ELECTRONICS Australia

with CB and HIFI NEWS

AUST $1.25* NZ $1.25 MAY, 1978

NEW LOUDSPEAKER SYSTEM * SIMPLE 3MHZ COUNTER

TRANSCEIVER POWER SUPPLY * 2650 MINI COMPUTER

Sony Racks Up 'Studio' Sound

If you've yearned to escape from those wooden "living-room" stereos, and go all the way with the professionals, meet Sony's all-new, rack mounted "studio" look.

From our fantastic new F series of systems, the superbly matched F-11. Truly professional in both looks and sound. More than just a matched system this rig is totally integrated. And that means more than just "look-a-likes". Components are factory planned to work perfectly together.

The PS-11 turntable. A direct drive auto-return, auto-cut model with reject. The PS-11 boasts Sony's proven magnedisc servo control system and Sony's new linear torque BSL (brushless and slotless) motor to reduce wow and flutter to less than 0.03%WRMS.

The TA-11 amplifier delivers 25 + 25 crisp, clean watts RMS, (20 to 20,000 Hz with THD of 0.02%) with loudness and muting switches and with line/mic mixing you can be part of your music.

And the new ST-11 AM/FM Stereo tuner features: FM front end (RF stage) with FET, PLL and IC in the multiplex stage and 4 element uni-phase filters in the IF stage. That adds up to high sensitivity (1.8 uV) and low distortion.

The new SS-L1 speaker system, designed to give you everything the F-11 components can produce. And if you've read this far you'll know that's plenty. With a 20 cm Carbocon woofer and a 6.5 cm tweeter combined with Sony's newly designed passive radiator. For clear and mellow, bass enhanced sound.

The F-11 components are designed to look their best mounted in the new "studio" look rack. To complete that professional look why not add a Sony front loading cassette deck.

Yes, Sony racks up a system for true Hi-Fi buffs. The F-11.

SONY®

Research makes the difference.

GAC S 9650

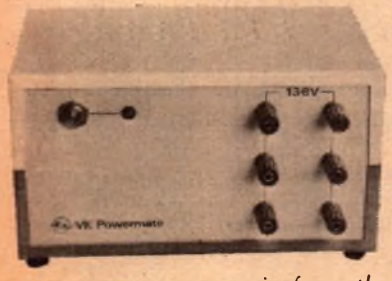
ELECTRONICS Australia

Australia's largest selling electronics & hi-fi magazine

On sale the first Monday of each month

VOL. 40 No. 2 MAY, 1978

Intended mainly for flats and home units, this new loudspeaker system is compact yet offers a high standard of performance. Full constructional details on page 30.



Power your amateur rig from the mains with the VK Powermate. It provides 13.8V DC at up to 5A and features overvoltage protection. See page 46.

On the cover

You could win one of the fantastic pieces of test equipment shown on this month's cover simply by entering the Parameters-EA Grand Instrument Contest, to be run in EA over the next few issues. Total value of the prizes is $2,500, and there are several prizes to be won each month. You'll find the first competition on page 60.

FEATURES

HIFI NEWS AND REVIEWS

PROJECTS AND CIRCUITS

AMATEUR RADIO, CB SCENE, DX

COLUMNS

DEPARTMENTS

Now. Two 3-way 40 watt speakers with nine tonal choices

Save about $50 per hour while you assemble them

Even if you didn't know them by number, you probably heard about the Philips AD12K12 MK11 Speaker Kits.

Because they are now a no.1 best-seller.

And here is the compact AD8K30, 8" 3-way compact system, with fine electronic and acoustic components (1" domed tweeters, 5" mid-range, super 8" bass drivers). Brilliant clean sound, with a frequency response closely following the ideal Bruel & Kjaer curve for hi-fi equipment measured in an actual listening room, using the "Third Octave Pink Noise Method".

Plus 9 combination tonal choices to adjust to the acoustics of your own listening-room.

You can assemble the AD8K30's in about two hours. You will get a professional result and save about $100 per pair over a comparable system.
Phone or send coupon now for full details of this and all our kits.

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Please send me full details and brochures on your loud speaker kits and a list of retailers who stock them.

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EA

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Editorial Viewpoint

Reflections on our new mini computer

As you may have noticed already, one of our construction projects this month is a small computer based on the Signetics 2650 microprocessor. One of the reasons for developing this project was the release of the latest MOS static RAM memory devices, which offer 4096 bits of memory in a single 18-pin IC package.

Largely as the result of using these new memory chips, we have been able to produce a design which allows you to build up a computer with 1024 words ("1K") of ROM memory and up to 4096 words ("4K") of RAM memory, on a single printed circuit board measuring only 208 by 81mm. Complete in a case and with a power supply, a kit should cost you less than $120 for a basic version with 1K of RAM, and less than $200 for a 4K RAM version.

It is hard to grasp the full potential of this project when you see its deceptively small PC board. Even when fully populated it still comprises only 13 integrated circuits with a few minor parts, and draws less than 5 watts of power. Yet within those 13 integrated circuits are contained something like 75,000 transistors, providing computing power superior to that of many first and second generation "mainframe" computers.

When staff designer David Edwards showed me the finished and working prototype PC board, it suddenly struck me how far we have come in the last few years. I can still vividly remember cutting my teeth, as an amateur programmer, on our parent company's first minicomputer about 11 years ago. Complete with teleprinter terminal it had cost around $30,000, I think, and seemed very good value for money. It was about the size of a typical refrigerator, and had a power dissipation of about 800 watts.

At the time, it seemed unlikely that EA staff members would ever have unrestricted access to a computer of similar capability, let alone be in a position to describe one in the magazine. Yet now in 1978 a couple of us have home computer systems of comparable power, and this month we are describing one in the magazine. Not only that, but the computer and a video terminal can be built for less than the cost of a typical hi-fi system!

It certainly makes you wonder what further developments are likely to occur in the next 10 or 11 years, doesn't it?

Actually I hope to gain some insight along these lines very shortly, during a brief trip to the west coast of the USA. As part of the trip I am planning to visit most of the major semiconductor and microprocessor manufacturers, with the idea of getting some first-hand knowledge of future trends and developments.

By the time you read this, all going well, the trip should be almost over. I will probably be within a day or two of returning home, brain hopefully bulging with insights! But whether this occurs or not, I will try to pass on my reactions to you over the next few months.

— Jamieson Rowe

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News Highlights

Viewdata — British Post Office says GO!

The world's first public Viewdata service, which enables people to call information over the telephone and have it displayed on their television sets, will be started by the British Post Office during the first quarter of 1979. It will follow a public trial of this revolutionary telephone-TV linked communication system which starts in London, Birmingham and Norwich in June 1978.

One of Viewdata's chief attractions is that it will make available virtually limitless information on a huge range of subjects — from stock market prices to sports results and from household hints to travel timetables. The information can be called up at the touch of a button and displayed in words or simple diagrams on the TV screen.

Eight firms in Britain's television industry are preparing to make available 11 different TV models — for business as well as home use — equipped to receive Viewdata. Each model will be equipped with a small pushbutton unit — covering the numbers 0 to 9 — enabling users to select the desired "page" of information.

In addition, a special typewriter keyboard will be available as an alternative for people to send messages to each other and have them displayed in words on the screen. This will be of particular benefit for the deaf.

A massive £23m has been earmarked by the Post Office to establish the Viewdata service. Up to £5m would be spent immediately to set up 10 Viewdata centres, located in London and at least two other cities. The rest, £18m, has been made available to extend and develop this revolutionary service during 1979.

Plans now being drawn up are for Viewdata centres in London, Birmingham, Cardiff, Edinburgh, Leeds, Manchester and Norwich.

Among the 150 information providers already involved in Viewdata, the nation's newspaper industry is well represented, with Westminster Press, Eastern Counties Newspapers and Reuters taking part. In addition, the Financial Times and Extel have formed a new organisation — Fintel — which will exploit the opportunities Viewdata offers. Other publishing organisations include the British Printing Corporation, the International Publishing Corporation, Exchange and Mart, W. H. Smith, Guinness Superlatives and HMSO.

Consumer guidance will be available from the Consumers' Association and the Department of Prices and Consumer Protection. There will also be rail and air travel information, tourist information, careers guidance, job vacancies, educational opportunities, and welfare information.

RCA to supply TV cameras for Shuttle

RCA has been awarded a NASA contract valued at $10.5 million to supply the high-quality television camera system that will transmit "live" colour and black-and-white TV pictures during manned orbital Space Shuttle flights.

The closed-circuit TV camera system will be installed on the Space Shuttle for earth orbital missions starting in 1979 and will be used on the subsequent flights scheduled for the 1980s.

The TV system will be especially useful in aiding crew members to retrieve satellites from space and to remove others from the cargo bay of the Shuttle Orbiter. In addition, the cameras will provide visual assistance to the crew in repairing or replacing parts on a satellite attached to the servicing platform mounted in the Orbiter payload bay.

Each Space Shuttle Orbiter can carry up to six TV cameras as part of the closed-circuit TV system. The system will consist of several television cameras, a video control unit, pan and tilt mechanisms, and various monitors.

Simple microwave leakage detector

A production prototype of a simple unit for detecting leakage of microwave radiation has been produced by the CSIRO National Measurement Laboratory.

The Laboratory is seeking a commercial manufacturer of the unit pictured. Many requests have been received by the Laboratory from people wanting to purchase detectors, but so far no manufacturer has agreed to produce them.

The detector contains a light emitting diode that glows red whenever it encounters microwave radiation exceeding the recommended safety level.

The leakage detector is particularly useful to owners of microwave ovens, to operators of microwave diathermy equipment and in factories using microwave heaters operating at 2450MHz.

Users of microwave ovens are able to check that the oven seals have not deteriorated and diathermy operators can check for stray radiation during treatment. As the eyes are particularly susceptible to radiation injury, accidental exposure of the eyes during irradiation of other parts of the patient's body should be guarded against.

Hong Kong order for Philips colour sets

The Consumer Products Division of Philips Industries in Australia has received an order from Hong Kong for 5,000 48cm colour television sets, a most unusual export order to that part of the world to say the least! The 48cm sets are fully designed and manufactured in Australia.

The export order was closed during a recent overseas visit by Mr Ken Lucas, General Manager of Philips Consumer Products Division.

The story began when research showed that there would be a demand in Australia for 48cm colour television sets. With no existing source of technology for this new size available through any overseas Philips company, Australian engineers at Philips Clayton developed their own technology. The result was the Model KE207.

There has been a similar demand for this size set in Hong Kong, leading to the order for 5,000 receivers with repeat orders a strong possibility according to Philips.

Anti-skid braking system for cars

Electronic circuits and devices are expected to become increasingly important in motor vehicles in the future, performing a wide variety of diagnostic and control functions. One critical area that is currently receiving a great deal of attention from engineers is the development of a cost-effective anti-skid braking system.

The latest anti-skid device to receive publicity is a Doppler-based system now being developed by two Japanese companies, Hitachi Ltd and Nissan Motor Company Ltd. Essentially, the system consists of a Doppler vehicle speed sensor, a wheel speed sensor, a control circuit and a brake actuator.

The system prevents the rear wheels from locking by comparing vehicle speed (measured by the Doppler module) during braking with the wheel speed, obtaining a slip ratio of the wheels and controlling this ratio according to a pre-set value.

If, during a panic stop, the slip ratio exceeds this pre-set value (20 per cent is the optimum), an actuator operates to relieve the hydraulic pressure in the brake lines. Use of the Doppler speed sensor module means that the system does not depend on anticipatory calculations, so that a simple system can be used which permits efficient brake control for all kinds of cars.

Ad wrangle for Philips VCR

Australian commercial television stations recently rejected a commercial for a home video cassette recorder. The commercial, submitted by Philips Industries Holdings Ltd, is part of a $500,000 project to promote the Philips N1700 VCR, which is already on the market in Australia.

TV station executives fear that the unit, which records both sound and colour pictures off a standard colour set, will reduce their audiences. The immediate dispute concerns copyright, however.

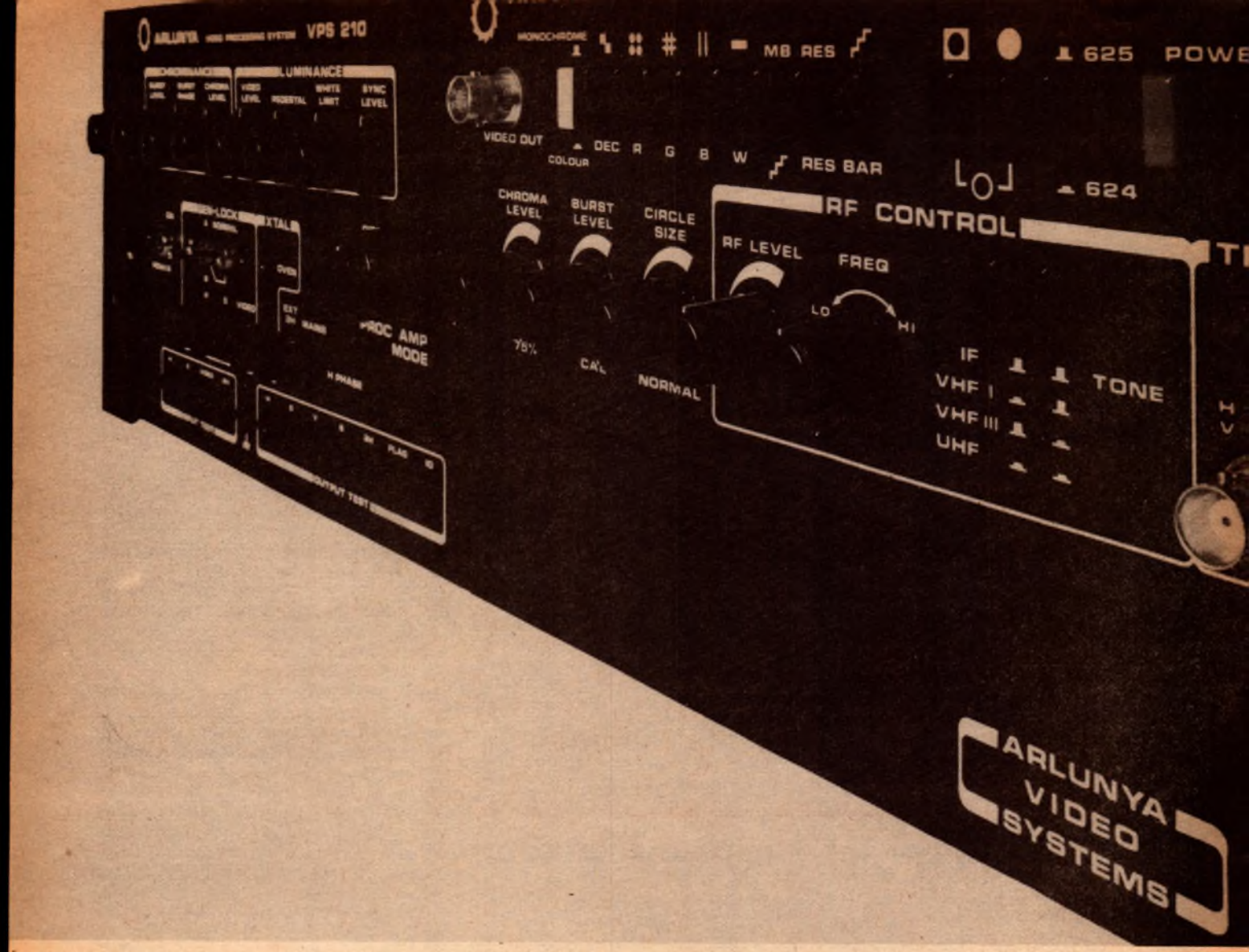
The commercial submitted by Philips to the stations simply referred buyers to copyright details on the brochure when buying the N1700 VCR. Problem was that Philips' interpretation of copyright differed from that of the networks. Philips took the line that people could record all shows if only for private use, while the networks took the view that only live shows could legally be recorded without permission.

All prerecorded shows and movies, according to this latter view, could only legally be recorded with the permission of the television station or the movie company.

However, in a move calculated to get its promotional campaign under way as quickly as possible Philips decided not to argue, instead returning the commercial to its advertising agency for rewording. The modified commercial was accepted by the networks at the end of March.

New video projection system

Just released onto the Australian market by National, this new video projection system features a 144cm screen, remote control, and input facilities for a VCR or TV camera. Cost is around $6,000 mark. Enquiries to National.



Professional Pattern Generators

The new Arlunya PG. 100X Series of Professional Pattern Generators produce superb quality video signals for testing VCR's. VTR's, Monitors, T.V. Receivers, Broadcast and CCTV systems operating to the Pal standards.

All versions give eight monochrome and ten colour patterns with override controls providing superimposed variable size circle, spot, porthole, chroma level, burst level and interlace or non interlace selection.

Patterns include: Crosshatch, Dots, Checkerboard, Vertical Bars, Horizontal Bars, Multi Burst, Resolution Bars, Linear Grey Scale, Standard Colour Bars, White-Red-Green-Blue-Cyan-Plain Rasters, Chroma Decoder Pattern, Chroma Staircase, Chroma Resolution, "Colour Black".

Outputs are Video, R.F. (switched and variable for most VHF, UHF TV channels) and trigger.

PG. 100XPB provides slaving from any colour SPG generating subcarrier and standard pulses thus enabling broadcast format signal generation in combination with a broadcast station SPG. A rear internal/external switch determines operating mode.

PG. 100XP provides slaving facilities from the Arlunya VPS.210 Video Processor with which it is mainframe compatible.

Designed and manufactured in Australia by

THE ARLUNYA DIVISION OF THE DINDIMA GROUP PTY. LTD.

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NEWS HIGHLIGHTS

Finds faults in overhead power cables

To find a fault in an overhead power cable. . . . just walk down the line and this new British instrument will flash when you reach it.

Earth faults in high voltage overhead electric lines where unearthed and arc suppression (Petersen) coil earthed systems are used, can be detected faster than by conventional methods using hand-held "Pathfinder Mk 6".

With it a line inspector can stand under the power conductors and, by operating the instrument, can tell if an earth fault current is flowing overhead. He can walk down the line to the exact fault position, with the instrument indicating at each junction of the line the route of the fault current.

Under normal conditions the magnetic field produced by each phase current is almost zero under the conductors at ground level, whereas earth fault currents produce a much larger magnetic field. When the local field strength (pre-set by the instrument's sensitivity control) is exceeded, a light-emitting diode flashes on the instrument indicating a fault. This method of location is faster than conventional methods, which often require switching and associated loss of power to the consumer.

Pathfinder Mk 6 is powered by a standard 9 volt battery which provides some 30 hours of use. The detector itself consists of a small coil in which a voltage is generated by an alternating magnetic field.

Readers wishing to know more about the "Pathfinder Mk 6" should contact Bowden Brothers Ltd, 107 Plaistow Rd, Bromley, Kent, England.

The Pathfinder Mk6 quickly locates faults in overhead power cables.

Low-cost device adds up the sunlight

Scientists at the CSIRO Division of Horticultural Research have developed a cheap unit to add up the amount of sunlight that falls on a crop, orchard or greenhouse during a specified period. The reading appears on a digital display which can be provided by modifying a pocket calculator.

The unit is based on the combination of an E-cell (a commercial microcoulometer) with a tube solarimeter. The solarimeter converts sunlight into electrical current and the E-cell adds up the current like a miniature electricity meter.

The solarimeter, a common glasshouse instrument, consists of a 1-m tube containing a 2-cm wide black and white chequered wafer. The chequered regions assume different temperatures when exposed to solar radiation. A system of metal junctions translates these temperature differences into current which is stored by the E-cell and later registered on the digital display.

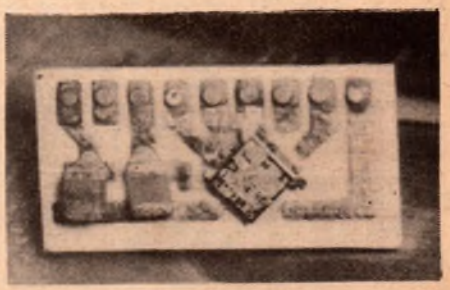
Electronic pulse rate meter

This miniature electronic recorder presents a rapid and accurate illuminated display of the pulse rate when held to a patient's wrist. Called the Pulsaid, it is believed to be the first of its type in the world.

The device is held between the first and second finger, so that the pulse can be felt manually whilst being read automatically. With it, doctors and nursing staff are provided with a fast beat-to-beat reading, assisting in the detection of pulse rate variations and abnormalities.

The instrument takes the pulse pressure from the patient's wrist and transmits it through a flexible rubber membrane to a piezoelectric transducer. The transducer converts the mechanical pressure changes into electronic voltage pulses. After filtering and amplification, these trigger analogue and digital circuits that measure the interval between successive electrical pulses and convert them into rate. This shows on the digital display as beats per minute.

The device is manufactured by Techcare Ltd, 6 Mainland Avenue, Harpenden, Hertfordshire, England.



IC hearing aid

A lightweight hearing aid, claimed to set new standards in miniaturization and battery life, has been developed in Australia.

The aid uses an integrated circuit about the size of a matchhead, developed by AWA Microelectronics, under contract to the National Acoustic Laboratories.

The chip contains 38 transistors and 27 resistors and performs all amplification functions of the hearing aid. It is mounted on a hybrid microcircuit smaller than a one cent piece, developed by STC Components Division, also under contract to NAL.

Because of its small overall size, it mounts unobtrusively behind the ear of a deaf patient, superseding the bulky high-power vest-pocket amplifiers which were once necessary for acutely deaf people. It is also anticipated that the hybrid construction will reduce maintenance problems.

The aid is now being supplied by the National Acoustics laboratory to pensioner patients with pronounced hearing problems, and will also be supplied to many deaf children.

The name "L. M. Ericsson" is one well known in the telecommunications industry. Not so well known is the story of the telecommunications pioneer who formed the company that carries his name.

L. M. Ericcsson:

telecommunications pioneer

On April 1, 1876 Lars Magnus Ericsson opened an electro-mechanical workshop in a rented kitchen at 15 Drottninggatan in Stockholm.

His physical assets were meagre, consisting primarily of an instrument maker's pedal lathe. His working capital was 1,000 kronor (about $50), his labour force a single twelve-year-old assistant.

In America Alexander Graham Bell had just received his first patents on the telephone. A great new era in communications was about to open.

In the beginning Ericsson was engaged mainly in the repair of telegraph instruments and other electrical devices. But he soon began to produce improved equipment of his own design.

A notable example was a dial telegraph instrument for use in railway systems. He also designed a fire telegraph system for small communities that became the prototype of systems used at home and abroad for many decades.

Ericsson's reputation for quality work soon enabled him to obtain orders from a wide variety of public and private authorities in such fields as telegraphy, fire protection, police administration and rail transportation.

Not long after opening his workshop Ericsson brought in a former workmate, Carl Johan Andersson, as his first and only partner. Andersson, who had also studied abroad with the assistance of Government grants, contributed 1,000 kronor to the enterprise which now became known formally as L. M. Ericsson & Co. Andersson continued as Ericsson's closest associate for many years, even after the partnership was later dissolved and the founder regained complete financial control.

Ericsson and his wife, Hilda, with an early telegraph instrument.

Two significant events in Ericsson's life occurred in 1878. At the age of 32 he married Hilda Simonsson who became not only the mistress of his home but also an active colleague in business.

For a number of years the winding of electromagnet reels with silk-insulated copper wire was entrusted to Mrs Ericsson, at first working alone and later with the help of one or more assistants. It is said that even when confined to bed Mrs Ericsson continued her work with the winding machine propped on her knees.

The second major event of 1878 was the delivery, during the month of November, of the first telephones of Ericsson's manufacture.

American made instruments had been introduced in Sweden the previous year and some of them had already been in Ericsson's shop for repair.

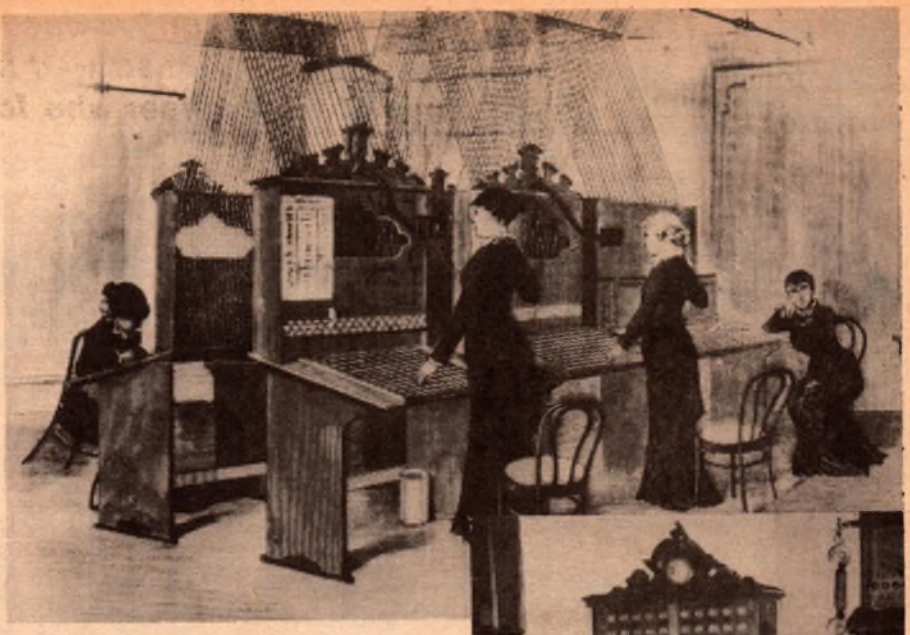
The experience thus gained, coupled with the studies Ericsson had undertaken after reading news accounts of Bell's invention, had enabled him to design and produce "serviceable" instruments.

Other orders followed in close sucession and, although the telephone continued to be regarded as a luxury, Ericsson intensified his efforts to improve the instruments and related equipment.

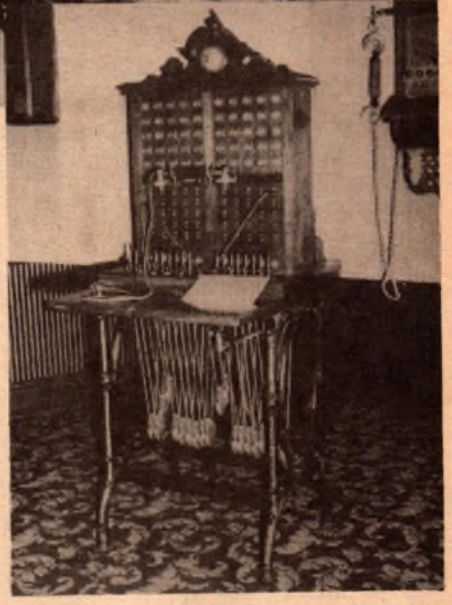
The "break-through" of telephony in Sweden occurred in 1880 when the American Bell Company, using American equipment constructed the first telephone networks. The situation was critical for Ericsson. He stood to lose virtually all of his home market unless he and Andersson could demonstrate convincingly that their equipment was equal, if not superior, to Bell's.

The showdown came the following year — 1881 — when the city of Gavle,

Right: Line drawing of Stockholm's first telephone exchange, as it appeared in 1881. The exchange was installed by the American Bell Company.



Ericsson pioneered the development of the desk telephone. This famous design was introduced by his company during the early 1890s.



This magnificent example of an Ericsson 50-line exchange of the 1890s is preserved in the Museum of Applied Science in Melbourne, Victoria.

on the Baltic coast, called for bids to supply a local telephone system. The Bell Company in Stockholm offered to install and operate a system for 200 kroner per subscriber per year, based on a minimum of 50 five-year subscriber contracts.

At this point a local entrepreneur entered the picture. Relying on Ericsson's engineering and price estimates, he offered to install the system for 275 kronor per subscriber and thereafter to operate it for 56 kronor per subscriber per year.

At the end of January, instruments from Bell and Ericsson were set up in Gavle for comparative testing. The testers certified that both functioned very well but that they considered Ericsson's telephones "simpler, stronger and more attractive."

The Gavle Exchange Association, which had responsibility for the final decision, nevertheless decided to call in a new jury of two telegraph experts and one technician. On February 15 the new inspectors reported Ericsson's telephone "to be better made, provided with a better ringing device and with a better designed and movable microphone . . ." Ten days later the bid on behalf of Ericsson equipment was accepted with only minor modifications.

The victory over Bell at Gavle and later the same year at Bergen, Norway were major milestones in the development of Ericsson's five-year-old enterprise. He had demonstrated that Swedish craftsmanship and Swedish technique could compete on an equal footing with the largest company in the field. He had established a firm position in his home market and he had opened up the first in a long succession of markets outside Sweden. Both were momentous achievements.

At the beginning of 1880 Ericsson had 10 workmen on his payroll. Four years later the number was close to 100. The dynamic growth of the enterprise which was to continue — with few setbacks — for nearly a century was under way.

In 1888 Ericsson provided the principal support for the formation of Sieverts Kabelverk, in the Stockholm suburb of Sundbyberg, to produce covered copper wire. Max Sievert had for a number of years represented a foreign manufacturer of this type of wire, which was becoming increasingly important in Ericsson's production program.

The Sieverts company, now the largest producer of cable in Northern Europe, is today a subsidiary of the Ericsson Group.

One of Ericsson's important contributions was to give telephone instruments and their important components a light, attractive appearance without any impairment of technical performance. In this respect, Ericsson instruments differed substantially from the early equipment offered by other manufacturers.

Ericsson instruments produced during the last two decades of the 19th century, widely imitated by other companies, are today collectors' items throughout the world.

Ericsson's first transmitter, the so-called "spiral microphone" developed in 1880, was an original and ingenious design which greatly facilitated the spread of the telephone service in Scandinavia prior to the introduction of the carbon transmitter.

It was Ericsson who provided the practical design and engineering for the first hand sets which combined receiver and transmitter in a single unit. While the concept is not regarded as his invention, he is credited with recognizing its value and with establishing the new-style instrument in world markets.

Similarly, Ericsson contributed substantially to the design of early telephone exchanges, designing and producing the first "multiple desk" in Europe in 1884.

With Cedergren, he is also credited with developing several automatic connecting switchboards that offered unusually low subscriber rates in 1883. Many of these switchboards continued to be used for more than half a century.

In the concluding years of his business life Ericsson participated actively in the design and engineering of the then new central battery system.

One of Ericsson's major contributions to telephony was his continuing insistence on product quality.

(Continued on page 118)

Electronic Backgammon

. . . you play the computer!

Stablemate to the recently released "Chess Challenger", the "Gammonmaster II" backgammon computer is the latest leisure item to be based on a microprocessor. It is designed for ease of play, will defeat an average player more often than not, and compete evenly with experts.

by GREG SWAIN

It's not going to be easy to write this article; not in my present depressed state of mind. After all, it's not every day that one plays 3 games of Backgammon and loses the lot to, of all things, a . . . . . computer!

Of course I could say that the computer cheated. Yes, that's it . . . . thinking back to those ill-fated games, the computer did seem to throw a lot of high doubles for itself and deal me a host of low, odd numbers. And to add insult to injury, it lit up a smug little "I WIN" indicator to announce my downfall at the conclusion of each game.

I took my revenge at the end of the third game by removing its power plug from the wall socket. What a smart alec!!

Actually we had a lot of fun playing the Gammonmaster II, a computer controlled backgammon game made by the US firm Tryom Incorporated of Cleveland, Ohio. Based on the Motorola 6800 microprocessor, the Gammonmaster incorporates 6k of memory and plays such a high standard of backgammon that it is a real challenge for its human opponent to win.

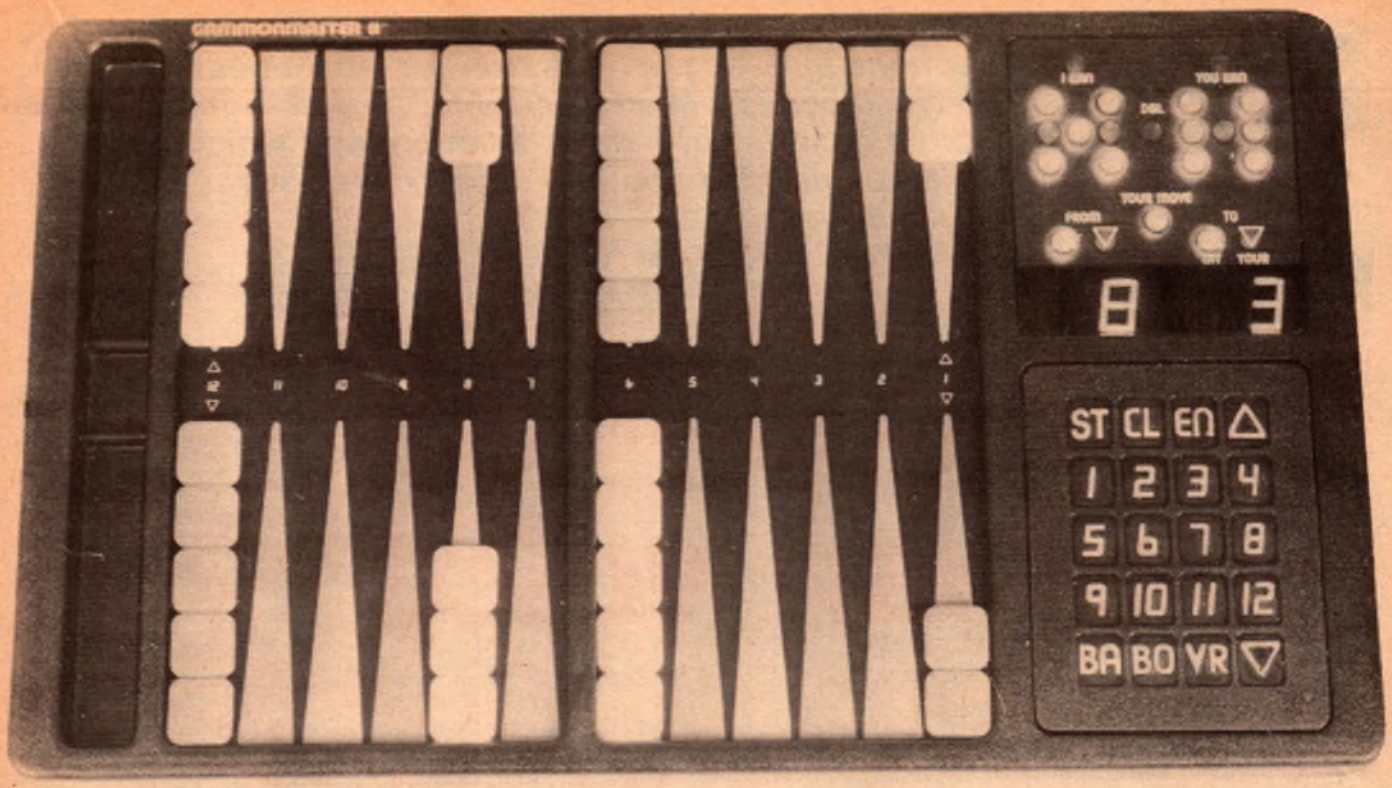
All the rules and strategies of backgammon are programmed into the computer and include running game, blocking game, hit and run game, back game, blot hitting contest, and bear-off game. Any or several of these strategies can be employed by the computer during the course of a single game, depending on how its human opponent develops his own game.

The unit itself is compact and portable. It comes housed in a moulded plastic case that incorporates all of the electronics (except for the power transformer), a control panel, and a standard backgammon board. A neat touch is the narrow channel running down the left hand edge of the case, to accommodate pieces taken off the board.

A simple numerical coding system is used to enable the computer to keep track of each piece on the board. The points are labelled right to left from 1 to 12, while arrowhead symbols are used to indicate either an upper point or lower point. ▼ indicates a lower point, while ▲ indicates an upper point.

The control panel consists of a keyboard, a 7-segment LED readout, 2 electronic dice controlled by a random number generator, and various indicator lights. The latter simply indicate such things as upper or lower point, the winner, and whose turn it is to move!

The Gammonmaster II comes packaged in a neat little carrying case. Transformer and playing chips are included in price.



How do you decide who goes first? Well, the machine decides that for you on the first roll of the dice. The game is started by pressing the ST key and if the rightmost die is the highest number, the player is the first to move. But if the leftmost die is the higher, then the Gammonmaster II moves first.

Although not stated in any of the supplied literature, it is presumably impossible to throw a double when the ST key is pressed to commence the game. We certainly were not able to do so!

To play the game, the player now has to key in the appropriate moves and place the pieces in their new positions. The computer then responds with its own moves. Keyboard entry is quite logical and straightforward, as the following example will illustrate.

Let's say that the player has thrown a 3 and a 5 on the electronic dice and wishes to move one piece from upper 12 to lower 8, and a second piece from lower 6 to lower 3. All he has to do to enter his moves is key in the following sequence: ▲ 12 ▼ 8 ▼ 6 ▼ 3 EN. The dice will roll again and, after a slight delay, the computer will display its own move on the readout.

The player then moves the computer's piece to the position indicated. Further moves are indicated at each press of the EN key, until the computer has finished its turn. Pressing the EN key again then causes the dice to roll and lights the "your move" indicator LED.

Playing a piece from the bar, or bearing off, is just as easy. For example, to enter from the bar, the player simply presses the "BA" key followed by the row designation and the point number. Bearing off is carried out by first designating the piece and then pressing the "BO" key.

The game thus depends on correct use of the keyboard and proper positioning of the pieces. But what if you inadvertently place a piece in the wrong position; or key in an illegal move?

For either event, the Gammonmaster II has a trick up its sleeve. First, the position of every piece on the playing board can be verified whenever the "your move" indicator LED is lit. By pressing the "VR" key, the first point number checked will be displayed in the "from" window, with the number of pieces on the point shown in the "to" window. Subsequent points are then verified by repeatedly pressing of the "VR" key.

Only points which are occupied by at least one piece are verified.

Illegal moves are met with double zeros ("00") on the display. This situation is corrected by clearing the display (CL key) and re-entering each move, making sure that the error is corrected. The CL key can also be used to clear any unwanted moves.

The position verifier is a good feature, as it is easy to inadvertently misplace a piece. When playing a human opponent, there is no way that any dispute can be satisfactorily resolved. With the Gammonmaster, the computer keeps track of each piece as the game progresses, so there can never be any doubts.

And because it knows where each piece should be, there is no way that you can cheat. Nor will it let you inadvertently cheat yourself!

Operation of the keyboard is thus virtually foolproof. There is only one way to destroy a game in progress, and that is to press the "ST" key twice. If there is an incorrect move or a keying error, the machine simply refuses to take its turn until the situation has been corrected.

So we were very impressed with the Gammonmaster II and the way it operates. Not so impressive was the small 240VAC to 9VAC step-down transformer supplied with the unit. Both the line-in and line-out cords enter straight through the plastic case housing the transformer, ultimately risking cord breakage due to flexing.

Is it possible to beat the Gammonmaster II?

In a word, yes! Backgammon is a game of luck as well as skill, so the machine can be beaten.

In fact, since writing those introductory paragraphs, the writer has been able to regain some of his lost self-esteem by winning several games. It's very sporting about losing too — no temper tantrums or sulking here. It just sits there, waiting to take its revenge in the next game.

The only sad note is perhaps the price which, at $299.00 recommended retail, is definitely for the "well-heeled". Still, the price is probably not unreasonable — after all, the Gammonmaster II is a complete dedicated computer programmed with all the rules of backgammon!

You can buy the Gammonmaster II from Futuretronics Pty Ltd, 756 Burke Rd Camberwell, Victoria 3124. A microprocessor-based draughts game, called the "Checker Challenger", should also be available from Futuretronics by the time this article appears in print.

Machines that can talk already exist, as when a tape recording of a telephone message is replayed. But what about machines that can talk by means of an electronic "throat" — imitating the subtle pitch changes of human emotion, and which are so realistic that you think you can identify the accent? . . . by Duncan Campbell.

Machines with a human voice

Since the 18th century scientific researchers have been trying to build a machine which could imitate the characteristics of human speech. Only in the past 10 years or so has it been possible to use sophisticated electronics to create machine speech which people will not at once recognise as artificial.

Two recent developments sponsored by the British Government have advanced work in the fields of basic speech research and its practical use. The two new pieces of artificial speech equipment, although different in many important principles, both have the aim of producing electronically synthesised human speech.

One is the "Formant Synthesiser", produced by The Plessey Company Ltd, near Portsmouth in southern England, which is designed to imitate electronically the characteristics of the throat, mouth, lips and so on under the control of a small computer. The other is a "vocoder", or voice encoder, developed by the Marconi Company Ltd, Chelmsford, England, which is used in communications.

The vocoder is the simpler device because the electronic throat at the far end of the communications link is controlled by signals which are produced by analysing a real human speaker as he or she talks. The analyser part of the vocoder, to which a telephone microphone is connected, sends special data describing the type of speech it is analysing.

The advantage of this system over an ordinary telephone is that the amount of data needed to describe the way someone is speaking is far less than the amount needed to describe the actual sound waves being emitted. So, when it is important to do this, speech can be transmitted in the form of digital data without the need for a communications link of wider bandwidth.

An important application of this is seen in the provision of "scrambled" telephone links for heads of state, or overseas embassies. The only way to ensure the amount of secrecy needed on such "hot lines" is to turn the speech into digital data and then apply secret codes.

