph meters. These have a very fast response to signal peaks.

In contrast to the new features it incorporates, the styling of the Technics RS-673 is quite conventional. The front panel and wrapover cover have a matt charcoal finish while the control lettering is in subdued gold.

Dimensions of the deck are 450 x 140 x 336mm (W x H x D) and the mass is 9.5kg. Power consumption is 45 watts.

The cassette transport mechanism is actually based on the RS-676-US deck which we reviewed in the May 1975 issue of "Electronics Australia". Access is gained to the cassette compartment by pushing the eject button. This lowers the cassette door via a damped mechanism which works very smoothly and quietly. The cassette is loaded by placing it on a horizontal platform which is then depressed to the operating position.

An internal light and a mirror set at 45 degrees make the cassette visible, provided the user has his head at window level. As we noted with the previous model using this transport, a light behind the cassette would be a worthwhile addition. As yet, Technics have not taken up this suggestion.

Next to the cassette window are the six push-bars for solenoid control of the tape transport. They do not have the very light action of the control buttons on most solenoid controlled decks. This is partly because the push-bars on the RS-673 are latched (ie, they lock in until released by depressing another push-bar).

Presumably, the latched push-bars are the only easy method of enabling the deck to be used with a timer. The deck can be set in the record mode with push-bars latched awaiting the appointed time which is set by a timer. The timer must also control the tuner or other program source to be recorded.

So, in order to obtain the advantage of being used with a timer, the RS-673 seems to have sacrificed the advantage of feather-touch control. It also seems to have sacrificed the desirable advantage of the optional remote control unit which was available with the earlier RS-676 series.

Both the Record and Play push-bars have miniature lights to highlight the fact that the deck is in the record or play mode. In this reviewer's opinion, these lights should be made more visible. In fact, the overall control visibility on this deck is altogether too subdued. Maybe Technics should realise that although well-heeled audiophiles may pride themselves on their aural acuity, their visual capability may not be up to the same standard.

Above the controls for the transport are five pushbuttons to select memory rewind, Dolby noise reduction, bias level, and equalisation. The three buttons for bias level and equalisation are not well explained either in the owner's manual or in the table on the deck cover. In any case, a deck in this price range really should have automatic tape sensing to differentiate between ferric oxide and Chromium dioxide tapes.

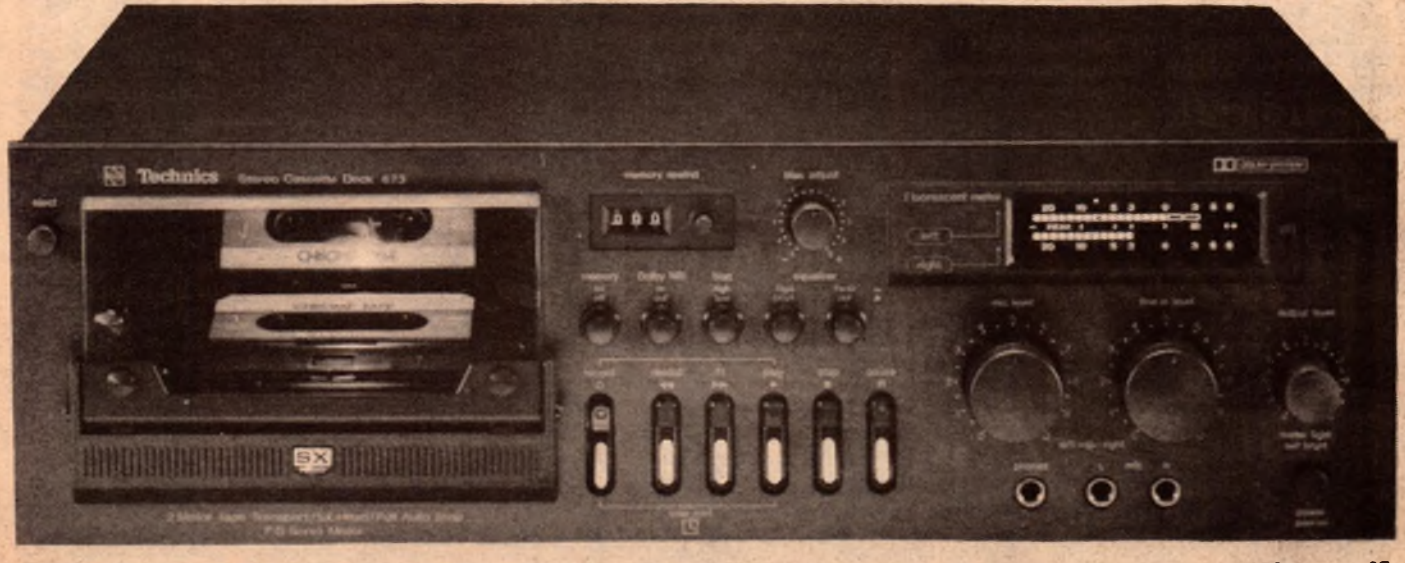
As an interesting sidelight, the earlier RS-676 model did have automatic sensing for chromium dioxide tapes. Has Technics deleted it for a particular reason?

The equalisation button marked FeCr is for ferri-chrome tapes and overrides the other buttons for bias and equalisation.

A worthwhile feature of the RS-673 is the variable bias knob. This has a centre detent and the knob gives a bias variation of ±15% about the standard settings provided by the bias switches. Technics provide a brief list of tapes and optimum bias settings but the list of 10 is too short to be really useful.

Basically, the idea behind the variable bias knob is that it allows the user to select the best compromise between the widest frequency response and distortion at high recording levels. In general, reducing the bias improves the high frequency response while degrading the distortion performance and vice versa.

The problem with this concept is that it is a matter of trial and error to find the best bias setting for a particular brand and type of tape (if not in Technics' brief list). Here the RS-673



suffers by comparison with a number of competitive decks which have a third head and variable bias.

Perhaps the most interesting feature of the RS-673 is the fluorescent bar graph display panel. This has the advantage of fast response time, good visibility and eliminates the need for separate LED peak overload indicators.

The display panel is driven by a pair of custom ICs which perform signal rectification and analog-to-digital conversion. The accuracy of the display is very good: with 0dB as reference, individual calibrations are accurate to within ±0.5dB over the full range.

However, resolution of the fluorescent bar graph display is no better (perhaps worse) than a conventional analog meter. This is because the individual segments of the bar graph light up in increments of two up to 0dB. Above that, increasing signal causes the individual segments to light in sequence.

Technics state that the display has a virtually instantaneous (less than 5uS) response although the attack time of the metering circuitry is about the same as that driving a conventional meter — about 10 milliseconds.

By comparison, the decay time seems excessively long at about 1.5 seconds for the readout to drop from 0dB to 20dB.

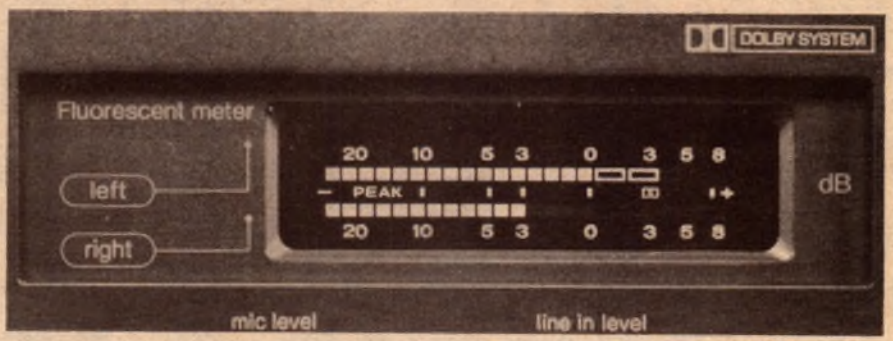
Other front-panel features include the microphone and line input mixing knobs, the output level knob, headphone and microphone sockets.

On the rear panel are RCA and DIN sockets for inputs and outputs, a mains voltage selector and a preset control for adjusting the bar graph display brightness. Main power connection is a sheathed two-core flex fitted with a three-pin plug. The RS-673 is double insulated, so no mains earth is required.

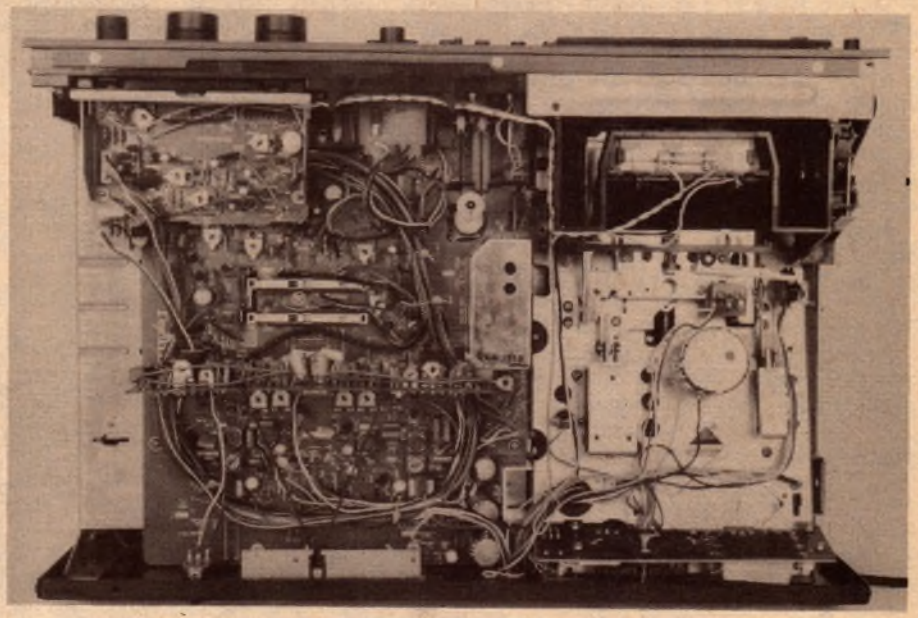
Removing the outside cover and composition-board base of the RS-673 reveals a crowded and complex interior with quite a lot of wiring around the PC boards. The mechanism is rather unusual in that it slopes up towards the back. The power transformer is mounted underneath.

Two motors drive the cassette transport. One drives the capstan via a rubber belt and large flywheel while the other drives the cassette hubs. Both motors run from low voltage DC but the capstan motor has tachometric feedback.

Quite some time is needed to become fully familiar with the features of the RS-673. This process is not really made easier by the owner's manual. It is set out in five languages: English, Swedish, French, Dutch, and Danish. The first seven pages of detailed diagrams and multi-language captions creates an air of confusion that is not dispelled by the remaining text. Technics would do better to produce the briefer, single-language manuals produced by some other makers.



Above is a close-up of the bar-graph display while below is the internal layout of the RS-673.



We found that the transport and its controls operated smoothly and quietly, although unfortunately a malfunction developed when our tests were quite advanced. A spring in the cassette ejection mechanism became detached and from then on the cassette could not be ejected without a little tinkering with the transport while the cover was off. Although a minor fault, it would have required some disassembly to repair.

Rewind times for a C60 cassette averaged about 75 seconds and the automatic stop operated at about 3.5 seconds after end of tape for all transport modes.

We found that we were able to obtain a frequency response within ±2dB from 30Hz to 15kHz or better with a variety of good quality tapes, provided the bias setting was optimised. Harmonic distortion at 100Hz, 1kHz and 10kHz was about 1% at levels up to 0dB and increased slowly above that. Switching in Dolby noise-reduction had little effect on the frequency response so the Dolby levels must be close to optimum.

Separation between channels (record/replay) checked out at 41dB at 100Hz, 40dB at 1kHz and 30dB at 10kHz. Unweighted signal-to-noise ratio was typically 40 to 50dB with respect to 0dB. Allowing the recording levels to rise to +5dB gives an effective dynamic range of about 55dB. Switching in Dolby gives the usual 8 to 10dB improvement in signal to noise ratio above 5kHz.

Wow and flutter is quoted at 0.056% (WRMS) or 0.15% DIN. We measured it as typically 0.1% DIN with a best figure of 0.08% DIN which is very good.

Overall performance of the RS-673 must be rated as very good. With the facility for bias adjustment, consistently high performance can be obtained from most tapes whether they are ferric oxide, ferri-chrome or Cr02.

Recommended retail price of the Technics RS-673 is $599. Further information can be obtained from high fidelity retailers or from the Australian distributors, National Panasonic (Australia) Pty Ltd, 57-59 Anzac Parade, Kensington, NSW 2033. (L.D.S.)

REAL POWER LINE UP

sanwa

AX-303TR

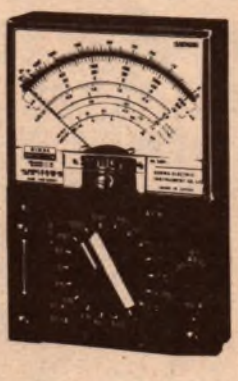
44μA meter movement — Si diode protection against pulse input.
Measures hFE (0-1000) by using the extra connector

N-501

2μA suspension movement — 0.05mA/1mV resolution.
Double protection — fuse & Si diode.
Constant 1MΩ input impedance (ACV) — RF-diode rectified current direct to movement

BX-505

Fast-response, 24μA movement — fuse & diode protected with high resolution factor. (0.4μA/scale division)
Revised scale marking — intermediate readings readily determined.



U-60D

44μA movement — quality performance, diode protected.
Temperature measurement of −30°C to +150°C with extra scale.

CAM-250D

Clamp meter
Economical and multi-function. Single motion core arm.
Compact yet provides 4 ranges on ACA and 2 ranges on ACV

PDM-500/C

Performs as low resistance ohmmeter besides insulation tester.
Measurement, scale calibration and battery check are all operated by pushbutton switches.
Has constant voltage impressed irrespective of the value of resistance checked

N-501

● ±DCV 0-60m 0-0.3-1.2-3-12-30 0-120-300-1.2k-30k (w/HV probe) ● ±DCA 0-2μ 0-0.3-0.3-1.2-3-12-30m 0-0.12-0.3-1.2-12A ● ACV 0-3-12-30-120-300-1.2k ±2.5% Freq. 20Hz to 50kHz ● ACA 0-1.2-12 ● Ω x 1-x10- x 100-x 1k-x 10k-x 100k (max. 200M) Batt. 1.5V x 1 & 9V x 1 ● dB −20 to +63

AX-303TR

● ±DCV 0-0.3-3-12-30-120-300-1200 ● ACV 0-6-30-120-300-1200 ● ±DCV 0.60μ -3m-30m-0.3-12 ● Ω x 1- x 10- x 1k- x 10k (max. 20M)

U-60D

● DCV 0-0.1-0.5-2.5-10-50-250 -1k-25k (w/HV probe) ● DCA 0-50μ -2.5-50-500m ● ACV 0-2.5-10-50-250-1k ● Ω x 1-x 10-x 100- x 1k (max. 5M)

BX-505

● ±DCV 0-0.12-3-12-30-120-300-1200-30k (w/HV probe) ● ±DCA 0-30μ -3m-30m-0.3-12 ● ACV 0-6-30-120-300-1200 ● ACA 0-12 ● Ω x 1-x 10-x 1k-x 10k (max. 20M)

CAM-250D

● ACA 6-30-60-300 ● ACV 300-600 ● kΩ 0-50k ● Batt. 1.5V x 1

PDM-500/C

● V/Ω rated 500V/100M ● Scale range 0-0.1-100-200m (1st effective scale range underlined) ● Ω 0-100Ω ● Power source AM or UM-2 x 3

WARBURTON FRANKI

● ADELAIDE 356-7333 ● BRISBANE 52-7255 ● HOBART 23-1841
● MELBOURNE 699-4999 ● PERTH 277-7000 ● SYDNEY 648-1711
● AUCKLAND N.Z. 79-7781 ● WELLINGTON N.Z. 698-272

Make this clock for the car or bedside table

4 or 6-digit Quartz Clock

"Not another clock! You've had umpteen in the last few years," we can hear you exclaiming. Well, that is true, but we think this particular clock will have considerable appeal. It is crystal controlled and has a six-digit display. It can be used in cars or recreational vehicles, or used in the home and powered by a plugpack. It is very compact and straightforward to build.

by LEO SIMPSON

Though it may come as a surprise to many people, clocks are a very popular constructional project with hobbyists. Between the various suppliers to the market, many thousands of kits and modules have been sold in the last three or four years. Recently, there has been a demand for a six-digit clock for use in cars or in the home.

Designing a clock suitable for use in cars, recreational vehicles or in the home presents problems of compatibility. For use in a car, the clock requires a crystal oscillator for precise timekeeping and a display with high brightness and low current drain which is able to be switched off with the ignition key. Ideally, if the display is really bright, the brightness should be adjustable for night driving.

For use in the home, the display need not be as bright but should be legible at a greater distance than required in cars. Indeed, the display should not be too bright at night, otherwise sleep can be disturbed. The crystal oscillator can be dispensed with and the mains used as the time reference instead.

We desired that the clock should also be as compact and as unobtrusive as possible. In particular, we wished to use a neat and very compact case which is presently being marketed by Dick Smith Electronics. This placed a very tight constraint on the PCB configuration — very little space was available.

The need for a six-digit display was a problem too. While fluorescent displays are currently very popular, they are most commonly available in 3½ or 4-digit arrays in a common glass envelope. And despite the advantage of their low current drain and attractive green display we have misgivings about their longevity.

So seven-segment LED displays really were the only choice. Normally with six digits being driven, this would mean a high current drain, but we have selected a high efficiency type and run it at low current to minimise the total power.

The resulting display is bright enough to viewed with ease in sunlit rooms or cars. At the same time, the display is not too bright for totally dark rooms. In short, we think it is a good compromise which keeps current drain to a minimum and avoids the need for an adjustable brightness control.

There is another advantage in the low current drain. Because the proposed clock case was so small we did not have sufficient space for the power supply components, particularly the transformer. We could have accommodated the rectifier diodes and a small filter capacitor but the transformer would not fit. That left the option of using an ac plugpack.

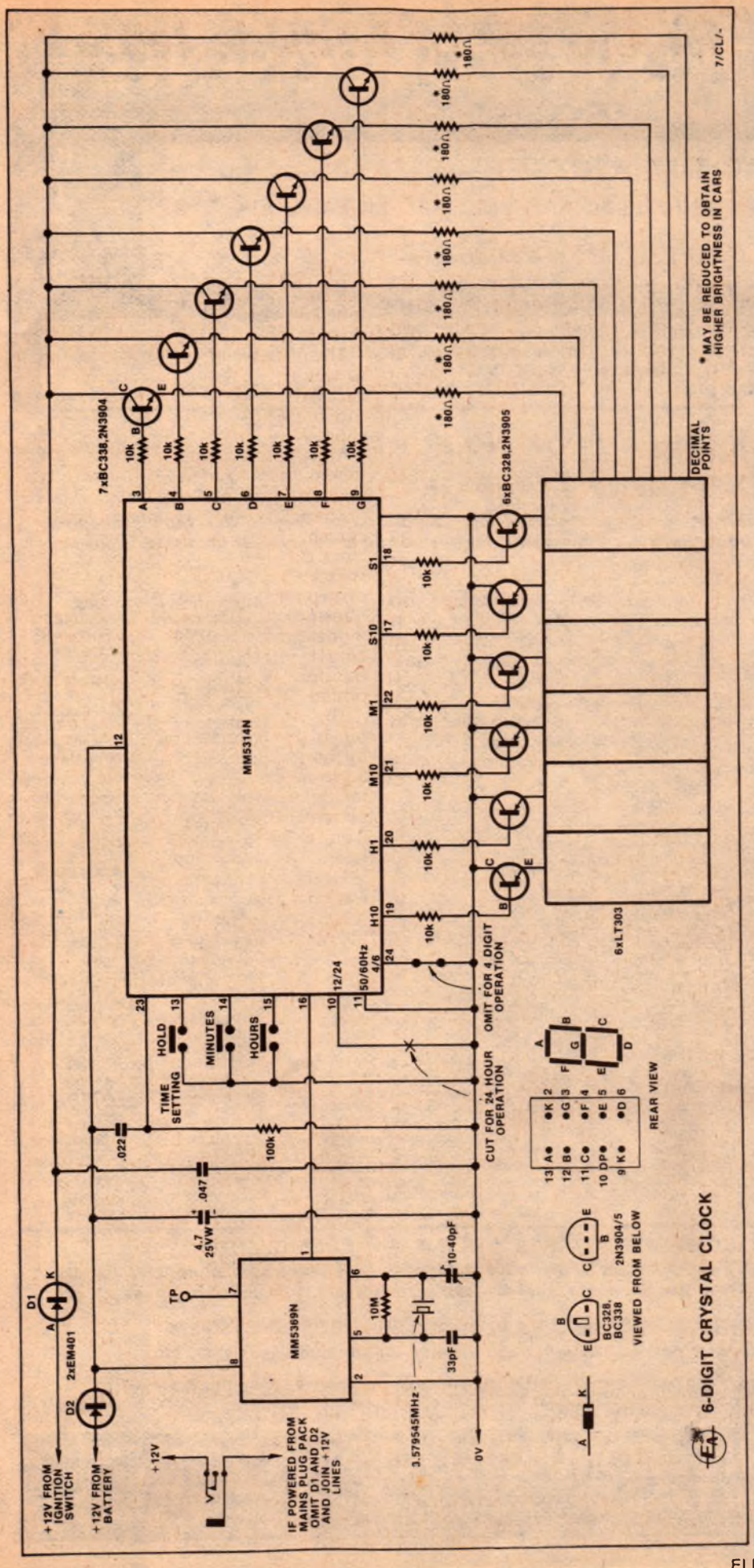
The AC plugpack is a neat solution but is not an item commonly stocked by most kit suppliers and parts retailers. So to make our job easier we decided to delete the power supply components entirely and power the unit from a DC plug pack. More on that later.

Heart of the clock circuit is the National Semiconductor clock chip MM5314N, which has been around for a few years now and is readily available at a reasonable price. It is a 24-pin package with a range of features outlined as follows. It will drive 4 or 6-digit displays in 12 or 24-hour format, with leading zero blanking in the 12-hour format.

The 5314 will provide time-keeping from 50Hz or 60Hz mains and drives seven-segment displays (with suitable buffering) in the multiplex mode to minimise the number of connections to the package. The chip is specified to work reliably with a supply voltage range of 11 to 19V DC, although we have found that typical specimens work at well below 11 volts.

In our circuit, the 5314 is driven from a 60Hz timebase derived from a crystal oscillator and a National Semiconductor MM5369N oscillator/divider IC. This chip is programmed to work with an American standard colour TV subcarrier crystal. While cut to resonate at 3.579545MHz in the TV application, the crystal is tweaked slightly in this circuit to run at 3.579540MHz. This is divided by a factor of 59,659 to give a precise 60Hz timebase. Both the 5369 IC and accompanying crystal are readily available at a few dollars each, making

This six-digit clock is very compact and is shown here approximately 75 per cent actual size.



an economical timebase.

Thirteen transistors are required to interface the 5314 with the six seven-segment displays. It is possible for the 5314 to drive these displays directly but brightness is low and liable to be inconsistent between digits and segments.

The 5314 chip will drive common-anode or common-cathode seven-segment displays, albeit with different interfacing circuitry. We have chosen to use common cathode readouts. This entails using NPN segment driver transistors and PNP digit drivers, all working as emitter-followers which means that they do not saturate when conducting.

One advantage of using the common-cathode readouts specified is that no links are required on the display PCB.

Separate positive power supply lines power the circuit. Both lines have series diodes to protect against polarity reversal when installed in a car. One line powers the two ICs and is connected all the time. The other powers the readouts and is connected via the ignition switch (when installed in a car) so that the display is blanked when the ignition key is removed.

There is another method of blanking the display available with the 5314. Pin 1 is the "output enable" control. When connected to the negative supply the segment driver outputs are blanked, thus turning off the display.

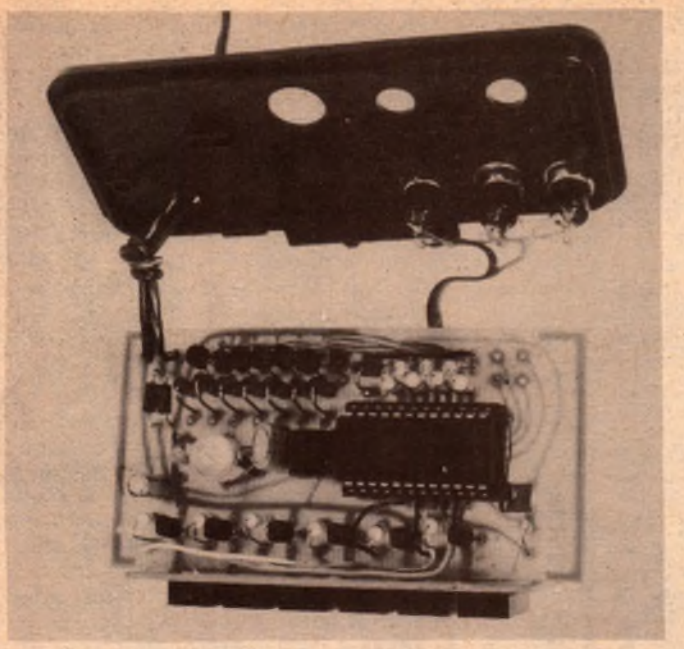
The problem with using the "output enable" control to blank the display (which would require at least one extra transistor) is that it does not blank the decimal points — in fact, because the multiplex operation stops, both the decimal point LEDs are energized continuously and draw an appreciable current.

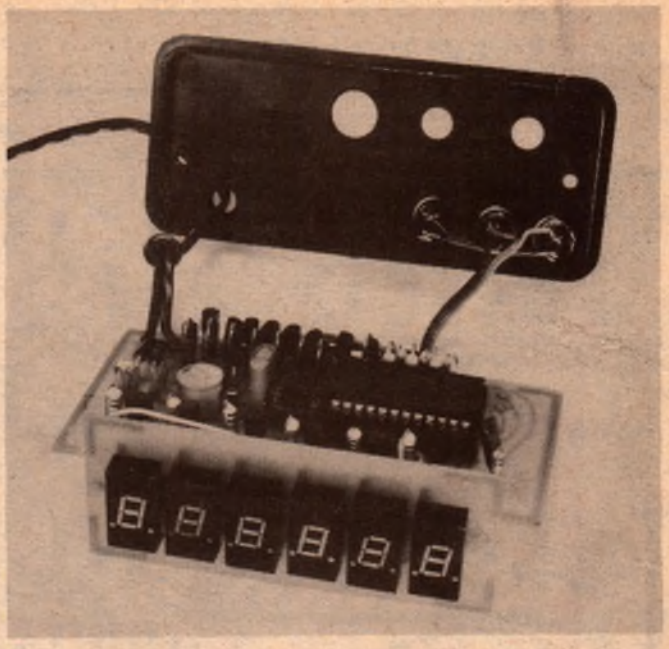
Because the digit and segment drivers are emitter-followers they all require 10k current-limiting base resistors. These are not to protect the transistors or the 5314 chip, but to prevent the 5314 chip from driving the LED displays directly, via the base-emitter junctions of the transistors, when the positive supply for the displays is turned off.

With the 10k resistors installed, the total current drain of the circuit drops to less than 10 milliamps when the display is blanked. This is virtually the current drain of the 5314 chip alone and is considerably below the current drain that would result if the 10k resistors were omitted.

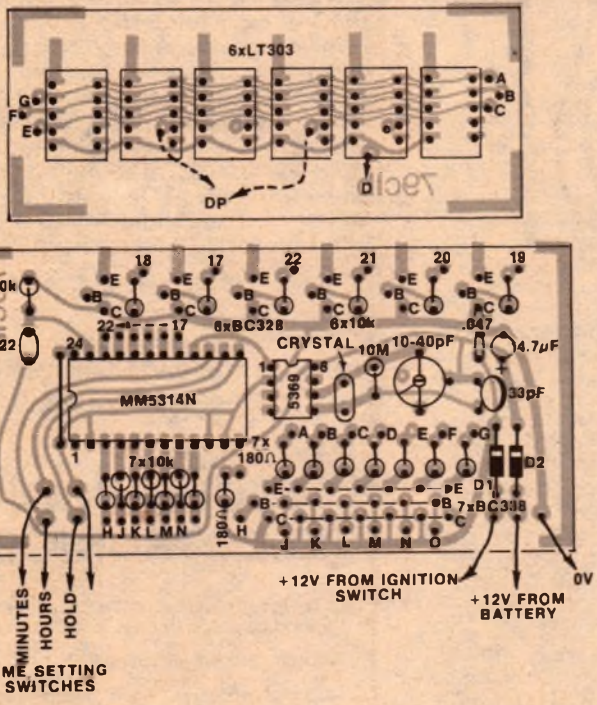
It may be thought that the 10k limiting resistors would not have been required had we used common-anode LED displays with the segment and driver transistors operating in common-emitter mode (where they saturate). However, in this configuration, each segment driver transistor requires a voltage divider in the base circuit. This would mean that one extra

At left is the complete circuit of the digital clock.





These three photos show the construction of the clock.



At left and top left are the PCB layout diagrams. The interconnecting wires are not shown, letters are used instead. Each point marked with a letter should be connected to the matching point with the same letter.

resistor would be required (in excess of our circuit).

The entire circuit is accommodated in two small PCBs, one measuring 102 x 52mm and the other 87 x 35mm. One PCB is attached at right angles to the other.

When assembling the main PCB, install the resistors, transistors and other small components before the two ICs. Make sure that the transistors are inserted correctly. If 2N3904/5 are used, the orientation is different from that for the BC328/338 series. Mount the resistors so that their colour code bands all run in the same direction, which makes it easier when checking your work.

It is possible to construct this clock in a number of variations. It may be four or six digit, with 12 or 24 hour operation. To build the four-digit version, omit the link to pin 24 of the 5314. To provide 24 hour operation, cut the copper track to pin 10, to disconnect it from the negative supply line.

It is not necessary to take any special precautions when soldering the two MOS ICs except to use a small low voltage iron. If you are worried, connect the soldering iron barrel to the PCB negative supply pattern and then solder the positive and negative supply pins of both ICs first, before soldering the rest.

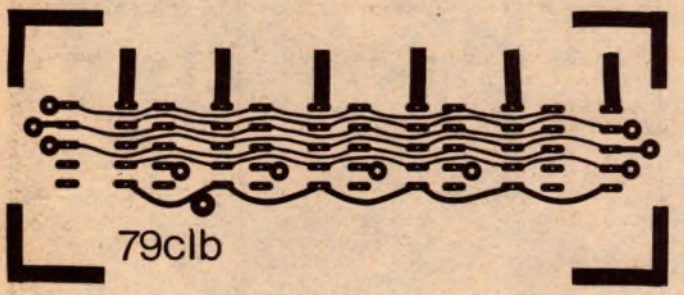
The copper pattern has been designed to accommodate two alternative trimmer capacitors, so there should be no supply problem regarding this component. The crystal is a miniature type. If the constructor wishes to use a crystal with a larger case (holder) it will have to be wired in on the copper side of the PCB.

The two diodes may be omitted if the clock is to be powered from a plugpack. Instead, put a link in place of one of the diodes and short the two positive supply lines together with another link, on the copper side of the PCB.

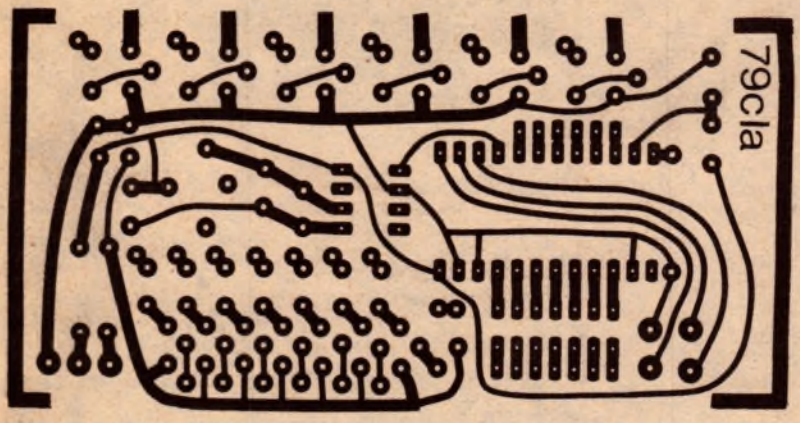
Assembly of the display PCB is straightforward. Make sure that each LED display is close as possible to the PCB surface before soldering. Do not solder those pins which have no connections. This way, if you have to remove a defective display, the job is easier.

If the 4-digit version is constructed,

QUARTZ DIGITAL CLOCK



Actual size artwork for the two PC boards.



PARTS LIST

1 compact plastic case with red perspex panel, size approx 108 x 44 x 68mm
1 PCB, 79c1a, 103 x 52mm
1 PCB, 79c1b, 87 x 36mm
3 miniature momentary contact push-button switches
6 seven-segment common-cathode LED displays LT-303, TIL-313, 5082-7740, Dialight 745-0019
1 MM5314N clock integrated circuit
1 MM5369N oscillator/divider IC
7 BC338, 2N3904 NPN switching transistors
6 BC328, 2N3905 PNP switching transistors
2 1N4001 silicon rectifier diodes

Resistors (10% tolerance). ¼ or ½W unless stated):
1 x 10M, 1 x 100k, 13 x 10k, 8 x 180 ohms/½W

Capacitors:
1 x 4.7uF/25VW PC electrolytic
1 x .047uF ceramic or metallised polyester
1 x .022uF metallized polyester
1 x 33pF N750 ceramic
1 10-40pF trimmer

MISCELLANEOUS

Light-duty hook-up wire, epoxy adhesive, solder.

OPTIONAL:

Ferguson PPA-9DC or A&R PS337 12V 1A plugpack power supply plus suitable male connector.

the 4 LED displays should be centred on the display PCB.

When the LED displays have been soldered, all the leads should be clipped as short as possible. Now attach one PCB to the other. Align the display PCB so that pin 2 of each display lines up with the corresponding copper strip on the main PCB. The top surface of the main PCB should align with the corner index marks on the display PCB. Now make the six solder connections, with the PCBs held at right-angles.

Now check that the PCB assembly will slide easily into the case, and that the display seats correctly against the front panel. If not, resolder the connections accordingly.

The resulting connection is not strong enough. We used epoxy adhesive to securely bond one PCB to the other, and suggest that you do the same. When the adhesive has set, make the interconnections from one PCB to the other, using light-duty ribbon cable, on the copper side. Follow the numbering system on the wiring diagrams to facilitate this task.

The case supplied by Dick Smith Electronics has a detachable red perspex window. The cutout in the front itself is large enough to suit a 4-digit display but must be enlarged to suit a six-digit display. This is an easy job with a pair of side-cutters.

Four holes need to be drilled in the rear panel to accommodate the time-setting switches and the supply connections. If a plugpack is to be used, a suitable socket will be required.

When the clock is initially switched on, it will show a random digit pattern with perhaps some of the digits blanked out. This is corrected by using the time-setting push-buttons.

The oscillator trimmer capacitor can be adjusted in one of two ways. The first and most precise method is to use a frequency counter of known accuracy, of one part per million or better, and adjust the timer so that the oscillator frequency (at pin 7 of the 5369) is exactly 3.579540MHz. This will result in a time accuracy of plus or minus a few seconds per month.

The second method of setting the trimmer capacitor is trial and error and involves comparing the clock time-keeping with the time signals on the radio or telephone. When the hourly "pips" are broadcast on the radio, the last pip gives the exact time to the second, eg "8.00.00". This method of trial and error can be tedious and could take several adjustments over a period of weeks for an optimum setting.

SUPERB KITS from DENMARK

Additional high quality kits coming soon!

JOSTYKIT is Europe's leading manufacturer of electronic kits featuring attractively styled boxes of Scandinavian design and high quality electronic components which will satisfy the most demanding kit builder.

JOSTYKIT's staff of qualified electronic engineers and educationalists supply up-to-the-minute, reliable electronic kits, designed around space-age solid state technology, but capable of construction without any great technical know-how or practical experience.

The JOSTYKIT instruction booklets supplied with each kit give clear, precise directions for assembly and testing. For those with special technical interests, each instruction booklet ends up by describing how the kit works. You'll always learn something when you construct a kit from JOSTYKIT.

Audio

AF300 AUDIO AMPLIFIER — 3 WATTS

A real workhorse, this universal power amp has a wide range of applications such as car radio, record players and small receivers. Due to its well designed electronic circuit, the AF300 can be used over wide voltage ranges without deterioration of the specification parameters.

Kit AF300 ..... $25.00

AF340 40 WATT AUDIO AMPLIFIER MODULE

High quality 20-20,000Hz, 37w RMS with low distortion.

Kit AF340 ..... $35.00

FM Tuners

HF325-2 QUALITY FM TUNER MODULE

The HF325 is a complete high quality FM tuner of professional standing. The tuner unit is ready-made and pretrimmed, making it child's play to assemble. Tuning range 88-108MHz, operating voltage 12-55v ac.

Kit HF325 ..... $79.00

Stereo decoder HF310 ..... $24.00

HF310 FM RECEIVER

The HF310 is a very reasonably priced HF FM tuner. Fully trimmed, the sensitivity according to IHF standards is better than 10uV. Features 60dB S/N radio and low harmonic distortion.

Kit HF310 ..... $49.00

HF330 STEREO DECODER

Gives 40-45dB channel separation, just add to a good quality FM receiver.

Kit HF330 ..... $24.00

Pre-amps (RF)

HF395 RF PREAMPLIFIER

Gain 30dB to 20MHz, 10dB to 100MHz and 5dB to 225MHz. Ideal to boost reception on short-wave receivers.

Kit HF395 ..... $6.00

HF385 VHF/UHF ANTENNA PREAMP

Superb quality with two aerial inputs and one down lead which simultaneously supplies current from the power supply. Frequency range 40-250MHz and 400-820MHz. Gain 9-18dB, depending on frequency.

Kit 385 ..... $30.00

Box B850 ..... $6.00

Optional Power Supply NT410 ..... $20.00

Quick assembly kits

JK01	GENERAL PURPOSE AMP 0.5W	$18.00
JK02	MICROPHONE AMPLIFIER	$19.00
JK03	SINE WAVE GENERATOR 20-20,000Hz	$30.00
JK04	FM TUNER 88-108MHz	$30.00
JK05	27MHz RECEIVER	$33.00
JK06	27MHz TRANSMITTER	$29.00
JK07	DUAL TONE DECODER FOR R/C MODELS	$43.00
JK08	240V AC LIGHT OPERATED RELAY	$20.00
JK09	SIREN KIT inc. SPEAKER	$19.00
JK10	PHOTOGRAPHIC TIMBER 240V AC.	$23.00
JK101	CAR BURGLAR ALARM KIT	$55.00

Light Shows

AT465 LIGHT SHOW

Turn your music into light. Simply connect this 3 channel light show to the audio terminals of your amplifier and this quality kit does the rest for you!

Kit AT465 ..... $64.00

Attractive box and knobs B6065 ..... $25.00

AT468 4 CHANNEL LIGHT SHOW

This superb kit drives 4 lights (400w per channel) from the audio amplifier output.

Kit AT468 ..... $75.00

Attractive box and knobs B3265 ..... $48.00

AT365 LIGHT SHOW

This quality kit uses microphone input instead of connection to the audio output. 1500W max.

Kit AT365 ..... $69.00

Box and knobs B3265 ..... $48.00

FM Transmitter

HF65 FM TRANSMITTER 60-148MHz

Will run 5W output with heat sink. Ideal for signal testing or for a miniature transmitter which could be received on a standard FM receiver.

Kit HF65 ..... $9.00

Ham Converter

HF305 AMATEUR BAND 2m CONVERTER

Converts 2m FM down to the FM band 88-108MHz.

Kit HF305 ..... $28.00

AM Receiver

HF61 MEDIUM WAVE RECEIVER

540-1600kHz receiver complete with ferrite coil antenna.

Kit HF61 ..... $19.00

Power Supplies

NT415 LAB POWER SUPPLY 0-30V

1 amp well-regulated supply for professional use. Complete with box and transformer.

Kit NT415 ..... $128.00

NT300 LABORATORY POWER SUPPLY 2-30V

High quality suppply, regulated 2-30V DC at 2 amps with overload protection. Complete with box and transformer.

Kit NT300 ..... $110.00

AT320 ALL ROUND AC/DC REGULATOR

This kit is a control unit with almost incredible possibilities. Use it as a touch control, burglar alarm, timer, heat/cold regulator. Power supply is built-in.

Kit 320 ..... $54.00

Sydney: **Custom Communications, 6 Orchardleigh Street, Yennora. Phone 681-3544.**

Adelaide: **Hamtronics, Goodwood Road, Kingspark. Phone 272-8417.**

Melbourne: **Eastern Communications, 898 Riversdale Road, Camberwell. Phone 836-8635.**

Canberra: **Daicom, Colbee Court, Phillip. Phone 82-3581.**

And all authorised Vicom dealers around Australia and N.Z.

NEW KITS

Dealers being appointed in all areas

MAIL ORDERS enclose $1 for P & P **to**

Distributed by:

VICOM

68 EASTERN ROAD, SOUTH MELBOURNE, VIC. 3205. PHONE (03) 699-6700

Sound effects for model trains

Designed to mate with the "High Performance Train Controller" featured in October 1978, this versatile sound effects unit should really gladden the hearts of model railroaders. It can realistically simulate the sound of both steam and diesel locomotives, the sound of air brakes being released, and even includes steam whistle and diesel air horn sounds!

by PETER STUART*

If you built the High Performance Model Train Controller featured in October EA, you will no doubt have given consideration to adding a white noise generator to the brake. The circuit presented here will therefore be of interest, because it extends that principle a little further by providing the full range of locomotive sounds, including air brake noise.

When linked to the train controller, the sounds realistically correspond to the motion of the train. Sounds available include steam locomotive exhaust, steam whistle, diesel locomotive, diesel air horn and air brake. As well, a decay circuit operates to fade out the air noise when the brakes are released.

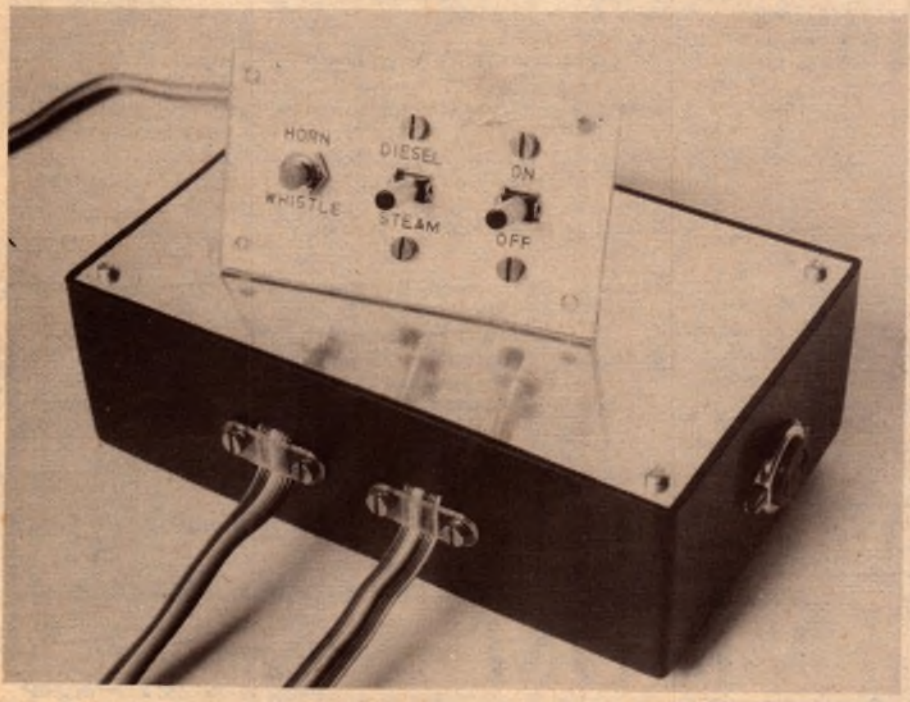
The sound generator is based on a Texas Instruments noise generator IC, the SN76477, described in detail in the June 1978 issue of EA. Briefly the SN76477 is capable of providing, at its output (pin 13), white noise, low frequency square waves, and audio from a VCO. These waveforms can be used singly, or in combination, by programming using simple logic switching. Other facilities are available on the chip, but are not utilised in this project.

To fully understand the operation of the circuit it is necessary to consider how the various locomotive sounds originate. Steam locomotive exhaust is simply white noise modulated by a low frequency square wave varying in frequency between zero and approximately 15Hz. The frequency is directly proportional to speed, but the sound exists only while the locomotive is pulling against a load. For these reasons, circuitry to reproduce this sound must be connected across the inertia capacitor, the voltage on which is directly proportional to train speed. Further, when the throttle is closed, the sound must cease; ie, the sound must only exist when the throttle voltage is greater than the inertia capacitor voltage.

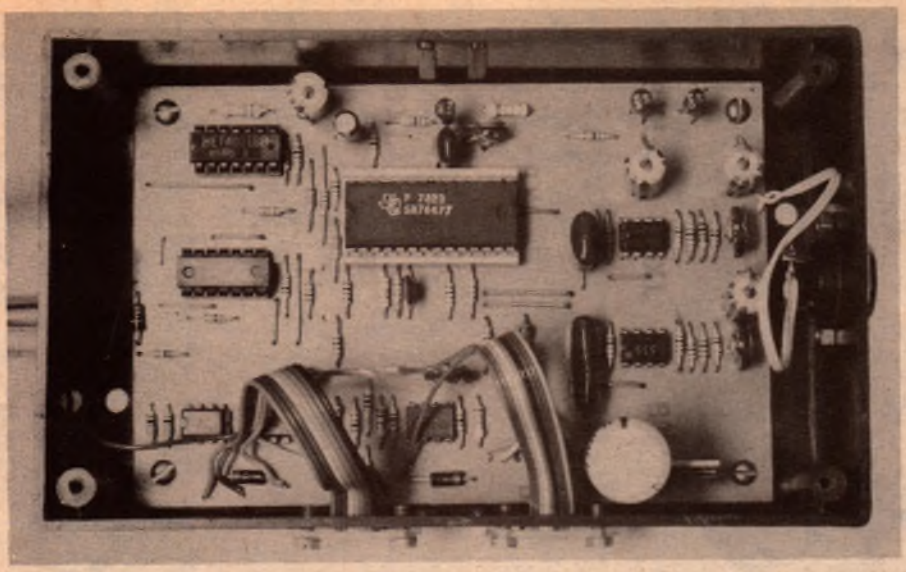
The circuitry to perform this comprises an inverting differential voltage amplifier IC3, and a comparator, IC2. IC3 is connected across the inertia capacitor and presents a voltage inversely proportional to train speed to pin 20 of IC1, when steam is selected on switch S2c. This causes the square wave generator inside IC1 to increase and decrease frequency with train speed. Trimpot R1 sets the frequency range. The white noise component is programmed by the steam/diesel selector switch and the logic gates in accordance with the truth table in Fig. 1.

Comparator IC2, is connected between the throttle pot wiper and the inertia capacitor such that the output on pin 6 is low only when the throttle voltage is greater than the inertia capacitor voltage. After feeding through gates IC6a and IC6b, a logic 0 is presented to pin 9 (enable) when the throttle is open. The diode provides a constant voltage drop, or offset, to ensure no sounds originate when the throttle is closed and the locomotive is stationary.

*24 Carmen Drive, Carlingford, NSW 2118.



At left is the prototype. The case housing the electronics can be screwed to the underside of the model layout, and the switch panel mounted on the main railway control panel.



A single PC board accommodates all the electronic components. Note plastic clamps used to secure the rainbow cables (see also facing page).

The steam whistle consists of the output from audio oscillator IC8, mixed with background white noise from IC1. The whistle can only be operated when steam is selected on switch S2. If desired, the amount of audio can be varied by adjusting the ratio of R8 to R9. R4 sets the whistle pitch.

Some readers may wonder why the internal VCO and white noise generator in IC1 are not utilised for the steam whistle. The reason is that the ratio of audio to white noise obtained in this manner is far from correct, and there is no way it can be adjusted.

Diesel engine sounds are rather more difficult to synthesise. A typical diesel engine sound contains detonation ping, exhaust beats, supercharger whine and alternator hum. In addition, each make of locomotive emits its own distinctive sound depending upon the number and arrangement of cylinders, number of strokes per cycle, and the speed range of the engine.

Clearly it would be impossible to synthesise all of these sounds to suit individual models. However, a reasonable engine sound can be generated by controlling the VCO in IC1 from the internal triangular sweep voltage, and limiting the VCO frequency sweep range from approximately 50 to 500Hz. The actual sweep range is variable using the 5k trimpot R5, so that readers can select the tone which suits them.

Since a diesel engine beat varies directly with the throttle setting, and exists even when the locomotive is stationary (engine idling) the connections to the controller are slightly different to those for steam sounds. The voltage which determines the triangular waveform frequency is taken from the throttle wiper and inverted in differential amplifier IC4. It is fed into pin 20 of IC1 via switch S2c. R2 sets the frequency range. The enable control (pin 9) is held permanently low.

The sound for the diesel air horn comes from a 555 oscillator, IC7. The frequency is variable using R3 so that individual modellers can make adjustments to suit their needs. I found frequencies around 400Hz produced a

PARTS LIST

PARTS LIST

1 Zippy box, 150 x 90 x 50mm
1 printed circuit board, 79se3, 136 x 89mm
1 8 or 16 ohm loudspeaker
1 28 pin DIL IC socket
2 14 pin DIL sockets
1 7 pin plug and socket
1 2 pin speaker plug and socket
1 3PST toggle switch
1 SPST toggle switch
1 momentary contact pushbutton switch

SEMICONDUCTORS
1 SN76477 sound generator IC
1 4001 quad 2-input NOR gate
1 4011 quad 2-input NAND gate
2 555 timer ICs
3 741 op amp ICs
1 7810 10V voltage regulator IC
1 BC558 PNP transistor
1 BC639 NPN transistor
1 BC640 PNP transistor
3 EM401 silicon diodes

RESISTORS (¼ or ½W metal glaze)
2 x 100 ohms, 15 x 1k, 5 x 1.5k, 1 x 2.2k, 9 x 10k, 1 x 39k, 2 x 47k, 1 x 68k, 1 x 100k, 1 x 680k, 6 x 1M, 4 x 2.2M, 1 x 5k mini trimpot, 4 x 10k mini trimpots.

CAPACITORS
1 390pF ceramic or polystyrene
1 0.033uF polyester
1 0.1uF polyester
1 0.22uF polyester
1 2.2uF 25VW electrolytic
4 100uF 10VW PC mounting electrolytics
1 1000uF 25VW PC mounting electrolytic

MISCELLANEOUS
Machine nuts and screws, hookup wire, rainbow cable, solder, scrap aluminium and perspex for front panel, cable clamps, etc.

NOTE: Resistor wattage ratings and capacitor voltage ratings are those used in the prototype. Components with higher ratings may generally be used provided they are physically compatible.

Fig. 1 (below): use this truth table as an aid to diagnosing circuit faults.

SN76477	STEAM			DIESEL		BRAKE
PIN	THROTTLE OPEN	THROTTLE CLOSED	WHISTLE	ALL THROTTLE SETTINGS	HORN	RELEASE SERVICE EMERGENCY
1	0	0	0	1	1	0
9	0	1	0	0	1	0
25	0	0	1	0	0	1
27	1	1	0	0	0	0
28	1	1	1	0	0	1

Tandy Parts Turn Your Ideas Into Projects

Photographic Printed Circuit Board Processing Kit

- 8 Piece Kit
- Includes all materials
- Fast, Most Accurate way to produce professional quality

The procedure is almost foolproof and the results are astonishing! Simply spray a copper-clad PC board with the Sensitizer, place a negative of the circuit you want to reproduce over the board, expose the board to strong light, develop it, etch it, clean it — and you have a precise printed circuit! Includes all materials necessary and comes complete with instructions.

276-1560

Normal Retail Price 19.95

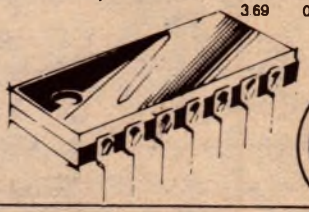
save $7 — 12.95

74C Series CMOS Integrated Circuits

- Guaranteed Electrically, Mechanically

	Reg.	Sale	Save
RS74C00 Quad Two-Input NAND Gate. Low Power, TTL compatible. 276-2301	1.09	0.50	0.59
RS74C02 Quad Two-Input NOR Gate. For digital systems Low power, TTL compatible. 276-2302	1.09	0.50	0.59
RS74C04 Hex Inverter. 276-2303	1.09	0.50	0.59
RS74C08 Quad Two-Input NAND Gate. 276-2305	1.09	0.50	0.59
RS74C74 Dual D Flip-Flop. 276-2310	1.99	0.50	1.49
RS74C76 Dual J-K Flip Flops. 276-2312	2.39	0.50	1.89
RS74C90 4-Bit Decade Counter. 276-2315	3.39	0.50	2.89
RS74C192 Synchronous 4-Bit Up/Down Decade counter. 276-2321	3.69	0.50	3.19
RS74C193 Synchronous 4-Bit Up/Down Binary Counter. 276-2322	3.69	0.50	3.19

100% prime, direct from National Semiconductor! All utilize MOS (CMOS) IC's and N and P-channel enhancement mode transistors. Require from 3.0-15V.IV guaranteed high noise margin. Inputs protected against static discharge.



50¢ ea

Resist-Ink Solvent

Use on PC boards after etching. Removes any remaining ink, lacquer or flux. 59.1 ml (2 fl. oz). 276-1532

'78 Cat. Price 1.69

save $1.20 — 49¢

Etchant-Resist Synthesizer

Photo-sensitizes PC boards, allowing the transfer of circuit patterns to boards by exposure to light. 88.7ml (3 fl.oz). 276-1562

'78 Cat. Price 4.69

save $2.70 — 1.99

Masking Film

Cut-and-peel type. Cut it where copper is to remain, then remove excess. 20.32x25.4 cm (8x10") sheet. 276-1563

'78 Cat. Price 2.69

save $1.70 — 99¢

AT THESE PRICES THEY WON'T LAST!

0.6" LED Single Digit Readout

Bright Red 7-segment Display is easy to read up to 7.6m

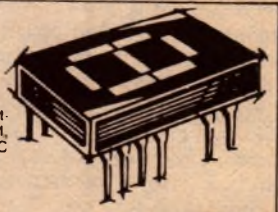
For comfortable viewing. Left decimal. Output, typically 5.0 mcd at 20 mA. Circuit board mounting similar to Litronix 747. Intensity-coded for uniformity. Common Cathode. 276-066

Normal Retail Price 4.99

save $2 — 2.99

0.3" LED Single Digit Readout

Circuit Mounting Board



Easy to read up to 3.048m (10'). Light-pipe construction. Left and right decimals. Voltage per segment, 1.7V at 20 mA. Light output, 0.25 mcd at 10 mA. IC compatible. Set of 4.