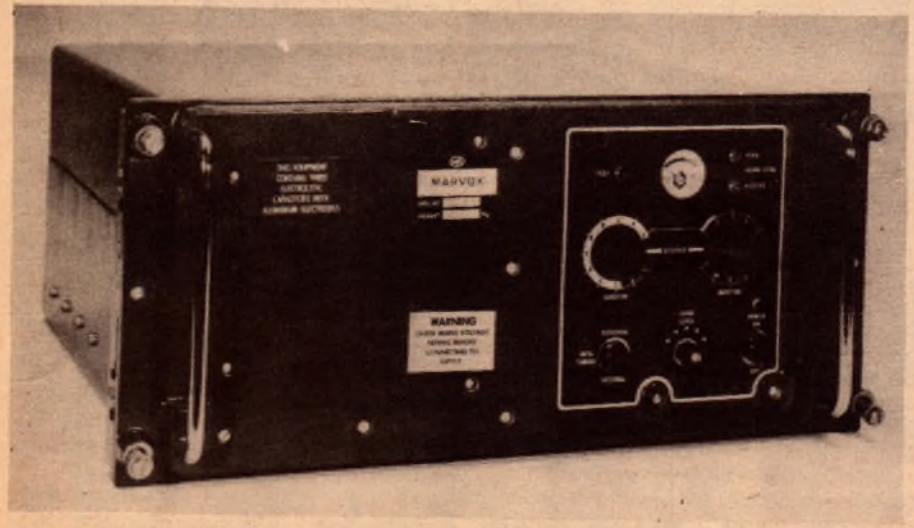
All these machines rely on years of research into the way in which we speak. The important determinants of speech are the larynx, or vocal chords which produce the basic pitch of speech; the resonances or musical characteristics of the mouth, nose and throat, which help make the different vowel and consonant sounds; and the "unvoiced" sounds which are produced by the rush of air through the throat and mouth, such as "shhh" and "sss".

The vocal chords, which are located in the air passage to the lung, are pulled across the windpipe when we wish to speak. Pulses of air passing through cause them to vibrate at a fundamental frequency. When the chords are tightened the fundamental frequency rises, changing the pitch of the voice.

A man's fundamental frequency is normally in the range of 70 to 150 cycles per second — a woman's is twice as high.

On their own, the vocal chords just produce a buzzing sound. What gives the richness to human voices is the way that this tone is modulated and controlled by the cavities in the mouth, throat and nose, just as an organ pipe determines the sound that a reed within it makes.

There are many frequencies, called harmonics, which are multiples of the fundamental vocal chord frequency, such as double, three times, and so on. The power with which each of these



The Marconi Marvox voice encoder identifies whether a sound is voiced or unvoiced and analyses the sound power in each of a number of different frequency bands — thereby identifying the formants.

harmonics is emitted is determined by the shape of the cavities.

Some sounds, such as "O", have a lot of power in the lower frequencies because the mouth is open. Others have most of the power in the higher frequencies. The general distribution of power into different frequencies is known as the spectrum of the speech.

As we speak, not only is the pitch of the speech controlled by the vocal chords continually changing but the spectrum of emitted sounds is adjusted by movements of the tongue, lips, jaw and throat. The spectrum is distinguished by a number of special frequencies called "formants" which are the frequencies at or about which most power is emitted. The formants are associated with different parts of the vocal tract.

The other sounds, called unvoiced, are produced by air passing through the mouth or throat at high speed without necessarily using the vocal chords at the same time. As the air becomes turbulent it emits a continuous spectrum of frequencies whose power distribution is again determined by the formants. These become characteristic sounds like "sss".

It is possible to speak entirely without using the vocal chords — when whispering.

In the Marconi Marvox vocoder the equipment identifies whether a sound is voiced or unvoiced and analyses the sound power in each of a number of frequency bands — which identifies the formant. A vital and complicated piece of electronics has to identify the fundamental frequency of the vocal chords at any moment from the numerous frequencies which are present.

Many times a second this information is sent as data to the synthesiser at the far end. A series of filters plus electronics, which represent the vocal chords and so on, produce the synthetic speech.

The main use of the vocoder is for scrambled telephones. When in use, the voice of the speaker is still identifiable from voice characteristics, despite the fact that the sound is really coming from an electronic throat operated as similarly as possible.

By altering some of the normal adjustments, however, tricks can be played. If the pitch of the voice is made artificially to slide up and down the speaker inevitably sounds Welsh. A Welsh accent has a rapidly varying pitch and sometimes sounds "sing-song".

If the pitch of the reproduced speech is made constant any speech sounds emotionless, like a religious chant, no matter how interesting the original speech.

To continue the work on fundamental speech research a new Formant Synthesiser has been built for the British Government's Joint Speech Research Unit near London. It can talk entirely artificially, fed with information on formants and the pitch of the larynx or vocal chords, and some other parameters including the nasal frequency.

The fundamental problem now in getting totally machine speech from, say, a text fed in by typewriter, is first to teach the computer to use its new electronic throat to make the right sounds. The second and more difficult problem is to ensure that the right emphasis and speed are placed on different words.

The solution to these problems is a set of speech rules, and the Formant Synthesiser is helping in experiments to create as useful and powerful a set of speech rules as possible.

As work in this exciting area of research progresses we may yet have a singing computer announcing its first recording.

One obvious use of electronic speech synthesis units is in voice scrambler circuits for security applications. This British device, known as the "Privateer" is able to scramble and unscramble telephone conversations.

Paralleling the development of machine speech systems are machines that can recognise spoken words. Above is Threshold Technology's Voice Data Entry System (VDES), a voice recognition system that enables data to be entered verbally into a computer.

A tribute to

"The Father of British HiFi"

GILBERT BRIGGS

(1890-1978)

At the ripe old age of 87, Gilbert A. Briggs died recently, literally within hours of leaving his writing desk. A dominant figure in a whole generation of colourful audio pioneers, G. A. B. was known affectionately as "The Father of British hifi".

by NEVILLE WILLIAMS

From the personal files of our late Editor, John Moyle, this picture shows Gilbert A. Briggs (often simply G.A.B.) at the peak of his career.

It was a title that fitted him well as he stood on the stage of the Royal Festival Hall in London, hosting the now historic gatherings where a live performance was compared directly with the same sound reproduced through Wharfedale loudspeakers.

Or as he gathered together the material for his eighth book: "Audio Biographies". Published in 1961, it summarises the careers of more than sixty of his near contemporaries in the audio/hifi field, including some whose names are well known to Australian enthusiasts: D. W. Aldous, W. A. Chislett, N. H. Crowhurst, H. A. Hartley, P. W. Klipsch, G. W. Tillett and C. E. Watts, to mention just a few.

Or yet again, as I met him in 1968: Reminiscing over lunch in Bradford and then insisting that I come and hear the prototypes of what turned out to be the new breed of Wharfedales for the seventies.

I had hoped to visit him again while in Britain last year, but it wasn't to be. All I can do now is to express, on behalf of this journal, my condolences to his wife Doris, who features in his "Audio Biographies" and to his two daughters Ninetta and Valerie.

In his own biography, Gilbert Arthur Briggs notes that he was born on the 29th of December 1890 in Clayton, Bradford, Yorkshire.

Contrary to the sometime impression that he was born into a well-to-do textile family, able freely to indulge his outside interests, he gives his place of education as Crossley and Porter's Orphan Home and School, Halifax. This was followed by a period at night school and, much later, additional tuition by a teacher from the Bradford Technical College.

It sounds much more like the biography of a battler!

Gilbert Briggs did, in fact, begin work in the textile industry, which was nothing unusual for a 16-year-old lad in Bradford. What set him apart was an instinctive love for classical music and a mounting interest in ways and means of enjoying such music in his own home. It was this preoccupation which led him early to dabble with acoustic gramophones, tapered papier mache horns, electric pickups and "wireless" loudspeakers.

In 1932, much to the amusement of his family, Gilbert Briggs decided to build a few loudspeakers himself and entered a couple of them into a local competition. Suprisingly he won and, even more surprisingly, the effort generated an order for 144 copies from a wireless distributor.

There and then, Briggs decided that selling loudspeakers was a lot easier than selling piece goods. Accordingly he registered a firm in his wife's name and started manufacturing in earnest — only to discover the hard way that there was a basic difference between selling loudspeakers and making money on the operation!

But, problems notwithstanding, the enterprise gradually expanded during the thirties, with annual production running to about 9000 units in 1939. Then the war intervened and the facilities had to be diverted to the production of loudspeakers and transformers for the nation's needs.

After the war, Gilbert Briggs became more dedicated than ever to the quest for the ultimate performance from loudspeakers. His was essentially an empirical approach: trying this or that, listening to the result, modifying the approach and then listening again.

Significantly he placed a great deal of emphasis on the enclosures in which the drivers were mounted and, at a time when most enthusiasts were still mounting speakers in open-backed "furniture" cabinets, Briggs and his team were talking sand-filled baffles, brick enclosures or, at the very least, ponderous solid-core timber systems. By such means he was substituting fundamental for harmonic bass — to the joy of dedicated enthusiasts and the despair of their wives!

By the middle fifties, the standard of reproduction being achieved by Wharfedale loudspeaker systems and (typically) multiple QUAD amplifiers was such that Briggs was prepared to stage performances which gave the public the opportunity to compare the sound of musicians on stage with an on-the-spot recording played back through amplifiers and speakers. There were four such demonstrations in the Royal Festival Hall, London, and two in the Carnegie Hall in Philadelphia, USA.

That they were taken seriously is evidenced by the fact that the London musicians included Leon Goossens (oboe), Denis Matthews (piano), Ralph Downes (organ), Harold Blackburn (bass) and Gerald Glover (accompanist). In the US the Philadelphia Wind Quartet provided the music, while the on-the-spot recordings were

done respectively by EMI and CBS.

Considered alone, the demonstrations proved to be an expensive way of diverting staff from the immediate task of producing loudspeakers but, taking the longer view, they returned an enormous amount of publicity to Gilbert Briggs and to Wharfedale.

This was certainly the case in Australia where our then Editor, the late John Moyle, developed a strong regard for the Briggs approach. At the time, the hifi market here was dominated by Goodmans, but John Moyle tended to discount the Goodman's sound as rather too "commercial": thrusting, obvious, intended to impress. Wharfedale, he heard as "rounder", "more musical": the creation of musicians rather than engineers!

There were others, of course, who held the reverse opinion while yet another group, seemingly blessed with a larger cheque account, would hear of nothing but Tannoys!

I well remember the stereo pair of loudspeakers that John had built and installed in his home a couple of years before his premature death: two 3-way Wharfedale sysytems, complete with matching crossover networks, housed in timber enclosures of quite imposing dimensions. In their day, they sounded nothing short of magnificent and were the envy of his many musical friends.

In a very real way, those systems typified and climaxed the Briggs approach:

- A tweeter that extended the top response without obviously "squirting" the treble at the listener;
- A mid-range that deliberately avoided making its "presence" felt;
- A husky woofer (usually 12in) with low cone resonance, a big magnet and mounted in a large, heavy enclosure (usually vented).

As I mentioned earlier, Briggs and his team relied heavily on their ears and, while they took curves by the best means at their disposal, their choice of tweeters and mid-range drivers were based largely on subjective preferences.

Their study of woofer curves, on the other hand, lead them to what might be termed empirical" maths, resulting in widely published formulas and graphs relating cone size, cone resonance, enclosure volume and port dimensions. Goodmans and others added their contributions to do with internal damping, "resistive" port coverings and suchlike.

Few appreciated at the time that these early data omitted certain quite fundamental factors but, right then, it didn't matter all that much. If one started off with a big, husky woofer and was prepared to mount it in an enclosure of 6 cubic feet or larger, an impressive bass response was almost automatic. The penalty for a suspect calculation was not too obvious in a typical listening room.

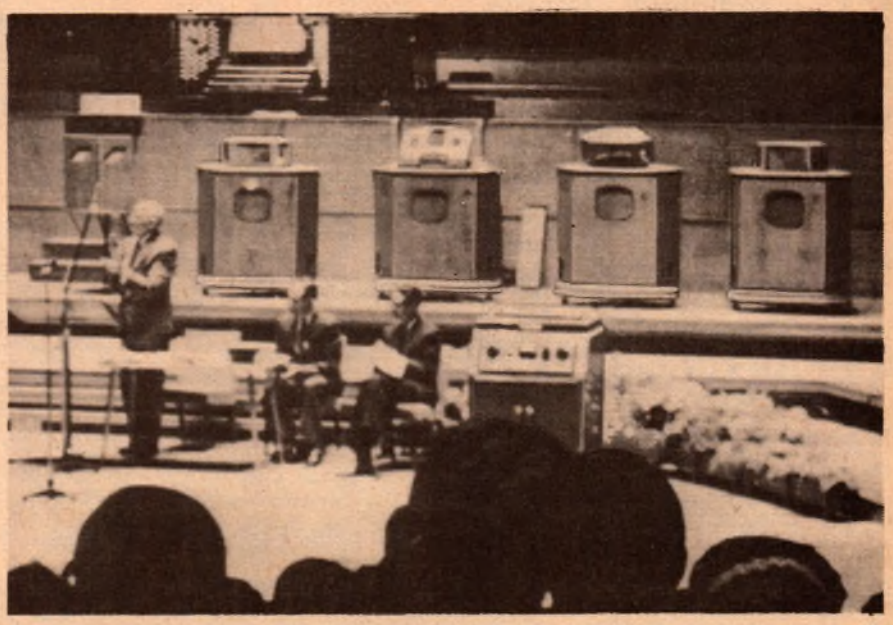
A tribute to Gilbert A. Briggs

It was the prospect of domestic stereo that, more than anything, disturbed this empirical structure and ultimately revealed its shortcomings. While keen audio enthusiasts might be able to argue for one large enclosure in the living room, not many could justify two of them! A demand inevitably had to emerge for smaller loudspeaker systems — without loss of frequency response at the bass end.

In our files is a prophetic letter written by John Moyle to Gilbert Briggs, dated October 28, 1958.

John had just given the first lecture-demonstration in Australia of stereo from phono records — this before the Audio Society in the Sydney Conservatorium of Music. It had been followed by a further demonstration to the Wireless Institute of Australia, in which "another packed house listened to those railway engines and shouted for more". His letter concludes:

"It will be interesting to note how the major manufacturers attack the stereo problem. One thing is certain, they will have plenty of scope. Speaker manufacturers, too, have a big field ahead. Maybe I had better not open that subject in a short letter!"



A snapshot of Gilbert Briggs compering a demonstration at the Festival Hall, London, during the summer of 1955. On stage, fronting the console of the organ are four Wharfedale systems and a tape recorder loaned by EMI. Personal note: the picture was taken by Eric Minns of EMI and the two heads silhouetted in the foreground belong to a couple of newlyweds: Mr and Mrs Neville Thiele!

As it transpired, the responsibility of finding Wharfedale's answer to the stereo situation was to be shared by others. Realising that his company was very vulnerable as a one-man concern (albeit in his wife's name), Gilbert Briggs had sold the business to the Rank organisation only a month previously and, while he remained in the chair, development and marketing responsibilities transferred gradually to other shoulders.

While I have no documentation to support it, my impression from 13,000 miles away was that profound changes took place in Wharfedale in the period between 1958 and my own visit to the factory ten years later.

- Wharfedale had become Rank-Wharfedale.
- The Briggs working-at-my-hobby style had given place to a more hard-nosed approach which, for a time at least, put the Wharfedale image at risk.
- All the assumptions of Briggs (and his contemporaries) about driver and enclosure design had been questioned in the effort to repackage high fidelity into smaller boxes.

So it was that, when Gilbert Briggs showed me the latest Wharfedales in 1968, I had the impression that I was seeing, not his children, but his grandchildren, one generation removed! They sounded fine, but they looked very small and very conservative compared with the Briggs-inspired monsters that I remembered in John Moyle's living room.

Curiously, it was an Australian engineer, working on this side of the globe, who up-ended the theories behind the design, not only of the early Wharfedales, but any number of vented systems around the world. He put a question mark over Goodman's ARU (Acoustic Resistance Unit) and AWA's pet schemes of internal enclosure damping.

Neville Thiele, an acknowledged expert in network theory, translated the entire driver/enclosure combination into a precise electrical analog and worked out the influence and interplay of the many parameters involved. He showed the need for specific driver parameters to meet specific performance criteria; he showed the error of trying to compensate unsuitable driver characteristics by damping the enclosure or the vent; he showed that, for a given small enclosure, there was an inevitable trade-off between sensitivity and bass response.

His work, which dates (from memory) around the mid sixties, was taken up by others and has since been translated into a computer program. I recall an article by an English hifi writer telling of a recent visit to Wharfedale, where he was shown their computer/program set-up, based on Neville Thiele's work. Invited to do so, he punched in some specifications for enclosure size and bass response — and back came the specifications for the driver that would need to be produced: cone diameter, resonance, Q-factor sensitivity, and so on.

Some years ago, I remember Neville Thiele remarking that Gilbert Briggs had set back enclosed design by five years because, having established the need for a proper enclosure in many people's minds, he expounded his undertaking of the principles with such conviction that it took that long for someone to question them!

But the other day, chatting with Neville Thiele during the preparation of this article, he had another thought:

"You know, it was Briggsy that really set me going!

"He pointed out that the top hump of the classic double-hump curve was due to an increase in speaker resonance; he said he was uncertain about the bottom one.

"I went looking for that answer and came up with the rest of it!"

Today the research that Gilbert Briggs triggered off, and which Neville Thiele pursued to its resolution, is basic to system design around the world. Implicit in that work is the answer to the oft-repeat question: "What happened to the sensitivity of those old-time hifi speakers, the Wharfedales, the Goodmans and the Jensens?

"Simple: you swapped it for smaller size and extended bass response!"

In more ways than one, Neville Thiele and Rank-Wharfedale's resulting computer program are at the opposite ends of the earth from the late Gilbert Briggs, the hobbyist who started building speakers in an attic in Bradford.

Then what about the title "Father of British hifi"? Is it justified?

"For sure", says Neville Thiele, "For sure!"

Forum

Conducted by Neville Williams

The professionals: Applying for a patent isn't a job for amateurs!

Predictably, perhaps, there was a sharp reaction to the article on patents, written by M. G. Maxwell, and published in our February issue. A number of patent attorneys have offered contrary opinion — expressed with different degrees of emphasis: the budding inventor who seeks to take out his own patent is likely to finish up a very disillusioned and disappointed person.

One of the writers prefaced his letter with an appreciation of the many helpful articles published in "Electronics Australia" but went on to say that he was therefore all the more horrified to read the one on patents "in which the writer appears to be uninformed relating to a number of aspects of the subject on which he writes."

By inference, we should have been more discerning in our decision to publish, or not to publish; now, after the event, we should feature material expressing the contrary view "which will at least warn people of the dangers involved".

While it would be comforting never to receive such a strongly worded brickbat, we are not dismayed by it. There is no practical way in which a commercial magazine can so control and manipulate what is published that it becomes the last word on any particular subject, brooking no challenge.

Appreciating this, we take the view that our columns should provide a medium for the promulgation and exchange of ideas, our job being to see that they are selected and presented in a responsible fashion. In the February issue, Mr Maxwell suggested that inventors should consider handling their own patents; the response has been a chorus of "not sos".

If we were responsive only to courtesy, we would probably publish all the objecting letters in full and in sequence, with individual rebuttal or acceptance by the original author. But, since there are other considerations, we will settle for publication in full of the first letter received. Happily, it mirrors fairly well, the sentiments expressed by the other correspondents.

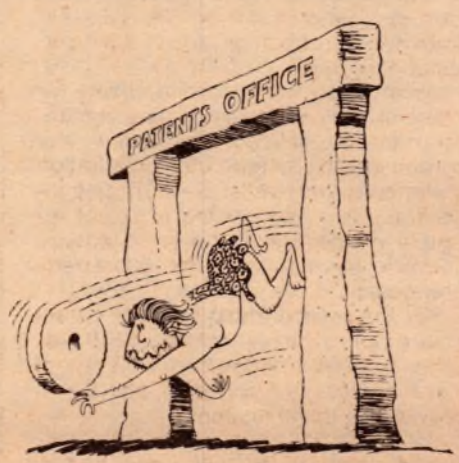
Here it is:

A TYPICAL LETTER:

I am writing to correct certain false impressions given by Mr M. G. Maxwell in his article "Applying for a Patent" (Electronics Australia, February, 1978).

On the matter of searching Mr Maxwell gives the impression that a search of Australian Patent Specifications will reveal all and that, providing nothing relevant is found, the inventor will get a valid patent as a matter of course.

In fact, searching has a dual function. The first is to ascertain whether an invention is new. In this connection it must be pointed out that Australian Patent Specifications constitute only a small portion of the available literature in any given field. Thus, a search of Australian Patent Specifications which yields negative results is, in itself, no guarantee of novelty. The second is to ascertain whether the commercial exploitation of an invention would infringe a claim of an existing patent which is in force. An Australian patent can remain in force for 16 years from lodgement of the complete specification but an annual fee is payable to keep the patent in force.



— Brian Evans

It can be extremely difficult to decide on the matter of infringement, particularly where the invention lies in a close art, since the precise meanings of claims have to be ascertained.

A further point on searching is that it is not always easy to determine the correct classes to search. If the field in which the invention lies is not classified under a specific subject matter heading, it is quite feasible to search the wrong classes and thus miss completely the most relevant prior art. Further, some subject matter classes are so large that they would certainly require more than a day to search. It may be necessary to set aside a week or more!

As for searching United States Patent Specifications in Australia, I am unaware of any classified system of US Patent Specifications which would enable a search to be conducted in Australia. Since there are over 4,000,000 US patents it is quite impossible to do a search through unclassified specifications.

With regard to the drafting of specifications, it is true that a provisional specification has only to describe the invention, whilst a complete specification has to particularly describe the invention, including the best method of carrying it out, and must end with a claim or claims defining the invention. However, it is modern practice to include as much information as possible in a provisional specification, including drawings or examples. This is especially important if a filing is contemplated in the United States, since a provisional specification drafted only in general terms would probably be considered as an inadequate basis for a claim to priority; therefore an application for a patent in the United States would only have the date of filing in the United States, which could let in a competitor.

Further, it is not necessary to lodge a fresh provisional specification for each and every modification or addition that is made to the original invention. This only becomes necessary if the modification or addition extends or alters the inventive concept, providing of course that the original provisional specification is properly drafted.

Also, once the invention has been disclosed to a third party without any obligation of confidence it is essential to maintain the priority date conferred by the provisional specification by lodging the complete specification within 12 months. Otherwise protection is lost.

It is also true that the claims of a complete specification should be drafted in broad terms but it must be remembered that a broad claim is of no value if it covers the prior art. Thus, the

Mr Maxwell replies:

I am sure your readers will be gratefull to K.L. for the information he gives in his letter — information which is additional to that in my article and not contrary to it. My brief was to give an easy to read run down on the process of applying for a patent — that is precisely what my article does. I advised readers to obtain the guide books issued by the Australian and US patent offices, because these cover most of the points mentioned by K.L. and give a lot more information besides.

The purpose of the article was to get young people started off on their own bat instead of being scared off by the prospect of having to pay substantial fees. In fact, K.L. makes this point for me. He says that most firms of patent attorneys charge about $200 for preparation and lodgement of a provisional patent application whereas, if they do it themselves, the cost could be substantially less than this.

The reason I advocated consulting an accountant or solicitor to vet an agreement for commercial exploitation, whilst discouraging them from consulting a patent attorney in the early stages, is that such agreement only comes into being when terms satisfactory to both inventor and the commercial concern have been reached. By this time the inventor has some prospect of reaping financial reward so that $50 or so to have the agreement examined is neither here nor there. Patent attorneys come into their own if litigation for infringement ensues, but in the early stages of applying for a patent they are definitely not necessary in Australia nor in the United States.

I really cannot take the analogy about the brain tumor seriously. It is not possible for the layman to carry out brain surgery whereas it is possible for the layman to apply for a patent, as I have shown in my article.

Regarding the many problems which one correspondent says I ignored or glossed over, my answer to him is the same as my answer to K.L. on this aspect — I necessarily had limited space to cover a voluminous subject so I described the basic modus operandi of applying for a patent and I advised readers to obtain the guide books issued by patent offices. These books cover all the points which he considers I ignored or glossed over.

An amount of $1000 is mentioned. I assume most of this expense to be incurred by attorney's fees since, as I have shown, the cost of securing a patent need only be a fraction of this. If any reader wants to ascertain the precise figures he has only to consult the above mentioned guidebooks wherein are given scales of patent fees.

The various remarks are interesting, but they in no way negate any of the statements in my article, which were based on information obtained from Australian, United States and South African patent offices.

claims must be drafted broadly, whilst being distinguished from the prior art.

Further, in most instances there is no need to worry unduly about having the "damage point moved back" to an early date. The question of damages only arises where there is infringement. Thus, it is nearly always preferable to lodge a provisional specification in the first instance. Also it must be remembered that there are certain restrictions on claiming damages for the period between the publication of the complete specification and the date of grant. If the claims of the complete specification are not expertly drafted, it is quite possible that no claim for damages prior to grant would be sustainable.

Further, a potential infringer may well take advice on the probability of a complete specification leading to the grant of a valid patent. If the complete specification is poorly drafted he may well feel that any business risk arising from the pirating of an idea would be acceptable.

Mr Maxwell also fails to mention that in Australia and the United States and in many other countries, the specification is examined by an examiner in the patent office. In almost all cases the examiner makes objections to the specification, particularly as to novelty of the claims over the prior art. A person unaccustomed to dealing with examiners' objections usually finds that gaining acceptance of his application, whilst obtaining worthwhile protection for his invention, is a very difficult task indeed. This situation would be made worse by trying to prosecute a United States patent application at a distance of thousands of miles since, in that country, disagreements with the examiner are frequently resolved by personal interview.

Finally, I do not understand why Mr Maxwell advocates consulting an accountant or solicitor to review any agreement for commercial exploitation of the invention, whilst discouraging individuals from consulting a patent attorney in the first instance to ensure that the patent specification is properly drafted.

For the record, most firms of patent attorneys charge about $200 for preparation and lodgement of a patent application accompanied by a provisional specification.

Providing the invention is relatively simple and can be fully described in about eight pages, and providing the

APPLYING FOR PATENTS — Continued

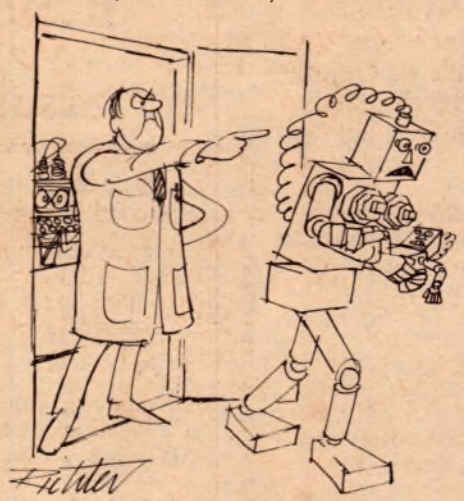
inventor can provide sketches which are sufficiently clear to serve as informal drawings, the initial charge should be of the order set out above. By employing a patent attorney, other charges would be incurred at other stages in the life of the patent application but, if the invention was adopted by a manufacturer within the first 12 months, these charges would be relatively small compared to the overall cost of bringing the invention to the market place.

K.L. (Noble Park, Vic.)

OTHER QUOTES:

So much for the letter which I chose to quote in full. Two other correspondents lead off with analogies and I quote the first one to hand, from a patent attorney in Dee Why, NSW:

"It would, for example, be quite possible to write an article similar to Mr Maxwell's suggesting that, if your child were to suffer from a brain tumour, instead of employing a brain surgeon, you could go along, buy one or two books, a selection of scalpels and a good bone saw and do the job yourself. Obviously enough, your lack of training and years of experience could prove disastrous for your child. While I would not like to push the analogy too far, becoming a self-applicant for a patent could be equally disastrous for the child of your brain — your invention."



— "Electronic Age"

The same correspondent makes a concession to Mr Maxwell but, in so doing continues his criticism:

"While what Mr Maxwell has to say is quite correct, he has completely ignored or glossed over the many problems with which an applicant is faced in obtaining the grant of a patent which will give effective protection for his invention. These problems arise not only in the prosecution of a patent application before the Patent Office but in the enforcement of patent rights through the courts . . ."

A little later:

"The point I wish to make is that obtaining valid patent protection is nothing like as easy as it sounds from Mr Maxwell's letter and while I realise that he is addressing himself to engineers and technicians, these are the very people with whom I work and few of them really understand what it is that I am trying to do for them.

"There are exceptional people around who can make a pretty good fist of drafting a patent specification but, believe me, they are very much in the minority."

On the matter of costs:

"While it is quite easy to spend $1000 from the time of lodging an application with a provisional specification to the grant of a patent, on official fees and patent attorney's fees, this amount is extremely small when compared with the costs involved in any facet of the commercialisation of an invention."

In advancing his argument against inventors doing their own thing, a patent attorney from Adelaide puts this further point of view:

"There are so many things that an amateur does not know, and so many things that he does not know that he does not know . . . The dangerous part of the exercise is that he will not know that he has not achieved the necessary result. It may take two or three years before he discovers his omissions."

IN CONCLUSION:

Well, having read all this, you can have a look at Mr Maxwell's rebuttals, deliberately kept brief by our request. Having glimpsed both sides of the argument, it's still a matter for the individual inventor to decide whether or not he is one of those "exceptional people" who can handle their own patent negotiations.

It seems to us that the most frustrating aspect is that chasing the rewards of an invention either way is rather like seeking pirates' bullion or a fortune from the lotteries. For every good invention that earns its author a packet, hundreds (perhaps thousands) lie yellowing in the patent files.

Some time ago, I put a question to an acquaintance who looks after the patent affairs of one of our local electronics companies:

"How do you keep track of all the odd patents your engineers may inadvertently infringe when they design and produce routine pieces of electronic gear?"

His reply was quite brief:

"We don't and we can't. We discharge our responsibility in regard to major obligations but simply add a small margin to costs to cover any other likely challenge!"

Electronics is where it's all happening

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But more than that, you hear each part of it. Each sound. Every sound. All the sound.

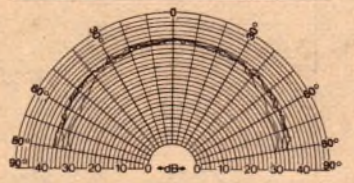
Most loudspeakers can't do that. They only meet you half way. Only left and right, all or nothing. JBL's new L110 goes all the way. It looks at music the way you do.

Left. Right. Front. Back.

The L110 has almost perfect stereo imaging – a result of precise, uniform dispersion at every frequency.

Inside the L110, there's a brand new, super-sophisticated crossover network designed specifically to match the new components.

There's a new 10" woofer which utilizes a massive 3" voice coil and 7½ lb. magnetic assembly – normally found in 12" woofers.



Frequency Dispersion of the L110

~~at 400Hz ~~at 2kHz ~~at 10kHz

JBL's new L110 loudspeaker is part of the same research and development breakthrough that created our no-tradeoff, top-of-the-line L212 system.

If this graph looks familiar, it should. The L212 produced an almost identical one.

The result is smooth, accurate bass, plus an amazing level of efficiency and power handling capability throughout the entire system. (One more nice: You get more headroom for your amplifier. Less clipping.)

Now look at the L110. The most acoustically transparent grille JBL has ever created is visually transparent, too. You can see right through to the satin black components inside.

If you'd like a lot more technical information on the L110, write us and we'll send you an engineering staff report. Nothing fancy. Except the specifications.

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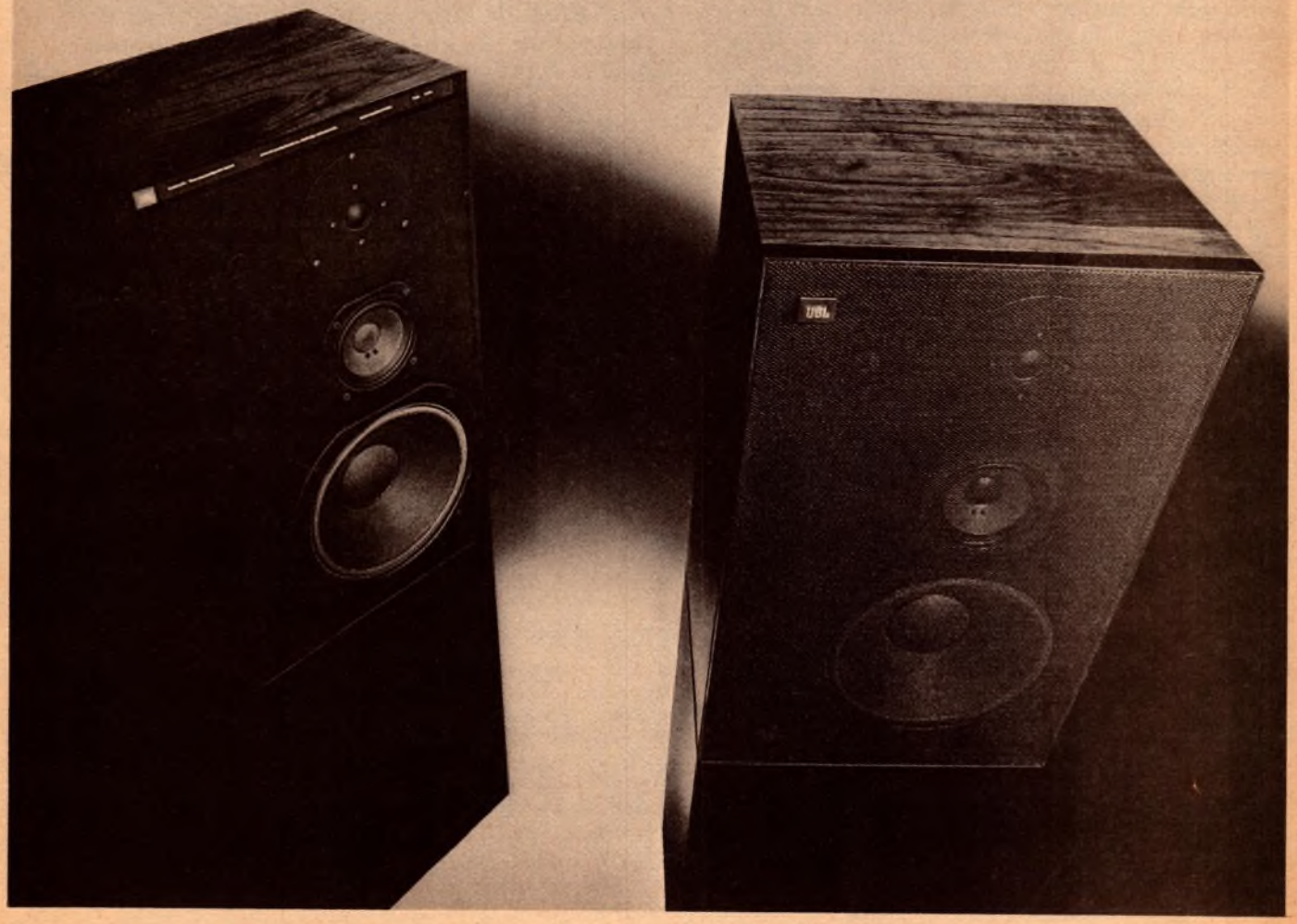


THE BATTLE FOR SURROUND SOUND: WHICH SYSTEM WILL WIN THROUGH?

An international controversy is raging among audio engineers about which surround sound, or quadraphonic, system should be adopted as the universal standard. What are the facts behind the claims? This article examines the background as an introduction to a unique confrontation between the theories of two of the leading protagonists which we publish in subsequent issues.

by ADRIAN HOPE*

The recent announcement by the BBC that its Matrix H quadraphonic system had been modified for alignment with its best known British competitor, the NRDC-backed Ambisonics 45J system, is only a small element in a world-wide discussion which should lead to the adoption of a universal standard for surround sound, both for records and broadcasting.

Among the main protagonists are the US CBS company — which has the support of Britain's EMI — with the SQ system, and the British contingent with the newly named HJ configuration. Needless to say, neither side accepts that the other has even a viable case, and the forthcoming articles in this series reflect the completely opposing views of CBS's Ben Bauer and Ambisonics' Michael Gerzon.

It is worth recalling briefly how and why the quest for surround sound reproduction began.

In the late 1960s, audio engineers sought to improve domestic sound reproduction by capturing the ambience of a concert hall. When music is heard in a large hall the ears receive sound from all directions, not just direct from the orchestra. But when an ordinary stereo record is reproduced through two loudspeakers in a small room the listener's ears receive sound only from the front.

The original 1960s idea was to record the sound from the rear and sides of the hall as well as from the front, and replay it through loudspeakers around the room.

First of all, multi-track tape recorders were used to capture the various sounds arriving. Seeing this new use of tape as a threat to disc sales, engineers subsequently sought a system that would capture all the arriving sounds in the single groove of a stereo disc and allow separation of them, on replay, for reproduction through more than just a pair of stereo loudspeakers.

Soon after this, musicians and producers became enchanted with ideas of using the new facility to create unreal effects, for instance location of the listener in the middle of an orchestra, rather than to reproduce reality. The resultant effect, whether used to reproduce natural ambience or to create unnatural effects, is surround sound.

The fact that surround sound is at present within the reach of very few people, either on record or over the air, might suggest that the controversy is a trivial one. This is only valid in the short-term. Present manoeuvrings should lead to adoption of a world standard by the broadcasters and record companies.

The Ambisonics approach is double-pronged. On one hand there is the matter of how best to encode the necessary information in the available channel space. The second prong concerns the method of handling the signals once they have been decoded or retrieved, that is to say generating signals which, when fed to the

*Published by arrangement with "New Scientist", London.

BACKGROUND

Quad

During the 1960s tape equipment manufacturers held a potential advantage which, at that time, seemed to be unique to the medium: the possibility of offering consumers "surround" sound, making use of additional tracks to drive additional amplifier channels. Discs, it seemed, were limited to two channels.

Nervous about the tape threat, disc engineers addressed themselves to the problem and quietly developed methods of encoding additional signal information on to the tracks of 2-channel stereo records.

Unfortunately, they became even more wary of one another than they were of the tape industry, with the result that their developments were jealously guarded, made the subject of numerous patents and deeply entrenched by inter-company agreements, involving both equipment and pressings.

In the early 70s, the whole situation "blew up", with the various groupings exploding on the consumer market, all bent on convincing the consumer that 4-channel "quadraphonic" sound had arrived, but each promoting its own system to the exclusion of the others. The public became thoroughly confused and, after a period of hesitation, went back to buying the product it knew — conventional 2-channel stereo.

Four-channel sound seemed to have died but, in fact, it has only been lying down!

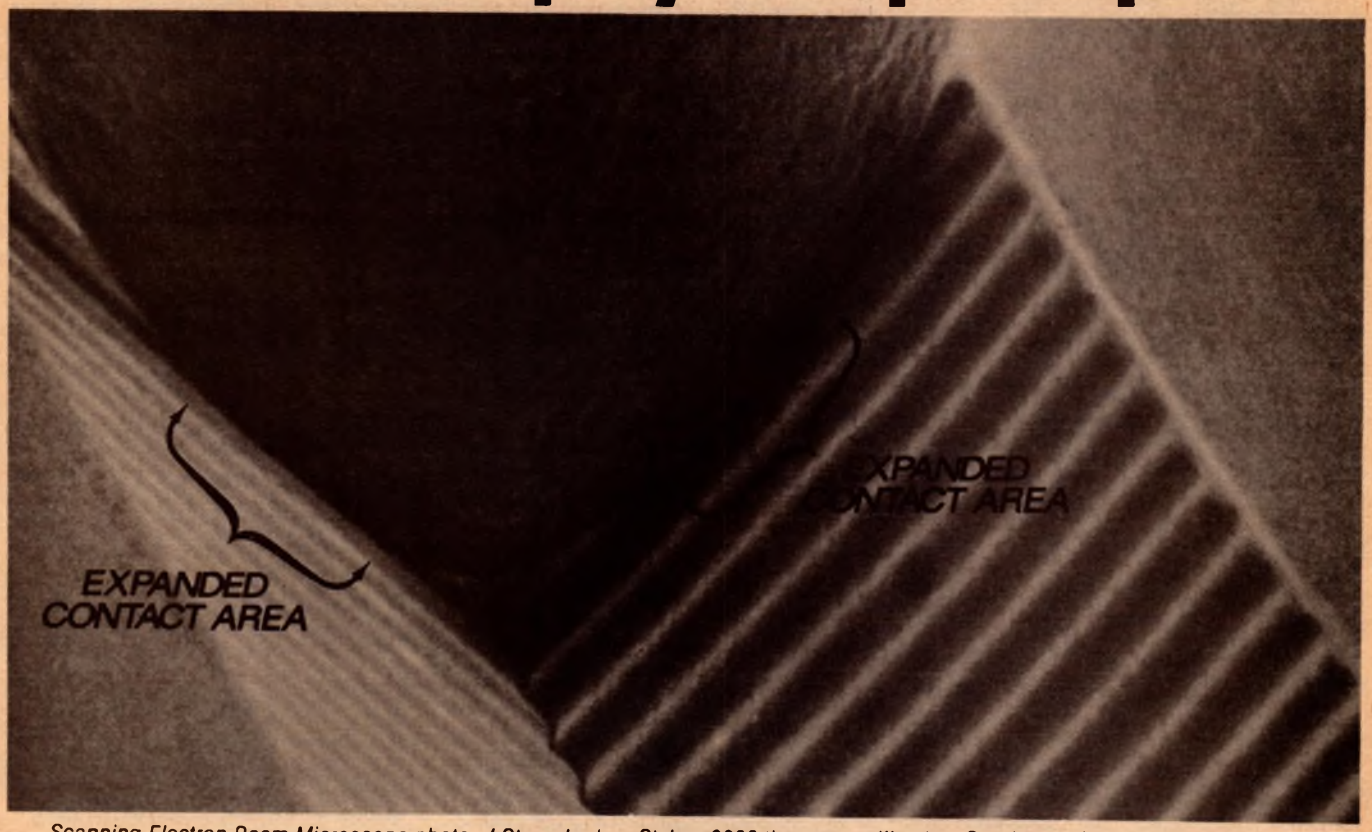
During the last two or three years, the combatants have merged into two or three major groupings, conscious that one of them has to emerge a clear winner the next time round.