	Reg.	Sale	Save
Common Anode 276-1210	12.95 Pkg 4	5.99	6.96
Common Cathode 276-1211	12.95 Pkg. 4	5.99	6.96

save $6.96 — 5.99

Two 30-Watt Power Transistors

Ideally suited for audio output stages, bull horns, PA systems. Complimentary pair similar to 2N4921 and 2N4918. 276-117

'77 Cat. Price 2.95

sale — 30¢

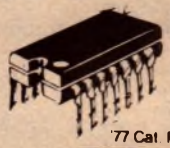
Right-Angle IC Slot

Allows LED displays to be mounted vertically for easy viewing. Standard 16-pin spacing. 276-1985

Normal Retail Price 1.99

save $1 — 99¢

Phase-Lock Loop



Type LM-565. General-purpose. Frequency range, 0.001 Hz to 500 kHz. Requires 5-12 VDC at 12.5mA. 14-pin DIP. 276-1720

'77 Cat. Price 5.25

sale — 1.99

IC Digital Clock Chip

RS-7001. 12-hour calendar alarm clock. 276-1756.

Normal Retail Price 14.95

save $5 — 9.95

Temperature Controller

RS3911. Rated for operation over a -25°C to +85° temperature range. 8-pin epoxy mini-DIP case. 276-1706

Can be calibrated in °K, °C, °F

Normal Retail Price 3.99

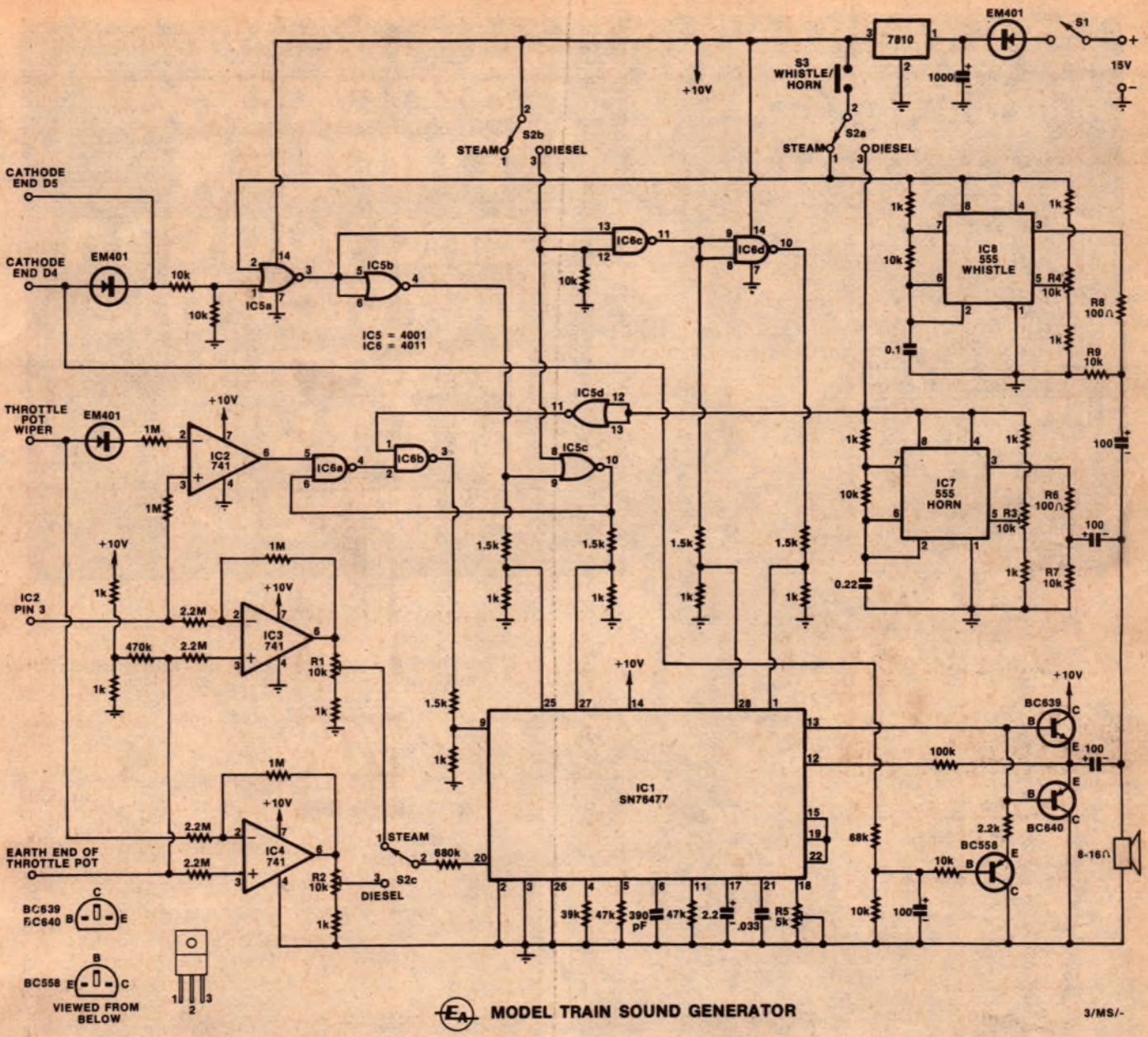
save $2 — 1.99

Pre-Punched Phenolic Perfboards

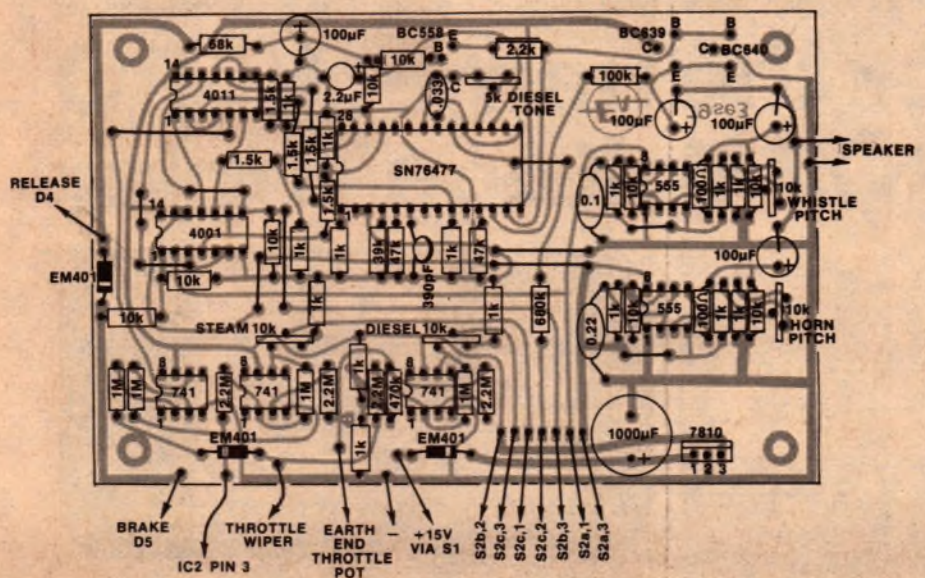
Cat. No.	Size	Reg.	Sale	Save
276-1583	17.4x24.7cm	2.49	1.49	1.00
276-1393	14.2x22.8cm	2.69	1.49	1.20
276-1391	14.2x22.8cm	2.39	1.49	0.90

save up to $1.20 — 1.49

Call in or Mail Order from any Tandy Store or Participating Dealer or Tandy Electronics Mail Order Department, P.O. Box 229, Rydalmere, N.S.W. 2116.



The SN76477 sound generator IC from Texas Instruments forms the heart of the circuit (top). Below is the component overlay diagram as viewed from the component side of the board.



realistic horn sound for a typical main line diesel locomotive. Pin 9 is held high to disable any sounds from IC1.

Finally, the air brake sound is simply white noise, controlled by the brake switch on the controller and generated by IC1. This sound is available at all times in both steam and diesel modes. A special decay circuit utilising a BC558 transistor causes the white noise to fade out over a period of about one second when the brakes are released. This is intended to simulate the sound of air escaping to atmosphere from the brake cylinders.

The easiest way to understand the operation of the fade circuit is to picture the BC558 as a variable resistor in series with the 2.2k resistor. Normally the transistor is near saturation and the amplifier transistors, BC639 and BC640, are biased to earth with about 2.2k ohms. When the brakes are released,

Stock one TRIPLER and you can service the majority of CTV's in Australia

The MH1001/PO3 manufactured by Varo is the extremely reliable 32KV Silicon Voltage Tripler chosen by many leading TV manufacturers in America, Europe and Australia for their colour TV production.

Soanar Electronics Pty. Ltd. now have substantial stocks of this Tripler available for use as direct replacements or substitutes in the repair or servicing of television sets.

The Varo MH1001/PO3 replaces Philips, Ero, Roederstein, Procon, AEG, Siemens and Origin Triplers and can be used in the following brands of CTV receivers:

Philips Kriesler Philco Korting Siemens Healing Telefunken Schaube Lorenz Norge Blaupunkt ITC HMV/EMI Luxor Graetz AWA/Thorn Nordmende Barko Saba Rank Pye Luxor Grundig Decca Autovox

Remember the name! VARO MH1001/PO3 Voltage Tripler

By stocking one 'universal' type Tripler, you can reduce your inventory and save time, space and costs.

What is more, Soanar can provide circuits for utilising the MH1001/PO3 in those earlier model CTVs, as well.

Available in every state. Just phone us.

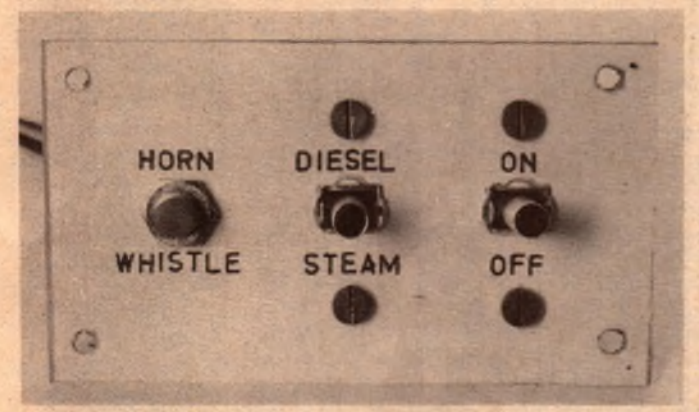
SOANAR GROUP

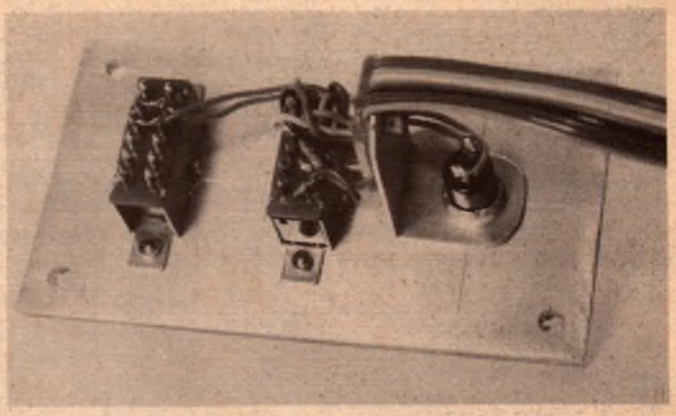
SOANAR

Soanar Electronics Pty Ltd

A member of the A & R Soanar Electronics Group
30 Lexton Road, Box Hill, Vic., 3128. Australia

SALES OFFICES	
VICTORIA: 89 0661	S. AUST.: 51 6981
N.S.W.: 789 6733	QUEENSLAND: 52 5421
	W. AUST.: 381 5500





The switch panel (left) is made by sandwiching together 18 SWG aluminium, a sheet of white card with black lettering, and 1.5mm thick clear perspex. View at right shows how rear of switch panel is wired.

the 100uF capacitor charges through the 68k resistor, decreasing the conduction of the BC558, and thus increasing the effective bias resistance on the amplifier.

Under these conditions, the output volume of the amplifier rapidly fades to zero. There is a slight recovery time for the fade circuit after the brake handle is moved to "running", during which the pre-existing locomotive sound swells to its original volume. In practice, it really only affects the diesel engine throb, and the effect is minimal.

So far, only brief mention has been made of the logic gates, IC5 and IC6. As explained previously, the sounds available from the SN76477 are determined by programming the logic input pins. The logic voltages are either +5V (logic 1) or zero volts (logic 0). Because of the large number of combinations, mechanical switching of the five logic inputs becomes unwieldy, so logic gates have been employed. CMOS logic gates appeared to be a good choice because of their wide supply voltage range. The voltage dividers on the CMOS outputs are necessary to limit the logic swing from 0 to 5V to suit IC1.

Input requirements are a 15VDC supply, typically from the same source as the controller. A 10V regulated supply is derived from this by a 7810 IC voltage regulator. 10V was chosen because of the requirements of the SN76477. It also suits the other ICs and gives a reasonable sound level when driving an 8 ohm speaker through the amplifier. Readers will recognise this part of the circuit as being similar to that used in the June article. Avoid using speakers smaller than 10cm, as their limited low frequency response tends to impair the quality of the diesel sounds, particularly the air horns.

On the construction side, readers should have little difficulty provided the work is not rushed and reasonable care is taken. Most of the components are accommodated on a single PCB, code 79se3. The board is mounted in a 150 x 90 x 50mm plastic utility case, which can be screwed to the underside of the model layout. The switches are mounted on the railway control panel using rainbow cable to connect to the PCB.

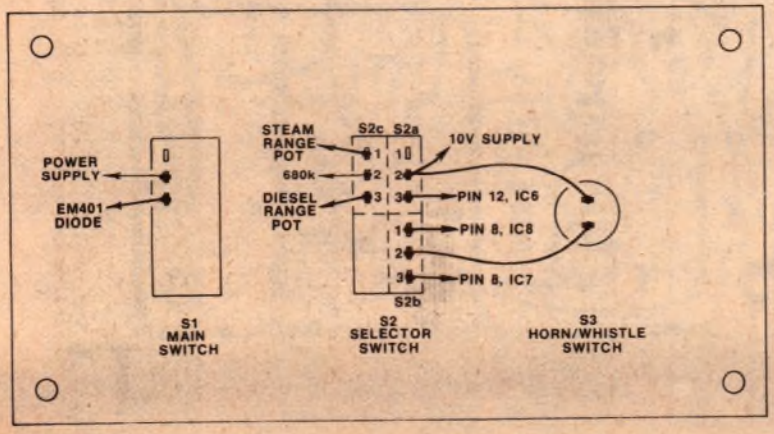
Because of the large number of connections necessary to the controller, use of a plug and socket is recommended. When attaching the wiring to the controller, it will be found necessary to break the copper pattern where it joins the cathodes of D4 and D5, before soldering one wire to each diode.

Here, we should point out that there is an error in the component overlay diagram on page 44 of the October 1978 issue. The anode of diode D5 should connect to the anode of diode D6, and not to the cathode of D6 as shown. To correct this fault, cut the copper track between D5 and D6, and connect the anode of D5 to the anode of D6 (at the switch terminal) with a short length of hook-up wire. The circuit diagram shown on the same page is correct.

Because of the close spacing of components on the PCB, metal glaze resistors have been specified in the parts list. There are eleven links to be inserted, one of which lies partly under IC1.

If you have not used CMOS ICs before, take care with the 4001, 4011 and SN76477. IC sockets are recommended, particularly for these ICs. Sockets allow every other component to be soldered to the board, then the ICs are simply inserted (without touching the pins) as a last step. If you do solder the ICs direct to the PCB, earth the board to the barrel of your soldering iron, and solder the supply pins first.

Check all wiring very carefully, particularly that which runs to the switches and the controller. Switch on and check out all the sounds, remembering that the range pots for both steam and diesel will need careful adjustment. If it is found that the steam beats begin before the locomotive actually moves, and this cannot be cured using R1, ad-



Follow this diagram and the photograph at top of the page when wiring up the switch panel.

justment of the zero speed pot on the controller may be necessary. In extreme cases, changing the value of the 680k resistor to pin 20 of IC1 can be beneficial.

If problems are encounted with the logic circuits, the truth table in Fig. 1 will be found useful in diagnosing the fault.

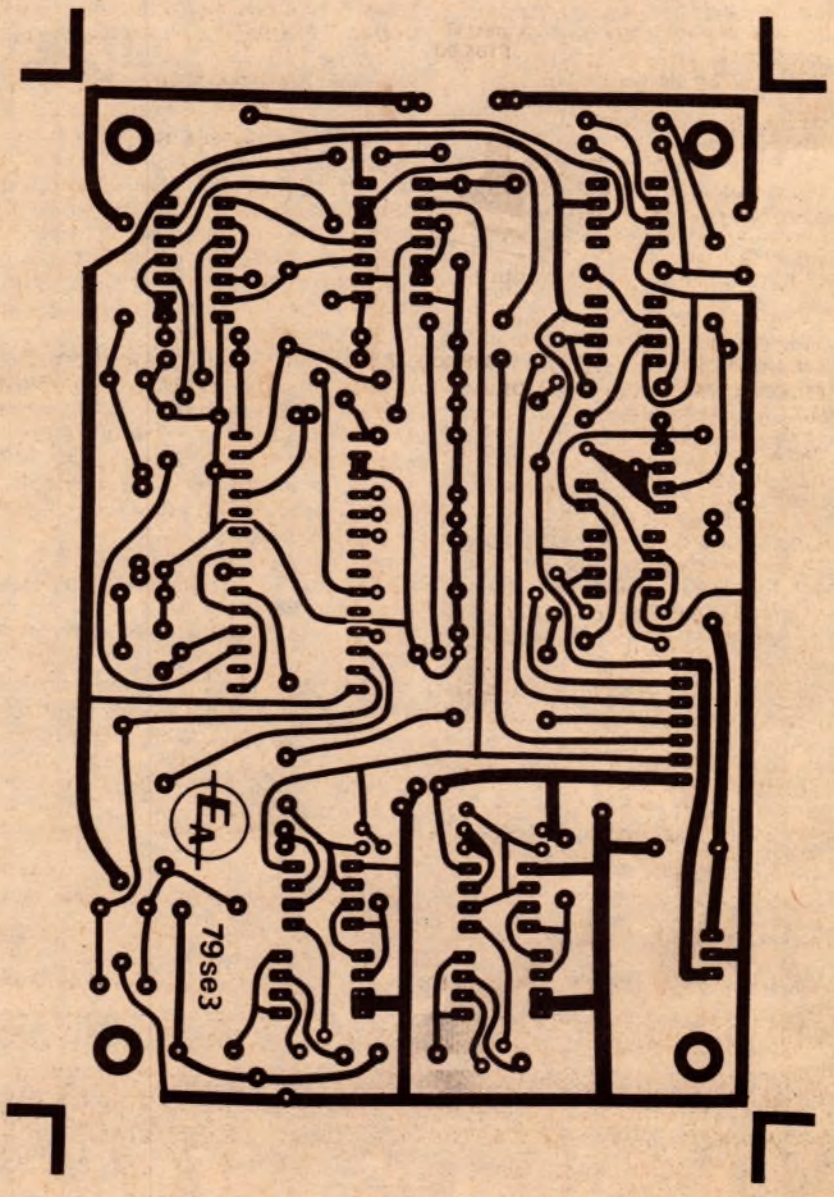
For those who may wish to tailor the circuit to suit their own needs, the following information may be useful. The output volume of sounds generated by the SN76477 can be adjusted by varying the 2.2k resistor on the amplifier base circuit. Practical limits lie between 1k (loudest) and 5k (softest). The output volume from either of the 555 oscillators is dependent on the ratio of the 100 ohm to 10k resistors. For louder sounds, the 100uF capacitors can be connected directly to pin 3 and the resistors omitted; for lowest sound volume the two resistors should be equal at 4.7k. A 7812 voltage regulator can be used in place of a 7810, to give a 12V supply, but the overall sound level will be much greater. Do not go above a 12V supply.

The circuit will operate on speaker impedances of 8 or 16 ohms, and headphones can be used if other members of the family complain about trains rumbling through the house!

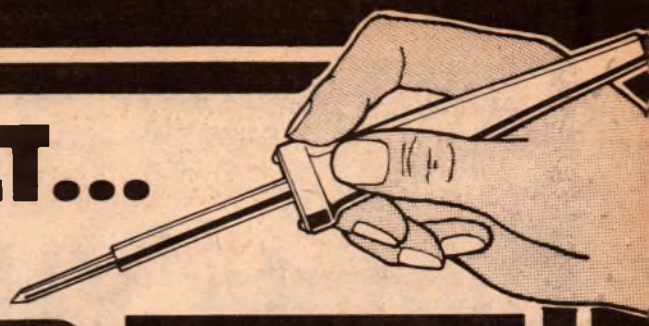
The rate of decay on the brake release fade circuit is determined by the 100uF capacitor. This can be varied between 50 and 250uF to give shorter or longer fade periods respectively.

Finally, if you run only steam or only diesel locomotives you can use the same PCB, leaving out the unnecessary components. The CMOS logic circuits remain the same. Use wired links to replace the steam/diesel selector switch. And if you want to run and simulate the sounds from double headed trains, just build two sound generators!

Below is an actual size reproduction of the PC artwork.



BUILD A PROJECT...
from a Dick Smith kit



CAR STEREO BOOSTER (E.A. January 1979)
Boosts power output of your car cassette or FM stereo radio to 12 watts per channel — gives you home quality sound while you drive. This project is extremely easy to build. The Dick Smith kit contains everything you need — even a special anodised heatsink bracket and front panel decal — plus a specially written step-by-step construction manual.

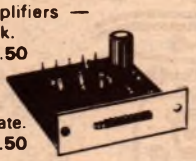
$29.50
Cat. No. K-3493

AUDIO AND AMPLIFIERS

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 .... $159.50



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

ETI480 100W POWER AMP MODULE
(E.T.I. December '76)
100 watts for $25.00? Unreal, man! (mono module).
Cat. K-3442 ..... $25.00

ETI480PS 50W POWER AMP MODULE
(E.T.I. December '76)
As above, but 50W. Easily extended to 100W.
Cat. K-3440 ..... $19.50

CAR STEREO BOOSTER
(E.A. January '79)
Boosts power output of your car cassette or FM radio to 12 watts per channel.

Cat. K-3493 .... $29.50

ETI480PS POWER SUPPLY MODULE
(E.T.I. December '76)
To run either 1 x 100W or 2 x 50W modules.
Cat. K-3438 ..... $19.50

MUSICOLOR Mk 111 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 amps.
Cat. K-3425 ..... $13.50

AMATEUR CB, ETC.

VK POWERMATE
(E.A. May '78)
Shortform kit – no metalwork, mains wiring etc.
Cat. K-3449 ..... $32.00

CB POWER SUPPLY
13.8 volts at 2A continuous (4A peak). Complete kit.
Cat. K-3448 ..... $29.50

MORSE KEYER
(E.A. April '78)
Perfect Morse code — electronically generated. Including paddle.

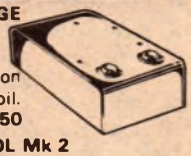
Cat. K-3470 ..... $39.50

45 WATT VHF AMPLIFIER
Fibreglass PCB, 13.8V operation. Requires 8 -- 12W of 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

MISCELLANEOUS

CAPACITOR DISCHARGE IGNITION
(E.A. July '75)
Save petrol, end ignition troubles. Pre-wound coil.



Cat. K-3280 ..... $27.50

DRILL SPEED CONTROL Mk 2
(E.A. July '76)
Suits 240V 'universal' motors (not electronically switched or controlled types).
A must for the home handyman.
Cat. K-3080 ..... $13.50

HIGH POWER STROBE
(E.T.I. August '71)
A real blast — ideal for parties, discos, etc.

Cat. K-3150 ..... $29.50

TV MASTHEAD AMPLIFIER
(E.T.I. August '71)
Can turn an unwatchable mess into a brilliant picture.
Cat. K-3230 ..... $32.00

MAIL ORDERS? Certainly! Postage & packing extra.

COMPUTERS, ETC.

LOW COST VIDEO DISPLAY UNIT
(E.A. February '78)
Communicate with a computer. Matches above.
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

2650 MINI COMPUTER
(E.A. May '78)
1k of memory — contains ALL parts required.

Cat. K-3447 .... $125.00

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 player to communicate with computer.
Cat. K-3465 ..... $24.50

SHORTFORM MINISCAMP
(E.A. May '77)
Contains PC board and components only.
Cat. K-3445 ..... $59.00

TV GAMES

10-GAME VIDEO GAME
(E.A. July '78)
Features 4-way bat control, many combinations of bat sizes, ball speeds, angles, etc.
Cat. K-3491 ..... $49.50

STUNT MOTORCYCLE GAME
(E.T.I. June '78)
Play 4 different games, motorcross, enduro, drag and stunt. Easy to build!
Cat. K-3474 ..... $29.50

TEST EQUIPMENT

40MHz DIGITAL FREQUENCY COUNTER
(E.A. August/Sept. '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

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

R-L-C 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 valuable service aid.
Cat. K-3469 ..... $32.00

NOTE: Prices & stock availability could change between publication deadline & on-sale date due to circumstances beyond our control. Please check with our stores for latest availability & prices.

* SEE OUR DOUBLE PAGE AD FOR FULL LIST OF STORES AND DEALERS

DICK SMITH ELECTRONICS

Explore the VHF spectrum with this

Simple VHF Receiver

Here's a novel little project designed especially for the experimenter. You can build it up very easily and use it to explore the VHF radio spectrum. It can be modified in a number of ways, if you wish, to extend its performance — you can even listen in to the FM broadcasts, using the "slope detection" technique.

by IAN POGSON

Simple regenerative receivers have always had a fascination, especially for beginners but also for more experienced hobbyists. The most common types in the past have been made to tune the medium wave or broadcast band, although some have also been made to tune the lower end of the high frequency range. Generally the upper limit seems to have been drawn at about 30MHz; rarely does one see a simple regenerative receiver made to tune any of the VHF band.

Recently my attention was drawn to a neat design for a VHF regenerative receiver tuning the VHF FM band (88MHz to 108MHz) and described in "Radio and Electronics Constructor" for May, 1978. It looked quite promising and suggested the idea of producing a similar unit adapted for Australian conditions. The idea seemed straightforward enough, although on further analysis component availability posed some problems.

There were three items in particular which posed problems. They were (1) a direct replacement FET for the regenerative detector; (2) a variable capacitor for tuning; and (3) a specified name-brand inductor with no value given. All of these obstacles were overcome, as the circuit diagram bears witness.

A rough prototype was made up using a locally available junction FET. The inductor was provided for by using a low value RF choke, one of a series readily available. The inductor turned out to be non critical and no further problem was encountered here.

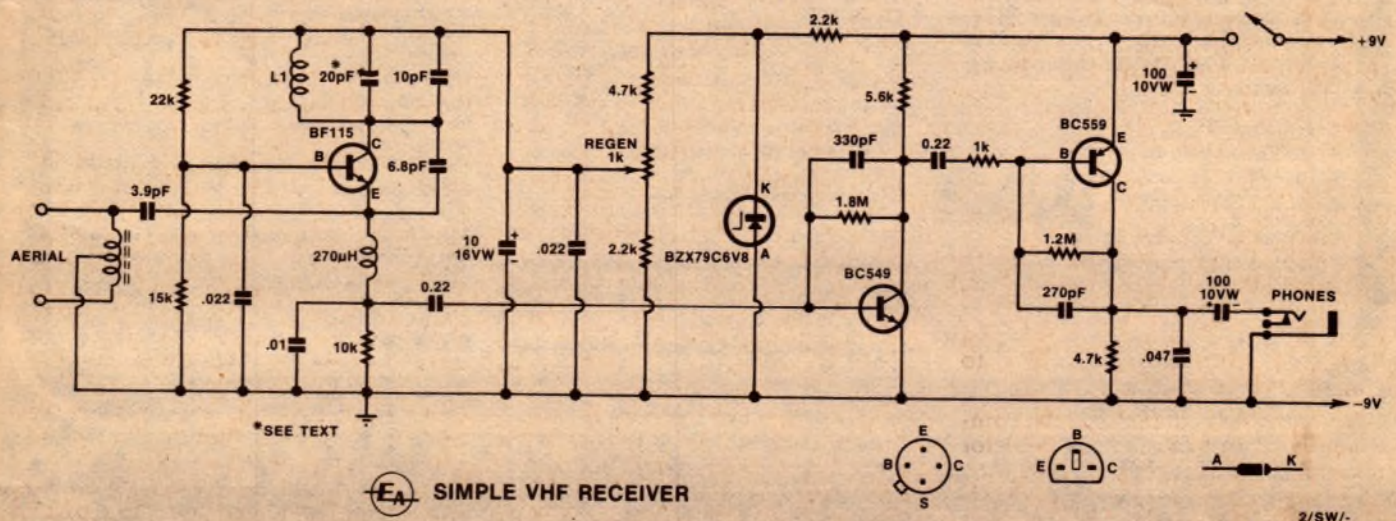
For the tuning capacitor I first used a BA102 varicap diode, controlled by a potentiometer from a zener regulated power supply. The varicap did work, but it was difficult to make it cover the full band. Also, the "Q" of the tuned circuit seemed to be low and it was difficult to maintain satisfactory regeneration right across the band.

At this stage, it seemed wise to try to locate a suitable miniature variable capacitor. After some searching, one which is little larger than a trimmer was located at Davred Electronics Pty Ltd, 104-106 King Street, Newtown, NSW 2042, where readers may obtain similar ones for building this receiver (type C1604). After fitting this capacitor, it was found that it would easily cover the wanted band, as well as making regeneration of the stage more satisfactory. However, I was still anything but satisfied with the overall performance, particularly with regard to sensitivity.

I must hasten to mention at this point that a simple receiver of this type cannot be expected to bring the world to your doorstep. It is purely a "fun" type of device but I felt that in spite of all this, it could be improved. But how?

The thought that a good bipolar transistor can give quite high gain, particularly when compared with the usual junction FET, prompted me to try a substitution. Obviously biasing would have to be changed, but this could be done without introducing any real problems. This done, we were rewarded with a receiver which had rather more "get up and go" than previously. The operating conditions were optimised and this is how we arrived at the circuit for the detector.

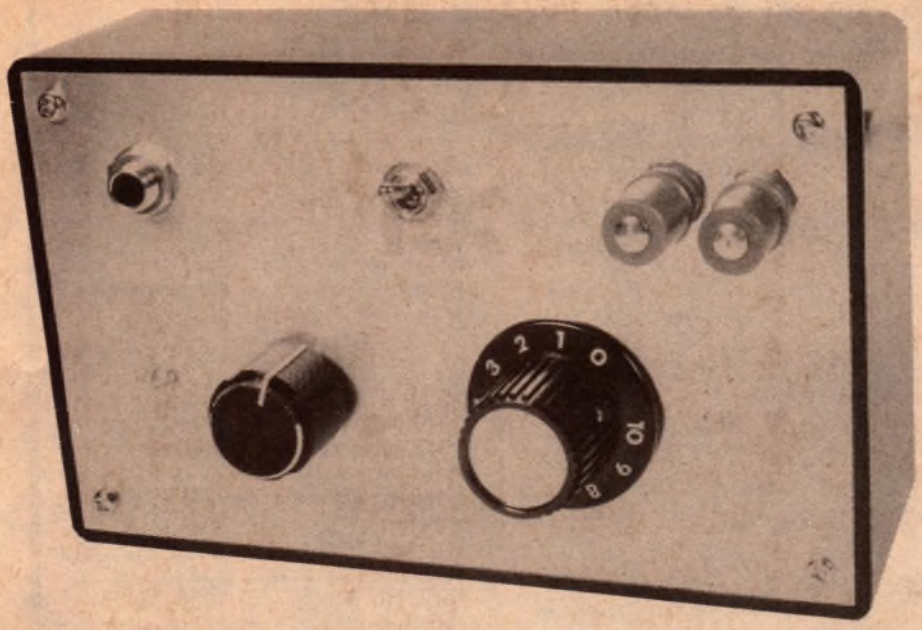
At this stage, let's have a look over the whole circuit and see what makes it go. In order to provide for a balanced aerial feeder system, a "balun" transformer is used to feed the signal into the emitter of the detector, via a 3.9pF blocking capacitor. Incidentally,



SIMPLE VHF RECEIVER

2/SW/-

A regenerative detector followed by a two-stage audio amplifier forms the basis of the new receiver.



Front panel facilities are (clockwise from top left): headphone socket, on/off switch, aerial terminals, tuning control, and regeneration control.

the capacitor is made very small to avoid loading the detector unduly, which would stop its proper operation. The 270uH RF choke is used to prevent the RF signal from being short circuited to earth via the .01uF capacitor, which bypasses the 10k emitter resistor.

The 10k emitter resistor just referred to is somewhat higher in value than would normally be expected. However, although the value is not critical, this order of resistance seems to give close to optimum performance. It is also worth noting that it is across this resistor where the audio is taken from the detector. The .01uF capacitor is of such a value that it bypasses residual RF components but not the audio frequencies.

The base bias is set by the 22k and 15k resistors and the base is grounded to RF by the .022uF capacitor. Feedback is obtained with the 6.8pF capacitor between collector and emitter. The collector circuit is tuned with the inductor L1 and the variable capacitor of 20pF. The tuning range is limited with the 10pF fixed capacitor shunted across the variable capacitor.

Regeneration is controlled by the 1k potentiometer, by varying the supply rail voltage to the detector transistor. The voltage supply for regeneration is regulated by the 6.8V zener diode. This helps to avoid having to change the setting of the regeneration control with changes in battery voltage due to aging.

As mentioned earlier, the audio component is taken from the 10k detector emitter resistor. From here it is fed via a 0.22uF capacitor to the first audio amplifier, BC549. From this stage, the signal is also fed via another 0.22uF capacitor to the second audio amplifier, BC559.

High frequency response is limited in the audio amplifiers by the 330pF and 270pF capacitors shunting the 1.8M and 1.2M resistors respectively. The high frequency response is limited further by the low pass filter consisting of the 1k resistor and the capacitance in the base of the second audio amplifier, together with the .047uF capacitor across the 4.7k collector resistor. All this is done to avoid any trouble with RF getting into the audio stages.

The audio output from the receiver is sufficient to drive a pair of headphones or an earpiece. We have tried a crystal earpiece as well as high and low impedance headphones. While high impedance headphones are to be preferred and I suggest that you use them if you have a pair, even 8 ohm headphones can be used quite satisfactorily. A crystal earpiece is not very comfortable to use in my opinion, but it will do the job quite well and it may be connected directly across the 4.7k collector resistor by omitting the 100uF electrolytic if you wish (although leaving it in won't do any harm).

Another idea would be to use a set of low-impedance (8 ohm) phones with an old speaker transformer for matching. Connect the phones to the "voice coil" side, and the high impedance side to the receiver output.

The current drain of the whole receiver is only about 2 or 3mA and so the relatively small 9V battery should give many hours of listening time.

Construction of this little receiver is simple and straightforward but as it is for use at very high frequencies, a certain amount of care must be taken to ensure satisfactory operation.

PARTS LIST

1 Zippy box, 150mm x 90mm x 50mm
2 Aerial terminals
1 SPDT miniature toggle switch
1 6.5mm stereo panel socket
1 Variable capacitor 20pF (see text)
1 Potentiometer 1k linear
2 Knobs to suit
1 9V battery No 2362
2 Brass spacers 25mm long tapped ⅛in Whitworth
1 Balun core Neosid type 1050/1/F14
1 Miniature resistor panel, 18 tags long
1 270uH RF choke
1 Zener diode BZX79C6V8 or similar 6.8V type
1 Transistor BF115 or similar
1 Transistor BC549 or similar
1 Transistor BC559 or similar

RESISTORS (½ watt)

1 1k	*1 15k*
2 2.2k	*1 22k*
2 4.7k	*1 1.2M*
1 5.6k	*1 1.8M*
1 10k	

CAPACITORS
1 3.9pF NPO ceramic
1 6.8pF NPO ceramic
1 10pF NPO ceramic
1 270pF polystyrene
1 330pF polystyrene
1 .01uF 50V greencap
2 .022uF 25V ceramic
1 .047uF 63V ceramic
2 0.22uF 100V greencap
1 10uF 16VW electrolytic
2 100uF 10VW electrolytic

MISCELLANEOUS
Hookup wire, solder lugs, solder, battery clips, insulating washers, 20 gauge tinned copper wire, 24B&S enamel wire for balun.

NOTE: Resistor wattage ratings and capacitor voltage ratings are those used in the prototype. Components with higher ratings may generally be used provided they are physically compatible. Components with lower ratings may also be used in some cases, provided the ratings are not exceeded.

Before proceeding, it should be pointed out that not all locations have an FM broadcasting service and this should be considered before readers embark on the construction of this little receiver. However, it is possible to make some simple alterations to make the receiver cover other ranges. These could include the 144MHz to 148MHz amateur band, the 118MHz to 136MHz aeronautical band, the 75MHz to 85MHz fixed and mobile band, and possibly some others.

It should also be noted that where there is not an FM broadcasting or TV service on a particular channel in a

RADIO PARTS

MULTIMETERS OVER 40 MODELS NOW IN STOCK

Multimeters — Digital voltmeter CRO's and calculators ideal for students, engineers and service technicians — A vast range of test equipment is now on show in our showrooms.

TMK VF5
20,000 Ohms/V
$31.30
($27.22 plus 15% tax)

SPECIFICATIONS —

DC VOLTAGE:	0-0.25-2.5-10-50-250-1,000V at 20,000 Ohms/V
AC VOLTAGE	0-10-50-250-1,000V at 9,000 Ohms/V
DC CURRENT	0-50uA, 0-10-250mA, 0-10A
RESISTANCE	0-5-50-500K, 0-5M (64-640-6.4K 64K at centre)
BUZZER:	
CAPACITANCE	0.0005-0.2uF (AC 50V range) 0.005-1uF (AC 10V range)
DECIBELS:	-18 to +22dB. (0dB=1mW in 600 ohm)
PROTECTOR:	diodes and fuse

DIGITAL VOLT METERS
SINCLAIR PDM35
$63.47
($55.19 plus 15% tax)

SINCLAIR PDM35
SPECIFICATIONS —

SENSITIVITY:	3½ Digit LED Display (10 Meg Input DC)
DC VOLTAGE	1 MV to 1000 V (Four Ranges)
AC VOLTAGE	1 V to 500 V (40 Hz — 5 kHz)
DC CURRENT	1 MA to 200 MA (Six Ranges)
RESISTANCE	1Ω to 20 Megs. (Five Ranges)
DIMENSIONS:	153 x 76 x 38 mm
POWER	9 Volt Battery (e.g. 216 Eveready)

A full scientific calculator with LCD display.

National Semiconductor NS108

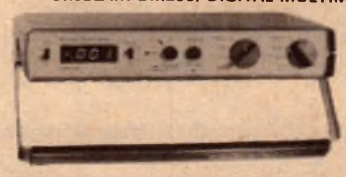
A superb new, ultraslim (7.5mm thin) scientific calculator featuring a 10-digit liquid crystal display, 11-digit internal calculating for extra accuracy, and special display prompting for user convenience plus all the calculating power that you expect from National Semiconductor. Improved circuitry and the inherent low power drain of liquid crystal displays provide for over 860 hours of operation.
The improved internal accuracy of the NS108 can be easily demonstrated: key in the number 30 and then the functional sequence cosine, tangent, sine, sine^{-1}, tangent^{-1}, cosine^{-1}; the number 30 will appear as the answer. Most other calculators would show a result slightly less than 30 due to internal roundoff.
The liquid crystal display contains a series of alphabetic characters which appear below the display numbers to signal the mode of the calculator, particularly helpful during lengthy calculations.

RADAR MODEL 200H
20,000 Ohms/V
$15.95
($13.86 plus 15% tax)

SPECIFICATION (14 MEASURING RANGES) —

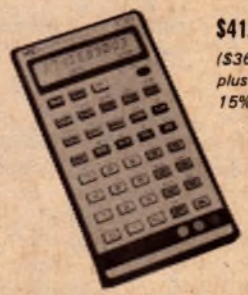
SENSITIVITY:	20,000 Ohms/Volt DC
DC VOLTS	0.5, 25, 125, 500, 2500
AC VOLTS	0-10, 50, 250, 1000
DC CURRENT	0-50uA, 250mA
RESISTANCE	0-50K, 0.5M Ohm
DECIBEL	-20 to +22
DIMENSIONS	118 x 85 x 34mm
WEIGHT	0.29 kg
ACCESSORIES	Test Prods, 1.5v Battery, Instructions

SINCLAIR DM235, DIGITAL MULTIMETER



$149.62
($130.10 plus 15% tax)

FEATURES OF THE DM235
● 3½ digit resolution ● Large, bright, wide angle LED display reading to ±1999 ● Automatic polarity selection ● Industry standard 10M ohm input impedance ● 0.5% of reading basic accuracy
Six functions in 28 ranges ● DC Volts — 1mV to 1000V ● AC Volts — 1mV to 750V ● DC Current — 1uA to 1A ● AC Current — 1uA to 1A ● Resistance — 1 ohm to 20M ohm ● Diode test — 0.1uA to 1mA ● 10M ohm input impedance
Reading rate: 2½ per second **Temperature coefficient:** <0.05°C of applicable accuracy specification **Dimensions** 10" x 5.8" x 1.6" (255 x 148 x 40mm)
Supplied complete with test leads and prods, and operator's instruction manual.



$41.69
($36.25 plus 15% tax)

Features ● Ten-digit liquid crystal display shows full 10-digit mantissa or 8-digit mantissa and 2-digit exponent plus sign ● Display prompting alpha characters below the mantissa signal the calculator mode: ● "X10" helps interpret scientific notation ● "DEG," "RAD" or "GRAD" indicates the angular mode ● "HYP" indicates hyperbolic mode ● and "Σ out" shows while performing statistical summations and the pending nature of the problem ● "F" or "2nd" indicates secondary function of double function key will be selected ● Direct access accumulating memory: M+, M−, MR. Memory store, Memory-Display exchange ● Two levels of parenthesis ● Trigonometric and logarithmic functions, inverse trig and log, hyperbolic functions ● Algebraic logic ● Statistical functions: three accessible, accumulating memories for summations ● Sum X, X^2, and n ● Calculates mean and standard deviation, adding to and subtracting from the summations as well ● Separate keys for permutations and combination calculations ● Mode selection in degrees, radians or grads ● Rectangular/ polar co-ordinates ● Degrees, minutes, seconds ● Square, square root and factorial X! ● Reciprocals, powers and roots ● Integer/fraction isolation ● Degree, radian, grad conversion ● Complete with vinyl billfold style carrying case and 3 silver oxide batteries.

TMK 500
30,000 Ohms/V
$45.31
($39.40 plus 15% tax)

TMK 500
SPECIFICATIONS —

SENSITIVITY:	30kΩ/Volt DC, 13kΩ/Volt AC
DC VOLTAGE	0.25V, 1V, 2.5V, 10V, 25V, 100V, 250V, 1000V
AC VOLTAGE	2.5V, 10V, 25V, 100V, 250V, 500V, 1000V
DC CURRENT	250uA, 5mA, 50mA, 500mA, 12A
SHORT TEST	Internal Buzzer
DECIBELS	-20 to +62dB
DIMENSIONS	160 x 85 x 70 mm

N.L.S. — LM-350 WITH LCD DISPLAY

SPECIFICATIONS:
SENSITIVITY: 3½ Digit LCD Display (10 Meg Input AC/DC)
DIMENSIONS: 96 x 66 x 47 mm

$123.82
($107.67 plus 15% tax)

MODE	RANGE	ACCURACY LM 300	ACCURACY LM 380	RESOLUTION	INPUT RESISTANCE	TEST CURRENT
VOLTS DC	1 10 100 1000	±1% Reading	±0.5% Reading	1 mV 10 mV 100 mV 1 V	10 M ohm	
KILOHMS	1 10 100 1000 10000	±1% Reading	±0.5% Reading	1 ohm 10 ohm 100 ohm 1 k ohm 10 k ohm		1 mA 100 uA 10 uA 1 uA 100 nA

KAMODEN Model 360-TRCX
Multimeter with Capacitor & Transistor Tester
PRICING CODE No. 2849 8750

● High input impedance of 100k ohms/V at DCV range adopting 8.5uA ultra-sensitive meter. ● Measurable h_{FE} and I_{CEO} value of transistors. ● Able to measure the capacitance value of capacitors by built-in transistor oscillator. (50pF–50uF 2 ranges). ● Protection circuit of fuse and diode. ● Able to measure high voltage of 50kV (for TV service) and 100kHz–30mHz (for CB service) by optional probe.

$64.83
($56.37 plus 15% tax)

SPECIFICATIONS:
100,000 Ohms/V

Measuring ranges:
DCV: 250mV, 2.5V, 10V, 50V, 250V, 1000V (100kΩ/V, 25kΩ/V only 1000V)
DCA: 10μA, 2.5mA, 25mA, 500mA, 10A (250mV)
ACV: 5V, 10V, 50V, 250V, 1000V (10kΩ/V)
ACA: 10A (250mA)
Ω: ×1, ×10, ×1K, ×10K
(Center) 20Ω, 200Ω, 20KΩ, 200KΩ
(Max.) 5KΩ, 50KΩ, 5MΩ, 50MΩ
(Min.) 0.2Ω, 2Ω, 200Ω, 2KΩ
dB: −10dB ~ +16dB ~ +62dB
h_{FE}: 0 ~ 1000
I_{CO}: 0 ~ 50μA
Capacity: C1, 50pF ~ 3μF; C11, 0.01μF ~ 50μF
Tolerance:
DCV: ±3% of maximum measuring scale
DCA: ±3% of maximum measuring scale
ACV & ACA: ±4% of maximum measuring scale
Ω: ±3% of scale length
dB: Accordance with ACV
h_{FE} & I_{CO}: ±5%
Capacity: ±6% of scale length
Dimensions: 180(h) x 140(w) x 80(d)mm

TRIO
CS-1560A
130mm DUAL TRACE
15 MHz, TRIGGERED
SWEEP OSCILLOSCOPE

$558.47
($485.63 plus 15% tax)

● Simplified circuitry improved performance and dependability have been successfully realized with the use of ICs throughout ● A vertical amplifier provides as wide a bandwidth as DC to 15 MHz as high a sensitivity as 10 mV/div. and a low input capacitance ● A sweep rate extends from 0.5 usec/div to 0.5 sec/div in 19 ranges. Further TV vertical and horizontal syncs are available for measuring video signals and, with its ±5 magnified sweep, its range of application is extremely wide ● Very easy X-Y operation of high input sensitivity for Lissajous measurements ● Dimensions: 260(w) x 190(h) x 385(d)mm. Weight: 8.4kg.

National Semiconductor 4650

● Display 8 mantissa digits, 2-digit exponent (Calculates to 9 digits internally for accuracy.) ● Algebraic logic permits entry of calculation as you say it ● Two level parentheses: imperative for direct entry of complex equations ● Full accumulating memory: addressable in all four arithmetic functions ● Trigonometric functions: sine, cosine, tangent and the inverse trig functions ● Degree/Radian conversion ● Rectangular/Polar coordinates conversion ● Logarithmic functions: log, Ln, e^x ● Scientific notation or floating decimal point system: handles numbers as large as 10^{99} or as small as 10^{-99} with reformatting capability from one system to the other ● Automatic constant ● Automatic reciprocal, square and square root, powers and Pi entry keys ● Memory exchange and register exchange keys ● Operates on NiCad rechargeable batteries ● Carrying case and AC adapter/charger.

$30.66
($26.66 plus 15% tax)

We regret prices are subject to change without notice.

To:
Radio Parts Group,
362 Spencer Street, West Melbourne (03) 329-7888.
1103 Dandenong Road, East Malvern (03) 211-8122.

bankcard welcome here

Please send me .....

I am enclosing cheque ☐ money order ☐

Or please debit my Bankcard — Number .....

$1 P&P in Aust. Outside Aust. freight on .....

Write for our comprehensive Semi-Conductor price list.

Signature: .....

Name: .....

Address: .....

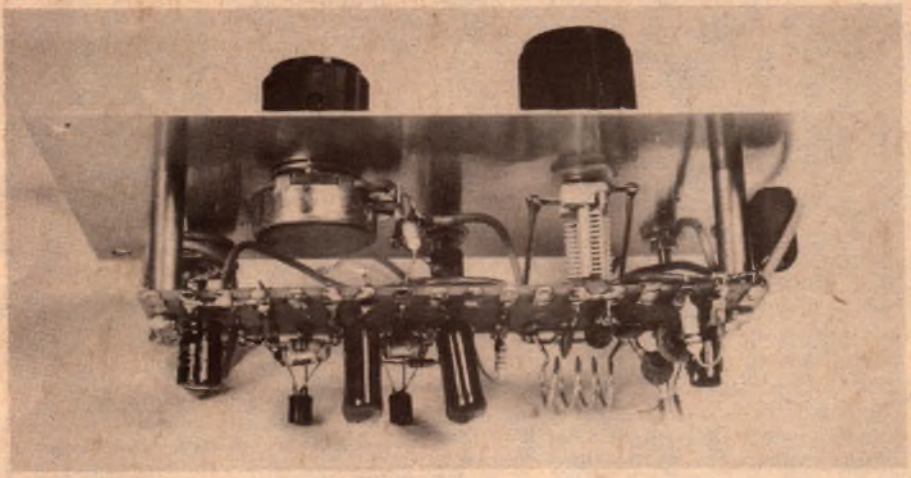
P Code .....

FILL OUT FORM BELOW FOR TAX FREE PRICES.

SALES TAX (EXEMPTIONS & CLASSIFICATIONS) ACT
To the Commissioner of Taxation and the Commonwealth of Australia

I hereby certify that the Calculator purchased by me
from .....
on ..... (date) is for use in .....
(name of University or School)
in or directly and essentially in connection with the production of facts, by means of observing, measuring, testing or otherwise experimenting with material phenomena, for the purpose of providing or illustrating natural principles or laws. Exemption is accordingly claimed under item 63 (1) in the First Schedule to the Sales Tax (Exemptions and Classifications) Act.
Signature of official of University or School .....
Designation .....
Name of University or School .....
Date ..... Signature of Student .....
Address of Student .....

Simple VHF Receiver



Inside the prototype. Leads to the tuning capacitor should be kept short and neat.

location, there may be other communication systems used by local authorities. At least one way to find out just what is available in any particular location is to listen! More will be said about changes to the tuning range of our receiver later on.

As this receiver is essentially an experimental or instructional type of thing, we have not made up a special printed circuit board for it. Rather we have made use of the technique of fixing the majority of the components on a piece of miniature tag board with 18 pairs of tags. We have prepared a detailed drawing of this assembly and by following it carefully no problems should be experienced.

Before proceeding with the board assembly, the tuning coil L1 and the balun transformer should be wound. The tuning coil consists of four turns of 20 gauge tinned copper wire wound on a 5/16in diameter piece of rod or a drill. The turns are spaced to make the coil 12mm long. Bend the ends at right angles to the axis and cut them to a length of about 6mm. The balun transformer is wound on the ferrite former. 24B&S enamel wire is used and two windings, each having two turns, are wound around the centre core. The finish of the first winding and the start of the second are cleaned of enamel, twisted together and soldered.

When assembling the components on the board, care should be taken to make good soldered joints and components should not be overheated. Regard must be given to the polarity of components such as electrolytics, transistors and diodes. It is also a good idea to follow a logical order of assembly. In general, the resistors could be fixed first, followed by the capacitors and other items.

It is very important that all capacitors associated with the detector stage should be neatly mounted on the board with a minimum of lead length. This also applies to the 270uH RF choke and the tuning coil. Also, it should be noted that we have used a solder lug at each end of the board, from each end mounting hole, to the adjacent earthy terminal. This effectively connects the earthy line of the board to the front metal panel, via the brass mounting spacers.

At this stage, the wiring board assembly may be put aside for the time being. The metal panel of the jiffy box should now be drilled to take the components which are to be mounted on it. These are the tuning capacitor, regeneration potentiometer, headphones jack, battery switch and two aerial terminals. Oh yes, do not forget the two holes for the two brass spacers.

This is all straightforward enough, except for the hole for the tuning capacitor. It must be remembered that both sides of this capacitor are at the positive supply potential, so the mounting bush must be insulated from the metal panel accordingly.

We used part of a plastic mains cable clamp to make up two insulating washers. The two flat pieces were cut off with a pair of cutters and the holes were enlarged to clear the bush on the capacitor. Drilling the plastic will result in a burr surrounding the hole and this should be left on. The front panel hole should be made large enough to clear the burr. This helps to insulate the bush inside the hole and the main body of each washer serves to insulate the shoulders of the bush.

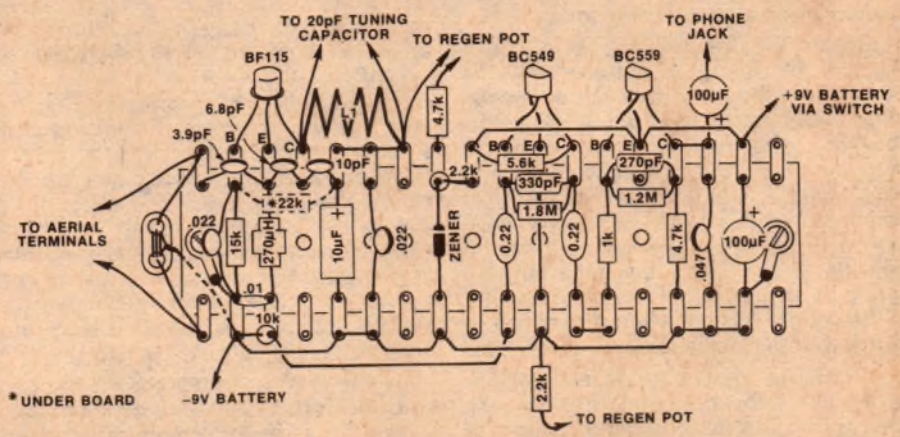
The components are now mounted on the panel. It should be noted that both of the aerial terminals must be insulated from the panel with the washers supplied. Also, the aerial terminals should be provided with solder lugs.

The main board assembly may now be fixed to the panel. Make sure that it is the right way around, so that the leads to the tuning capacitor and other items will be short.