In 1970, the emphasis was almost entirely on providing four channels of information on a disc. Now it is much broader, because the encoding system which gains universal acceptance for disc will almost certainly be adopted by FM stations around the World for transmitting programs compatible for 4-channel, 2-channel and mono receivers.

A simple, universal encoding system may also be important for another reason: to fend off the impending challenge to the whole analog recording process by the emerging digital techniques.

or ambisonics?

Better stereo records are the result of better playback pick-ups



Scanning Electron Beam Microscope photo of Stereohedron Stylus; 2000 times magnification. Brackets point out wider contact area.

Enter the New Professional Calibration Standard, Stanton's 881S

The recording engineer can only produce a product as good as his ability to analyze it. Such analysis is best accomplished through the use of a playback pick-up. Hence, better records are the result of better playback pick-up. Naturally, a calibrated pick-up is essential.

There is an additional dimension to Stanton's new Professional Calibration Standard cartridges. They are designed for maximum record protection. This requires a brand new tip shape, the Stereohedron®, which was developed for not only better sound characteristics but also the gentlest possible treatment of the record groove. This cartridge possesses a revolutionary new magnet made of an exotic rare earth compound which, because of its enormous power, is far smaller than ordinary magnets.

Stanton guarantees each 881S to meet the specifications within exacting limits. The most meaningful warranty possible, individual calibration test results, come packed with each unit.

Whether your usage involves recording, broadcasting or home entertainment, your choice should be the choice of the professionals . . . the STANTON 881S.

Mike Reese of the famous Mastering Lab in Los Angeles says: "While maintaining the Calibration Standard, the 881S sets new levels for tracking and high frequency response. It's an audible improvement. We use it exclusively for calibration and evaluation in our operation."

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NAKAMICHI BLACK BOXES

Nakamichi Research Inc, Japan, has developed and released a group of specialised audio components designated as the "BlackBox" series. They are intended to meet the identified needs of advanced audiophiles and to fill those gaps which inevitably occur from time to time in sophisticated hifi systems. Seven units are included in the range:

PS-100 POWER SUPPLY: Delivers a closely regulated +10V supply with a sufficient current rating to cope with up to six of its companion units. ($98.30).

SF-100 SUBSONIC FILTER: Will cut response at 10Hz by approx. 50dB. without significant phase shift in the passband. Optional 5dB boost at 30Hz. ($93.00).

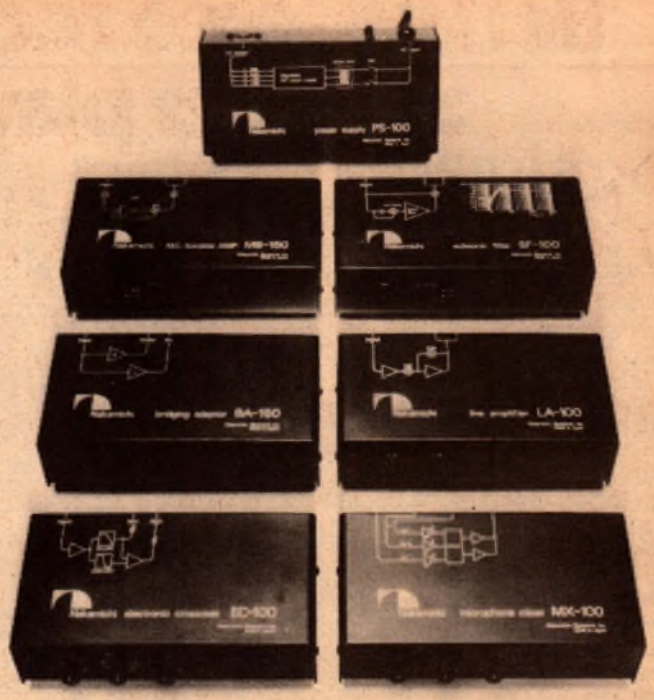
LA-100 LINE AMPLIFIER: Designed for introduction into systems where there is an impedance disparity or lack of gain. Gain can be set for 0dB, +6dB, +12dB and +18dB. ($98.30).

BA-150 BRIDGING ADAPTOR: Designed for use with Nakamichi power amplifiers, it blends their inputs to produce a highpower mono type signal ($86.40).

MB-150 MOVING COIL BOOSTER AMPLIFIER: Extra low noise design, with switchable gain, to install between a moving coil cartridge and the normal RIAA compensating preamplifier. ($140.30).

EC-100 ELECTRONIC CROSSOVER: Active crossover unit for use between the preamplifier and multiple power output amplifiers. Gives 12dB/octave slopes at 29 selectable positions from 66Hz to 7.4kHz. ($141.00).

MX-100 MICROPHONE MIXER: Has three inputs, typically left, right and centre blend. Can be used with tape recorders and/or P.A. amplifiers to expand their microphone facilities, or with amplifiers not having a microphone input.



(Further details and specifications of the above are available from Convoy International Pty Ltd, 4 Dowling St, Woolloomooloo 2011. Tel. 02 358 2088.)

SURROUND SOUND — continued

loudspeakers, produce good surround sound.

In both areas there is major disagreement between Bauer and Gerzon. This becomes abundantly clear from the two articles which will follow, especially as neither author saw the other's contribution prior to publication.

In the United States, the CBS SQ matrix system is being vigorously promoted by Bauer, although it has been widely criticised over recent years. Bauer is highly respected as an audio-engineer of long standing, and his faith in the system must be taken seriously. It is of prime significance that he recently went on record as saying that "the BBC H matrix would hardly entice any self-respecting record manufacturer — it is unsuitable for high fidelity broadcasting or recording".

As the NRDC-Ambisonics system has much in common with Matrix H, Bauer's criticism also applies, by implication, to the former system and now to HJ. Indeed, if one thing in the surround sound field is certain, it is that the Ambisonics-BBC and CBS approaches could hardly be more different.

The debate is both technically and commercially important. The CBS proposals have tremendous commercial backing. The company is talking of a billion dollars' worth of record sales next year. If it decided to release all these records only in stereo-compatible SQ quad, then the public would without doubt be keenly looking for SQ quad decoders to buy.

Although this has not happened, nor is likely to, Bauer and CBS are petitioning the American FCC to make SQ the only surround sound broadcast system in the US.

Gerzon — of the Mathematical Institute, Oxford — has for several years been the prime mover behind the Ambisonics work, researching not only encoding and multiplexing techniques but also ways and means of psychoacoustically handling the retrieved signals so that they produce a realistic surround of sound, rather than an all-enveloping mush or a collection of point sources in the room corners.

Gerzon has rethought the problem from scratch, probably for the first time since Blumlein in the 1930s, whose work resulted in loudspeaker stereo as we know it today. In short, he believes the principles of Blumlein's stereo are not directly applicable to surround sound, and is seeking to provide a modified approach. But no truly successful demonstration has yet been given to the press or public.

Perhaps surprisingly, no magazine has hitherto given the two protagonists back-to-back space to put their differences on record. It will be interesting to see whether these two articles help to resolve the dispute. They should certainly widen understanding of the issues.

The decisions being taken now will affect us all in the future, whether or not we ever choose to progress from casual mono and stereo listening to the reproduction of a full, horizontal surround sound field (and eventually vertical or height information as well).

One of the crucial issues of the continuing debate is mono/stereo compatibility, that is the simple question of how a surround sound record or broadcast reproduces on mono or stereo equipment.

This is not just a question of esoteric mathematical formulae; it really does matter if the voice of an actor in a sur-

Toshiba-EMI service

Toshiba-EMI (Australia) Pty Ltd has announced the appointment of Mr Ian West as service manager. He will be based at the Company's head office and warehouse complex at 16 Mars Road, Lane Cove, NSW. Mr West's responsibilities will include assessment of new products and the appointment of service agents throughout Australia.

round sound production disappears when the broadcast is received on a mono radio.

If the wrong decisions are taken now over a standard for the future, we shall be stuck with them for decades to come. Witness the continuing existence of that dinosaur, 405-line television, in the UK.

It is now clear that the CD-4 multiplex system developed by JVC of Japan is unlikely to become the standard. Indeed JVC has modified the CD-4 system to enable the loudspeaker reproduction of binaural or dummy head recordings, with impressive results but very limited commercial appeal.

Various other recording and broadcast systems have failed to demonstrate commercial potential on a world-wide scale and, as some aspects of the QS sytem from Sansui have been adopted by the BBC, it is evident that the final battle is to be between one British and one US system.

Earlier this year the BBC started test transmissions using its Matrix H system, and these still continue. Criticism centred largely around the adverse effects of the large (48°) phase discrepancy present in the front sound images. The BBC then transmitted every Prom from the Albert Hall in surround sound, and clearly used the opportunity to experiment further with the encoding.

Listeners around the country detected audible changes, and it was inevitable that the BBC would formally announce a change in its encoding format. This confirmed that the new format will be called HJ to mark the co-operation of the BBC and Ambisonics teams and signify a fusion of the two systems.

The difference between the new and original BBC formats (the phase discrepancy in the front sector has now been reduced to around 30° to improve stereo compatibility) is more significant than a casual reading of the BBC announcement might suggest.

As such it will inevitably cause some distress to those who have bought, made or ordered H decoders as a result of BBC publicity's eulogies on the original test transmissions.

Tinkering by the BBC with the original H encoding format followed not only the expression by some listeners of discontent with the original format, but also an agreement by the BBC to negotiate with Ambisonics. This in turn followed a decision by the IBA to negotiate with Ambisonics, and the announcement of an agreement in principle between the Japanese giant Nippon Columbia and Ambisonics.

Nippon Columbia had previously backed the Denon UD-4 system, which (in combining both matrix encoding and multiplexing techniques to transmit surround sound information over a broadcast channel or in a record groove) had much in common with Ambisonics. A deal was inevitable, if only to avoid expensive patent litigation.

JBL SEMINARS: To familiarise Australian sound reinforcement contractors with modern technology, JBL will be running two sound workshops in Sydney and Melbourne during May. The workshops will be conducted by George Augspurger of Perception Inc, a man with many years of experience in sound contracting and television broadcasting. George Augspurger was Technical Director of JBL until he resigned in 1970 to form Perception Inc, a consulting group specialising in architectural acoustics and technical design. Significant projects completed by Perception Inc. include the Los Angeles Music Centre, Hollywood Bowl, Pittsburgh Symphony Association, Capitol Records, and Brigham Young University.

For further information and a prospectus, write to Harman Australia Pty Ltd, PO Box 6, Brookvale 2100.

M. R. ACOUSTICS announce that they are now Australian agents for Nightingale NM1 loudspeakers from the United Kingdom.

The subject of favourable reviews in the hifi press, the NM1 uses an 11 x 8-inch bass driver in a labyrinth/reflex enclosure, plus a 4-inch mid-range and a 1-inch tweeter specially positioned in an upper foam section. The sides of the cabinet are a timber finish, in teak, walnut or rosewood. The price in Australia is $1340 per pair.

While the NM1 will handle a power of 50W nominal, 100W peak, Nightingale produce the larger and heavier NM2, with eight drivers in each enclosure.

For further details: M. R. Acoustics, PO Box 110, Albion, Brisbane 4010.

Remote volume control for hifi systems

First mentioned in these columns a few months ago, the unit pictured above is now available direct from the manufacturers: Remote Control Systems Australia Pty Ltd, of 102 Chandos St, Crows Nest, NSW 2065 (Phone [02] 439 6948).

Called the "Stereo Commander", it provides a means of remotely controlling the volume level of a typical domestic hifi system. From any likely listening position in a room, the user can raise or lower the volume, as desired, over a very substantial decibel range, by simply pressing the appropriate button on a hand-held supersonic "wand".

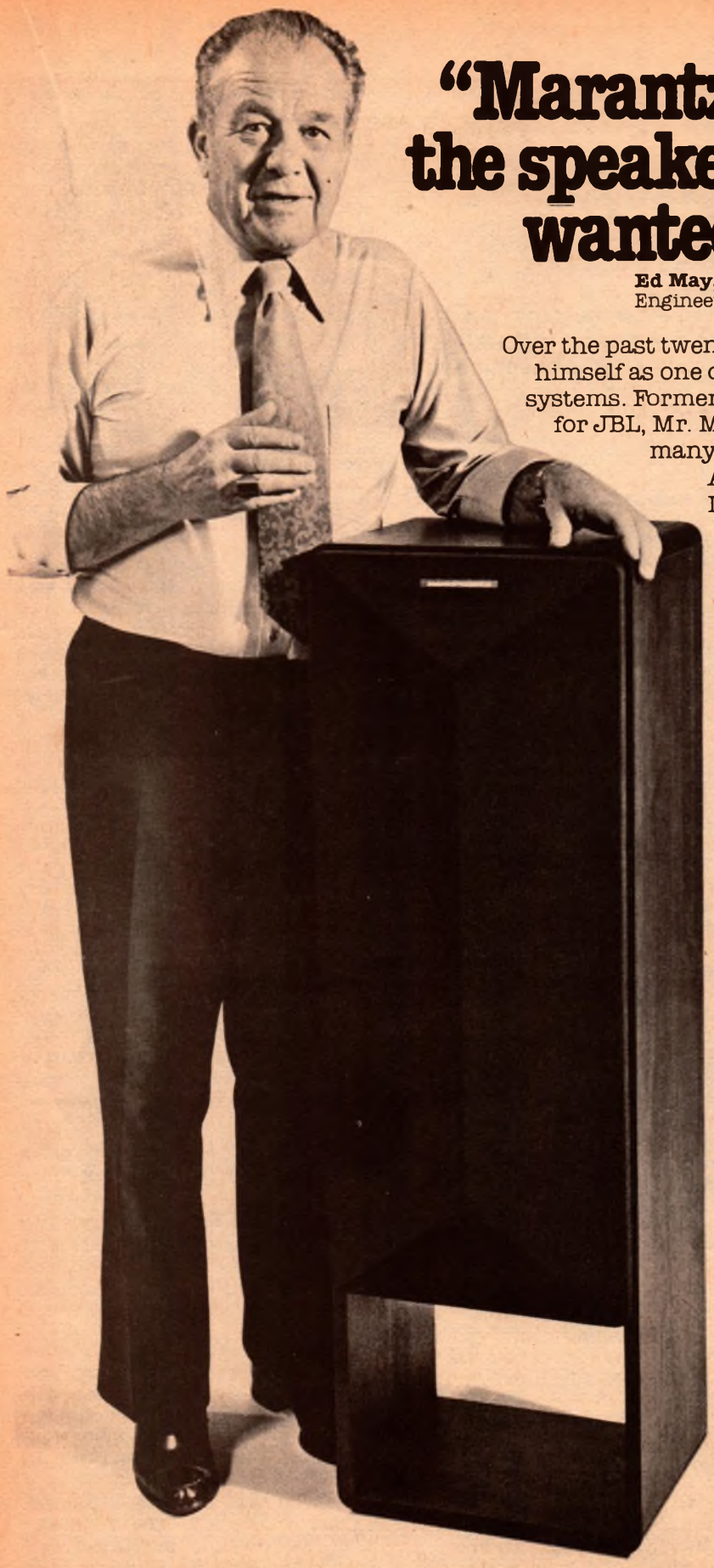
The main control section of the Stereo Commander is a neat black box measuring 157mm x 110mm x 55mm (w x d x h) and having a row of eight LEDs on the front panel. These are intended to provide a visual indication of the status of the control circuitry. Logically the unit would be placed on top of, or alongside, the amplifier, within easy view of the operator.

At the rear of the black box controller is a line of eight RCA plugs, allowing it to be interposed by the patch cords between the preamp. and the main amp. circuitry. A leaflet with the unit shows typical interconnections, including provision for a tape recorder. Power for the unit comes from a miniature wall plug supply, terminating also in an RCA plug. This is one point we would be nervous about, because it could be plugged inadvertently into any one of the audio signal sockets, possibly causing damage.

As indicated earlier, the actual control function is initiated by a supersonic tone radiated from a self-contained hand-held wand and picked up by a microphone located behind the grille on the face of the Stereo Commander. The manufacturers claim that the system will operate over distances up to about six metres and up to about 45 degrees off axis. The effective control distance can be extended by using an external pick-up microphone plugged into the rear of the main unit.

The system appeared to operate quite smoothly, giving an ample variation in level and introducing negligible loss in the signal path at its maximum setting. The design assumes that the signals passing through it will be within the range 50-200mV, at which level THD is likely to fall within the range 0.1 to 0.2 per cent.

Further information can be obtained from the manufacturers at the address given above. The Stereo Commander can be obtained direct from the manufacturers for $89 retail, plus postage and packing.



"Marantz let me build the speakers I've always wanted to build."

Ed May, Vice President Speaker Engineering for Marantz

Over the past twenty years Ed May has firmly established himself as one of the industry's top experts on speaker systems. Formerly the manager of speaker engineering for JBL, Mr. May has personally been responsible for many of the advances in speaker technology. As the new director of Marantz Speaker Development we asked him to comment on the new Marantz Speaker line.

"Since joining Marantz I've never been turned down on anything I've wanted to do to improve quality. When it comes to quality, cost is no object."

"Our new Marantz speaker line is one of the top lines in the industry. The reproduction capability of our speakers can equal or out perform speakers that cost two to three times the price."

"We don't follow fads. We stay away from frivolous things that only increase the price tag without increasing performance."

"Our toughest critics are ourselves. Many of the things we measure and test for are seldom encountered in the field."

"My philosophy is to build the speaker so it reproduces all frequencies as smooth, as flat as possible in all angles of radiation. No matter where you sit you hear exactly the same sound."

"I'm very proud of our new Marantz speaker line. It's what I've always wanted to build. My hat is off to Marantz for letting me do it."

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For Brochures contact — **Marantz Company, PO Box 604, Brookvale, NSW 2100**
Marantz Company is a trading division of Superscope (Australasia) Pty Ltd

B&W DM-7 loudspeaker

The B&W DM7 is a 40 litre 3-unit system which entails the results of B&W's computer-aided research into linear phase and transient response. Features include an unusual top-mounted tweeter and a frequency response selector.

Over the past few years, B&W Loudspeakers Ltd has certainly produced some weird-looking loudspeaker systems. The latest in the line, the DM7 is no less unconventional but has a certain elegance in its styling.

These subjective reactions apart, the DM7 is a massive unit in spite of its modest enclosure volume of approximately 40 litres. Outside dimensions of the enclosure, including the removeable grill, are 270 x 650 x 380mm (W x H x D). Adding to the impression of mass, the enclosure is raised 190mm by a cylindrical stand. Mass of the unit is 30kg.

Perhaps the most unusual feature of the DM7 is the tweeter which is mounted, like a pimple on a pumpkin, on the satin-finished aluminium top surface of the enclosure. One or two other manufacturers have used this method to compensate for time-delay effects without the need for a complex stepped baffle. B&W give a further rationale and refinement of the idea. They claim that a baffle-mounted dome tweeter "produces a strong standing-wave pattern which deteriorates both the amplitude and phase characteristics of an otherwise good unit". B&W term their new tweeter a spheroidal unit. Presumably this is because it has a dome diaphragm and a roughly spherical housing. The tweeter has a mesh cover over the dome and a further mesh shield over the whole unit.

The woofer is similar in appearance to the midrange unit of the DM6 model, reviewed in these pages in August 1976. It has a curvilinear cone with an effective diameter of 140mm, woven from synthetic fibre. It is a rugged unit with a large magnet structure. Below 100Hz, the response is augmented by a passive radiator.

Crossover from woofer to tweeter is at 3kHz, performed by a 13 element LCR network. All the capacitors are moulded polyester units instead of electrolytics. The complication added by the Contour selector control means that the crossover PC board is quite large, occupying the entire bottom panel of the enclosure.

The cabinet is made from veneered particle board lined with 12mm thick bituminous anti-resonance panels. As well, the enclosure is lined with thick foam. It is available finished in white, teak, walnut, rosewood or black ash veneer. The grille cloth is black.

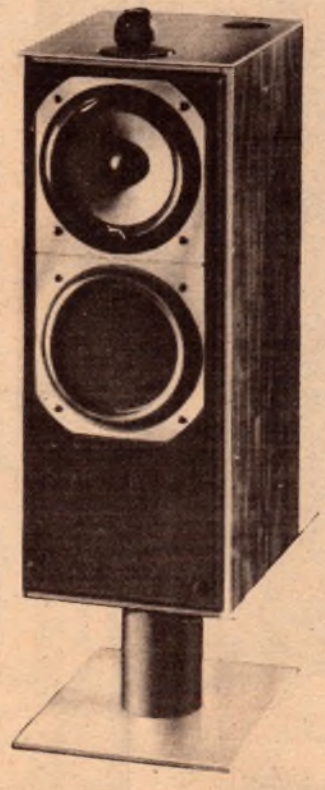
Besides a flat frequency response setting, the Contour selector will provide modest cut below 150Hz, modest cut above 3kHz or a combination of these two effects. In a good listening room, the flat setting should provide the most natural result, but smaller rooms with hard reflecting surfaces will require one of the other settings.

Frequency response of the system is quoted as 70Hz to 20kHz ±2dB and with -3dB at 50Hz. This is the tightest specification we have seen to date and we can testify that the DM7 is very smooth indeed, over the whole range.

The impedance modulus of the system is above eight ohms for the whole frequency range, so it should not present loading problems to most amplifiers. Recommended minimum amplifier power rating is 50 watts per channel and the unit will safely accept full program drive from amplifiers up tl 200 watts per channel. The DM7 is protected against overdrive by fuses.

In spite of the worth of their engineering, which should be self-evident to most potential buyers, B&W are not above resorting to hyperbole in selling their product. For example, we were intrigued to read that the drivers, cabinet and grille were all "purpose designed". This presumably means that they were not adapted from packing cases built to transport parts for the Leyland P76!

Seriously, though, our overall reaction to the B&W DM7's is very favourable. They give excellent reproduction of all types of program, and are likely to set a standard for many years to come. The catch is that they are not inexpensive, at a recommended retail price of $1059 per pair.



The B&W DM7 is available from selected high fidelity retailers throughout Australia. Alternatively, further information can be obtained from the Australian distributors of B&W loudspeaker systems, Convoy International Pty Ltd, 4 Dowling Street, Woolloomooloo, NSW 2011. (L.D.S.)

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The DM4 is a 3-unit monitor loudspeaker system that produces high quality results from an incredibly small cabinet (20.8 litres) making it perfect for home or small studio use where space is at a minimum.

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A compact 3-speaker system for flats and home units:

BUILD OUR NEW 3-26L PLAYMASTER

Described here is a companion loudspeaker system to our earlier 3-75L and 3-53L models. Designated as the 3-26L, it caters for those who may want a more compact and less expensive system but one which, at the same time, offers a high standard of performance, appropriate for serious listening.

by NEVILLE WILLIAMS

The original 3-75L system (3 drivers, 75 litres) was described exactly 12 months ago, in the May 1977 issue. It has been extremely successful since then and has sold in large numbers both in kit form and ready built.

At the time, most of our earlier do-it-yourself loudspeaker systems had fallen by the wayside, mainly because of the uncertain supply of locally made drivers. After a certain amount of hassle, we settled on a 3-driver kit marketed in Japan under the Nisco label — drivers which look remarkably like some of those we have seen in the big-name Japanese brands. They were imported for the project by the Dick Smith organisation, along with a pre-assembled crossover network and a pair of constant impedance fader pads for the mid and high range drivers.

We made the point at the time that other suppliers could purchase the units through D. S. Distributors or could import them direct, and we understand that both options have been exercised freely.

The 3-53L system followed in the June issue, using the same tweeter and squawker but a 25cm woofer and a 53 litre sealed enclosure. In the article, we stressed that the smaller drivers had a margin of sensitivity over the woofer and recommended use of, either the constant impedance pads, or fixed resistors of specified value to balance the overall response.

During the past few months, a strong demand has built up for something smaller and cheaper again, to suit the needs of listeners in flats and home units — but it had to be a 3-speaker system and it had to offer the best possible sound for the money!

Resulting inquiries finally brought to light a complete pre-packaged Nisco system containing two 20cm woofers, two squawkers, two tweeters and two simple crossover networks. The latter are ready fitted with leads and spade connectors and permit immediate and easy assembly.

As a packaged system, the price was certainly right, but what about the performance?

Since the bass response would depend heavily on the size of the enclosure, our first reaction was to specify something fairly generous but the result looked altogether too bulky for what was intended to be a compact system. So we had to reverse our approach and settle for dimensions more in line with user expectations, optimising the sound balance thereafter.

Another important aspect had to do with timber cutting sizes. Considerable economies, can result from nominating panel sizes which can be cut without waste from standard metric sheets, particularly if the modern fold-together method of assembly is to be used.

An enclosure to the dimensions shown in the accompanying diagram meets the basic requirements: it looks compact and well proportioned, it uses materials economically and it offers adequate, if not thunderous bass.

That aspect settled, we foresaw problems with overall balance. If the earlier Nisco tweeters and squawkers had too much sensitivity for the 30cm and 25cm woofers, it was a safe bet that they would have an even greater lead on the 20cm woofer, if simply fed through the network supplied.

This indeed turned out to be the case, with the mid frequencies overshadowing everything else. Closer examination showed that this was caused not only by the high sensitivity of the mid-frequency "squawker", but by the fact that the woofer itself had plenty of output over this region, unrestrained by any kind of inductor in the divider network.

If it had been a purely technical exercise, we might simply have discarded the crossover network supplied and specified something more pretentious — but that would have been the surest way to push the cost out through the ceiling! What we clearly had to do was to use the network supplied but supplement it with extra bits, as necessary.

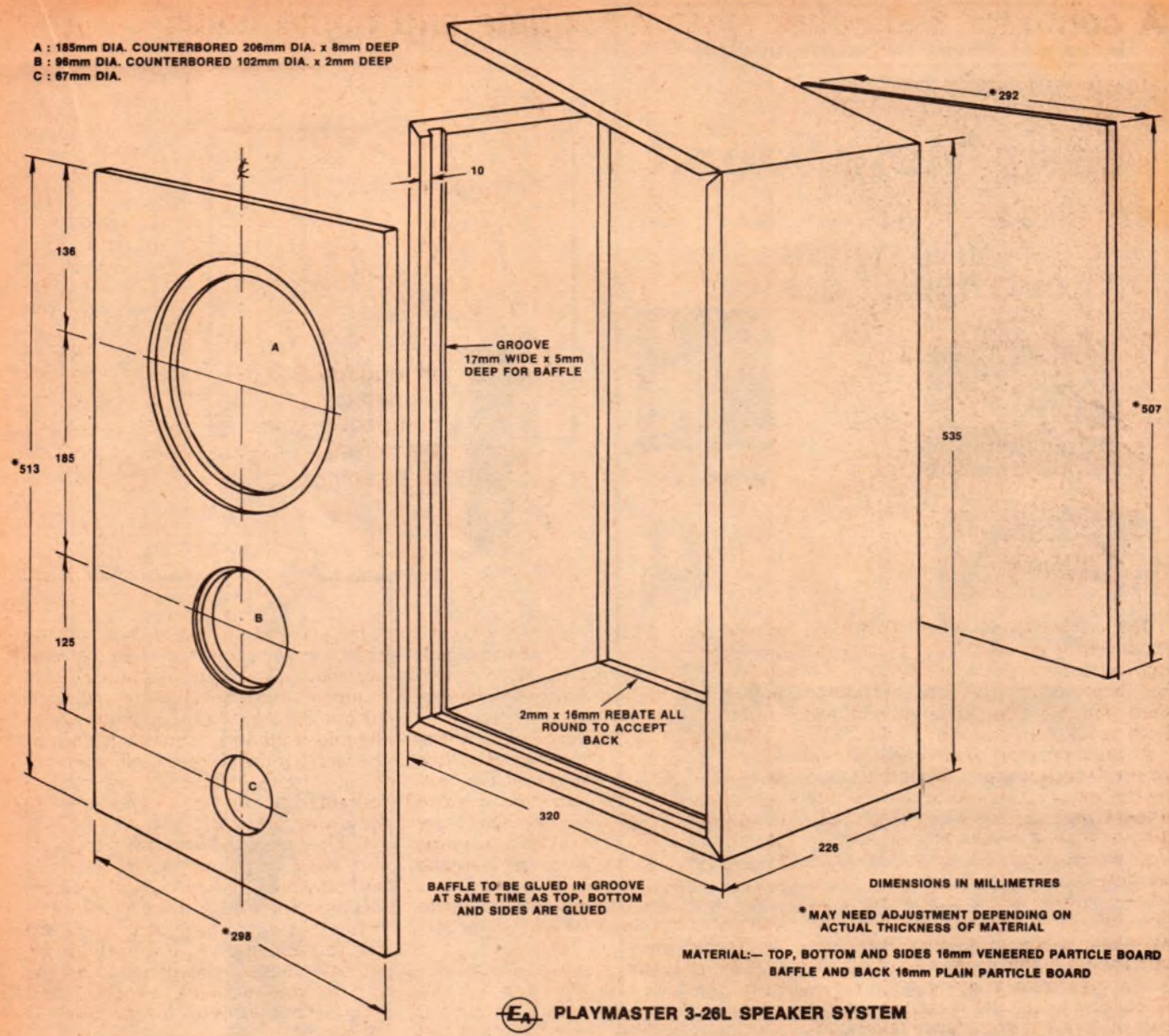
So we have specified an 0.7mH inductor in series with the woofer to restrain its output in the mid-range. The inductor is actually the same component as used in this position in the crossover supplied with the 3-75L and 3-53L systems. Dick Smith Electronics are arranging to import supplies of this inductor for those wanting to build the 3-26L.

Alternatively, it can be hand-wound and we repeat the specifications given in the June 1977 issue: make up a non-metallic bobbin with a 25mm diameter centre and 50mm cheeks 20mm apart. Wind on 165 turns of 18B&S or 19SWG for an inductance of about 0.7mH.

For a stereo system you will need two such inductors.

To attenuate the output from the other drivers, we suggest purchasing four 15-ohm resistors of not less than 3W dissipation and four 4.7-ohm resistors of not less than 1W dissipation. These should be adequate for the average situation but higher wattage types may be desirable if you anticipate

Above: A front view of the prototype 3-26L Playmaster system, which offers excellent performance, while economising in both cost and space. In a fully finished unit the drivers would be covered by an acoustically transparent foam grille, as in the larger systems.



PLAYMASTER 3-26L SPEAKER SYSTEM

The above drawing shows dimensional details of the 3-26L enclosure, as designed for fold-around assembly. It is drawn in the upside-down position in which it is assembled; when turned the right way up, the join is at the bottom, on the carpet, and the tweeter is at the top. Other more conventional methods of construction can be used, if working from raw materials, and the individual dimensions can be varied, provided the effective internal volume is not decreased. The enclosure must be airtight.

running the systems at a high level for prolonged periods.

An accompanying diagram shows the content of, and connections to, the basic crossover network, plus the additional components we regard as essential for well balanced sound.

With 15 ohms in series and 4.7 ohms in shunt, the mid-range driver is cut back drastically but the total output of woofer and squawker is still ample.

The resistors are used the other way round in the tweeter circuit, giving much less attenuation for optimum balance.

Incidentally, the inductor in shunt with the tweeter, which we measured at 0.6mH, is part of the crossover network supplied. If, for any reason, you wanted to wind one up, the required inductance would be given by about 83 turns of the same wire on the bobbin specified earlier.

For those with ordinary soldering skills and facilities, the addition of the extra components will not involve any great hassle. The woofer series inductor can be clamped in some way to the baffle and wired in series with the active lead. The resistors can be attached either to the respective drivers or to the lugs on the network or, better still, assembled on a seperate strip of tagboard. Where they mount physically is not important, provided they are firmly anchored and in the correct position in the electrical circuit.

For those who prefer not to get involved in soldering, etc., we gather that Dick Smith Electronics will be providing a sub-assembly which will permit push-on connections to the loudspeakers and the original crossover network.

While this might seem to add up to a lot of "fiddling" with the original kit, our clear objective was to achieve a general behaviour commensurate with the larger units in the series — and this we have achieved.

Sensitivity is virtually the same and, while the power handling capability would obviously be less, it should be well suited to the domestic scene with any amplifier having a power rating of around 10 to 25 watts per channel. Typical of such compact systems, it lacks the bottom octave around 40Hz and may therefore not be a prime choice for classical organ fans. But, on ordinary program material, there is no sense of inadequate bass, and there is plenty of everything else.

The middles are prominent enough to give the kind of "presence" that

THE PLAYMASTER 3-26L SYSTEM

Assembly of the enclosure is simplicity itself. With the grooves and baffle edges wetted with glue, fold the sides top and bottom around the baffle as shown, with what will be the top resting on the floor.

Being careful not to stretch or fracture the surface coating, bring the edges of the bottom and side firmly together. Wipe off any surplus glue, secure with adhesive tape and leave overnight to set.

many like, while the top end is well sustained — and better than the average pair of adult ears!

The enclosure pictured at the head of this article was a prototype, supplied ready built by the cabinet maker, and we therefore cannot offer instructions on the basis of "this is how we put it together". However, the cabinet kit which will be offered through the Dick Smith organisation (and possibly others) will almost certainly be along the same lines as those for the earlier (and larger) 3-75L and 3-53L systems. For the sake of completeness, therefore, we summarise those instructions on how to proceed:

In the now popular fold-over type of enclosure kit, you will find that the sides, top and bottom have been made from a single strip of pre-surfaced particle board. Ninety-degree grooves have been milled where the joints will be, leaving the segments held together only by the timber-grained surface finish. An additional rectangular groove is milled to take the front baffle, and a shallow rebate to take the rear panel as a final step in the assembly When adhesive in run into the grooves and the sides, top and bottom are folded around the baffle, as illustrated on these pages, a potentially airtight enclosure is formed.

(These days, most commercial loudspeaker enclosures and, indeed, most TV console cabinets are made in this fashion.)

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Before starting, make sure that you have available a large tube of PVC adhesive ("Aquadhere" is fine), some adhesive tape, a clear space on the floor covered with paper (in case you spill some glue) and a scrap of clean cloth to wipe off any surplus.

Open the cabinet timbers full length on the floor and stand the baffle, tweeter end down, in what will ultimately be the top of the enclosure. The idea is that, when the panels are folded around it, the join where the two outer ends meet will be at the bottom. Remember also that the rebated side of the baffle is the front face.

Having worked out how everything will fit together, put the baffle aside and apply adhesive to all the 45-degree surfaces and to all surfaces of the rectangular slot for the baffle. Apply enough adhesive so that, when spread with a finger, it will wet all surfaces evenly. Wet the butt edges of the baffle all round and run a thin extra line of glue in the bottom of each V and in the rectangular groove.

This done, slip the baffle into position, tweeter end down and rebated face to the front, without pushing it too hard into the groove. Now fold the sides and bottom carefully up around it, allowing the baffle to slip into its natural position, without straining either "hinge". Bump the panels into place with the ball of the hand, bringing the two free edges tightly together. Hold them in this position with as many strips of adhesive tape as seem necessary.

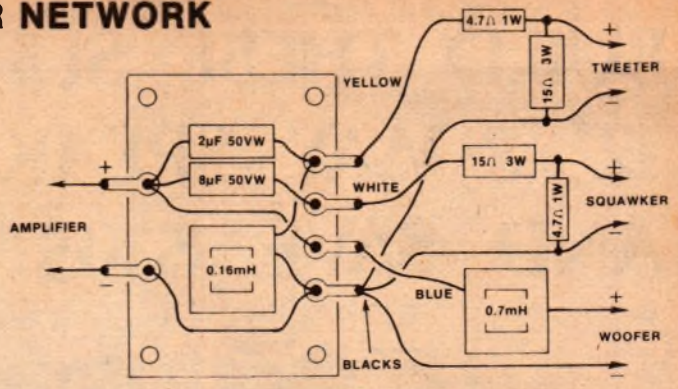
Wipe away the surplus adhesive and put the enclosure aside overnight for the joints to set hard. The second enclosure can be assembled in a similar manner.

The next logical operation is to mount the drivers — a job that calls for

Fixing the drivers in position calls for care: don't damage the cones and don't fracture the edges of the cutouts by using over-large screws or failing to drill pilot holes. The drivers must be bedded down against some kind of sealing material.

CROSSOVER NETWORK

While it is logical to use the network which comes with the driver kit, it leaves too much emphasis on the middle register. The additional components are essential to the design. Nominal impedance is 8 ohms.



care, if you are not going to end up with a finger or the tip of a screwdriver through a cone!

With the enclosure on its back, position each of the three drivers and make sure that they rest snugly against the surface of the baffle. If they don't, dress the hole with a file until they do. go easy, however, because each of the drivers will ultimately have to be sealed into position. This done, line up the holes for the sake of neatness, mark their positions with a soft pencil and put the drivers safely aside.

The simplest way to secure the drivers is with flat-headed self-tapping screws of appropriate diameter and length. However, don't try to drive them straight into the particle board or you may fracture the edges of the cutouts. Drill a suitable pilot hole for each, angling it, if anything, slightly away from the cutout.

It is absolutely essential that the drivers make an airtight seal against the face of the baffle. An elegant method of sealing, applicable to the woofer and tweeter, is to affix a gasket to the face of the baffle made from adhesive backed foam (eg Engels no. 5C draught excluder, sold by hardware stores).

Lay the drivers in position and poke a hole through the gasket where the screws go through. Then insert the screws, tightening them just sufficiently to compress the foam. Too much pressure and you'll collapse the threads in the particle board.

Sealing the squawker is a little more difficult, because of its shape, but it can also be done with a layer of adhesive foam, given a little extra care.

As an alternative to the adhesive foam, the drivers can be bedded down against a ring of soft, non-hardening caulking compound. The art in using this is to apply it as a "string", rather than in lumps, so that it squeezes out evenly under pressure. Particularly in the case of the squawker, it can also be worked into the crevice from the rear, rather like plasticine.

Now move to the rear of the cabinet and install the wiring as per suggestions earlier. Be particularly careful that you identify the "plus" leads on the drivers (stamped + or a red washer under the lug) and on the main input terminal strip (red spot). Make all other connections as shown in the diagram. Watch this carefully and the phasing of your stereo pair will be correct.

Exactly where the crossover network and other components are placed is not critical, as long as they are rigidly mounted and connected correctly into the circuit. Attached to the rear of the baffle is probably as good a place as any.

A certain amount of damping material is desirable inside the cabinet, but not too much in this case. We suggest a strip of Innerbond about 30cm wide and about 110cm long. Double it over and, with drawing pins, suspend it as a double curtain from the top of the enclosure, so that it hangs down behind the drivers, resting against the sides and the bottom and dividing the enclosure roughly into two compartments.

This done, the back can be inserted and glued in position— a rather final act because, thereafter, any future access to the enclosure will have to be gained through the loudspeaker holes.

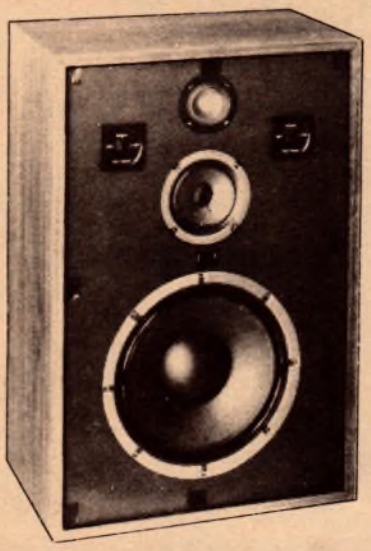
Because the access through a small woofer hole is limited, and because we thought we may want to experiment further with the system at some future date, we went to a little extra trouble: we fitted internal cleats right around, in line with the rear rebate, added a gasket of adhesive foam and screwed the back into position. Knowing we were going to do this, we also used bolts and nuts to secure the drivers, rather than the self-tappers.

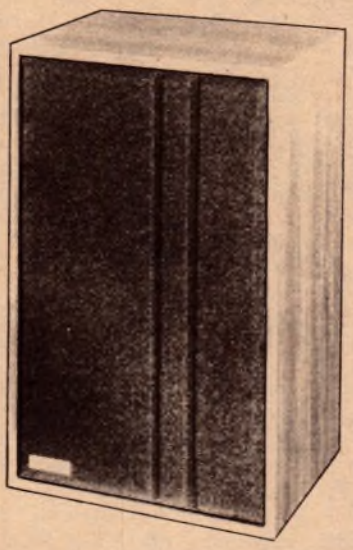
However, assuming that you follow the simpler course, lay the enclosure face down and wet the entire rebated surface with PVC adhesive, without leaving any surplus behind. Also wet the edges of the rear panel and press it into position. For good measure run a thin line of adhesive around the space between the two, leaving the enclosure face down until the adhesive has hardened.

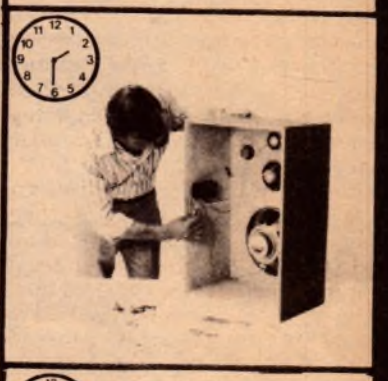
Finally, stand your enclosure the right way up, wipe off any signs of your toil, press the foam grille into place and the job is done.