The two leads from the tuning capacitor to the coil should be of 18 or 20 gauge tinned copper wire and they should be straight and direct, for minimum length. The 4.7k and 2.2k resistors should be strung between the appropriate terminals on the potentiometer and the board. Similarly, the 100uF electrolytic capacitor is strung between the jack and the board. If you are using a stereo jack and headphone combination, the two corresponding terminals of the jack should be tied together.

The balun transformer is mounted between the three lugs on the board, using its own leads which have been cut to avoid any excess length. All other leads to complete the wiring consist of normal hookup wire.

The receiver is virtually finished now but before going further, the whole unit should be carefully checked to make sure that there have been no errors in construction. Satisfied that all is well, you will need a good antenna system to use with the receiver. If you have an FM antenna available, then this



Follow this diagram when wiring up your receiver.

would be ideal. If the feedline is of 300 ohm ribbon, just connect a conductor to each terminal. If the feedline is coaxial cable, connect the inner conductor to one terminal and the outer braid should be connected to the earth line. An extra terminal could be used for this.

If you do not have an antenna available, then it is quite an easy matter to make one. The suggested antenna consists of a piece of 300 ohm TV ribbon, with both ends shorted and one connector cut in the centre to connect in another length of ribbon, which acts as a feeder. The length of the antenna proper is calculated by dividing the desired frequency in MHz into 14070. This gives the length of the dipole in centimetres.

As we are interested at present in the FM broadcast band, 88MHz to 108MHz, then the antenna may conveniently be cut for 98MHz, which is the centre of the band. Using the above formula, we find that if we divide 98 into 14070, we get very close to 144cm. The antenna should be made to this dimension, with a feedline no longer than necessary to do the job. The antenna may be fixed for example, by taping it to a piece of wooden dowel to act as a stiffener. It should then be mounted as high and as in the clear as possible and it should be broadside on to the wanted station(s). Remember that the better the antenna, the better your reception is likely to be.

With the receiver and antenna now ready, we are in a position to try them out. However, on switching on for the first time, it is a good idea to make sure that all is well before continuing. A multimeter check of the supply voltage under load and a similar voltage check across the zener diode are a worthwhile precaution. One should be close to 9V, the other around 6.8V. Also, having made voltage checks, it is a good idea to set the multimeter to a current range and connect it in series with the supply to check the actual current drain. As mentioned earlier, ours was around the 3mA mark.

Before looking for stations, a check should be made to ensure that the receiver will go into and out of oscillation right across the tuning range, by varying the regeneration control. Oscillation is indicated by what may be described as a loud fast ticking sound in the headphones. With the regeneration control correctly wired, oscillation should occur when the regeneration knob is turned clockwise and oscillation should cease when the knob is turned anti-clockwise.

If you are unable to achieve oscillation right across the band, then the 4.7k resistor should be reduced in value and the 2.2k resistor could possibly be increased in value. A certain amount of experimentation is possible here. If on the other hand, it is not possible to stop oscillation at some part of the band, then the opposite will apply.

Because of the simplicity of this receiver, quite a deal of skill is required on the part of the operator — you must develop a "feel" for the receiver to get the best out of it. What this means is that the receiver must be kept just below the point of oscillation when tuning for signals. This is rather easier said than done, mainly because the point of oscillation changes as the tuning capacitor is varied. This means that the receiver tends to go into oscillation, whereupon the regeneration control must be slightly reduced, or the receiver requires more regeneration, at which point the sensitivity is seriously reduced.

I hope that I have not discouraged prospective builders. Indeed, this is not the intention. What I am trying to say is that you must give the receiver a fair trial by playing your vital part as the operator. In short, it is not like tuning your broadcast transistor portable receiver. Suffice to say that a few minutes of careful twiddling of the controls will give you the general idea.

Provided you have made the receiver according to instructions, particularly with regard to the coil and tuning circuit components, then you should have no trouble with band coverage. However, due to some unavoidable spreads, you may find that either one end or the other of the band may be missing. If you cannot tune to the lowest end of the band, then squeeze up the coil a little. On the other hand, the coil turns should be spread out somewhat to make the receiver tune higher in frequency. Actually, our prototype tuned from 75MHz to 111MHz.

Earlier I mentioned the possibility of modifying the tuning circuit so that the receiver could be made to cover other frequency bands. A very easy change is to alter the coverage so that it tunes the amateur 2 metre band, 144MHz to 148MHz.

To do this, lift the 10pF capacitor which is wired across the tuning coil. Remove the tinned copper wire lead from between the fixed plates on the tuning capacitor to the coil and replace it with a 4.7pF NPO ceramic capacitor. Makes sure that leads are kept as short as possible. Squeeze up the tuning coil so that it is a little less than 10mm long. With these changes our prototype tuned from 144MHz to 151MHz.

By the way, if your interests happen to be with the 75MHz to 85MHz band, which is a general communications allocation, including taxis and many other services, then you will not have to make any changes as the receiver already covers this range together with the FM broadcast band.

Another possible band of interest is that for aeronautical use, from 118MHz to 136MHz. This range may be covered with our little receiver by making a few changes to the circuit. A new coil is required. It consists of three turns, 5/16in diameter and 5mm long, wound in a similar fashion to the four turn coil described earlier. The 10pF capacitor shunted across the coil is changed to 6.8pF. The lead from the collector side of the coil to the variable capacitor is replaced with a 10pF NPO ceramic capacitor. It may be necessary to change the length of the coil slightly to get the proper band coverage.

By the way, don't forget that if you elect to make the receiver cover any range other than that for the FM broadcast band, then you will need to change the length of the aerial accordingly.

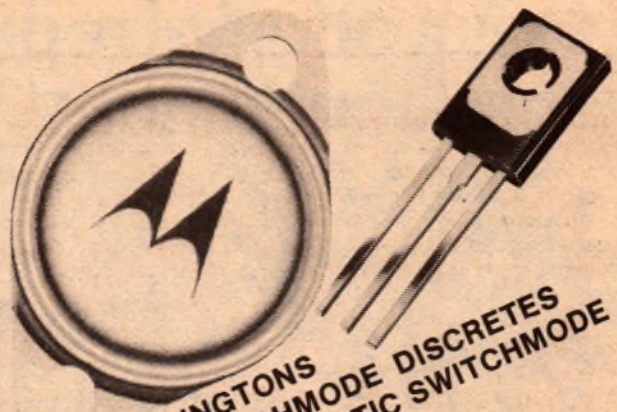
Apart from checks and measurements on the receiver in the EA workshop I tried it out at home in one of the northern suburbs of Sydney. The two FM stations ABC-FM and MBS-FM were both received very well. At low level in the background was some other program material, possibly from one or more of the television services. Also, some frame buzz was also heard, no doubt from the same source. It did not interfere unduly with the wanted signals however. This effect will vary according to the ratio of signal strengths between the wanted FM signal and the TV signals, at your particular location.

The usefulness of this receiver on 144MHz to 148MHz would possibly be greatest where one or more repeaters are available. Our own tests on this band were a little disappointing. During a short test one repeater was heard, but although the amount of audio level was sufficient in the headphones, its resolution was not good. This is more than likely due to the fairly narrow deviation used by amateurs, when compared with the deviation used by TV sound and FM broadcasting.

Having brought the receiver back to the workshop I made the changes to cover the aeronautical frequencies. Our workshop is in the City and not very good for reception, but it is fairly close to the Sydney airport. Listening across the band would give the impression that it is not used very much. Transmissions on any one frequency are very short and to the point; you have to be lucky to be tuning across a particular frequency to catch anyone on the air. To one not familiar with this band, it is quite a challenge to log any transmissions. In case you were wondering, I did get a few words here and there!

So there it is. A "fun" receiver which is wide open to experiment, and a challenge to get the most out of a small unit. Quite a good project for a wet weekend!

Motorola and Cema bring you Switchmode power



- THE ONLY SWITCHMODE DARLINGTONS
- THE MOST SWITCHMODE DISCRETES
- THE FIRST PLASTIC SWITCHMODE

SWITCHMODE DEVICES, SPECIFICALLY DESIGNED AND CHARACTERIZED FOR SWITCHERS- ALL THE WAY, EVERY WAY.

The Spec:	The Advantages
1. Active region SOA	Specified limits for turn-on energy.
2. V_{CEO} (sus), I_C (max), h_{FE}, f_T	Complete information on basic requirements.
3. RBSOA under clamped inductive conditions at 100°C	Turn-off energy capability aids in reliable design.
4. 100°C specs for VCEV, ICEV, VCE (sat), VBE (sat)	No dependance on "typical" or room temperature specs; efficiency with lower P_D.
5. Inductive switching data, 100°C	Accurate determination of switching losses under actual operating conditions.

No unknown empiricals, vague or non-existent device specs., but solid, practical data from the "DESIGNERS DATA SHEET"
Write in for your data package

Cema Electronics and Motorola Superpower... bringing you into the design cycle instead of keeping you out

CEMA ELECTRONICS PTY. LTD.

MOTOROLA

SYDNEY:
21 Chandos Street, St. Leonards, N.S.W. Tel: 439 4655
MELBOURNE:
208 Whitehorse Road, Blackburn, Vic. Tel: 871 5311
BRISBANE:
22 Ross Street, Newstead, Qld. Tel: 52 4261
ADELAIDE:
170 Sturt Street, Adelaide S.A. Tel: 51 6483
NEW ZEALAND:
7-9 Kirk Street, Grey Lynn, Auckland. Tel: 76 1169

CANBERRA: Ortex
Tel: (062) 82 4995

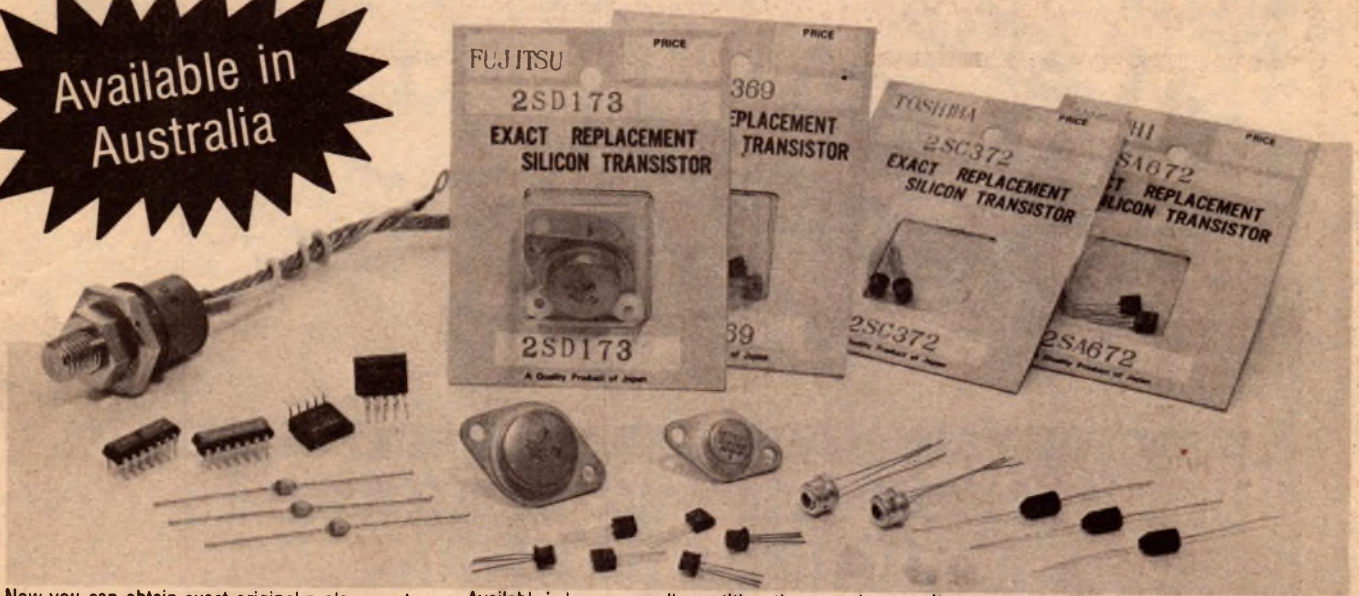
WOLLONGONG: Macelec
Tel: (042) 29 1455

PERTH: Reserve Electronics
Tel: (09) 275 2377

NEW GUINEA: Daltron Electronics, Boroko.
Tel: 25 6616

exact original replacement Japan-made semiconductors!

Available in Australia



Now you can obtain exact original replacement Japan-made semiconductors to service CB's, Hi-Fi Equipment, TV's, Car Radio/Stereos, Industrial and Professional Electronic Equipment manufactured in Asia.

Available in large or small quantities, the extensive availability includes over 2,000 items from Japan's leading original manufacturers — Sanyo, Toshiba, Hitachi, NEC, Toyo, Matsushita, Sony, Sanken, Oki, Fujitsu, etc.

Items ex stock will be despatched within 48 hours; items not immediately available will be ordered ex Japan by Air Mail delivery and should be received within max. 4-6 weeks.

CUT OUT THIS PAGE AND KEEP FOR FUTURE REFERENCE

Due to advertising lead times and international exchange rate fluctuations, prices are subject to change without notice.

2SA 329	0.66	2SB 529	1.30	2SC 840	3.11	2SC 1239	4.32	2SC 1975	2.95	AN 241	3.54	UPC1028H	2.83
2SA 483	7.00	2SB 536	1.70	2SC 867	12.07	2SC 1243	1.22	2SC 2028	1.27	AN 245	7.59	UPC1156H	3.80
2SA 484	3.91	2SC 372	0.32	2SC 897	5.48	2SC 1295	7.13	2SC 2029	0.24	AN 247P	6.90	TA7045M	3.57
2SA 493	0.78	2SC 380	0.40	2SC 930	0.39	2SC 1306	2.12	2SC 2091	1.44	AN 264	3.30	TA7074P	8.51
2SA 495	0.44	2SC 403	0.61	2SC 933	0.43	2SC 1307	7.59	2SC 2092	3.54	AN 277	3.54	TA7120P	1.58
2SA 496	1.24	2SC 458	0.40	2SC 945	0.28	2SC 1312	0.37	2SD 198	3.30	AN 313	9.78	TA7200P	5.29
2SA 550	1.30	2SC 461	0.42	2SC 959	2.32	2SC 1317	0.46	2SD 199	5.06	AN 315	4.26	TA7201P	5.59
2SA 562	0.52	2SC 495	0.83	2SC 960	2.72	2SC 1318	0.66	2SD 213	12.42	AN 331	9.66	TA7202P	5.87
2SA 564	0.40	2SC 496	1.08	2SC 973	32.20	2SC 1345	0.54	2SD 234	1.42	AN7115	3.68	TA7203P	5.18
2SA 606	3.44	2SC 509	1.34	2SC 995	2.72	2SC 1358	15.76	2SD 235	1.77	AN7150	4.26	TA7204P	3.80
2SA 607	3.92	2SC 535	0.52	2SC 1000	0.46	2SC 1364	0.54	2SD 313	1.72	HA1137W	5.02	TA7205P	4.10
2SA 634	1.28	2SC 536	0.37	2SC 1011	16.36	2SC 1407	1.10	2SD 315	2.22	HA1156W	3.54	TA7214P	9.62
2SA 640	0.64	2SC 538	1.10	2SC 1013	1.10	2SC 1419	1.44	2SD 325	1.34	HA1199	3.84	TA7222P	4.56
2SA 671	1.87	2SC 563	1.34	2SC 1017	1.42	2SC 1444	4.97	2SD 330	1.70	HA1306W	4.44	TA7310P	2.17
2SA 673	0.56	2SC 620	0.61	2SC 1018	1.89	2SC 1446	1.54	2SD 350	9.66	HA1322	5.02	LA1201	2.95
2SA 678	0.84	2SC 645	1.20	2SC 1030	4.11	2SC 1447	1.58	2SD 358	1.75	HA1342AR	4.58	LA3300	4.65
2SA 683	0.72	2SC 674	0.61	2SC 1034	12.65	2SC 1448	2.95	2SD 359	0.98	HA1452W	2.90	LA3301	3.42
2SA 684	0.73	2SC 681	4.90	2SC 1060	1.65	2SC 1449	0.86	2SD 360	1.10	SAS560S	5.32	LA3350	4.65
2SA 697	0.78	2SC 710	0.39	2SC 1061	1.65	2SC 1475	1.17	2SD 361	1.58	SAS570S	5.32	LA4030P	3.80
2SA 705	1.03	2SC 711	0.37	2SC 1096	1.42	2SC 1509	0.88	2SD 380	12.65	TBA810SH	4.14	LA4031P	3.68
2SA 706	2.12	2SC 712	0.39	2SC 1098	1.54	2SC 1520	2.08	2SD 388	6.56	M5115AP	7.59	LA4032P	4.83
2SA 715	1.37	2SC 730	6.44	2SC 1114	11.04	2SC 1550	1.65	2SD 389	1.68	M5152L	2.08	LA4050P	3.91
2SA 719	0.56	2SC 732	0.46	2SC 1116	1.17	2SC 1624	1.89	2SD 525	2.36	M5153P	8.40	LA4051P	4.32
2SA 725	0.54	2SC 734	0.61	2SC 1128	1.17	2SC 1628	1.70	2SD 526	1.88	M51513L	3.54	LA4400	4.95
2SA 733	0.49	2SC 735	0.46	2SC 1129	1.30	2SC 1669	2.36	2SK 19	0.90	M51515L	6.67	LA4430	4.14
2SA 740	4.37	2SC 738	0.49	2SC 1162	1.30	2SC 1674	0.49	2SK 30A	0.90	M51841P	3.30	STK011	9.66
2SB 54	0.52	2SC 741	0.42	2SC 1166	0.76	2SC 1675	0.37	2SK 40	1.03	M5320P	1.03	STK015	11.04
2SB 56	0.52	2SC 756	3.91	2SC 1169	4.14	2SC 1678	2.48	2SK 49	1.12	M53273P	1.84	STK016	13.62
2SB 324	0.66	2SC 772	0.56	2SC 1172B	13.23	2SC 1728	1.42	3SK 45	2.08	M53274P	1.84	STK024	20.04
2SB 435	2.10	2SC 784	0.52	2SC 1173	1.17	2SC 1760	1.39	BA 301	1.89	M53393P	5.98	STK433	12.88
2SB 507	4.56	2SC 789	1.84	2SC 1175	0.71	2SC 1909	4.14	BA 511A	3.54	UPC554C	2.95	STK439	19.55
2SB 514	2.12	2SC 799	9.89	2SC 1195	8.74	2SC 1951	1.42	BA 521	4.14	UPC574J	1.61	MB3705	3.45
2SB 523	1.51	2SC 815	0.73	2SC 1211	0.54	2SC 1957	0.98	AN214Q	3.66	UPC575C2	2.79	MB3708	3.45
2SB 526	1.58	2SC 828	0.30	2SC 1212	1.42	2SC 1964	0.25	AN 214P	3.78	UPC1009C	6.00	MB3712	3.30
2SB 527	1.70	2SC 829	0.32	2SC 1213	0.52	2SC 1969	6.90	AN 239	11.50	UPC1020H	4.03	MB3713	3.30
2SB 528	1.84	2SC 839	0.40	2SC 1226	1.15	2SC 1974	2.76	AN 217	3.07	UPC1025H	3.11	PLL02AG	12.19
												SG613	13.80

Orders over $25, less 10 percent — over $50, less 15 percent — over $100, less 20 percent — over $250, less 25 percent. Pack, Post and Handling Charge — $2 all orders. All enquiries must include SAE for fast reply.

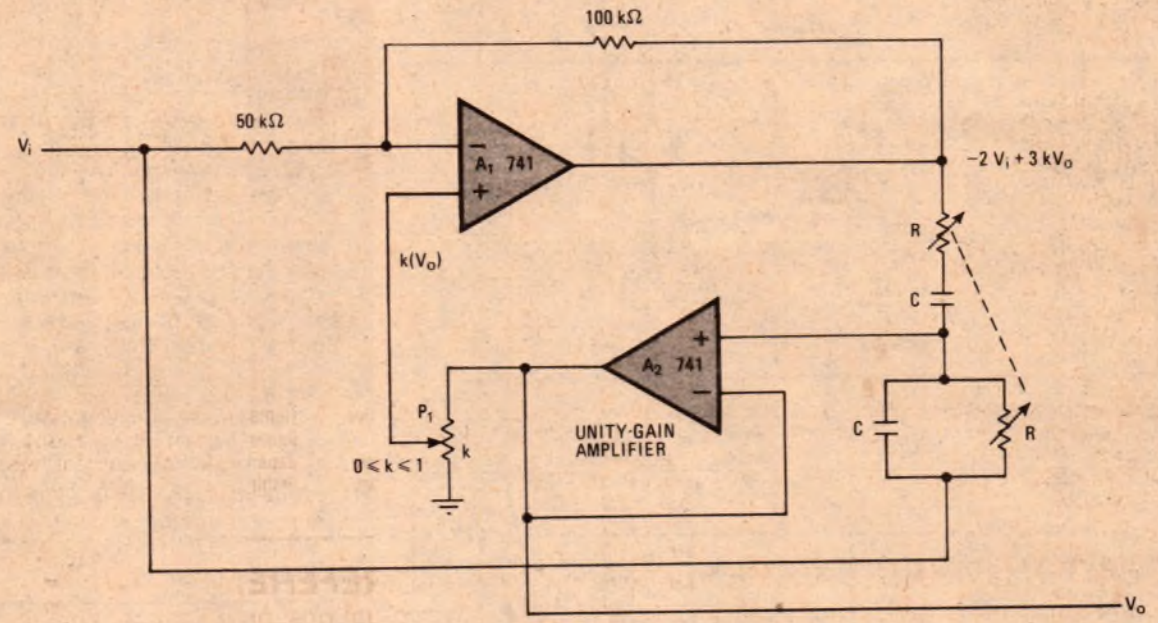
SEMICONDUCTOR IMPORTS P.O. BOX 43, NSW CROYDON 2132

Circuit & Design Ideas

Conducted by Ian Pogson

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. Your contributions are welcome, and will be paid for if used.

Wien bridge and op amp select filter's bandwidth



The band over which a notch filter provides rejection of unwanted frequencies can be selected with this circuit, which uses a Wien bridge plus an operational amplifier with fixed gain. Such a circuit represents one of the simplest configurations for easily adjusting the selectivity of the filter, which has a notch depth of nearly 60dB, independent of component precision.

The notch filter operates at up to 200kHz and selects a bandwidth over which frequencies are rejected. RC components determine the centre frequency of the filter. P1 selects the notch bandwidth and the notch depth is fixed at about 60dB.

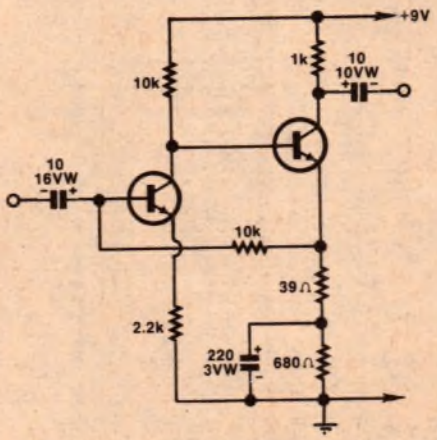
It will be noted that the popular twin-T variety of notch filter is almost identical but in practice, the twin-T is not very easily adjusted. This is because a greater number of components must be trimmed, and more careful adjustments made, to achieve the desired degree of selectivity and notch depth required.

(By Dominique Fellot, in "Electronics".)

Preamplifier for microphones, mixers, etc.

This preamplifier has a gain of approximately 30 and it can be built on a very small board space, using general purpose silicon transistors. The type used in the prototype are equivalent of the 2N2222, which I obtained from Tandy Electronics.

The circuit configuration is that of a "DC feedback pair", a circuit which provides good frequency response with high input impedance. As such, it is ideal for use as a microphone preamplifier and it could also be used as the basis for a microphone mixer. Current drain is approximately 3mA and a type 216 9V battery could be used with a long life expectancy. The circuit gives a maximum output swing of about 3V peak-to-peak, for an input signal of about 100mV.



For higher gain the 39 ohm resistor can be omitted. If a volume control is required, the wiper of a 100k potentiometer can be connected to the input, one of the ends connected to the input signal and the other to ground.

(By Mr R. Linz, 27 Albert Street, Ingleburn, NSW 2565.)

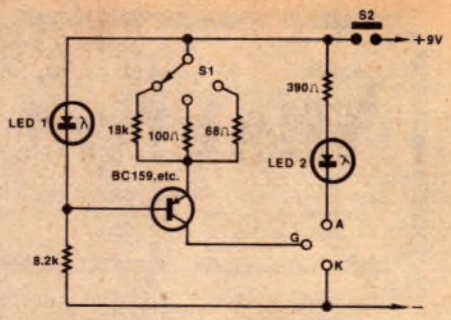
Simple method of testing thyristors

This circuit is for making simple checks on thyristors. Three levels of triggering are provided, being approximately 50uA, 10mA and 15mA. Thus a wide variety of devices can be accommodated. The triggering current levels are selected by S1, with position 1 corresponding to the 50uA level. A

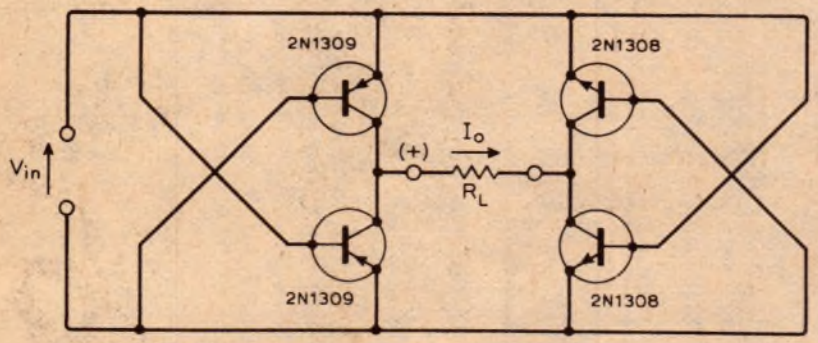
device which is functioning correctly will be indicated by the illumination of LED2, when S2 is depressed.

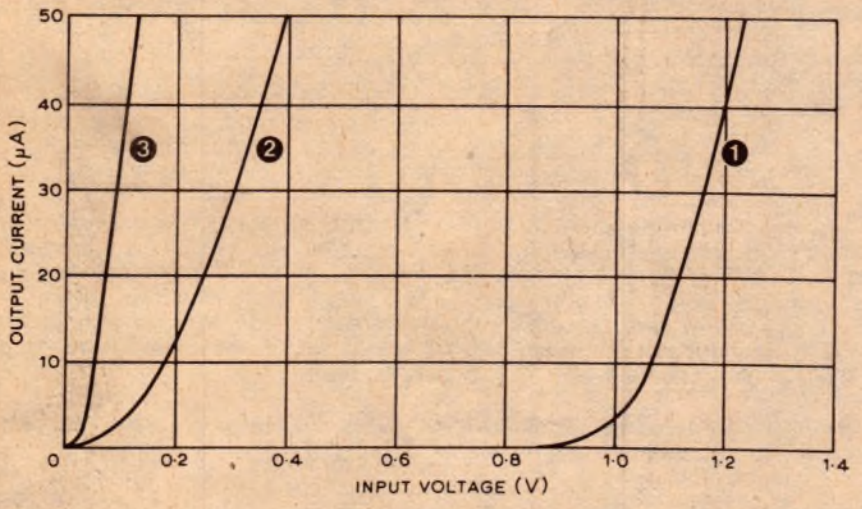
The LEDs may be any of the readily available red types. It should be noted that PUTs cannot be tested on this circuit as it is, as extra facilities are needed for the purpose.

(By Mr L. Murokami, 19/368 Military Road, Tennyson, SA 5022.)



Cross coupled transistor rectifier bridge





This circuit shows a full wave rectifying bridge which has an offset voltage an order smaller than conventional diode bridges.

The graph shows transfer characteristics for a conventional full wave silicon diode bridge in curve 1, a germanium diode bridge in curve 2, and the cross coupled transistor bridge in curve 3. The off-set voltage of the transistor is about 30mV with good linearity above the knee.

The circuit was developed for use in a simple but sensitive field strength meter. The meter is protected by the base-emitter junctions of the transistors. With the devices shown, the frequency response is up to 30MHz and the optimum value of RL is about 2k.

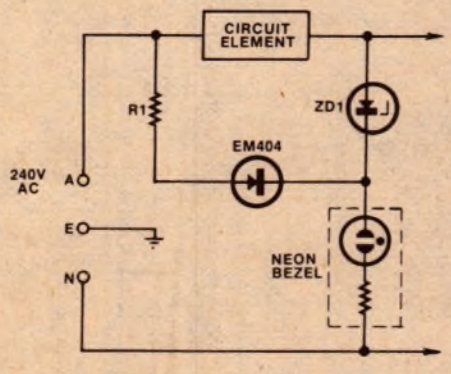
(By L. D. Thomas, in "Wireless World".)

Dual function neon indicator

Where it is desired to have "standby" and "operate" indication and it is undesirable to have two separate neon lamps, this circuit can be added to an existing neon indicator.

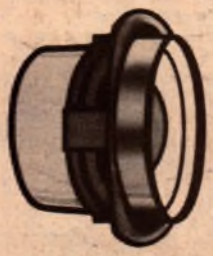
"Circuit element" may be a switch, fuse, thermostat, etc. ZD1 may be a 400mW zener diode rated at about 100V. R1 should be of such a value to give a dull glow. Values between 1M and 3M could be tried.

With "circuit element" open, one electrode of the neon lamp will glow weakly, when closed it will operate at full brilliance. If ZD1 is replaced by an EM404, two levels of indication will be given but the neon lamp will not operate at full brilliance.



(By Mr R. A. Vickers, 31 Aylmer Street, North Balwyn, Vic 3104.)

Plessey components. The complete range. (Well almost).

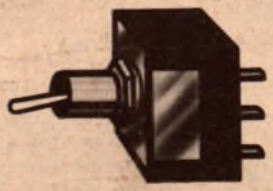


Speakers – Foster & Fostex
Speakers ranging from guitar, woofers, mid range, tweeters, horns, full range and elliptical, all are available.

Sonalerts – Mallory
Electronic audible signals providing a startling innovation in warning devices, producing a penetrating sound by purely electronic means. Circuitry is all solid state for maximum efficiency, lowest current requirements, and highest reliability.

Lamps and indicators
Consisting of filamentary, neon and LED styles designed for all general illumination applications.

Switches
Rotary, lever key, toggle, thumb wheel, touch activated including illuminated.



Optoelectronic devices
Including LDR'c, LED'c photodiodes, phototransistors, photocouplers and 7 segment, alphanumeric and cold cathode displays.

Speaker Enclosures
One of the range of Plessey Foster and Fostex speaker enclosures.

"E" Cell
The "E" Cell device suitable for a number of applications such as repetitive timing and control, pulse counting and memory, timing, current-time integration, use-time measurement.

Connectors
A multitude of connectors including the Multicon range consisting of 2, 4, 6, 8, 10, 12, 18, 24, and 33 pole. Also the 159 range of plugs and sockets ranging from 7 to 71 poles. Gold flash on contacts and solder tags for long term protection against tarnishing. Also the 22 range of marine and aviation connectors.

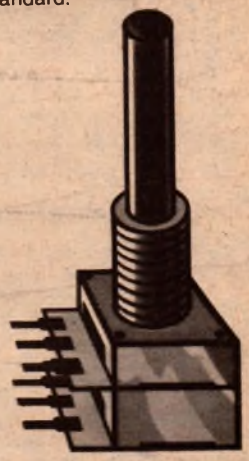
Dry reed inserts and relays
Suitable for most switching functions the inserts have proven extreme reliability, long life, and the ability to operate in grossly unfavourable environments.

Batteries – Saft
Nickel cadmium (rechargeable) cells and batteries, for domestic, heavy industrial, emergency power, military and aviation.

Capacitors
Capacitors for a wide variety of applications, ranging from tantalum, chip ceramic, long-life and electrolytic.

Service and elapsed time indicator
For trucks and other vehicles, trains and stationary engines – where ever there's a suitable power source to indicate elapsed time and when service is due.

Potentiometers
Moulded carbon track and wire-wound of both commercial and professional standard.



PLESSEY

Plessey Australia Pty. Limited
Components Division
Christina Road,
Villawood NSW 2163
Telephone 72 0133 Telex 20384
VIC: Plessey Australia Pty. Ltd.
North Melbourne 329 0044;

AD 105

INDEX TO VOLUME 40—April 1978 to

General Features

Theory

Hi Fi Reviews

The Serviceman

The Australian CB Scene

Constructional Articles

March 1979

Microprocessors

Forum

Audio Talk

Regular Features

Lists & Tables

Circuit & Design Ideas

Unique Hole Inspector

C & K of Australia present this unique American hole inspector which substitutes for expensive and inconvenient fisheye lens microscopes.

The Hole Inspector features:

- ☐ Magnified full 360° inside view of holes.
- ☐ Allows instant detection of potentially costly drilling imperfections – spiralling, roughness and burring.
- ☐ Facilitates checking of PCB holes for plating voids, smoothness and solder flow.
- ☐ Automatically focuses on contact with surface.
- ☐ Requires no operator training.
- ☐ Can be used anywhere – pocket sized
- ☐ Low cost . . . **just $48.95** plus tax

C & K . . . the engineering oriented company . . . consider the advantages.

C&K COMPONENTS

C&K Electronics (Aust.) Pty Limited

Office 2/6 McFarlane Street Merrylands NSW 2160
PO Box 101 Merrylands 2160 Telephone 682 3144 Telex AA23404
Agents Melb 598 2333/Adel. 269 2544/Bris. 36 1277/Perth 458 7111

Obligation free and comprehensive data is yours for the asking.

MAIL ORDERING FROM US MAKES CENTS FOR YOU —

If any of these models are advertised at a lower price in this magazine, tell us and we will supply them at a lower price. Check our price on the model you want — WHY PAY MORE? We Offer — SERVICE — SATISFACTION — and SUPER SAVINGS.

TEXAS PROGRAMMABLE SYSTEMS

PC100A Alpha-Numeric Printer ~~$278~~ $210 ($234)

For Ti59 and 58 — Lists, Traces, Prints Words (64 characters). Plots Graphs, etc.

MODULES ~~$36~~ $32 ea plug into Ti59 or 58. Pre-programmed with approx. 5000 steps

- Leisure Time
- Marine Navigation
- Aviation
- Real Estate and Investment
- Statistics
- Surveying
- Business Decisions
- Securities Analysis

NEW MODULES

- Maths/Utility
- Electrical Engineering

GREATEST PACKAGE OFFER EVER!!

A ti59 and PC100A printer $686 only $450 ($503)

(Also any extra modules ordered with package only $30 ea.)

Ti59 ~~$326~~ $245 ($274)
Programmable to 960 steps or 100 memories, also master module with 5000 steps, magnetic cards, 3 manuals, program pad, charger, carrying cases, etc.

Extra Magnetic Cards
Pack of 40 and case $15

Specialty Pakettes $10 ea
Programs for mag cards —
● Electronic Eng ● Civil Engineering ● Statistics ● Programming Aids (Decoders and disassemblers) ● Securities ● Oil/gas energy ● Black body ● Printer utility

ALSO
Ti58 ~~$141~~ $108 ($120)
Ti57 ~~$92~~ $73 ($82)
Ti55 ~~$67~~ $52 ($58)
MBA ~~$82~~ $75 ($83)

NEW CANON

Desk Computers, AX1 & BX1 (basic) — floppy disk etc (Write for details)

DESK CALCULATORS/MINI COMPUTERS/ ANSWERING MACHINES/DICTATING MACHINES/CASH REGISTERS

TERMS – LEASING — EXTRA 5% OFF FOR CASH

PACKING & POSTING — All LCD models $1.50 anywhere in Australia. Otherwise $2.00 for NSW, elsewyere $3.00 per order for certified mail. (Another $1.50 if you require registered.)

SALES TAX FORMS must be duly signed and stamped.
(Forms available.)

HEWLETT hp PACKARD

SPECIAL OFFER – POST FREE! and SUPER LOW PRICES

HP 31E $60 ($67)
(replacement for HP21)

HP 32E $80 ($89)
(replacement for HP45)

HP 33E $100 ($112)
(replacement for HP25)

HP 29C $162 ($181)
(continuous memory)

HP 19C $210 ($234)
(a 29C with printer)

HP 38E $120 ($134)
(programmable business)

HP 67 $450 ($501)
(card programmable)

HP 97 $750 ($835)
(a 67 with printer)

HP 10A $165 ($184)
(basic funcs & printer)

School and College Super Specials

(SCIENTIFIC MODELS)
CANON F41 (22 functions)
$16.90 ($18.99)
CASIO fx31 (29 functions)
$19.90 ($22.40)
TEXAX Ti25 (L.C.D.)
$27 ($30)
NATIONAL SEMICONDUCTOR
NS108 (L.C.D./50 funcs.)
$36 ($41)

WE WILL NEGOTIATE PRICE ON QUANTITY ORDERS

WELCOME HERE
COPY OR COMPLETE:
Please debit my Bankcard

NO. .....
Expiry Date .....
Signature .....

SEND A STAMPED ADDRESSED ENVELOPE FOR OUR FREE COMPLETE DISCOUNT PRICE LIST ON ALL MODELS
TEXAS — HEWLETT PACKARD — CANON — CASIO — SANYO — SHARP — NATIONAL SEMICONDUCTOR

ELECTRONIC CALCULATOR DISCOUNTS

Phone (02) 624 8849 (8am till 3pm) P.O. Box 106, Baulkham Hills, N.S.W. 2153

9V Plugpack Doubler

This simple circuit develops +18V or -9VDC from a 9V plugpack

by LEO SIMPSON

While DC plugpacks with nominal outputs of 9V can substitute for batteries in many applications, they are not suitable for circuits requiring balanced positive and negative supplies, or 15 to 18 volts DC. This simple circuit can be used to develop either a negative 9V DC rail or 18V DC from a plugpack.

Using this approach, circuits using op-amps which require positive and negative rails can be run from a 9V DC plugpack rather than using two 9V batteries.

The ideal approach in designing a voltage multiplying circuit is to use a high frequency inverter based on a transformer, as these are very efficient. But since we intend the circuit to be run from a plugpack, efficiency is not a major consideration. We have power to burn, relatively speaking. So our doubler circuit employs the ubiquitous timer IC, 555.

The 555 is connected to operate as a free-running oscillator producing a square wave of close to 50% duty cycle. It runs at the fairly high frequency of about 31kHz (31168Hz calculated) to minimise ripple problems and enable the use of a small coupling capacitor to the rectifier system.

The rectifier is a half-wave voltage doubler which produces approximately 18VDC from the square wave output of the 555. Alternatively, by re-arranging the diodes the circuit can be made to deliver minus 9VDC, which is handy for op-amp circuits requiring positive and negative supplies.

Readers may wonder how it is that a simple circuit like this can virtually double the input voltage without the need for an intervening transformer. This can be explained by reference to figure 1. In this diagram, the 555 is shown simply as a DPST switch which rapidly toggles its output between the positive and negative supply rails.

With the 555 output connected to the negative rail, capacitor C1 is charged, via diode D1, to the value of the positive rail (say 9V). Then, with the 555 output switched to the positive supply, the negative end of C1 is suddenly jacked up by the value of the positive supply (to say 18V). C1 can then deliver a substantial current pulse to C2 via diode D2.

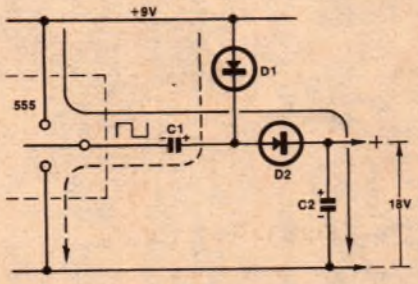


FIG. 1

Long arrows on Fig. 1 show the directions of current flow for the two halves of this charging cycle.

A number of repetitions of this cycle will charge C2 up to a positive voltage which is almost twice the amplitude of the square wave input from the 555. Perhaps this mechanism of operation is better explained by the alternative title for this rectifier configuration, "diode pump".

So if it makes it easier to understand, think of this diode configuration as a "diode pump". C1 and the diodes can be thought of as gradually pumping C2 up to twice the input voltage swing.

Fig. 2 shows the alternative connection of the "diode pump" to obtain a negative output voltage. When the 555 output is positive C1 is charged by diode D1. Then, with the 555 output negative, C1 is discharged via diode D2, which charges C2. By this means, C2 develops a negative voltage.

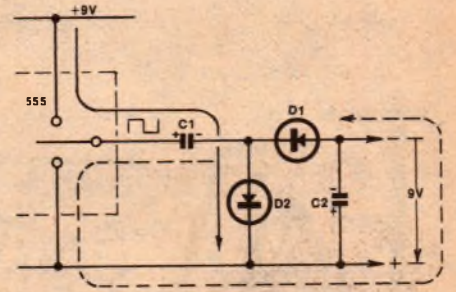


FIG. 2

In the above explanation we have neglected the effects of voltage losses in the 555 and in the rectifier diodes. There are also charging losses in the two capacitors. It may seem that our complete circuit also ignores these losses. After all, it starts with a nominal 9V plugpack and ends with 18VDC output.

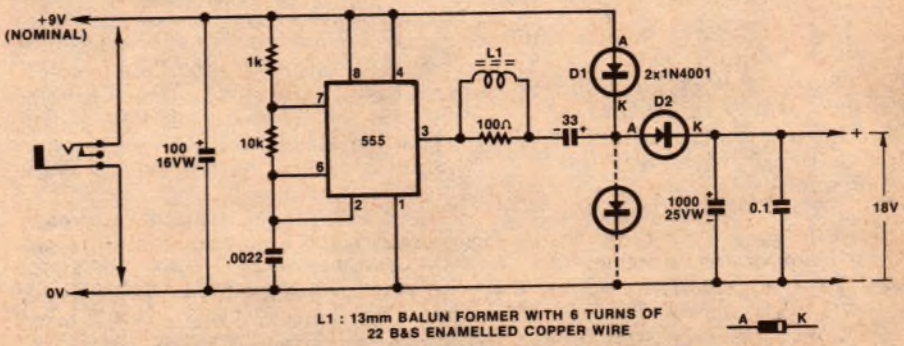
This is explained by the fact that most plugpacks have very poor regulation. While they may deliver 9V at their rated load, their output voltage rises considerably siderably when lightly loaded. So when used with this circuit, typical 9V plugpacks will deliver 11 to 12VDC, which is enough to produce 18VDC at the output of the doubler.

Maximum load on the 18V output is about 20 milliamps, and the same figure applies for the -9V version.

Unloaded, the current drain of the doubler circuit from the plugpack is about 10 milliamps.

An inductor shunted by a 100 ohm resistor is connected in series with the rectifier system. This removes the switching transients produced by the rapid switching of the 555. A 1000uF capacitor connected across the output provides very good filtering and produces a DC output which has far less hum and noise than the roughly filtered input from the plugpack source.

All the components are accom-

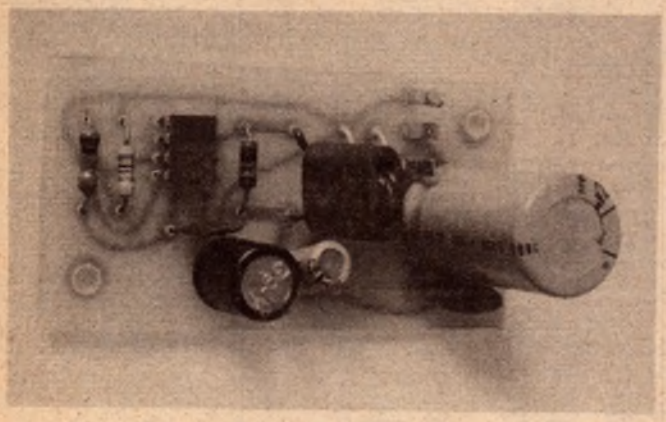


L1 : 13mm BALUN FORMER WITH 6 TURNS OF 22 B&S ENAMELLED COPPER WIRE

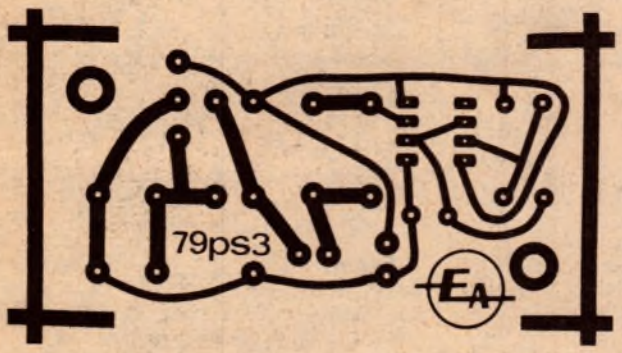
9V PLUGPACK DOUBLER

2/PS/-

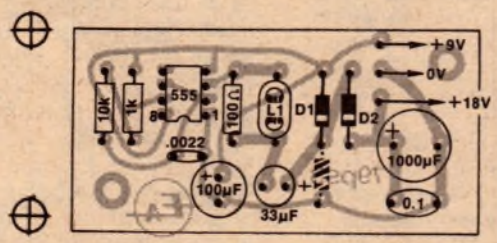
9V PLUGPACK DOUBLER



This shows the Doubler PCB wired for +18VDC.



At left is the actual size artwork for the PCB.



Diodes and capacitors should be connected as shown in Figures 1 & 2 to obtain +18V or -9VDC.

PARTS LIST

1 PCB, 70 x 35mm, code 79ps3
1 555 timer IC
L1: 6 turns of 22 B&S enamelled copper wire on a 13mm balun former
1 x 10k, 1 x 1k, 1 x 100 ohm, all ¼W resistors
1 x 1000uF/25VW PC electrolytic
1 x 100uF/16VW PC electrolytic
1 x 33uF/16VW PC electrolytic
1 x 0.1uf/100VW metallised polyester
1 x .0022uF/100VW metallised polyester

Note: Component ratings are as used in our prototype. Components with higher or lower ratings may be used, provided their ratings are not exceeded and that they will fit into the PCB.

modated on a small PCB measuring 70 x 35mm and coded 79ps3. Assembly is a straightforward matter.

The inductor is a standard 13mm balun former wound with six turns of 22 gauge enamelled copper wire. If a negative output version of the circuit is required, reverse the polarity of diode D2 and the two associated capacitors (33uF and 1000uF) and change D1 to the position shown dotted on the PCB component diagram.

We should register a note of caution on the circuit. If the intended use is for powering low level circuitry, it may be necessary to keep the doubler PCB well away for the circuit in question, otherwise interference may result. Alternatively, shielding the doubler PCB may be the solution.

What you don't know can hurt you.

When you're considering buying something as important as a new cartridge or tonearm, it's always wise to arm yourself with the facts.
This advice has never been so pertinent as it is today, because ADC have just made a massive step forward for the whole world of hi-fi.
The Audio Dynamics Corporation have built an enviable reputation throughout the world for pioneering dramatic advances in perfecting the state-of-the-art in stereo reproduction.
Today, this dedication to perfection has allowed the frontiers to be pushed out even further with a new, fully compatible range of cartridges, tonearms and frequency equalisers.

The new ZLM Aliptic cartridges for zero record wear
Tip mass almost 50% less than the XLM MkII.
New tapered cantilever.
New Aliptic stylus shape extends vertical bearing surface on groove wall by 100%, and gives greatly extended frequency response ±1dB from 20Hz to 20kHz and ±1½dB beyond to 26kHz.
Greatly reduces record wear and still prevents dust and dirt being reproduced.

The new XLM Mk III
Many of the design features of the ZLM, but with a tiny, nude elliptical diamond, with ·004" x ·008" rectangular shank.

The new VLM Mk III
A budget XLM Mk III, featuring the XLM Mk II nude diamond tip.

The new QLM MkIII series
QLM 36 MkIII, QLM 34 MkIII, QLM 32 MkIII, QLM 30 MkIII.
Incorporates our new design criteria, and innovations such as the Diasa (diamond + sapphire) elliptical tip.

The new LMF-1 & 2 Carbon Fibre tonearms
Brand new low mass tonearms in tapered carbon fibre.

LMF-1
Integrated head for lowest mass.

LMF-2
Added advantage of a unique moulded carbon fibre removable head.

Magnesium Headshell
Weighs only 7.83 grams. An aluminium headshell of the same thickness weighs 13 grams.

The new SS-1 & 2 Sound Shapers
New dynamic frequency equalisers designed by ADC to virtually turn your hi-fi system into a recording studio. Allows you to remix all those record and tape tracks you dislike.

To: BSR (A'asia) Pty. Ltd.,
Anne Street, St. Mary's, NSW 2760.
Please send me full details of the following items from the new ADC range.
☐ Cartridges & Tonearms ☐ Sound Shapers
Name_____
Address_____
_____
_____
_____Post Code_____

ADC

BSR152

ADC
A BSR Company
Distributed by: EXPO International Trading Pty Ltd
27 Buckley St., Marrickville NSW 2204

BSR (A'asia) Pty Ltd. Anne St., St. Marys NSW 2760

Measure Dynamic Headroom with our

1kHz Tone Burst Source

The instrument presented here is designed for the specific purpose of performing the tests defined by the American Institute of High Fidelity for "Dynamic Headroom" and "transient Overload Recovery Time". To this end, the instrument provides 20 millisecond bursts of 1kHz sinewave at intervals of 0.5 second.

by DAVID EDWARDS & LEO SIMPSON

The last occasion we published an instrument of this type was an article in April 1968 entitled "A Synchronous Gating Unit for AF Tone Burst Testing", by Jamieson Rowe (File No 7/AO/15). This 1968 instrument was envisaged as being suitable for a variety of audio measurements, a particular one being that for "dynamic power rating" of amplifiers.

The "dynamic power rating" required a source which would provide 10 millisecond bursts of sinewave signal at a low repetition rate. This test method was devised in 1966 by the American Institute of High Fidelity to overcome shortcomings in previous "music power" tests.

Recently, in September 1978, the American IHF has superseded the "dynamic power rating" in a new document, IHF-A-202, "Standard Methods of Measurement for Audio Amplifiers". This document introduces the tests for Dynamic Headroom and Transient Overload Recovery Time.

Both tests require a source applied to the amplifier auxiliary (line) input which consists of (quoting IHF-A-202) "a 1kHz sinusoidal wave, alternating in level between a nominal level and level that is 20dB greater than the nominal level. The signal shall maintain the nominal level for a period of 480ms ±10% and shall increase in level for a period of 20ms ± 10%. The cycle shall repeat with a 0.5 second ± 10% period."

The output of the amplifier is observed on an oscilloscope and the input level is adjusted to the maximum value which corresponds to the onset of clipping at the amplifier output. The resultant power output calculation is then referred to the continuous power output of the amplifier and the ratio, for the Dynamic Headroom, is expressed in decibels.

A typical Dynamic Headroom rating for a modern stereo amplifier would lie between 1 and 2dB.

Transient Overload Recovery Time is measured in a variation of the above procedure. It is defined as "the time required for the amplifier to recover from a 10dB overload, of 20ms duration, occurring at a repetition rate of once every 0.5 seconds". The toneburst source is adjusted to provide an output level from the amplifier between bursts which is 10dB less "than the continuous power output.

The output of the amplifier is observed on an oscilloscope and the sweep adjusted to observe the portion of the waveform just after the 20ms burst. A measurement is made of the time required for the amplifier to recover so that there are no visible signs of distortion.

The majority of modern amplifiers have overload recovery times of a few milliseconds or less. Many have virtually instantaneous recovery times.

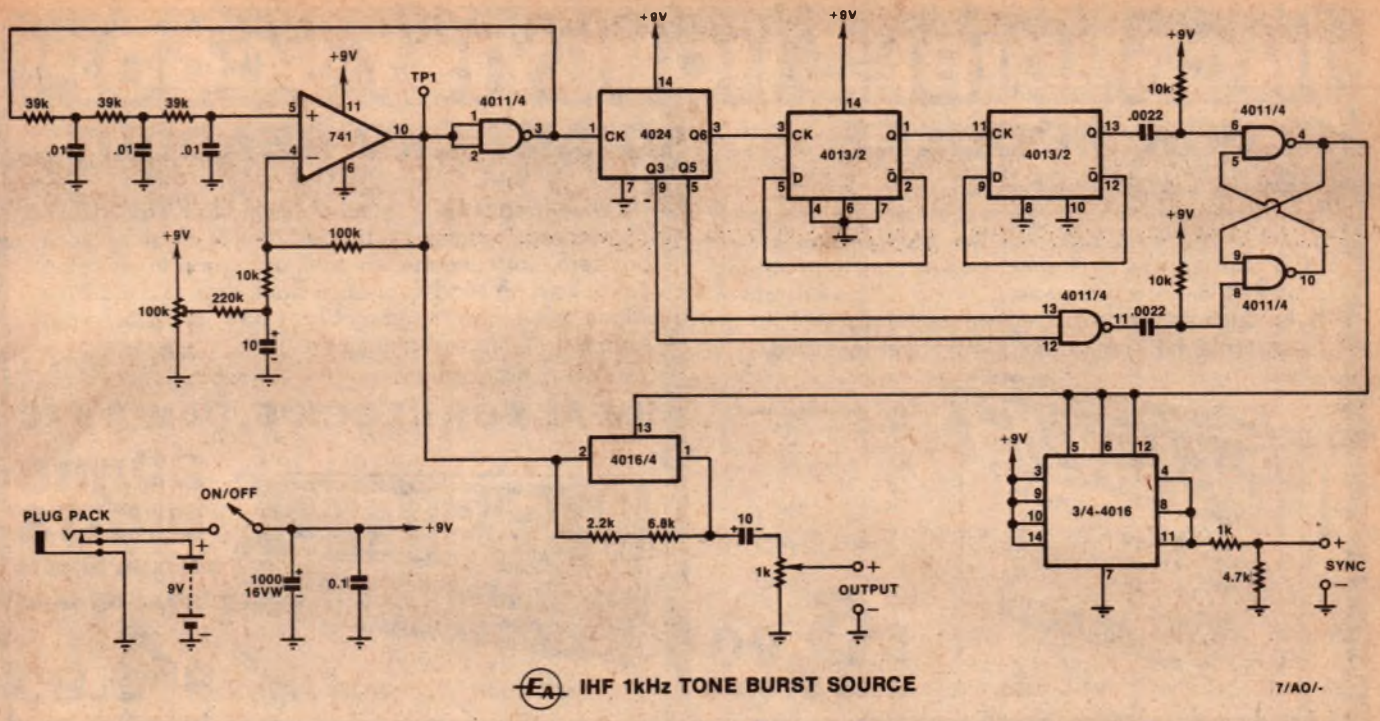
Because the recommended test procedures have changed in this way, we decided to develop the instrument presented here. Rather than present a general purpose instrument which could be used for a variety of tests, we decided to keep the design as simple as possible by making it fit the quite specific definition stated above. The instrument could also be used for toneburst testing of loudspeakers, however.