All that remains is for you to sit back and enjoy the results of your handiwork — and we think you'll do just that. The 3-26L looks fine and sounds fine and the money you'll save on its commercial equivalents will be money you can spend on records and tapes!

BUILD THESE SUPERB PLAYMASTER 12" 3-WAY SPEAKERS IN 2 HOURS AND SAVE $105







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Impedance:	8 ohms	8 ohms
Sensitivity:	93 dB	92 dB
Power Rating:	80 watts music	60 watts music
Crossover:	3-way (1500Hz & 5000Hz)	3-way (1500Hz & 5000Hz)
Dimensions:	71.7(H)x47.5(W)x29.3(D) cm	62.0(H)x39.3(W)x29.3(D) cm

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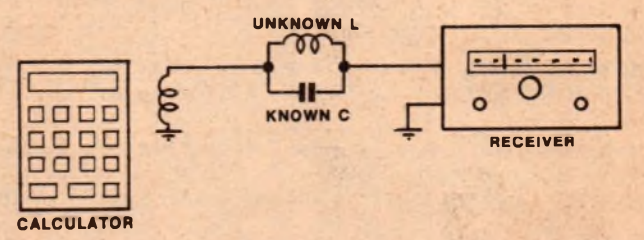
Interesting circuit ideas and design notes selected from technical literature, reader contributions and staff jottings. As they have not necessarily been tested in our laboratory, responsibility cannot be accepted. Your contributions are welcome, and will be paid for if used.

Finding capacitance using an AM receiver and RF noise

The value of an unknown microhenry inductor, including toroids, or of a picofarad range capacitor can be determined accurately using the broad spectrum of RF noise generated by a calculator's interrupted LED readout, feeding an AM radio's antenna input through a parrallel LC filter having one element already known. The receiver is tuned for minimum noise with the calculator loosley coupled to a 1- or 2-turn pickup loop, and the audio gain set high in order to reduce the automatic gain feedback compensation.



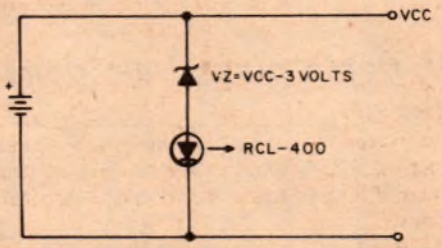
Alternatively, the needle of an S-meter on the receiver can be observed, or the AGC voltage level can be monitored to find the frequency blocked by the LC filter resonance. The Q factor can be estimated from the sharpness of the null. There is no problem from broadcast transmitter interference at poor reception locations inside steel-framed buildings.

(By James F. Wilkins, 6215 Lone Oak Drive, Bethesda, Maryland, USA.)

Battery voltage monitor uses only two components

A device introduced by Litronix, Inc., has wide application as a voltage monitor in all types of battery-operated equipment. The RCL-400 Battery Status Indicator is a current-controlled LED which has a voltage sensing integrated circuit incorporated into a small LED package.

The only additional circuit component necessary to build a voltage monitor is a suitable zener diode, or string of forward-biased diodes, to bring the device into its normal operating range. The RCL-400 is designed to turn on at 3V and off at 2V. Thus normal operation can be provided by selecting $Vz = Vcc - 3V$. When Vcc drops to Vz + 2V, the LED is switched off by the internal IC voltage sensing circuit to give



a low voltage indication. Since the device has a relatively constant current demand in the on region (about 10mA), the zener power rating need only be 250mW for most battery-powered equipment. One precaution is necessary. You must be sure that the voltage across the LED does not exceed 5V (its maximum rating).

For low voltage IC circuits using a nominal 4.5V battery, the required value of Vz is only 1.5V. It is easy to obtain this value by simply substituting a pair of silicon diodes in series with the LED.

(By Stuart W. Hawkinson, in "73".)

Editorial note. We have checked with the Australian representatives regarding the availability of the RLC-400. This particular type is not available but the RLC-410 is available. The only difference seems to be that where the RLC-400 off voltage is 2V, it is 2.4V for the RLC-410. Supplies of the latter should be available through Silicon Valley, 23 Chandos Street, St Leonards, NSW 2065.

Hunting RF noise with a grid dipper

Noise external to receiving equipment can sometimes be difficult to pinpoint. A spectrum analyzer is beyond the reach of most amateurs. Here is a cheap substitute that has been proven.

Some time ago man-made interference was tearing up communications across a wide spectrum, seriously upsetting some military operations. Engineers tried to solve this with a spectrum analyzer and failed. As radio amateurs, a friend and I were asked if we could solve the problem. I devised the idea of using my grid dip oscillator and a CRO. The CRO was connected to the internal dipper diode and ground.

At 2MHz there was plenty of grass when the dipper coil was placed near any building wiring. Reducing the CRO sensitivity, the grass was barely noticeable. We probed around. It didn't take long to locate a relay used for aircraft obstruction lights that was defective.

Any battery operated dipper can be used. It can be hooked up to the audio section of a battery operated portable radio. Make sure the dipper switch is in the diode position, so it is being used as a field strength meter. To hook the dipper up, solder one wire to the output side of the dipper diode and the other wire to ground. These wires go either to the CRO vertical input or, in the case of a radio, to the volume control.

Tuning the dipper to harmonics, hunting parasitics, or debugging a transmitter is easy too, since the CRO gives an excellent visual display.

(By John P. Dieringer, W6RVP, in "73".)

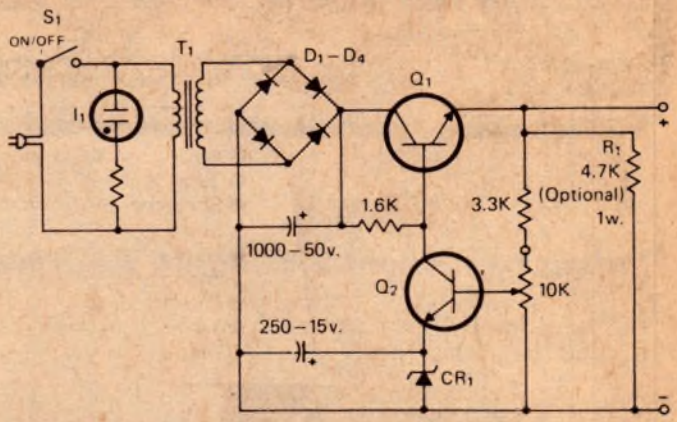
Low voltage power supply is short-circuit proof

This little power supply is virtually short-circuit proof, handy and cheap. It supplies a regulated output of up to 500mA between 6 and 30 volts and current limits itself at about 1A. It can supply lower voltages (down to about 2.5V) if the proper zener diode is selected. To determine the proper zener voltage rating subtract one volt from the desired minimum voltage. Thus, for a 6V bottom limit the zener would be 5V.

To improve regulation at low current levels, R1 (4.7k 1W) should be added to the circuit as shown. This is optional.

Transformer T1 should have a secondary winding of 24V at 0.5A. I1 is a 240V neon lamp and the rectifier diodes should be rated at 1A and need only be 50PIV types. Q1 may be any NPN power transistor rated at 15 watts or more, such as the 2N3055. Q2 is a 2N697 or similar.

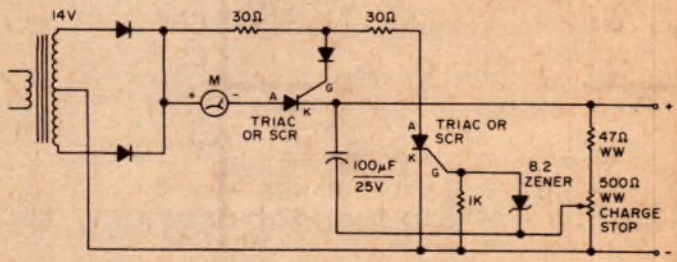
(By Jim Huffman, WA7SCB, in "CQ".)



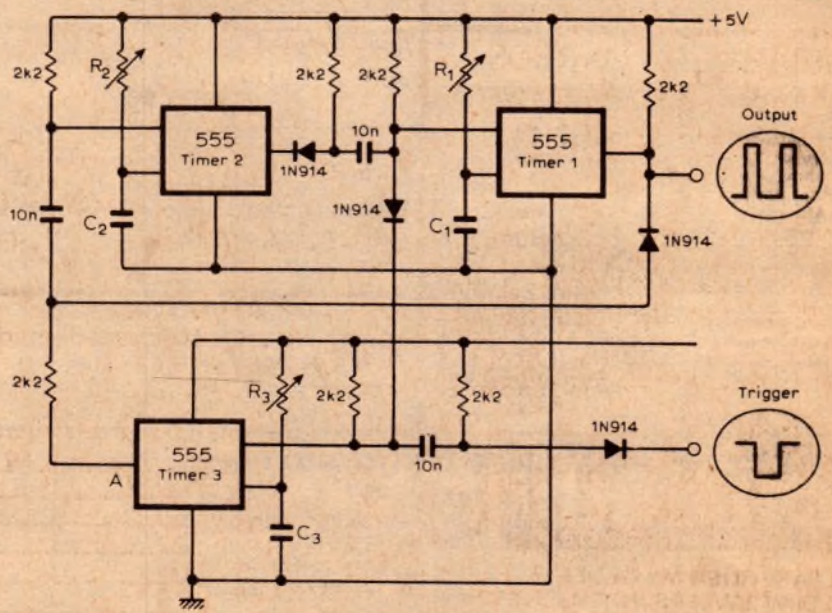
Simple 12V battery charger has automatic shutoff

This automatic shutoff battery charger will not dry out batteries by overcharging. It should be adjusted by setting the 500 ohm potentiometer while it is connected to a fully charged battery.

(From "73".)



Variable pulse train generator



The circuit shown will generate a pulse train in which the pulse duration, pulse interval, and number of pulses can be varied independently by setting the time-constants R1C1, R2C2 and R3C3, respectively.

When a negative-going trigger pulse is applied, timers 1 and 3 are activated. With A high, T2 is triggered at the end of T1 timing interval, and T1 is triggered at the end of T2 timing interval. A train of pulses is generated at the output. When A goes low at the end of T3 timing interval, T2 can no longer be triggered by T1. The pulse train ends when T1 completes its last timing cycle.

(By Dr N. H. Sabah, in "Wireless World".)

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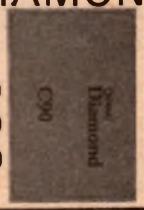

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A low-cost 3MHz frequency counter

This little frequency counter is of basic design and uses a minimum of components, thus keeping down the initial cost. At the same time, it is capable of good performance and should meet the needs of many readers who do not want the ultimate in accuracy or high frequency capability. In any case its shortcomings can be considerably improved by adding circuitry if required.

by IAN POGSON

In Circuit & Design Ideas for June 1977, we included an item describing a simple frequency counter using CMOS devices taken originally from a short item by Lloyd F. Botway, in "Electronics" for 16th September, 1976. The basic idea appealed to me and I thought that it would be worthwhile "dressing it up" and making a full construction project.

A quick mock-up of the basic circuit and some tests showed that it would be worthwhile pursuing to a logical conclusion. Looking at the circuit, a number of questions arose. How many digits would we use? Would we retain the suggested astable multivibrator timebase, or would we provide some other arrangement? Also an input preamplifier would be needed, together with a suitable power supply.

In considering the astable multivibrator, it was set up and it worked quite well. However, the stability and accuracy of the unit would only be modest and furthermore, its frequency would generally have to be set by making the counter read correctly a known incoming frequency.

After some consideration, I decided that it would be better to use the 50Hz mains frequency as the timebase, thus eliminating the need for calibration. True, this would mean accepting the fact that the mains frequency constantly drifts slightly about the mean of 50Hz, so that the accuracy of the timebase would be only about 0.5 per cent. However, this is not a serious shortcoming for many general-purpose frequencies. In any case the instrument could be provided with an external timebase jack, so that a better timebase could be used if available.

The original timebase had a period of 20ms, with 10ms for counting and 10ms for display. The 10ms counting means that we have a count with a resolution of 100Hz. Also, the rapid switching of the short intervals gives a LED readout which appears to be on continually. This feature would be retained, but the question arose as to whether the resolution should be brought to 10Hz and possibly even to 1Hz. This could be provided by adding two decade dividers.

Provision for external timebase and 5-digit readout are features of the design.

The 1Hz resolution would mean that there would be counting and display times each of 1s, which is also quite satisfactory. However, with the intermediate resolution of 10Hz, the counting and display times would each be 100ms, resulting in "blinking" of the readout LEDs. This was considered to be objectionable by the original author. However, I tried it and while the blinking is very much in evidence, I considered that it would be worthwhile including it, as it only entailed an extra switch position.

As it was considered worthwhile to take the resolution right down to 1Hz, it naturally followed that it would be desirable to go to a five digit readout.

This left the questions regarding a power supply and a preamplifier to be resolved. A suitable power supply presented no particular problems. A preamplifier could be a problem, as a reasonable amount of gain is required, together with a high input impedance. As this counter is intended to be a simple one, the preamplifier circuit finally adopted is relatively simple, yet it does the job required.

A look at the circuit will reveal just how simple the final counter is. The power supply consists of one of the Ferguson 5VA range of transformers, together with a silicon diode bridge rectifier circuit, a three terminal IC voltage regulator and two electrolytic filter capacitors. This supplies 12V regulated to the whole unit, including the display LEDs.

The output of the bridge rectifier consists of a series of pulses at twice the mains frequency, or 100Hz. In order to

retain these pulses, which would otherwise be severely reduced in amplitude by the first filter capacitor, an isolating silicon diode is added between the output of the rectifier and the first filter capacitor. The pulses are taken off via a voltage divider consisting of a 1.8k and a 10k resistor in series. The junction gives a voltage suitable to drive a Schmitt trigger.

A .01uF capacitor is shunted across the 10k resistor and its purpose is to filter off any spikes which may find their way in via the mains and which may otherwise upset the smooth flow of pulses feeding the Schmitt trigger. As a further precaution, a small signal silicon diode is added between the input to the Schmitt trigger and the supply rail. This is added to shunt off any spikes which may get past the .01uF capacitor and which may damage the Schmitt trigger.

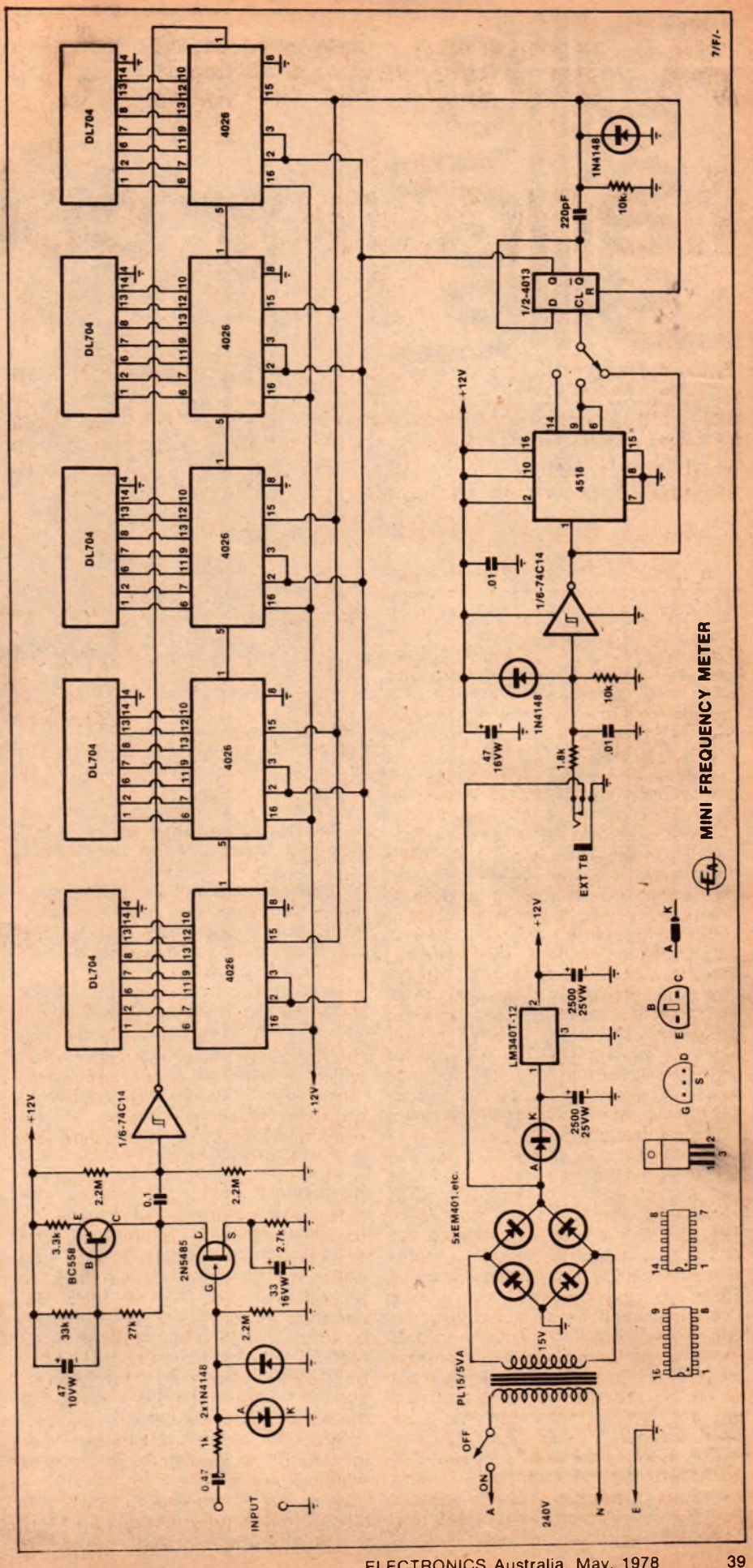
The 100Hz square wave output from the Schmitt trigger is suitable for driving subsequent circuits. For a resolution of 100Hz, we require a waveform such that we can use 10ms for counting and 10ms for display, or a total period of 20ms, which is 50Hz. To achieve this, the output of the Schmitt trigger is fed into one half of a 4013 dual D flip-flop.

To achieve resolutions of 10Hz and 1Hz, we need counting and display periods of 100ms and 1s, respectively. To do this, the output of the Schmitt trigger is fed into a 4518 dual BCD counter. Each section is used to divide by 10, and the rotary switch is used to select the signal straight from the Schmitt trigger, or from one or two decade dividers as required.

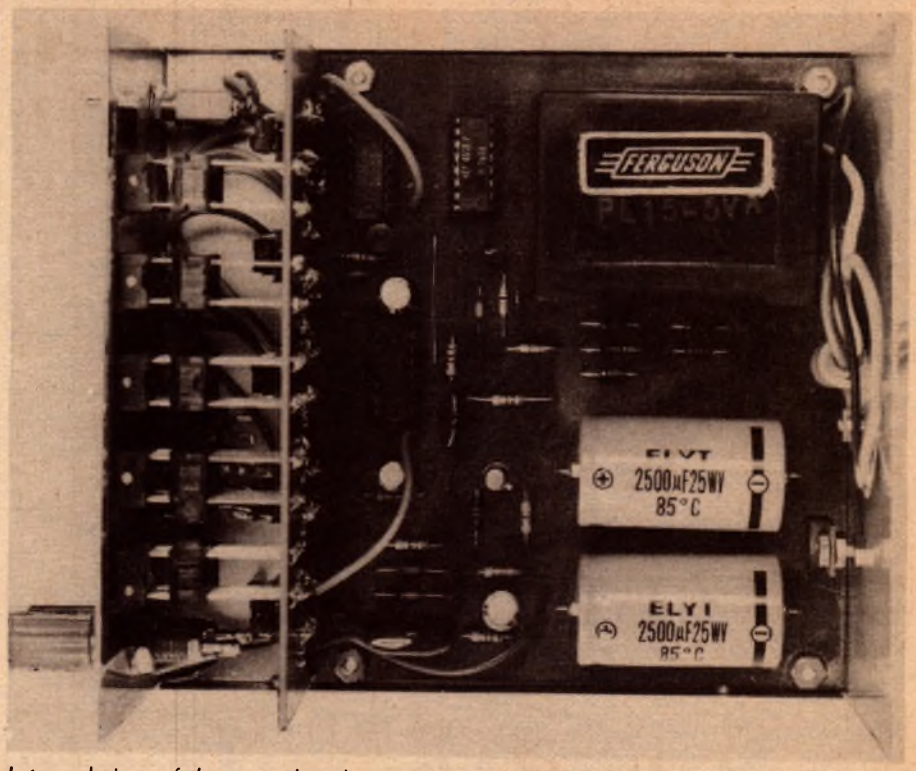
Before the frequency to be measured can be fed into the 4026 decade counter and decoders, it is fed into a preamplifier, followed by a Schmitt trigger. The preamplifier consists of a 2N5485 junction FET, with a PNP bipolar transistor type BC558 as the load for the FET. The input impedance of the preamplifier is high for low level signals but when the signal becomes large enough for the two diodes in the input circuit to clip, then the impedance as seen by the input signal becomes low, limited by the 1k resistor in series with the diodes.

With sufficient input, the signal at the output of the preamplifier is of suitable level to drive the following Schmitt trigger and the output of the Schmitt trigger in turn drives the first 4026 counter and decoder, and so on.

As mentioned earlier, the preamplifier has been kept reasonably simple and as such, has its limitations. The sensitivity of the device at audio frequencies is better than 100mV. The sensitivity is retained into the lower RF range but starts to fall off as higher frequencies are approached. At about 3MHz, the sensitivity has fallen to the point where about 1V is required for a reading. A little above 3MHz is typically the upper limit of the counter as a whole.



Low-cost 3MHz frequency counter



Internal view of the completed prototype. 16-pin DIL sockets with wire-wrap type connections are used as standoffs for the 7-segment LED readouts.

Counting and displaying are controlled in turn from the 4013 flip-flop. When the Q output is low, the clock input of each 4026 is enabled and the counters are operative. At the same time, the displays are disabled. When the Q output goes high, the clock inputs are then disabled and the displays are operative.

At the end of each display period, the Q-bar output is differentiated by C2 and R2 and the resultant pulse resets the counters. The periods used for the foregoing sequence are 20ms for 100Hz resolution, 200ms for 10Hz resolution and 2s for 1Hz resolution.

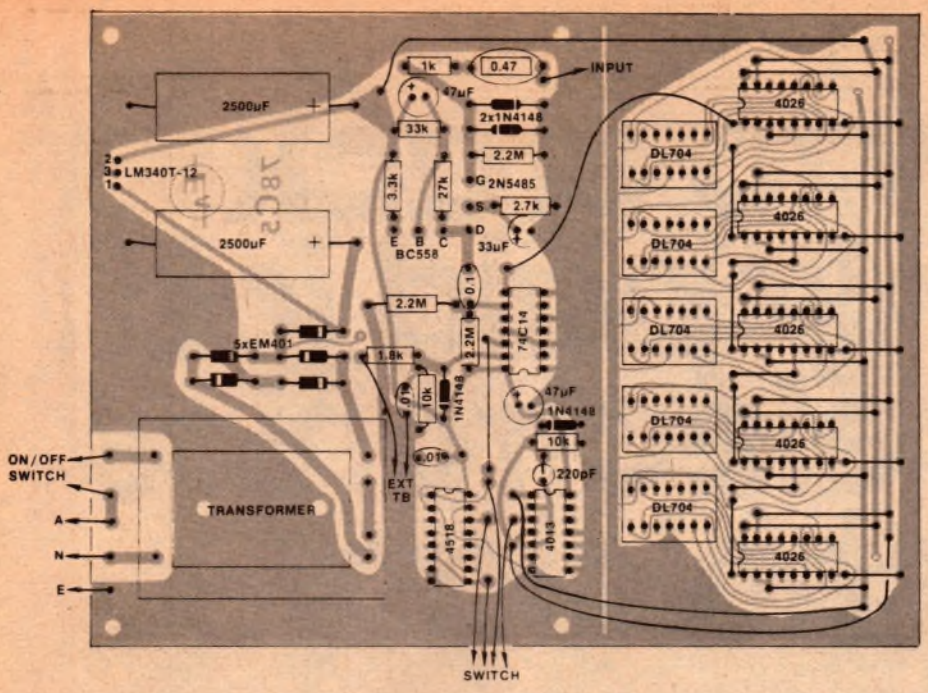
As part of the economy and simplicity of this counter, it will be noted that there are no limiting resistors between the decoders and each segment of the display LEDs. The original designer of the basic circuit commented that resistors were not necessary. It would appear that the source resistance of the decoders is sufficient to limit the current to an acceptable level. Indeed, a random check on a number of segments showed that the current per segment to be about 8mA in each case. This is well within the limits set by the makers of the DL-704 displays.

Intending builders should have no trouble in obtaining all the components to complete the Mini Counter. The box which we used to house the unit is available from Dick Smith Electronics. The printed board was kindly supplied by RCS Radio and supplies should be available from this source as well as from other board makers and various component suppliers. The power transformer is made by Ferguson Transformers and this item should be readily available.

In short, I had no trouble to get all the components to make up the prototype. However, there is just one item which may present a challenge to builders. This is the small piece of red Polaroid film which I used as a window for the five digit display. If the kitset supplier is unable to help with this item, it may be obtained from the Custom Service Division of Polaroid Australia Pty Ltd, Waterloo Road, North Ryde, NSW 2113. The price at the time of writing is 12c per square inch, plus 15 per cent sales tax.

Construction of the Mini Counter is not difficult. Physically, the board and other items have been arranged to fit neatly into one of Dick Smith's "deluxe" metal cases. Readers who wish to use some other box may have to cope with different mechanical problems.

As may be seen from the pictures, the board assembly has been arranged in the form of an "L", with the larger area being used for the horizontal part and the smaller area being vertical. The latter contains the digital displays and the 4026 counter/decoders. By incorporating the displays and counter/decoders together, the



The component overlay pattern shows the PC board from the component side. Separate the main and display boards before mounting components.

problem of many interconnecting leads has been solved. The break caused by joining the two sections of the board at right angles can be readily bridged with only four flying leads.

Although I have just referred to the board assembly being in the form of an "L", this is not the way it comes in the first place. Having obtained a board, you will find that it is in one flat piece, similar to most other boards. There is a line in the form of a slot in the copper pattern, and the board must be carefully cut in two along this line. A hacksaw may be used and the edges touched up with a file after cutting. Be careful not to file off too much. Also, during these operations, considerable care should be taken not to damage the board in any way.

With the board cut into two pieces and before any attempt is made to join them together, each piece should be assembled with its components first. The usual procedure and precautions apply. Be careful not to overheat the components and start off with the smallest components first. There are 27 links on the display board and one on the main board. These are followed with resistors, diodes, and so on and finally the power transformer.

If you elect not to use sockets for the ICs, then it is wise in the case of CMOS devices to connect the barrel of the soldering iron to the earth copper on the board during the soldering process, with a suitable clip lead. The earth and supply pins of each IC should be soldered first. It is also wise to check every joint with a magnifying glass to make sure that there are no dry or faulty joints. This can save a lot of searching later on.

The sockets for the displays have been specified with long leads, so that the displays can be set well off the printed board for mechanical reasons involving items on the front panel of the box. When the sockets are soldered in place, full use should be made of the length of the leads available. Only about 1mm should protrude through the copper to allow for a good soldered joint.

Care should be taken to keep all the sockets square with the board and in line with each other.

With the two pieces of board assembled, leave the displays off the small board for the present. The next job is to solder the two boards together at a right angle. The cut edge of the larger board and the long uncut edge of the smaller board are the two edges to be brought together. The small board is set so that there is between 1mm and 2mm of copper protruding beyond the copper of the larger board. The amount of overlap will be dictated by the row of soldered joints on the small board fouling the edge of the large board.

With the amount of overlap determined, make three spot solder fillets, one at the centre and one near each end. Make sure that the boards are where they will finally be soldered and that they are square with each other. At this stage, it is still easy to unsolder a joint or two and make corrections, as well as bending the joints to make the assembly square. Satisfied that all is well, run a fillet of solder right along, thus making a permanent and strong joint.

The assembly can now be completed by adding the four flying leads between the vertical and horizontal sections. Other leads destined for terminations on the front panel components may be added, either from the copper points underneath the board, or through the holes above the board as convenient. Before the assembly is fitted into the box, it is wise to make a thorough check to make sure that there are no errors. Transistors, electrolytics and diodes should be connected correctly,

PARTS LIST

1 Metal box 134mm wide x 76mm high x 150mm deep
2 Terminals 1-red 1-black
1 Miniature toggle switch SPDT
1 Rotary switch single-pole 3-position
1 3½mm closed circuit jack socket
1 knob
1 Printed board 127mm x 168mm code 78C5
1 Red polaroid film, 4in x 1in, type HRCP/7
1 Power transformer PL15/5VA
1 IC, LM340T-12
1 IC, 4013
1 IC, 4518
1 IC, 74C14
5 ICs, 4026
5 LED displays, DL-704
2 IC sockets, 14-pin DIL (optional)
6 IC sockets, 16-pin DIL (optional)
5 Display sockets, 16-pin DIL with wire-wrap type connections
5 Silicon diodes, EM401 or equivalent
4 Silicon diodes, 1N4148 or similar
1 Transistor, BC558 or equivalent
1 Transistor, 2N5485 or equivalent

RESISTORS (½W)

1 1k	2 10k
1 1.8k	1 27k
1 2.7k	1 33k
1 3.3k	3 2.2M

CAPACITORS
1 220pF polystyrene
2 .01uF 250V greencap
1 0.1uF 250V greencap
1 0.47uF 250V greencap
1 33uF 16VW electrolytic (PCB)
1 47uF 10VW electrolytic (PCB)
1 47uF 16VW electrolytic (PCB)
2 2500uF 25VW electrolytic (axial)

MISCELLANEOUS
Hookup wire, solder, solder lug, rubber grommet, screws, nut, 3-core power flex, 3-pin plug, flex clamp, tinned copper wire for links.

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.

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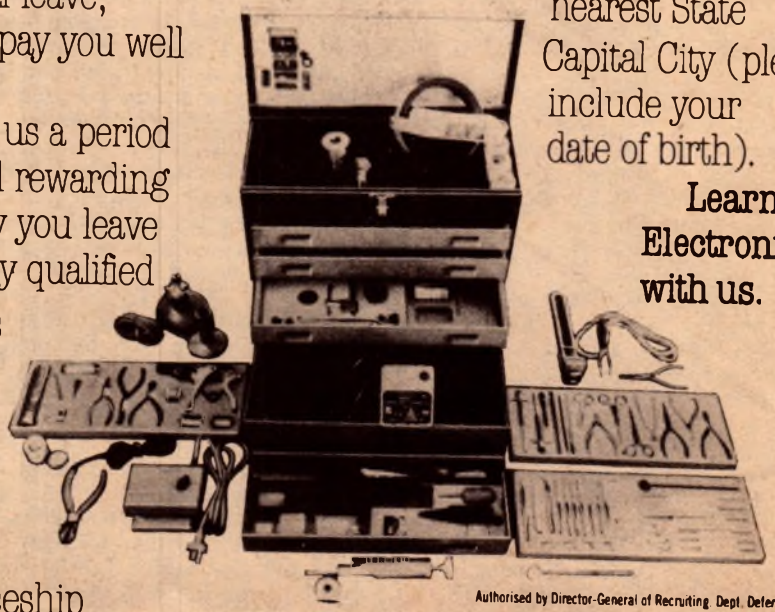

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with nothing omitted and all external leads ready for the next operation.

Fitting the board assembly to the box along with items on the front and back panels is straightforward, but is best done in sequence for convenience. Four holes are needed in the back panel: a large hole for the grommet for the power lead and small holes each for the power lead clamp, earth lug screw and for heat sinking for the voltage regulator.

On the front panel, holes are drilled for the two terminals, the rotary and toggle switches, and the jack socket. The large rectangular cutout for the display window is 82mm x 18mm, with the top edge 6½mm from the top of the panel. Four holes are required on the bottom of the box to mount the board assembly.

Fit the components to the front panel and the rubber grommet to the back panel. Insert the five displays in their sockets, with the decimal points lowermost. The displays are not pushed right into the sockets but rather only far enough so that when the board is fixed into the box, there is a gap of about 2mm between the face of the displays and the back of the panel. Run the power lead through the grommet and terminate the neutral and active leads on the board, and the green earth lead to a solder lug on the back panel. Do not clamp the mains lead at this stage.

Cut off the protruding transformer terminations, and any other protruding leads likely to short to the base of the box. It is also a good idea to add a strip or two of insulation tape to the bottom of the box and underneath the mains terminations as a safety measure. The four leads for the rotary switch should be terminated before fixing the board to the box. The piece of red Polaroid film should be fixed over the window cutout. It may be glued or fixed with some strips of adhesive tape.

The board assembly is fixed to the box with four round head screws, ⅜in long x ⅛in Whitworth, using two extra nuts on each to stand the board off the bottom of the box.

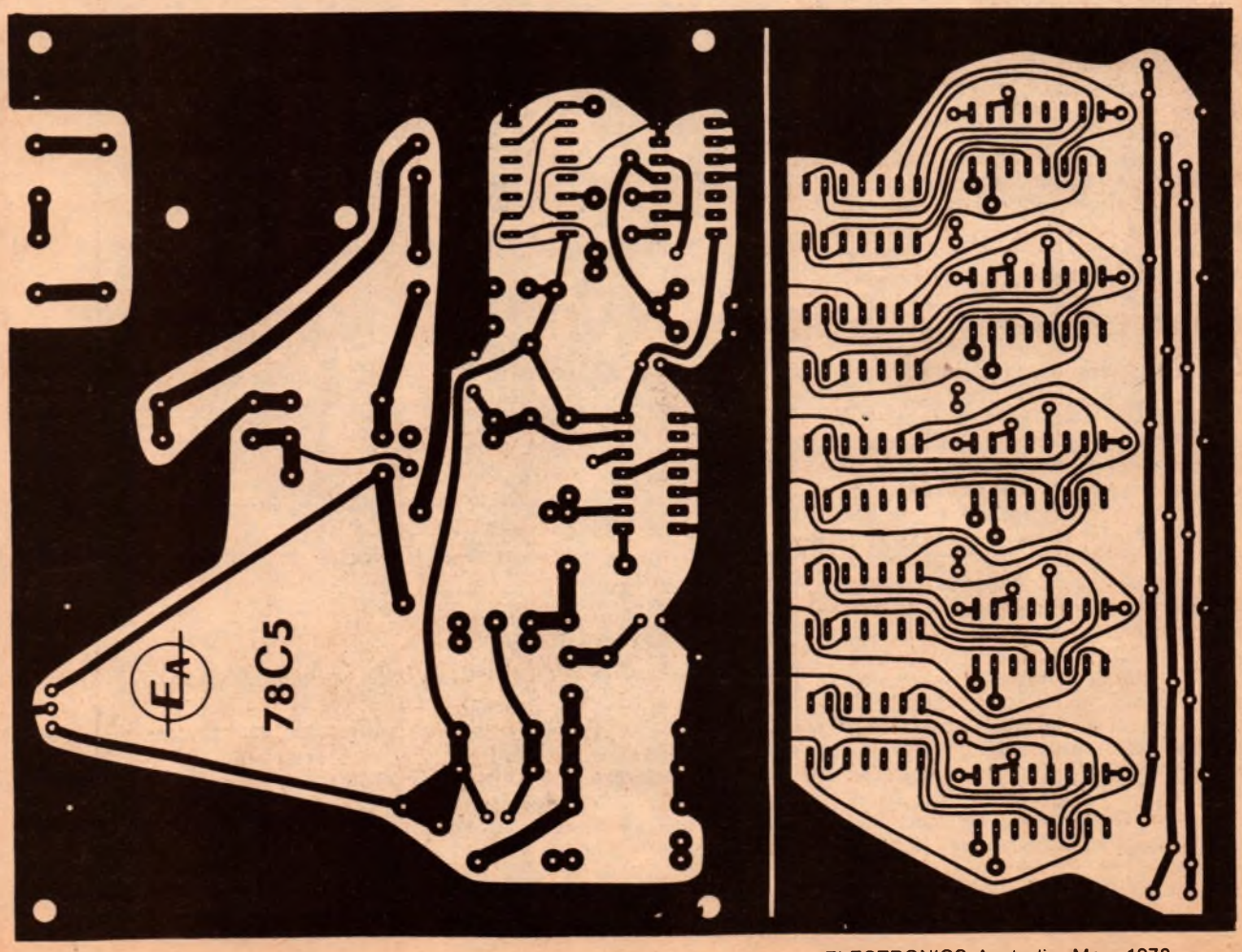
Finishing touches include clamping the mains lead and running a ½in x ⅛in Whitworth RH screw through the back panel to the voltage regulator. There are two nuts between the panel and the regulator, and one on the other side of the regulator. The appropriate leads are then run to the two input terminals, the "External TB" jack socket and the mains on/off switch.

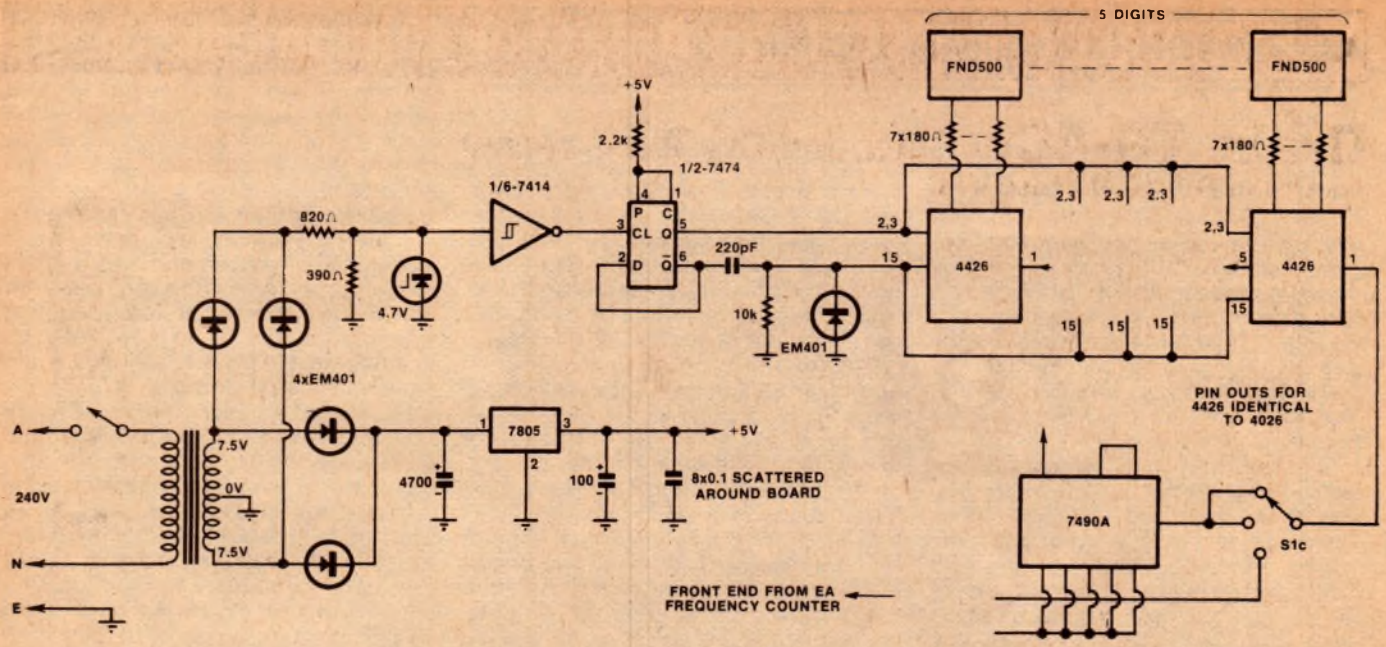
You should now be ready to test the completed counter and make some frequency measurements. As a cross check that all is well it would be a good idea to have a known frequency or two which can be fed in and measured. The signals available from a calibrated audio generator would do nicely.

Having fed a signal in, with the range selector set to "X1" and provided that the frequency has no more than five digits, the answer of say 12345 will be displayed on alternate seconds, being updated in between. Moving the selector switch to "X10" will move all significant figures one place to the right, giving a reading of 01234. The display and update periods are now 100ms each and the display will blink. By moving the selector to "X100", the significant digits will move another place to the right, giving a readout of 00123. At the same time, the periods have been reduced to 10ms each and the readout appears to be continuous.

Apart from any possible instability in

Below is an actual size reproduction of the PC pattern.