Our 1968 instrument required an external sinewave oscillator and used RTL (resistor-transistor logic) integrated circuits and a FET for the signal gating. It comprised six ICs and 12 other semiconductor devices such as transistors and diodes.

Our new toneburst source has an in-built 1kHz sinewave oscillator and runs from a single 9V battery or 9V DC mains plugback. It comprises five IC's, four of which are low-power CMOS devices. Current consumption at 9V is a mere 5 milliamps.

Briefly, the circuit operates as follows: the 1kHz sinewave signal is generated, squared and divided by a

The front panel of the unit shows the test functions.



IHF 1kHz TONE BURST SOURCE

7/AO/-

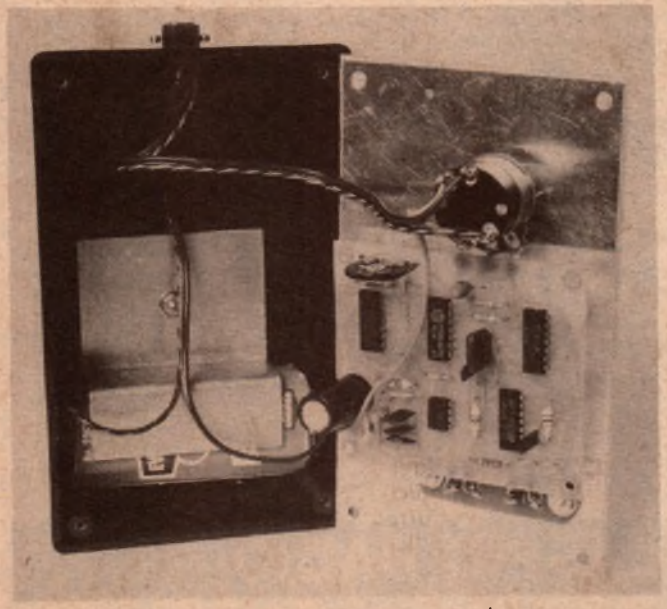
Just five ICs make up this circuit for measuring Dynamic Headroom and Transient Overload recovery of amplifiers.

nine-stage counter to provide a test cycle period of 512 milliseconds. An additional logic circuit is used to derive the 20ms burst period required at the start of every 512ms cycle. The 20ms pulse is used to gate a CMOS analog switch to provide burst of 1kHz sine wave. A resistor network shunting the analog switch provides the 20dB ratio between reference level and the 20ms burst.

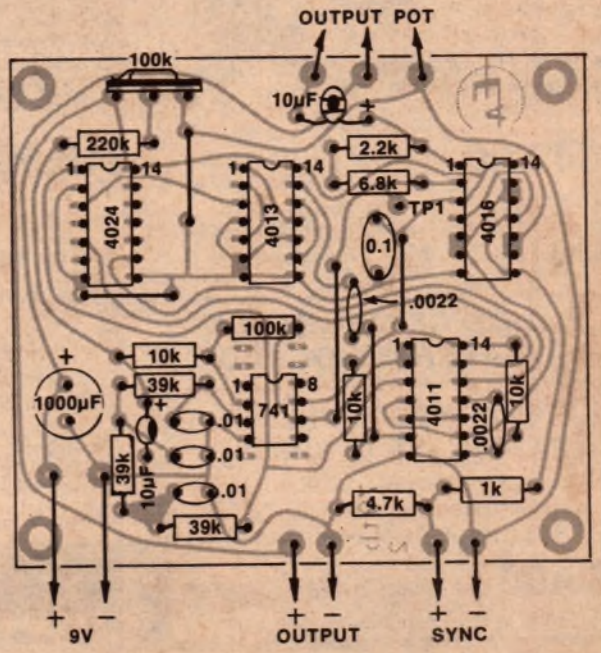
The 1kHz sine and square waves are generated simultaneously by an interesting circuit based on article by L. Nelson-Jones in the November 1965 issue of "Wireless World". The originator regarded the circuit as a

PARTS LIST

1 PCB, 79tb2, 81 x 71mm
1 plastic box, 158 x 96 x 50mm
1 9V battery, Eveready 2362 and clips to suit
1 1k linear switch potentiometer
1 100k trimpot
1 741 operational amplifier
1 4011B buffered quad gate
1 4024 7-stage binary counter
1 4013 dual D flipflop
1 4016 quad CMOS switch
1 x 220k, 1 x 100k, 3 x 39k, 3 x 10k, 1 x 6.8k, 1 x 4.7k, 1 x 2.2k, 1 x 1k resistors (all ½W)
1 1000uF 10VW PCB electrolytic capacitor
2 10uF tantalum capacitors
1 0.1uF polyester capacitor
5 0.01uF polyester capacitors
1 dual RCA socket
1 5mm DC power socket
1 knob
Machine screws and nuts, solder, hookup wire, tinned copper wire.
NOTE: Resistor wattage ratings and capacitor voltage ratings are those used for our prototype. Components with higher ratings may generally be used provided they are physically compatible.



The PCB is wired direct to the front panel.

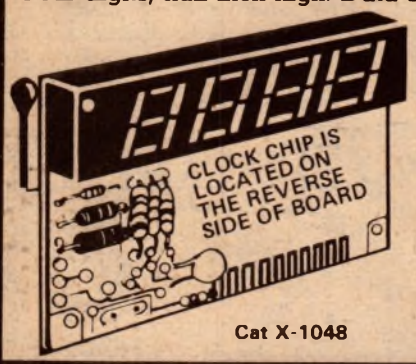


INCREDIBLE HOBBYIST SCOOP!

CLOCK MODULES

NEARLY HALF PRICE!

Ready-to-go — no component assembly required! Yes, this fantastic clock module is complete on its own PCB. All you do is connect power and time setting switches, and away it goes. Clock building has never been this simple. Ideal project for beginners.
Four digits, half inch high. Data sheet included.



Cat X-1048

You may also need:
Transformer: Cat M-2822 ..... $4.25
Push Button Switches, Cat S-1102..... 35c
Toggle Switches Cat S-1173..... $1.20

$6.90
WAS $13.50

GIANT LED READOUT

NEW — from the U.S. electronics giant: FAIRCHILD. This incredibly useful 4 digit readout is ideal for clock builders, instruments, in fact any project needing clear, easy-to-read numerals. Each digit is a massive 20mm high, yet needs only 1.65V @ 20mA per segment. (Common cathode).
Ask for a data sheet.

IDEAL FOR CLOCK'S, DVM'S ETC

20mm DIGITS
SELLING NOW IN USA FOR $6.95

Cat Z-4165 **OUR PRICE $4.95**

DICK SMITH ELECTRONICS

SEE OUR OTHER ADS IN THIS ISSUE FOR STORE ADDRESSES

497EA379

SPECIAL PURCHASE OF SPEAKERS & SPEAKER KITS

RANK-ARENA 2 WAY SPEAKER

- 10 Watts RMS
- 8 ohm impedance
- 8" woofer with tweeter
- Supplied with lead and plug

$42.00 PER PAIR

Dimensions 18"H, 11"W, 9½"D
Freight extra per rail, air or road transport

RANGE OF MAGNAVOX SPEAKERS STOCKED

SPEAKER GRILLE FABRIC AT ½ PRICE

AVAILABLE IN BLACK, BLACK WITH GOLD FLECK, LIGHT & MID BROWNS. WIDTH 60in.

$6.00 Per YARD. post & pack. $1.00
Send two 20c stamps for samples.

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 45 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.

$18.50 PER KIT

CABINETS AVAILABLE
Post & packing extra, NSW $2.50, Interstate $3.50.

NEW IMPORTED HOKUTONE 12" HI-FI SPEAKERS

These 12" speakers have a frequency range power to 5000 cycles with a resonant frequency of 30 cycles. Max. power 30 watts. Post & packing NSW $2.50. Interstate $3.50. **$17.50**

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. Condensers 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.

CLASSIC RADIO

245 PARRAMATTA RD, HABERFIELD 2045. PHONES 798-7145, 798-6507.

variation of the well-known phase-shift oscillator, differing from the normal configuration in that it has a phase-retard rather than a phase-advance network.

Fig 1 is a schematic diagram of the oscillator. It consists of a non-inverting amplifier followed by a Schmitt trigger feeding a three-stage low pass filter, which connects back to the input of the amplifier. (Highly incestuous, you might say!)

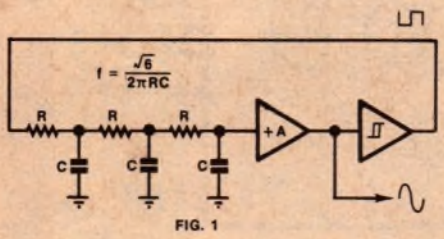


FIG. 1

Now consider a small sinewave signal fed to the non-inverting amplifier. The signal is reproduced in larger form at the amplifier output and fed to the input of the Schmitt trigger. This produces a square wave at its output which is then fed to the three stage lowpass filter. The filter progressively attenuates the higher harmonics of the square wave so that the resulting output is a small amplitude sinewave with virtually no harmonics.

Provided the gain of the amplifier and Schmitt trigger combined is greater than the attenuation of the fundamental in the low pass network, the circuit will oscillate. In fact, it oscillates at a frequency where:

$$f = \frac{\sqrt{6}}{2 \pi RC}$$

At this frequency, the low pass filter produces an exact 180° phase shift which complements the phase shift of the Schmitt trigger.

The resultant oscillator has a stable amplitude without the need for thermistors or other means of amplitude stabilisation. It also has a harmonic distortion content which is low enough for the job. Provided that the square wave output from the Schmitt trigger is exactly 50%, the third harmonic content will 2.18% while the fifth harmonic content will be 0.3% (by calculation). Higher harmonics are negligible.

Our realisation of the circuit uses a 741 operational amplifier for the non-inverting amplifier and a buffered CMOS gate (¼ 4011B) for the Schmitt trigger. The 4011B requires a signal of several volts peak-peak to work satisfactorily as a Schmitt trigger. Accordingly, the 741 is connected as a non-inverting amplifier with a voltage gain of 10 times.

This provides adequate amplification of the attenuated output of the low pass filter, so that the 4011 provides a good square wave with fast rise and fall times. Another essential outcome is a generous output signal to drive the amplifier.

In order to obtain a square wave with an exact 50% duty cycle (and thus minimum distortion in the sinewave output) the sinewave fed to the Schmitt trigger should swing symmetrically about the centrepoint of the Schmitt trigger hysteresis. As it stands, the 741 op amp is biased from the average DC level provided by the square wave output of the Schmitt trigger.

Now by virtue of the 100% DC feedback around the op amp, the sinewave output will swing symmetrically about the centrepoint defined by the average DC level of the Schmitt trigger square wave. However, the hysteresis of the Schmitt trigger will generally not be centred about the same level, so some means of correction is required. This is done by applying an adjustable DC offset to the op amp by the 100k trimpot and 220k isolating resistor.

The DC offset also corrects for any inherent offset error in the op amp and the offset error produced by the unequal DC resistance paths to the inverting and non-inverting inputs.

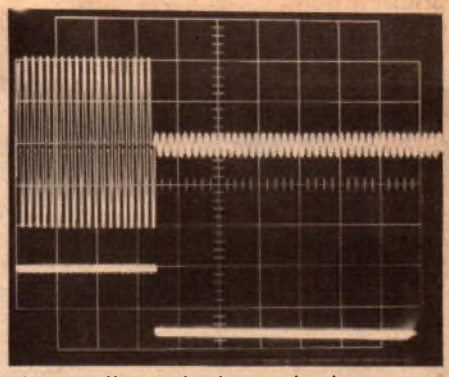
The method of adjustment is to display the square wave output of the 4011 on an oscilloscope and adjust the trimpot to obtain a 50% duty cycle. With this done, the harmonic distortion of the sinewave output should be very close to 2.2%.

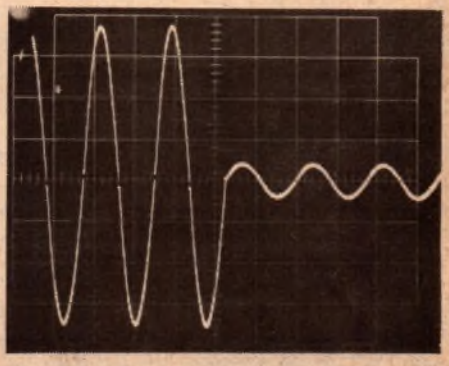
The resistors and capacitors in the low pass network give a calculated oscillator frequency of 999Hz and in our prototype, an actual frequency of 943 Hz. This is within +10% of 1kHz. If the frequency is outside these limits it can be reduced by increasing one of the 39k resistors. If the frequency is too low, decrease one or more of the 39k resistors.

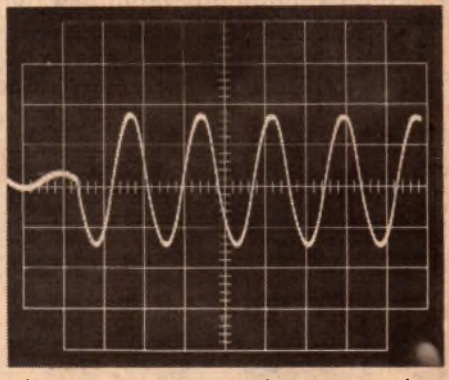
Output from the Schmitt trigger is used to clock a 9-stage counter made up of a 4024 7-stage divider and a 4013 dual-D flipflop. This divides the clock input to provide a 512ms period.

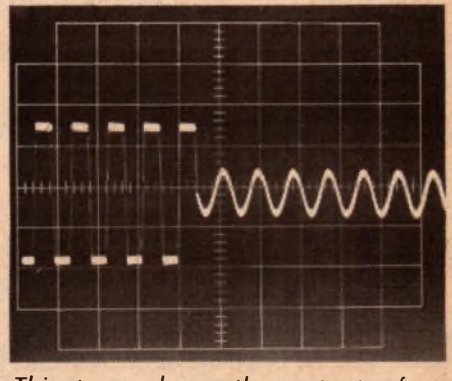
Two of the 4011 gate elements are used to make up an R-S flipflop. This is "set" by the negative going edge produced by the last stage of the counter when the 111111111 to 000000000 transition occurs. The fourth 4011 gate is used to decode the 21st counter state, and to "reset" the R-S flipflop.

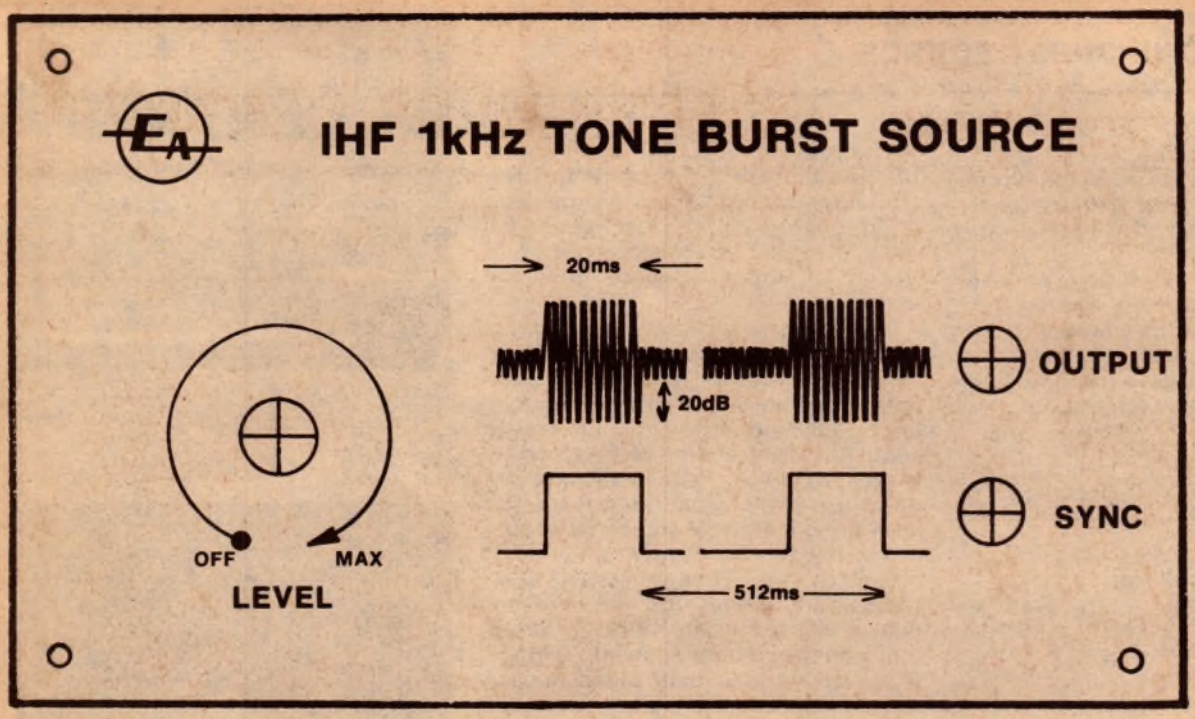
Thus the R-S flipflop is in the set state for 20 of the 512 states of the counter, and reset for the rest. It is used to turn on a 4016 CMOS switch, which thus provides 20 cycles of the test waveform every 512ms. The three remaining 4016

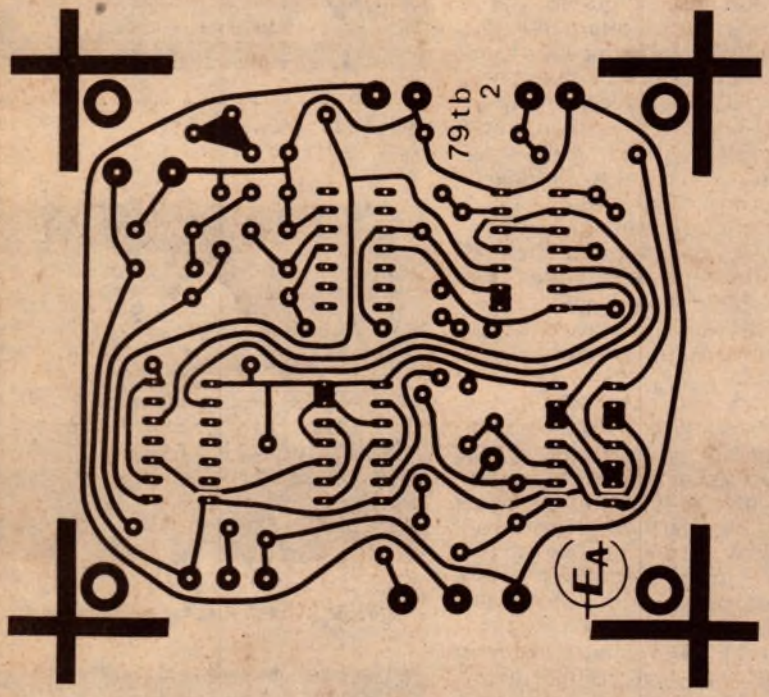

This oscillograph shows the burst output (1V/div) and the sync output (5V/div).


This oscillograph shows the zero voltage switching of the pulse waveform.


This trace represents the output of an amplifier driven just beyond clipping.


This trace shows the output of an amplifier subjected to the Transient Overload Recovery test. Recovery is instantaneous.





A copy of the artwork used is reproduced above. The battery can be clamped into the plastic section of the case using a clip fashioned from scrap aluminium, and the socket for the plug-pack mounted on one end of the case. Complete the wiring to these components with insulated hook-up wire.

switches are used to provide a buffered output from the R-S flipflop, to act as a scope sync waveform.

The 9k (2.2k + 6.8k) resistor in shunt with the 4016 is used to provide the reference signal 20dB below the main gated signal. The 1k pot is used to control the output level.

The total unit requires a 9V supply rail, and draws a current of approximately 5mA. It can be powered either from an internal battery or from a 9V plug-pack. Supply bypassing is provided by the 1000uF electrolytic and the 0.1uF polyester capacitors.

Construction of the unit should not present any problems. Almost all of the components are mounted on a single printed circuit board, coded 79tb2, and measuring 81 x 71mm. The complete unit is mounted in a plastic box, measuring 158 x 96 x 50mm.

A dual RCA socket is mounted towards one end of the case, and the output level control at the other end. The PCB is suspended between them, using the component lugs and a small amount of tinned copper wire. The copper side of the PCB is towards the front panel.

The front panel of the prototype was made from photo-sensitive aluminium.

The Serviceman

Take care — small faults can cause big troubles

An aspect of servicing which I have touched on in these notes before concerns what I choose to call production line servicing, as distinct from field servicing, and which calls for a quite different approach. Because it is unusual in conventional service work, it can present problems when it does occur.

The story I told in the January notes, about a Playmaster amplifier, was an example of production line servicing, though I failed to appreciate this when I started. As a result the job became much more involved than it should have been.

By a coincidence, the story I am about to tell also involved a Playmaster Twin 40 amplifier and could also be classified as a production line type of service. The main difference was that in this case there was no doubt as to the approach required.

Basically it was a case where the customer had built the amplifier but was unable to get it going. I don't know why he picked on me to help him out, unless it was because he had heard about my previous effort, but I was certainly glad that I had already found my way around the circuit and chassis on the previous job.

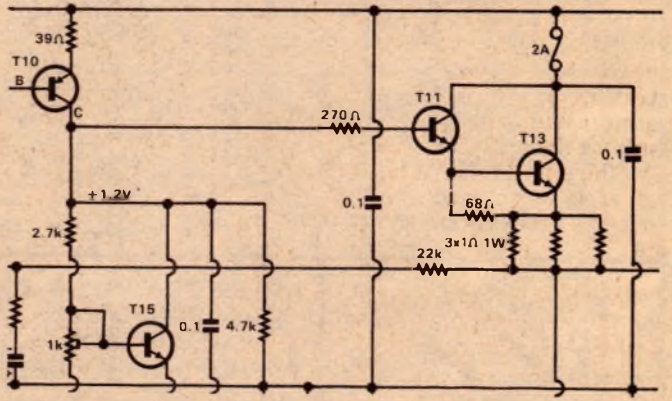
The customer's complaint was that the quiescent current in one channel could not be adjusted properly and, as far as it went, this statement was accurate enough. But, as is so often the case with new equipment, curing one fault only serves to reveal other, usually more subtle, faults. In this case we found a total of four distinct faults before the amplifier was performing as its designer had intended.

Setting the quiescent current for this amplifier involves connecting a 100 ohm resistor across each of the two fuseholders in each channel, and measuring the voltage across them. The 1k tab pot in the base of T15 is then adjusted to give 2V across each fuse or, by calculation, a current of 20mA.

Happily, the accompanying trouble shooting text gave a number of likely items to check in the event that this figure could not be obtained. This saved me a lot of mental effort in visualising the behaviour of the circuit and working out some simple test procedures.

So, together, we set up the amplifier for a quiescent current check of the offending channel. The check confirmed his complaint; while it was possible to adjust the voltage across the negative rail 100 ohm resistor down to zero, the positive rail resistor was running at about 5V (indicating a current flow of 50mA) and nothing would bring it below this.

At this point I recalled that the trouble shooting article had pointed out that, if the quiescent current was zero, it could be due to T15 being short circuit. Looking at the circuit the reasoning behind this isn't hard to follow, so it occurred to me that, by deliberately shorting T15, I should be able to bring the current down to zero — and that this mightn't be a bad place to start from.



The output stage in which the quiescent current could not be adjusted. The current is checked by measuring the voltage across a 100 ohm resistor in place of the 2A fuse.

Suiting the action to the thought I was surprised to observe that the mysterious 5V remained. This was silly because there seemed to be no way that either T11 or T13 could draw current under these conditions.

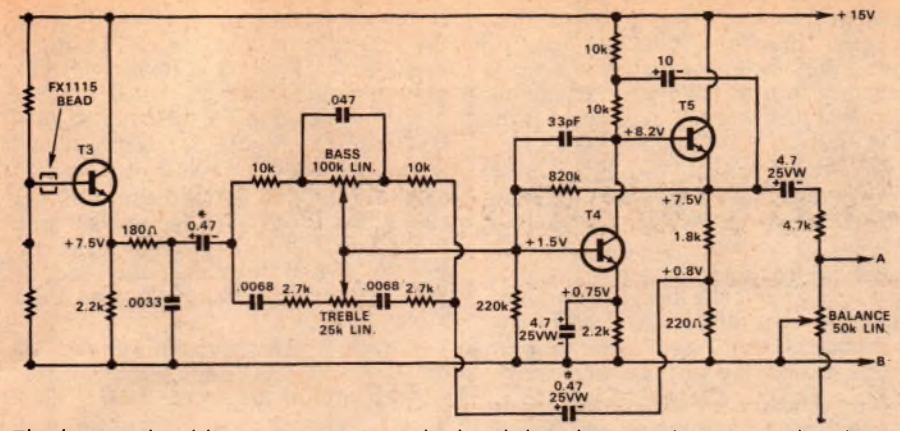
Of course, one of them could be faulty. I was considering this possibility when I noticed an extra lead running from one of the fuse holders; a lead which, for the moment, I couldn't identify. Tracing it revealed that the customer had added the speaker protection circuit described in the same issue (June 1976) that carried the trouble shooting instructions. The lead was, in fact, the 30V supply line for the protector.

And closer inspection revealed something else. This lead was connected to the collector side of the fuse rather than directly to the main 30V supply rail. This meant that any current drawn by the protector circuit would be flowing through the 100 ohm resistor. Could this be the source of the mysterious 5V across it?

Disconnecting the speaker protector line proved the point; the mysterious 5V vanished and a few moments spent adjusting T15's base pot was all that was needed to obtain a proper quiescent setting.

Having set the quiescent current, I decided to restore the speaker protector supply line, and connect it to the other side of the fuse this time. This was where I made a boo-boo. In my determination to do the right thing I accidentally connected it to the correct side of the wrong fuse; the negative rail fuse to be exact. Transistors don't like this kind of treatment, and the relay driver (TR5) was no exception. It promptly turned itself into a short circuit, turning on the relay regardless of what was happening in its base circuit.

Feeling rather foolish I apologised to the customer, and we agreed to put this problem aside for the moment. He was rather anxious, now that the main



The bass and treble control section which exhibited a noise bass control and — ultimately — an intermittent loss of gain and bass response. Note the .047uF capacitor which is intended to keep DC out of the 100k bass control.

problem was under control, to have me give the unit a more detailed checkout while we had it set up on the bench with the necessary test gear to hand.

In fact, the next fault called for little more than ears and eyes to observe and correct. All I did was operate each control in turn, before I even put a signal into the system. One of them, the bass control in one channel, turned out to be noisy.

Maybe circuits and techniques have changed a lot in recent years, producing some quite strange symptoms in some equipment, but a noisy control is a regular from way back. While noise in an old control is probably due to its age, noise in a new control almost invariably means that unwanted DC is somehow being allowed to flow through it.

Looking at the circuit I decided that the most likely source of such voltage would be the emitter of T3 which was at 7.5V. The emitter is coupled to the bass and treble network via a .047uF capacitor, which should effectively prevent this voltage appearing on the other side of it. However, the voltmeter confirmed that there was, in fact, this order of voltage at the appropriate terminal on the bass pot.

Perhaps the capacitor was faulty? Perhaps, but I didn't really expect to find that it was. Carefully tracing the voltage back along the copper pattern brought me to this capacitor, and confirmed that the voltage was the same on both sides of it. But it wasn't the capacitor's fault; it was the customer's.

It is quite a small capacitor, physically, and the two pads to which it connects are quite close together, with only about 1mm between them at the closest points. Apparently the customer had been rather heavy handed with the solder, and had effectively bridged the two pads. This was bad enough in itself, but the real trap was the fact that, once the two pads were bridged, there was nothing to indicate that this should not be so. No amount of visual checking would pick it, unless it was compared directly with the board pattern.

At this point I was ready to connect the amplifier to the audio generator and CRO, plus a dummy load, and confirm that it was delivering a clean signal at the stated power output. That is, until I happened to put my hand on the back of the case, in the region of the output transistors, and realised that these were running quite hot; much hotter than I thought they should, considering that there was no signal being handled and that they had been running for only a short time.

Switching off, I picked up the CRO leads, connecting them across one of the speaker pairs. I turned the volume control right back, then switched on.

The CRO pattern remained clean until I advanced the volume control, then — wham! The horizontal trace expanded into a solid rectangle of supersonic oscillation. What's more, once it started there was little I could do to stop it, short of switching off, retarding the volume control, and switching on again.

I don't mind admitting this rocked me somewhat. Instability can be a tricky problem in any amplifier, and this was a solid state one about which I really had only a superficial knowledge. The only consolation was that I felt confident enough that it would not be an inherent fault; something, somewhere, was not as the designer had intended.

I found the trouble by sheer good luck. While checking over the dress of the speaker leads. I suddenly realised that the active and cold leads, to both speakers, had been transposed. More specifically, the cold leads, which were bypassed at the speaker terminals, were connected to the active side of the output stage, while the un-bypassed speaker terminals connected to the zero volt line.

I couldn't be sure how important this was in terms of the instability problem, but there was no sense in leaving it that way. So I reached for the pliers and soldering iron again and made some more corrections. Then I switched on and tried again. And, Presto — the CRO gave forth only a horizontal line and

nothing I could do with any of the controls would alter it.

So another redskin bit the dust.

I'm not certain as to the exact mechanism by which this error caused the instability, but a few points about these capacitors may be helpful. As I understand it, their primary role is to bypass any rubbish — broadcast programs, CB transmissions, hash or spikes from appliances etc — which might otherwise find their way into the system via the speaker cables and thence to the front end of the amplifier via the feedback system.

I imagine that, in the transposed positions, they created earth loop currents at signal frequencies which found their way into the front end circuits and were of such phase and amplitude as to constitute positive feedback.

Both channels now delivered their rated power quite easily and, in fact, the only abnormality I could find was a small gain descrepency — about 5dB — between channels. Following this up I found that the lower gain channel also appeared not to have a flat frequency response, but was falling slightly at the bass end.

On the other hand, a quick twist of the tone control knobs while watching the CRO pattern indicated that these seemed to be working normally. Not being quite sure where to start I decided to separate the main amplifier from the front-end control section at the balance pot, and determine in which section the loss was occurring.

On this basis it didn't take long to establish the main amplifiers were virtually identical and that the loss was in the front-end. Similarly, I compared the performance of the phono pre-amplifier stages from the phono input through to the input of T3 and, again, came up with virtually indentical figures. So it looked as though it was somewhere between T3 and the balance control.

Well, at least that was something, although it still left a lot of components to be checked. I started with T5 and T4, removing both and checking them in the tester. Both checked OK. I did the same with T3 and came up with the same answer.

So, if it wasn't one of the transistors it had to be one of the passive components. I checked the gain of the T3 stage carefully and could find nothing suspicious, then expanded the test area to include all the components from the selector switch through to the input of the tone control network. Again I drew a blank.

I shifted over to the T4 and T5 network and went over each resistor, without finding anything. Then I made a gain measurement through this network, first with the feedback network intact and then with feedback removed (by shorting the 220 ohm resistor in the emitter of T5). While I had no exact details of the gain I should expect, I was anxious to see what happened when I removed the feedback. It is quite possible for a serious loss of gain to occur within a feedback loop, and be largely masked by the feedback, resulting in only a modest loss, as in this case.

But the test quickly blew that theory out the window; removing the feedback resulted in a massive increase in gain, which left little doubt that it was working normally.

Luckily, at this point the fault had suddenly become intermittent, wavering up and down as I prodded around the tone control section.

It seemed most touchy near the .0068uF capacitor on the T3 side of the treble control and, possibly inspired by frustration, I seized it and gave it purposeful sideways wrench. And that was it. One lead came clean away — as classic a dry joint as I have seen for many a day.

Needless to say a few minutes work with a hot soldering iron was sufficient to put things right, after which the system came good in all respects.

That left only the speaker protection circuit to be repaired and refitted. I replaced the damaged transistor and checked it out before replacing it. But the act of doing this made me realise something else; this circuit could only have accounted for the spurious 50mA had it been activated, since it draws only a few milliamps in its quiescent state. But why would it have been activated? I could think of no reason unless it was faulty.

But if it was faulty, what had happened to the fault? Why was it now behaving in exemplary fashion? Was it — perish the thought — intermittent?

Then another thought occurred to me. Could it have been triggered by the supersonic oscillation from which the amplifier was suffering at that time? Unfortunately, I couldn't be sure. The description of the protector made no mention of such a possibility, yet I had the feeling that a spurious signal as

(Continued on page 125)

HERE IT IS!
THE SYNTHESIZED VOICE

SPEECH IS CREATED THROUGH THE NEW REVOLUTIONARY "VOICE SYNTHESIZER IC" FROM TEXAS INSTRUMENTS, WHICH SCIENTISTS BELIEVED TO BE YEARS AWAY.

THE MOST INNOVATIVE PRODUCT, WHICH MAKES USE OUT OF THIS BREAKTHROUGH TECHNOLOGY, IS "SPEAK & SPELL" from TEXAS INSTRUMENTS. It contains:- two 128k ROM's, storing more than 200 words (provision for expansion), special version of the TMS 1000 Microprocessor IC (capable of addressing up to 2.1 megabytes), Voice-Synthesizer IC with 10-stage digital filter and digital to analogue converter, 8-digit alpha-numeric Display etc. After seeing, operating and hearing "Speak & Spell" you will agree, that it is the ultimate in Self-Teaching-Aids for children, also blind poeple will find it of invaluable help.

SPEAK & SPELL MOTIVATES THE STUDENT TO BECOME A BETTER SPELLER AND READER.
Speak & Spell is a confidence builder. It can give students an edge in spelling and pronouncing words normally difficult for their age and grade levels.
Speak and Spell is an interest builder too, It helps encourage longer study sessions by providing instantaneous grading and words of praise. Happy musical tones precede each new activity selected and accompany student scores.

Teaches the everyday words most often misspelled.
More than 200 of the most common reading and spelling stumbling blocks are programmed in Speak & Spell's computer-like memory. They're the words the noted educators report to be most frequently misspelled from beginning spelling through adulthood. They're words like anxions, ocean, language, obey and learn. They're not uncommon words; they're "problem" words. These exceptions to the rules typically have to be learned by rote.

Here's how it works.
Speak & Spell pronounces the word. Student keys-in the spelling. Speak & Spell praises students for right answers and encourages them to try again when they miss. Pressing a key can have a word repeated ("Repeat" key). Another key can get an entire list replayed ("Replay" key). Another key can change the spelling before it's entered and scored ("Erase" key).
After every set of 10 words, the "voice" of Speak & Spell announces the score as it's shown on the display. The unit praises students for good scores and encourages them to try again when they miss.

Speak & Spell provides 4 levels of spelling achievement. For beginning spellers and up.
Students progress through four levels of about 50 words each, setting their own pace. Level one starts with words students encounter as beginning spellers. As they gain confidence and skill, they progress up the range to tougher, more challenging words.

Pronunciation drill improves vocabulary.
Speak & Spell is converted to a pronuciation quiz instantly with the "Say-It" key. A word is displayed, the unit says, "Say it", then pauses while the student pronounces the word. It then gives the correct pronuciation.

Games add extra dimension of fun.
Speak & Spell is a "must" for rainy days and long trips. The student can complete in a number of games against the unit alone or in a group with friends or family.

"Mystery Word".
Similar to the age-old Hangeman game, Speak & Spell lets players guess words one letter at a time. Pressing a "Clue" key can give the player hints and turn this into a new game. At the end of the game, the unit declares the winner by announcing, "You win", or "I win".

Secret Code.
Speak & Spell codes and decodes words and phrases. Children can use Speak & Spell as a "secret agent" device. Older youngsters and adults can use it to play "Cryptograms."

Letters.
Speak & Spell provides random letters for a variety of games which are covered in the activities booklet and that children make up themselves.

Expandability.
Provison for future plug-in modules.

Children have fun learning spelling, pronunciating and reading.
As spelling and pronuciation skills improve, reading comprehension is improved as well. Speak & Spell has been created scientifically with the guidance of leading educators to sharpen world skills scientifically. It involves the student three ways: hearing the word, spelling the word, and seeing the word. Speak & Spell is designed to impress a word on a child's mind in a lasting manner. It helps extend the student's classroom experience in a fascinating way that's never been possible before.

Special Activities booklet.
Speak & Spell comes with a 32-page illustrated book, "Fun with Words," filled with stimulating spelling games and activities for young students. Easy-to-understand instructions coupled with colourful graphics make this educational addition to each Speak & Spell package a very special bonus.

Power requirements & Warranty.
4 C cell batteries, Warranty - one year.

FORWARD ORDERS TO: DELTA SCIENTIFIC PRODUCT DISTRIBUTION
RED BANK COURT, ST. ALBANS VIC. 3021, Phone (03) 366 3742

Please forward ..... (No.) SPEAK & SPELL at $58.25 including Sales Tax, Post & Pack to:

NAME:..... Please print.

ADDRESS:.....

TOWN:..... Postcode:.....

[ ] Please tick if you wish to resell Texas Instruments Products.

[ ] Please tick for free 50 page Texas Instruments Product Catalogue.

If you wish to pay by Bank Card, please complete
Name on Bank Card (Please print)

.....

Bank Card No:.....

Expiry Date:.....

Signature:.....

Winner of 2nd prize in the Parameters-EA contest:

Improved Logic Probe for TTL & CMOS

Here is the design which won second prize in the Parameters/EA Grand Instrument Contest No. 1. Much lower in cost than comparable commercial probes, it offers high input impedance, one-shot pulse stretching, "open" and "short to rail" detection, and the ability to test both TTL and CMOS circuitry.

by MURREY N. GEDYE

135 Hills Road, Christchurch NZ

Although many logic probe designs have appeared from time to time, most have been very limited in their range of applications, and suffered from low input impedances. Based on three common IC's, this probe boasts six displayed conditions in TTL and four in CMOS. It operates from supplies between 5 and 15 volts and its inherent high input impedance (approximately 3 megohms) ensures minimal loading upon the gate under test. Beside the normal high and low levels, shorts to positive and negative rails (TTL only), incorrect (mid rail) levels and pulses down to less than 1 microsecond are detected and displayed.

The probe was designed with compactness and simplicity of circuitry in mind and to this end 0.125in LEDs were chosen as a display medium. To remove any ambiguity, orange LEDs were used for short to rail, green for high, red for low and orange for pulses. The incorrect level state is shown by an absence of any display.

Referring to the circuit diagram, it will be seen that IC1, an LM324 quad op amp, has each of its elements connected as voltage comparators with one input connected to a fixed reference voltage and the other commoned to the input probe. The outputs of IC1 are decoded by IC2, a 7400 NAND gate, which also drives the display. The 555 timer IC3 is arranged as a non-retriggerable, negative edge triggered monostable with an output pulse of approximately 300 milliseconds.

The input probe is held under quiescent conditions at approximately 37% of the rail voltage by R1 and R2 and the voltage at this point is fed via R3 to pins 3, 6, 9 and 12 of IC1. Section A of IC1 is used to detect shorts to the positive rail. Its inverting input, pin 2, is held at a reference of 50mV from the positive rail by resistors R4 and R5.

Logic high is detected by IC1B. The reference voltage at the inverting input, pin 12, is changed for CMOS or TTL circuits by Switch SW1A. In the TTL position the reference of 2.4 volts is obtained from resistors R6, R8 and R9, while the combination of R6 and R7 provide a reference of approximately 70% of rail voltage for a CMOS high.

When the input voltage on the probe exceeds the references of IC1A and IC1B, output pins 1 and 14 go high. The diode-resistor combinations R16-D1 and R18-D2 limit this voltage to a compatible level for IC2.

The last two sections IC1C and IC1D are used to detect logic low and shorts to the negative rail respectively. Resistors R14 and R15 form the 50mV from rail reference, which is connected to pin 10 of the non-inverting input of

LIST OF PARTS

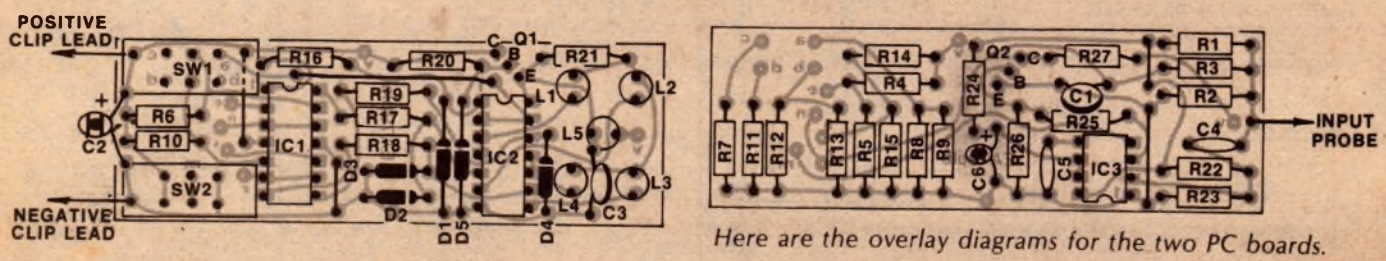
PCB 79/pl/a, 79/pl/b
IC1 LM 324 quad op amp
IC2 7400 quad gate
IC3 555 Timer
L1-5 3mm LEDs (three orange, one red, one green)
PCBs (2) 81 x 26mm, 79p1a/b
Q1, Q2 BC182-3-4 or similar
D5 5.6V/400mW Zener
D1-4 3.3V-4.7V/400mW Zeners

RESISTORS (all ¼ or ½W 5%)

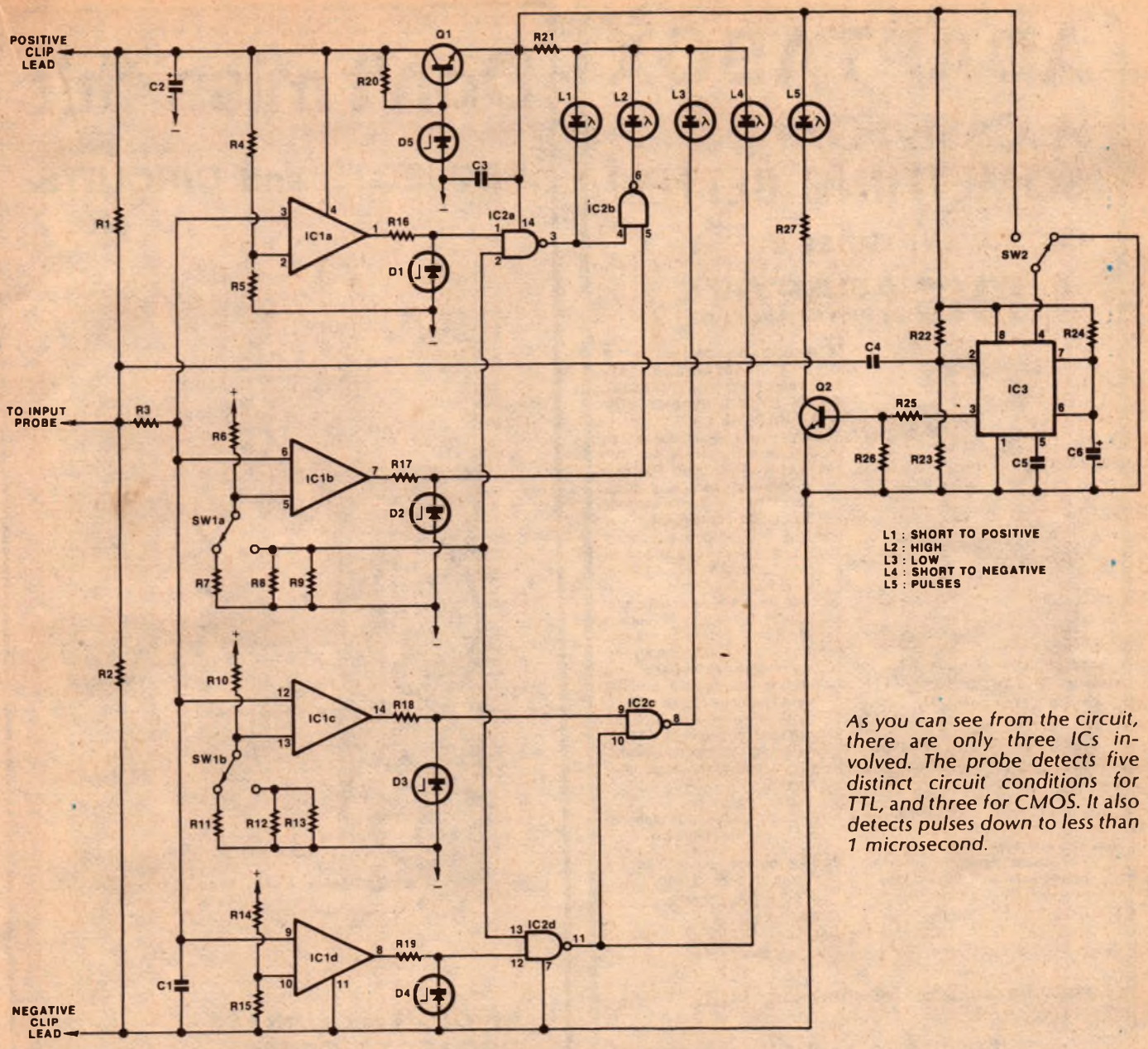
R1	*5.6M*	*R8*	*1.5k*
R2	*3.3M*	*R9*	*15k*
R3	*27k*	*R10*	*3.3k*
R4	*100 ohms*	*R11*	*1.5k*
R5	*10k*	*R12*	*680 ohms*
R6	*1.5k*	*R13*	*8.2k*
R7	*3.3k*	*R14*	*10k*
R15	*100 ohms*	*R22*	*3.3M*
R16	*560 ohms*	*R23*	*2.7M*
R17	*560 ohms*	*R24*	*330k*
R18	*560 ohms*	*R25*	*2.2k*
R19	*560 ohms*	*R26*	*470 ohms*
R20	*330 ohms*	*R27*	*470 ohms*
R21	*470 ohms*		

CAPACITORS

C1 .047uF 50V disc ceramic
C2 10uF 20V tant. bead
C3 0.1uF 50V disc ceramic
C4 .01uF 50V mylar or polyester
C5 .01uF 50V mylar or polyester
C6 1uF 20V tant. bead
Note: Smallest physical size is the most important parameter for C4 and C5.
SW1 Miniature DPDT slider.
SW2 MINIATURE DPDT slider.



Here are the overlay diagrams for the two PC boards.



TTL-CMOS LOGIC PROBE

As you can see from the circuit, there are only three ICs involved. The probe detects five distinct circuit conditions for TTL, and three for CMOS. It also detects pulses down to less than 1 microsecond.

IC1D. The logic low reference for TTL is derived by R10, switch SW1B, R12 and R13 and is set at 0.8V. The CMOS low reference of approximately 30% rail voltage is formed by R10, switch SW1B and R11.

Like the "short to rail", the "low" reference is connected to the non-inverting input, pin 5, so that when the probe goes low and the voltage falls below these references, output pins 7 and 8 go high. As with the previous sections the resistor-diode combinations limit this voltage to a TTL compatible level. The value of the zener diodes D1 to D4 can be anything from 3.3 volts to 4.7 volts.

IC2 drives the respective LEDs, and also performs gating to prevent the normal "high and "low" logic level LEDs from being illuminated in "short to line" situations. This is done by connecting the outputs of IC2A and IC2D to the second inputs of IC2B and IC2C, as shown. As a result, if either of the "short to line" situations is detected, sending the output of IC2A or IC2D low, this holds the output of IC2B or IC2C high and prevents the second LED from illuminating.

Because with CMOS the difference between a normal low or high and the rail voltages is only a few millivolts, a "short to rail" indication is impractical. IC2 is therefore arranged also to disable the "short to rail" LEDs when the probe is switched for CMOS levels. This is done by connecting pins 2 and 13 to the top of the R8/R9 combination. When SW1A is switched to the TTL position, this point becomes a logic high, enabling both IC2A and IC2D and the "short to rail" LEDs; but when SW1A is switched to the CMOS position pins 2 and 13 fall to the low logic level, disabling the LEDs.

The five volt rail required for IC2 is provided by a simple series regulator comprising Q1, R20 and D5. To maintain a constant light output over the wide voltage variations of the probe, this rail also supplies the LEDs, with R21 and R27 limiting the current.

IC3 is the pulse detector. Resistors R22 and R23 help increase its sensitivity so that in practice, pulses even shorter than 1us and pulse trains in excess of 5MHz are still detected. Transistor Q2 inverts the output and drives the "pulse" LED. The switching of pin 4 by SW2 enables this LED to be held off when not required as it would pulse every-time the probe is brought into contact with a LOW.

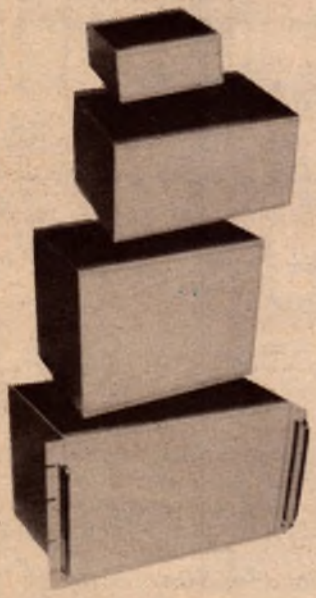
The method of construction of the probe will depend largely upon the resources and ingenuity of the constructor. The layout shown consists of two PC boards mounted inside a folded

ADAPTABOX

A CASE FOR SOMETHING BETTER!

INSTRUMENT CASES BY

AE ADAPTIVE ELECTRONICS P/L



A RANGE OF CABINETS TO GIVE A PROFESSIONAL APPEARANCE TO THAT SPECIAL PIECE OF EQUIPMENT YOU ARE BUILDING!

The standard cabinet is supplied in kit form and consists of:

(a) Satin anodised 1.6mm aluminium front and back panel, with surfaces suitable for screen printing, etc.

(b) Top and bottom panels of hard wearing black "MARVIPLATE" with a 1.0mm steel base.

(c) Side panels of satin anodised 3.0mm aluminium (m series) and 13mm timber (w series).

(d) Four specially designed aluminium extrusions are used to hold the top, bottom, front and back panels in position. Provision is also available on the extrusion for mounting a metal chassis, circuit boards or edge connectors.

(e) Eight screws . . . four through each end plate to complete the assembly.

Options available are:

(1) The front and rear panels can be replaced with 3.0mm satin anodised aluminium.

(2) The bottom panel can be replaced with 3.0mm satin anodised aluminium.

(3) Side panels can be of the rack mounting type, and with this option handles are also provided.

Cases are suitable for mounting PCBs, Transformers, etc.

There are 13 Standard sizes of metal case ranging from 89 x 178 x 178 mm ($16.34) to 267 x 483 x 280 mm ($60.97).

Special sizes available for quantities of 10 or more.

For further details and prices contact our distributors:

Ellistronics, 289 LaTrobe Street, Melbourne 3000 (Tel. 602-3282)

Stewart Electronics, 33 Sunhill Road, Mt Waverley, Victoria, 3149 (Tel. 277-0622)

Rogers Electronics, 44 Heather Drive, Para Vista, South Australia 5096. (Tel. 08-42 6666)

Interstate outlets required

or contact

AE ADAPTIVE ELECTRONICS P/L

77 BEACH ROAD, SANDRINGHAM, VICTORIA, AUSTRALIA 3191
TELEPHONE (03) 598-4422
TELEX: 35666

Don't miss this

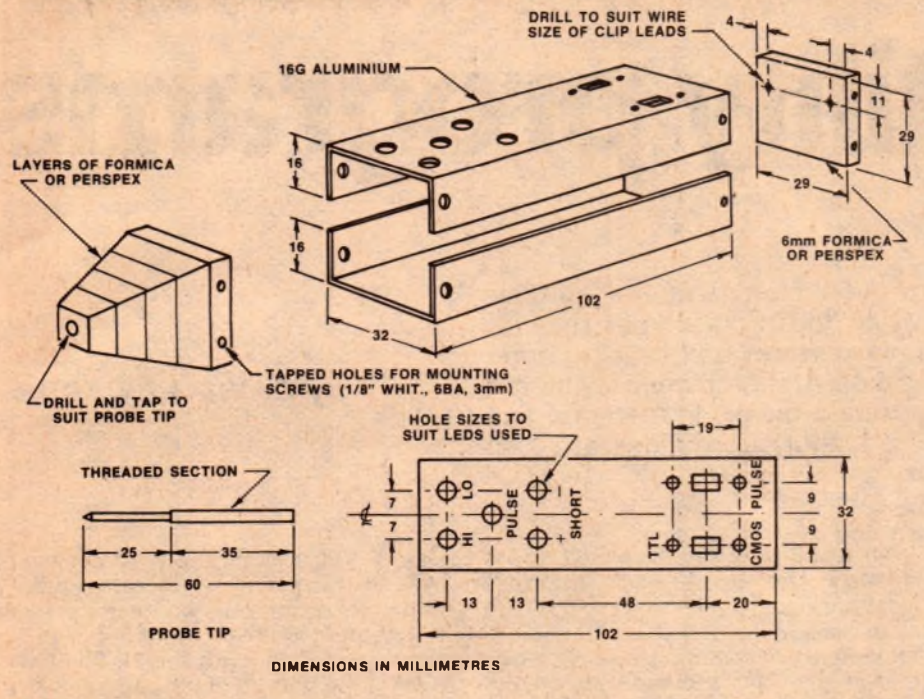
PROJECTS and CIRCUITS No. 2

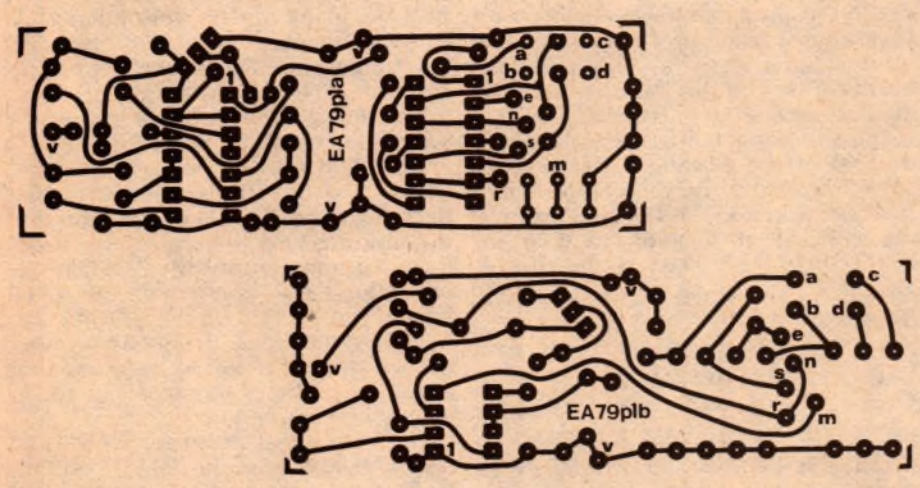
27 DO-IT-YOURSELF PROJECTS FROM "ELECTRONICS AUSTRALIA"

You can't afford to miss out on this exciting new book from "Electronics Australia". Here are just a few of the projects it contains: remote TV headphones, multi-band vertical aerial, roulette wheel, radar burglar alarm, model train control, voice-operated relay, transistor tester, water level alarm . . . plus many more. Get your copy now!