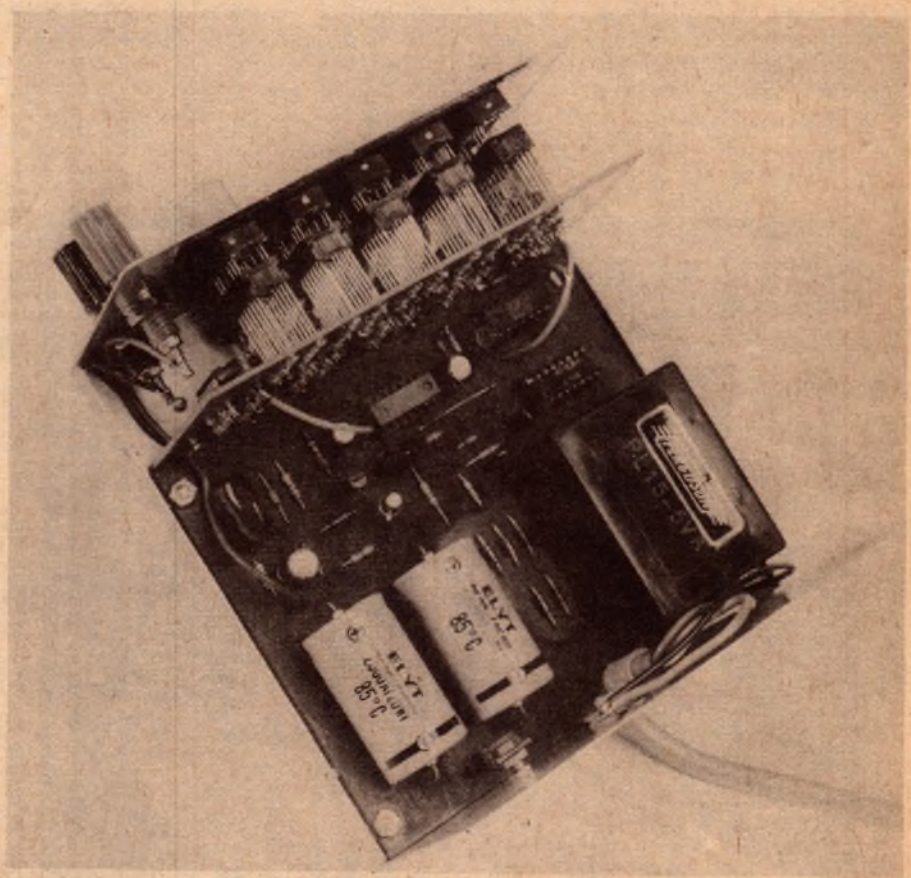
This alternative counter circuit was developed by Alan Peek of Woolwich, NSW.

the signal to be measured and particularly in the "X1" position, you will observe that the last figure or so will be constantly changing on each successive display. You will also observe that the variation will take place about an approximate mean, over a period of time. These variations are due to slight variations in the phase of the 50Hz mains supply.

The variations in readout just referred to amount to a relatively low order of accuracy but it is generally quite adequate for most audio work and for other measurements where a high order of accuracy is not required. This naturally leads to the question as to what can be done to upgrade the accuracy of the Mini Counter. The answer to this is that provision has been made to inject a more stable 100Hz timebase instead of the 100Hz derived from the mains.

A precision timebase may be derived from a stable crystal oscillator and divider chain, to give the requisite 100Hz. This signal needs to be about 10V peak-to-peak. Having said all this, it is up to the resources of the reader if he wishes to add this refinement.

I did try this facility myself and where more accurate readings are required, it is a must. I fed in 100Hz from the divider chain from a precision 5MHz crystal oscillator. I also fed into the input circuit, 1MHz from the divider chain. With such an enclosed setup one could expect a reading of precisely the correct frequency. However, this is not quite how things turn out with the Mini Counter, because of the simplicity of design. Due to the fact that the reset pulse eats into the counting time, the counter reads very slightly low at high frequencies. At 1MHz we got a consistent reading on the last five digits of 99999. This could be allowed for when required.



Note how the voltage regulator is secured to the back panel.

At a time when the development of the Mini Counter was at an advanced stage, we received a letter from Mr Alan Peek, 10 Gale Street, Woolwich, NSW 2110, saying that he too was attracted to the item in Circuit and Design Ideas and that he had made up a counter using it as the basis for his design. In the circumstances, we were unable to publish Mr Peek's efforts in full, due to insufficient space being available. However, we have redrawn his circuit in slightly abbreviated form and this should give interested readers enough information to make comparisons and even adopt his ideas if they wish.

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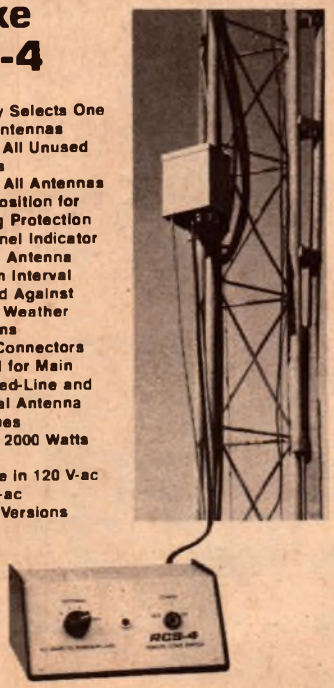

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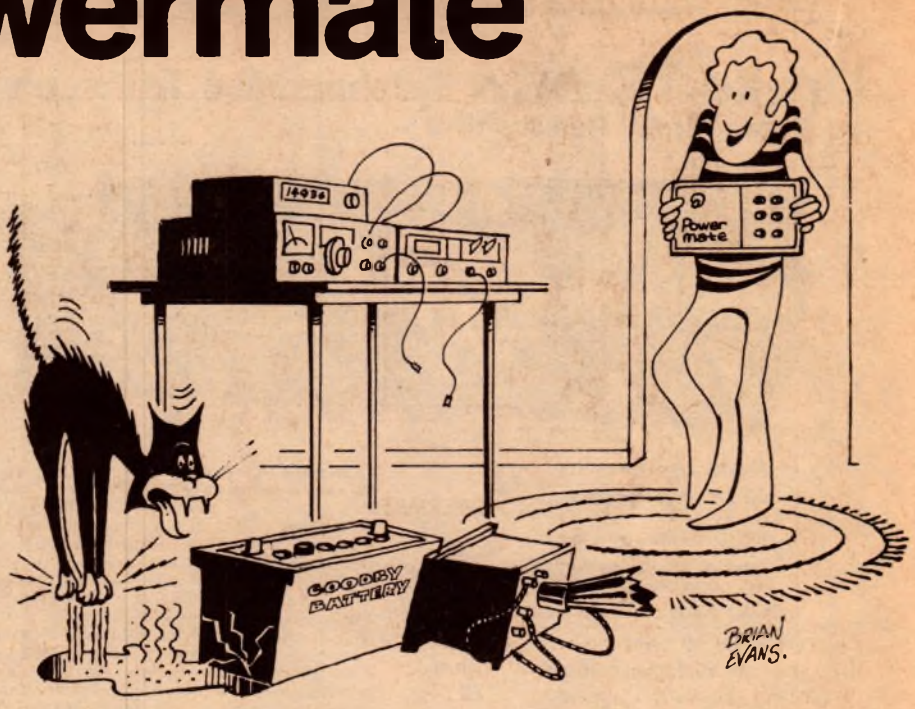
VK Powermate

Build this 5-amp power supply and retire that messy battery



In the last year or so there has been a growing demand for a power supply to run amateur-band transceivers which run from a nominal 12V supply. The supply featured provides 13.8V DC at up to 5 amps. It has very good line and load regulation, over-voltage protection and negligible hum output.

by LEO SIMPSON

More often than not, radio amateurs are running high-performance "mobile" transceivers from a car battery teamed with a trickle charger. Such an arrangement is reasonably satisfactory, provided the amateur is not "on the air" for long periods which would tend to discharge the battery. Even apart from this, operating from a car battery is not the safest method nor does it provide 13.8V.

The VK Powermate presented here is adjusted during construction to give an exact 13.8 volts output. For load variations from zero to 5 amps, the output voltage drops by less than 30 millivolts. To put it another way, the output impedance is less than 6 milliohms. Hum and noise is less than 5 millivolts peak-to-peak at 5 amps. Both the above parameters, regulation and ripple rejection, apply for mains voltage variations from 220 to 260 volts and the line regulation for this range is 4mV or less.

This performance is maintained with little variation over a wide temperature range.

The odd figure of 13.8 volts DC is selected because the majority of transceivers are rated to give maximum RF output with this voltage. Originally, transceivers of this type were designed primarily for use in cars where a nominal 12V supply is available from the battery.

However, since the electrical system in a car normally runs at between 13 and 14 volts, the manufacturers of transceivers long ago decided to rate all their equipment for about 13.8 volts. This enables considerably more power to be achieved, as much as 20 per cent more, than would be available if the rating was at exactly 12V.

Ergo, since amateur radio operators are keen to obtain the maximum performance from their equipment, this power supply provides 13.8 volts DC.

Apart from the provision of fuses, the VK Powermate does not have short-circuit protection. Our first prototype did have a "foldback" current-limiting characteristic, which gives reduced power dissipation under short-circuit conditions, compared with a simple current-limit characteristic. Unfortunately, the line regulation was found to be inadequate so we discarded the current limiting feature.

The circuit of the VK Powermate is based on the 723 regulator integrated circuit. This was originally introduced by Fairchild as the uA723, second-

This photo shows a typical transceiver teamed with the VK Powermate.

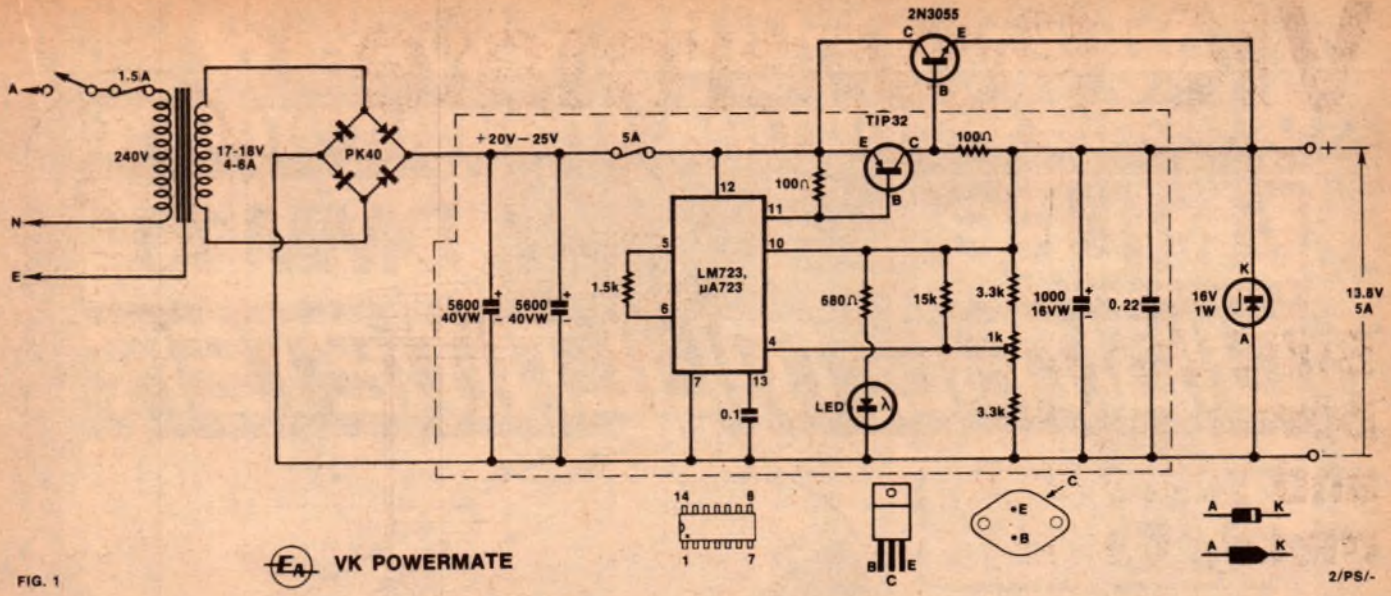


FIG. 1

While it comprises relatively few components, this circuit gives very good regulation characteristics.

sourced by National Semiconductor as the LM723 and produced by other manufacturers with similar "723" designation.

Figure 1 shows the complete circuit diagram of the VK Powermate while figure 2 shows the schematic of the 723 regulator. The latter figure shows the 723 regulator as comprising a series pass transistor, error amplifier and reference voltage source. The error amplifier compares a proportion of the output voltage with the internal reference voltage source and makes continual adjustment to the base current of the series pass transistor.

Maximum current rating of the series pass transistor in the 723 regulator is 150 milliamps. This requires amplification by at least two transistors to obtain a reliable 5 amp supply. A first approach would be to combine the 723 with two power transistors in a Darlington configuration. This is how we did it with our first prototype.

While it is simple in concept, a problem with a Darlington "voltage follower" configuration is that it is almost impossible to saturate. This problem is compounded, in the case under discussion, by the fact that the internal output circuitry of the 723 is also a Darlington pair.

The resulting double-Darlington has four base-emitter junctions in series and needs quite a high voltage drop from input to output in order to function correctly. In other words, it has a high "drop-out" voltage, below which the ripple rejection and regulation is poor. When this factor is combined with the voltage loss inherent in a current limiting circuit, the circuit is impractical.

For these reasons we adopted a less conventional method of using the 723 to drive external power transistors. The internal series pass transistor of the 723 provides current drive to a PNP power

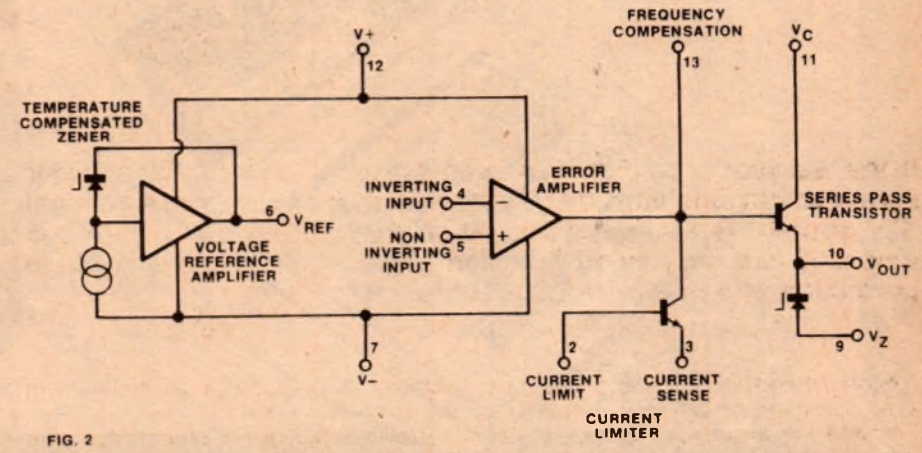


FIG. 2

transistor (TIP32) which, in turn, provides current drive to an NPN power transistor (2N3055).

This arrangement has a low dropout voltage of about 3V, which is equal to that of the 723 when used alone. Consequently, this circuit has very good line regulation without having excessive power dissipation.

Both the external power transistors have 100 ohm resistors connected between base and emitter to avoid the possibility of high temperature leakage degrading the regulation chatacteristic.

A 1.5k resistor is connected between pins 5 and 6 of the 723. This is included to make the source impedance feeding the non-inverting input of the error amplifier approximately equal to the source impedance of the output voltage divider which drives the inverting input. Adding this single component makes quite a worthwhile improvement to the temperature stability of the output voltage.

The output of the regulator is heavily bypassed to give a low output impedance at radio frequencies and to ensure good transient response.

A crude but effective method of over-voltage protection is used in this circuit. It consists of a 16V zener diode, of 1W or higher rating, wired directly across the output terminals. If, for any reason, the regulator circuit malfunctions and the output voltage tends to rise above 16 volts, the zener will draw very heavy current and blow the 5 amp fuse.

In blowing the 5 amp fuse the zener itself will go short-circuit unless it has a rating of 3 watts or more, in which case it will probably survive. No doubt there are more elegant methods of protecting transceivers against over-voltage, but this method is simple and reliable.

In other respects the circuit is quite straightforward, although a number of practical aspects need to be mentioned.

Most of the circuit components with the exception of the transformer, bridge rectifier and output transistor, are mounted on a PC board measuring 81 x 91mm. Dominating this PC board are the two 5600uF/40VW electrolytics (Elna) which have a combined ripple rating of 8.6 amps at 12Hz. Substitution of smaller electrolytics is not recommended, as their lower ripple

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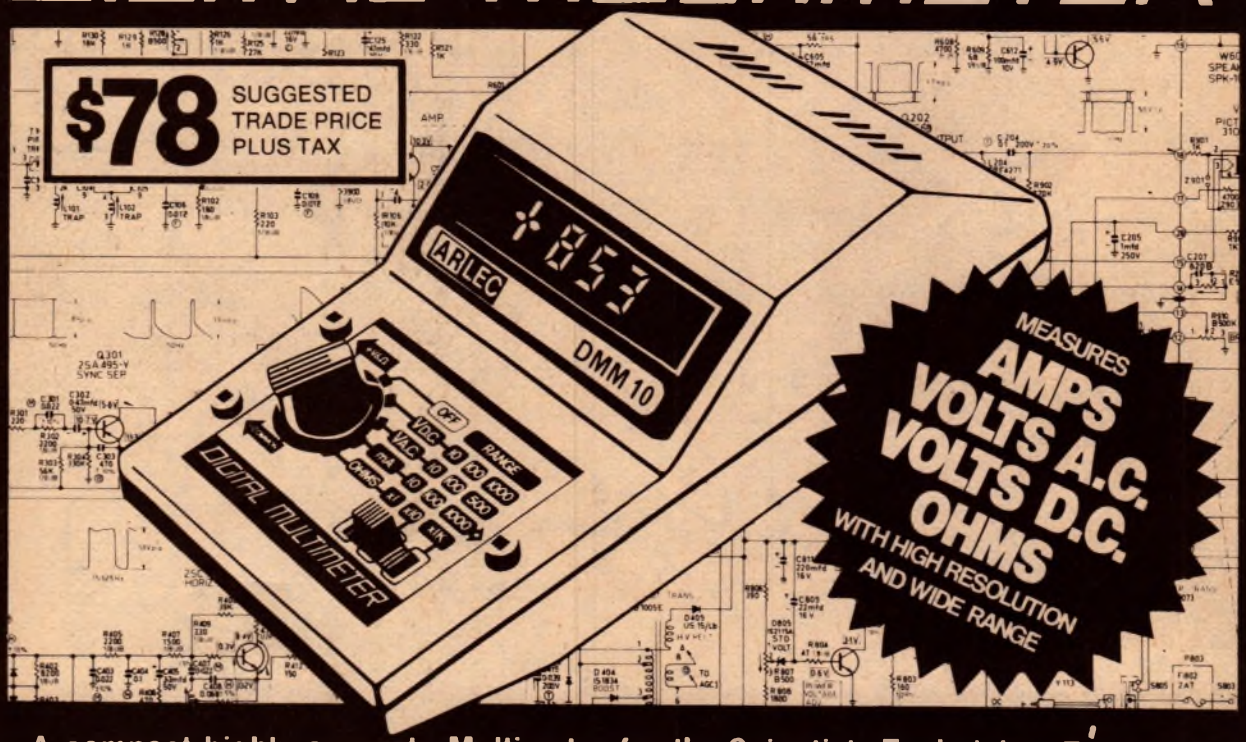

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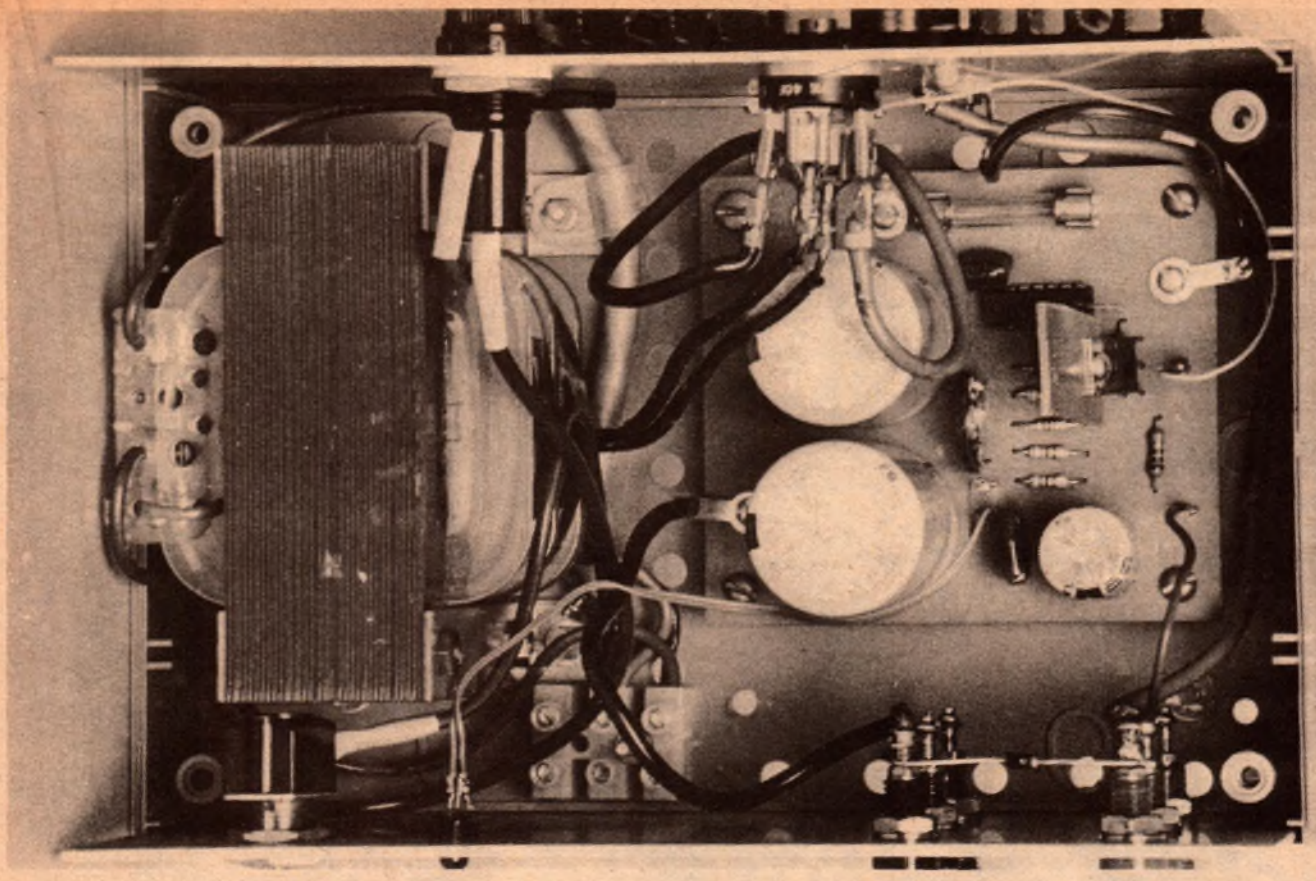


Use 4mm auto cable for the high-current wiring. The wiring diagram and this photograph should be closely followed.

ratings will result in reduced life expectancy.

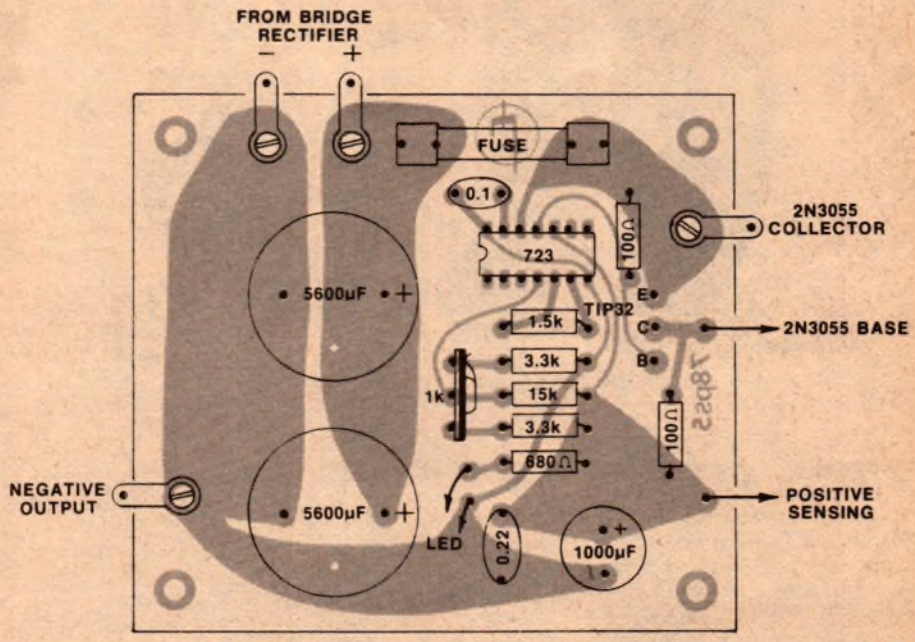
Do not substitute a less rugged transistor for the TIP32, which has a collector current rating of 4 amps. Other transistors (such as 2N3053 or BD140) will work, but on overloads they will "punch through" before the 5 amp fuse blows. And if that happens, the 723 IC will blow too.

By the same token, do not try to boost the output rating of the Powermate by increasing the fuse rating. This raises the possibility of damage to the 2N3055 before the fuse blows. If the 2N3055 does blow in these circumstances, it can easily take the TIP32 and the 723 with it. It is possible to boost the rating of the Powermate, by modifying the circuit; we discuss this later.

A small flag heatsink is fitted to the TIP32. This is made of light-gauge aluminium measuring about 20 x 30mm.

Heavy currents flow in this circuit. We had to devise an effective method of making low-resistance, high-current connections. One method is to use solder lugs. We secured the solder lugs with screws and nuts and soldered the nuts to the copper pattern of the PCB. Another method which is more elegant, is to use Utilux connectors such as we used on the bridge rectifier.

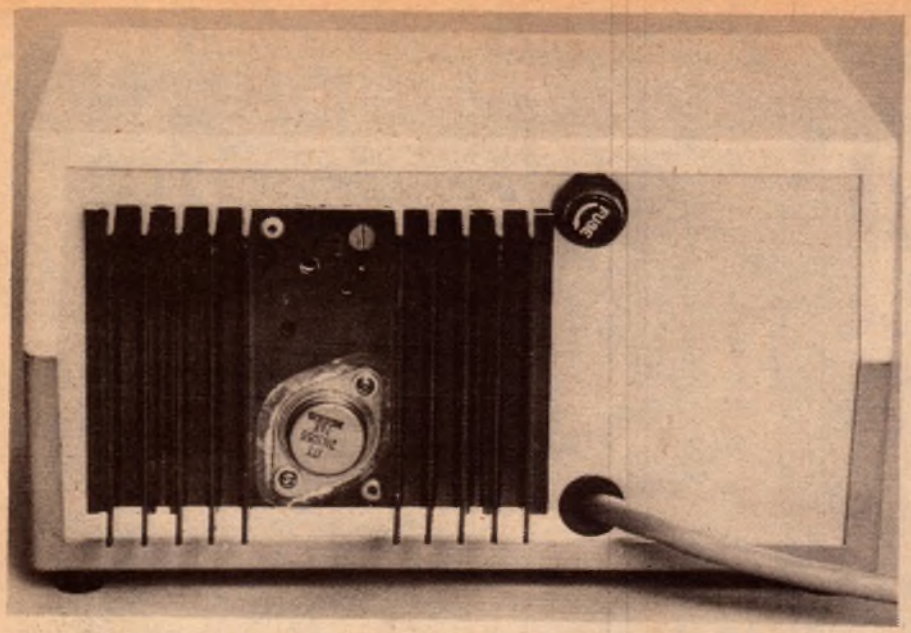
Low current connections to the PCB can be made with PC stakes. When assembling the PCB install the smaller components first.



At the time of writing there were no readily available cases at reasonable prices. The one we used is made in England by Vero Electronics (part No 23507) and is quite expensive. It measures 206 x 116 x 139mm (W x H x D). No doubt most amateurs will be able to obtain a suitable case, even if they have to make it themselves.

The case should be well ventilated to dissipate heat produced by the transformer and other components inside.

The transformer we used was kindly supplied by Dick Smith Electronics and is listed in their catalog as M-2000. It is rated 18VAC at 6 amps. While this serves very well, virtually any transformer with a secondary voltage of 17 to 18 volts at a current of 4 to 6 amps will be suitable. Most battery charger transformers with a rating of 4 to 6 amps



Actual size reproduction of the PCB pattern.

are suitable. An example is the A&R 5509 transformer.

Note that if a different transformer is substituted for the one we used, there are likely to be slight differences in the load and line regulation of the circuit.

An EDI Minibridge, type PK40F, was employed as the bridge rectifier. It has an average current rating of 8 amps. Alternatively, the bridge rectifier could be made up of suitable stud-mounted diodes.

A reasonably substantial heatsink is used to dissipate the heat produced by the 2N3055. The type we used is a single sided extrusion which is drilled to take two TO-3 power transistors. It is available from Dick Smith Electronics. we mounted the output transistor at the bottom of the heatsink while the bridge rectifier was mounted at the top, although it is actually inside the rear panel of the case.

Use a mica washer, two insulating bushes and heatsink compound when mounting the output transistor.

Three pairs of binding post-cum-jack sockets are used for the output connections. This enables a number of pieces of equipment to be connected permanently, even though they may not all be used at the same time.

Use heavy duty insulated cable for all high current wiring. The type we used is known in the trade as "4mm auto cable". Do not install the zener diode across the output terminals until the Powermate is finished and working correctly.

Take care with the mains wiring. The three-core mains cord should be passed through a grommetted hole in the rear of the case and anchored with a cord clamp. Mechanically terminate and solder the earth wire to a solder lug secured under one of the transformer mounting screws. The rest of the circuit is not earthed.

Terminate the active and neutral conductors plus the wires to the transformer primary and the mains switch to a three-way insulated terminal block. Make sure that the soldered connections to the mains switch and transformer primary fuse are insulated with heatshrink tubing or similar material.

When the Powermate is complete check all wiring and apply power. With

POWERMATE PARTS LIST

1 case, 206 x 116 x 139mm, or larger
1 PC board, 91 x 81mm, code 78ps5
1 transformer with secondary 17 to 18V at 4 to 6 amps DC
1 SPST mains toggle switch
1 3-way insulated terminal block
1 single-sided heatsink, 110 x 75mm
6 binding posts, 3 red, 3 black
1 3AG fuse holder and 1.5A fuse

SEMICONDUCTORS

1 LM723 or uA723 IC regulator
1 TIP32 PNP transistor
1 2N3055 NPN transistor
1 PK40 or equivalent bridge rectifier
1 16V 1W zener diode
1 LED and bezel

CAPACITORS

2 x 5600uF/40VW PC electrolytic
1 x 1000uF/16VW PC electrolytic
1 x 0.22uF metallised polyester
1 x 0.1uF metallised polyester

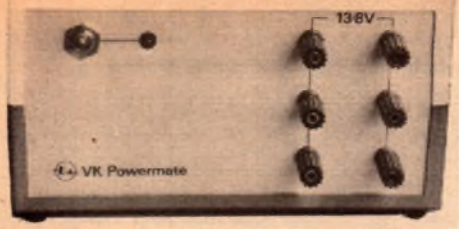
RESISTORS

(½ or ¼W, 10% tolerance)
1 x 15k, 2 x 3.3k, 1 x 680 ohms, 2 x 100 ohms
1 x 1k preset potentiometer
2 fuse clips, Swann (McMurdo) FC1
1 5 amp 3AG fuse
4 PC pins
5 solder lugs
1 flag heatsink for TIP32

MISCELLANEOUS

4 rubber feet, 4 6mm spacers, 1 grommet, mounting hardware for TO-3 transistor, heatsink compound, 4 Utilux quick-connectors, mains cord and three-pin plug, mains cord and clamp, heatshrink tubing, 4mm auto cable, hook-up wire, screws, nuts, lockwashers, solder.

NOTE: Component substitutions are not recommended. See text.



the aid of an accurate multimeter set the output voltage to exactly 13.8 volts. Turn off the power and wait until the LED power indicator is extinguished. Then wire the zener diode across the output terminals. Now the unit is ready for work.

During normal operation, the output transistor heatsink will become quite hot, especially if it is running at 5 amps continuously. This is quite normal. All components are within ratings.

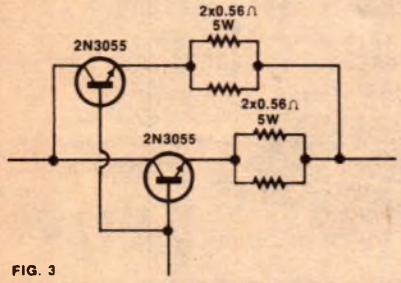
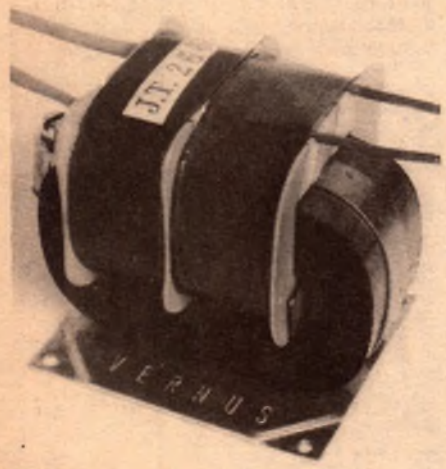


FIG. 3

Use this booster circuit and the transformer below to increase the rating to 8 amps.



As noted previously, it is possible to increase the rated output of the VK Powermate. It is fairly straightforward to boost the output to 8 amps. Substitute a higher rated transformer such as the JT 266 which is rated at 8 amps continuous. It is made by Jones Transformers Pty Ltd, c/- 22 William Street, Henley, NSW 2011.

Figure 3 shows the other required modification. Substitute two 2N3055s for the single output transistor is in the 5 amp circuit. The parallel-connected 0.56 ohm resistors ensure that each transistor equally shares the load. Each transistor should be mounted on a substantial heatsink.

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C90UD	C-3075	$3.20	$2.70

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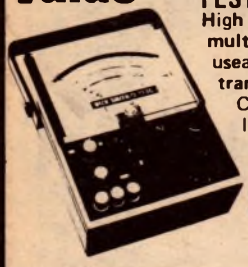

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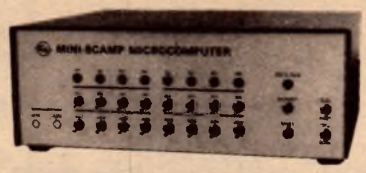

This is the original Mini-scamp microcomputer kit as described in E.A. It is ideal for teaching (and learning) basic computer functions —it really works! Kit is complete with 256 byte memory — easily expandable to 1k at low cost. Team it up with our other computer kits (e.g. tape reader, video display unit, ASCII encoder, etc) and you're really in business.

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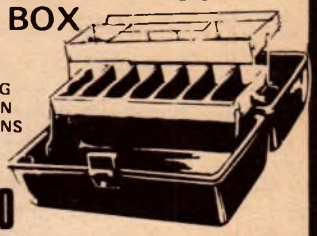

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These tool boxes sell elsewhere for around $25 — $35 and even more. Now look at our price for the same thing! Ideal for tools and components. Divided sections swing out at top. Incredibly useful; incredibly priced!

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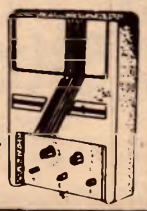
Sure does — you select the tune. Complete kit is so easy to build. **Cat. K-2020.**



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See the articles in Electronics Australia, Dec. '77 & Electronics Today, Sept. & Dec. '77 for full details outlining the use of photo-sensitive products.

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Cat T-5106 – Vacuum base vyce – mounts on any polished surface. 2" opening .. . $19.95
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Cat N-1060 – CRC 2-26 Ideal for wet ignitions, etc. Loosens frozen nuts $4.75
Cat N-1056 – Spray freezer – canned cold for tracking down intermittents $3.00
Cat N-1200 – Thermopath 167 – silicone based heatsinking compound $1.20

WIRES & CABLES: For all purposes – mains leads, jumper leads, connections etc.

Cat W-2010 – Mini Fig. 8 cable. Ideal for speaker leads. Polarity marked 15c/m
Cat W-2055 – 3 core mains cable, 240V rated. 40c/m
Cat W-2220 – flexible light duty hook-up wire. Many colours available 8c/m
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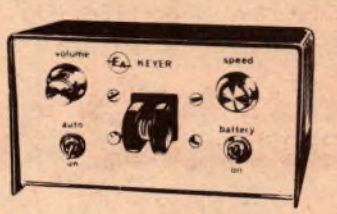
PLUS MILLIONS OF METRES OF WIRE – TOO NUMEROUS TO LIST!

SEMICONDUCTORS – INTEGRATED CIRCUITS – VOLTAGE REGULATORS
Dick Smith has a huge range of solid state devices . . . this list is just a tiny section. If the device you want isn't here, it's probably stocked anyway. (See our new cat.)

AC127	Z-1062	80c	TT801	Z-2068	$1.00	DSE12	Z-4802	75c	4449AE	Z-5720	55c
AC128	Z-1064	80c	2N3055	Z-2145	$1.20	ZN414	Z-6520	$3.95	MC14584	Z-5413	$1.60
AC188	Z-1082	95c	2SC1306	Z-2501	$4.50	IC 24	F-4420	$12.50	74C00	Z-5410	50c
BC107	Z-1300	25c	2SC1307	Z-2502	$6.50	MM5314	Z-6814	$5.90	74C926	Z-5414	$12.00
BC108	Z-1308	25c	1N4002 (EM401)			CT7001	Z-6821	$6.50	MM3001	Z-6132	$13.50
BC109	Z-1319	27c		Z-3202	15c	7400	Z-5010	45c	MM5369	Z-5781	$3.50
BC109C	Z-1329	49c	1N4007 (EM410)			7404	Z-5014	45c	MM5303	Z-9204	$5.90
BC157	Z-1340	33c		Z-3207	30c	7413	Z-5023	45c	MM5740AAF	Z-9202	$27.50
BC158	Z-1348	33c	1N5624	Z-3222	45c	7447	Z-5047	$1.80	2102	Z-9302	$4.50
BC159	Z-1359	30c	MR110	Z-3240	90c	7473	Z-5073	$1.10	2114	Z-9306	$14.50
BC639	Z-1388	75c	BYX21L/200	Z-3260	$2.20	7474	Z-5074	$1.10	LM301	Z-6040	$1.05
BC640	Z-1389	75c	OA91	Z-3040	25c	7490	Z-5090	$1.00	LM380	Z-6080	$2.00
BD139	Z-1443	95c	BA100	Z-3060	35c	7493	Z-5093	$1.10	UA709	Z-6352	$1.00
BD140	Z-1444	95c	1N914	Z-3120	12c	74121	Z-5260	80c	UA741	Z-6382	60c
BF115	Z-1560	90c	C122D	Z-4330	$2.60	9368	Z-5354	$3.52	LM3909	Z-6109	$1.50
D13T1	Z-1780	$1.54	SC141D	Z-4510	$2.00	95H90	Z-5360	$16.50	NE555	Z-6145	$1.00
DS2646	Z-1786	$1.20	ST4	Z-4740	$1.10	4000AE	Z-5600	46c	NE556	Z-6146	$2.75
FPT100	Z-1950	$2.00	RL 209R	Z-4010	30c	4006AE	Z-5696	$3.02	OM321	Z-6180	$15.00
MPF102	Z-1832	80c	TIL 220R	Z-4030	35c	4017AE	Z-5617	$2.92	SAK140	Z-6230	$3.10
TIP31B	Z-2020	95c	OL704	Z-4110	$2.50	4023AE	Z-5623	46c	SL440	Z-6250	$9.84
TIP32B	Z-2024	$1.00	TGS812	Z-6860	$8.90	4027AE	Z-5627	$1.28	7805	Z-6542	$2.00
TT800	Z-2064	$1.00	ORP12	Z-4800	$1.45	4028AE	Z-5628	$2.31	7812	Z-6552	$2.00

**** PROJECT KIT BUILDERS ****
This column is just for YOU! Each month, we will endeavour to bring you the very latest in kits from the magazines (providing, of course, we have details in time). Remember, we not only stock kits, but the parts to make them as well. So if you just want the PC board, we have it! Or other special components. Just ask! If we don't stock a particular kit, it's probably because all the component parts are normal stock lines. So if a project you want to make isn't listed, ask at your nearest store.