Available from "Electronics Australia", 57 Regent St, Sydney. **PRICE $3.00.** OR by mail order from "Electronics Australia", PO Box 163, Beaconsfield 2014. **PRICE $3.60.**

Improved TTL-CMOS logic probe . . .





Full details of the probe housing are shown in the upper diagram, with the PCB patterns shown actual size below.

aluminium case but equally well, it could be made in any type of container that has a minimum internal dimension of 29mm square by 90mm in length.

The components and links, with the exception of the LEDs and switches are assembled on the boards as shown in the diagram. Next the LEDs are mounted in the case and the legs of the outer four bent to suit the PC board. The switches are fitted to the case and 20mm lengths of tinned copper wire are soldered to their terminals. Lengths of wire are also soldered to the pads marked "e", "n", "s" and "r".

Board "A" is now fitted onto the legs of the LEDs and switches and soldered into place. The legs of the LEDs are trimmed as are the centre wires of switch SW1, the outer and unmarked centre wire of the switch SW2.

Three Vero pins (large) are used to space the boards and also provide positive and negative supplies to board "B" as well as a connection between the pulse LED and transistor T2. These pins are soldered to the pads marked "v" on each board. Board "B" is now fitted in place and all spacers and interconnecting wires are soldered and trimmed. The voltage supply clip leads are connected to board "a" and pass through holes in the end of the case; they should be 400-500 mm in length. The input probe is connected to board "B" via a short length of hookup wire.

It is difficult to estimate a cost for building this probe, but purchasing everything at retail prices, it should not involve more than $25.00, which should compare more than favourably with commercially available probes.

Can be stored in a 2708 EPROM:

2650 utility programs

Here are five utility programs for the 2650 microcomputer, suitable for loading into a 2708 EPROM using the programmer recently described. The routines allow you to perform hex listings, enter programs rapidly in hex from the keyboard, search memory blocks for an instruction, move program or data blocks in memory, and verify program tapes. A number of useful subroutines are also available for use by other programs.

by DAVID EDWARDS

The routines presented in this article are modifications of those originally presented on the Philips/Electronics Australia software record, described in the April 1978 issue. The original routines are quite useful, but have one disadvantage: they have to be loaded into memory every time that the computer is switched on.

By having them stored permanently in a ROM, however, you can avoid this trouble, and make them available for use at a moment's notice. So after completing the EPROM Programmer, my thoughts immediately turned towards these routines, and whether they could be stored in a ROM.

My first idea was to have the EPROM occupy the uppermost memory locations, i.e. from X'7C00 to X'7FFF, so as to leave all of the space below this for memory expansion. However, when I examined the programs in greater detail, I realised that it was necessary to have a small amount of RAM available in the same page as the EPROM, because of the limitations in 2650 memory reference instructions.

The additional hardware required to shift 1k of the existing RAM up into page 3 proved to be too complicated, so I compromised, and decided to put the EPROM at locations X'3C00 to X'3FFF inclusive — i.e., at the top of page 1. The modifications to achieve RAM in this page then became quite simple, involving only one extra gate.

My system at the moment has page 0 completely filled, with the 1K PIPBUG ROM at the bottom of the page, and 7K of RAM filling up the remainder. This RAM is mounted on the prototype 8K RAM board (see December 1978), with pairs of 2114s occupying all locations except those corresponding to the addresses occupied by PIPBUG.

Note that this involves a rearrangement of the high-order address decoding. The 74LS138 decoder on the expansion board is used as the page decoder, and controls the 74LS138s on both the RAM board and the CPU board. The 74LS138 on the RAM board becomes the page 0 decoder, while that on the CPU board becomes the page 1 decoder. Refer to Fig. 1 for a diagram of the wiring.

The chip select signal for PIPBUG is now obtained from the 74LS138 on the RAM board, while the four "spare" RAM pairs on the CPU board are controlled by the 74LS138 on that board. Strictly speaking, only three of these pairs should be used, to avoid overloading the address bus, but in practice we have found that all four pairs can be used without problems.

It is now necessary to disable the main data buffers whenever either PIPBUG or the four RAM pairs are selected. This is the function of the additional gate, the 74LS30 shown in Fig. 1. This is an eight input gate, and is used to replace the inverter provided on the expansion board. It can be mounted on a small piece of Veroboard.

These modifications allow a maximum of 13K of memory to be used, including 11K of RAM. PIPBUG occupies locations X'0000 to X'03FF, RAM from X'0400 to X'2FFF, and the EPROM from

```
0600 CD 0F FA CE 0F FB 17 76 40 77 02 75 18 3F 02 DB
0610 3B 6E 3B FA 3B 0F CD 0F FC CE 0F FD 3B F0 CD 0F
0620 FE CE 0F FF 17 DA 02 D9 00 17 0D 0F FA 0E 0F FB
0630 3B 73 3B 4C ED 0F FC 16 EE 0F FD 17 3F 00 8A 0D
0640 0F FA 3F 02 69 0D 0F FB 3B F9 04 20 3F 02 B4 17
0650 3F 3C 07 3B 67 0D 8F FA 3B E9 3B 6E 3B 4C 9E 00
0660 22 0C 0F FB 44 0F 98 6D 1B 69 3B E5 3B CF 0C 8F
0670 FA EC 0F FE 98 0D 07 01 0F EF FA EC 0F FF 98 03
0680 3F 3C 3C 3F 3C 2A 9A D7 1B 64 3B C5 3B F3 3F 02
0690 86 C3 3F 02 B4 E7 07 18 C6 E7 20 18 0B 0C 0F FF
06A0 CC 0F FE CF 0F FF 1B 66 0C 0F FE 3F 02 46 D3 D3
06B0 D3 D3 CF 0F FE 0C 0F FF 3B F2 6F 0F FE CF 8F FA
06C0 3B C2 0C 0F FB 44 0F 18 43 1B 43 3F 00 8A 3F 3C
06D0 00 0C 8F FA 14 3F 02 B4 3F 3C 2A 1B 71 76 40 3F
06E0 02 86 E4 3A 98 79 20 C8 97 3F 02 24 CD 0F FA 3B
06F0 F9 CD 0F FB 3B F4 59 0E 05 3D 06 31 3B 95 9B 22
0700 04 2C 04 28 04 29 C9 FA 3B E0 08 F4 18 09 05 3D
0710 06 34 3F 3C CB 9B 22 C3 CB EA 3B CE 0B E6 EB E2
0720 18 08 01 EF EF FA 98 66 DB 6E 08 D4 98 60 1F 3C
0730 DF 4F 4B 00 46 41 55 4C 54 59 00 3F 3C 07 ED 0F
0740 FA 19 34 EE 0F F3 1D 3D 84 0C 8F FA CC 8F FE 3F
0750 3C 2A 9E 00 22 3B 07 3F 3C 25 3B 09 1B 6B 0D 0F
0760 FE 0E 0F FF 17 CD 0F FE CE 0F FF 17 0D 0F FC 0E
0770 0F FD 3B 07 CD 0F FC CE 0F FD 17 FA 00 E6 FF 98
0780 02 F9 00 17 3B 66 77 09 3B 54 AE 0F FB AD 0F FA
0790 75 01 8E 0F FD 8D 0F FC 3B 4B 75 08 0C 8F FC CC
07A0 8F FE 3F 3D 5E 3B 54 3F 3D 65 3B 40 0C 8F FC CC
07B0 8F FE ED 0F FA 19 6B EE 0F FB 19 66 9B 22
```

FIG. 2

When in ROM, the programs must reside at location X'3C00 to X'3DBD.

X'3C00 to X'3FFF. This should allow quite large programs to be run.

The uppermost RAM locations can be reserved for scratchpad use by programs in the ROM. Only six locations are required by the programs presented in this article, so this leaves nearly 11K of RAM available for your programs.

Now that the hardware has been sorted out, we can discuss the programs themselves. These use PIPBUG routines GNUM, CRLF, BOUT, COUT, LKUP, CHIN and BIN, as well as RAM locations CNT, BCC and MCNT.

The first program provided is titled HEX LIST. This produces a hexadecimal listing of any desired memory block, with each line consisting of an address followed by 16 data bytes. To call this routine, type G3C50 AAAA BBBB cr, where A is the start address of the memory area to be dumped, and B is the end address. The listing will include the specified start and end addresses.

If you wish to have fewer data bytes per line, change the contents of location X'3C65 to the appropriate hexadecimal number before you burn the EPROM.

The second routine is called SEARCH. It will list all locations within a given memory block that match a given test pair of data bytes. The matching addresses are printed out in a single column. To call this program, type G3C6A AAAA BBBB XXYY cr, where A and B are the start and end addresses of the range to be searched, and XXYY is the test pattern.

The addresses printed out are those of the first byte of the matched pairs. The search is inclusive, and includes the start and end addresses.

The third program is called HEXIN, and will enable data or programs to be entered into RAM much faster than using the PIPBUG "A" routine. To call the program, type G3C8A AAAA cr, where A is the address of the first RAM location at which bytes are to be entered.

The program will respond by printing out the start address on a new line, and then wait for you to enter hexadecimal characters. Bytes are separated by spaces, and only the last two characters entered before a space are accepted by the program. This means that if you make a mistake, you can simply type in the correct characters before typing the space.

After 16 bytes have been accepted, the program will give a CRLF, and then print the current address at the start of the new line. In this way, if you are careful, you will produce a hex listing as you input the bytes. To terminate the entry mode, type a control-G "BELL" after the space entering the last byte.

The fourth program is titled VERIFY, and is used to check that a PIPBUG absolute object format dump tape is correct and contains no errors, before the master in RAM is destroyed. To use the program, simply type G3CDD cr, and

ASP ?

ASP is the superb ASP SYSTEM ONE Computer for business, scientific or educational use. Problem solving at a very reasonable price.

ASP is a professional quality conversion of the IBM SELECTRIC typewriter to a word processing quality printer with either S100 or RS232 interfaces.

ASP is the magnificent MALIBU DESIGN GROUP printer. 160 cps bi-directional and graphics capability with the looks of a high quality piece of furniture.

ASP is the new ASP Computer Portrait System - a profitable small business that can be transported in your vehicle.

ASP MICROCOMPUTERS

DEAR ALI please rush me brochures on:
- EVERYTHING!
- ASP SYSTEM ONE
- SELECTRICS
- MALIBU
- COMPUTER PORTRAITS
- DEALERSHIPS!

SELECTRIC is a Trademark of IBM

ASP is ALI!

NOTE OUR NEW ADDRESS:

799 DANDENONG ROAD EAST MALVERN 3145

& OUR NEW TELEPHONE NUMBERS:

211 8855 211 8344

"THE S100 BUS STOP"

$100 16K STATIC RAM

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. Special offer price $299.00 for STD kits $5.00 P&P Reg. mail.

EXTEND UV EPROM ERASERS

New product range. LEE/T 15W tube — 20 min. timer — up to 40 eproms — will erase in 10/15 min. Model MEE/T — 8W tube — 20 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 $83.47, MEE $73.90. P&P $3.00

S100/6800 CHASSIS

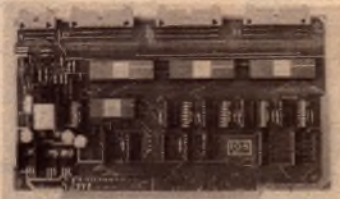
11 Slot back plane, 10 amp power supply, fan, key switch, bench mount, rack mount, fully card guided, anodised alum.

Basic Bench Mount	$189.00
Power Supply S100	$ 79.00
Accessory Kit	$ 46.00
Basic Rack Mount	$166.00
Reg. Power Supply 6800	$104.00

Sent F.O.B. Overnite Transport

S100 16K Eprom Board Kit	$90.00	P&P $3.00
S100 Z80 CPU Board Kit	$149.00	P&P $3.00
S100 Floppy Disc Controller Kit	$159.00	P&P $3.00
S100 8 Slot Back Plane	$22.50	
S100 11 Slot Back Plane	$36.00	
S100 Sockets	$7.50	
S100 Wire Wrap Board	$22.50	
S100 Extender Board Kit	$22.50	
Number Cruncher Kit	$49.50	
Paper Tape Reader Kit	$69.50	
Front Panel Display Kit	$87.50	
8080 Single Step Control Kit	$21.65	

$100 I/O PORT BOARD



9 Parallel Ports (programable), 1 Serial Port-TTY RS232 or TTL. Baud rate generator 9600 to 75, fully address decoded, low power buffers, plated thru holes, solder mask.
KIT PRICE $164.00 P&P $3.00.

DISC DRIVES

Shugart SA400 Mini	$355.00	P&P $5.00
Shugart SA800	$580.00	P&P $5.00
6800 PRODUCTS		
6800 5 Slot Back Plane	$26.50	
6800 11 Slot Back Plane	$36.00	
6800 11 Slot Chassis (Basic)	$166.00	
2708 EPROMS		
450nS. guaranteed quality	$12.00	
2716 Eproms (single supply)	$43.50	
2114 RAMS Low Power 450nS with 300nS available	$8.50	

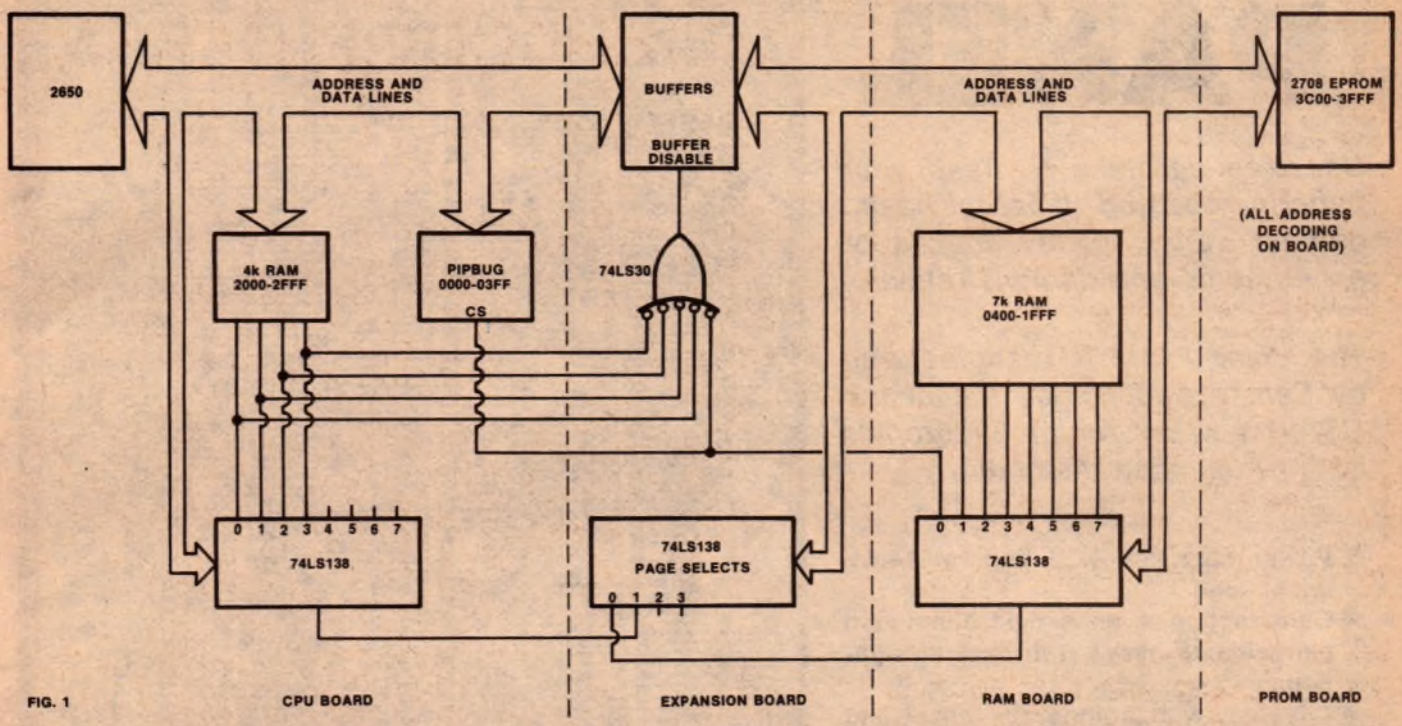
Send 60c in stamps for computer printout catalogue for full product information.
All products Aust. made and ex-stock (almost).
Dealer enquiries welcome.

SM ELECTRONICS MELBOURNE

bankcard

BUILT AND TESTED P.O.A.
ALL PRICES ADD 15% S.T. IF APPLICABLE

S.M. ELECTRONICS
10 STAFFORD CRT. DONCASTER EAST, VICTORIA, 3109
BOX 19 DONCASTER EAST, 3109.
PHONE (03) 842 3950.



The schematic diagram shows how the author's system is configured.

then play back the tape to be checked. The program will then read from the tape, and compare its contents with those of the appropriate section of RAM.

If all is correct, the program will respond with the message "OK". If a fault is found, the message "FAULTY" will be printed. This program can only be used to check 110 baud tapes produced by the PIPBUG Dump command. The RAM dumped must still be in memory when the verification is performed, of course.

The fifth and final program is called MOVE. It will shift a specified block of memory to any other location in memory. A memory block can be any size, and can be moved either upwards or downwards in memory by any amount. To use the program, type G3D3B AAAA BBBB CCCC cr.

A and B represent the start and finish locations of the block of memory to be moved, and C represents the new start location. The program will move the memory starting at A and ending at B so that it starts at C and ends at C + A — B. The original memory block will only be changed if the new locations overlap the old locations.

The MOVE program can be used to copy memory from one page to another page, and can also move blocks straddling page junctions. Memory locations will not be destroyed if the new start location is the same as the old start location.

A number of useful subroutines are also included as part of the programs. If you branch to location X'3CF8, the message "OK" will be printed, and if you branch to location X'3D0E, the message "FAULTY" will be printed. In both cases control will return to PIPBUG after the message is printed.

A message printing subroutine is included at locations X'3CCB to X'3CDC. This expects R1 and R2 to point to the start of a an ASCII message string. The string must be terminated by the null (X'00) character. If you enter this routine at location X'3CCB, the message will be printed on a new line, while if you enter at location X'3CCE, the message will be printed on the current line.

A subroutine called GPAR is located at address X'3C07. This uses the PIPBUG subroutine GNUM to get three parameters from the PIPBUG line buffer, and store them as bytes in locations X'2FFA to X'2FFF inclusive. The first parameter is stored in locations X'2FFA and X'2FFB, and is called START.

The second parameter is incremented, and then stored in locations X'2FFC and X'2FFD. It is called END. The third parameter, called NEW, is stored in locations X'2FFE and X'2FFF.

The subroutine INCRT is called at location X'3C2A, and increments the value START. It then compares START with END, and sets the condition code bits accordingly before returning. The condition code is set to "less than" (10) if START is less than END.

Another useful subroutine is called PADR, and is called at location X'3C3C. It will print the value of START, as a four digit hexadecimal number, at the start of a new line. The address is followed by a single space.

A number of smaller subroutines are also contained among the programs, but these are rather specialised, and will not be used very often. Interested readers can use the disassembler to disassemble the listing, and hence locate them.

To burn the program into a 2708, simply load it into a convenient area of RAM, and use the program supplied with the Prom Programmer article (Jan 1979) to copy it into the PROM. The program contains absolute addresses, and will only run at the correct locations, starting at X'3C00. RAM must exist at locations X'2FFA to X'2FFF inclusive.

Note that the listing of the programs given in this article shows them stored temporarily in the RAM at locations X'0600—07BD. This should be a convenient place to store them initially in most systems, before burning them into your PROM.

SOLAR PANEL

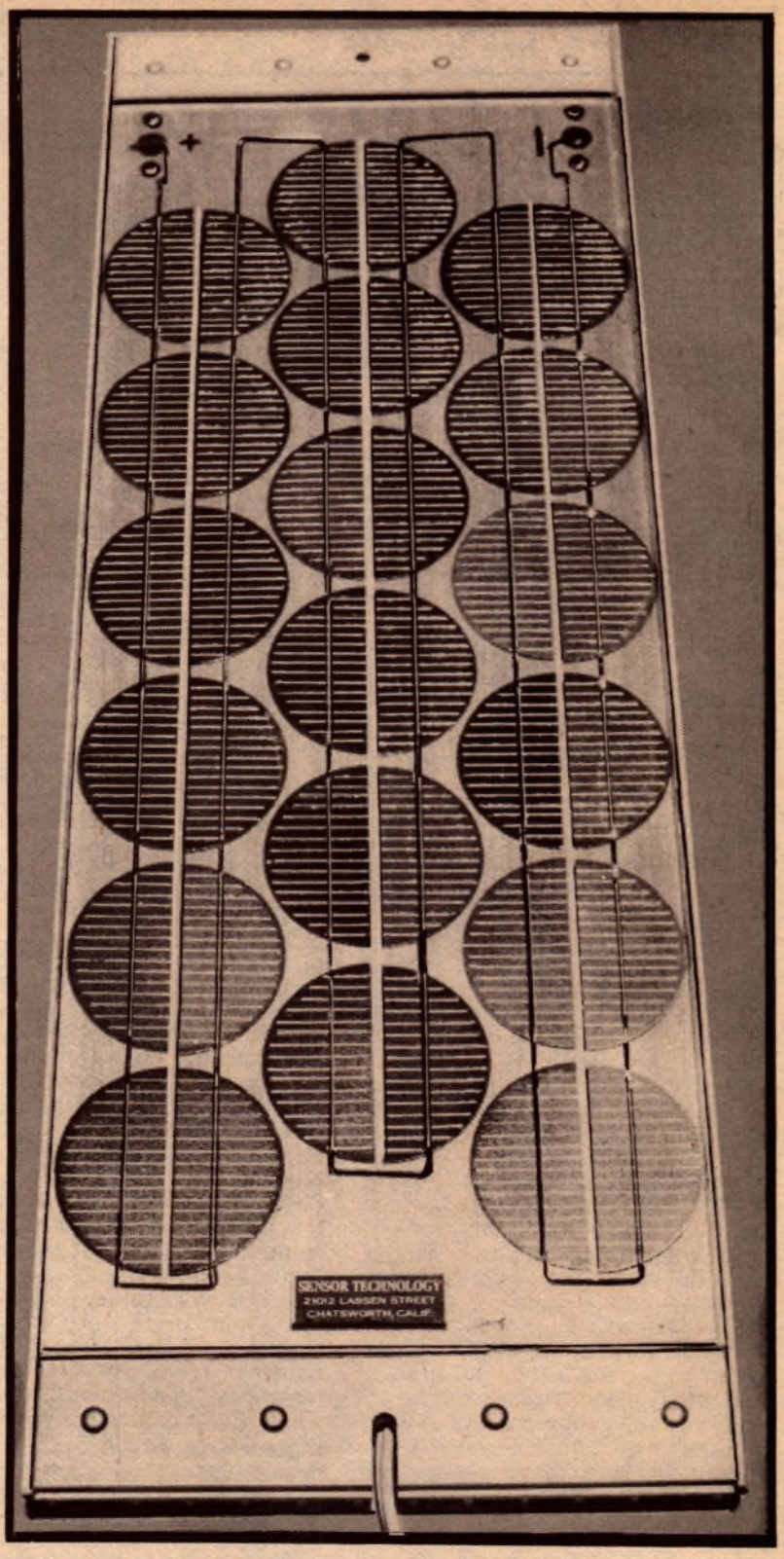
Use free sunshine to keep your batteries charged. Ideal for boats, camper vans, holiday shacks or experiments and demonstrations.

●

The Solar Panel is manufactured by Sensor Technology Inc of the USA, for whom Amtex Electronics is the Australian distributor.

●

- **Power output is 4.32 Watt at 14.4V under load**
- **Construction is on a rigid aluminium extrusion to assist with heat dissipation.**
- **Covered with tempered glass and sealed against dust and moisture**
- **Built-in Schottky diode prevents reverse current damaging the panel**



$147 Including sales tax plus

$5 Certified Post and handling

OR $130 plus $5 Certified Post and handling (if order is accompanied by an official sales tax exemption certificate).

HOW TO ORDER: Fill in BOTH sections of the coupon, in each section print your name and full postal address in block letters. Cut the entire coupon out around the dotted line. Send it with your money order or crossed cheque to this Magazine's Mail Order Dept (Solar Panel 74/78), Box 4000, GPO, Sydney, 2001. Cheques should be endorsed on the back with sender's name and address and made payable to this magazine. This offer is open to readers in Australia only. PLEASE ALLOW 4 WEEKS FOR DELIVERY.

Name .....

Address .....

..... State .....

Postcode ..... Quantity .....

THIS MAGAZINE'S SOLAR PANEL OFFER 74/78

Name .....

Address .....

..... State ..... Postcode .....

Please send me ..... (state quantity) Solar Panel/s. I enclose my cheque, postal/money order to the value of $ EA3

Track down faults in your memory boards:

Memory test routine

Here is a memory diagnostic routine for your 2650 Mini Computer. It will exercise each and every bit in a specified memory range with four distinct tests, and produce a printout of any faulty locations. It can also be used to track down intermittent faults.

by DAVID EDWARDS

Memory testing can be a very tedious and time consuming process, so most operators of small systems simply assume that all is OK, and get on with writing programs. But when a program you have triple checked and are sure is OK fails to operate correctly, you start to wonder about your memory.

Ninetynine times out of a hundred, of course, the memory is working correctly, and the bug is in your program (moral: check, check and check again, and if you can get a second opinion, do so!). But what do you do if the program still refuses to operate correctly?

Well, you can always employ the old standby, the walking finger test. This involves placing your index finger in turn on all of the memory chips. The chip (or chips) that sends you running to the first aid cabinet is then faulty. Don't laugh, this does work, and I have used it in the past.

But this test will not show up faults like open circuit address or data lines, or short circuits between adjacent PCB tracks. This type of fault is quite common on large memory boards, as they have more and more memory crammed onto them.

In these situations, what is required is some sort of software test routine which will exercise all memory locations of interest, and provide clues as to where the fault is. This is the function of the program described in this article.

The tests described here are based on those presented by Charles E. Cook, in the October 1977 issue of the US magazine, "Kilobaud". Two of the tests are quite simple, and check that each location can store and read back both a null (X'00 and a delete (X'FF).

The third test is known as the "walking bit test", and is perhaps the most important test. It verifies the "changeability" of each bit of the test location, by storing first the pattern 00000001, then 00000010, and so on up to 10000000, each time checking that only the correct pattern can be read back from the memory. The test bit (the 1) has been "walked" through the test byte.

The fourth test is really a combination of the three earlier tests. The whole of the test area of memory is first cleared, and then tested for correct clearing (this is the first test). Next, the walking bit test and the delete test are performed on the first test location. Then before these two tests are carried out on the second location, it is tested to see if it is still zero. If it is not, then there is obviously a memory fault of some type or other.

This process is repeated in turn throughout the test memory area, and forms the fourth test.

In order for the operator to be able to use these test results, it is necessary to know not only the type of faults encountered, but also their locations. To simplify matters, we have called the first test the Z test, the second the L test, the third the W test, and the fourth the S test. Then all the program has to do is print out the code letter of the test, followed by the appropriate address.

A flowchart for the basic test routine is shown in Fig. 1. Test S is carried out at the start of the main loop. The failure sections incorporate the error message printing routines, and produce a listing five entries wide, which can be accommodated on a 32 character-per-line VDU.

If the test routine is run once, it will catch and record all permanent faults, but is unlikely to give any indications of intermittent faults. To catch this type of fault, we must repeat the basic test routine a large number of times.

It would be wise, of course, to arrange that once a fault has been detected, that the program stops at the end of the current basic test. If this is not done, then there is a fair chance that you will be rewarded with a great screed of endlessly repeated error message sets, whereas only one set is required.

The complete program, incor-

```
0440 09 1E 0A 1D DA 02 D9 00 C9 16 CA 15 17 3B 71 E9
0450 0D 16 EA 0B 17 09 05 0A 04 3B 6D 17 00 00 00 00
0460 00 00 04 5A 1B 0C 04 53 1B 08 06 40 04 57 1B 02
0470 04 4C 3F 02 B4 09 69 3F 02 69 09 65 3B FA 04 20
0480 3B F1 FB 05 3F 00 8A 07 05 04 01 C8 01 17 00 76
0490 40 77 02 75 18 3F 02 DB C9 42 CA 41 3B F8 DA 02
04A0 D9 00 CD 04 5E CE 04 5F 3B EC CA 62 3B D7 07 05
04B0 3F 04 55 20 CC 84 60 3F 04 4D 1A 77 3B F3 0C 84
04C0 60 BC 04 62 3B F2 1A 76 3B E7 0C 84 60 BC 04 66
04D0 06 80 CE 84 60 EE 84 60 BC 04 6A D2 9A 74 04 FF
04E0 CC 84 60 EC 84 60 BC 04 70 3B CD 1A 5D 0E 04 8E
04F0 1E 04 B0 FA 00 CA F7 5A F8 9B 22
```

FIG. 2

This is a hexadecimal listing of the 2650 memory test program. You can use the dissassembler program to produce a mnemonic listing of it.

porating all of these points, is given as a hexadecimal listing in Fig. 2. It occupies locations X'440 to X'4FA inclusive, and is not easily relocated. It uses PIPBUG routines COUT, BOUT, CRLF and GNUM.

To be able to use this program, the memory area it occupies must be working correctly, and so must the processor. If you are not sure about this, try it anyway; if it works, then all is OK. Otherwise, you will have to do some fault-finding and corrections first.

To call the program, type G48F XXXX YYYY ZZ cr, where X is the start address of the memory range to be tested, and Y is the end address. Remember that the existing contents of the test area will be destroyed, and that you cannot test the area of memory occupied by the test program.

The parameter Z determined how many basic tests are to be carried out. X'01 gives one test, X'02 gives two, and so on up to X'7F, which produces 127 tests. All negative numbers such as X'80 and X'FF, produce an unlimited number of tests, terminated only when an error is detected.

The first time you use the program, specify only one test. Any errors you get will almost certainly be permanent faults, and should be found and corrected first. Only when this has been done should you attempt to trace intermittents using multiple tests.

In these initial tests, it may be advantageous to test only small amounts of memory at a time, say 1K blocks. This will allow you to isolate any faults more rapidly.

At this stage, you are probably wondering what all the rather strange lists of error locations mean, and how they can be used to locate faults in your memory. Well, simple faults should show up as easy to understand patterns.

For instance, if a data line to a particular chip is open, then all locations in this chip should fail the W and L tests. Similarly, if an address line to a particular chip is open, then we would expect test S to fail at all locations where this address line would normally go high. This is because the open line will normally float high, so that when we address lower bytes, we will actually write into higher locations, and will get an S message when we do address these bytes.

Further information on the types of faults which can occur in memory, and the results they produce with our test program, can be obtained from Cook's article. In any case, you will have to play at being a detective, and apply a little deductive reasoning.

Finally, a few detailed comments on the program for those who may wish to modify it. The start, end and current addresses are stored in locations X'45C to X'461, while the number of tests is stored in location X'48E. The number of error messages on each line is specified in locations X'488 and X'4AF.

To remove the auto-stop facility when errors occur, change locations X'48B and X'48C to the NOP code, X'C0. If you wish to obtain an error message every time the walking bit test fails, rather than just once for each walking bit test, change locations X'46A and X'46B to NOPs.

By changing locations X'4ED to X'4F2 inclusive to NOPs, you can delete the repeat forever facility, and obtain a maximum of 256 basic tests (specify X'00 in the calling line).

In conclusion, I wish you happy fault hunting, and successful debugging of your own programs. Because once you have assured yourself that your memory is OK, then you realise that the reason your program won't run correctly is because you have written a bug into it!

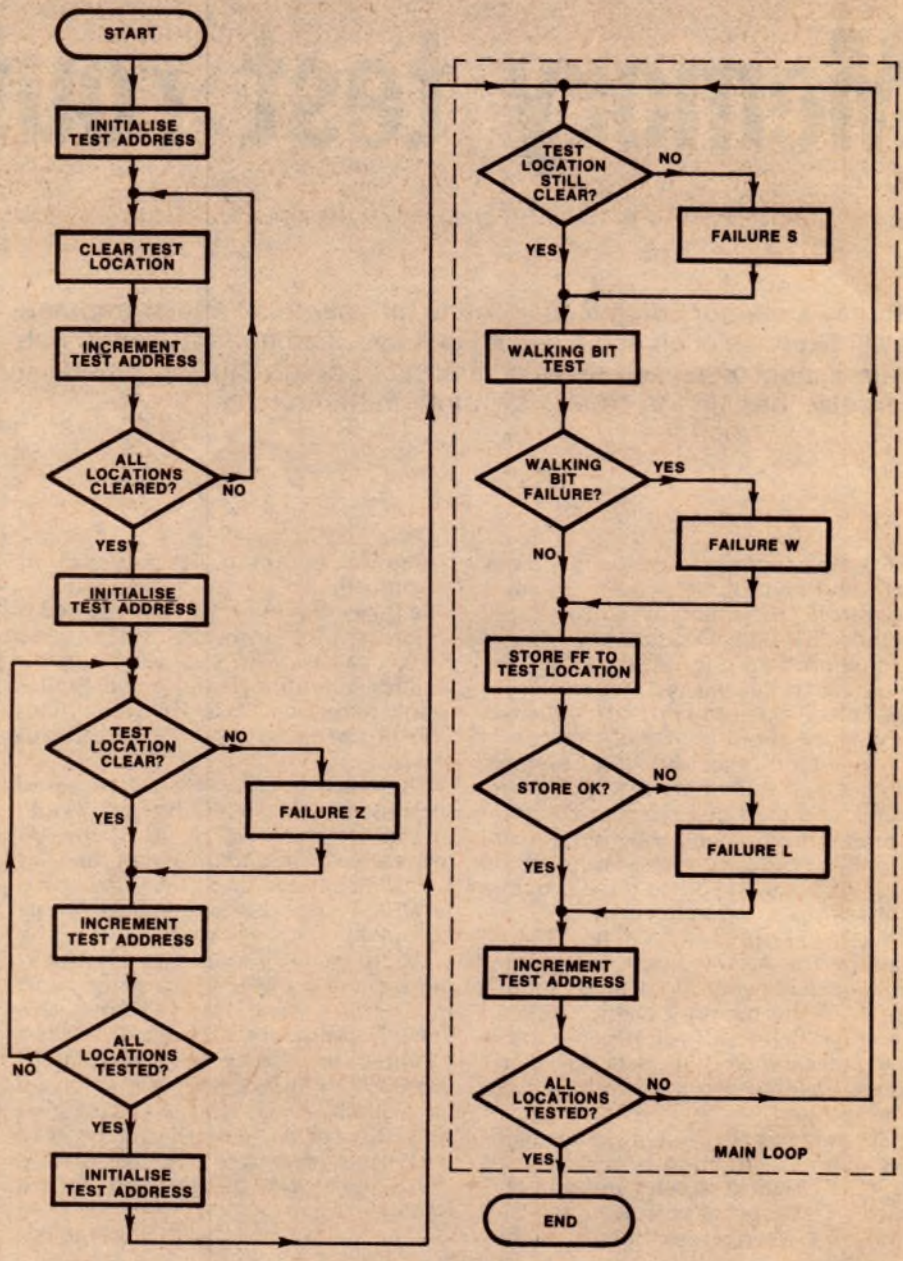


FIG. 1 BASIC TEST ROUTINE

Readers with systems based on CPUs other than the 2650 can use this flowchart to write their own diagnostic routines.

Discount Components

SPECIALS

10 RED LEDS	$1.50	100 RED LEDS	$13.00	10 uA301	$3.30
7805	90c	10 4016	$4.50	4N28	$1.00
7812	90c	6 LUG TAG STRIPS	5c	4N29	$1.10
LM317K	$2.90	309K	$1.50	10 7490	$3.00
TIL209	18c	10 GREEN LEDS	$2.90	10 74123	$5.00
10 BC547	$1.20	10 YELLOW LEDS	$2.90	10 741	$2.90
IN4003	7c	10 4011	$2.00	LED CLIPS	2c
IN4002	7c	10 74LS00	$2.00	10 723	$4.50

LINEARS

301	.40
307	.65
308	1.25
309K	1.90
311	.80
317K	2.90
318	3.25
324	1.25
325	4.60
339	.85
348	1.60
349	2.25
356	1.65
377	2.75
379S	6.95
380 14 Pin	1.30
381	1.95
382	1.95
387	1.90
386	1.90
555	.35
556	.85
565	1.90
566	2.40
567	2.60
709	.70
723 (VR)	.50
741	.30
747	.90
3900	.85
3909	1.20
CA3028	2.90
CA3046	2.10
CA3130	1.95
CA3140	1.95
RL4136	2.90

REGULATORS

7805	1.00
7806	1.20
7808	1.20
7812	1.00
7815	1.20
7818	1.20
7824	1.20
7905	1.50
7906	1.50
7908	1.50
7924	1.50
7912	1.50
7915	1.50
78L05	.40
78L12	.40
78HGKC	8.50
78H05	7.90
78H12	7.90
723	.50
309K	1.90
317K	2.90

OPTO

FND357 C.C.	1.30
FND500 C.C.	1.25
FND507 C.A	1.40
FND800 C.C.	3.50
TIL209 Leds	.20
RED LEDS	.18
100 for	13.00
YELLOW	.30
GREEN	.30
Mounting Clips	.3

DIODES

1N4148	.5
100 for	4.00
1N4002	.7
1N4003	.8
1N4004	.9
100 for	7.00
1N5625	.50

RESISTORS

1/2 Watt I.R.H. Metal Glaze 1 ohm to 1M (E24 Values). 1-99 .3
100-999 .2.5

TRANSISTORS

BC547/8/9	.15
BC557/8/9	.20
BD139	.55
BD140	.55
2N3055	.85
MJ2955	.95
BC337	.25
BC338	.25
BF115	.85
BF180	.75
PN3643	.25
PN3645	.25

BRIDGES

MDA3501 35A 100V	4.10
MDA3502 35A 200V	4.20
MDA3504 35A 400V	4.50
WO4 1.5A 400V	.80

SCR

C103YY 8A 60V	.80
C106A1 4A 100V	.95
C106D1 4A 400V	1.30
C122D1 8A 400V	2.50
C122E 8A 500V	2.60

I.C. SOCKETS

8 PIN	.25
14 PIN	.33
16 PIN	.35
18 PIN	.50
20 PIN	.60
22 PIN	.75
24 PIN	.80
28 PIN	.90
40 PIN	1.00

TTL

7400	.25
7401	.25
7402	.25
7403	.25
7404	.35
7405	.35
7406	.50
7407	.50
7408	.32
7409	.32
7410	.25
7411	.35
7413	.55
7414	.90
7416	.60
7417	.60
7420	.25
7421	.50
7422	.30
7426	.45
7417	.45
7430	.30
7432	.40
7437	.50
7438	.50
7440	.30
7441	1.50
7442	.70
7447	.95
7448	.95
7450	.35
7451	.35
7453	.35
7454	.30
7460	.35
7470	.65
7472	.45
7473	.60
7474	.65
7475	.65
7476	.45
7480	1.25
7483	1.25
7485	1.45
7486	.65
7489	1.90
7490	.50
7491	1.00
7492	.65
7493	.65
7494	1.10
7495	.95
74100	2.45
74107	.65
74121	.50
74123	.90
74132	1.25
74150	1.60
74151	1.10
74153	1.10
74154	1.70
74157	1.10
74160	1.55
74161	1.75
74164	1.55
74165	1.55
74173	2.75
74175	1.65
74180	1.35
74192	1.40
74193	1.40
74197	1.50
74221	1.50
74251	1.50
74367	1.20
74368	1.20

74LS

74LS00	.25
74LS01	.30
74LS02	.25
74LS03	.30
74LS04	.35
74LS05	.35
74LS08	.30
74LS09	.30
74LS10	.25
74LS11	.30
74LS12	.30
74LS14	1.00
74LS15	.35
74LS20	.30
74LS21	.30
74LS22	.35
74LS26	.40
74LS27	.30
74LS28	.40
74LS30	.30
74LS32	.30
74LS37	.45
74LS38	.45
74LS40	.30
74LS42	1.10
74LS47	1.40
74LS48	1.50
74LS49	1.80
74LS51	.45
74LS54	.45
74LS55	.45
74LS73	.90
74LS74	.50
74LS75	.70
74LS76	.95
74LS78	.50
74LS83	1.50
74LS85	1.50
74LS86	.50
74LS90	1.10
74LS92	1.20
74LS93	1.10
74LS95	1.50
74LS107	1.20
74LS109	.50
74LS112	1.20
74LS113	.55
74LS114	.55
74LS122	2.00
74LS123	1.90
74LS125	1.90
74LS126	1.50
74LS132	1.60
74LS126	.79
74LS138	1.20
74LS139	1.90
74LS151	1.20
74LS153	1.90
74LS154	1.60
74LS157	1.00
74LS158	1.90
73LS160	2.20
74LS161	2.20
74LS162	2.30
74LS163	1.20
74LS164	1.30
74LS168	3.30
74LS169	3.50
74LS170	3.50
74LS173	2.10
74LS174	1.00
74LS175	1.00
74LS190	2.80
74LS191	1.20
74LS192	1.20
74LS193	1.20
74LS194	1.20
74LS195	1.20
74LS196	1.20
74LS197	1.90
74LS221	1.90
74LS253	1.85
74LS279	.65
74LS365	.75
74LS366	.90
74LS367	.75
74LS368	.75
74LS386	.95

CMOS

4000	.40
4001	.25
4002	.25
4006	1.40
4007	.25
4008	1.25
4010	1.25
4011	.25
4012	.25
4013	.55
4014	1.30
4015	1.20
4016	.50
4017	1.30
4018	1.40
4019	.75
4020	1.55
4021	1.35
4022	1.60
4023	.25
4024	.90
4025	.40
4026	2.10
4027	.80
4028	1.25
4029	1.85
4030	.40
4040	1.30
4041	1.25
4042	1.25
4043	1.59
4044	1.50
4046	1.80
4049	.60
4050	.60
4051	1.20
4052	1.20
4053	1.20
4060	2.60
4066	1.00
4068	.40
4069	.35
4070	.40
4071	.40
4072	.40
4073	.40
4074	.40
4076	1.85
4077	.40
4078	.40
4081	.40
4082	.40
4510	1.40
4511	1.40
4518	1.50
4519	.95
4520	1.45
4528	1.20
14553	7.30
14584	1.25
74C00	.40
74C02	.40
74C04	.40
74C08	.40
74C10	.40
74C14	1.75
74C48	2.40
74C73	1.20
74C75	1.20
74C76	1.35
74C90	2.20
74C93	2.20
74C175	1.85
74C192	2.20
74C193	2.20
74C221	2.20

Minimum pack and post $1.00 please stipulate if any items are out of stock that a credit be issued or the items to be backordered or an immediate refund be issued.
Send 40c stamp for copy of free condensed catalogue
Open from — MON-THURS 8.00am—5.30pm.
FRI 8.00am—7.00pm. SAT 8.30am—12.30pm

ALL GOODS ARE PRIME SPEC. FROM LEADING MANUFACTURERS

MAIL ORDERS TO: P.O. BOX 135 NORTHCOTE, VIC. 3070
PERSONAL SHOPPING AT THE SHOP AT 499 HIGH ST NORTHCOTE, VIC. 3070.

ROD IRVING ELECTRONICS

Microcomputer News & Products

Computer games

Futuretronics Australia has announced a number of intriguing new electronic games based on microcomputers. One is the new Atari Video Computer System pictured at right, which mates with 30 different plug-in cartridges to provide a very wide range of video games and diversions. There are "sport" games like football, golf, bowling and basketball, gambling-type games like blackjack and poker, fun games like "Space War" "Sky Diver", "Canyon Bomber" and "Human Cannonball", and mind games like Video Chess and Backgammon. There are also educational cartridges like a maths tutor.

Many of the cartridges provide a number of games and game variations, and Atari claims a total of over 1300 game variations. All games have realistic sound effects, and many have on-screen scoring.

A special feature of the new Atari game system is that it automatically changes the colours on the screen every five seconds, to prevent phosphor burn-in damage. Up to four

players can take part in many of the games.

Also available from Futuretronics are a Bridge Challenger game and a Bridge Bidder, both from Fidelity Electronics — makers of the Chess Challenger and Backgammon Challenger games. The Bridge Challenger features an inbuilt optical scanner for custom playing cards, and offers a wide variety of well known bidding conventions.

Perhaps of even greater interest is a new Chess Challenger game which is due to be released shortly, featuring realistic speech! Called the Voice Chess Challenger, the new game will audibly describe every move and capture, and can describe the full board status on demand. It is therefore ideal for blind players, or for those who would like to be able to tape record a particular game strategy. The number of moves in a game can also be displayed at the conclusion of play.

The Voice Chess Challenger is due to be released around June, and should sell for around $600. Versions speaking in either English or German will be available, with a French version following later.

Further information on these products from Futuretronics Australia Pty Ltd, 79-81 Levanswell Road, Moorabbin, Victoria. Telephone (03) 95 5536.

8K RAM card

Techniparts has announced an 8K static RAM card kit, designed especially for 2650-based microcomputer systems based on the KT9500 prototyping card, but also suitable for other processors and systems. The card uses 2114 memory devices and has full provision for address and data bus buffering. Full on-board 8K decoding is provided, with four spare inverters to allow for page-select gating.

The card kit is priced from $48 with 1K of RAM, to $185 with a full 8K. Further details from Techniparts, PO Box 118, Paddington, Qld 4064. Telephone (07) 36 1474.

2650 "MicroBASIC"

A "MicroBASIC" interpreter for small 2650-based systems has been developed by a reader, Mr Alan Peek of 10 Gale Street, Woolwich NSW 2110. The interpreter fits in a mere 1.6K bytes of memory, not counting its stack and variable table, a feat which has been achieved by using single character commands, reverse Polish notation and a novel line numbering system.

The MicroBASIC interpreter is available in PIPBUG-loadable cassette form, with literature, for $8.50 including postage.

Computer clubs

Currently we know of organised computer hobby clubs or groups, as listed below. Details of other clubs will be published if we are advised of their formation or existence.

CANBERRA. The Microprocessor Special Interest Group (MICSIG), which although affiliated with the Canberra branch of the Australian Computer Society also welcomes non-ACS members, both hobbyist and professional. Meetings are held at 7.30 pm on the second Tuesday of the month in Building 9 at the Canberra College of Advanced Education. Further information from the Registrar, MICSIG, c/- PO Box 446, Canberra City, ACT 2601.

SYDNEY. The Microcomputer Enthusiasts Group (MEGs). Meetings are held at 8pm on the first and third Monday of each month at the WIA centre, 14 Atcheson Street, Crows Nest. Mail address PO Box 3, St Leonards 2065.

IREE SYDNEY MICROPROCESSOR GROUP. Meets monthly. Details available from Dr Barry Madden, School of Chemical Technology, University of NSW, PO Box 1 Kensington, NSW 2033.

MELBOURNE. The Microcomputer Club of Melbourne (MICOM). Meetings are held at 2pm on the third Saturday of each month at the Model Railways Hall, Glen Iris (opposite railway station). Contact is Roger Edgecome on (03) 836 1077 (bus hours).

BRISBANE. The Microcomputer Interest Group. Meetings are held at 7.30pm on the second Friday of each month at the Windsor State School, Harris St, Windsor. Contact is Norman Wilson, PO Box 81, Albion, Qld 4010.

PERTH. The Western Australian Computer Enthusiasts' Group (WACEG). Meets on the last Monday of the month at 7.30pm, at Taimac Video Corporation, 1st floor, Cnr Newcastle and

William Sts, Perth WA. Further information from Bob Langlois, c/- Memorex Pty Ltd, 49 Hay St, Subiaco WA.

HOBART. The Tasmanian Amateur Computer Society (TACS). Meetings are held at 7.30pm on the first and third Tuesdays of the month in the Computer Studies area of the Rosny Matriculation College, Hobart. Further details from the secretary, Clive Myers, on Hobart 65 2252.

NEWCASTLE. Newcastle Microcomputer Club. Meetings are held at 7pm on the second and fourth Mondays of the month in room G03 of the Engineering building at the University of Newcastle, Shortland. Further information from Brian Hill, 5 Kalinda Street, Blacksmiths, NSW 2281.

NEW ENGLAND. The New England Computer Hobbyists Club. Membership is by no means limited to students, and enquiries are invited. Further information from Colin Kemp, secretary New England Computer Hobbyists Club, University of New England, Armidale, NSW 2351.

TOWNSVILLE. Microprocessor Special Interest Group, associated with the Townsville Chapter of the Australian Computer Society. Meetings are held monthly. Further information from the secretary, Peter Quodling, MICSIG, ACS, PO Box 82, Aitkenvale, Qld 4814.

2650 USERS' GROUP. Further information is available from Applied Technology Pty Ltd, 109-111 Hunter St, Hornsby, NSW 2077. APPLE-2 COMPUTER USERS CLUB. Further information is available from Computerland Pty Ltd, 55 Clarence St, Sydney 2000. TRS-80 USERS' CLUB. For further information contact Pitt St Microcomputer Shop, PO Box 105, Marrickville 2204.

NEW ZEALAND MICROCOMPUTER CLUB. Meets monthly at 7.30pm on Wednesday evenings in E block staff room, Auckland Technical Institute. Mail address Box 6210, PO Auckland.

WELLINGTON MICROCOMPUTER CLUB. Mail address Box 1581, PO Wellington, NZ.

CHRISTCHURCH. Contact Paul Campbell, 50 Francis Ave, Christchurch, NZ.

Classical Recordings

Reviewed by Julian Russell

Mendelssohn: "superb piece of music making"

MENDELSSOHN — Octet in E Flat. Variations and Scherzo for String Quartet, Op.31. The Cleveland Quartet and Tokyo String Quartet. RCA Red Seal Stereo ARLI 2532.

I must confess to a feeling of relief — and enjoyment — that I followed the Tchaikovsky reviewed below with the Mendelssohn Octet. Yet despite the undeniable brilliance of the playing, even this disc is not without some slight faults. Mendelssohn left on record that he wanted it played in "symphonic style", which perhaps encouraged the engineers to sometimes use a harsh tone unusual in chamber music. The effect is often like listening to a chamber orchestra recorded too close to the microphone.

But I must stress that this only occurs during the loud passages. The softer ones are always a delight. I must also mention an aspect of style which seems to be developing among all but the most classically minded combinations — a tendency to swell in the middle of a long-held note — or even phrase. These do not occur frequently in the Octet, certainly not often enough to spoil the rest of this undoubtedly virtuoso reading, but it does become a little tiresome in the fill.

But despite these remarks the splendid accuracy, expressiveness and unanimity must all be remembered in this superb piece of music making. Even the most exposed passages pass without a hitch. The Octet is a masterpiece by this far too frequently under-rated composer, a fact that happily is being put right by the various recording companies who are nowadays reviving interest in his lesser known works — though I wouldn't put the great Octet in the lesser-known category.

The scoring — except for the overstressed fortes and fortissimos — has all the brilliant transparency characteristic of the composer. The softer sequences never have a dull overall quietness but are full of lovely rises and falls in dynamics always immaculately phrased.

The Octet, despite its complete expertise, was a comparatively early work. The third movement has much of the fairylike quality of the composer's incidental music to A Midsummer Night's Dream and is taken at a brisk speed without any noticeable pushing. And here the engineering is impeccable.

But if you think the third movement is taken fast, but still cleanly, wait till you hear the next, the Finale. It is close to a miracle in speed and accuracy. I have never before heard it go at such a spirited pace and still retain all its joyous quality.

The two movements of the unfinished Quartet, Op. 31, a set of variations and a scherzo, are played by the Cleveland alone. The work was composed during the composer's deep sorrow at the early death of a well loved sister. But Mendelssohn was not at his best describing tragedy. His temperament was too mercurial for that despite his outwardly stiff demeanour.

The variations have a slow theme followed by an ingenious set of variations. In them you will hear more beautiful playing — except for the swelling on slow passages mentioned above. The Scherzo is so typical of Mendelssohn that the Midsummer Night's Dream music again comes irresistably to mind. The whole disc makes a valuable contribution to Mendelssohn's recorded chamber music.

Tchaikovsky — Piano Concerto No. 2

TCHAIKOVSKY — Piano Concerto No. 2 in G major. Werner Haas (piano) with the National Opera Orchestra of Monte Carlo. Philips Sonic Series Stereo Cassette 7317 196.

Tchaikovsky's Second Piano Concerto doesn't give its performers the chance to display the panache of the First, although there are plenty of occasions that give soloist and orchestra their "bits of fat". And since its composer was one of the world's greatest melodists it contains some lovely tunes too. It is in these latter that Haas' superiority over his accompaniment is at its most obvious. He deserved better, though it is clear that Imbal is doing his best with the material he's using. The least attractive features of the orchestral playing are heard in the contributions of the first desk orchestral soloists.

This disc, by the way, offers the only uncut version of the slow movement I can recall having heard. True, it seems to go on for ages, but if the composer didn't cut it himself I can think of no very good reason that anybody else should. I admit, however, that the temptation must be great. It contains so much solo violin and cello playing it almost becomes a trio with orchestra. Perhaps purposely? But at any rate there is compensation to be had in the very lovely ending to the movement.

But Haas' really splendid playing does much to encourage lenience in the listener with what is after all not one of the world's finest orchestras, though I have heard it play better than this on other recordings. Haas uses a true Tchaikovsky style — plenty of persuasive bravura without too much overemphasis and truly lyrical but never sentimental presentations of the cantilena passages. He is particularly brilliant in the Finale, in which he leaves the orchestra for dead!

☆ ☆ ☆

BEETHOVEN — Piano Sonata No. 29 in B Major (Hammerklavier). Maurizio Pollini (piano). Philips Stereo Cassette 3300 869.

This is one of the finest performances of the Hammerklavier I have heard. And I have reviewed my fair share of

other versions by undoubted masters. In fact, on consideration, I feel safe in saying that it is the best I have ever heard!

In a work of this magnitude there are bound to be occasional moments when another reading is preferred, but I must stress that Pollini's reading as a whole seems to me to be nearer to Beethoven's intentions. It is not simply a matter that every bar has been examined and re-examined so that it fits perfectly into the whole. Listening to Pollini's performance is to be convinced that there is no other way to play it.

The Hammerklavier covers such a great spectrum of sound that memories of other performances sometimes — but rarely — intrude. However, these are only in snatches and one immediately resumes complete involvement in Pollini's grand design.

I am assuming, after what I have written, that you are taking the pianist's technique for granted when it comes to the mere playing of the notes. But to this I must add mention of his superb rhythmic control and the use of a great variety of sonorities in the most sensitive passages of this monumental work. The Finale is simply stunning, even after all the magic that has gone before it.

I add only for the benefit of the veriest beginner in the field of Beethoven's music that I know of no more difficult piano sonata, a work that makes almost inhuman demands on its performer's technique and concentration.

☆ ☆ ☆

STRAVINSKY — The Rite of Spring. New York Philharmonic Orchestra conducted by Zubin Mehta. CBS Stereo Disc 235902.

This is as difficult a record to review as I can recall. What I write is bound to read like a mass of contradictions.

There are plenty of good things and some odd ones too. Parts of it are taken at strange tempos and the range of dynamics tends to the extreme. The loudest passages make a terrific impact — if one's neighbours are home.

Yet massive though the sound might be, much of the inner detail is never overlain. True, here and there are strange balances, and this in the most unexpected places. Mehta's reading is at variance with most others, especially Stravinsky's own which was issued many years ago. At times he is expressive when he should be dead pan and vice versa.

Yet the whole effect is vivid, if not quite in the way the composer intended. For that reason I should not be surprised if it proves a popular issue with the general record buying public, especially those to whom the work is unfamiliar. It faces, of course, tremendously strong competition by fine orchestras directed by famous conductors. But I can't imagine prospective buyers plodding through most of these before deciding on which to choose because each has its own distinctive quality and none is quite like Mehta's.

I have not the space to go into the many different readings, each with its own strong characteristics. But to help you a little in your choice if you intend to shop around for another version I personally would reduce my search to listening to the performances of Abbado, Solti, and Karajan. These are among the most recent.

☆ ☆ ☆

SAINT-SAENS — Symphony No. 3 in C Minor (The Organ Symphony). New York Philharmonic Orchestra conducted by Leonard Bernstein. Leonard Raver (organ). CBS Stereo Disc SBR235932.

At his best Leonard Bernstein can be fine, albeit even then given to a slight tendency to exaggerate a phrase here and there. I prefer him recorded because you can then avoid having to watch his balletic antics on the rostrum. But there are times when he indulges in "expression" reminiscent of middle-period Stokowsky at his most intemperate, but without Stokowsky's insistence on ensemble and attack.

This performance, I am afraid, is Bernstein in one of his "less than best" moods. It is quite different from that which I heard him conduct at the Lincoln Centre in New York in 1965, a performance which, if not echt-French in idiom, was at least clean so far as the unadjusted acoustics of the hall permitted. To put it bluntly, in this recording Bernstein just doesn't seem very interested in what he is doing. His usual drive is missing and he is much too lavish in this use of rubatos.

His tempo in the Allegro Moderato is unnaturally slow and when he comes to the slow part of the movement he becomes excessively sentimental. All through his phrasing seems to lack purpose. Nor has his orchestra — the same that I heard him conduct in New York — always have the precision one has the right to expect from that highly respected body. In fact his players seem just as uninterested in what they are doing as Bernstein himself, and for this Bernstein must be held responsible.

However, there is no lack of precision in the Scherzo in which Bernstein takes great care to see that everything goes along as it should. Indeed he seems to have taken extra trouble in rehearsing this movement at the expense of the Finale which, of course, is the famous organ movement. To say that it is disappointing is an understatement.

The engineering is not an example of CBS at its best and this might account for the lack of impact of the organ at the beginning of the movement and which fails to gain viability as the movement progresses. During the whole movement there is an alien slackness in the playing of both the orchestra and organ, the latter played by Leonard Raver. This slackness extends even to what should be an exciting coda.

Before deciding to buy a Saint-Saens Third I advise readers to compare Bernstein's performance with some of his current competitors, especially that of Fremaux who is at present resident conductor of the Sydney Symphony Orchestra. Personally, I would prefer almost any one of them to Bernstein's.

Borge — Balderdash!

I have been associated with Editor-in-Chief Neville Williams for something like 20 years, and during the whole of that time I cannot recall a cross word having passed between us. He combines competence with amiability and, to my mind, was the last person I would have expected to play a dirty trick on me. But I suppose there had to come a time, and this is it.

In the January 1979 issue of "Electronics Australia" he reviewed a set of two discs by alleged musical comic Victor Borge: Excerpts from "My Favourite Intervals". On these, he commented favourably. He then passed the records over to me for my printed opinion.

Now bear in mind that he's the boss, and that everybody's touchy about their sense of humour. Some people, for instance, think Ronnie Barker very funny. Others, heaven help them, think the same of Eric Sykes. And Mr Williams obviously found much of the Borge performance amusing and some of it down- right hilarious.

I leave it to you to estimate the extent of my integrity when I flatly contradict the boss in public and announce that I didn't even raise a smile from beginning to end. In my opinion, Mr Borge should leave the letter "g" out of his name.

Lighter Side

Reviews of other recordings

Devotional Records

HOUSE-BETWEEN-TWO-RIVERS. Becky. Stereo, Maranatha Music HS-030. (From S. John Bacon, Pty Ltd, 12-13 Windsor Ave, Mt Waverley, Vic. 3149.)

A close scrutiny of the jacket notes reveals that "Becky" is Becky Ugartechea, the latter name meaning "House-between-two-rivers" and speaking of inner spiritual peace. That explained, Becky holds copyright for all the songs, does all the lead vocals and some of the backing — and plays acoustic guitar for good measure. A very gifted and busy lady!

The lyrics, all with a strong devotional flavour, are set out on an inner sleeve: Who's The Master — Never Knew How Happy — Son Of The Living God — Take All The Lonely Times — Driftin' — Simple Joy — He'll Lift You Up — There Is Love — Glory And Honour — Now Is The Time.

Involving drums, bass, electric, acoustic and steel guitars, piano, flute and mandolin in various combinations, the sound is essentially soft rock, capably and smoothly presented. If I had any criticism to offer, it would be that there is a certain sameness of sound which might deter one from listening to more than a few tracks at a time. But, in terms of content, Becky certainly has something to say! (W.N.W.)

☆ ☆ ☆

TENNESSEE ERNIE FORD — HYMNS. Stereo, World Record Club, W.R.C.-R.03875.

Originally released on the Capitol label, and with orchestral and choral backing under the direction of Jack Fascinato, this is probably a fairly old recording. Be that as it may, the technical quality is quite okay, with no obvious noise or distortion to compromise the performance.

In relaxed style and with a basss baritone voice strongly reminiscent of Bev. Shea, Tennessee Ernie presents a dozen well known hymns: Who At My Door is Standing — Rock Of Ages — Softly And Tenderly — Sweet Hour Of Prayer — My Task — Let The Lower Lights Be Burning — The Ninety And Nine — The Old Rugged Cross — When They Ring The Golden Bells — In The Garden — Ivory Places — Others.

Traditional hymns, modestly embellished but with every word distinct, this W.R.C. album will have a strong appeal to those who appreciate their Gospel music in this style. Judged on this basis, a good one. (W.N.W.)

For information on World Record Club albums, contact the club at 605 Camberwell Road, Hartwell, Victoria, 3124. Tel. 29 3636.

JOY IS LIKE THE RAIN. Stereo, Move/World Record Club AV-101.

Showing a rather mixed heritage, this album was recorded on the American east coast and distributed in that country by Avant Garde. Subsequently released in Australia by Move Records, it has finally reached us through the World Record Club.

It features the original songs of Sister Miriam Theresa Winter, as performed by a group of her fellow sisters from the Sisters Medical Mission, based in Philadelphia.

Described on the jacket as "songs of our day, in the folk style of our times", the songs have a predominantly biblical derivation: Joy Is Like The Rain — Zaccheus — Speak To Me, Wind — Come Down, Lord — Spirit Of God — It's A Long Road To Freedom — How, My Soul — Pilgrim Song — How I Have Longed — Ten Lepers — God Gives His People Strength — The Wedding Banquet.

Although they sing with obvious sincerity and rapport, the sisters who present the songs are not in any sense a regular group; in fact, having made this recording, they scattered to medical posts around the world.

A pleasant and listenable album, it is rounded off by the catchy "The Wedding Banquet". (W.N.W.)

Instrumental, Vocal and Humour

☆ DIRECT TO DISC

J.S. BACH: Concerto for Violin, Strings and Continuo in E major, BWV 102; Chorale Prelude "O Man Bewail Thy Grievous Sin", BWV 622; Prelude from Partita in E for solo violin, BWV 1006; Ricercare from The Musical Offering, BWV 1079. The Toronto Chamber Orchestra conducted by Boyd Neel, Steven Staryk solo violin, Umbrella direct disc recording, limited edition, UMB-DD9. (From M.R. Acoustics, P.O. Box 110, Albion, Qld 4010.)

I can't remember when I listened to a more satisfying recording of chamber music. Direct-to-disc recording must inevitably place an additional strain on all concerned — both musicians and recording engineers — but nowhere on this disc did I find it evident. Dr Neel and the Toronto Chamber Orchestra give a most sensitive, yet lively performance of these well-known Bach pieces, with no trace of tension or self-consciousness. And the recording is excellent.

The clarity of the strings is remarkable, particularly in the treble region — I found myself searching for hackneyed words like "transparent" and "clean" to describe the sensation, and then rejecting them as not good enough. The dynamic range is so good that in the quiet passages, domestic noises start becoming obtrusive — yet the distortion on loud peaks is imperceptible. And the lack of pre- and post-echo is almost uncanny; the music begins and ends in almost complete silence. There are simply none of the residual problems normally due to intermediate tape stages.

In short, the reproduction from this disc is likely to be the nearest thing you'll get to hearing Dr Neel and the Toronto Chamber Orchestra in the flesh. Direct-to-disc recording may involve technical hassles, but as this disc shows they're worth it — at least until digital recording is perfected.

Highly recommended. (J.R.)

Reviews in this section are by Neville Williams (W.N.W.), Jamieson Rowe (J.R.), Leo Simpson (L.D.S.), Norman Marks (N.J.M.), David Edwards(D.W.E.), Greg Swain (G.S.), and Danny Hooper (D.H.).

MAGIC MANDOLINS. The Geoff Love Mandolins. World Record Club WRC R 03852.

If you are in a Mediterranean mood, this record should surely please you, with it's 12 tracks of Italian style hits: The Man Who Plays The Mandolin — Summertime In Venice — Come Back To Sorrento — By The Fountains Of Rome — Siempre Amore — Festival Of Flowers — Forget Domani — Non Domenticar — How Wonderful To Know — Al Di La — Arrivederci Roma — Funiculi Funicula.

The overall quality is very good, making an ideal record for relaxing on a balmy summer's night — if you are lucky enough to get the time!

The original recording was released by EMI and if you wish to enquire about World Record Club records, their address is 605 Camberwell Road Hartwell, Victoria 3124. (N.J.M.)

☆ ☆ ☆

DICK HUGHES looks back and around. 44 stereo 6357 716. Distributed by Phonogram Pty Ltd.

It may be thought from the title of this album that the material is introverted and introspective. Well, it may well be introspective on the part of Dick Hughes but the music is extrovertive to be sure. With the exception of the track "Three Gymnopedies" subtitled "slow and tender, slow and sad and slow and sombre" the music is definitely up-tempo.

Dick Hughes leads on piano and vocals, Bruce Johnson is on trumpet, Chris Taperall on tenor sax, Hon Heap on bass and Alan Geddes on drums. I can thoroughly recommend this Australian quintet for the lively jazz they produce. And you need have no fears about the recording quality — it's right up to standard.

The remaining track titles are: You Meet The Nicest People In Your Dreams — Soup Plus — Tillie's Down Town Now — Half-Caste Woman — Mr Dombey's Boogie — What's The Use Of Reading Books About Love — Buddy Holden's Blues — The Buzzard. (L.D.S.)

BACK TO EARTH. Cat Stevens Island Records L 36756. Festival release.

Cat Stevens has the same voice as always, but his songs and music seem to have changed. No longer does he seem to put the same emotion into his songs, and they are less tuneful anyway. In short I found this new album to be a disappointment.

In order, the tracks are: Just Another Night — Daytime — Bad Brakes — Randy — The Artist — Last Love Song — Nascimente — Father — New York Times — Never. Recording quality is good, with a very transparent sound. (D.W.E.)

☆ ☆ ☆

CHARLES CHAPLIN FAVOURITES: The Tony Mansell Singers and the Val Merrall Orchestra. 7 Records, MLR 229.

I looked forward to hearing this disc with keen anticipation, having long been a fan of Charlie Chaplin's films and music . Perhaps that made me a bad choice as the one to review it, because I suspect that it will be found enjoyable mainly by those who are NOT Chaplin fans.

Why? Well, the Tony Mansell Singers and the Val Merrall orchestra perform very professionally, and the arrngements are bright and imaginative. It's just that somewhere along the way, much of the feeling that Chaplin put into the music has been lost.

The titles include Smile (from "Modern Times"), Falling Star (from "The Great Dictator"), This Is My Song (from "The Countess from Hong Kong") and Eternally (from "Limelight"). But the titles don't really matter anymore. If you want to hear the actual music as Chaplin conceived it, I don't think you'll find this disc enjoyable; it's really 13 tracks of pleasant background listening, with a Chaplinesque flavour.

The recording quality is fine. (J.R.)

☆ ☆ ☆

GUITAR PLAYER. Nine famous guitarists. MCA stereo MCA2-6002. 2-record set at $11.99.

This 2-record album may be likened to a telephone directory. It's full of interesting characters but is very thin on plot. While supposedly recorded specially at the behest of the American

BINAURAL RECORDING DIRECT TO DISC

DAVID MONTGOMERY, Piano pieces by Schumann, Liszt and Chopin. Binaural, direct-to-disc. Sonic Arts Laboratory Series No. 5. (From specialty record stores or direct from P.C. Stereo, P.O. Box 272, Mt Gravatt, Brisbane 4122. $19.50, post paid).

This has to be a noteworthy disc: on the one hand direct cut; on the other, recorded especially for binaural listening, therefore involving the use of high quality stereo headphones. At the same time, for such an ostensibly "purist" venture, it was curious to read on the jacket an invitation to try it on stereo speakers and even on a quadraphonic system switched to SQ!

According to the jacket notes, it was recorded using twin miniature microphones, worn by a "captive" enthusiast, with the mics located at the entrance of the respective ear canals. Needless to say, the "victim" was exhorted to stay as still as possible for the entire duration of each side, so as not to have the sound image moving erratically with involuntary movements of his head.

Side 1, containing piano pieces by Liszt (The Consolations, No. 3 in D Flat) and Chopin (Four Mazurkas, Op.17) was recorded with the "bugged" enthusiast well back from the piano, in a position which he, as an experienced listener, was asked to select. Perhaps predictably, the pianist was not too keen on this "remote" sound and more or less insisted that side 2 — the Papillions, Op. 2 by Chopin — be recorded as near as possible to the way the piano sounded to him; very close up.

As heard on headphones, I certainly liked the second side better — and I think I know why. The basic problem that frustrates all such binaural recordings is that the system lacks the capability to provide any basic clue as to whether the sound is coming from front, back, above or below. It can convey a sense of remoteness, but direction is strictly a matter of logic or autosuggestion.

Side 1 therefore suffers because the sound suggests a certain remoteness, without positively putting the piano out front, where it should be. Side 2 is better because the instrument sounds closer and, if it still seems to envelop one, that's not too far from reality anyway, with a concert grand!

My gear was not set up to check on the quadraphonic suggestion, but I did try it in normal stereo, moving the speakers fairly close together and squatting in front of them. That way, the sound really was in front of me, but powerful and intimate. I liked it much better than binaural on headphones, all the more so because I was less conscious of a very faint surface "prickle" from the vinyl.

For the rest, the music is appropriate for a special interest album like this, the performance is all that you would expect and the overall quality very clean. I guess it's a toss-up between the special interest and the rather special price! (W.N.W.)

THE LIGHTER SIDE — continued

"Guitar Player" magazine I'm afraid it comes across as a record sampler. While it features very fine guitarists the lack of a common theme running through the entire presentation causes it to lack lustre.

Perhaps if these same performers had been brought together for a properly managed stage performance the recording would have been very successful.

The nine guitarists featured are as follows: Laurindo Almeida, Irving Ashby, John Collins, Larry Coryell, Herb Ellis, Barney Kessel, B. B. King, Joe Pass and Lee Ritenour. My advice: buy a record with the guitarist you like. (L.D.S.)

☆ ☆ ☆

McCANN THE MAN. A&M L36755 Festival Release.

I must admit to not having heard much of Les McCann's music before and it has been my loss. This record with its seven tracks of superb jazz, is too good to miss. The opener is Billy Joel's "Just The Way You Are". Then follows: Flow With The Feeling — How Can You — You Think You're Something, Mr Man — I'm Always Waiting For You — Para Ti, Para Mi.

McCann appears on all the tracks, both vocally and on keyboards, with Richard Tee, Piano; Nicholas Kirgo, Guitars; Steaurt Liebig, guitars; Tim May electric guitar; James Rowser and Eddie Watkins, bass; Kevin Johnson, drums; Elmira Collins and Garry Coleman, percussion and Harry Bluestone and his Fabulous L.A. Strings. The technical quality is superb, just what one has come to expect from A&M records. Go and enjoy it. (NJM)

☆ ☆ ☆

AMERICAN GENERATION. The Ritchie Family. RCA VPL1 4090. RCA release.

This disco album from the Ritchie Family, seems sure to provide another winner from the dynamic trio.

The opening track is a brilliant revival of the old Shirley Bassey hit "Big Spender"; the remaining four tracks are originals. "American General", the

title track, is brilliant: "Good In Love" and "Music Man" are both good, but the closing track "I Feel Disco Good" is far too repetitive for this reviewer.

However, despite the lack of appeal of the last song, the album could still be a worthwhile addition to a disco follower's library. (D.H.)

☆ ☆ ☆

SMOOTH TALK. Evelyn "Champagne" King. RCA APL1 2466. RCA release.

"Smooth Talk" is the debut album in Australia for the 17-year-old American girl Evelyn "Champagne" King.

The eight tracks on the album are: Smooth Talk — I Don't Know If It's Right — Til I Come Off The Road — Dancin', Dancin', Dancin' — Shame — Nobody Knows — We're Going To A Party — The Show Is Over.

The first seven tracks could be categorised as disco or soul and the last as a ballad. "Shame" is a 6.45 minute version of the single that made it to the Top 10 in the American charts.

All in all, Evelyn "Champagne" King shows great potential as a singer with this refreshing album. (D.H.)

☆ ☆ ☆

MOVE IT ON OVER. George Thorogood and The Destroyers. Stockade Records S 109. (PO Box 113, North Ryde, NSW 2113.)

If you are fed up with the mindless Disco rot that seems to abound of late, then this record may be just what you need. It is just plain Rock and Roll, with no frills at all. The title track is an old Hank Williams original, and George and his band play it like they were teenage Rolling Stones. It is just great.

The rest of the record just seems to get better and better, with George's wailing guitar and nasal voice leading the assault. I thoroughly recommend the album for all rock 'n' roll fans. Recording quality is extremely good, with a very clean sound. (D.W.E.)

☆ ☆ ☆

PAST HITS & PREVIEWS. Richard Clapton. Infinity L 36691. Festival release.

This is a great album by a great Australian performer, featuring his past hits and including other numbers from the years 1973-1978.

The 10 tracks on the album are: Stepping Across The Line — Girls On The Avenue — Goodbye Tiger — Capricorn Dancer — I Wanna Be A Survivor — When The Heat's Off — Deep Water — Blue Bay Blues — Need A Visionary — Suit Yourself.

In summary an excellent album incorporating the unique Clapton sound. (D.H.)

BRITISH HUMOUR — BBC STYLE

I'M SORRY, I'LL READ THAT AGAIN. BBC Radio Show, original cast. Stereo, World Record Club W.R.C.-R 05202.

Despite its innocuous title and the rather modest way it was originally launched on BBC radio, "I'm Sorry, I'll Read That Again" turned out to be a very funny show, with its own cult following, rather like that of the more publicised Goon Show.

But the ingredients for success are the same: good scripting, good timing, an air of spontaneity and a gifted cast that served its apprenticeship with the Footlights Dramatic Club of Cambridge, followed by on-stage seasons in London, New Zealand and Broadway.. The cast, by the way, includes John Clease, Tim Brooke-Taylor, Graeme Garden, David Hatch, Jo Kendall and Bill Oddie.

On this album, they present about 10 excerpts from the radio show: The Auctioneer — The Day After Tomorrow's World — The Doctor — Blimpt — John And Mary — Robin Hood — Identikit Girl — Family Favourites — The Curse Of The Flying Wombat; plus closing announcements and Angus Prune Tune.

I'm always a little uncertain as to how many times one can listen to a comedy album, or what one does with it after that, but let it be said that this one is genuinely funny, without the usual reliance on double entendre, and it will evoke plenty of laughs. So, if you want a record of BBC style humour, go to it. (W.N.W.)

L. E. CHAPMAN

122 PITT RD, NTH CURL CURL
MAIL ORDERS BOX 156, NSW 2099
TEL.: 93 1848

CAPACITORS

0·0022 uF	400V	10 for $1
0·0022	630	10 for $1
0·027	100	10 for $1
0·033	160	10 for $1
0·047	400	10 for $1
0·068	400	10 for $1
0·1	400	10 for $1
0·1	600	5 for $1
0·15	100	10 for $1
0·18	160	10 for $1
0·18	400	10 for $1
0·22	50V	10 for $1
0·33	250	5 for $1
0·39	250	5 for $1
0·47	200	10 for $1
0·47	400	5 for $1
1·0	250	5 for $1

POLYSTYRENE CAPS
1200pF, 2200pF, 2700pF, 4700pF, 125V
ALL 15c ea.

1500V CAPS 5 for $1
0·0039uF, 0·0068uF, 0·011uF,

ELECTROLYTICS

10uF/16V	10 for $1.
47uF/200V	5 for $1.
68uF/16V	10 for $1.
100uF/400V	$1·50.
470uF/16V	10 for $1.
470uF/25V	10 for $1.
1000uF/10V	10 for $1.

SPECIAL!
100 MIXED NEW CAPACITORS.
ALL USEFUL. $2

WW POWER RESISTORS
2W 1·5Ω, 12; 15c ea.
3W 950, 2·5K, 6·8K; 20c ea.
5W 2·4, 10, 12, 22, 27, 40, 47, 50, 75, 150, 330, 470, 1K, 5K; ALL 25c ea.
10W 8, 100, 220, 3·3K, 4K, 6·8K; ALL 35c ea.
21W 1·5K; 50c ea.

SPECIAL!
100 MIXED NEW RESISTORS,
ALL USEFUL. $2

THERMISTOR-STUD TYPE,
15Ω; 50c ea.

SLIDE POTS

25KA Dual	4 for $1;
50KC Single	4 for $2;
250KA Dual	4 for $1;
500KB Dual	4 for $1;
1MA Dual	4 for $1;

5K Vert TRIM POT 15c.
500Ω WW POT 50c.
10K TRANSISTOR POTS
4 for $1;

TUNING CAPS
2 & 3 GANGS CAPS $1·ea
2 GANG TRANSISTOR. 50c

FUSES 10 for $1
0·5A, 2A, 3·25A.
IN LINE FUSE HOLDERS 30c.
POWER LEADS for CASSETTE & TAPE RECORDERS $1 ea.
RCA JACK PLUGS 25c.
SMALL CHROME HINGES 40cPr

DIODES

HR15	30c;	1N295B	10c;
1S309	10c;	OA630	30c;
OA636	1000V 2A	50c;	
EM404	400V 1A	10c;	
BA244	VHF SW	25c;	

TRANSISTORS

2SA15	20c;		
2SA101	20c;		
2SA234	20c;	BC548B	10c;
2SA351	20c;	BD139	50c;
2SB75	20c;	BD238	95c;
2SB186	20c;	OC9304	40c;
2SB303	40c;	OC9524	40c;
2SB337	60c;	OC9554	40c;
2SB370	40c;	2N1110	30c;
2SB405	25c;		

AD161/AD162 $2·50 PAIR;
OC955/OC957 $1 A PAIR;
OC967/OC968 $1 A PAIR;

SPECIAL
25 MIXED TRANSISTORS $2;

FANCY CHROME KNOBS FOR ¼in. SHAFT, PRESS FIT. FOR AMPS, etc 6 for $1.

MICRO SW
2A/250V AC 40c ea
5A/250V AC 60c ea

6 x D size BATTERIES HOLDER $1 ea.

SPEAKER PLUGS 4 PINS 10c
" SOCKETS 4 PINS 10c

PILOT LIGHTS	Screw in
6·3V	10 for $1·50
12V	10 for $1
24V	10 for $1

AUDIO LEADS
3·5mm to 3·5mm 7ft. 75c
3·5mm to 6·5mm 7ft. 75c
6·5mm 7ft long, 50c

AERIAL & OSC COILS FOR VALVE RADIOS. 75c ea

455K IF TRANS. $1

TV TUNER VALVE
Type inc. valves, $2.00

GARRARD PLUG-IN PICK-UP FOR MDL210, $6.

GARRARD 11 in. TURNTABLE with Cueing & Cartridge. Slightly shop soiled.
ONLY $14.

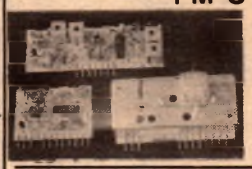
pack & post $2·50,
INTERSTATE $3·50.

HOOK UP WIRES 50 mixed lengths & colours - $1.
250 Mixed SCREWS, Self Tappers, Nuts & etc - $1·25

POWER TRANSFORMERS
240V to 18V, ½ amp, $2.50

SUPER SPECIALS!

FM STEREO TUNER KITS

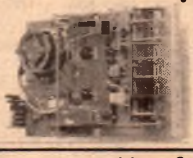


SETS OF 3 MODULES INCLUDE FM TUNER, DECODER & IF/DETECTOR. CIRCUIT DIAG. SUPPLIED; CAN BE USED WITH AMP MODULES.
ONLY $18!

POWER AMPLIFIER KITS

10W RMS per CH. WITH POWER TRANSFORMER & CIRCUIT DIAGRAM.
SUPPLY incl. +15V for TUNER or PREAMP
ONLY $15!

VORTEX DECKS



COMPLETE WITH HEADS & CIRCUIT FOR AMPLIFIERS FOR THE DECK.
ONLY $25!

SPARE ERASE HEADS for above $2 ea

VU & BALANCE METERS

STEREO VU $3

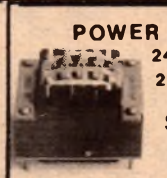
12Kn 100uA $2

BALANCE $1

SPEAKERS

4 ohms	7x5	$3·50 ea	15 ohms	5 in.	$3·50.
8 ohms	5x3	$2·50		6	$4·50.
	6x4	$2·50		8 Dual cone	$5.
	6x9	$6.		10 MAGNAVOX 12W RMS	$10.
	5 in.	$3·50		6x4	$2·50.
	6in Dual cone	$5.		7x5	$4·50.
	8 " "	$9.		9x6	$6.
	10JX MAGNAVOX Dual cone	$10.	47 ohms	9x6	$7.

TRANSISTOR 7 RADIOS 2 DIODES, COMPLETE inc SPEAKER NO CABINET - $3·75 each.
MINIATURE SPEAKER TRANSFORMERS, Drive & Output $1 pair.



POWER TRANS.
240V/120V +
2 x 25V + 6·3V
$6 ea.

Size 10x7·25x4 with 6x4 spkr.
IDEAL AS EXT. SPEAKERS.
ONLY $4·50 ea.

SPEAKER CABINETS
10W RMS with 2 Dual cone SPEAKERS; size 16·5 x 10·25 x 8;
$16 ea.
P&P NSW $3 pair INTERSTATE $5.

TV Stick Rectifiers
TV 20 SC
75 cents

SPECIAL!
PORTABLE 4 SPEED RECORD PLAYER
$27.50

24V MOTORS
REVERSIBLE.
only $2 each

PHILIPS TV TUNER
Transistor NT3032
Colour
$10 ea

Quality ham gear from VICOM

STATE OF THE ART TECHNOLOGY

Icom

IC701	HF solid-state 160m-10m transceiver	1380.00
IC701PS	Matching power supply/speaker for above	253.00
IC22S	2m fm synthesised transceiver	330.00
IC280	2m fm remotable cpu controlled	450.00
IC215	2m fm portable incl. 5 channels	245.00
IC402	70cm ssb portable, 3 watts	469.00
IC502	6m ssb portable, 3 watts	239.00
IC202E	2m ssb portable, 3 watts	239.00
IC202S	2m ssb portable, 3 watts	357.00
IC211	2m all-mode ac/dc transceiver	799.00
ICRM3	Remote control unit	169.00
ICSM2	Condenser-elect desk mic	45.00
LC-25	Leather case for portables	12.00
FA-1	Rubber ducky for 215/202	12.00
MMB-E	Mobile mount 211/701	22.00
MMB-B	Mobile mount 215/4026202	22.00
BC-20	Nicad pack for portables	69.00
CK-28	Remote cable kit IC280 incl cable, case cover, head mount & screws	38.00
MMB-F	Mobile mount IC22S	22.00
EX-1	IC701 interface kit for linear	43.00
HC-HP1	Icom headphones	54.00
IC-CF1	Optional cooling fan for IC701PS	45.00
HM-1	Hand ptt mic, low Z	18.00
IC-511	6m all-mode ac/dc transceiver (coming soon)	

ICOM

ICOM IC-280 remotable 2m FM mobile

Frequency 143.90-148.11 MHz • Power: 10 watts Hi, 1 watt adj. Low • Power requirements: 13.8 VDC at 2.5 amps • Main PLL control head may be detached and remotely mounted • With microprocessor, stores 3 frequencies • Easy to read LED's.

KENWOOD

TS520S	HF TRANSCEIVER 160-10m	735.00
TS120V	HF MOBILE TRANSCEIVER	630.00
TS820S	HF TRANSCEIVER DELUXE	1,150.00
AT200	ANTENNA TUNER	185.00
SM220	STATION MONITOR	440.00
BS-5	PAN ADAPTER	66.00
TL922	LINEAR AMPLIFIER	1,389.00
TR7400A	2m FM SYNTHESISED	542.00
VC-2	TWIN METERS 3-150 MHz	35.00
SWR200	OSKERBLOCK 3-200 MHz	86.00
SW210A	DAIWA TWIN-NEEDLE 1.8-150 MHz	99.00
SW410A	DAIWA TWIN NEEDLE 140-500 MHz	129.00
SWX777	DAIWA TWIN NEEDLE 1.8-30 MHz	131.00

antennas

	HUSTLER ANTENNAS	
BM-1	Deluxe universal bumper mount	25.00
RM80	80m resonator	30.00
RM40	40m resonator	25.00
RM20	20m resonator	16.50
RM15	15m resonator	16.00
RM10	10m resonator	15.00
MO2	fold-over mast (reqd. for all resonators)	33.00
RSS-2	medium duty spring	13.00

Jaybeam

5Y/2m	5el 2m, 7.8dBd gain, length 1.6m	43.00
8Y/2m	8el 2m, 9.5dBd gain, length 2.8m	51.00
10Y/2m	10el 2m, 11.4dBd gain, length 4.4m	84.00
10XY/2m	10el 2m cross yagi, 11.3dBd	84.00
D8/70cm	twin 8el, 70cm, 12.3dBd gain, 1.1m	64.00
PBM18/70	18el, 70cm, 14.9dBd gain, length 2.8m	71.00
MBM4870	48el, 70cm, 15.7dBd gain, length 1.83m	83.00
MBM8870	88el, 70cm, 18.5dBd gain, length 3.98m	102.00
PMH/2C	Phasing harness	18.00
	NAGARA	
SS56	6m 5 element beam, 1 Kw	159.00
V5JR	80-10m trap vertical, 6.7m high	129.00
V4JR	40-10m trap vertical, 5.2m high	99.00
	DISCONE ANTENNAS	
GDX-1	80-480 MHz commercial discone	85.00
SCAN-X	65-530 MHz (receive only)	39.00
	RINGO ANTENNAS (2 metres)	
ARX-2	Ringo ranger Gain omni directional	49.00
	SCALAR	
M22T	½ wave 2m mobile whip, top only	7.00
M25T	5/8 wave 2m mobile whip, top only	14.00
BASE B/L	Belling Lee bases for above	4.00
	HY GAIN ANTENNAS	

HYQUAD, 204BA, TH6DXX, 14AVQ/WB, 18AVT/WB, TH3MK3, TH3JR, 203BA, LONG JOHN

hy-gain

	HAND-HELD 2m TRANSCEIVER	
AR240	800 ch synthesised dial-up, 1.5w output	399.00

TRY US FOR A TRADE-IN

Morse keys

HK702	Deluxe key with marble base	41.00
HK708	Economy key	23.00
HK706	Operator's key	25.00
MK701	Manipulator (side-swiper)	45.00
EK103Z	Electronic keyer	336.00
PALOMAR	IC keyer	149.00

Antenna couplers

CNW217	DAIWA incl SWR/PWR, direct reading, 200w	199.00
CNW417	DAIWA incl SWR/PWR, direct reading, 500w	245.00
MFJ901	Matches everything 1.8-30 MHz	112.00
MFJ16010	Random wire tuner 160-10m	79.00
MFJ941	160-10m, 300w, incl SWR/PWR	139.00

Rotators

DR7600S	Heavy duty with controller & mast clamps	289.00
DR7500S	Medium duty with controller & mast clamps	199.00
6 CORE	Cable for above (200m rolls)	1.00/m

LP filters

FD30M	32 MHz Fc, 1 Kw, 3 stages,	39.00
FD30LS	32 MHz Fc, 200w, 3 stages	20.00

Noise bridge

PALOMAR	Rx noise bridge to 100 MHz	93.00

coax switches

CS201	2 position, high pwr, up to 500 MHz	
CS401	4 position, high pwr, up to 500 MHz	

Speech processors (DAIWA)

RF440	Phasing type processor, ac/dc, 6 dB gain	136.00
RF550	Filter type processor, ac/dc, 6 dB gain	184.00
MC330	Speech compressor ac/dc	99.00

coax relays

CX-2L	1.8 thru 170 MHz, 100w	48.00
CX-2H	1.8 thru 450 MHz, 200w	69.00

mics

VM1	Noise cancelling hand ptt, dynamic, Low Z	10.00
VM2	Desk with preamp, dynamic, Low Z	27.00
	CW FILTERS	
FT101E	Yaesu	49.00
TS520S	YG3395C Kenwood	57.00
TS820	YG88C Kenwood	57.00

bankcard welcome here

500 Watt RF Transformer

NEW

Palomar Engineers

- New! Broadband antenna matching
- For mobile whips and all short vertical antennas
- Convenient switch selection of impedance taps
- Taps at 8, 12.5, 16, 22, 32, and 50 ohms
- Small size. High efficiency
- RF ferrite toroid core
- Teflon insulated wire
- Full 500 watt CW capability. No time limit.

LEADER Dip Meter $124

Multimeters

DM3003	Digital DAIWA	120.00
TP-10S	2000 ohms/v	29.50
117 FET	Quality for service tech.	54.00
S-100TR	100,000 ohms/v plus Xistor checker	75.00
ZQM3	Transistor checker	59.00
OB-330	20,000 ohms/v incl. field strength	41.00

From DAIWA

cross-needle

CN-620

$99

SWR & Power Meter

Simultaneous direct reading SWR, Forward Power and Reflected Power
Frequency Range: 1.8-150 MHz
SWR Detection Sensitivity: 10 W Min.
Power: 3 Ranges FWD 20/200/1000 w)
Input/Output Impedance: 50 Ohm

NEW

AMATEUR RADIO DIVISION

VICOM

HEAD OFFICE AND MAIL ORDERS

68 Eastern Road
SOUTH MELBOURNE VIC 3205
PH (03) 699 6700 Telex AA30566

DEALER ENQUIRIES INVITED

Sydney	681.3544
Adelaide	43.7981
Gold Coast	32.2644
Canberra	82.3581
Melbourne	836.8635
Perth	321.3047
Hobart	43.6337
Cairns	54.1035
Launceston	44.3882
Ballarat	32.7234

AMATEUR RADIO

by Pierce Healy, VK2APQ

Record breaking trans-Tasman VHF/UHF opening

Between the 7th and 11th January, 1979 there was an almost continuous 2-metre path between parts of Australia and New Zealand. This opening was coincidental with an almost stationary high pressure system between the two countries, and abnormally high temperatures.

In Australia, late December and early January has been regarded as the VHF DX period, particularly for the six metre (52MHz) band, with the possibility of above normal propagation conditions occurring on two metres (144-148MHz) and higher frequency bands. In fact, the Ross Hull Memorial Contest, sponsored by the Wireless Institute of Australia, has been held for many years as an incentive for VHF/UHF operators to make long distance contacts.

Unfortunately, the opening reported here commenced within the concluding hours of the 1978/1979 contest period, otherwise many very high scores would have been recorded.

Early on Sunday afternoon 7th January, 1979 the 144MHz band opened across the Tasman to New Zealand, as well as north-south along the coast of NSW. (The latter had occurred several times during previous days.) It was reported that one of the first to observe the trans-Tasman opening was John Colliton, VK2AYC at Hurstville, south of Sydney. Initially, some disbelief was expressed by the New Zealand station, ZL1AQF, which John tried to contact.

Such was this disblief that ZL1AQF, initiated a trans-Tasman telephone call to John to confirm that the call was genuine!

The opening continued until Thursday 11th January, 1979 during which time an almost stationary high pressure system with widely spaced isobars, centred near mid-Tasman, stretched over the east coast of Australia, the north island of New Zealand and into the south Pacific as far as the New Hebrides. During the same period eastern Australia and New Zealand were experiencing above normal temperatures.

During the early stages the opening appeared to extend from Ulladulla on the south coast of NSW to Coffs Harbour on the north coast and to the top half of the north island of New Zealand. As time progressed the area spread to include Brisbane on the east coast of Australia and the whole of the north island of New Zealand plus Blenheim and Nelson in the South Island. In the early stages, Australian stations located very close to the coast line appeared to have an advantage over those a few kilometres inland.

During the four days of the opening the two metre FM repeater stations along the coast of NSW and those in the New Zealand north island gave operators a very good indication of how the band was behaving, as also did the sound carriers of TV stations in both areas. In fact New Zealand stations were heard working VK2 stations through repeaters in Sydney, Wollongong, Newcastle and Port Macquarie. Also, VK2 stations were operating through the New Zealand repeaters.

The longest distance for a repeater contact was through the Brisbane repeater at Mount Glourious. In addition to several VK4 — ZL contacts it is also claimed that New Zealand stations contacted each other through the

Intruder watch protects amateur bands

The intruder watch is a world wide monitoring organisation of amateurs. It collects positive proof and identification of transmissions heard on exclusive amateur bands, which are not of amateur origin and therefore, under ITU regulations, illegal.

This is not a new amateur activity. The intruder watch has been operating in Great Britain for over 21 years, in Australia for over 11 years, and in other countries for similar periods. All activities are under the direction of the International Amateur Radio Union.

Since 1972, this world-wide activity has been co-ordinated in Great Britain and recently the Home Office has allocated the special call sign GB2IW for the IARU co-ordinator (Stan Cook, G5XB).

Between 0600GMT and 0645GMT each Friday on 14.140MHz, GB2IW exchanges information on intruders with intruder watch organisers in other countries. Stan keeps a schedule with stations in Australia, New Zealand and the USA. However, he is not allowed to make ordinary contacts while using the special call sign.

Well in excess of 2000 reports are received each month. These are cross checked, summarised and published in the Intruder Monthly Summary, which is distributed to monitoring societies and official administrative bodies, including the ITU.

Although a difficult task in some instances, there has been a reasonable degree of success in eliminating some of the interference from amateur bands through co-operation with and by local administrations. However, with the approach of the World Administrative Radio Conference to be held in Geneva in September, 1979, the assistance of all amateurs in logging intruders is needed to produce the necessary evidence to preserve amateur frequency allocations.

The intruder watch co-ordinator in Australia is Alf Chandler, VK3LC with assistant co-ordinators in all states.

Report forms, together with instructions for filling them out, are available. Also available, to anyone submitting a C90 cassette or a reel of 40 minutes capacity, is an identification program covering the various types of signals which may be heard.

For full details write to Alf Chandler, VK3LC, Federal Intruder Watch Co-ordinator WIA, PO Box 150, Toorak, Victoria 3142.

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

ANNOUNCING . . .

THE INCREDIBLE NEW YAESU FT – 101Z

Everyone knows the incredible track record of the FT-101 series — but this latest design is set to break DX records the world over!

The features of the FT–101E, plus much more:

- ★ Selectable AGC
- ★ Front panel VOX control
- ★ All-new, threshold adjustable noise blanker
- ★ 6146B finals
- ★ Clarifier on either/both Tx or Rx
- ★ Fully compatible with FT-901 series accessories

UNBELIEVABLE INTRODUCTORY PRICE: **$849.00**

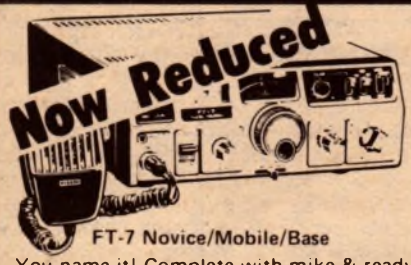
Cat D-2862

FINANCE AVAILABLE TO APPROVED APPLICANTS

DICK SMITH NOW IN HONG KONG!

Yes, Dick Smith Electronics now has a branch in Hong Kong. Duty Free shopping, with full Australian warranty through any of Dick's Australian branches. A warranty you can trust - from a company you can trust. Dick Smith Electronics: the best thing that has happened to Hong Kong (for Australians) since Suzie Wong!

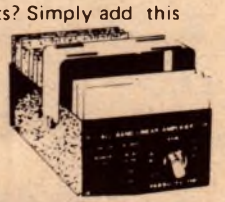
Dick Smith Electronics, Gnd Fl, Kowloon Cntr Bldg, 29-39 Ashley St, Kowloon. Ph 3 698 467.



FT-7 Novice/Mobile/Base

You name it! Complete with mike & ready to go. **Cat. D-2866.. .. .. $535.00**
Imagine – only $54.00 deposit & as little as **$4.60 per week**

FL-110
Want the full 200 watts? Simply add this linear, NO TUNING.
Cat. D-2884
.. ..$255.00



HF Equipment

FT-101E transceiver Cat. D-2860 **$975.00**
FL-2100B 1.2kW linear Cat. D-2546
Incredible performance **$585.00**
FTV-250 2m transverter Cat. D-2894 **$339.00**
FT-301 S/S 200W transceiver Cat. D-2870
Huge Reduction SAVE $100.00! **$895.00**
FP-301 AC power supply Cat. D-2872 **$195.00**
FC-301 antenna tuner Cat. D-2896 **$249.00**
FT-901D ultimate transceiver Cat. D-2854 **$1375.00**
FC-901 new antenna tuner Cat. D-2855 **$289.00**
YC-500S 500MHz counter Cat. D-2892 **$499.00**
QTR-24 world clock Cat. X-1054 **$37.50**
YD-148 new desk mike Cat. C-1118 **$44.50**

901D
An unbelievable unit at an unbelievably low price! Has features you've probably only dreamed of. You can even work the overseas 10M FM repeaters! CALL IN FOR A TEST DRIVE TODAY.
Cat. D-2854.. .. ..$1375.00

Follow Oscar

Take the hassle out of satellite work. Complete kit for both OSCAR 7 and 8 – full instructions.
Cat. K-3480
$9.50

Dick Smith's Oscar Tables
Full basic details on OSCAR, prediction tables, standard orbits and tracking details.
Totally practical. Cat. B-3482 **$1.50**

Receivers

FRG-7 HF receiver Cat. D-2850 **$395.00**
FRG-7000 deluxe HF receiver Cat. D-2848 **$695.00**
Shortwave antenna kit Cat. K-3490 **$9.50**

VHF Equipment

FT-227R 2M synthesized. Cat. D-2890 **$395.00**
FT-227RA with up /down scanner. Cat. D-2891 **$445.00**
CPU-2500K 25 watts, keyboard mic, 4 memories & scanner. Cat D-2889 **$575.00**

★ **FREE** *PVC dust cover with each FRG-7, FRG-7000, FT-101E, FT-901D, FL2100B sold* ★ *Cat. D-9050 usually $3.95*

DICK SMITH ELECTRONICS

bankcard welcome here

SHOPS OPEN 9AM to 5.30PM (Saturday 9AM – 12 noon) BRISBANE 1/2 Hour earlier

* ANY TERMS OFFERED ARE TO APPROVED APPLICANTS ONLY

SYDNEY	125 York Street, SYDNEY. Ph 290-3377 147 Hume Hwy, CHULLORA. Ph 642-8922 162 Pacific Hwy, GORE HILL. Ph 439-5311 30 Grose Street, PARRAMATTA. Ph 683-1133
MELBOURNE	399 Lonsdale Street, MELBOURNE. Ph 67 9834 656 Bridge Road, RICHMOND. Ph 42 1614
BRISBANE	166 Logan Road, BURANDA. Ph 391 6233
ADELAIDE	203 Wright Street, ADELAIDE. Ph 212 1962

MAIL ORDERS P.O. Box 747, Crows Nest, N.S.W. 2065. Post and packing extra. Dealers across Australia.

Many lines available from the Dick Smith Electronics Centres at

GRACE BROS
Broadway · Bondi · Chatswood · Liverpool Miranda · Mt Druitt · Parramatta · Roselands and Warringah Mall

AMATEUR RADIO

Brisbane repeater. It is also believed that similar contacts took place through some NSW repeaters.

Two-way contacts were in no way confined to the repeater channels. Many simplex contacts were made by stations using both FM and SSB with portable, mobile and base stations. The common expression heard was "they are working ZL's all over the place". Signal strength varied between S5 and S9 with quite selective paths, with stations a few kilometres apart operating on the same frequency were unable to hear each other on the station the other was working across the Tasman. A similar effect was also noted in relation to elevation; often beach level being better than higher ground nearby, as well as the reverse.

The contacts were not limited to the 144-148MHz band; several stations made two-way contacts on the 432MHz band. The most outstanding of these appears to be between Rod Graham, VK2BQJ near Sydney and Ray Thomas, ZL1TAB Auckland NZ which lasted 90 minutes on 432.1MHz SSB. While the contact did not break the Australian distance record it did break the New Zealand record of 630km set in 1971. The approximate distance for this contact was 2230km (1394 miles).

Among the more successful stations on the two metre band were Jamie Campbell, VK2YCJ operating portable from seaside cliff tops near Newcastle, with 228 contacts, and John Telfer, VK2BTQ at Ulladulla with 200 contacts. Another was Geoff Hunziker, VK2BGF at Taree who had a two-way simplex contact with a New Zealand station, both using hand held units, with R5 signals both ways.

A number of contacts were made with mobiles at one end or the other and there probably was at least one mobile to mobile. Phil, VK2ZBX, worked ZL1AQF while the latter was mobile on the Auckland bridge. This was only one of several mobiles contacted by Phil.

There were many more stations on both sides of the Tasman who made contacts and, as these notes were being prepared shortly after the opening occurred, it is anticipated that more reports will come to hand to be reported in future notes.

Although this is not the only opening it is the longest known and the most extensive.

At the same time as the trans-Tasman openings, 2-metre DX conditions in NSW and NZ were at a peak. Stations on the NSW north coast were able to work stations through the Port Macquarie, Newcastle, Sydney and Wollongong repeaters. Tamworth and Ulladulla stations working through Sydney repeaters and stations operating through the Port Macquarie repeater were heard in Sydney's south western suburbs, using a whip antenna indoors.

It may be of interest to recall that the first Australian to make two-way contact with New Zealand on the 144MHz band was Allan Llewelyn, VK2AH about 1954. During December 1965 and January 1966 a number of Sydney stations made contact with New Zealand stations, using amplitude modulation. The NSW distance record was set by John Thornthwaite, VK2ATO operating from Valley Heights in the Blue Mountains to ZL2HP in Palmerston North, New Zealand.

The achievements of those days remain outstanding in another sense. It was in the days before commercially built, high performance, VHF transceivers, and the equipment was essentially home constructed. Much was based on disposals units, either converted or as a source of components to build self-designed stations. All were valve equipped.

Those readers interested in monitoring the 2-metre band for possible further openings may find the following list of frequencies a handy guide as to where to listen.

NZ FM REPEATER CHANNELS

CHANNEL	INPUT	OUTPUT
A	146.200	145.500
B	146.225	145.525
C	146.300	145.600
D	146.350	145.650
E	146.400	145.700
F	146.450	145.750
G	146.500	145.800
H	146.550	145.850

NZ AM REPEATER CHANNELS

CHANNEL	INPUT	OUTPUT
A	144.600	145.725
B	144.650	145.775
C	144.700	145.825

NZ VHF BEACONS

ZL1VHF	Auckland	145.100
ZL1WHW	Wiakato	145.150
ZL2VHP	Palmerston	52.500
ZL2VHP	Palmerston	145.250
ZL3VHF	Christchurch	145.300
ZL4VHF	Dunedin	145.400

1296MHz RECORD

At 1230GMT on the 29th December, 1978, what is believed to be a world record 1296MHz two-way contact was made. The distance was 2109km (1310 miles), across the Great Australian Bight.

This outstanding achievement was by Chris Skeer, VK5MC at Hatherleigh in the south-east corner of South Australia and Wally Howse, VK6KZ operating portable 160km west of Albany near Walpole, Western Australia. On CW signal reports were R5 S5 T9 each way, and an AM signal from VK6KZ/P was readable 5 and quite strong at VK5MC.

The 1296MHz test followed successful contacts on 144MHz and 432MHz.

In a note from Chris, he explains that it was his first contact on 1296MHz, using equipment being prepared for moonbounce (EME) operation. He is satisfied that it was a good test for the gear.

The VK5MC equipment was a six metre diameter dish antenna with circular polarisation, home built preamps using NEC1336, and a home built converter. The transmitter final amplifier used a pair of 3CX100A5s and delivered approximately 40W.

VK6KZ/P used a one metre diameter dish, horizontal polarisation, home built 1296MHz preamps using BFR91's and microwave modules converter. The transmitter final was a varactor tripler giving approximately 3 watts output.

WIRELESS INSTITUTE NEWS

The federal office of the WIA advises that the latest revision of the "Handbook for Operators of Radio Stations in the Amateur Service" had been handed to them. There are numerous amendments and concessions in this latest revision, compared with the draft copy received last November. The federal office commented "In so important a document every word counts and members will be pleased to know that every word was 'counted'."

The Wireless Institute Civil Emergency Network has been in operation since the early 1950's and has played an important role during civil emergencies such as bushfires, floods, cyclones, etc.

AMATEUR RADIO

In the past many restrictions made WICEN exercises rather difficult to conduct.

However, in more recent times the need for organised amateur communications in emergencies has been recognised.

The letter from the P&T department has set out their current requirements in the matter of message handling.

"Emergency Amateur Networks —

"In confirmation of our discussions on 22nd November 1978, the following revised conditions for the operation of Emergency Amateur Networks and the conduct of practice exercises have been notified to our State Superintendent for intruction on a trial basis. It is proposed that these conditions, modified where necessary, will be printed in the next edition of the Amateur Handbook.

"It should be noted that practice exercises are to be considered as primarily a means of training operators in the passing and recording of messages.

1. "With the approval of an authorised officer of the Department, the licensee of an amateur station may, as a member of an organisation of amateurs approved by the Department, participate in special amateur radiocommunications networks in times of civil emergency or disaster.

2. "During a period of emergency, such networks, through a nominated co-ordinator and control station, may pass messages on behalf of a statutory authority responsible for the particular emergency (eg, bush fire, flood etc.). The log book of the control station shall have entered in it the name, rank, or position and telephone number of the officer of the statutory authority who requested communication assistance, and the name and position of the Postal and Telecommunications Department officer who authorised the transmission of third party messages. (See Wireless Telegraphy Regulation 36 [36].)

3. "During the period of the emergency, the licensee shall confine his transmissions to those necessary for the exchange of essential traffic. Casual conversation or unnecessary calling or testing should be avoided. Any necessary testing should be conducted on a frequency separate from that used for emergency communications.

"Correct procedures as detailed in the Handbook should be adhered to during the emergency working.

4. "Copies of messages handled by all stations in the emergency network should be retained for 12 months.

5. "A licensee not participating in an actual emergency network once aware that an emergency exists should ensure any transmissions he makes, do not cause interference to any station involved in emergency communications.

6. "Exercises by organisations mentioned in Para 1, above, to enable members to obtain practice in passing and recording messages, may be permitted, following written application to and approval by the Superintendent, Regulatory and Licensing. As a general rule the following conditions will be applied:

"(a) Applications should reach the Superintendent at least two weeks prior to the exercise, indicating time, date, benefits expected, frequency, location etc;

"(b) In any case where the exercise is to consist of providing communications for a group, the group must be either a statutory authority (fire, state emergency service, etc), or a recognised community service group or charitable organisation (eg, Apex, Rotary, Red Cross).

"(c) The amateur organisation should not be involved in press or media promotion;

"(d) A report on the exercise as a message handling experience is to be provided to the Superintendent by the co-ordinator within two weeks, accompanied by a sample of message forms from the exercise.

"(e) Log book of control station is to be submitted for Departmental inspection from time to time;

"(f) Abbreviated callsigns not permitted — full identification to be used by all participants; and

"(g) The use of any specific frequency should not cause interference to other stations already in contact.

NEW SOUTH WALES DIVISION

A special general meeting of the NSW division WIA has been called for Friday 23rd March, 1979, commencing 8.00pm at the Wireless Institute Centre, 14 Atcheson Street, Crows Nest.

The meeting has been called following a recommendation from the divisional council to sell the Institute property at the above address.

Following announcement of the proposal, which it is understood was carried by a one vote majority at the November, 1978, meeting of the council, this special meeting was demanded by a large number of members who expressed objection to the proposal and also to the overall performance of the council. It is understood that the matters raised in the petitions will be discussed at the meeting.