VK POWERMATE (See May '78 EA)
Short form kit includes all electronic parts but not metalwork, heatsink, mains wiring or terminals
Kit: Cat K-3449 .. .. $32.00
PCB (only) Cat H-8342 .. . $2.00
Special 5600uF/40V electrolytic capacitors: Cat R-4570 ... . $3.90
Power Transformer Cat M-2000 .. . . $17.32



ELECTRONIC MORSE CODE KEYER (See March '78 EA)
Complete kit, supplied with paddle, undrilled case & plain painted panels.
Kit: Cat K-3470 .. .. $37.50
Paddle only: Cat D-7103 .. .. . $17.50
9 volt battery: Cat S-3200 ... . $2.00
PCB only: Cat H-8340 .. .. .. $3.75

R-C-L BRIDGE (See March '78 EA)
Complete kit, supplied with printed, but un-punched panel,
Kit: Cat K-3468 .. .. $34.50
PCB only: Cat H-8339 .. . . $4.75

Special kits for the following are not made up, but parts are normally stocked for these and most other EA constructional projects:
White & Pink Noise Generator (see April '78 EA)
Photo Timer (See April '78 EA)
LED Chaser (See April '78 EA)

DICK SMITH ELECTRONICS

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Sat 9AM 12 noon
(Brisbane hour earlier)

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$25 $49.99	$3.00
$50 $99.99	$4.00
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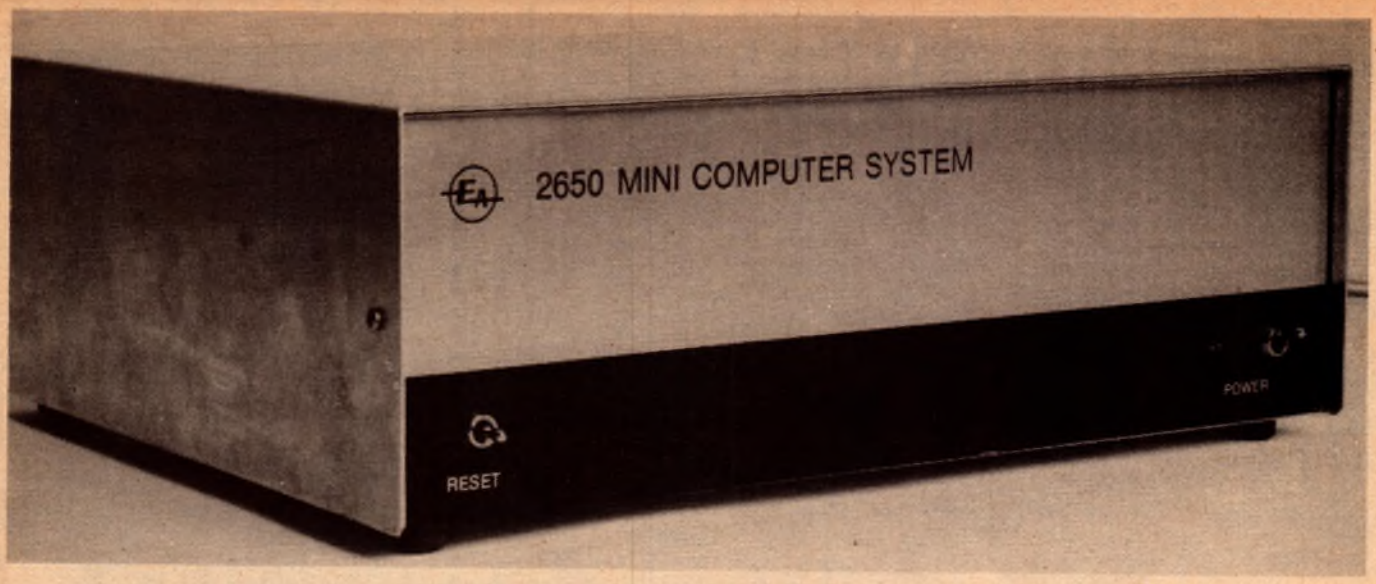


Uses latest 4K-bit RAM chips:

New, expandable 2650 mini system

The Signetics 2650 microprocessor has become quite popular among computer hobby enthusiasts, spurred on by our "baby" 2650 system described in the March 1977 issue. This and the recent release of 1024 x 4 bit RAMs has prompted us to redesign the circuit, with this article and the unit described herein as the result.

by DAVID EDWARDS

Our previous approach was to present a design for a printed circuit board unit only, which reduced costs to a minimum. With this project however, we are also describing a case and power supply, so that the unit becomes a complete stand-alone mini computer. Of course, if desired the PCB can be used by itself, as before.

We estimate that the complete unit will retail for around $115.00, which is very reasonable considering the features of the unit.

What are the features of the unit? Well, it has a debug and monitor program resident in a 1k ROM, a standard 20mA asynchronous communication link, a minimum of 1k of RAM, full memory decoding, provision for memory and I/O expansion, and an on-board power supply.

All this is contained on a single-sided PCB, measuring only 218 x 81mm. The only other components required are a reset switch and a power transformer and associated hardware.

At the heart of the circuit is the 2650 MPU chip itself. This is an 8-bit device, with an instruction set of 75 instructions, and having eight different addressing modes. It is fabricated using low threshold ion implantation, and is an N-channel silicon gate device operating from a single 5V supply, with all inputs and outputs TTL compatible.

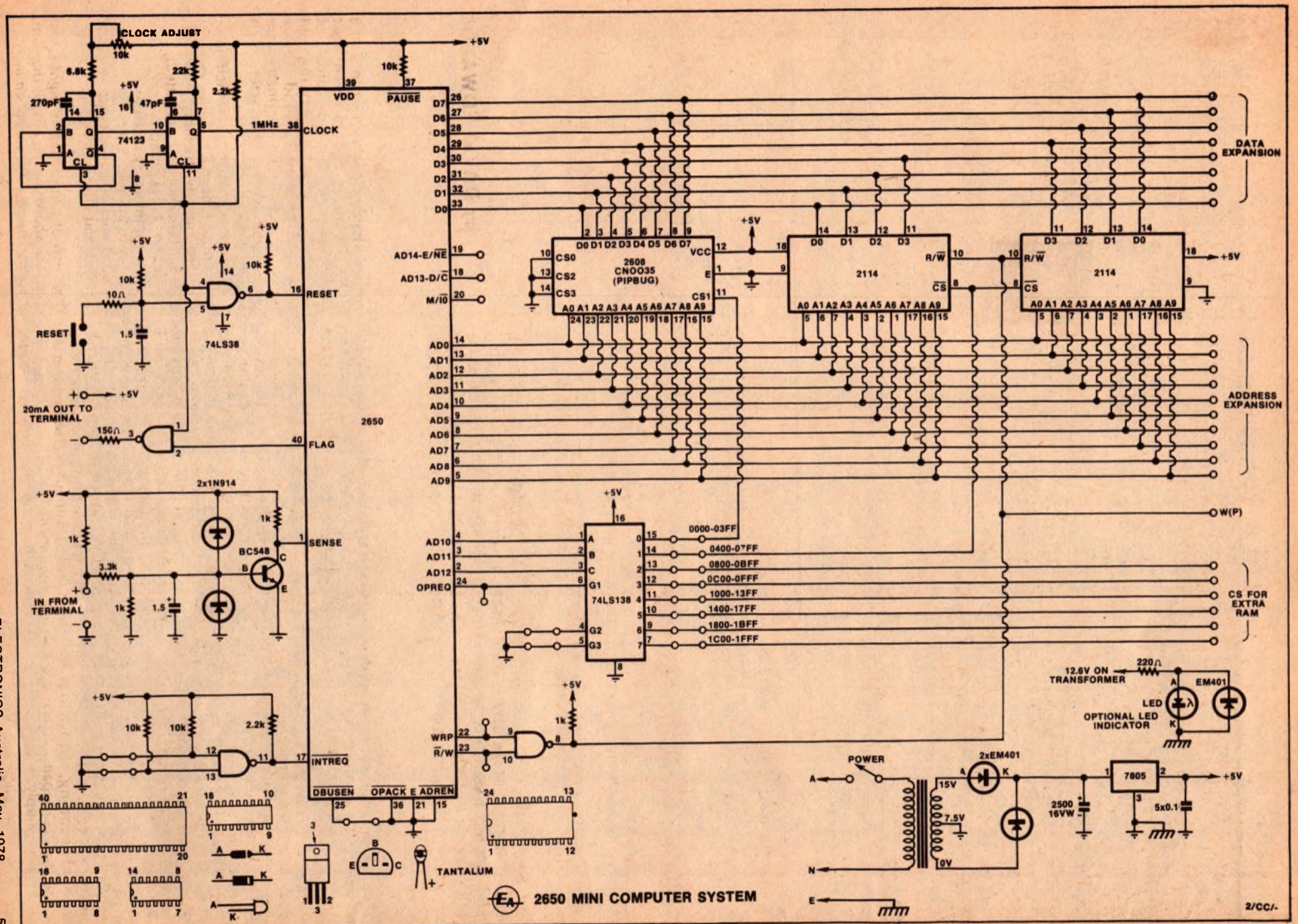
A 74123 dual monostable is used to generate the single phase 1MHz clock required. A trimpot is used to set the correct operating frequency, which can be adjusted without the use of special test equipment.

The debug/monitor program, code named "Pipbug", is resident in a 2608 ROM. Pipbug recognises seven basic commands, each of which consists of an alphabetic character, any required numerical parameters, and a terminating return. The parameters are given as hexadecimal characters, with leading zeros unnecessary.

The seven commands and their functions are as follows:

A — See and alter memory;
B — Set breakpoint (2 permitted);
C — Clear breakpoint;
D — Dump memory to tape;
G — Go to address, run;
L —Load memory from tape;
S — See and alter registers.

Only two of a maximum of eight RAM chips are shown in the circuit diagram at right. The rest are wired similarly.


CLOCK ADJUST
10k
+5V
6.8k
22k
2.2k
270pF
47pF
74123
1MHz
CLOCK
VDD
PAUSE
10k
D7
D6
D5
D4
D3
D2
D1
D0
DATA EXPANSION
2608 CNOO35 (PIPBUG)
2114
R/W
CS
ADDRESS EXPANSION
AD14-E/NE
AD13-D/C
M/IO
RESET
74LS38
10Ω
1.5
20mA OUT TO TERMINAL
150Ω
2650
FLAG
2x1N914
1k
BC548
3.3k
IN FROM TERMINAL
SENSE
AD0
AD1
AD2
AD3
AD4
AD5
AD6
AD7
AD8
AD9
AD10
AD11
AD12
OPREQ
74LS138
0000-03FF
0400-07FF
0800-0BFF
0C00-0FFF
1000-13FF
1400-17FF
1800-1BFF
1C00-1FFF
W(P)
CS FOR EXTRA RAM
12.6V ON TRANSFORMER
220Ω
EM401
LED
OPTIONAL LED INDICATOR
WRP
R/W
INTREQ
DBUSEN
OPACK
ADREN
TANTALUM
POWER
15V
7.5V
0V
2xEM401
2500 16VW
7805
5x0.1
2650 MINI COMPUTER SYSTEM
2/CC/-

The D command may be used to dump out onto paper or magnetic tape any desired range of memory locations, with leader, checksum and trailer to facilitate reloading. Both the A and S commands may be auto-incremented, by terminating with a line feed instead of a carriage return.

Pipbug is explained further in Signetics Application Memo SS50, which you should receive with the 2608 ROM. It also includes a listing of Pipbug, which among other things lets you make use of some of its utility subroutines such as the serial input and output routines "CHIN" and "COUT".

Only two ICs are required to implement the basic 1k of RAM provided, thanks to the new 2114 memory devices. These are 4096-bit static memories, organised as 1024 4-bit words. Access time is 650ns or better, and all inputs and outputs are TTL compatible. At the time of writing, only devices made by Synertek are available, and these are coded SY2114.

We understand that in the near future similar devices will be available from National Semiconductor (coded MM2114) and Signetics (coded 2614). At present, the Synertek devices are available from Radio Despatch Service Pty Ltd, of 869 Gearge Street, NSW 2000, and also from Dick Smith Electronics stores and dealers.

Memory address block decoding is performed by the 74LS138 device. The A, B and C inputs, operating on address lines AD10, AD11 and AD12 produce output signals which effectively divide the memory space into eight 1k blocks, each of which is uniquely decoded within the 2650's memory address "pages" of 8k.

The first 1k block, from 0000 to 03FF, is assigned to the ROM, with the next block, 0400 to 07FF, assigned to the first 1k of RAM. The first 63 locations of this block are used by Pipbug as temporary storage locations, so that user memory commences at 0440.

A 74LS 38 quad open collector gate is used to perform the remaining housekeeping functions. One element is used to combine the R-bar/W and WRP signals, to form the W-bar (P) signal, which is then used to drive the R/W-bar lines of the RAMs.

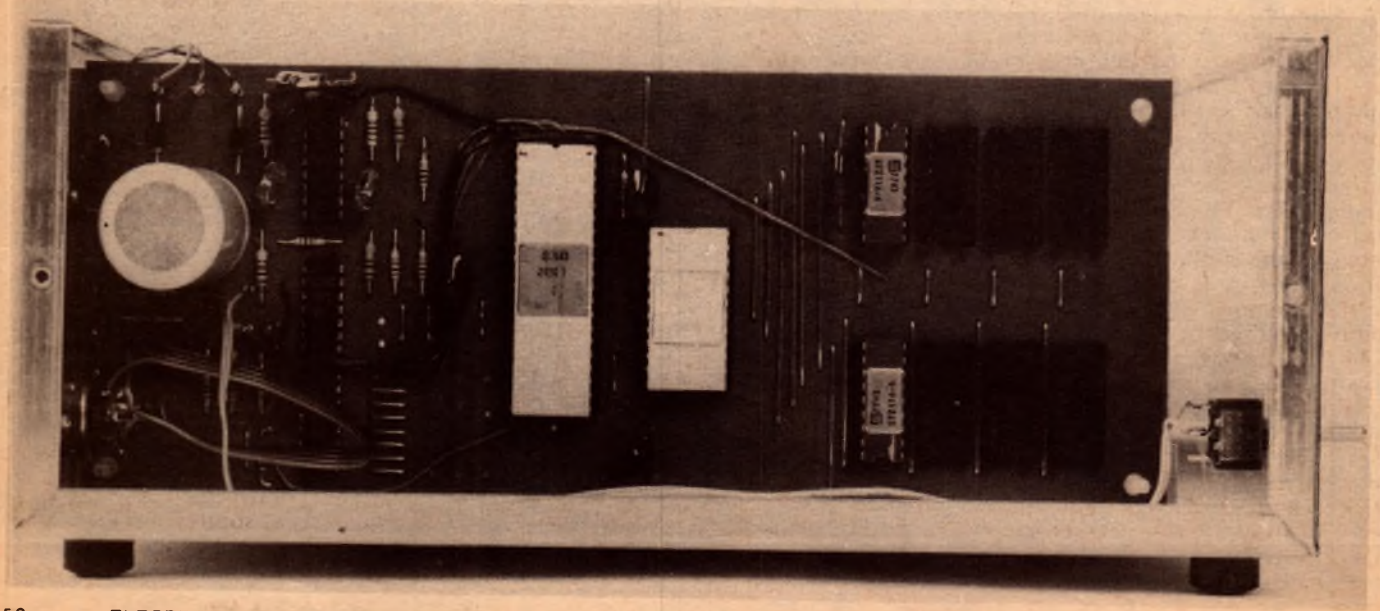
A second element is used to buffer and invert the signal from the reset switch, allowing a cheap and readily available normally-open type switch to be used.

The third element is used as a 20mA current sink for the teleprinter (TTY) output signal. It was for this reason that an open collector type gate was used, necessitating the three pullup resistors on the other element outputs. The current level is set by the 150 ohm resistor, and is sufficient to operate the current loop input of an ASCII TTY or video data terminal.

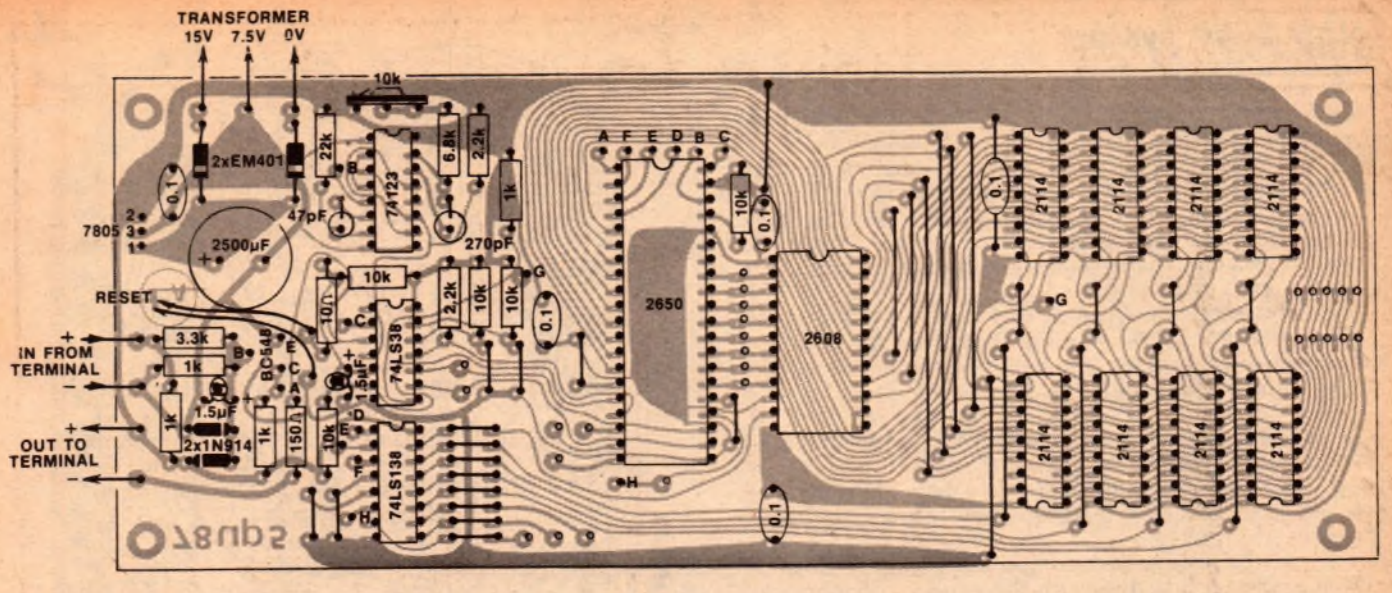
The remaining gate element is not strictly required, but since it was available, we have used it to provide

List of component parts

SEMICONDUCTORS
1 2650 MPU chip
1 2608 CN0035 ROM (Pipbug)
2 2114 1024 x 4 static RAMs
1 74LS38 quad open collector gate
1 74123 dual Schmitt trigger
1 74LS138 decoder
1 7805, LM340T-5.0 5V regulator
1 BC548 or similar NPN transistor
2 1N914 or similar silicon diodes
2 EM401 or similar silicon diodes
CAPACITORS
1 2500uF 16VW PCB mounting electrolytic
2 1.5uF tantalum electrolytics
5 0.1uF polyester
1 270pF polystyrene
1 47pF polystyrene
RESISTORS (all ¼W)
1 10k trimpot (5mm lead spacing)
1 22k, 5 10k, 1 6.8k, 1 3.3k, 2 2.2k, 4 1k, 1 150 ohm, 1 10 ohm
MISCELLANEOUS
1 40 pin DIL socket
1 24 pin DIL socket
2 18 pin DIL sockets
3 PCB standoffs (9.5mm)
1 SPDT miniature toggle switch
1 SP miniature momentary contact switch
1 transformer, 240V to 15VCT @ 1A. DSE 2155, A&R 2155 or similar
1 PCB, coded 78up5, 218 x 81mm
1 case, 284 x 93mm (see text)
1 output connector (see text)
4 rubber feet
1 mains cord, mains plug, grommet, cord clamp and terminal block
2 aluminium brackets (see text)
Machine screws and nuts, PCB pins, solder, tinned copper wire, hookup wire, rainbow cable
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.



This close-up photograph of the board should aid in placing the components on the PCB.



two buffered interrupt request inputs.

The TTY input circuitry uses a single NPN transistor, along with a few passive components to provide a level translation from the 20mA circuit to the TTL-compatible sense input. The passive components form a filter to mitigate the effects of induced hum and switch bounce, if present.

The power supply circuit is very simple, requiring only two diodes, one electrolytic capacitor and a three terminal regulator, apart from the mains transformer. Five 0.1uF capacitors are distributed about the circuit, to minimise noise and spikes on the supply lines.

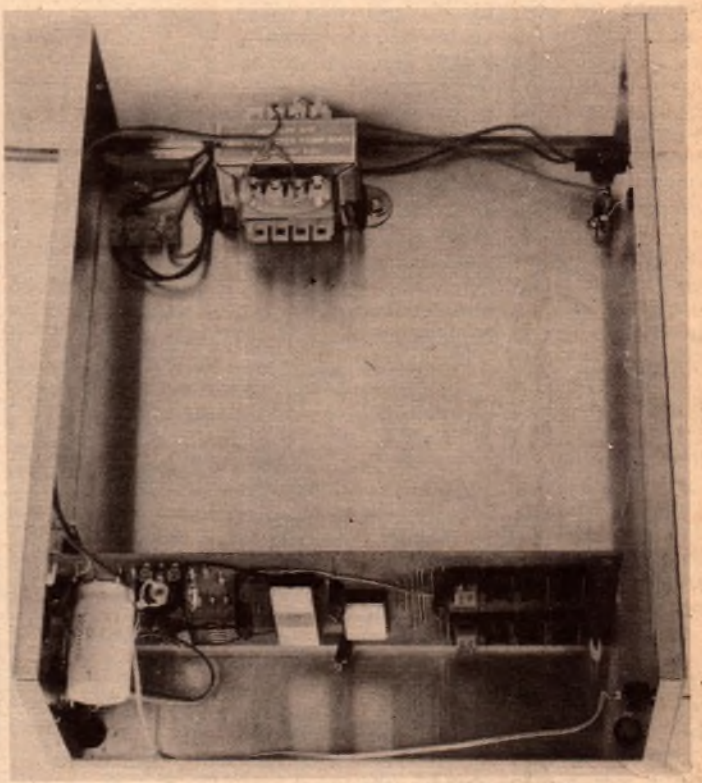
All of the previously mentioned circuitry is built up on a single printed circuit board, coded 77up5. In order to contain costs, we did not use a double sided board, so that a number of links are required. Most of these are normal uninsulated links, although there are eight insulated links which wander across the board.

Provision has been made on the board for up to four pairs of 2114 RAM chips, giving a total on-board capacity of 4k bytes of RAM in addition to the 1k byte Pipbug ROM. Note, however that only one pair of 2114's is required for operation; the other three pairs are optional, to allow you to expand the system as required.

Four pairs of 2114s represent the maximum number which can be connected to the 2650 without overloading the address and data outputs. For further memory expansion, buffering will be required.

As you can see from the photographs, the board dimensions are such that in the case we have used it can be stood on edge from front to back. This is an aluminium case of similar dimensions to that used for the Mini Scamp microprocessor design, and also the Minibrute power supply. The prototype was obtained from Dick Smith Electronics Pty Ltd.

Use the overlay diagram at the top of the page to guide you in placing components onto the PCB. Eight insulated links are required, joining the corresponding letters.



You can see in the photograph at right how much room is left in the case for expansion purposes.

The method of mounting used allows room for at least two similar sized boards in the case as well, so that mechanically, future expansion is quite easy. It also means that both sides of the board are accessible at once, so that servicing and addition of extra parts is quite simple.

The board is supported on two brackets, which we fashioned from scrap aluninium. The large bracket at the rear holds the board near the rear panel, so that the regulator can use the panel as a heatsink. The front of the board is supported by a single bracket fastened to the floor of the case. We used PCB standoffs as well, so that the PCB could be removed easily; but these may not be necessary in all cases.

We used a DIN socket as the terminal interface connector, as these are cheap and readily obtainable. It was fitted to the rear left hand corner, to minimise the length of wire needed from the PCB.

The reset switch is mounted in the front left-hand corner, with the board a little to the right of it, to allow clearance for the supply electrolytic capacitor. The transformer and associated components are mounted in the right hand side of the case, leaving the centre section clear for expansion purposes.

Commence construction by fitting all the hardware and support brackets to the case. The front panel of the prototype was made using "Scotchcal"

photosensitive aluminium, and we hope that commercial versions will be made available in due course.

We assembled the LED indicator and its support components on a small piece of tagstrip, mounted immediately below the LED BEZEL. Only one wire is required from the tagstrip to the transformer, the earth connection being made via the chassis and the tab of the power supply regulator.

Commence construction of the PCB by fitting the uninsulated links. All soldering should be done with a small pencil shaped bit, and with a minimum of solder. Be careful to avoid solder bridges.

We recommend that sockets be used for the CPU chip, the ROM chip, and the RAMs if you are at all unsure of your soldering ability with these MOS devices. Or if you wish to add extra RAM at a later date. Fit the sockets to the board at this stage, before any other components are fitted.

Now fit all the passive components, followed by the TTL ICs. Circuit board pins for the external connections should also be fitted at this point, if they are required. Mount the regulator IC, and then locate and drill the mounting hole for it in the rear panel.

The next step is to fit the eight insulated links to the board. Use rainbow cable, and join the lettered points together, routing the wires between the components, so that a neat finish is obtained. Once this has been done, mount the board in the chassis, and complete the connections to the outer connector, the reset switch and the power transformer.

Now visually check the completed board for misplaced or misoriented components, and for dry joints and solder bridges. Bolt the regulator IC to the chassis, using a little heatsink compound for improved heat transfer. Do not insulate the mounting tab from the chassis.

Now monitor the 5V rail, and switch on. If the supply does not rise immediately to 5V, switch off, and trace and rectify the fault. If all is well, adjust the clock preset so that the signal at pin 5 of the 74123 is 1MHz. If you have no means of measuring this frequency, leave this adjustment till later.

Now switch off, and insert the MPU chip, the ROM chip and one pair of RAMs. Note that the lower RAM is inverted with respect to all the other ICs. Then connect a suitable TTY or video terminal, and switch it on.

Switch the computer on, and then press the reset switch. You should be rewarded by a carriage return, a line feed and an asterisk (*). If you get something garbled, adjust the clock frequency while repeatedly pressing the reset switch till an asterisk appears. Once this happens, set the preset to the middle of the region wherein an asterisk can be obtained.

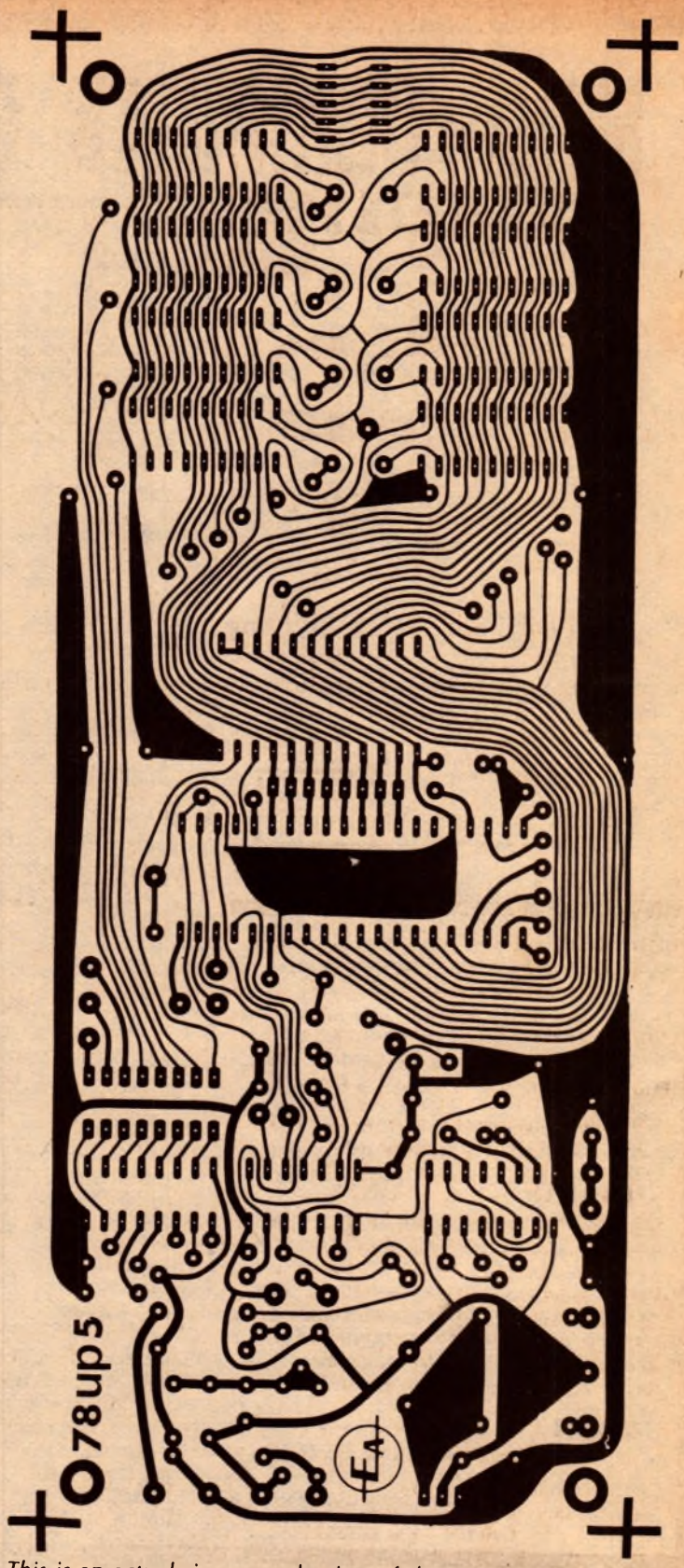
Now check out the Pipbug commands, and verify that you can load data into memory. If you have purchased the 2650 Software Package Recording offered in the April 1978 issue, then you will be able to load and run some of the smaller programs, such as "Nim" and "Number Guessing".

Note that if you can afford the full 4k of memory, you will be able to run all of the programs, with room left over for your own programs as well. And if you haven't ordered your record yet, do it now, as stocks are strictly limited.

Finally some comments concerning the expansion capabilities of the board. Most of the MPU pins required for expansion have been made available on the board. Some of them are grounded via links for normal operation, so that these links will have to be removed for expansion purposes.

Eight links have been provided at the 74LS138 outputs so that the memory configuration can be altered if required. These are arranged in a DIL pattern, so that a socket and programming plug can be used if desired.

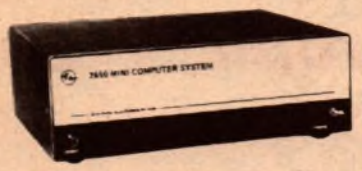
The address and data lines, as well as the W-bar (P) signal, have been made available, so that memory expansion and input/output capabilities can be provided. It is our intention to present a second article in the near future, showing how to expand the memory up to at least 7k of RAM, and provide two non-extended I/O ports.



This is an actual size reproduction of the PCB pattern.

MINI-COMPUTER BREAKTHROUGH!

COMPLETE SYSTEM $369.20

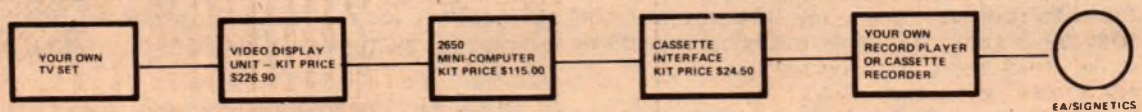


Here it is at last — the first mini-computer kit system for the electronics enthusiast who knows nothing (or a lot) about computers.

If you're one of the people who think that computer technology is beyond you, this is the system for you.

Just imagine it — after building it, you use your standard record player to 'input' the program with the EA/Signetics record, and you're using your computer right away. You don't need to know any complicated machine 'languages'. You communicate with it in English!

Incredible bargain — you'd pay over $800 for a similar built-up system!



TYPICAL SYSTEM

2650 MINI-COMPUTER

Fantastic new 2650 Mini Computer (see May '78 EA). Complete kit includes all electronic parts, PC board and power supply plus case, Marvi-plate lid and deluxe brushed aluminium front panel.

Complete kit for above: Cat K-3447 .. .. $115.00 *

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2650 microprocessor chip only: Cat Z-9201 .. .. $28.50

2608/CN0035 pip bug 8k ROM only: Cat Z-9309 .. .. $19.75

VIDEO DISPLAY UNIT

Incredibly low cost Video Display Unit uses your own TV set as the monitor. See EA, February & May '78 for details.

Basic Video Display Kit: Cat K-3460 .. .. $97.50 *

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Keyboard Console Metalwork: Cat H-3130 .. .. $24.50 *

Keyboard (fully assembled): Cat X-1180 .. .. $55.00 *

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AC/DC cassette recorder ideal for this system.

Cassette recorder Cat A-4092 .. .. $39.95

Cassette tapes: C60 LN – Cat C-3350 .. .. $1.50

C90 LN – Cat C-3352 .. .. $2.00

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PAPER TAPE READER KIT

See page 33 or our new catalogue for full details. Ideal for use with the 2650 mini-computer. Kit includes all electronic components, handsome black anodised aluminium case, ribbon interface cable and complete assembly and interface instructions, schematics and software.

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PARAMETERS/ELECT

GRAND INSTRUME

Design a simple Electronic Project and you could win one of the valuable prizes opposite . . .

Parameters in conjunction with Electronics Australia, will be running a series of contests over the next few months with instruments from Trio and B&K as prizes. The first is a project design competition with a first prize of a Trio CS1560A, 15MHz dual trace oscilloscope. This popular laboratory instrument is worth over $500 and is widely used by hobbists and professionals alike.

The aim of the first contest is to find electronic projects which readers can construct from readily available components. The winning entry will be the project which is most ingenious, well designed and practical. While there is no limit to the cost of the project, entries costing under $50.00 will be more favourably received. It is important that all components are readily available and that the circuit should not rely on critical components or tolerance for successful operation. Although ideas may be drawn from other sources, we will be looking for a significant element of original planning.

TO ENTER

Submit a description of your project with circuit diagrams, parts list etc. and a brief description of how it works. Your submission should be broadly similar to the project articles in Electronics Australia.

Entries should preferably be typed and double spaced. A carefully presented entry will stand a better chance than one that is careless or incomplete. Physical and printed circuit layouts and photos of the completed project should also be included if possible.

The judges will be the editorial staff of Electronics Australia and Bruce McCarthy of Parameters.

Each entry must be accompanied by a signed entry coupon.

CLOSING DATE for the contest is Monday 4th September. Entries delivered by hand or postmarked later than that date will not be eligible.

Depending on the location of the winners, prizes may be presented at their local electronics stores.

REMEMBER – Enclose circuit, description, layout diagram, photos, parts list, cost estimate and declaration coupon. DO NOT send completed projects. Address your entry to: Parameters/E.A. Grand Instrument Contest No. 1
c/o Electronics Australia, P.O. Box 163, Beaconsfield
N.S.W. 2014.

CONDITIONS

1. Readers may submit as many entries as they wish, but each must be entered as a separate item in its own envelope with circuit, text, diagrams, parts list etc. and a signed entry coupon as below (or copy where this requirement is illegal).
2. Electronics Australia will take reasonable care of entries but accepts no responsibility. Entries can only be returned if requested and if an envelope and sufficient return postage are included.
3. Projects should conform to current legal and safety requirements.
4. Electronics Australia shall have exclusive publication rights to any entry for a period of 12 months. All articles used will be paid for at current E.A. rates with copyright vested in Electronics Australia.
5. Members of the staff of Parameters and Electronics Australia and associated companies are not eligible to enter the contest.
6. The decision of the judges will be final and no correspondence will be entered into.

ENTRY COUPON

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What electronic test gear do you already own?

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Title of Project . . . . . .

I declare that the above project has been designed, built and tested and shown to work as per the circuit and other information enclosed. Further, to my knowledge it does not duplicate or infringe any design previously published. I also agree to abide by the conditions of the contest.

Signed . . . . . Date . . . . . .

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2nd. PRIZE

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The Serviceman

On direct coupling, cable colour codes &c

I have rather a mixed bag this month. As well as a rather tricky fault in the sound section of a TV set, there are a couple of letters from readers regarding previous comments in these notes. There is also a puzzling fault in a potentiometer.

First the tricky fault in the TV set. It was a Pye monochrome set using a T26 chassis and the complaint was no sound. More exactly, it was a failure in the audio amplifier section.

The audio amplifier used a fairly standard complementary-symmetry class B output stage fed by two amplifier stages, and direct coupled throughout. There is also a DC feedback path from the output stage to the input stage.

Elegant and all though such circuits may be in terms of performance versus costs, I doubt if there are many servicemen who like direct coupled circuits. And this includes some of us who are old enough to remember the direct coupling boom in the valve era, back in the days of the 24A and the 47.

The objection was much the same in both cases; a fault in any part of the set was usually reflected in voltage abnormalities right through the circuit, making fault finding just that much harder.

In this case I started by measuring the voltage at the emitter junction of the two output transistors, Q33, Q34, which turned out to be almost zero, instead of around half the rail voltage as one would expect.

The next logical check point was the collector of the driver stage, Q32, This determines the bias for the output stages and should be at about 20V. Instead, it was also near zero.

I moved on to the base of Q32 which, according to the circuit, should have been at 0.6V. I read it as 0.7V and reckoned that that was close enough. I moved on to the first amplifier stage, Q31, but, as far as I could determine, all voltages here were within acceptable tolerance. So why no collector voltage on Q32?

Suspecting that Q32 itself might be faulty I replaced it, but this achieved nothing. Then I removed the output transistors, but still no collector voltage for Q32. (It was getting silly now!)

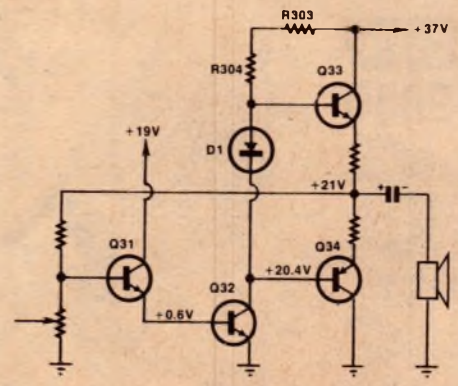
A check at the base connection for Q33 (still out of circuit) revealed zero voltage again and this left only R303, R304, D1, and Q32 as the likely offenders. A measurement at the junction of R303 and R304 showed about 15V, suggesting a heavy current through these four components.

The next step was to remove Q32, whereupon the voltage at the collector point jumped to almost the full rail value. For whatever reason, Q32 was drawing excessive current. Suspecting it was faulty, I replaced it, but the new one performed exactly the same.

I replaced the output transistors and went over the voltages again. The first hint came when I measured the base of Q31 the second time. It measured 0.6V, as it had before, and this seemed fair enough at first glance.

Then I realised that this voltage was incompatible with the circuit. Q31 derives its bias from the emitter junction of the output stage which, at the moment, was at zero. So where was the 0.6V coming from?

The only explanation I could find was that Q31 had a degree of collector base leakage; something which could easily upset the whole delicately balanced direct coupled system.



Simplified circuit of the TV audio amplifier. Excessive leakage in one transistor upset several voltages.

Sure enough, a new transistor in this position put all voltages back to normal and the set burst into song. (Well, it was a commercial actually, but it was music to my ears.) In particular, I noticed that the base voltage for Q32 dropped from the previous 0.7V to the 0.6 marked on the circuit. There had been a clue there, had I but recognised it.

And from the story itself we can deduce the following: Murphy's Law states that, in any direct coupled system, a faulty transistor will always be the last one you remove, regardless of which end you start from. And if you start in the middle, you'll always move in the wrong direction!

And now for the letters. The first one, from N. S. of Burnie, Tasmania, is really self explanatory and I need only say "thank you" on behalf of both myself and any readers who benefit from his experience.

Dear Sir,

I read with interest your article in the February issue with reference to the regulator circuit used in the AWA P15 TV set.

I have come across this fault several times and now regard it as a stock fault.

After close investigation with a particularly stubborn P15 regulator the kick start capacitor shown as 5.0uF was changed (by trial and error) to a value of 15uF.

This restored normal operation and I have since used this modification to cure all P15 regulators which have been reluctant to start.

I hope this information is of some value.

Yours Faithfully,
N. S. (Burnie, Tas.)

The second letter, from G. T. of Turramurra, N.S.W. is equally interesting in its own way, but does raise a number of questions.

Dear Sir,

I read your article in the November 1977 issue concerning the new coding

of three core appliance cable. (Red, black, green = brown, blue, green with yellow stripe.)

The reason behind this is colour blindness. To people who are colour blind, both red and green look black so, when they are confronted with a three core cable, all they see is a mass of black wires.

For this reason the red and green have been changed to colours that are distinctive: brown and green with a yellow stripe; and the black to blue, so that it isn't confused with the green portion of the earth wire. The striping is a reinforcement to the colour coding.

Yours Faithfully,
G. T. (Turramurra, NSW)

I have never heard of colour blindness being given as a reason for adoption the new appliance cord code, in spite of having seen several announcements regarding its adoption. I was sufficiently intrigued, therefore, to contact the Standards Association of Australia for their version of its origin.

According to them, the main reason was simply to end the confusion caused by a large number of individual standards, particularly in Europe, by producing a standard which was agreeable to all countries.

(Some European countries, working on the basis that red stands for danger, had allocated red as the earth wire!)

As far as the SAA is concerned the only reference to colour blindness which they can recall is that the striped earth lead may be beneficial in some cases. (I gained the impression that finding a combination agreeable to all parties was far too big a problem to permit consideration of a mere seven per cent of the male population. They would have to do what they have always done; manage as best they can.)

Having said that, it is still interesting to look at the problem of colour blindness, and see how it is likely to be affected by the new arrangement.

I have always been under the impression that there were several forms of colour blindness, involving quite different colour combinations. Granted, the commonest form, Daltonism, does involve confusion between red and green, but the first reference I consulted said, simply, ". . . inability to distinguish between red and green" There is no mention of these colours appearing as black.

Later I was able to borrow a couple of very good references which shed a good deal more light on the subject. According to one ("Principles of General Psychology", by Kimble and Garmezy), "Colour blindness comes in many gradations, ranging from the complete absence of colour vision through various degrees of colour weakness to normal colour vision."

And again, "The most frequent type of colour blindness is the red-green variety, which is fairly common in males and much less so in females. People

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with this defect have difficulty distinguishing green from red, seeing them both as yellowish." That last statement would seem to be of particular significance in this context.

The other reference, (Introduction to Psychology" by Hilgard, Atkinson, and Atkinson) makes a similar comment; "By far the most common form of colour blindness is red-green blindness .... This deficiency affects some 7 per cent of men but less than 1 per cent of women. Total colour blindness, in which the person sees merely black, white, and grey is extremely rare; yellow-blue blindness, in which the red-green discrimination is preserved, is rarer still."

So where does this leave us? With the old style cable, a red-green blind person would see the active (red) and the earth (green) as similar shades of yellow, with the neutral (black) the only one clearly identified. While not as suggested by my correspondent, the difference is largely academic; there is still confusion between the two most important wires, with the possibility of tragic results.

And what about the new system? The blue (neutral) is the one most likely to stand out for the red-green victim, after which he has to differentiate between the brown (active) and green and yellow (earth). Since he sees green as yellow he may or may not be able to discern the stripe, depending on contrast, but this may not be important.

The real question is how he reacts to brown. Brown is a difficult colour to analyse but the best definition I have found so far is that it is a form of yellow. On the face of it this sounds bad, but it is likely that it is a dark enough colour to permit it to be recognised.

Let's hope so, anyway!

Reverting to technical problems, a colleague recently handed me — literally — an intriguing puzzel he had encountered. It was a plastic bag of bits and pieces which I recognised as a twin slide-type potentiometer.

According to my colleague it had come from a well known imported brand amplifier, and the customer's complaint was that one channel was dead. It did not take him long to trace the fault to the appropriate section of the twin pot which, in simple terms,was open circuit.

As a first step he tried a few squirts of cleaning fluid and then, when this did no good, he pulled the unit apart for a closer look, thinking it might be nothing more than a set of contacts that needed tensioning.

The device was a fairly conventional design. There were two parallel tracks, one metallic and one carbon, above which ran a small nylon carriage. This carried two sets of contacts, one for each track, and the lever for the operating knob protruded from the opposite side.

The puzzling thing about the faulty section was that there was no obvious fault. Careful checking with the ohm meter confirmed that both the metal and carbon tracks were intact, as were the terminals connecting to them. But when assembled so that the two tracks were bridged with the contacts, exerting adequate pressure, there was no continuity between the two tracks.

Nor was there any obvious fault in the bridging contacts, which were punched from one piece of metal. In short, somebody — or something — was breaking Ohm's law!

This was as far as my colleague had investigated the problem. When it was obvious that there was a serious fault in the pot he simply scrapped it and replaced it with a new one. But still puzzled as to why it wouldn't work, he passed it over to me.

The contacts on the puzzle pot which failed to complete the circuit between the two tracks on the base.

Having made all the obvious tests and confirmed my colleague's findings I pulled the thing to pieces again and examined it in detail. This revealed nothing, but I did discover that, by pressing the two contacts onto their appropriate tracks I could establish a circuit, but only by rocking the nylon carriage about the contact points. While ever it was parallel with the tracks there was no circuit.

A jeweller's loupe solved the problem. Under the glass it was obvious that the plating on the contacts had worn through where they rubbed on the track, uncovering the base metal. This had apparently tarnished quite badly, to the point where it was not only an excellent insulator, but would not respond to any of the usual cleaning fluids.

I'm not sure just how valuable this exercise was, apart from satisfying our curiosity, but it is probable that I will be less inclined to try salvaging such pots in future. If the plating is all that poor, and the base metal so prone to tarnishing, there is little point in trying to prolong their life.

Tape reader kit for hobby computers

A significant amount of microcomputer software is made available in punched paper tape form, so that a low cost paper tape reader can be a worthwhile addition to most hobbyist systems. In this article the author reviews the Oliver OP-80A reader, which is available in kit form.

by JAMIESON ROWE

Although most computer hobbyists tend to use magnetic tape cassettes for their own program storage, for economy, punched paper tape still tends to be used quite often for program interchange. Probably one reason for this is the variety of different magnetic recording methods and formats, many of them incompatible. Another is perhaps because paper tape is not so easily "erased".

Of course for someone with a teleprinter like the well-known Teletype ASR-33, it is easy to generate and load in punched paper tapes using the built-in punch and reader. But few hobbyists can afford the luxury of an ASR-33, as even second-hand units can cost as much as $800. And alternative tape punches and readers are not easy to come by.

Still, if you can't run to both a punch and a reader, the next best thing is to have a reader only. Then at least you can load into your system tapes produced by commercial software suppliers, or from more fortunate hobbyists.

Happily, you can buy simple paper tape readers quite readily, and for a relatively modest cost. Some of them are even available in kit form, like the unit reviewed here: the OP-80A, made by Oliver Audio Engineering of Glendale, California. The kit reviewed was kindly supplied by Computerland, of 55 Clarence Street, Sydney, who have it available for $91.95 plus tax if applicable.

As paper tape readers go, the OP-80A must be pretty close to the simplest one could get without seriously sacrificing performance. There are no moving parts at all apart from the tape, which is simply pulled through the reader either by hand or via a separate winder. The data sensing is performed optically, by an array of phototransistors, using light provided by an external source such as a small desk lamp. The tape is held in correct alignment by simple guides of stout wire.

There's almost nothing to go wrong! OAE have made the reader self-clocking, by using the tape sprocket holes to generate the data strobe signal. This means that after the reader and its light source have been set up correctly, you can get very reliable reading at speeds up to about 5000 characters per second, despite speed variations.

Actually the circuitry of the OP-80A is quite ingenious. Nine of its 11 ICs are 555s, those ubiquitous devices normally regarded as timers. The designer of the OP-80A has been able to use them as sensitive level detectors, following the phototransistor array. The other two devices are a 7474 dual flipflop and a 7437 quad buffer, neither of which is fully used. In fact the two most expensive items in the kit are the double sided/plated through PCB, and the optical sensor array.

Unpacking the OP-80A kit on arrival, I found it to consist of four items: a plastic pack containing the PCB and electronic parts, another containing the extruded aluminium case, a length of rainbow cable with DIL connector fitted for interfacing, and the manual.

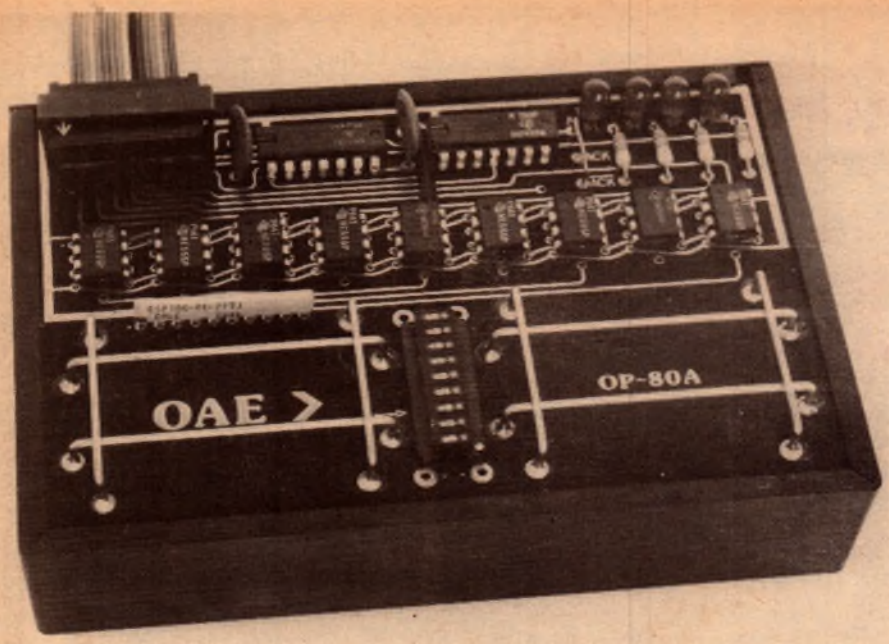
Virtually everything required is supplied with the kit, including a hank of fine gauge resin-cored solder and the pre-formed wire tape guides. These solder onto the double-sided PC board, which forms the lid of the case.

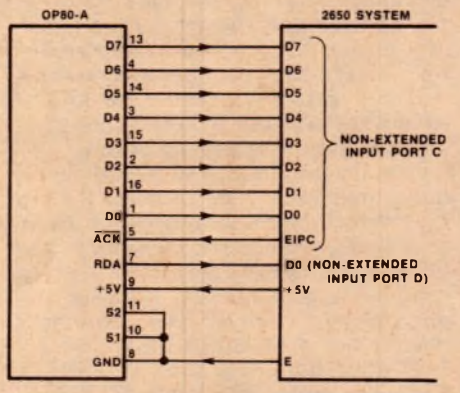
Using the manual as a guide and not hurrying, I was able to assemble the reader from the kit in less than two hours. The manual is well written, although fairly terse. Assembly was not difficult, although I spent few anxious moments looking for a 5/32in drill to use as a spacer for positioning the horizontal tape guides. I did decide to deviate from the manual instructions slightly, by packing the optical detector array about 1mm up from the PCB before soldering. This brings it closer to the underside of the tape, which should minimise reading parallax.

Once the reader was finished, I then had to try it out with a computer system to make sure it worked. The system I elected to interface it with is my 2650 system, which has parallel input and output ports readily accessible.

The OP-80A has a number of interfacing requirements. As well as the eight data bit outputs, it provides a "reader data available" or RDA strobe signal, available in either polarity as required. In turn it requires a resetting "acknowledge" signal from the computer, also of either polarity (a link is used to adjust the OP-80A for whichever is available). The reader also requires +5V at around 120mA.

The OP80A kit when it arrives; A bag of parts, a case, a cable for interfacing and a manual. We put it all together in less than two hours.





INTERFACING OP80-A TO 2650 SYSTEM
(NUMBERS REFER TO 16-WAY DIL SOCKET)

```
13A1 70
13A2 44 01        ANDI,R0
13A4 18 7B        BCTR,EQ   13A1
13A6 30
13A7 17
13A8 3B 77        BSTR,UN   13A1
13AA 3B 89        BSTR,UN   13B5
13AC D3
13AD D3
13AE D3
13AF D3
13B0 CB 86        STRR,R3   13B8
13B2 3B 6D        BSTR,UN   13A1
13B4 3F 02 46     BSTA,UN
13B7 6F 04 12     IORA,R3
13BA 03           LODZ,R3
13BB C1           STRZ,R1
13BC 3F 02 3D     BSTA,UN
13BF 17
13C0 3B 5F        BSTR,UN   13A1
13C2 E4 3A        COMI,R0
13C4 98 7A        BCFR,EQ   13C0
13C6 20           EORZ,R0
13C7 C8 96        STRR,R0   13DF
13C9 3B 5D        BSTR,UN   13A8
13CB CD 04 0D     STRA,R1
13CE 3B 58        BSTR,UN   13A8
13D0 CD 04 0E     STRA,R1
13D3 3B 53        BSTR,UN   13A8
13D5 59 03        BRNR,R1   13DA
13D7 1F 84 0D     BCTA,UN
13DA C9 90        STRR,R1   13EC
13DC 3B 4A        BSTR,UN   13A8
13DE 0C 04 2C     LODA,R0
13E1 98 96        BCFR,EQ   13F9
13E3 C3           STRZ,R3
13E4 CB 83        STRR,R3   13E9
13E6 3B 40        BSTR,UN   13A8
13E8 0F 04 29     LODA,R3
13EB EF 04 28     COMA,R3
13EE 18 06        BCTR,EQ   13F6
13F0 01           LODZ,R1
13F1 CF E4 0D     STRA,R3
13F4 DB 6E        BIRR,R3   13E4
13F6 08 E7        LODR,R0   13DF
13F8 9C 00 1D     BCFA,EQ
13FB 1B 43        BCTR,UN   13C0
```

For those who have 2650-based systems, the interfacing and loader program used by the author to test the OP-80A are shown above.

The way I interfaced it to the 2650 system is shown in the small circuit diagram. The data outputs D0-D7 are taken to non-extended input port C, while the RDA output is taken to bit 0 of port D. The ACK-bar input is taken to the "port C enable" signal line (EIPC), so that the acknowledge signal is automatically sent to the OP-80A whenever the computer reads from port C.

Hooking the reader up to the computer in this way, the first thing you discover when power is applied is that the OP-80A has an indicator LED driven from the sprocket hole detector, to make it easy to adjust the light level. Naturally enough, the light level for optimum reading reliability varies according to the type of paper tape; it is somewhat more critical for white translucent tape than for dark tape.

To adjust the light level, you load some tape into the reader and pull it slowly through, watching the sprocket hole LED and adjusting the light until the LED is only flashing on abruptly when each sprocket hole is immediately over the sensor. The light must be vertically above the reader, to ensure that parallax doesn't cause reading errors.

To "service" the reader with the interfacing shown, the computer software needs to sense input port D, and detect when the OP-80A's RDA line takes bit 0 to the high logic level to indicate that a frame of data has been read from the tape. Then the software can read from input port C, to both fetch the data and reset the OP-80A via the EIPC-ACK line.

The routine to do this is very simple, involving only five 2650 instructions. To try it out properly I incorporated the routine in a loading program, adapted from the loader in the Signetics PIPBUG monitor. A disassembler listing of the loader is reproduced in this article, for the benefit of those readers with 2650 systems.

The routine to service the OP-80A reader is in fact the first five instructions, currently occupying addresses 13A1-13A7. This routine effectively replaces the "CHIN" subroutine in PIPBUG, performing the basic retrieval of characters from the reader. Following this routine is another, occupying addresses 13A8-13BF, which effectively replaces the PIPBUG "BIN" subroutine. This routine calls the first routine twice each time it is called itself, to load in two hex characters and convert them into a binary byte.

The actual loader program itself which calls the two routines occupies addresses 13C0-13FC, and starts at 13C0. It functions in exactly the same fashion as the PIPBUG loader, being used to load program tapes into memory. The only difference is that it is designed to load them via the OP-80A.

Incidentally the loader is relocatable, and may be moved anywhere in the first page of 2650 memory space (0440-1FFF). Note also that the two routines at the start may be used by any other programs intended to work with the OP-80A.

After the light level had been adjusted, I used this loader to load quite a number of programs into the 2650 via the OP-80A. They loaded in without a single error, despite the inevitable speed variations caused by "hand drive". Thanks to its self-strobing circuitry, the OP-80A seems virtually immune to speed variations, reading reliably even if you pull the tape through in a series of "jerks".

No doubt you could produce errors if you really tried, but otherwise the reading reliability is remarkably high.

To summarise, then, I found the Oliver OP-80A tape reader very easy to assemble from its kit, and the assembled reader both convenient and reliable in use. For those wanting a reasonably low cost way of being able to load software into their hobby computer from punched paper tape, it can be recommended.

ECONOMY POWER SUPPLY

Ideal for microprocessors, this kit supplies +5v/10A, +12v/1A, −12v/1A fully regulated (S100 users can use the +8v. ±16v unregulated outputs as well) and optional overvoltage protection can be fitted. This comprises of transformer, bridge rectifier and all diodes, filter capacitors, PCB. regulators and full assembly instructions. Can be readily adapted to fit any metal work.

$49.50 KIT EPS.100
Package and Post $3.50

CASSETTE INTERFACE

Adapted from a design described in Radio Electronics, this 300 baud interface uses the Kansas City standard 1200/2400 Hz. encoding. Easily constructed, using standard TTL chips and a special test tape is supplied to simplify alignment. Kit is supplied with PCB, all components, test tape and full instructions.

$22.50 KIT R.E.C.I.
Pack and Postage $1.00

S100 PROTOTYPE BOARD

This is an ideal card for any prototype work. Consists of top quality tin plated PCB with hard gold S100 edge fingers. Will suit virtually any IC package, has power and ground plane and provision for on card voltage regulator.

$19.50 S100 PROTO BOARD
Pack and Postage $1.00

S100 MOTHER BOARD

This 8 slot S100 Mother Board will greatly simplify construction of your S100 system. Has provision for power distribution and bypass capacitors. Also accepts 16 PIN DIL connections to adapt to other systems.

$22.50 S100 MOTHER BOARD
Pack and Postage $1.00

LOW COST V.D.U.

As described in E.A. February, this compact V.D.U. is an ideal peripheral for microprocessor systems.

- 32 characters/line. 16 lines.
- parallel ASCII (TTL) input.
- video output.
- 1K on board memory.
- Automatic scrolling, carriage return, line feed.
- screen clear facility.
- uses low power TTL and MOS devices.
- requires +5v at 800 M.A.
  −12v at 30 M.A.
- Plated through hole PCB.
- supplied with full instructions and trouble shooting guide and Xtal.

$99.50 LOW COST V.D.U.
Pack and Postage $2.50

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This very simple device works with TTL circuits and TTL compatible levels from microprocessors and identifies LOW LOGIC STATE . . . . . .
HIGH LOGIC STATE.
FLOATING OR H1 Z INPUT.
EXCESSIVE OR INSUFFICIENT VCC.

Also doubles as a pulse injector!

Kit consists of PCB, IC's, LEDS, RESISTORS/CAPACITORS and full instructions.

$2.50 POST FREE

OR

FREE with any order over $20.00 (offer expires April 15, 1978).

SC/MP ON S100 CARD

Interested in expanding your Miniscamp to a more useful system? This handy PCB. makes it possible to connect the SC/MP (N or P Channel) to the hobby standard S100 buss. Has provision for Xtal clock and full buffering of the chip, and of course on-card regulators. Board is top quality fibre glass tin plated with hard gold S100 edge fingers.

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Reaction time program for Mini Scamp

Here is another simple program for Mini Scamp, from its designer Dr. John Kennewell. Designed to show the use of interrupt programming, it measures human reaction time in hundredths of a second. The additional hardware required is minimal: a pushbutton switch and a resistor!

by DR JOHN KENNEWELL
Physics Department, Newcastle University

The program to be described here can be used to measure your reaction time and display it in one-hundredths of a second on the LED's of Mini Scamp. Only minimal external hardware is required, and the program makes use of the interrupt facilities provided on the SC/MP CPU chip.

The concept of interrupt programming is a very important one, and is employed in many situations where slow peripherals (e.g., a keyboard) are communicating with the computer. In this instance, it would be a waste of time if the CPU was almost permanently in the hold mode waiting for a character to be input from the keyboard. On the other hand, if the CPU went away and did something instead of waiting on the keyboard, it might miss the character, which could be input at any time. The resolution of this problem lies in the use of interrupt programming. In this mode of operation, the CPU does what it will most of the time, but as soon as a signal appears at its interrupt input, it suspends what it is doing and jumps to a specified program routine to "service" the device that created the interrupt (in this case, to accept the next character from the keyboard).

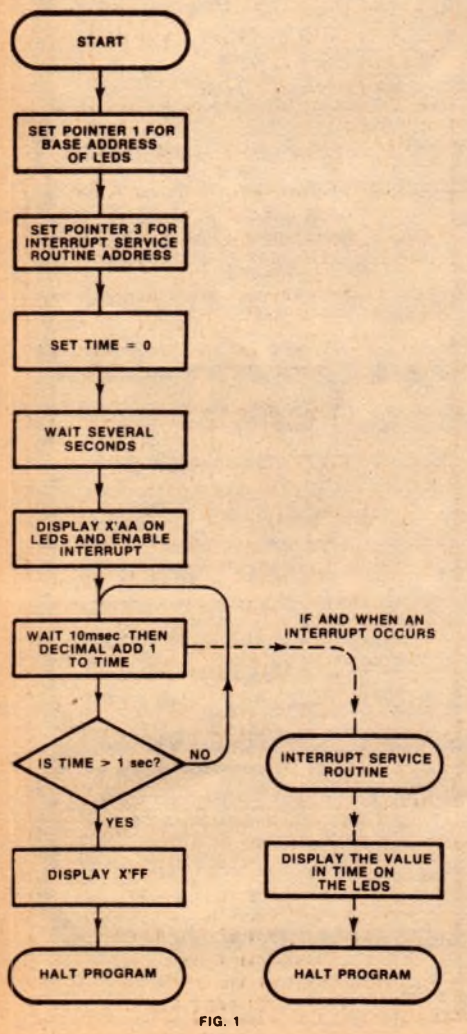


FIG. 1

In the SC/MP, the sense A input also serves as the interrupt input. However, the interrupt mechanism is only enabled after an IEN instruction has been executed in the program. It may also be disabled, with a DINT instruction.

If, at any time after an IEN instruction has been encountered, the sense A input goes high, the CPU will complete execution of the instruction it is presently working on, and then will jump to whatever address is contained in pointer register 3. It is thus essential that register 3 has been loaded with the starting address of the interrupt service routine, prior to giving the IEN command. To avoid the problems which would be caused if a second interrupt occurred while the first was still being dealt with, the interrupt facility is automatically disabled after the interrupt, and must be re-enabled, if desired, by the programmer through another IEN command.

To enable a better understanding of the operation of the program to measure reaction time, a flow chart is shown in Fig. 1. Notice that the main body of the program and the interrupt service routine are two separate programs, with no logical connection (represented by a continuous line) between them. The dotted line represents the jump that occurs between the two if and when an interrupt occurs.

The flowchart is fairly self explanatory. As the LEDs are required for display purposes, their address must be first set up in pointer register 1. The address of the interrupt service routine is also loaded into pointer register 3 at this stage.

The variable TIME is used for counting the reaction time, and is set to zero each time the program is run. A delay of several seconds is then incorporated into the program. After this time the LEDs are set to display the binary word "10101010". This particular number was chosen because it is dissimilar to any other display produced by the program. Thus, whatever the LED's were displaying before this time, they will change at this moment. This provides a visual cue to the subject whose reaction time is being determined. The moment he or she sees the LEDs change, the pushbutton of Fig. 2 should be depressed, causing a high logic level to appear at the sense A input, and thus creating an interrupt.

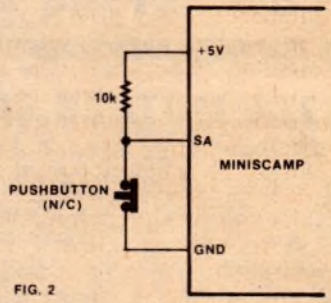


FIG. 2

However, immediately the LEDs change the program starts to execute a

```
                *REACTION TIME
0000 08                 NOP
0001 C400               LDI   0
0003 37                 XPAH  3
0004 C42F               LDI   X'2F          ;DISPLAY ADDRESS
0006 33                 XPAL  3
0007 C400               LDI   0
0009 31                 XPAL  1
000A C408               LDI   8
000C 35                 XPAH  1
000D C400               LDI   0
000F C829               ST    TIME
0011 C40F               LDI   15
0013 C824               ST    DELAY
0015 8FFF   DLP         DLY   255
0017 B820               DLD   DELAY
0019 9CFA               JNZ   DLP           ;DELAY 4 SECS
001B 05                 IEN                 ;ENABLE INTERRUPT
001C C4AA               LDI   X'AA
001E C902               ST    2(1)          ;FLASH 10101010
0020 C400   TLOOP       LDI   0
0022 8F08               DLY   8             ;DELAY 10 MS
0024 C014               LD    TIME
0026 EC01               DAI   1
0028 C810               ST    TIME
002A 9CF4               JNZ   TLOOP
002C C4FF               LDI   X'FF          ;REACTION TIME
002E C902               ST    2(1)          ;> 1 SEC
0030 90FE   HALT        JMP   HALT          ;STOP
0032 C006               LD    TIME          ;DISPLAY SUBROUTINE
0034 C902               ST    2(1)          ;DISP REACT TIME
0036 90FE   HALTA       JMP   HALTA         ;STOP
0038   00   DELAY       BYTE  0
0039   00   TIME        BYTE  0
003A                                    END
```

Fig. 3: the reaction time program listing for Mini Scamp.

loop that adds one to the variable TIME for each 10 millisecond interval that elapses until the interrupt actually occurs. Upon receiving the interrupt, the CPU jumps to the service routine whereupon it then displays the current value of TIME on the LEDs. Because decimal addition was employed to increment this variable, the readout on the LEDs contains two BCD numbers. These numbers represent the reaction time in one-hundredths of a second.

One condition we have not yet discussed is what happens if the interrupt does not occur. Well, as you may have realised from the flowchart, each time around the 10 ms counting loop there is a test made to determine if TIME contains a value indicating that more than 1000 ms (1 second) has elapsed. If it does, the program is terminated and all the LEDs are turned on to indicate this condition. Those of you who find this happening frequently when running the program would be well advised to have a physical checkup or drink less!

The actual program listing is given in Fig. 3. I have incorporated a delay of about four seconds between the time of setting the RUN/HALT switch to RUN and that when the LED's change. This may be lengthened (by increasing the number in address X'12) if you find that you are able to anticipate this change too readily. In fact, those with a little ingenuity might like to incorporate the random number generator routine of August 1977 at this point, to provide a random starting delay of between say 3 and 15 seconds.

The delay of 10 milliseconds is fairly critical if you wish to achieve accurate results with this program. Unfortunately, this value depends upon your exact clock frequency, and this will in turn depend on the exact value of the 470 pF capacitor (or crystal) used in the SC/MP clock circuit. Fortunately, even without access to an accurate frequency meter, it is possible to measure this frequency. This can be done by running an earlier program "Binary Count and Display", and determining (using a watch) how many seconds it takes to run right through a complete cycle; that is, to count from 0 through 255 and back to 0 again. The clock frequency (in megahertz) of your computer is then equal to 67.272 divided by this time. More importantly, the time of one microcycle (in microseconds) is equal to the above time (in seconds) divided by 33.636.

The number of microcycles required (R) in the 10 ms delay instruction is now given by 10,000/(microcycle time (*us*)) —72. As the actual delay in microcycles is 13 + 2 x (accumulator) + 514 x (displacement), the displacement (address X'23 in the program) is given by D = (R — 13)/514, forgetting the remainder. The accumulator value (address X'21) may be found by (R — 13 — 514 x D)/2.

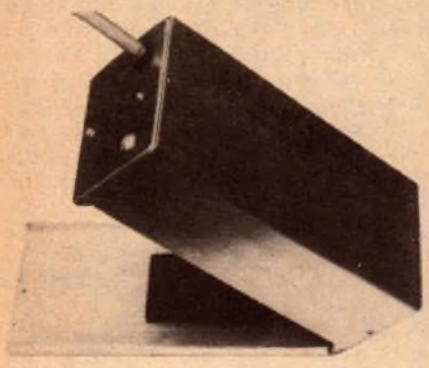
The above procedure may seem rather complicated, but is worth trying to follow if you wish to make accurate measurements of reaction time.

The final point of note about the program is the method employed to "stop" the program. Although the SC/MP CPU does have a HALT instruction, it requires additional circuitry, external to the chip to implement it. Otherwise it will be regarded as an NOP instruction. The way I have chosen to implement a pseudo HALT it to simply put the machine into a tight loop (HALT JMP HALT) wherein the JMP instruction simply jumps back to itself. For most purposes the machine thus appears to be effectively halted.

After loading the program into your computer, it may be run in the usual way (i.e., CPU, RESET, RUN). The normally closed pushbutton (Fig. 2) should then be pressed as soon as the LEDs change. Your reaction time will then be displayed on the LEDs. For example, if the LEDs display 00101001 this would indicate a reaction time of 0.29 seconds. Note that the first four LEDs (from the left) are a BCD representation of the first number after the decimal point. The rightmost four LEDs give the second decimal place. A healthy young adult should have a consistent reaction time with this apparatus of between about 0.2 and 0.3 seconds. To run the program again simply go through the sequence HALT, RESET, and RUN.

Microcomputer News & Products

EPROM eraser

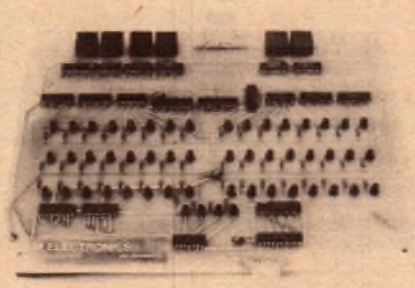


SM Electronics, of PO Box 19, Doncaster East, Victoria, are marketing an ultraviolet erasing unit for EPROM devices such as the popular 2708 and the newer 2716. Mains operated, it will erase up to four devices at once. The unit is small in size, measuring only 75 x 100 x 150mm. Typical erasing time is 15-30 minutes.

The EPROM eraser is available in assembled and tested form only, at $47.50 plus postage where applicable.

Also available from SM Electronics is a universal front panel display board for microcomputer systems. This features 16 address bus and 8 data bus LEDs, 12 LEDs for various system status and control signals, and two 8-bit output ports with LEDs as well.

As an optional extra the front panel is also available with hexadecimal displays



on the address and data bus lines. Power supply is from a single +5V source, and low power Schottky buffering is used for low loading.

Price of the standard panel is $75.00 including tax, with the hex display option available for $30 extra.

SM Electronics also advise that there was an error if their advertisement in the February issue. The price given for the Backplane boards should read $24.50, regardless of quantity.

Club in Hobart

A microcomputer society has been formed in Tasmania. Called the Tasmanian Amateur Computer Society, or "TACS" for short, it meets at 7.30 pm on the first and third Tuesdays of each month in the Computer Studies area of the Rosny Matriculation College in Hobart. Further details are available from the secretary, Mr Clive Myers, on Hobart 65-2252.

Teletypes for sale

Dr Simon Rosenbaum, of 19 A'Beckett Street, Prahran, Victoria 3181, has written to advise that he has over a dozen ASCII teleprinter machines which are available for sale. They are Teletype models ASR-33 and ASR-38, and have all been overhauled and serviced.

Dr Rosenbaum writes that the prices are negotiable, but would probably be around $500 for ASR-33s and $600 for ASR-38s.

To those wanting to add "hard copy" and punched paper tape facilities to their system, they should be of great interest. But you may have to be quick, as they are likely to go fast! Dr Rosenbaum's telephone number is (03) 51-1156.

TI micro seminars

Texas Instruments extends an invitation to engineers to attend a three-hour seminar covering their microprocessor family. Main topic in the seminar will be the 16 bit TMS9900 microprocessor and its associated products, including microcomputer modules. This is a highly powerful, very flexible MPU and is already being used in a wide variety of applications.

Also to be discussed in the seminar will be the four-bit TMS1000 device and its derivatives. This is a more dedicated MPU with built-in masked ROM ideally suited to volume production because of its cost effectiveness.

Seminar dates are as follows.
Melbourne: 9th May, 1978, at Institute of Management, St Kilda.
Sydney: 10th May, 1978, at El Rancho Motel, North Ryde.

Those wishing to attend are asked to contact Miss Virginia Bradshaw at TI's Sydney office; phone 887-1122, in order to have their names registered.

32K dynamic RAM

Innovative Micro Processor and Computer Technology have announced that they now have stocks of a new 32 kilobyte dynamic RAM board from Technico Electronics in the USA. The T99MA board measures 178 x 406mm, the same size as the 16-bit T-9900-SS single board microcomputer, and is intended primarily to be used with this.

The two boards require only two 16-way ribbon cables for interconnection. It is claimed that the resulting system is the simplest and most economically priced 16bit 34k byte system on the market.

The T99MA dynamic RAM board can also be used with other 8-bit and 16-bit microcomputer systems.

The T99MA is available either as a kit or assembled and tested. It comes with sockets for 32k bytes, but with either 8, 16, 24 or the full 32k populated. Two T99MA boards can be used with the T-9900-SS microcomputer to produce a full 64k system.

Prices range from $528 plus tax for an unassembled 8k kit to $1100 for an assembled and tested 32k board.

A special 15 per cent discount is available if a T99MA board of any size is purchased with a T-9900-SS microcomputer board.

Further information is available from IMPACT at Box 177, PO Petersham, 2049.

Micro consultants

A new Melbourne-based consultancy is offering a service that is claimed to offer industrial microprocessor users a potential saving of thousands of dollars. Elston Micro Control provides an alternative programming and design service, using powerful program development equipment and software development aids. A microprocessor program can be written and debugged in a fraction of the time required with more simple facilities.

A hardware and software commissioning service is also available.

Further details are available from Elston Micro Control, 71 Peel Street, Windsor, Victoria. Telephone 51-2062.

Japanese 8080A microprocessor forms heart:

NEC TK-80 system

Tecnico Electronics have released a single board microprocessor evaluation kit based on the 8080A MPU chip. It is the TK-80 system from Nippon Electric Co Ltd, and is based on the uCOM-8 family of LSI devices. A keyboard and LED display is provided on board for man to machine communications, making the unit fully self-contained.

by DAVID EDWARDS

In the past we have reviewed a number of microcomputer systems, produced by American companies but the unit reviewed here is unique in that it is of Japanese origin. It is an 8080-based system mounted on a single double sided printed circuit board, measuring 310 x 170mm. A number of rubber feet are fitted to the underside of the board, so that it is held away from the workbench.

A keyboard is fitted to the bottom right hand corner, with a LED display covered with a transparent red window occupying the top right hand corner. Part of the board is formed into an edge connector, to facilitate external connections.

Most of the integrated circuits are fitted into sockets, with a number of extra sockets provided for expansion purposes. There is also a small area of the board, to the left of the keyboard, reserved for user-generated expansion circuits.

The large white IC is the 8080A chip, with the RAM and ROM immediately above it. The remaining chips are support chips for the CPU and for the keyboard and display. Three documentation books are provided: a user's manual, a software manual and a program application manual.

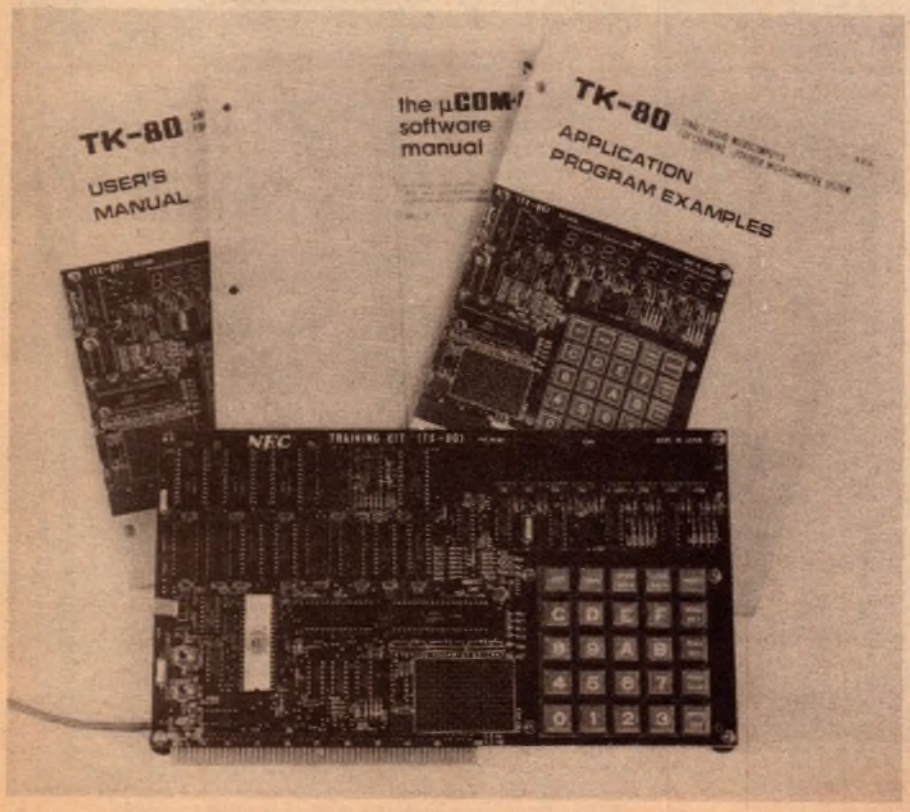
The 8080ACPU chip is supported by an 8224 clock generator and an 8228 system controller. Three factory-coded uP464 ROMs are used to store the monitor program, while two 5101 CMOS RAM chips provide 512 bytes of user memory. Provision has been made to enable expansion up to 1k of RAM, and 1k of ROM.

An 8225 programmable peripheral interface is used to provide two 8-bit bidirectional I/O ports, and two 4-bit bidirectional I/O ports. This unit is also used to implement the keyboard scanning, under monitor program control.

Eight 7-segment LED displays are provided, so that input data, memory address and data, and the contents of CPU registers and flags can be displayed. The required data for display is stored in RAM, and a hardwired logic circuit periodically samples this area using direct memory access (DMA) mode.

25 keys are provided for entry of monitor commands and user data. One of these is a direct reset key, with another 16 being the hexadecimal data entry keys. The remaining keys allow the following functions to be implemented:

Read from memory with automatic address increment or decrement
Write to memory with automatic address increment
Program run with optional breakpoint



This photograph of the TK-80 shows the three manuals supplied, as well as the main printed circuit board assembly.

Single step operation
Trace system status including all CPU registers and flags
Modify CPU registers and flags
Store and load memory to and from external audio cassette tape.

Only a single breakpoint can be set, but the number of times the breakpoint can be passed before being executed can be specified. This means it is possible to set a breakpoint in a loop, and have it acted upon after the loop has been traversed say 10 times.

Full details are provided on how to drive the LED displays, and how to get data from the keyboard. The store and load data routines operate via 110 baud teleprinter-compatible logic levels, which can be stored to and read from cassette tapes by means of a simple interface circuit. The interface as described, however, is not compatible with the Kansas City standard.

Two power supplies are required, +12V @ 150mA and +5V @ 1A. Since very low power CMOS RAMS are used, it is possible to use dry cells as a memory backup, so that programs can be retained during power failures or overnight interruptions.

The user's manual supplied with the kit contains full and complete details of the TK-80 system, including notes on power supply requirements, monitor operations, and system expansion. A circuit diagram, monitor listening and board edge finger pin assignment list are also provided.

The companion application manual contains several demonstration programs, which can be implemented with a minimum of external components. These include detailed flowcharts and program listings, and full explanations of how to use the various subroutines available in the monitor ROM.

The last four programs require the use of an audio amplifier and speaker, and implement respectively an electronic siren, a programmable metronome, an electronic organ (using the keyboard for note selection), and an automatic music player.

After working through these examples, the budding programmer should have a good understanding of programming in general and the 8080A instruction set in particular.

In conclusion, we would recommend the TK-80 single board microcomputer to those wishing to gain a thorough understanding of both the hardware and software normally used with an 8080A system. Ample provision for expansion has been provided, as well as a comprehensive explanation of the programming art and the routines resident in the monitor ROM.

Recommended retail price of the unit, which is supplied fully assembled and tested, is $215.00 plus sales tax where applicable. Further inquiries should be directed to the Australian agents, Tecnico Electronics, P.O. Box 12, Marrickville, NSW 2204.

How to program a computer and retain your sanity

Many computer industry professionals still tend to look with scorn at microprocessors, and take some delight in pointing out that those using them are making the same mistakes which they themselves made 20 years ago. On a more positive note, here's a very readable and enjoyable article by an experienced programmer, offering some down-to-earth practical advice to hobbyists on programming.

by JOHN LESLIE

This article is the result of a challenge to computer industry "old timers", to stop laughing at computer hobbyists and write something helpful for them instead. Actually, I have not been laughing at computer hobbyists, and I may not qualify as a true old timer. But I have been around long enough to make a lot of my own mistakes. I was playing "Space War" in 1963, and started programming in earnest in 1965. Since then, I have barely stopped long enough to catch my breath.

I believe that there are nine basic principles to bear in mind concerning computer programming, whether you are programming big mainframe systems or a small hobbyist microcomputer. I offer these principles to you, in the hope that they will ease at least some of the frustration.

Principle No. 1: The best study of programming is programming.

In the past 12 years or so, I have been asked approximately 7812 times how one gets started in programming. Each time, I have responded that you start by writing a program. (This, for me, is a marvel of consistency. I cannot offhand think of any other question I have answered the same way every time.)

If you run across someone who ridicules you for making mistakes, feel sorry for him. It is quite impossible to become a functional programmer without making at least 5000 mistakes. If you are one of those people who finds his identity shaken by each mistake he makes you had better find another hobby, pronto!

Of the hundreds of people who have asked me how to break into programming (perhaps I should explain that I was a physics major; to a physicist, 100 is approximately equal to 7812), I would be surprised to find more than two or three who have become successful programmers. Ninety per cent of them, I am sure, have yet to write their first program.

Now, I probably shouldn't criticize here. It was well over a year after I was introduced to computers before I wrote my first program. The thing I remember that stopped me was a feeling that it would be a terrible waste of expensive computer time to run any program I might write. Recall that in those days, computer time cost over $100 per hour.

Well, none of you reading this have that excuse. Many of you have your own computer, or know someone else who does. Computer time is as close as you can get to free.

The next thing I remember holding me back was that I couldn't think of anything I wanted the computer to do. This problem is certainly still with us. I suppose I could give some examples of first computer problems here, but I'm not going to. What you do for your first program is of utterly no importance. Personally, I haven't the remotest idea what my first computer program did. Just don't choose anything particularly important. After all, it isn't going to work.

Principle No. 2: Programming is like pancakes: throw away the first one.

In the past year, I have read at least 20 articles saying (among other things) that you should plan out all details of a computer program before writing the first line of code. This occasionally may be good advice; I must admit that it follows my actual practice on many occasions. But for the beginner, it is the worst possible advice.

The novice programmer, you see, has even less idea how to design a program than he has how to write it. (Granted, we may be dealing in infinitesimally small quantities here.) To find out whether the program works, he just runs it. To find out whether the design is good, he would have to talk to an experienced programmer and probably wouldn't even be able to understand the language. So don't waste your time worrying about the design. Dive in and write a program.

Once it is written, try to make it run. And once you can make it run (more or less), throw it away. Yes, I know that hurts — all that time going to waste. But wait! Think for a minute. What was the purpose of this exercise?

Give up? The purpose was to learn about programming. And if you actually managed to get a program running, you have learned a lot. So, the exercise was a success. You have not been wasting your time.

Now, if it turns out you made a poor choice for a first program, and in fact you could actually make use of such a program, still throw it out. But take advantage of this opportunity to learn a little bit about design. One thing you will have learned is the actual nature of the task you set out to make the computer do. When you started out, you no doubt thought you knew just what you wanted. If you go back over what

decisions you had to make, though, you will find how pitifully little you actually knew of the task when you started. But now you know. And since you know, you have some basis for designing a program.

So before you write the second version, spend a little time breaking the task into pieces. Draw a flowchart if you want, but keep it all on one page.

Principle No. 3: It's always harder than it looks.

This is not what you want to hear. You want to be reassured that all the trouble you have been having will go away with time. Well, I can reassure you there: it will. But new problems will crop up. The next time you hear a programmer saying some task was straightforward, check to find out what he means. The only thing that conceivably could be written without having to back up at some point and change the way you did something is a task you already fully understand. And those are rare.