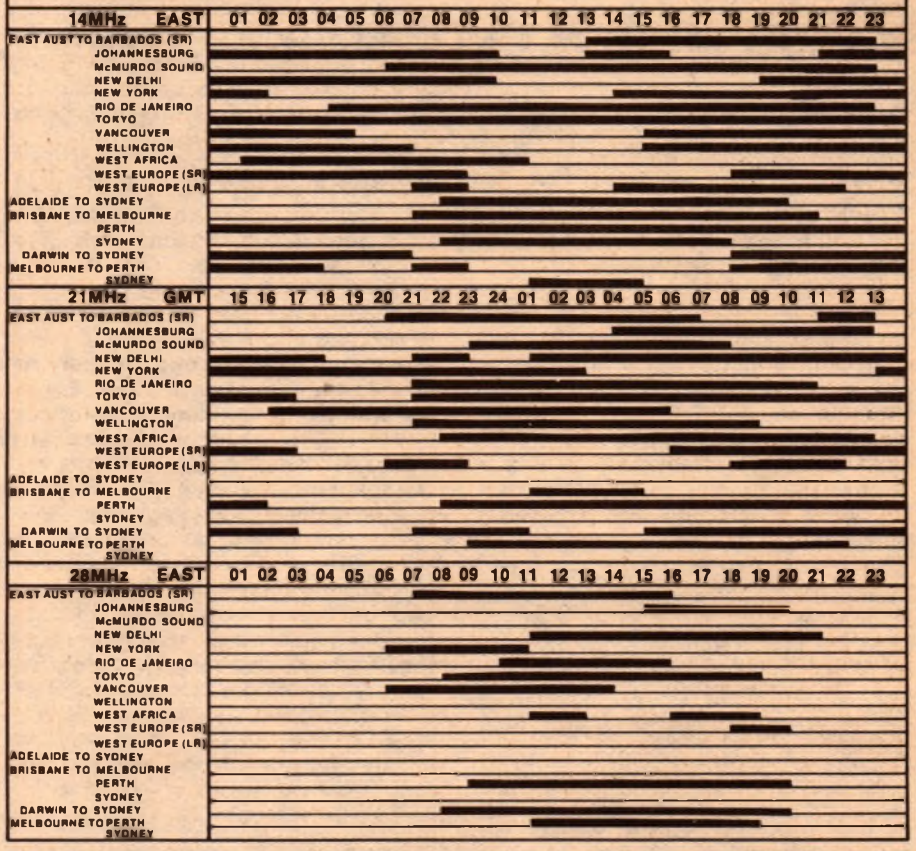
The WIC was officially opened on 12th March, 1960, the date coinciding with the foundation of the Wireless Institute on 10th March 1910, and marked the culmination of many years of voluntary work and donations by members. It overcame many problems by providing premises with free access at all times, thus eliminating the restrictions imposed by renting public halls etc.

A figure of $120,000 has been quoted as the offer to purchase the property which, it is claimed, could be invested

AMATEUR RADIO

IONOSPHERIC PREDICTIONS FOR MARCH

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. 3.79



to pay for office facilities and full time secretarial salaries.

Opponents to the move claim that the figure is much lower than rising values indicate and that inflation would reduce the real value of the money invested. Also, that there is no necessity to sell, as the NSW Division is in a very healthy financial position.

In some quarters it is thought that the Division should itself develop the property to its full potential and so maintain the benefits gained from the voluntary efforts of members who had the foresight to firmly establish a home for the Institute in NSW. Further, selling the property would eliminate many of the service facilities now enjoyed by members.

There are also many nostalgic points of view being expressed which, it is claimed, must be considered as a part of the heritage passed down from earlier generations of amateurs, that cannot be matched by cold financial investments.

As a point of comparison, a similar situation arose within the Victorian Division a few years ago and the decision by members to retain their property is claimed to have strengthened the position of affairs in that division.

150th YEAR CONTEST

The West Australian 150th Year Celebration Contest: The aim of the contest is for amateurs in all continents to contact amateurs in Western Australia (VK6), on all bands using all modes, to commemorate the 150th year of the foundation of Western Australia.

REWARDS: The three highest scores from each continent for mixed and individual modes will receive a commemoration certificate. This contest is also open to short-wave listeners.

For amateurs and short-wave listeners in other Australian states the three highest scores from each state will be eligible for a certificate while Western Australian participants who have more than 100 out-of-state QSO's will get an award.

RULES:

1. DURATION: The contest will commence at 1600GMT on 31st December, 1978 and end at 1600GMT on 31st December, 1979.

All amateur bands may be used between 1.8MHz to 28MHz, using any mode appropriate to the entrant. Operators are encouraged to operate both phone and CW.

2. SCORING: One contact in each mode is allowed in each band every day with the same station, for which the following scores and multipliers will apply:

CW — 5 points per contact
phone — 3 points per contact
RTTY — 6 points per contact

Multipliers — one point per band used, provided that 30 QSO's are obtained on that band, excepting for 1.8MHz and 3.5MHz, where one QSO will count.

Final score = Total points x Total multipliers.

LOGS: Contest logs to be set out as shown below and bear a front cover bearing the following:

Call sign: .....
Address: .....
Claimed score: .....
Signature: .....
Date/Time/Call/Band/Mode/RST out/RST in/Points scored.

Contest logs are to be forwarded to: The Contest Manager, 150th Celebration Contest, PO Box 6250, Hay Street East, Perth 6000 Western Australia.

RADIO VK2BQK

More licensed operators are required to assist in fully manning the Museum of Applied Arts and Science amateur radio station VK2BQK. The museum is located in Harris Street, Ultimo, about 400 metres from Railway Square and Broadway Sydney. Private car parking facilities are available to operators while on duty.

(A more detailed description of the station appeared in last month's notes.)

This is an interesting and rewarding opportunity to demonstrate amateur radio to the general public and to publicise the worth of amateur radio within the community.

Should you wish to join the group of volunteer operators and be rostered as duty operator to suit your own convenience, contact Mr Jeff Sergel, at the Museum during office hours (phone 211-3911) or through the Education Officer, WIA, 14 Atcheson Street, Crows Nest 2065.

YAESU MUSEN CPU-2500R 2-METRE TRANSCEIVER

Dick Smith Electronics Pty Ltd has submitted for inspection a sample of the Yaesu CPU-2500R 2-metre transceiver, a set which they regard as being in the "top of the line" class of 2-metre FM equipment. One of its most attractive features is an ingenious and versatile system of channel selection, obviously aimed at simplifying mobile operation.

The CPU-2500R features a 25W transmitter with a low power (3W) setting and a fairly conventional (by modern standards) double change superhet receiver. The specifications give the receiver sensitivity as 0.3uV for 20dB quieting, and selectivity as -6dB at +/-6kHz and -60dB at +/-12kHz. The IFs are 10.7MHz and 455kHz. Audio power output is 1.5W.

The set is designed to operate from a nominal 12V DC supply and draws 500mA on receive and 6A on transmit (25W) at 13.6V. Transmit current drops to 2.5A on low power (3W). Deviation is set at +/—5kHz and spurious emissions are quoted as better than —60dB.

The frequency selection system is, basically, similar to that used in the earlier model FT-227R which we reviewed in the March 1978 issue. It uses a PLL frequency selection system, activated by an optically coupled interrupter circuit which advances the frequency in 10kHz steps. Together with a 5kHz up-shift switch this provides 5kHz steps from 144 to 148MHz.

But from this basic system the 2500R has been expanded to provide a number of additional features. There is now a five position memory system, including a "Receive Memory" position for odd repeater split operation, and a six digit frequency display. A seventh, separate, digit shows the memory position in use.

A memory backup circuit is provided whereby frequencies stored in the memory, or set up on the main dial, are not lost when the set is switched off from the front panel.

In addition to the optical interrupter and associated panel knob, the frequency can be selected by two other means: a scanner system, and a push button keyboard.

The scanner may be set to stop when (1) the PTT button is pressed, (2) when it finds an occupied channel, or (3) when it finds an unoccupied channel. Alternatively, it can be set to scan the four memories, stopping in accordance with the above situations, as instructed.

The third method uses a keyboard on the microphone and, in most cases, is the simplest of the three systems. Only three digits have to be entered, the first two (14—) and the last one (—0) being permanently programmed. The digits appear in the readout as they are entered.

Other keyboard facilities include: entering a selected frequency into any of the memories, or extracting a previously stored frequency from one, and initiating either up or down scanning.

Odd repeater offsets may be accommodated by using either the "Receive Memory" position as already noted or by an alternative system whereby the actual offset value (eg, 700kHz) is fed into the system via the microphone keyboard. Once entered, this offset is available at any time, with either + or — sign, as an alternative to the normal 600kHz offset. It will be held while ever the memory backup system is activated.

Other features, some of limited interest in Australia, include access tone burst, touch tone signals from the microphone keyboard, and a tone operated squelch system, the latter as an optional extra.

A front panel meter serves as a relative signal strength meter on receive, and a relative power input meter on transmit. It is calibrated simply 0-10.

The set is well made and well finished. On the air it behaved exactly as one would expect from its specifications, and all the features performed as they were intended to. The most attractive single feature is undoubtedly the frequency selection via the microphone keyboard. It is probably the simplest and quickest frequency selection system we have seen in a PLL system.

Nearly as attractive, in its way, is the memory system which, with one frequency set up on the dial, allows five of the most frequently used channels to be pre-programmed and selected at the turn of a knob.

On the other hand, the multiplicity of other features which the set provides is likely to create, initially, an impression of being a mixed blessing. Just remembering all the things which the set will do is rather daunting, without remembering how to implement them!

This is not so much a criticism as a warning; this is not a set which can be taken out of its box, connected up, and used without due attention to the instruction manual. In fact, the manual will have to be kept within easy reach for a reasonable time if the user is to learn how to make full use of all the features.

Also, when handling the microphone, be aware that the scanning buttons on the top are very easily activated!

But once having learned to drive it, the user will find it a most versatile and attractive set and one which combines the flexibility of 5kHz steps, with the convenience of switched channel selection.

It must rate as one of the most versatile and comprehensive 2-metre transceivers we have examined to date.

Price of the CPU-2500R is $575.00, including sales tax, and it is available ex-stock. Further details from Dick Smith Electronics Pty Ltd, PO Box 747, Crows Nest, NSW 2065. (PGW).

YAESU

bail

HF Mobile FT-7B ... power and performance for the Ham on the move

FT-7B SSB, CW, AM all solid state compact transceiver from Yaesu, 80-10m, 100W peak input.

With all the features of the FT-7, inc. noise blanker, cal., clarifier, semi-break-in CW with sidetone, etc., plus many more:- provision for Digital readout, full coverage on 10M, A.M., Audio peak filter for sharp selectivity and improved S/N ratio on CW, Drive Control, RF attenuator. Sensible compact shape (W230 x H80 x D320 mm inc. heat sink) so that it easily fits into most modern cars. Handy tilt-up foot for desk use. **FT-7B** price, inc. 28.5-29 crystal, mobile bracket, mic., power cable, English inst. book, connectors, and Bail 90 day warranty, **$639**.

Options, YC-7B ext. dig R.O. can be mounted on dash or steering column for convenient and safe viewing, includes adjustable sunshade, **$125**. Extra 10M range crystals **$12** each.

Prices & specs subject to change. All prices inc. S.T. Freight & ins. extra.

bail

Bail Electronic Services, 60 Shannon St., Box Hill Nth, Vic. 3129. Tel. (03) 89 2213
Branches in all States and A.C.T.
Fred Bail VK3YS — Jim Bail VK3ABA

JAS7879 — 35

RADIO DESPATCH SERVICE

THE SPECIALIST STORE

869 GEORGE STREET, SYDNEY, NSW 2000. (NEAR HARRIS STREET)
PHONES: 211 0816, 211 0191

DISTRIBUTORS FOR THE FAMOUS

TEXAS INSTRUMENTS

MARCH IS CALCULATOR MONTH AT R.D.S. DON'T BUY A COMPUTER, BUY A T.I.59 PROGRAMMABLE WITH SOLID STATE SOFTWARE MODULES. PRICE EXCL. S.T. $247.00 INCL S.T. $275.50.

	Excl. S. Tax	Incl. S. Tax
T.I. 25	32.30	35.45
T.I. 30 Std. Pk.	20.00	22.10
T.I. 55	53.00	59.00
T.I. 57	70.90	78.55
T.I. 58	109.00	120.70
Little Professor	15.00	16.57
First Watch	16.50	19.66
Data Man	21.00	23.25
Data Clip	25.90	28.67
Business Analyst	30.00	33.15

	Excl. S. Tax	Incl. S. Tax
T.I. MBA	73.00	80.95
T.I. Programmer	53.60	59.00
T.I. 5025	73.85	81.76
T.I. 5220	173.40	192.00
T.I. 5100	44.80	49.60
Library Modules	32.00	35.30
Blank Mag. Cards	14.63	15.95
TP 30250 (3 Rolls)	11.39	12.50
PC 100A Printer	213.57	236.00
T.I. 5040	154.00	162.22

OPEN: MON-FRI 8.00 am-5.30 pm
Thursday late night shopping until 8.30 pm, Saturday 8.00 am-11.45 am.

AMATEUR REPEATER CHANNELS

AREA	CALL SIGN	CHAN Nos.	WATTS ERP (Prop)	TIME OUT (Min)	IDENT Mode	HEIGHT ASL (m)	RANGE (km)	SITE	SPONSOR	STATUS
ACT (VK1)										
Canberra City	VK1RAC	6/6900	10	4	MCW	180	40	Mt Majura	ACT WIA	Op
Eden-Monaro	VK1RGI	7/6950	40	4	MCW	1770	190	Mt Ginini	ACT WIA	Bu
NSW (VK2)										
Maitland (RTTY)	VK2RPI	6625	20	3.5	MCW		50	Maitland	Maitland PIARC	Op
Western Plains	VK2RDX	1/6650	10	4	MCW	1372	150	Mt Bindo	St George ARS	Te
Sydney (RTTY)	VK2RTY	6675							ANARTS	Pl
Port Macquarie	VK2RPM	2/6700	25	3.5	MCW		30	Port Macquarie	Oxley Reg. ARC	Op.
Orange	VK2RAO	2/6700	50	3	MCW	760	100	Mt Conobolos	Orange ARC	Op
Ulladulla	VK2RMU	2/6700	70	3.5	MCW	300	110	Milton	Mid South Coast ARC	Op
Gosford	VK2RAG	3/6750	10	4	MCW	300	80	Somersby	Central Coast ARC	Op
Wagga	VK2RWG	3/6750	10	4.5	MCW	490	90	Mt Flackney	Wagga District ARC	Op
Bega	VK2RFS	3/6750						Nimitabel	Far South Coast RC	Te
Sydney	VK2RLE	4/6800	30	3.5	MCW	240	65	Heathcote	St George ARS	Op
Lismore	VK2RIC	4/6800	20	3.5	MCW	460	50	Parrots Nest	Summerland ARC	Op
Griffith	VK2RGF	5/6850		3	Verb.		50	Mt Binya	Griffiths ARC	Op
Wollongong	VK2RAW	5/6850	35	3.5	MCW	370	50	Mt Murray	Illawarra ARC	Op
Gunnedah	VK2RAB	5/6850	20	3.5				Tamworth	North West ARG	Op
Sydney	VK2RMB	6875						Beacon Hill	Manly & D. ARC	Bu
Newcastle	VK2RAN	6/6900	40	3.5	MCW	430	70	Mt Sugarloaf	Hunter Br WIA	Op
Sydney	VK2R	6925							Gladesville ARC	Bu
Moree	VK2RMI	7/6950	20	3.5			70	The Tops	North West ARG	Te
Sydney	VK2RWI	8/7000	40	3.5	MCW	270	65	Dural	NSW WIA	Op
Blue Mountains	VK2RBM	9/7050			MCW			Medlow Bath	Blue Mountains RC	Op
Westlakes	VK2RWC	10/7100	10	3	MCW			Watigan Mts	Westlakes ARC	Op
Sydney (WICEN)		7125						Sydney (Mobile)		Pr
Sydney (WICEN)		11/7150						Sydney (Base)		Pr
Sydney (WICEN)		7175						Sydney (Mobile)		Pr
Upper Hunter	VK2R	12/7200							Hunter Br. WIA	Pr
Sydney (SSTV)	VK2RST	7225					60	Arcadia	Hornsby & D. ARC	Bu
Sydney	VK2RNS	13/7250						Cowan	Hornsby & D. ARC	Te
sydney ATV Liaison	VK2R	14/7300								Pr
Mittagong	VK2RHR	15/7350						High Range	Sth Highlands ARS	Bu
Forster	VK2R	15/7350							Great Lakes ARC	Pl
VIC. (VK3)										
Melbourne	VK3RML	2/6700	50	2.5	MCW	580	130	Mt Dandenong	Vic Br. WIA	Op
Ballarat	VK3RBA	3/6750	15	3	FSK	80	225	Mt Bunnyong	Vic Br. WIA	Op
Bendigo	VK3RAM	4/6800	40	2.5			100	Mt Alexanda		Op
Central Gippsland	VK3RLV	4/6800	40	2.5	MCW	380	120	Mt Tassie	E. Zone WIA	Op
North West Victoria	VK3RMM	5/6850	25	2.5				Mt Macedon	Vic Br. WIA	Te
Swan Hill	VK3RSH	6/6900	40	2.5	MCW	60	55	Swan Hill	Swan Hill ARC	Op
East Gippsland	VK3REG	6/6900	25	5	MCW	880	100	Baldhead Rgs.	E. Zone WIA	Op
Stawell	VK3RWZ	7/6950	25	2.5	FSK	1010	130	Mt William	W. Zone WIA	Op
Mildura	VK3RMA	8/7000	100	4	MCW	50	55	Airport	NW Zone WIA	Op
Geelong	VK3RGL	8/7000	100	3	Verb.	400	120	Mt Anakie	Geelong Rep. Gr.	Op
Wodonga	VK3RNE	8/7000	25	4	MCW	610	120	Mt Big Ben	NE Zone WIA	Op
QLD (VK4)										
Gold Coast	VK4RGC	2/6700	200	4.5	MCW	500	70	Mt Tamborine	Gold Coast ARC	Op
Rockhampton	VK4RAR	2/6700	25	3	MCW		80	Mt Archer	Rockhampton ARC	Op
Townsville	VK4RAT	2/6700	10	4.5	MCW	740	50	Mt Stuart	Townsville ARC	Op
Bundaberg	VK4RBU	4/6800	20	3.5			60	Mt Goomememah	Bundaberg ARC	Op
Ipswich	VK4RAI	6/6900	25	4	MCW	180	30	Denmark Hill	Ipswich ARC	Op
Brisbane	VK4RBN	8/7000	25	4	MCW	730	70	Mt Glorious	Brisbane WIA	Op
Toowoomba	VK4RDD	10/7100	10	3	MCW	610	55	SE Toowoomba	Darling Downs ARC	Op
SA (VK5)										
Port Pirie	VK5RMN	2/6700	10	5	MCW	460	95	The Bluff	Port Pirie ARC	Op
North Adelaide	VK5RHO	5/6850	5	2.5	MCW	375	80	Haughton	SA Div. WIA	Op
Mount Gambier	VK5RMG	6/6900	25	5	MCW	100	80	SES-8 Studios	South East ARC	Op
Adeliade	VK5RAD	8/7000	15	3	MCW	610	130	Crofters	SA Div. WIA	Op
WA (VK6)										
Perth (Hills)	VK6RAP	2/6700	25	3	FSK	360	70	Roleystone	WA Div. WIA	Op
Perth (City)	VK6RAH	4/6800	25	3	MCW	90	55	Wireless Hill	Perth Rep. Gr.	Op
Albany	VK6RAA	4/6800	40	3.5	MCW	100	65	Mt Barker	South. Elect. Bd.	Op
Bunbury	VK6RHB	6/6900	5	5			150	Mt William		Op
Perth	VK6RPD	7/6950			FSK	150	30	IT Campus	WA I. Tech ARC	Op
Kalgoorlie	VK6RAK	8/7000	40			40		Tourist Mine		Op
Wagin	VK6RAW	8/7000	25	3.5	MCW	70	40	Mt Latham	WA Div. WIA	Op
Perth	VK6RWC	10/7100			FSK	150	30		West Coast ARC	Op
TAS. (VK7)										
Hobart	VK7RHT	2/6700	70	2.5			110	Mt Wellington		Op
Ulverstone	VK7RNW	3/6750	30	4.5	MCW	70	60	Mt Leona	NW Br. WIA	Op
NE Tasmania	VK7RAA	8/7000	60	4	MCW	1400	150	Mt Barrow	N Br. WIA	Op

AMATEUR REPEATER DATA

REPEATER CHANNEL NUMBERING SYSTEMS

As this list was being prepared a number of suggested 2 metre channel numbering systems, for both repeater and simplex channels, were under discussion. This has been brought about by the need to allocate channels with only 25kHz separation, as distinct from the 50kHz separation on which the present (1 to 15) channel numbering system was based.

One suggestion is for an alpha-numeric system, ie. channels 1a, 2a, etc, but most committees seem to favour either a three digit or four digit number directly related to frequency.

An important factor in favour of the all numerical system is the increasing use of equipment with digital readouts, since such readouts would be directly compatible with either numbering system. Some readouts, in fact, present only the last four digits, the first two digits (14) being understood.

The three digit system would use the last MHz digit and the following two kHz digits, eg, the present channel 1 (146.650MHz) would become channel 665, while the next highest channel (between the present channels 1 and 2, 146.675) would become channel 667.

The four digit system is an extension of this idea and is proposed for use on the repeater channels only; mainly to allow ready differentiation between repeater and simplex channels. It would simply add the last digit, missing from the three digit system. When used for repeater channels, the number for either the three or four digit system would be based on the REPEATER OUTPUT frequency. Either the three or four digit system has the additional advantage that (with one exception) the first digit will indicate whether the user's transmitter offset should be up or down. If the first digit is "6" the offset is down, if it is "7" the offset is up. The exception is the present channel 8 (147.000MHz) which would become channel 7000, but with offset down.

For this current list we have presented both the old numbering system and the four digit system. Thus the list will be applicable while ever the old system remains in use, but will not become out of date if either the three or four digit system is adopted. (For the three digit system, simply drop the last digit.) It will also serve as a conversion table during any transition period. The oblique stroke (/) can be read as "or".

REPEATER FREQUENCIES AND CHANNEL NUMBERS

REP. CH. NO.	INPUT FREQ.	OUTPUT FREQ.
1/6650	146.050MHz	146.650MHz
6675	146.075MHz	146.675MHz
2/6700	146.100MHz	146.700MHz
6725	146.125MHz	146.725MHz
3/6750	146.150MHz	146.750MHz
6775	146.175MHz	146.775MHz
4/6800	146.200MHz	146.800MHz
6825	146.225MHz	146.825MHz
5/6850	146.250MHz	146.850MHz
6875	146.275MHz	146.875MHz
6/6900	146.300MHz	146.900MHz
6925	146.325MHz	146.925MHz
7/6950	146.350MHz	146.950MHz
6975	146.375MHz	146.975MHz
8/7000	146.400MHz	147.000MHz
7025	147.625MHz	147.025MHz
9/7050	147.650MHz	147.050MHz
7075	147.675MHz	147.075MHz
10/7100	147.700MHz	147.100MHz
7125	147.725MHz	147.125MHz
11/7150	147.750MHz	147.150MHz
7175	147.775MHz	147.175MHz
12/7200	147.800MHz	147.200MHz
7225	147.825MHz	147.225MHz
13/7250	147.850MHz	147.250MHz
7275	147.875MHz	147.275MHz
14/7300	147.900MHz	147.300MHz
7325	147.925MHz	147.325MHz
15/7350	147.950MHz	147.350MHz
7375	147.975MHz	147.375MHz

STATUS CODE

Op = Operational; Bu = Building; Te = Testing; Pl = Planning; Pr = Provisional.

ACKNOWLEDGEMENT

This table has been compiled from information supplied by the Wireless Institute of Australia, NSW Division, whose assistance we gratefully acknowledge. It has been updated as at January 1979.

SHORTWAVE SCENE

by Arthur Cushen, MBE

Greek Radio celebrates 43 years of operation

The Greek Radio at Athens is celebrating its 43rd year of operation and has announced that technical facilities are to be expanded in order to cover the whole of Greece with radio and television services.

The history of Greek Radio goes back to 1936. Today, 43 years later, it operates three channels which service Athens and feed the eight national networks. The short-wave transmission, known as the Voice of Greece has a 20 hour daily program in 12 languages, in its effort to serve its audience in the five continents.

ERT (Greek Radio and Television) operates one television channel and 17 transmitting stations, thus covering 95% of Greek territory.

The Radio and Television centre, located in Aghia, Paraskevi, a suburb 15 kilometres away from Athens, covers an area of 12,000 square metres. 8000 square metres are covered by the main building, which houses the headquarters and the radio and television production staff, and the remaining 4000 square metres, are covered by auxiliary buildings. Two more buildings are being used, in order to house the administrative staff and the financial services.

The radio studios are located in the western wing of the building and include seven studios for concerts and plays (four of which are stereophonic, eight editing studios), five announcement studios and five continuity studios.

For television program production, there are four fully equipped modern studios, located in the eastern wing of the building.

For the near future, the engineering departments are preparing a full program for the construction of new studios, the purchase of new equipment and the coverage of the whole of the Greek territory with transmitters.

The Athens Radio has a daily broadcast to Australia in Greek and this is received 0900-0950GMT on 9655 and 15160kHz. Other transmissions are broadcast 2100-2150 on 6140, 9655 and 9760kHz; and 2200-2250 on 9655kHz. English news is broadcast 15 minutes past the hour in these transmissions, with the balance of the broadcast being in Greek.

ENGLISH FROM LIBYA

The Libyan Broadcasting Service, which has been reported on 5980kHz with a broadcast in Arabic from 0600GMT and on 5960kHz around 0700GMT, has now been heard on these frequencies at 1800GMT.

It is understood the broadcast on 5960kHz originates from Malta and is the transmitter of Radio Mediterranean. The broadcast from 1800-1900GMT is a new International Service and it includes 20 minutes in Arabic, English and French.

Reception in this part of the world is spoilt by the fact that the channel is also used by Radio Moscow. The transmitter on Malta is also used by Deutsche Welle and, according to the BBC Monitoring Service, the use of the transmitter for broadcasting programs for the Libyan Broadcasting Service has been the cause of the German radio making it known that they are not party to the type of program being carried.

Deutsche Welle has operated a relay station on the Island of Malta since 1974, and this comprises one medium-wave and three short-wave transmitters of 250kW. The medium-wave transmitter on 1557kHz has also been heard in this area around dawn.

The agreement with Malta provided that transmission time not used by Deutsche Welle should be made available to the Government of Malta which would reimburse costs. Deutsche Welle, therefore, are not responsible for the content of any transmissions broadcast by the Government of Malta or any third party. Deutsche Welle, according to the news agency, had emphasised that it had not granted transmission time to "Radio Mediterranean".

VOICE OF THE MALAYAN REVOLUTION

The clandestine radio station using the slogan "Voice of the Malayan Revolution", and reported by the BBC Monitoring Service as broadcasting from southern China, is now using the new frequency of 9620kHz for some of its transmissions. The English broadcasts continue to be received on 11830 and 15790kHz during part of the transmission period 0430-0710 and 0930-1530GMT. The best reception of this station is during the English broadcast at 1030GMT and it is this transmission which has been widely reported by readers.

EXTENDED RED CROSS SERVICE

Full details have been announced on an extension of services by the International Red Cross in Geneva. A service in English will be broadcast on the fourth Monday of each month on 7210kHz 0600-0700, 1130-1230, and 1700-1800GMT. French will also be heard on the fourth Monday of each month, while on the Wednesday the transmission will be in German, Spanish and Arabic. The extension in broadcasting time was authorised by the Swiss Post, Telegraph and Telephone services, and broadcasts are now heard monthly instead of every two months as in the past.

ENGLISH FROM BUCHAREST

The latest schedule received from Radio Bucharest in Romania shows extensive frequency use of several bands for each transmission. The English service to North America is now broadcast 0130-0230GMT on 5990, 6155, 9570, 9690, 11840, 11940 and 15255kHz; and from 0400 to 0430 on 5990, 6155, 9570, 9690, 11705, 11840, 11940kHz. A broadcast to Australia and New Zealand is heard 0645-0715GMT on 11940, 15255,

Notes from readers should be sent to Arthur Cushen, 212 Earn Street, Invercargill, NZ. All times are GMT. Add 8 hours for WAST, 10 hours for EAST and 12 hours for NZT.

15335 and 17805kHz. A service beamed to Asia is transmitted 1500-1530GMT on 11940, 15250 and 17805kHz.

AFRICA

ETHIOPIA: The Voice of Revolutionary Ethiopia is reported by the BBC Monitoring Service as having made major changes to its English broadcast 1500-1600GMT. The transmission is carried on 7165 and 9615kHz and the new program includes a news bulletin at 1530, followed by a commentary, an editorial and a weekly topic. The first 30 minutes of the program is now devoted to music.

LIBERIA: Station ELWA at Monrovia has been observed opening at 0625GMT on 11830kHz with multi-language announcements. Gospel programs are then broadcast, with one in English commencing at 0700GMT. By 0730GMT there is considerable interference on the frequency.

ASIA

INDONESIA: The Voice of Indonesia at Jakarta is observed with a broadcast in English at 0100GMT. John Mainland of Wellington, NZ, has heard this transmission on 15200kHz when English news is broadcast.

PAKISTAN: Radio Pakistan has been observed on the new frequency of 21585kHz, which apparently replaces 21590kHz. The broadcast was tuned at 0605GMT and the transmission was in Urdu.

AMERICAS

COSTA RICA: Station TIUCR, Radio Universidad de Costa Rica, operates between 1200-0400GMT according to the "New Zealand DX Times". The frequency is 6100kHz but this varies from 6097 to 6103kHz. The station uses 10kW and is currently planning to introduce an international program on this new transmitter.

MEXICO: Radio Mexico now uses 11770kHz 2200-0330GMT, in parallel with 5985, 9705 and 15385kHz. Radio Mexico says that in the near future it will send LP discs to listeners who send in reception reports. The station has, in the past, issued some excellent LP recordings.

CHILE: New transmissions 0200-0730GMT from the Voice of Chile in Santiago have been noted by John Mainland of Wellington, NZ. Transmissions are on 11720, 15110 and 17800kHz, and appear to be directed towards Argentina.

MEXICO: Radio Mexico has been noted on the new frequency of 15430kHz around 0130GMT. This frequency replaces 15385kHz and is in operation up to 0340GMT. Towards sign-off it suffers interference from the Voice of America.

ECUADOR: HCJB, Quito, Ecuador is again using the 13-metre band and is on 15295, 17855 and 21480kHz to Europe, closing at 2200GMT after a broadcast in Swedish.

PERU: Two signals in the 49-metre band have been noted from Lima. Around 0600GMT reception of Radio America on 6010kHz has been noted, while later in the evening Radio Nacional on 6082kHz also provides good reception.

RADIO KAMPUCHEA

A new International Service was recently inaugurated by Radio Democratic Kampuchea (Cambodia) and, according to the BBC Monitoring Service, four transmissions each day are carried in English. These are broadcast on 6093kHz 2330-2400, 0001-0030, 1130-1200 and 1200-1230GMT.

The Domestic Service has been extended in its schedule on 4908kHz short-wave and 918kHz medium-wave, with the broadcasting times as follows: 2230-2400, 0400-0500 and 1030-1500GMT. On rest days, 10th, 20th and 30th of the month, transmissions are 2230-0200, 0400-0500 and 0900-1500GMT.

NORTH KOREAN RADIO

One of the stations broadcasting from North Korea uses the slogan "The Voice of the Revolutionary Party for Reunification" and has been heard for several years with English broadcasts on 1134kHz (medium-wave) at 1400GMT. The station verified our reception from a report sent to Pyongyang. Robert Clark of Perth WA also reports reception of the 1400GMT transmission on 4120kHz. The station announces that the schedule in English is 2230-2300GMT on 4557kHz and 1400-1430 on 4120 and 4557kHz. Both transmissions are also on 1134kHz medium-wave.

SPAIN'S ENGLISH BROADCASTS

Madrid used to be continuously heard in its service to North America but is now heard 0000-0200GMT and 0515-0615GMT. Both of these transmissions are available on two frequencies: 9630 and 11880 kHz. The station in its closing announcement asks for reception reports, and gives the following address: Radio Exterior De Espana, PO Box 150.039, Madrid 24, Spain.

According to the latest schedule, the relay station at Tenerife in the Canary Islands, which has two transmitters of 50kW, is now operating 1400-2000 on 11815kHz in Spanish and at the same time on 15365, Sundays only. A further daily transmission on 11815kHz to North, Central and South America is broadcast 2145-2400GMT.

RECENT VERIFICATIONS

DOMINICAN REPUBLIC: According to Dene Lynneberg of Wellington, reporting in the New Zealand DX Times, HISD, Radio Television Dominicana on 5969kHz verified with a letter in Spanish from J. A. Bruno Pimentel, confirming the frequency of 5969. The verification was received in two months by airmail, following the report which was sent in Spanish.

FRANCE EXTENDS SERVICE

Radio France International is now operating in the 11-metre band and can be heard in French 1100-1400 on 25620kHz. According to "Sweden Calling DXers", France intends installing a 500kW short-wave transmitter in Sri Lanka for relay of France Inter towards Asia. A relay station of the same type is also planned for Kourou, French Guiana, South America, for serving South America, and the Americas as a whole. So far, France has not constructed any overseas relay bases, and relys on the radio services in the various colonies to provide a broadcast relay of some of the major programs from Paris.

MOSCOW'S WORLD SERVICE

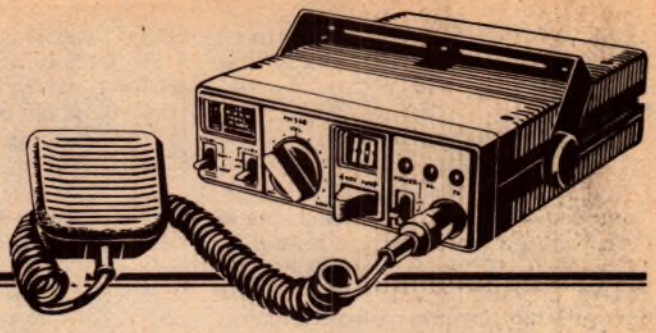
Radio Moscow's New World Service has issued a program schedule which shows that news is broadcast on the hour and on the half hour throughout the transmissions from 0400-2200GMT. The transmissions are directed to North America, Europe, Africa, Middle East, Asia, Australia and New Zealand. Broadcasts to Australia are only shown as metre bands in operation, as there are many frequencies carrying the program. The broadcast of Radio Moscow's World Service is 0400-0900GMT in the 16-metre band, 0400-1200 in the 19-metre band and 0800-1200 in the 31-metre band. Broadcasts for our morning reception 2100-2200 are in the 19, 25 and 31 metre bands.

LISTENING BRIEFS EUROPE

BELGIUM: Brussels continues to use 6080 and 9685kHz for the broadcast to North America. The transmission is 0015-0100GMT. English is broadcast to Africa on 17740 and 11940kHz, 1715-1800GMT.

GERMANY: The broadcast to New Zealand and to Australia in English is heard 0930-1030GMT on 9650, 11850, 15275, 17780, 17800, 21540 and 21680kHz. The broadcast in English for our morning reception is heard at 2100-2200GMT on two frequencies: 7130 and 9765kHz. The broadcast in German to Australia is 0600-0950GMT on 7285, 9690, 9735, 11705, 11785, 11795, 17845 and 21560kHz.

The Australian CB SCENE



A GLOSSARY — OF THE MORE TECHNICAL KIND!

In the past, any number of CB texts have provided a glossary of CB jargon — the highly conformist terms which CB operators are expected to substitute for plain language. Here is something different: An expanded glossary of some hand-picked technical terms which may be helpful to those who have progressed beyond the "10/4 good buddy" stage.

ALIGNMENT: The process of adjusting the internal circuitry of a receiver or transmitter, but particularly internal resonant circuits, so that it operates at the intended efficiency. The job is normally done at the factory; after that, realignment should only be attempted using equipment and procedures as specified in the maker's service manual. On no account should inexperienced people fiddle with the internal adjustments of a CB transceiver, in the hope of correcting a fault or making it perform better. Almost invariably, the reverse will be achieved, necessitating an additional service fee to cover the cost of realignment!

AMBIENT TEMPERATURE: In an electronic context, the temperature of the body of air in which a piece of equipment is operating. In a general sense, it may refer to the total environment; e.g. high ambient temperatures in summer in central Australia. In relation to CB equipment, it may be more to the point to consider the ambient temperatures in the immediate environment as, for example, inside a road vehicle under specific conditions.

AMPLITUDE MODULATION: Commonly abbreviated to "AM". A conventional definition reads: "The process of varying the amplitude of an RF carrier in accordance with the intelligence signal". In a more complete discussion, it would be pointed out that the process actually generates additional RF signals on either side of the original carrier. In a normal AM system, as used in all simple 27MHz CB transceivers, the total signal — carrier and sidebands — is transmitted and received. In the more complex "SSB" equipment, the carrier and one set of sidebands is suppressed, conferring a number of advantages in the noisy, crowded 27MHz band. In short, conventional 27MHz CB transceivers offer conventional AM facilities and/or SSB (single sideband) which is a special form of AM.

ANTENNA GAIN: Describes the intrinsic efficiency of an antenna, in terms of its ability to radiate signals in, or receive signals from, a particular direction, when compared to a reference antenna. One such reference is the so-called (and largely theoretical) "isotropic" antenna, which radiates equally in all directions. Most practical antennas have directional qualities and, as a result, exhibit "gain" in certain directions. A half-wave dipole, for example, has a gain of 1.64 times broadside-on, equivalent to just over two decibels relative to an isotropic radiator. Because a half-wave dipole is practical and widely used, it is common to use it as a standard when describing the gain of a beam array: i.e. so many dB relative to a dipole.

ANTENNA IMPEDANCE: When used in transmitting mode, an antenna appears to the transmitter as a load made up of resistance, capacitance and inductance. If the antenna is to absorb (and radiate) the maximum amount of RF energy, it must be made to look, as far as possible, like a pure resistance. This is accomplished

Up-dated CB handbook

DICK SMITH'S AUSTRALIAN CB RADIO HANDBOOK. 3rd printing. Stiff paper covers, 122 pages, 213mm x 140mm, illustrated by drawings and photographs. Published by Horwitz Publications. Price in Australia $3.95.

A familiar part of the Australian CB scene, Dick Smith's CB Handbook hasn't changed much in appearance, although it is now in its 3rd printing. As indicated on the cover, it has been revised and updated in detail, although some of the changes to regulations that are foreshadowed have still not materialised.

For those who have not seen the earlier editions, the book does not attempt to be any more technical than it needs to be for the uninitiated reader.

It talks about CB radio as a concept in relation to local licensing requirements. It discusses typical "rigs" and antennas for mobile and base installations, along with available accessories, and offers a few suggestions as to what to do if the equipment fails to operate as expected.

For the rest, the book concentrates on using the equipment, speaking the CB "lingo", CB radio clubs, P&T regulations, glossary, etc.

To established CB enthusiasts, it would all be elementary and "old hat" but, for newcomers, a few hours of reading would put them in the CB picture. The book is currently available from all Dick Smith outlets. (W.N.W.)

by manipulating the dimensions of the antenna so that it is physically resonant at the operating frequency. The apparent magnitude of this predominantly resistive impedance can be manipulated to meet specific requirements by the choice of connection point or the use of matching stubs, etc. Most CB antennas are designed to have a nominal impedance at the feedpoints of 50 ohms. In receive mode, they are electrically equivalent to a signal generator having an approximate 50 ohms output impedance.

ANTENNA MATCHING: Basically, the design procedures and the adjustments necessary to ensure that RF energy is transferred, with maximum efficiency, from a transmitter, via the connecting cable, to the antenna. In receive mode, efficient transfer is required from antenna, via the cable, to the receiver. Antenna matching is a very broad and complex subject but it is relatively circumscribed in the context of CB radio. Most CB transceivers have a nominal output (and input) impedance of 50 ohms and should be connected via a 50-ohm coaxial cable to an antenna of nominal 50 ohms impedance. Antenna matching consists largely of making sure that the cable used is indeed a 50-ohm type and that the antenna is installed and adjusted according to the maker's instructions.

ANTENNA POLARITY: When an ordinary antenna is made to radiate energy into space, it tends to produce an electric field which is in the same plane as the active element(s) of the antenna. The magnetic component of the radiated signal is at right angles to this plane. By convention, the polarity of a radiated signal, or the attitude of its energy planes, is identified with the electric field. The convention with CB radio is to use vertical antennas (whips, etc) so that antennas and signals alike are said to be vertically polarised. For best signal pickup, receiving antennas should also be of the vertical type. Loss of pickup, when using a horizontally polarised antenna to receive CB stations, can be as high as 20dB.

AUDIO COMPRESSION: In most CB transceivers, a system of automatic gain control (AGC), operating on the audio circuits, compensates substantially for the variations in the way individuals use the microphone. This tends to hold the transmitter modulation level fairly constant. The term "audio compression" is sometimes used simply to describe this AGC action but, more rigorously, it refers to another circuit provision which is found in the more advanced transceivers. Over and above ordinary AGC action, this additional circuitry tends to clip or compress peaks in the actual voice waveform which might fully modulate the carrier, even when the average voice level is modest. By restraining the peaks, the average modulation can be increased, without overmodulation or a significant loss in voice quality. As received, the transmission sounds louder, when compared with competing interference. In non-technical parlance, the end result is greater "talk power".

"I'll be glad when they change over to UHF!" (From D. Varovcic, 3 Park St, Burra 5417).

AUDIO NOISE LIMITER: AM transmissions on the HF bands are prone to interference from vehicle ignition systems, evident as sharp pulses of noise superimposed on the wanted signal. A noise limiter circuit tends to clip off or suppress peaks which exceed the average maximum amplitude of the incoming voice signal. While tending to clip and distort voice peaks to some extent, more importantly it reduces the severity of the noise pulses.

AUTOMATIC GAIN CONTROL: Abbreviated to "AGC", it is the term now preferred to the older and less accurate expression: automatic volume control ("AVC"). Most modern receivers include an AGC system — internal circuitry which automatically reduces the gain or amplification of the radio frequency and intermediate frequency stages in proportion to the strength of the incoming signal. With a weak signal, the receiver operates at high gain; with a strong signal, the gain is drastically reduced. This means that the level of signal available from the detector remains fairly constant, and the volume of sound from the loudspeaker does not vary much from the level which the operator has set with the manual volume control.

Without getting too complicated, we explain . . .

HOW an SSB system works

Most enthusiasts seem to understand that an SSB transmission comprises one sideband only, and no carrier; that to resolve it, the receiver needs to replace the carrier with a locally generated signal. The real gap, which this article seeks to fill, is an understanding of how an SSB signal is generated in the first place.

by W. EDMUND HOOD W2FEZ*

Suppressed carrier, single sideband transmission has so completely overtaken amateur radiotelephony on the HF (high frequency) bands that conventional AM signals are a rarity. In fact, many stations aren't even equipped to tune in an AM signal.

The advantages of single sideband are well worth the trouble of acquiring the more precise and complex equipment needed to produce and properly receive these signals. It does, however, burden the novice amateur with having to learn much more today than he might have needed 20 years ago, in order to reach an average level of understanding in the communications art.

When voice modulation of a radio signal was first accomplished, it was accepted simply that the level of the signal had been modulated, or caused to vary in a manner corresponding to the frequency and amplitude of the voice. Hence the term "amplitude modulation". However, it soon emerged that the concept, while not necessarily wrong, was certainly simplistic and incomplete.

In fact, the process of amplitude modulating a signal actually produces a pattern of frequencies comprising the original carrier plus adjacent signals, referred to as "sidebands", having a frequency and amplitude dependant on the superimposed audio. The modulated envelope which may be seen on the screen of a cathode ray oscilloscope is virtually a graphical summation of the carrier and sidebands. (See Fig. 1).

Thus, when we dissect an AM signal mathematically and examine it component by component, we discover that the so-called "carrier" remains constant in its level. We also find that a narrow band of spectrum above and below the carrier frequency is occupied by a symmetrical complex of signals resulting from the combination of the carrier with the voice — the sidebands.

This is consistent with the familiar theory that, when any two signals are combined in a nonlinear device, the output of the device usually contains the original two signals and two new signals, whose frequencies are the sum and the difference of the frequencies of the original signals.

For example, if we take a signal at 3.9MHz and combine it with a 1kHz signal, we obtain the original two signals plus a signal at 3.901MHz, resulting from the addition of 3.9MHz and 1kHz; we also find a signal at 3.899MHz, resulting from the subtraction of the 3.9MHz and 1kHz signals. If we were to attempt to radiate these signals, the 1kHz would not, of course, radiate, but the other three would. We would have a 3.9MHz carrier and a sideband at 1kHz above and below it.

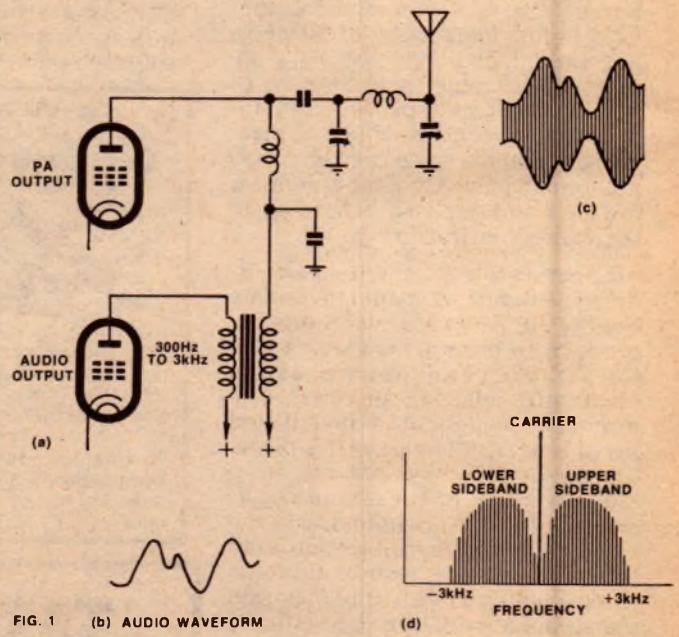


FIG. 1

A conventional AM transmitter output stage (a) modulated by an audio signal (b) produces a modulated waveform (c) as it appears on a CRO screen. However, upon analysis, (c) turns out to be equivalent to (d). The combination of the original carrier, with level unchanged, and two groups of sidebands, whose energy and distribution varies instantaneously with the audio signal.

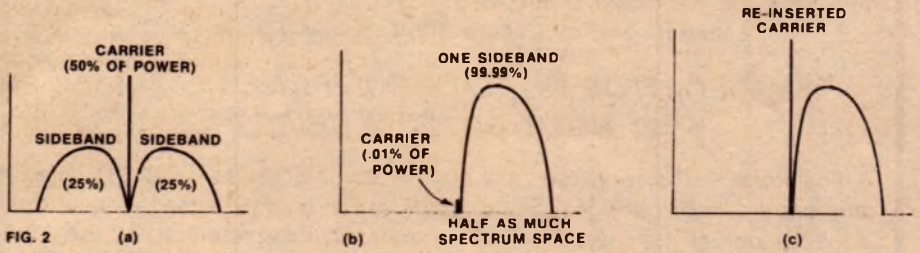


FIG. 2

Like 1d, 2a above depicts a conventional AM signal. In an SSB system, on sideband and the carrier are eliminated and the power capabilities of the output stage concentrated on the remaining sideband (b). A signal equivalent to the missing carrier can be reinserted at the receiver (c), allowing the original audio to be recovered.

*116 W. Park St. Albion NY 14411 USA.

HOW SSB WORKS

This is an AM signal of a 1kHz tone.

Now, suppose the carrier were eliminated and just the two sidebands transmitted. If we were to insert a corresponding signal or "carrier" at the receiver, it would combine with the 3.899MHz and 3.901MHz signals to reproduce the 1kHz tone. The original carrier, then, is therefore not really essential to recover the 1kHz tone.

To go one step further, we can also eliminate either one of the sidebands and still recover the 1kHz tone. Whether we eliminate the upper or the lower is simply a matter of preference.

If, instead of the 1kHz tone, we were using sidebands representing the complex waveform of the human voice, we can recover the voice in the same way, just as long as we insert a carrier at the correct frequency in the receiver.

The major disadvantage of the system is that the receiver must be very stable (i.e. free from tuning drift) and must include a stable oscillator to substitute for the missing carrier — usually in the IF system just ahead of the detector.

Any drift in receiver tuning tends to alter the pitch of the voice, as received, and may even render it unintelligible. While a certain amount of slow drift can be corrected by careful and frequent re-tuning, this is not practical where the drift is fast, or erratic, or where the tuning mechanism is "jumpy".

Fortunately, with advancing technology, frequency stability is much less of a problem than it once was. Which is just as well, because SSB offers certain very definite advantages.

When an AM signal is transmitted, the overall signal — assuming voice input — would typically cover a portion of the spectrum 6kHz or more wide. The transmitter power would be divided, half of it producing the carrier and half of it producing the two sidebands (one quarter of the power to each sideband).

Now the carrier doesn't do anything, except help the receiver demodulate the signal. If we get rid of it (Fig. 2) we have twice as much power available to transmit the sidebands, which contain all the information in the signal. But, if we get rid of one of the sidebands, there is that much more power available for the other one. (Because of the complex waveform of the sidebands, we only have the effect of two to three times the effective power in the signal, rather than four, as we might have expected.)

Then there's the narrower bandwidth. A single sideband signal occupies less than half the spectrum space required by an equivalent AM signal. This makes room for more stations and reduces the amount of atmospheric noise picked up by a receiver with appropriately narrow bandwidth.

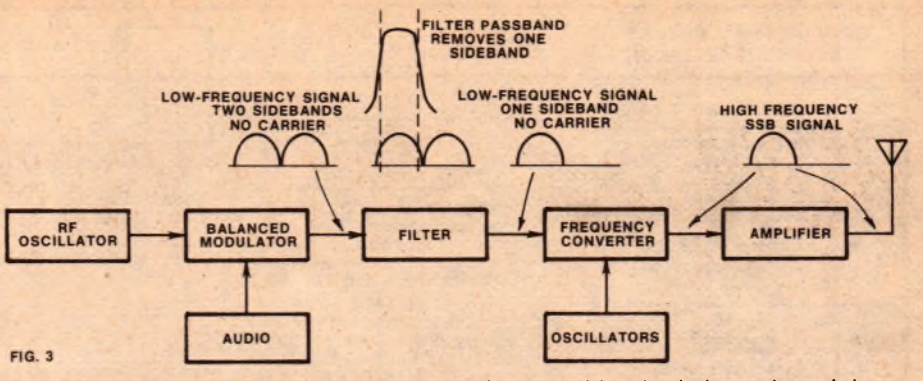


FIG. 3

In a typical SSB transmitter, the carrier is eliminated by the balanced modulator, leaving only the two sidebands. One of these is eliminated by a filter. The remaining sideband is heterodyned to the desired frequency, amplified and radiated.

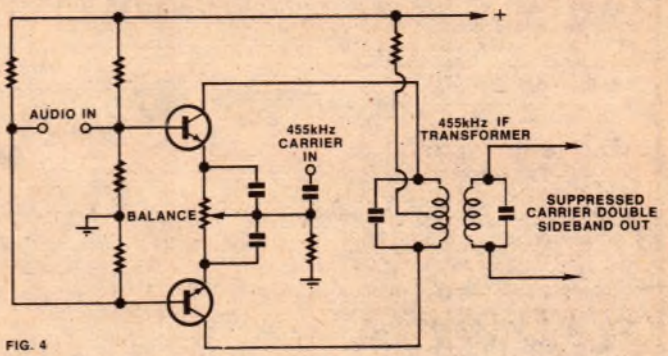


FIG. 4

A typical balanced modulator circuit. Being fed to the common emitter circuit, the carrier cancels in the push-pull output system.

A suppressed carrier, single sideband signal can be generated by several methods, and most of them produce an equally good end product. It is there, however, that the comparison ends. The phasing method of generating a single sideband signal is so complex that it is seldom used. In fact, I've only seen one amateur rig using this method, and that was produced 10 or 15 years ago by Heathkit.

The most popular method of single sideband generation is called the filter method, and it is this method that I will cover in detail. (See Fig. 3.)

The heart of any single sideband transmitter is a device called a balanced modulator. There is a wide variety of balanced modulator circuits available, some more complex than others, and each one is somebody's favourite. While I don't wish to push one type over the others, I will only cover a sampling here. A balanced modulator, incidentally, is also often used in a receiver to mix the incoming signal with that of the local oscillator to produce the IF signal.

Here is one of the easier to understand balanced modulator circuits. (See Fig. 4.) Note that the audio is fed to the two transistors in a push-pull arrangement. The carrier, however, is fed to the transistors in parallel. At the output, the carrier is of the same amplitude and polarity at opposite ends of the winding. Thus it cancels itself out, leaving only the two sidebands. Any small amount of carrier that gets by, due to unequal characteristics of the transistors, is eliminated by adjusting the balancing potentiometer.

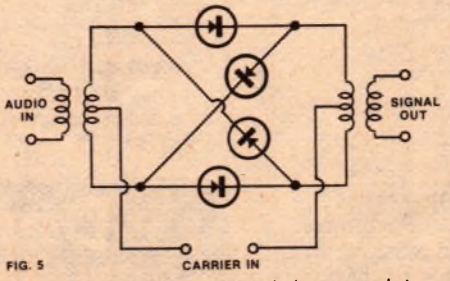


FIG. 5

A four diode ring modulator, relying for its efficiency on balanced components.

The four-diode ring modulator circuit shown in Fig. 5 needs no balancing potentiometer, so long as the diodes are well matched in their characteristics. Its operation is a bit more difficult to explain, but it operates by being thrown in and out of balance by the audio signal. It enjoys its greatest popularity as a radio frequency mixer circuit. The RF transformers are broadband toroids, and, in receivers employing this circuit, they are small enough to fit on your fingernail.

The two-diode balanced modulator of Fig. 6 is an easy one to make and often represents the best compromise in simplicity and efficiency. Any of the above circuits have carrier suppression of 50dB or better, when properly built and balanced. They are not, by any means, the only balanced modulator circuits in use, but are representative.

A balanced modulator, whichever circuit is used, produces the two sidebands characteristic of an AM signal, but no carrier. This brings us halfway to our goal. Now we must eliminate one of the sidebands. This is done with a very selective filter, hence the name "filter method".

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 **$65**.
Transmitter No. 11 suits 210 **$35**.
24 volt Power supply to suit above **$15**.
Or complete station with Headphones, Mic. Morse Key. **$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 1 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 perfection condition $35 per drum. $2.00 cartage to rail freight payable at destination.

RCA 44BX MICROPHONES

PROFESSIONAL QUALITY $75
P&P A. $1.80. B. $3.50. C. $4.55. D. $4.55

20X to 60X ZOOM TELESCOPE

With Tripod. **$115.50**.
Post **A$2.25, B$4.10, C$6.10**.

AERIAL CAMERAS

WITH 8" FL 3" DIAM. LENS F24 MARK IV 2.9 LENS STOPS 11, 8, 5.6, 4, 2.9 — $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 5/64
Carbon Steel. **$3 dozen**
Post 60c

ARTILLERY DIAL SIGHTS MK2

Can also be adapted as a Dumpy Level or as base for a telescope has full 360? 5½" 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	6BN8	$1.95
5U4	$1.95	6GV8	$1.95
EF50	$1.50	6AK5	$1.95
5Y3	$2.95	1H6	$1.50
2x2	$1.50	832	$5.00

P+P 80c

6x4	$1.95
VR65	$1.50

STC HI IMPEDANCE HEADPHONES

3400 ohms, brand new, only $4.95 pair.
P&P. A $1.65, B $2.75, C $3.10

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 **$7.95** each, post 60c.

BINOCULARS

PRISMATIC Coated Lenses. Brand new. Complete with case.

		P&P	
8 x 30	$36.50	A	$1.75
7 x 50	$48.95	B	$3.00
10 x 50	51.00	C	$3.10
12 x 50	53.00		

SMALL CLIP-ON POCKET TELESCOPE

15X **$6.50**, P+P 80c

3" ASTRONOMICAL REFLECTOR TELESCOPE

117X magnification FL 700mm with 5x24mm finder scope and two section hardwood tripod. **$169.25**.
Post **A$2.25, B$4.10, C$6.10**.

3000 TYPE RELAYS

P.M.G. 200 ohms — 1,500 ohm Coils **$2.50** each P+P 80c

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

SIEMENS Typing Perforator

240 Volt Type with Keyboard **$57.50**

ROLA 66 MK 2 TAPE RECORDERS

Good condition **$275.00**

CONDENSER LENS

1½" diam. 4½" F.L. 75c. 2½" 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" **$30.35**, ½" **$43.30**, ¾" **$47.60**
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.

MAGNESIUM DRY CELL BATTERIES

Suits PRC 25 and dozens of other uses. 15 volts long life only **$1.50** ea.
P+P: A. $1.35, B. $2.75, C. $3.60

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**

THEODOLITES

Made by Wilds Microptic, with tripod. Model T1, reads down to one minute of ARC **$750**.
(Usual Price **$1750**).
Model T2 reads down to one second of ARC **$1000** (Usual Price **$3200**).
Freight payable at nearest attended R'way Stn.

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.

TRANSCEIVERS Ex Army

No. C45 set 23 to 38MHz with headphones, mic. 24V power supply, etc. **$95.00**
$1.00 cartage to rail, freight payable at nearest railway station.

EX-ARMY TWO-WAY FM RADIOS

1.2 WATTS OUTPUT
SUPERHET
PRC9 AND 9A 27 to 39M/HZ
PRC10 AND 10A 38 to 55M/HZ
WITH HANDSET ANTENNA $25 EA
UNTESTED
Battery $3.95 extra. Harnes $4.50 extra.
$2 Cartage to Rail. Freight payable nearest attended Railway Station.

16MM SOUND PROJECTORS IN GOOD WORKING ORDER

240 volts operated complete with Speaker and Amplifier.
RCA **$275**
BELL & HOWELL **$195**.
$1 Cartage to Rail. Freight payable at nearest attended Railway Station.

SELSYN MOTORS MAGSLIP

RECEIVERS 2" MK2 $5.50
TRANSMITTER 3" MK2 $15.00

Post Packing A $1.75, B $2.75, C $2.75, D $3.65
P+P: A $1.75, B $3.00, C $3.10

COMMUNICATIONS RECEIVER

COLLINS R — 391/URR

Continuous tuning of range 500 Kills — 32MHz in 32 bands. Receive frequency indicated directly on digital counter type readout to within 300Hz. Selectivity adjustable in six steps. From 100Hz to 16KHz bandwidth. Sensitivity 1 microvolt or better 240 VAC operation — 10 inch rack mount — autotone on eight preset channels available complete with instructions and service manual and tested.
PRICE $500.

Deitch Bros.

70 OXFORD STREET, SYDNEY 2010

SORRY NO C.O.D.

HOW SSB WORKS

Two kinds of filters enjoy considerable popularity in this application. One is made using quartz crystals of the proper frequencies, connected in a lattice or similar arrangement. (See Fig. 7.) The other consists of two magnetic transducers, and a number of mechanically resonant discs. Mechanical filters, generally made by Collins, are more popular in commercial systems and in the more expensive amateur transmitters.

Whichever type of filter is used, it must pass a band of frequencies about 3kHz wide for normal speech transmissions and must reject all frequencies outside that band, with a very high amount of attenuation. (See Fig. 8.)

The nominal frequency of the RF signal fed into the balanced modulator is selected to be just outside the passband of the filter. The filter passes the desired sideband almost without loss and eliminates the other sideband and any residual carrier. The selection of either the upper or the lower sideband is accomplished by changing the (residual) carrier frequency from one side of the filter passband to the other.

FREQUENCY CHANGE

Single sideband signals are usually generated at a fairly low frequency and converted later to the desired transmission frequency. This is accomplished by mixing the low frequency signals with one of a higher frequency and then tuning out the unwanted products.

In one brand of commercial unit, for example, the signal is originally generated in the neighbourhood of 455kHz and then mixed with a signal close to 1955kHz. This results in a signal at 1500kHz and another at 2410kHz. The 1500kHz signal is selected and the other rejected by the tuned circuits. This signal is amplified and then mixed with a still higher frequency.

If, for example, we wanted the final product at 3.9MHz, we could obtain it by combining the 1.5MHz signal with a 5.4MHz signal.

We should note here that, each time we mix and use the difference frequency, rather than the sum, the sidebands invert. That is, the upper sideband would become a lower one and vice versa. It's okay to do this this way, as long as we are aware of this phenomenon.

Once we have the signal converted to the proper frequency, all we have to do is to amplify it to the desired power level. Here again, we have to be careful what kind of amplifier we use. Amplifiers are classed according to the way the grid of the valve or the base of the transistor is biased.

The most efficient of the radio frequency power amplifiers, in terms of DC input power, is biased as class C. This means that the voltage on the grid or the base is set so that current flows only during the peaks of input voltage. This is all right for CW operation, but wouldn't work very well with a single sideband signal due to the distortion that would occur.

A class B amplifier is biased so that current flows only during the positive half of the input cycle.

A class A amplifier is biased so that current flows at all times. It is the least efficient, but produces the least amount of harmonic distortion. Amplifiers biased at class A, class B, or in between are known as linear amplifiers, and this is the only kind that can be used when the input signal is already modulated.

The features just described represent the characteristics common to all single sideband transmitters. If you can grasp them, you are more than halfway to a general understanding of the mode.

Receivers designed for signals of this type differ from conventional receivers only in that they are more selective than their ancestors, and the detector circuit, instead of being a simple diode, is a balanced mixer. This enables the most efficient demodulation of the signal. Older receivers can receive single sideband signals as long as they have a CW oscillator. However, it does require careful tuning and adjustment of the pitch control or the CW oscillator, and, in the ultimate, success or otherwise depends on both the mechanical and electrical design.

The frequency conversion provisions common to SSB receivers and transmitters make transceiver design the most economical way to go, though not necessarily the most versatile. The carrier oscillator continues to operate in the receive mode, thereby enabling demodulation of the signal, and, since the same conversion oscillators are used in both modes, transmit and receive frequencies are automatically locked together.

When operating single sideband with separate transmitter and receiver, you should remember that very careful tuning is essential to get your transmitter and receiver on precisely the same frequency.

Some transmitters include a feature that produces just enough carrier to enable spotting the frequency on the receiver. With others, you may have to speak into the microphone while fine-tuning the vfo (in the spot mode, not in transmit, please) until the voice sounds natural in the receiver. Do this after having first tuned the receiver to the desired signal.

Upper sideband is generally preferred on the 14MHz amateur band and above, while lower sideband is commonly used for 7MHz and below. Other than custom, however, there is no rule dictating which sideband to use. A little practice, and the novice should very quickly be joining us after he gets the appropriate ticket. This article hasn't covered the entire extent of single sideband operation, but I hope that it has, at least, helped to get the beginner over the hump.

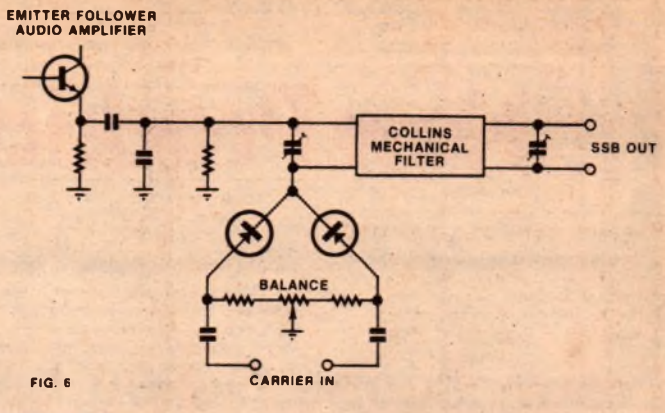


FIG. 6

At right: A two-diode balanced modulator, suggested as good compromise between simplicity and efficiency.

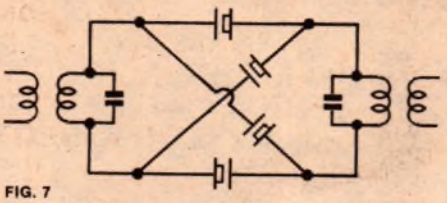


FIG. 7

Mechanical filters (Fig. 6) are efficient but also expensive and, as an alternative, crystal lattice filters, asabove, are often preferred for amateur equipment.

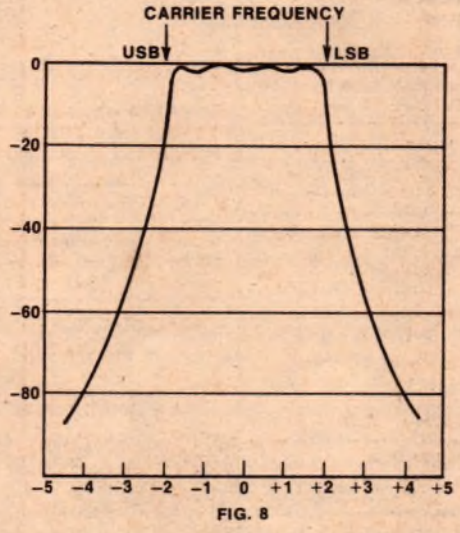


FIG. 8

The whole performance of an SSB transmitter depends on the filter characteristic, shown here.

New Products

Normascope D4000 has inbuilt DVMs . . .

The Normascope D4000 is a new release in Australia by the German Norma Messtechnik company. It combines the features of an oscilloscope with both AC and DC DVMs, whose readout is via the scope screen.

The case of the D4000 has a low profile with the dimensions 88 x 240 x 330mm (H x W X D). The mass is about 5kg and power consumption is 40W with a nominal power supply of either 220V or 115V AC. The CRT screen measures a modest 70 x 40mm.

The performance of the oscilloscope is quite reasonable considering all of the functions provided on the overall instrument. Maximum vertical sensitivity is 5mV per division, and the frequency response extends from 10Hz to 5MHz. The maximum timebase speed is 1us per division.

The DVM displays are located at the top of the screen. Both are 3½ digit displays and use a 5 x 7 dot matrix. The accuracy of the DVMs is quoted as ±(0.1% of reading ±0.1% of range) for DC, and ±(10.5% of reading ±0.5% of range) for AC voltages up to 750kHz reducing to ±1dB of range at 5MHz.

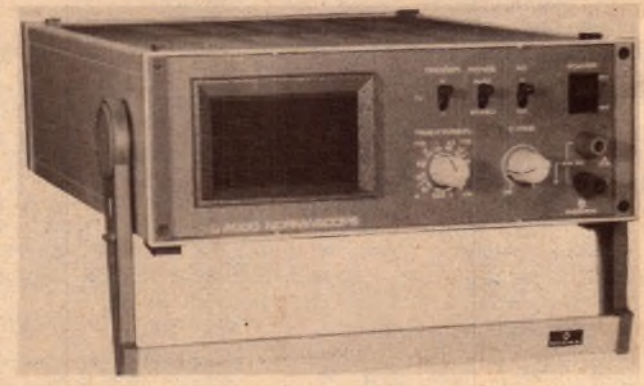
The digital displays of both DVMs are multiplexed with the scope display. At low timebase frequencies the displays are chopped to prevent flickering, while at high frequencies the readouts alternate.

The actual characters in the DVM displays are arranged on an 8 line, 128 column raster. Beam current is modulated in the usual manner to produce the presence or absence of a dot in the position currently being scanned.

The AC and DC DVMs are independently auto-ranged in five ranges from ±200mV to ±2000V with a maximum voltage of 1000V at either of the floating inputs. The vertical gain of the oscilloscope is also auto-ranged, but is dependent on the AC auto ranging. It can also be controlled to some extent by the Y-fine control, which can adjust the gain in the range 20:1.

The automatic ranging will switch to the next higher range at 2000 and to the lower range at 1000. The upper limit is extended to 3000 when the "stored" range is selected. The range will then remain the same in this mode even when the input voltage goes below the minimum.

Auto-ranging for both DC and AC DVMs is accomplished by switching reed relays to achieve the appropriate voltage division or amplification. The DC component is then passed through an active filter and A to D converted for display on the screen. The AC component is meanwhile processed by either an arithmetic mean or peak-to-peak detector and then also converted for digital readout.



The Normascope has surprisingly few controls for an oscilloscope or a DVM. The two main controls are for vertical gain and for timebase sweep rate, which has 12 settings, 0.3s, 0.1s, 30ms . . . 1us. The three remaining controls are for range mode, triggering and for selecting either average or peak to peak AC readings. There are none of the usual controls such as X-shift, focus or trigger level, but this could be an advantage where non-technical personnel are involved or in a production line situation.

The triggering is automatic and can be selected to trigger on positive or negative slopes or TV (video) signals.

Both input terminals are floating and may have a maximum voltage of 1000V with respect to earth. The common mode rejection ratio of these inputs is 130dB for DC and at 50Hz.

The input section does not employ a differential amplifier to obtain input isolation, but actually floats all the processing circuitry. Hence it is necessary when measuring high frequencies to use the LO input as ground, to avoid capacitive loading.

The power supply is of the inverter type and consists of a mains transformer, rectifier and DC to AC converter. This AC voltage has a frequency of about 20kHz and is coupled via a transformer to five separate supplies for rectification and filtering.

The case has rubber feet top and bottom and also has a tilting bail to enable convenient viewing. Accessories include two spare fuses and a pair of measuring leads and test prods.

In use the scope was very easy to handle and only required the adjustment of the gain and timebase to obtain a satisfactory trace. The digital readouts, being on screen, proved easy to read and were found to be within the accuracy stated in the specifications.

Additional accessories available for use with the Normascope D4000 include 3kV and 30kV high voltage probes and plug-in current shunts of 2A and 20A rating. Current transformers such as 100A/1A with plug-in shunts are also available.

The Normascope D4000 is available from the Norma Instruments Company, 36 Elouera Rd, Westleigh, NSW. List price before tax is $1632.56. (R. de J.)

Computer grade electrolytics

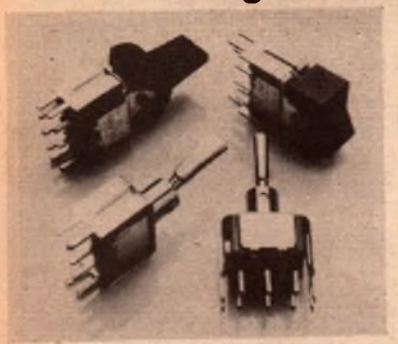
Soanar Electronics Pty Ltd now include computer grade electrolytics in their wide range of electronic components. These are listed as PW Series capacitors.

Despite their small size, these capacitors have exceptionally large capacity and are capable of handling high ripple currents. They are sealed in an aluminium can, and incorporate heavy duty screw terminals for handling the high currents involved. Mounting clamps are supplied as standard.

Soanar's initial stock covers the range 2900uF to 68,000uF in voltage ratings from 16V to 40V. Variations on the standard range are also available to original equipment manufacturers.

Further information from Soanar Electronics Pty Ltd, 30 Lexton Rd (PO Box 170), Box Hill, Vic 3128.

PCB mounting switches



Miniature toggle, rocker and lever-operated switches with support brackets for vertical mounting on PC boards are now available from the Dialight range. Included are the new 574 Series switches with rocker and lever actuators, and the new 577 Series toggle-actuated switches.

The UL-listed switches are available in SPDT and DPDT models that offer nine different switching functions and have PC terminals with or without epoxy seals. Actuator options include a variety of sizes and plastic or metal finish. Standard contact ratings are 5A at 120V and 2A at 28V DC, or 2A at 250V AC, resistive load.

Further information from Philips Electronic Components and Materials, 67 Mars Rd, Lane Cove, NSW 2066.

Multi-purpose patient monitor

The new Philips CM 120 patient monitor presents all monitored patient data — in both curve and digital form — on a single monitor screen. Its compact dimensions, only 37cm wide by 21cm high by 30cm deep, make it ideal for use in both the operating theatre and the intensive care unit.

The CM 120 can measure and display a number of physiological values simultaneously. The ECG (electrocardiogram) is displayed as the upper curve on the screen, while the lower curve can be switched to any one of four signals — the blood pressure wave, the peripheral pulse signal, the cascade ECG, or an appropriate external signal. Five parameters — heart rate, respiration rate, temperature and systolic and diastolic blood pressure values — are presented digitally at the bottom of the

screen, together with the patient's bed number.

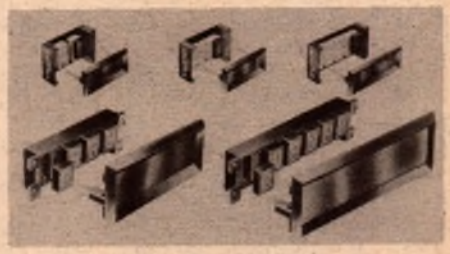
An alarm condition is indicated by displaying the relevant figure on a white background.

For further information contact Medical Applications Pty Ltd, 56 Buffalo Rd, Gladesville 2111.

Modular DIP digital display units

A range of modular DIP digital display units is now available to facilitate displays from two to six characters. There are three basic units: two and three digit (7.5mm); four and six digit (7.5mm); and four and six digit (15mm and 25mm).

The display digits plug into individual sockets set on an insulated rear plate, and whose terminations are suitable for soldering or wire wrapping. The matt black bezel employs concealed fixing, and the neutral (standard) and red (optional) viewing screens are circularly



polarised for improved contrast.

Further information from R. H. Cunningham, PO Box 4533, Melbourne, Vic. 3001.

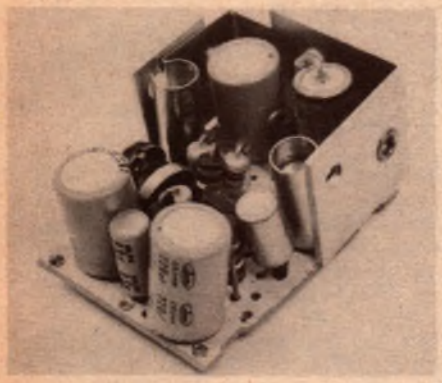
Versatile laboratory work benches

A new range of modular work benches is now available for electronic laboratories, electrical workshops and teaching institutions. Work stations can be easily built up from kits according to the user's requirements, and extended or rearranged to keep pace with changing demands.

The system incorporates a safety earthing system. Cupboards, drawer units and shelves can be added for compact, lockable storage space. Instrument panels above or below the bench accommodate dials, terminals, emergency switches, and mains outlets neatly and efficiently. Further information from Duff Steel Industries Pty Ltd, 25-35 Monro Ave, Kirrawee, NSW 2232.

New Products

1W audio amplifier



Requiring only a 9V DC power supply and a loudspeaker, this small utility audio amplifier should fill the bill for both experimental and practical applications; in fact, wherever a low power audio amplifier is required.

The compact module measures just 45 x 33 x 22mm, and employs four transistors for a power output of 1W. Three of the transistors are germanium types, and two of these are employed as a complementary output pair. A small aluminium bracket acts as a heatsink.

The unit was originally made by Philips, and is designated type UA411. Price is a very low $2.95, plus packaging and postage where applicable.

For further information, contact Electronic Agencies, 115-117 Parramatta Rd, Concord 2137.

Instrument cases

A new range of standard cabinets has been released by Adaptive Electronics Pty Ltd. Cabinet sizes range, in 13 models, from 178 x 89 x 168mm (W x H x D) to 413 x 267 x 280mm.

The cabinets are supplied in kit form, and consist of:

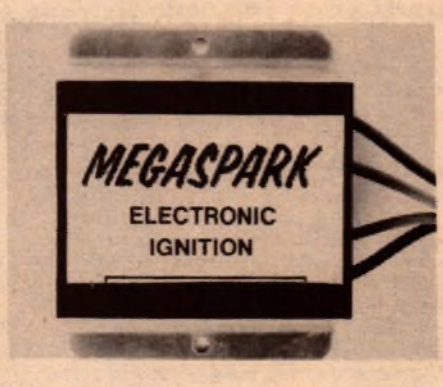
- Satin anodised 1.6mm aluminium front and back panels;
- Top and bottom panels of black marviplate, with a 1mm steel base;
- Side panels of satin anodised 3mm aluminium, or 13mm timber;
- Four aluminium extrusions to hold the top, bottom and side panels in position.

Provision is made available on the extrusions for mounting circuit boards and edge connectors.

Options available include 3mm thick front and rear aluminium panels, a 3mm thick bottom panel, and rack mounting type side panels with handles.

Further information from Adaptive Electronics Pty Ltd, 77 Beach Rd, Sandringham, Victoria 3191.

Transistor ignition



Car enthusiasts will be interested in this new transistor-assisted ignition system called Megaspark Electronic Ignition.

Megaspark uses a power transistor to switch the ignition coil primary, thus relieving the breaker points of this arduous task. The breaker points are retained, but are now used only to trigger a driver transistor. Claimed advantages of this system include longer points life, and more uniform ignition pulses due to points de-bouncing circuitry. Fuel consumption is also slightly improved because the engine stays in tune for longer periods.

The unit comes built into a small 60 x 50 x 25mm plastic case fitted with an aluminium bracket. No modifications are required to the car electrical system, apart from bypassing the ballast resistor.

For further information contact Enson Equipment, PO Box 355, Narrabeen, NSW 2101.

Icom transceiver

Icom has updated its popular IC202E 2-metre transceiver to the IC202S, a 3-watt model featuring both upper and lower sidebands. The earlier model suffered the disability of having only one sideband.

The IC202S also incorporates a number of circuit improvements over the IC202E.

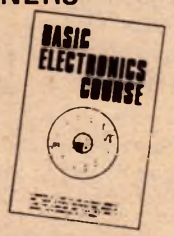
The Icom product range is distributed in Australia by Vicom, 68 Eastern Rd, South Melbourne, Victoria 3205.

READ ALL ABOUT IT!

BOOKS from DICK

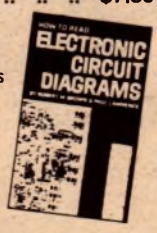
Dick has an enormous range of books for beginners, experts, professionals, hobbyists, amateurs. The titles listed here are just a small sample — call into a Dick Smith Store today and see the lot — or write to our Mail Order Centre for a detailed list!

BOOKS FOR BEGINNERS



Basic Electronics Course
Crowhurst — 361 pages.
A modern, self-study text for beginners, as well as a useful reference for trained technicians. Illustrated.
Cat. B-1689 .. .. .. $8.95

Electronics Self-Taught
Ashe — 285 pages.
Ten chapters crammed with everything the beginner in electronics needs to know.
Cat. B-1684 .. .. $7.50



How to Read Electronic Circuit Diagrams
Brown & Lawrence - 192 pages
Describes each circuit part and its function, gives clear pictures of components as well as circuit symbols.
Cat. B-1650 .. .. .. $6.50

Basic Electronics
E.A. Staff — 128 pages
An easy introduction to radio, hi-fi and electronics. 23 chapters profusely illustrated. Latest edition.
Cat. B-3620 .. .. $3.00

Basic Transistor Course
Kenian — 218 pages
Explains what transistors are, how they work and their relationships with other electronic components.
Cat. B-1567 .. .. .. $7.50

Fundamentals of Solid State
Rowe — 120 pages
An excellent introduction to semi-conductors and their applications. 17 chapters, many illustrations and drawings.
Cat. B-3621 .. .. $3.00

ANTENNA BOOKS

ABC's of Antennas
Lytel — 96 pages
Describes basic types of antennas, their radiation characteristics, uses and construction.
Cat. B-1000 .. .. $5.50

Wire Antennas for Radio Amateurs
192 pages
Gives construction details for many types of amateur band antennas including horizontal, vertical, multitrap and beam antennas, 2-160 metres.
Cat. B-2302 .. .. $5.75

All About Cubical Quad Antennas
112 pages
The world famous 'classic' on quads. Gives dimensions, data for many types of quad antennas.
Cat. B-2304 .. .. $5.50

Beam Antenna Handbook
200 pages
All information you need about construction of triband and compact beams including baluns, matching systems and test instruments.
Cat. B-2306 .. .. $5.75

BOOKS FOR AMATEURS (and aspiring amateurs)

Amateur Radio Techniques — RSGB
Hawker — 300 pages
Whatever branch of amateur radio you're interested in you'll find loads of information in this book's 300 pages with 700 illustrations. A bargain for the amateur enthusiast.
Cat. B-2040 .. .. $8.25

VHF-UHF Manual — RSGB
Evans and Jessop
This huge manual deals with techniques and equipment for operating above 30 Mhz. Valuable for amateur radio enthusiast.
Cat. B-2054 .. .. $17.00

NBFM Manual — RSGB
Hewes and Jessop — 60 pages
Completely dedicated to narrow band FM systems, this book will answer all your questions on transmitters, receivers and ancillary equipment.
Cat. B-2052 .. .. $2.40

NEW ARRL H'BOOK

The brand new 1979 edition of the amateur's 'bible'. Don't miss out on your copy from the first batch available in Australia. Hurry!
Cat B-2219 .. .. $14.95

Radio Handbook
Orr — 1080 pages
Incredibly comprehensive book on amateur communications. Over 30 chapters packed with information.
Cat. B-1106 . . . . . $23.95

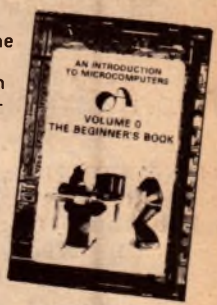
Understanding Amateur Radio
ARRL — 218 pages
Establishes the technical groundwork for all phases of amateur radio.
Cat. B-2232 . . . . . $8.75

Getting to Know Oscar From the Ground Up
QST — 45 pages
Everything you need to know about working the OSCAR amateur communications satellite.
Cat. B-2220 . . . $5.50

Questions and Answers for the Novice License
Howard — 104 pages
Explains the radio theory you need to know to sit for your Novice licence.
Cat. B-2315 . . . . . $3.95

ARRL Books
So well known they need no description.
SSB for the Radio Amateur
Cat. B-2212 . . . . . $6.75
FM and Repeaters for the Radio Amateur
Cat. B-2210 . . . . . $3.95
Specialist Communications Technique
Cat. B-2230 . . . . . $6.90
Hints and Kinks. 9th Edition.
Cat. B-2206 . . . Was $3.75. . . Now $2.99
Radio Amateur's Operating Manual
Cat. B-2208 . . . . . $3.95

BOOKS FOR MICROCOMPUTER ENTHUSIASTS



An Introduction to Microcomputers Osborne
Takes you from square 1 through to a thorough understanding of microcomputer technology

Volume 0 — the beginner's book
Cat. B-2339 . . . $12.00

Volume 1 — deals with basic concepts
Cat. B-2340 . . . $9.50

Volume 2 — discusses use of real products.
Cat. B-2342 . . . $15.00

Programming Microprocessors
McMurran — 280 pages
The most detailed, up-to-date information available in this price range.
Cat. B-2348 . . . . . $9.50

Microprocessor/ Microprogramming Handbook
Ward — 293 pages
An authoritative, practical guide to microprocessor construction, operation, programming and applications.
Cat. B-2346 . . . . . $9.50

How to buy and use Minicomputers and Microcomputers
Barden — 240 pages
Covers everything you need to know about selecting, buying and programming your own system.
Cat. B-1276 . . . . . $13.50

BOOKS ON SEMI-CONDUCTORS

Cookbooks
Contain all the recipes for a full understanding of the various types of IC's, their characteristics and applications

CMOS Cookbook
Lancaster — 416 pages
Cat. B-1248 . . . $13.50
IC Timer Cookbook
Jung — 287 pages
Cat. B-1244 . . . $13.50
TTL Cookbook
— Lancaster — 328 pages
Cat. B-1246 . . . $12.75

ABC's of Integrated Circuits
Turner — 96 pages
Discusses the basics of IC's and their applications in many types of electronic equipment.
Cat. B-1164 . . . . . $6.25

Transistor Equivalents
Gives equivalents of thousands of American, European and Japanese transistors.
Cat. B-4507 . . . . .$4.90

ALL BOOKS IN STOCK AND PRICES CORRECT AT TIME OF GOING TO PRESS.

✱ SEE OUR DOUBLE PAGE AD FOR FULL LIST OF STORES AND DEALERS

DICK SMITH ELECTRONICS

501 EA379

Books & Literature

Poorly executed

MAKE YOUR OWN ELECTRONIC GADGETS, by R. H. Warring. Coles Publishing Company, Toronto, Canada, 1978. Soft covers, 137 x 213mm, 136pp, many illustrations. Recommended Aust. retail price $4.95.

This is primarily a practical little book, written mainly for the beginner seeking to "get started" in electronics by building up some simple circuits. There are even three basic theory chapters at the front, to give the beginner a modest introduction to active and passive devices and their operation.

The broad idea is a good one. The circuits given are accompanied by a reasonable amount of explanatory text, the obvious intention being to provide much more insight than can be gleaned from the all-too-common "1001 handy circuits" potboilers. Unfortunately the execution just isn't up to the same standard.

The circuit diagrams in particular are so badly drawn and have so many obvious errors that it is evident that no one ever checked them. Figs. 23 and 112 are glaring examples — even a quick glance should have revealed the errors. The text is not quite as bad, but even here there are serious errors; on page 63 there are three different statements which equate a FET with a unijunction transistor.

In short, then, a good idea gone sour. As a result it can hardly be recommended, particularly to beginners.

The review copy came from Thomas C. Lothian Pty Ltd, 4-12 Tattersall's Lane Melbourne. (J.R.)

Power supplies

PRACTICAL SOLID-STATE DC POWER SUPPLIES, by T. D. Towers. Tab Books, Blue Ridge Summit, Pennsylvania, 1977. Soft covers, 130 x 210mm, 192pp, many diagrams. Price $9.75.

An unassuming little book on power supplies using solid state components, but one which is technically sound, clearly written and easy to read. The author is well-known British technical writer T. D. Towers, and he has apparently intended the book mainly for those who have progressed beyond the beginner phase, but seek some practical guidance regarding power supply operation and circuit configurations. It would certainly be very suitable for this type of reader.

It deals with both regulated and unregulated supplies, and with supplies for both low and high voltage applications. The treatment is fairly up to date, except that as it was written in 1976 there is virtually no mention of the three-terminal regulator ICs now so widely used. Still, the reader can easily gain supplementary knowledge of these from manufacturers' data books and applications literature.

My only other criticism is that the section dealing with transformerless high voltage supplies has no discussion of the inherent safety problems of this type of supply. This seems an unfortunate omission, in view of the intended readership.

All in all, however, a commendable little book and one which should be found of value. The review copy came from Technical Book and Magazine Company, 289-299 Swanston St, Melbourne. (J.R.)

Parts catalog

INSTANT COMPONENT SERVICE CATALOG. Stiff paper covers, 406 pages, 208mm x 215mm, freely illustrated. Published by Instant Component Service, with offices in Adelaide, Brisbane, Melbourne and Sydney. Price to the trade $7.50.

With its 400-plus pages, this is quite a large catalog and one would soon get lost were it not for the index up front — in the place where indexes should be!

It lists major product groups, as follows, most with sub-listings:

Accessories, Batteries, Books & Data, Capacitors, Connectors, Counters, Packaging Systems, Potentiometers, Power Supplies, Resistors, Relays, Semiconductors, Integrated Circuits, Linear ICs, Opto Electronics, MOS, Microprocessors, Switches, Tools, Transducers, Thermistors, Wire & Cable, Computer Products.

As one might expect from the size of the catalog, it contains much more than a mere listing by name of the various items. Really, it is a compilation of all the relevant data sheets from various manufacturers such as N. S. Electronics, ITT, Texas Instruments, Philips, etc. As such, it becomes a veritable mine of information, particularly for those who may not have ready access to such data from other sources.

Copies of the ICS (Instant Component Service) catalog are available from offices in the four capitals listed earlier. Our copy came to us from the Melbourne office at 248 Wickham Rd, Moorabbin 3199. Phone (03) 95 9566. (W.N.W.)

Basic theory

FUNDAMENTALS OF ELECTRONICS, Volume 4, Receiver Circuit Applications, Department of the Navy. Published by Coles Publishing Company Limited, Toronto, Canada. Paper covers 155mm x 203mm, 200 pages, illustrated by many diagrams and circuits. Recommended Australian retail price $7.50.

This volume is the fifth of a series, being preceded by Volumes 1a, 1b, 2 and 3. Although we have not seen these volumes and cannot comment on them, the subjects covered may be of interest. Volume 1a and 1b cover Basic Electricity, Direct Current and Alternating Current, respectively. Volume 2 covers Power Supplies and Amplifiers and Volume 3 covers Transmitter Circuit Applications. The full set is designed to give a full course in the "Fundamentals of Electronics".

Volume 4 consists of chapters 29 to 40 and to give some idea of the material it

Books & Literature

contains, here is a list of the chapter headings: (29) Solid State Power Supplies, (30) Two Junction Transistors, (31) Receiver Principles, (32) Transistor RF Amplifiers, (33) Transistor Oscillators, (34) Transistor Mixers and Converters, (35) Transistor IF Amplifiers, (36) Transistor Detectors, (37) Transistor Audio Amplifiers, (38) Electron Tube Receivers, (39) Receiver Control Circuits, (40) Frequency Demodulation.

The material in the text seems to me to be reasonably well presented and easy enough to understand. After several paragraphs, one or more questions are interposed relating to the foregoing text. Later on, answers are given to these questions. The idea is to give the student a means of checking whether or not he has grasped the subject matter.

The typeface is clear but rather small and light. However, within these limitations, the text is quite readable.

If you already have the other volumes, then this one should complete the intended course of study. One the other hand, if you only wish to study the material and subjects contained in this volume, then it would be a good idea to check the contents before you make a purchase.

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.)

AUDIO TALK from page 35

To my mind this is good. Perhaps amplifier manufacturers are now erring on the side of conservatism in their design and maybe a better engineering compromise would produce amplifiers with a dynamic headroom of 3 to 4dB. But because 3 or 4dB is not a large audible difference in loudness, this is largely academic.

What can be stated with certainty, is that almost all of today's amplifiers either meet or exceed their specifications for continuous power output. That is a big improvement over the situation of a few years ago.

INFORMATION CENTRE

FET VOLTMETER: I have had your FET Voltmeter (September 1978, 7/M/55) in operation for some months now and within the last month I have noticed that touching the positive probe will give me a reading of 1.3VAC. With the attenuator switched to 300mV I find tha bringing my hand near to either probe or probe lead will give a full scale deflection on the AC range and a "-juddering" on the DC range. Just recently these effects have noticed with the negative lead as well. Is this a fault and can I cure it? (A.B., Selby, Vic.)

● It seems as though you are using the voltmeter in the vicinity of a very strong AC field which may be due to a large transformer, RF oscillator, or TV set. As such, the behaviour is normal and it may help to install the voltmeter in a metal box to provide shielding.

AM/FM TUNER: I was greatly interested in your recent design for the Playmaster tuner. In studying it, however, I came across a stumbling block which lies in the information you gave for it in the December issue. You state a 50dB quieting level for a signal of 4uV but in the accompanying graph it is nearer 9uV. Which do I take as correct? (M.F., Doveton, Vic.)

● Thank you for your letter. As you can see we have quoted only one section. This month (March) we begin a new column on audio technicalities which should answer some of the general topics you raise.

On the question of tuner specifications, 9uV is the correct signal level for 50dB quieting and 4uV is the muting and stereo beacon threshold. Gremlins, again!

SERVICEMAN from page 78

possibly have been responsible. In any case, I had no desire to prolong the exercise at this stage, so I contented myself with warning the customer to be on the alert for any suggestion of false triggering.

(Editorial note: This protector will, in fact, respond to a spurious signal of the type described, even though this point was not made in the original article.)

Apart from this slight doubt concerning the protector, I felt confident that the amplifier was now working as it should, and that it would undoubtedly give the customer a lot of listening pleasure.

Notes & Errata

MOTOROLA D2 KIT SERIAL INTERFACE (March 1978, File No. 8/M/26): In the circuit diagram on page 75, Q2 should be labelled as a BC558 and Q3 as a BC548. The references to the two devices given in the text description of circuit operation are correct.

MODEL TRAIN CONTROLLER (October 1978, File No. 2/MC/16): The anode of diode D5 should connect to the anode of diode D6, and not to the cathode of D6 as shown in the component overlay diagram on p44. This can be corrected by cutting the copper track between D5 and D6, and connecting the anode of D5 to the anode of D6 (at the switch terminal) with a short length of hook-up wire. The circuit diagram on the same page is correct. Note that this error will only affect the operation of external sound effects circuits.

AUDIO IMPEDANCE METER (December 1978, File No. 7/CM/9; January 1979, File No. 7/CM/10): The meter specified for this project is no longer in good supply. The following circuit changes will allow a 200-0-200uA 650 ohm meter, such as the University HK35, to be used: R16 22k; R17 220 ohms; P7 (gain control option) 25k.

An improvement in calibration linearity on the 1 megohm range can be obtained by substituting type CA3140 op amps for the ICs 3 and 4. No other changes to the circuit are required. The CA3140 op amps avoid the component spread problems of the 741s, although calibration will not be quite as good on the lower ranges.

Finally, readers should note that the PC pattern on p69 of the January issue shows a small gap between the V-rail and the connection leading to pin 4 of IC3 (and IC4) This gap should be bridged with solder, or a short length of copper wire.

2708 PROM PROGRAMMER (February 1979, File No. 2/CC/35): In the overlay diagram on page 89, the 0.01uF and 0.0047uF capacitors connected to pins 14 and 15 of the 74LS138s should be exchanged. The circuit diagram is correct.

To prevent spurious triggering of the monostable chain, we have found it adviseable to ground the clear line (pins 3 and 11) of the 74LS138s during reads from the PROM. This is best achieved by using a three pole instead of a two pole switch for the read/program switch.

STEWART ELECTRONICS: In the advertisement for this firm in the February 1979 issue the price of the VDB-1 video display board with documentation should have been shown as $36.50. Similarly the price of the WW1 prototype board should be $27.50, and that of the CPZ-80 CPU board $44.50, and that for the WD-30 wire dispenser $4.50.

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. 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.

ELECTRONIC AGENCIES

115-117 PARRAMATTA ROAD
CONCORD: 2137
PHONE: 747 6472

9 am-5.30 pm weekdays, 9 am-noon Saturday

Proprietor: Bill Edge (R.O.C.P.)

"Fantastic Specials" this month only:

All ½ WATT Resistors 1 — 10 meg
(top quality, brand new) ONLY 4c ea
OR $3.00/100

CAPACITORS: TOP QUALITY "GREENCAPS"

(polyester film L.V.) — all prices drastically reduced:
.001 mfd (inf) to .022 mfd (22 nf) 10c ea (save 8c)
.033 mfd (33 nf) to .056 mfd (56 nf) 15c ea (save 4c)
0.1 mfd (100 nf), 0.22 mfd (220 nf) 20c ea (save 5c)
0.27 mfd, 0.33 mfd 25c ea (save 5c)
0.39 mfd 30c ea (save 5c)
0.47 mfd 40c ea (save 6c)
1.0 mfd $1.00 ea (save 20c)
2.2 mfd, 3, 3 mfd $1.60 ea (save 69c)

CABLE/WIRE SALE

Unbelievable reductions
Single shielded cable: PVC covered, light duty (1 x 7/0.12 mm), flexible for patch cords, mikes, etc.
Normally $20.00 (100 metres), save $8.50
NOW ONLY $11.50 (100 metres)

RG58RU COAX CABLE
Up to 500 MHz, CB Radio, Amateur Radio, Commercial 2 way Radio
Normally $30.00 (100 metres), save $3.00
NOW ONLY $27.00 (100 metres)

75 COAX CABLE
Used for aerial lead for colour TV's etc.
Normally $25.00 (100 metres) save $3.00
NOW ONLY $22.00 (100 metres)

TV 300 RIBBON
for connection to TV aerials
Normally $8.00 (100 metres) save $1.50
NOW ONLY $6.50 (100 metres)

SPEAKER CABLE
Low tension, for hooking up speakers, etc.
Normally $10.00 (100 metres) save $4.00
NOW ONLY $6.00 (100 metres)

An excellent range of semiconductors is always stocked by us.

Philips speakers & speaker kits are 10-15% below recommended retail — send for free brochures or see ad EA Jan '79.

MAIL ORDER

All mail orders are processed same day — give us a try and you might be pleasantly surprised. As an incentive this month we are offering a "FREE HOBBY-PACK OF 22g SOLDER (7 metres) (VALUE $1.00)" for all mail orders over $12.00.

DELIVERY/MAIL ORDER ADVICE
Please allow $1.00 to cover packing on all orders.
POST 5% of order value up to $80 and a flat $4.00 over $80.
C.O.D. — $3.00 deposit is required.
CARRIER Comet Overnight Transport is used — on your request, or on very bulky parcels where posting would be uneconomical. All parcels sent through carrier freight is payable by you on receipt of goods.
C.O.D. can be sent through carrier but 10% extra is charged by carrier.
RAIL On your request.

Marketplace

FOR SALE

AUSTRALIAN RADIO DX CLUB. Radio Dxing is the ideal hobby for the young people of today. 1979 is World DX Youth Year with a special introductory membership for people under 18 years old. The club covers shortwave, mediumwave and utility DXing. So why not take up this fascinating hobby right now: it's scientific and fascinating. Listen and QSL those distant radio stations. For full details write to PO Box 67, Highett, Victoria 3190; or PO Box 79, Narrabeen, NSW 2101 enclosing a 30c stamp.

FANTASTIC BARGAINS FROM MICRONICS! Incredible prices for new prime spec components. Look! Satisfaction guaranteed or money back. Ideal for servicemen, radio clubs, hobbyists, schools, etc. BC209-10 for $1.50, BC209C — 10 for $3, BC204 (BC177, BC557) — 10 for $1.40, BC206 (BC179, BC559) — 10 for $1.40. CMOS ICs — 4006 — $1.30, 4013 — 60c, 4017 — $1.30, 4018 — $1.30, 4024 — 90c, 4026 — $2.30, 4027 — 90c, 4929 — $2, 4035 — $1.40, 4047 — $1.50, 4049 — $1, 4055 — $2.50. MORE BARGAINS: 1N4007 (EM410) — 10 for $1.50, 2N2219A — 50c, 2N3563 — 50c, 2N3566 — 30c, 2N3638 — 45c, 2N3639 — 45c, 2N3646 — 45c, BD438 (BD188) — $1. MAD PRICES ON TOP QUALITY AUDIO ICs AND RADIO ICs. HURRY STOCKS ARE LIMITED!!! TAA611B — 4 Watts Peak Audio IC 12V supply, 8 ohm load — $1.75 ea. or 4 for $6.50 (Incl. Cct Diagram). TBA 810A — POWERFUL 13 Watts Peak Audio IC, 16 volts supply into 4 ohm load — $3.50 ea. or 4 for $13 (Incl. Cct Diagram). TBA651 — TUNER + IF AMP IC (Mixer, oscillator, IF AMP and AGC control all in one IC) Supply Voltage from 4.5V to 18V (Incl. CCt Diagram) — $2.95 ea. or 4 for $10. RESISTOR PACK: — ½W and 1W — 100 for $1. POLYESTER CAP. PACK (High and Low Volt) — 100 for $2.95. CERAMIC CAP. PACK (Disc and Tub. Caps) — 100 for $2. POST AND PACK 60c or extra for large orders. MICRONICS, PO Box 175, Randwick, NSW 2031.

FREE SAMPLE LED against 20c SAE
To see is to buy. Best value in LED in Aust. No brag just fact. Quality 17c ea. $12 a 100, $110 a 1000. 40c P&P. 5mm red well diffused wide viewing angle. Clips 3c each all quantities. Diggerman Electronics, Box 33, Coramba, NSW 2466.

COMPUTER PERIPHERALS: A rare chance to buy. Hard copy I/O typewriters. S.C.M. from $75 to $275. FRIDEN from $100 to $450 (ASCII). 7 level paper tape punches from $65 and readers from $65. Teletype 8½in wide one ply white paper rolls, $18 per box of 12 rolls; 1in paper tape $28 per box of 28 rolls. 5 plys 11in x 14in ruled tractor feed fanfold paper $8 per box. Sprocketted tractor feed Friden mechanism $15 each. Contact COMPUTER DISPOSALS, Box 95, PO Mascot 2020. Tel 667 1114 or 667 4279 ah: 27 2982 ah.

SPEAKER BOXES. Hand-made. Excellent accoustically. Write: SHERWOOD ELECTRONICS, PO Sherbrooke 3789.

TEAC A6100 2 track 7½/15 IPS Master Recorder, new condition, plus 2 x 3600ft Scotch pro tape $900 o.n.o. R. Groat, 131 Kingsford Smith Drive, Melba, ACT. Telephone (062) 58 4803 a.h., 47 3290 b.h.

PAPER TAPE READER. Siemens Model 108A 30 Char./Sec. Excellent condition $65. Ken Ryan, PO Box 50, Croydon, NSW 2132. Phone (02) 799 3000.

WANTED

DUAL TRACE CRO wanted 20/30MHz, BWD 540 or similar. Price and particulars to S. Payne, C/- 477A Charles St., North Perth 6006.

DISPLAY ADVERTISEMENTS IN MARKETPLACE are available in sizes from a minimum of 2cm x 1 col rated at $11 per col cm.
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.

Speak & Spell . . .

cont. from p15

that could pronounce a word as well as spell it, and talking directories for telephone numbers, addresses and the like. The technology could also give a voice to TI's upcoming home computer.

But Speak & Spell is here, and available now. We're betting that it will have tremendous impact, not only in normal teaching situations, but in remedial teaching as well. And just in case you're wondering, we came across no American spellings. Presumably, there are two versions — one for the American market and one for "foreigners".

Speak & Spell is available in Australia from Delta Scientific Product Distribution, Red Bank Court, St Albans, Victoria 3021. Price is $58.25, including sales tax and packaging and postage.

You won't want to miss this . .

ONLY $3.00*

+ 60c pack & post

27 DO-IT-YOURSELF PROJECTS FROM ELECTRONICS AUSTRALIA

You can't afford to miss out on this exciting new book from "Electronics Australia". Here are just a few of the projects it contains: loudspeaker protector, digital metronome, active filter, drill speed control, variable power supply, wiper control unit, tach and dwell meters, CDI, digital clock . . . plus many more. Get your copy now!

Use this handy order form

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.)

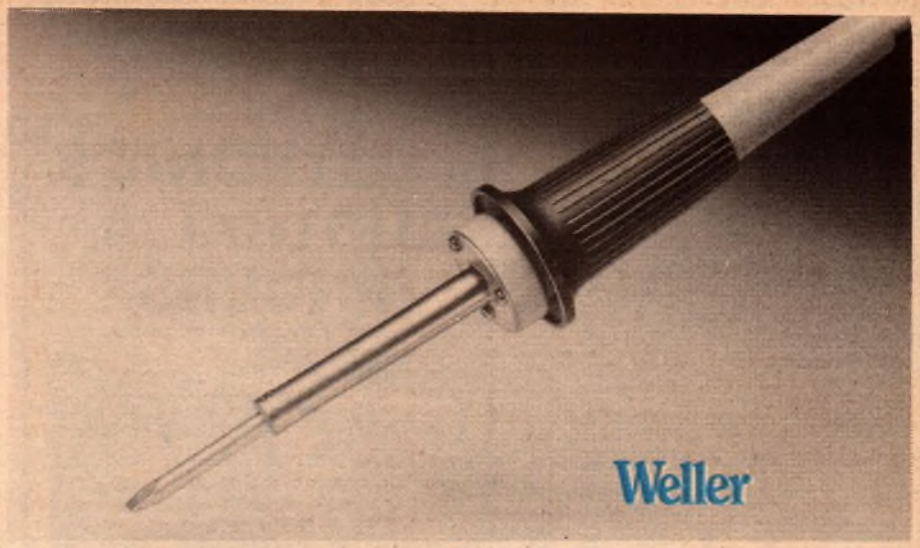
NAME .....

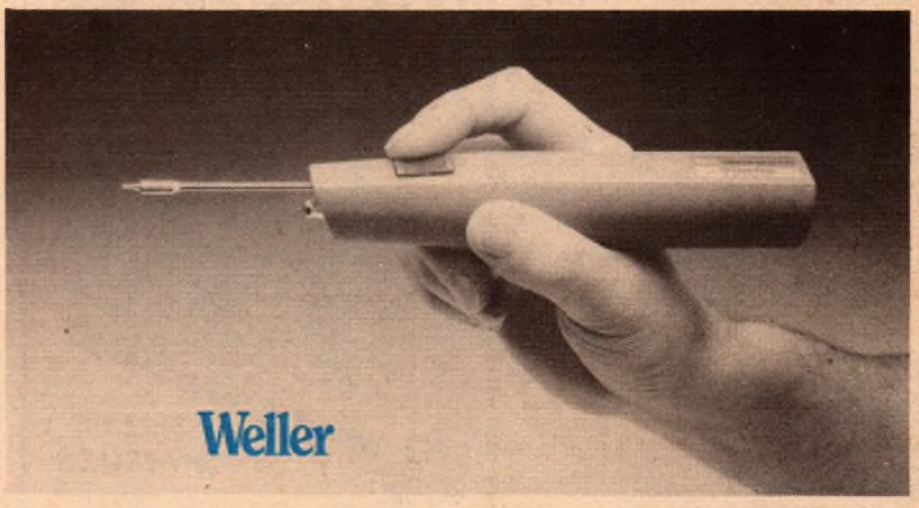
ADDRESS .....

.....

STATE ..... POSTCODE .....

I enclose a cheque/postal order to the value of $ .....





The Tools. from Cooper The Toolmaker.

Weller industrial SPI non-temperature controlled soldering irons, with nickel plated copper tips, stainless steel barrels. Impact and heat resistant handles are lightweight. Available in 25 or 40 watts.

The Weller WC100 cordless soldering iron has been specifically developed for the technician. It operates from long-life nickel cadmium batteries, and it is therefore ideal for in the field applications. Special adaptor available to re-charge from cigarette lighter in motor vehicles.

Lufkin
Official Supplier of Measuring Tapes to the 1980 Olympic Games in Moscow

The Cooper Tool Group Limited
P.O. Box 366, Nurigong Street
Albury NSW 2640, Australia
Tel 21551 Telex 56995

The Cooper Group
CRESCENT · LUFKIN · NICHOLSON · WELLER · WISS · XCELITE

ADVERTISING INDEX

THE DIFFERENCE IS STAGGERING.

Technics Linear Phase speaker systems were designed to reproduce music that sounds as close as possible to the original. Through exhaustive research Technics engineers designed and built equipment to find out exactly how sound travels at different frequencies. Then oscilloscopes were used to shape the revolutionary "staggered" design of the separate wide-range speaker units, so the sound from each reaches you simultaneously. So far as listening pleasure is concerned linear phasing means pure musical reproduction with brilliance when brilliance is needed and clarity in the softest as well as the loudest musical passages.

Shown above is the SB-7000, Technic's best selling linear phase speaker, and the SB-007 system. This is an exact image of its famous big brother in terms of performance capabilities as much as appearance. But around half the size . . . and cost. So now true linear phase response can be enjoyed in a convenient, compact format.

Technics linear phase speakers. A new experience in realism.

For a National Technics catalogue, please write to:
National Technics Advisory Service, P.O. Box 49, Kensington, N.S.W. 2033.

National Technics hi-fi

T78.19

When it comes to speaker design, JVC goes 2969 times further.

Traditionally, speaker systems have been designed by a tedious trial and error proccess, by which individual combinations of speaker, crossover and enclosure combinations are analyzed—one at a time—until the desired sonic results are achieved.

JVC has put an end to these time-consuming and archaic procedures, with a revolutionary new system called Phase Moire (Mor-ay) Propagation Technology, that uses a specially-constructed device to move a test microphone in a way that creates and preserves, via computers, video and high-speed filming, a field of nearly 3000 sound testing positions.

By viewing the film, our engineers can actually see what a speaker will sound like before they get too far into the design process.

The initial result of our unique Phase Moire Technology, combined with a great deal of human engineering, is the SK-1000. This unusually-efficient, extraordinary-sounding three-way speaker system delivers truly magnificent, rock-solid bass from its 12″ free-edge woofer and heavy magnet structure. Capable of handling up to 170-watt peaks (85 watts RMS), the SK-1000 reproduces vocals and midrange with unusual smoothness, thanks to our specially-designed 5″ midrange driver. Clear, crisp, brilliant highs are dispersed evenly within the listening area from a 1″ soft-dome tweeter.

We also give you complete control over midrange and tweeter response with a pair of front-panel level controls.

But all the technology in the world can't fool two of the most sophisticated testing devices known: your ears. And all the words in the world can't tell you what the SK-1000 (and its two smaller companions, the SK-700 and SK-500) really sound like.

So we suggest that you hear what we've been talking about at a JVC dealer.

For details on all JVC Hi-Fi Equipment, write to JVC Advisory Service, P.O. Box 307, North Ryde, New South Wales 2113.

For pure Hi-Fi entertainment!

JVC

the right choice