If you have the right outlook, though, there is no reason to despair just because it is harder than you thought it would be. That just means you have to slow down and think it

. . . nine basic principles to ease the frustration

over. And it always shows that you now understand the task better than you did when you thought it was easy.

Analyze a bit to find out why it seems harder now. Many times it is because you have found a flaw in the method you were using. If so, immediately look for other flaws in that method. One of those 20-year-old mistakes is the "special case". Twenty years ago, whenever programmers found a flaw in their methods, they assumed it was just a "special case" and put in code to check for that special case and to do a different computation for it.

The result of this was programs that computed a supposedly continuous function with half a dozen (or more!) different computations, based on the input value. This can lead to disaster many ways. For instance:

1. Programmers would sometimes neglect to test that case again after the fix or would test it incorrectly. Result: a time bomb, giving the wrong value the next time that input appeared.
2. Usage of that function might take the difference of closely spaced values, greatly magnifying the discontinuity. Result: inaccurate results, miserably difficult to trace.
3. In transferral of the program, a command might get garbled, affecting only that special case. Result: another time bomb, sprung on a user who has no understanding of the program at fault.

Programmers did this (creating special cases) because they were in a hurry and because the task was supposed to be easy. You have no excuse to be in too much of a hurry (you have no boss breathing down your neck); and you know that the task isn't as easy as it once looked. So don't try to fix things by creating "special case" code.

Programmers also used to create special cases when they thought they could save a little computer time by doing so. They were almost always wrong, if you count the computer time spent in debugging. It is hoped you won't feel too tempted to do that because each special case eats up memory space, which is usually in short supply for the hobbyist.

Principle No. 4: Don't waste your time trying to make the computer run faster.

I must immediately cite an exception. Sometimes the execution time is simply unacceptable, and you must do something to fix it. But this is quite rare; even then it should be fixed after the program works.

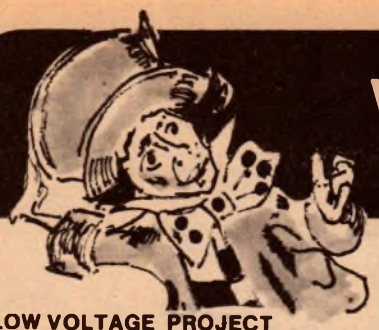
Computers 20 years ago were slower than today's microcomputers, so programmers must be excused for all the time they spent studying tables of execution times. I have finally cured myself of this habit (subject, of course, to occasionally working out timing on paper for a microcomputer I don't have access to). But one still sees articles comparing the relative worth of several microcomputers on the basis of their execution times. Such articles are valuable, but the novice should firmly understand that speed is just one of many factors and is hardly ever the most important.

It is far worse when the novice starts to think he should take advantage of the full speed capability of his microcomputer. There are a lot of tricks you can learn, and it is indeed fun sometimes to try to pry loose another microsecond. But when you are writing a computer program to do something, keep in mind that the most important thing is to get it done.

Twenty years ago, it was common practice to store a value away in some obscure, supposedly temporary, register, and use it in code several pages away from where it was stored. This, after all, saved perhaps 20 microseconds. But all too frequently two to four hours of computer time were wasted when it didn't work, trying to hunt down the bug.

We old-timers see a lot of this in today's computer hobbyists. Sure, it's a nice trick to save something away in the H and L registers of the 8080. But if you fail to comment what you've done, somebody's likely to get mighty confused about the way the program works. It's better to leave out such tricks unless you really are cramped for time.

Most successful programmers have developed the habit of noting, either explicitly or implicitly, which temporary registers are used by each subroutine. A common general rule is that



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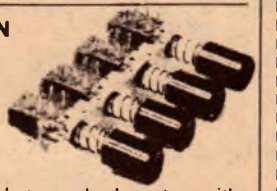

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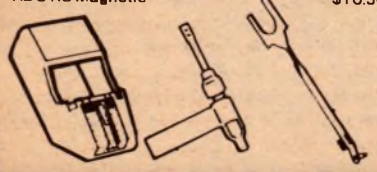

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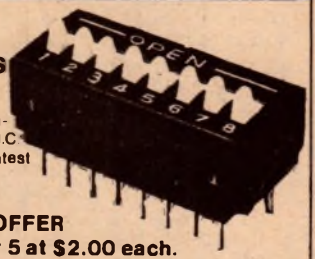

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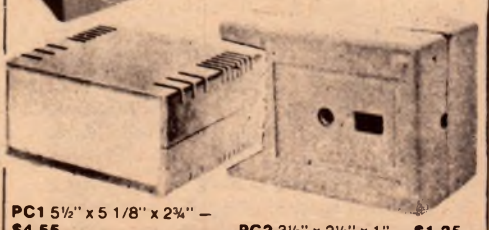

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each subroutine is expected to save and restore any temporary registers it uses. This means that at the beginning of the subroutine each temporary register is stored in some temporary area, and before returning, those saved values are loaded back into the registers. This method uses a lot of time and memory, but can save your sanity, surely more precious.

Alternatively, you could accept the convention that each subroutine may clobber any and all temporary registers, and that the calling code should do any necessary saves and restores. This takes less time and sometimes less memory, but is error prone, in that the programmer is too apt to remember that a particular subroutine doesn't clobber some register and omit the save and restore.

Principle No. 5: Don't cut corners.

When writing a program, it is exceptionally difficult to avoid thinking that some operation doesn't need to be done "in this case". Remind yourself that to omit it is to create a special case. This is perhaps the strongest area of temptation, since it requires more of your time, more execution time and more program memory to include the operation. But it will pay off handsomely if you make the rule that every operation is to be done unless some pressing need prevents it, and that even then a clear notation is required.

If you are testing for arithmetic overflow, test after every arithmetic instruction, not just after those you expect might overflow. If you are calling a subroutine that is entitled to clobber something, include code to save and restore, even though you know the subroutine, in fact, doesn't clobber it.

Now, probably I am just about to lose a whole lot of readers, who are saying, "How does this nut expect me to do all this within my 4K BASIC?" Frankly, I don't. If you want to be serious about programming (much of anything beyond copying someone else's BASIC program), you are going to need a lot more memory, or you are going to need to spend enough time to learn how to do things in machine language.

Something that will fill 4K BASIC can most likely be done in 1K in machine language. And you don't need the BASIC interpreter in memory to run machine language.

I have no particular desire to force machine language down anyone's throat. For typical hobbyist applications, it is often a rather poor choice. But, even if you obey my advice literally about cutting no corners, you can fit many more program features into available space. If you can afford enough memory to run complicated BASIC programs, by all means get it. If not, I recommend machine code. It does not require any great intelligence to learn to use it — just perseverance.

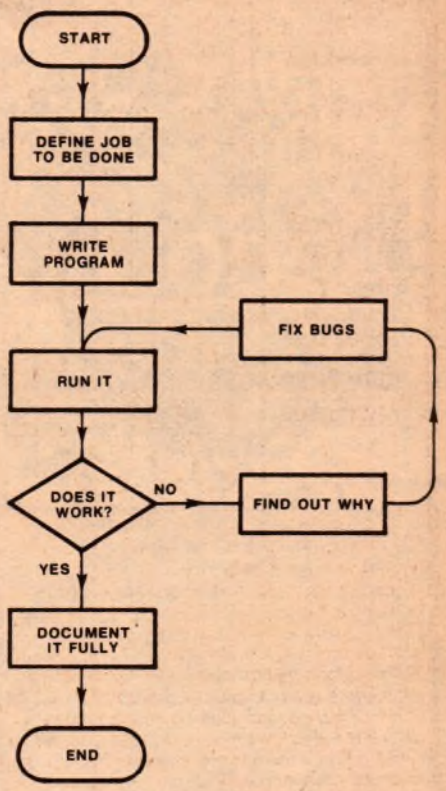
There is, of course, a middle ground: a high-level language compiler. In principle a compiler can generate reasonably compact code, and vacate its own memory space during execution of the program, giving you most of the advantages of machine code. In practice, there are problems of implementation, which make it difficult to write a compiler for a hobbyist system. At the moment, the choice is bleak. I hope this situation will improve substantially within a year or so.

Principle No. 6: Fix the right problem.

Programmers 20 years ago regarded the memory size of their computer as sacred. If their programs caused the compiler to strangle with too many symbols, they dutifully rewrote the program with shorter symbols or doubled up on variables. As you can imagine, this made for many quite unreadable programs.

The first assembler (machine-language compiler, more or less) that I ever worked with had an ingenious solution. All its symbols were a single letter followed by a number of integers, and the user had to declare the size of the symbol table beforehand. Presto! no symbol table overflow was possible. And it ran fast!

But if you can imagine a 10,000 line program with no mnemonic labels (was that Q231 or Q132?) you quickly see that it becomes unreasonably hard to read. So a local programmer wrote another version, which accepted six-character labels, and soon that assembler (perhaps 1/10th as fast-running) became the one most used. In due course people began to realize that six-character labels were a little too restrictive in larger programs; but as far as I know, that was not changed before the whole computer was replaced. We are seeing much the same thing with hobbyists. If your BASIC program doesn't fit in the available memory, we see you dutifully stripping off all the comments — which somehow reminds me of a program called CMPRS (system names were restricted to five characters). The purpose of this was to take an ordinary ALGOL program and compress it into the fewest possible characters. I'm not absolutely certain, but I think the main reason had to do with disc allocation: the program took up less disc space when compressed. As you can imagine, since ALGOL had no restrictions about the number of statements on a line, the result was nearly unreadable to a human.



It all looks very straightforward, doesn't it? But things don't always work out that way . . .

But this horror story has a happy ending. Someone realized the difficulty and set about writing a program to reverse the process. It was called XPAND, of course, and it carefully indented lines to show the actual block structure and loop structure of the program. So the net result of running the two of these was often a more readable program than the original.

Nowadays, large-scale computers always come with enough memory to support a ridiculously large program. After all, memory is cheap, and they come with enough mass storage (disc, etc.) so that people feel no desire to compact their programs into unreadable form.

All of this simply means that if you are running out of space, you need more memory — not more obscure programs. And if you are running out of time, you need a faster computer or a different method. You may have to get by for a while with the hardware you have, but never forget what the problem really is. Because that is what you are going to have to fix, sooner or later.

Principle No. 7: We have met the enemy, and he is us.

Almost all novice programmers seem

to assume that the enemy is the computer when they set out to write a program. This simply is not true. The computer is going to do EXACTLY what it is told; no more and no less. If it had anything resembling feelings, it would desire to please you.

Alas, the enemy is your self. Your brain is a marvel utterly beyond comprehension, but it doesn't think the way a computer works. It is capable of the same processes, but it has long since discarded them as ridiculously slow and inefficient. Someday, we will better understand the processes by which the brain does operate. And we will set out to build computers that work that way.

In the meantime, whenever you want to program a computer, you must think of a way to do the job using only the things the computer knows how to do.

The situation is complicated because what the computer can do, it can do many times faster than the human brain. This means that the practical solution tends to involve a combination of operations that the brain is virtually incapable of doing itself.

The best programmers learn to model these operations in their heads and work with the models. If you find yourself learning to do that, you might consider a career as a programmer. If not, I suggest you keep your current job. But don't give up computers. You can be a successful hobbyist without that skill.

Principle No. 8: If at first you don't succeed, try a smaller task.

Various studies have shown that there is an abrupt drop in comprehension whenever a concept is presented on more than one page. If you have been writing a program or designing one, and find yourself bogged down after you have written a few pages, it is definitely time to break the task down into pieces. The perfect tool for this job (or as close an approximation as we can expect) is the subroutine.

Subroutines were called into use over 15 years ago in order to save space (actually, many useful things came from our long avoidance of solving the memory problem with more memory); they quickly became popular. Gradually, we have learned to make effective use of them. And gradually, the hardware implementation is becoming better (for instance, most subroutine calls now save the program counter in the stack).

But too many people still think of the subroutine as just a tool to save memory. And they follow that to the logical conclusion that they shouldn't write something as a subroutine until they know they will call it at least twice. Consequently, they never take advantage of its more useful role.

The true advantage of a subroutine is that it needs absolutely no knowledge of the design or implementation of the routine calling it. All the information it needs is contained in a very few temporary or interface registers. Conversely, the calling routine needs absolutely no knowledge of the design or implementation of the subroutine. It merely must set up parameters and read results.

It is, of course, possible to accomplish this result without using the hardware subroutine call instructions. And the result would be just as desirable. That's not really the point. It is simply easier to do it with the subroutine call instructions.

So, take your bogged-down program, and start carving out some subroutines. Any logically distinct section that seems to require the better part of a page of code is a good candidate to be turned into a subroutine. It will take a lot of practice on many different programs before you learn to carve subroutines optimally, but keep at it. When you become proficient at carving subroutines, your whole program will be a lot of subroutines, each on its own page, called in strict hierarchy up through the main control program, also contained on one page. But don't worry about that now. Just break off enough pieces so that you can comprehend what is left and start work on what is yet to be done.

Principle No. 9: Enough is enough.

When you get too tired, stop and rest. When you come back to it tomorrow, or whenever, you will find you can't remember what you were doing. Don't worry. Put the necessary time in and you will come to understand it again. You will also unearth some of the errors you were making because you were too tired.

Speaking of too tired, I think this article has run long enough. Having done my duty, I will go back to laughing at programmers making 20-year-old mistakes.

What? You thought I wasn't laughing at computer hobbyists? But I wasn't! I was laughing at all the professional programmers who are still making 20-year-old mistakes.

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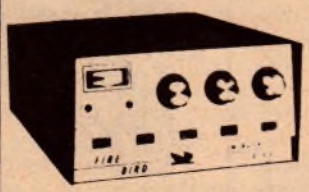

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Classical Recordings

Reviewed by Julian Russell

Liszt: Sonata in B Minor — "full of enchantment"

LISZT — Sonata in B Minor. Benediction de Dieu dans la Solitude. Two Concert Studies. Valse Oubliee No. 1 in F Sharp Minor. Claudio Arrau (piano). Philips Stereo Cassette 7300 402. (Also on disc).

In the last issue I wrote an unusually long review expressing my intense admiration for Arrau's playing of Liszt's Verdi Opera Paraphrases. The B Minor Sonata which he now plays on this admirably recorded cassette is a much more profound work than any of the Verdi Paraphrases, and Arrau illuminates it with a depth of understanding quite unlike any other performances I have ever heard. And there are many splendid accounts of the work currently available.

I mentioned in last month's review that Arrau had been a gifted pupil of Liszt, but then he cannot be alone in this respect. Yet Arrau's interpretation still remains unique. In his playing of it he seeks — and finds — a grandeur that ennobles an already great work.

His virtuosity is never in question, despite his 70-odd years of age, though he never makes it the most important feature of his interpretation. Indeed this is a style he uses even in Liszt's most flamboyant compositions.

Yet despite my admiration for Arrau's performance of the sonata under review, he sometimes makes small rubatos and hesitations that after repeated listening prepares one a little too often for their arrival. And what makes this odd is that Arrau was reported some years ago as saying that he disapproved of recording rubatos for this very reason. On the concert platform yes, he said, because there you only hear them once and don't anticipate their repetition. But listened to several times on a recording they produce the effect I have mentioned above.

On the other hand, of course, there is the nature of the sonata to excuse him in his effort to expose every detail of the depth of its beauty. And it must be remembered that he always sticks to his stated rubato principle in his superb playing of Beethoven and Brahms.

The sonata is in one movement comprising what might be described as five different but related pieces. But you will search in vain for any evidence of classical — or romantic — sonata form. This, Liszt went to pains to avoid but at the same time kept the work completely and logically integrated. Yet it has under Arrau's magic hands and penetrating mind all the structural beauty of the best examples of the four-movement school.

His passionate exposition of the first movement quite hides the virtuosity of his playing. Each repetition of the main descending phrase is subtly different — and full of meaning. He is never capricious and remains always the complete servant of the music. His changes of sonoritities provide unending delight. He gives the work symphonic proportions.

On Side 2 he opens with a powerfully spiritual account of the Benediction, a longish work for its type, though Arrau makes its length pass unnoticed. He makes of it a strangely mystical experience.

After this the two Concert Studies sound earthy, but in a very refined way. The first, Waldesrauschen, sounds in parts very like a precursor of the impressionistic school, and Arrau is very careful not to make it too showy despite its unending temptations to express sheer virtuosity.

The second study, Gnomenreigen, never sounds rushed though I doubt if it could be played faster. The Valse Oubliee is as gracefully played as one has come to expect from this master. The sound is excellent. Here is a cassette full of enchantment — and wonder.

Mahler — "The finest I have heard"

MAHLER — Symphony No. 3 in D Minor. Marilyn Horne (mezzo-soprano), Women's Voices of the Chicago Symphony Chorus; Glen Ellyn Children's Chorus; and the Chicago Symphony Orchestra conducted by James Levine. RCA Stereo RL 01517. (Two boxed discs).

This must be well up among the contenders for the title of the longest symphony ever written though to me it doesn't seem to go on for as long as a comparatively short one by Bruckner — the Bruckner Fourth excepted.

It offers such a variety of moods, delights in its orchestration, changes of rhythms and some really beautiful melodies — plus an occasional banal one — that the listening time seems to slip by unnoticed save for an occasional example of Mahler's characteristic prolixity. And all the way through there is the really wonderful playing of the Chicago Symphony which could excite even a near deaf listener's admiration.

It is in six movements and Mahler intended it to constitute a whole concert program. The first movement is so long — nearly three quarters of an hour — that Mahler recommended an interval after it was finished, with the performance resuming at the second.

Mahler disapproved of programmatic music yet he originally drew up a program that read, at the head of each part, Summer Marches In, What the Flowers of the Meadow Tell Me, What the Animals of the Forest Tell Me, What Midnight Tells Me, What the Morning Bells Tell Me, What Childhood Tells Me, and a discarded seventh movement, The Celestial Life. Although Mahler later dispensed with them they still offer useful clues to his intentions.

The whole is really a vast expression of the composer's joy in life and nature. In form it is so unlike any symphony that preceded it that it sounds almost rhapsodic. Ther are no examples of "sonata form" with the usual exposition, working out, recapitulation and other symphonic devices, yet it hangs together in a way one would not have thought possible — this in spite of the many digressions all along its long road.

Mostly it has the crowded exhuberance of a Hieronymus Bosch painting — without the devils. Though it is in many ways an expression of innocence, it has its moments of deeply felt warning.

The first movement could be taken as a piece apart, containing as it does as many different themes and transfor-

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mations as you'd be likely to find in a full length, more formal symphony. After a suitable rest you go on to a Tempo di Minuetto. This is no dance but for the most part a gentle cantilena, at times interrupted by a more energetic mood.

I might even go on to say that the constant repetition of this melody starts by enchanting but alas, such is the composers manner, that it becomes cloy. The Third movement has many of the features of an elaborated country dance, complete with bird calls and even a distant posthorn to emphasise its rustic atmosphere. Some, for whom Mahler is not a favourite composer, might accuse him here of contrived innocence in the Christopher Robin manner.

The "Nietzschean" Fourth movement is the subtlest in the symphony. It is based on the warning poem with which Nietzsche finished "Also Sprach Zarathustra". Animals and other examples of a lush nature know nothing of death, but here is man with all his fears and forebodings. The mezzo-soprano setting of the poem is most beautifully sung by Marilyn Horne.

The Fifth and Sixth movements have contrasting choruses by boy angels who, by the way, sing angelically. These lead to a great Adagio which mounts to a stupendous coda, a fitting finish to a work of such gigantic dimensions.

I realise that for a work of this magnitude my review is necessarily too brief. I have left much more unsaid than said. The best I can do in the way of condensation is to state that the Third Symphony is a radiant work, radiantly played and conducted by a musician to whom every detail is familiar and whose control of his fine orchestra is complete. Among its many great competitors I personally would put it down as the finest I have heard. The engineering is terrific.

☆ ☆ ☆

JAMES GALWAY RECITAL — Galway Plays Flute Music by J. S. Bach; Debussy; Paganini; Vibaldi; Gluck; Berkeley and Mozart. RCA Red Seal Stereo LRL1 5127.

James Galway is now well enough known and universally acclaimed to need no further praise from me. On this disc, as evidence of his versatility and command of period style, he plays eleven pieces by composers as widely seperated in time as J. S. Bach and Lennox Berkeley. In some he is accompanied by a piano, in others by an orchestra, and one, Debussy's Syrinx, he plays unaccompanied.

This last used to be often set as an examination piece — and may still be — at the Paris Conservatoire of Music.

On this disc you will find something to suit any taste from the baroque to the bizarre. They are all superbly played. I was slightly surprised that he didn't include Honneger's unaccompanied solo, "The Goat", a witty little piece that the great French flautist Marcel Moise used to play so beautifully on a 78 many, many years ago. I'm sure Galway was in no way perturbed by any fears of competition.

I have only one quibble — Galway goes from one piece to the other with hardly a break. While this might be satisfactory from the point of view of gained playing time, it gives his listeners too little time to get the preceding piece out of his mind. I counter this churlish objection with the hope that Galway recovers speedily, unimpaired by the terrible accident he suffered recently in Switzerland. He was hit by a motor bike and had both legs and one arm broken.

☆ ☆ ☆

BRUCKNER — Symphony No. 4 in E Flat Major (The Romantic). Original version of 1878/80. Berlin Philharmonic Orchestra conducted by Herbert von Karajan. DGG Stereo Cassette 3300 674. Also on disc.

Bruckner's Fourth (The Romantic) Symphony is perhaps his most popular. It is certainly mine. It is comparatively short, full of lovely melodies and doesn't give one the sense of being preached at, as does so much of Bruckner's music.

In the Fourth Bruckner makes much use of the horns, superbly played here by the Berlin Philharmonic. Indeed the work starts with a quiet horn solo. I once asked the renowned horn player Barry Tuckwell what he would do if he bubbled on the first notes of the passage and he answered without hesitation: "I'd play something else," though just how he would manage this he didn't explain.

Under Karajan, the symphony is true to its nickname. But by romantic I don't mean sloppily sentimental. Behind every bar, whether whispered or shouted, there is always Karajan's unmistakable mental energy — and sometimes physical, too.

He eschews mysticism but at the same time gives a highly sensitive, superbly inflected performance. Some he plays with the refinement of chamber music always making immediately apparent the difference between pp and ppp. Yet he gives a wonderfully spirited account of the famous "Hunting" scherzo. One never fears that, under Karajan's baton, a movement might become monotonous.

This is one production in which one can notice the marked difference between the engineering of the disc and the simultaneously issued cassette. It is the latter that I am reviewing here. The disc wins hands down. But don't blame the engineer too much. I think the nature of Bruckner's occasionally congested scoring may have something to do with it. Thickness in the fortissimos at times sounds almost grumous on the cassette. But bear in mind the many conveniences of the cassette form in handling, storing and the accidental damage a disc may suffer in use.

☆ ☆ ☆

BERLIOZ — Te Deum. Choir of the Orchestra of Paris, Choir of the Children of Paris, and the Orchestra of Paris conducted by Daniel Barenboim. CBS Stereo SBR235865.

A Te Deum, as everyone probably knows, is church music usually performed during a period of public rejoicing, particularly on the occasion of a military or naval victory. It is heard at its best in a large cathedral.

Indeed Barenboim plays it vigorously, often producing a volume of sound as if he had all the musical elbow room, so to speak, that the great St. Peter's nave would provide. His enthusiasm is undeniable and often yields exciting results.

And this he achieves without the support of CBS' usually splendid engineering. For instance one of the best features of the performance is the grand singing of the choir which surprisingly was not better exploited by the makers.

There are really curious bits of sound here and there and if you look for these you will find one soon after the beginning of Judex Crederis when the trombones enter. A pity this, because Barenboim is comparatively young to tackle such work — although I admit that he has come through other such trials with much success — and has his own very strong ideas of just what he wants.

These ideas, though not always orthodox, are stamped with his own very strong personality. He doesn't always stick strictly to the composer's markings, but when he doesn't you will find it hard to believe that he is not right. I am not expecting the more orthodox listeners to agree with me on this point.

Despite his exhuberance in the more forceful movements, Barenboim can scale down his dynamics to beguiling proportions in the more delicate reaches of the score. I should like to underline that there is nothing slapdash about his performance, despite his occasional deviations from the scripture of the score, if I might be permitted to make such a bad pun. He is well served by his orchestra, choir and a solo tenor whose pleasant timbre and fastidious style reminded me of a very good English oratorio singer.

Perhaps it was the hall in which the recording was made that now and again frustrates some of the best efforts of the conductor and engineer. I could find no reference anywhere as to where the recording was made but it doesn't sound like a Salle Wagram production.

I cannot finish this review without a special word of praise for the organist, Jean Gouillou. Altogether the record is not to be summarily dismissed despite its rather too frequent blemishes.

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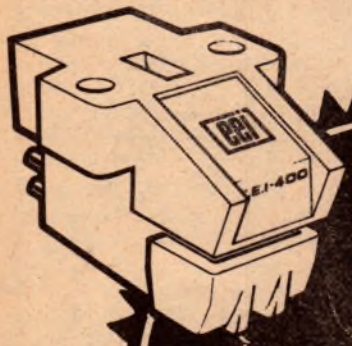

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Lighter Side

Reviews of other recordings

Devotional Records

NEVER DOUBT HIS LOVE. Marshall Kelly in Australia. Stereo ART Records, AST-509. (From Advent Radio-Television Productions, 150 Fox Valley Rd, Wahroonga, NSW 2076. Tel (02) 487 1844. $6.50 + $1 P&P.)

Marshall Kelly is a Seventh Day Adventist Pastor who normally ministers to a black uraban congregation in Detroit, Michigan, USA. At the same time an accomplished concert artist, he gave a concert at the Sydney Opera House a little over a year ago, and this album will be an excellent memento for the two-thousand-plus people who were present on the occasion.

Marshall Kelly has a magnificent bass voice fully equal to the demands of an unaccompanied rendition of the spiritual "Mumblin' Word". On most other tracks he has instrumental, orchestral and vocal backing, in the latter case from the Telaman Singers under Brian Keitley. The track titles: Deep River — I Did Not Take Time To Pray — Amazing Grace — Never Doubt His Love — Mumblin' Word — Time Moves On — Because He Lives — I Could Never Outlove The Lord — No Better Time — Steal Away — Law Of Love — Without The Power Of God (an excellent monologue) — It Takes Everything To Serve The Lord.

Mixed down from an original 16-track recording, the locally produced stereo pressing has a very smooth, rich sound, substantially free from noise and distortion. An album I can thoroughly recommend. (W.N.W.)

☆ ☆ ☆

SOMETIMES ALLELUIA. The Sonlight Orchestra. Stereo, Myrrh MSA-6560. (From Sacred Productions Aust, 181 Clarence St, Sydney and other capitals.)

One would judge that this album is intended primarily for those who are familiar with modern American Gospel songs as listed below. The melodies are presented in orchestral form and, purely as a reminder, the relevent lyrics are printed on the inner sleeve. Here are the titles, many of which have cropped up in albums previously reviewed in these columns: I Cant Wait — Prince's Song — You Got The Power — Sometimes Alleluia — Searchlight — I Am A Servant — Say "I Do" — For Those Tears I Died — Clean Before My Lord — It Took A Carpenter.

What if you aren't familiar with the above songs? Well, you can watch the lyrics and try to fit them to the music but you won't find it easy, primarily because the melodies here are "arrangements", again best suited to those already familiar with the original vocal versions.

So, you'll probably end up just listening to them as pleasant middle of the road sound, with a bias towards soft rock, and performed by a mix of traditional orchestral instruments, guitars, keyboards and synthesisers.

The sound quality is quite okay but only you can say whether the kind of recording I have described fits your scene. (W.N.W.)

Instrumental, Vocal and Humour

CHANGES/JOHN WILLIAMS. Stanley Myers and his Orchestra. FLY-5. Stereo. Distributed by RCA Ltd.

Here is a very enjoyable album featuring guitarist John Williams with Stanley Myers and his Orchestra. A variety of tunes is presented, some with traditional, some with fresh arrangements. Recording quality is good although there is a slight degree of surface noise.

Track titles are: Bach Changes — Theme from Z — Cavatina — Spanish Trip (Canarios) — Because — Raga Vilasakhani Todi — Woodstock — Good Morning Freedom — Nuages — Sarabande — New Sun Rising (House Of The Rising Sun). (L.D.S.)

☆ ☆ ☆

Fritz Reiner conducts Great Music of Spain. Chicago Symphony Orchestra. RCA Gold Seal Stereo AGL1-1332.

The music on this album represents three of the most famous composers of modern Spain: Isaac Albeniz (1860-1909), Enrique Granados (1867-1916) and Manuel de Falla (1876-1946). This reviewer has never really developed much liking for these modern Spanish composers but of the three, I prefer Granados. The Intermezzo from Granados' opera "Goyescas" is especially beautiful and is justifiably a very popular concert piece.

The third composer, Albeniz, is represented with three pieces: Navarra, Triana and Fete-Dieu a Seville from his opera "Iberia". These works I find trivial and noisy but others probably appreciate them.

Manuel de Falla is represented with Interlude and Dance from his opera "La Vide Breve" and three dances from "The Three-Cornered Hat". In picking this material, conductor Fritz Reiner has probably selected the best and most popular of Falla's work. That is my opinion anyway.

Recording quality on this re-issued disc is good without being outstanding and surface noise is low. At the Gold Seal price it is a good buy as an introduction to these composers. (L.D.S.)

☆ ☆ ☆

BARNEY KESSEL. SOARING. Interfusion L36454 Festival release.

Guitarist Barney Kessel conjures up some musical magic on this most enjoyable record, with Monty Budwig on bass and Jake Hanna on drums.

There are eight fairly long tracks in all: You Go To My Head — Get Out Of Town — Seagull — Like Someone In Love — You're The One For Me — Beautiful Love — Star Eyes — I Love You. This sort of performance shows how three superb jazz men can produce an exciting sound without tons of backing musicians etc; in short,

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.).

THE LIGHTER SIDE — Continued

a record to enjoy time and time again.

On the last track on side two, "I Love You" they really raise a storm, the overall quality is excellent. (N.J.M.)

☆ ☆ ☆

THE GUITAR ARTISTRY OF BADEN POWELL. Image ILP 4955 Astor release.

Baden Powell's skill with the guitar has been recognised for some time and this record clearly shows why. He was first brought to the notice of the American audiences by Stan Getz in the sixties, and his music, a mix of jazz and classical has proved to have wide appeal.

There are twelve tracks — It Must Be Love — Chorus For Metronome — Adagio — Beribau — Samba In Prelude — Winter Song — Sad Samba — Songs For Jussara — Prelude — Euridice — Bachiana — The Girl From Ipanema. The overall quality is excellent, making in all a most enjoyable record. (N.J.M.)

☆ ☆ ☆

CHET ATKINS & FRIENDS. Stereo. RCA VICTOR APLI 1985.

Chet Atkins is one of the greats in the "country & western" & "Nashville" sound field and, on this enjoyable disc, he gets together some of the other well known names in this genre: Lenny Breau, Les Paul, Johnny Gimble, Jerry Reed, Boots Randolph, Hank Snow, Ray Stevens, Merle Travis, Dolly Parton, Danny Davis and the Nashville Brass and Arthur Fielder and the Boston Pops.

With talent such as this you can expect some good music. Some of the tracks are: Terry On The Turnpike — Sweet Georgia Brown — Avalon — Do I Ever Cross Your Mind — Twichy — Poison Love — I'll See You In My Dreams.

The quality comes up to the usual high Nashville standard. Judging by the raucus laughter on some of the tracks, parts of the recording session must have been liquid fueled. (N.J.M.)

☆ ☆ ☆

THE OLDTIMERS. Olde-time dance band. Crest CRIN-TV-121. Available from Crest Record Co, PO Box 270, St Kilda Victoria 3182.

"The Oldtimers recreate and promote pre-1910 dances and have played for numerous "Turn of the Century" balls which have attracted young and old alike". So state the sleeve notes and I have no reason to doubt. I am rather keeen on it myself. And the selection of tunes is attractive.

Unfortunately, though, this album does a serious dis-service to the Oldtimers. It is unlistenable by anyone with any regard at all for quality. It is quite simply the worst recording I have heard for many years. The recording quality is execrable. I hope Crest International can remaster it because it has the potential to be a good seller. (L.D.S.)

☆ ☆ ☆

CALLING THE TUNE. The Wally Cook Square Dance Special. Crest. Stereo CRT-12SLP-038. Available from Crest Record Co, PO Box 270, St Kilda Victoria 3182.

Wally Cook has a voice that sounds as if he gargles with nitric acid every morning but he is the best square dance caller I've ever heard. The record makes awful listening but if you're keen on square dancing it's a beauty. Recording quality is okay. (L.D.S.)

☆ ☆ ☆

THE BEST OF WAYLON JENNINGS. Waylon Jennings. RCA VICTOR VPL1 7145.

This record will undoubtably appeal to the many fans of Waylon Jennings in Australia. The tracks presented show the varied facets of his talents, and added together make very pleasant listening. Willie Nelson and Jessie Colter lend a hand on some of the tracks, to add an extra amount of spice.

In order the tracks featured are: I'm a Ramblin Man — Rainy Day Woman — Oklahoma Sunshine — You Can Have Her — Me And Bobby McGee — Honky Tonk Heroes — Are You Sure Hank Done It This Way — Are You Ready For The Country — Suspicious Minds — Good Time Charlie's Got The Blues — Good Hearted Woman — Bob Wills Is Still The King.

Overall, a very pleasant record, sure to appeal both to new and old ones. Recording quality is excellent, with minimal surface noise. (D.W.E.

☆ ☆ ☆

BING CROSBY'S GREATEST HITS. MCA (Astor) MCA-3031. Also on Musicassette 4MCA-3031.

I guess that most middle-of-the-road record collections will contain at least one Bing Crosby album but, if yours is the exception, this nostalgic album will repair the situation.

Recorded at various times during the years 1939 to 1947, the numbers feature a variety of orchestras and groups, including the John Scott Trotter Orchestra, the Ken Darby Singers, Fred Waring & His Glee Club, Vic Schoen & his Orchestra, The Andrews Sisters, Victor Young and Woody Hermon.

The track titles are all readily associated with Bing Crosby: White Christmas — The Whiffenpoof Song — I Surrender, Dear — Blue Skies — Pistol Packin' Mama — Too-Ra-Loo-Ra-Loo-Ral — Ac-Cent-Tchu-Ate The Positive — Don't Fence Me In — You Are My Sunshine — Swinging On A Star — Deep In The Heart Of Texas — Where The Blue Of The Night.

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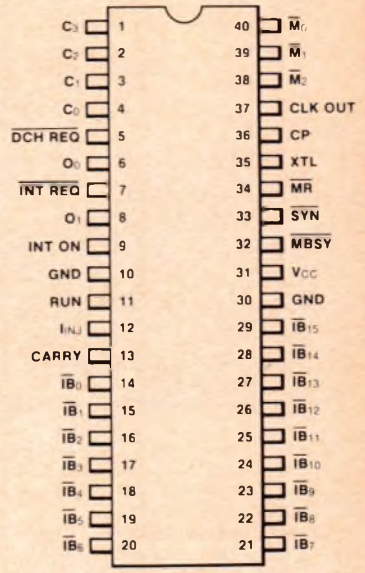
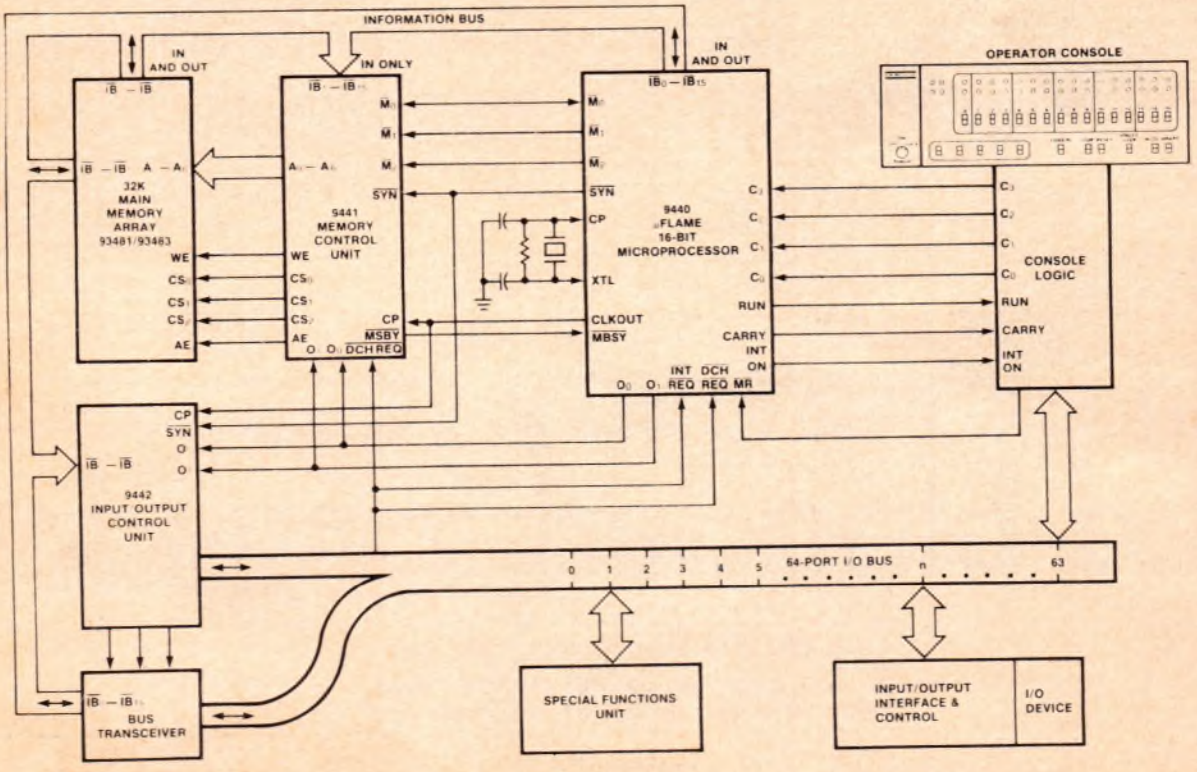


SYSTEM DIAGRAM



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THE LIGHTER SIDE — Continued

From recordings of this era one cannot expect wide-range sound but the quality generally is not so dated as to distract from your enjoyment of these nostalgic performances. (W.N.W.)

☆ ☆ ☆

JOIN THE COUNTRY CLUB. Jimmy Rodgers. ABC Dot stereo ABCA 44021 RCA release.

There is no doubt that if ever one had to review a succession of folk singers and balladeers, Jimmie Rodgers would have to be judged the archetype. For many years now he has been a consistantly high performer with universal appeal. This album is a collection of tracks recorded at different times but they are all good, in terms of appeal, performance and recording quality. I can thoroughly recommend it.

No less than sixteen tracks are featured: Honeycomb — Waltzing Matilda — No One Will Ever Know — Woman From Liberia — Tucumcari — Streets Of Laredo — Shenandoah — Kisses Sweeter Than Wine — Bimbombey — The Boll Weevil — Midnight Special — Danny Boy — Wolverton Mountain — Walk Right In — If I Had A Hammer — The World I Used To Know. (L.D.S.)

☆ ☆ ☆

DONOVAN. Donovan Leitch. RAK Records. SRAK.528. EMI release.

All of the 10 tracks that appear on this album are written and composed by Donovan Leitch. The lyrics in some cases are excellent — for example in the opening track "Brave New World" — but the musical composition somehow does not seem to complement the lyrics.

Donovan tracks through different styles of country, mellow, funk and vaudeville, but nevertheless, the end product is an album of a rather low standard.

"Dare To Be Different", the final track, is the single released from the album. Two other tracks which approach the standard of the single are, "Local Boy Chops Wood" and "The International Man". If however, you don't fancy the single, then forget about the album. D.H.

☆ ☆ ☆

I REMEMBER ROCK AND ROLL. Vol. 1. Various artists. ABC Records ABCA 30001. RCA release.

This record, the first of three volumes, is a compendium of early rock and roll hit tunes. It features artists such as Tommy Roe, Lloyd Price, The Mamas and The Papas, Fats Domino, Pat Boone and Three Dog Night. The time period covered is up to the early 1960s.

In order,the tracks are: Dizzy — Personality — Dark Moon — Monday Monday — Joy To The World — Hey There Lonely Girl — Pink Shoelaces — Pipeline — Speedy Gonzales — Red Sails In The Sunset — Tammy — The Sins Of A Family — Rub It In — Little Town Flirt — Ginny Come Lately — Susie Darlin'.

In conclusion, a good release for older listeners, with appeal also to those with an interest in early rock and roll. Technically, the record submitted for review was without major flaws, and was quite pleasing on the ear. (D.W.E.).

Thistle appeal!

THIS IS SCOTLAND. Stereo, RCA Victor VPL1-7148.

To anyone with nostalgic memories of Scotland, this double fold album would have strong attraction merely for the colour photographs on front, back and inside. I know the effect it had on me!

And the music can only add to that feeling. As distinct from a performance of Scottish music by any one artist or one group, the album is a collection of instrumental, pipe and vocal items presented by a whole array of artists and musicians picked right out of the Scottish scene.

Lack of space prevents me from listing all the items and all the artists; information which is covered by generous jacket notes. But here's what to expect: Scotland The Brave (pipes and drums) — Killiecrankie (vocal and guitars) — Lewis Lilt, &c (medley of reels) — Ginny Black (Scottish country band) — Peat Fire Flame (vocal duo) — Old Rustic Bridge, &c (pipe, drums and organ) — Mingulay Boat Song (vocal) — Amazing Grace (pipes) — The Lights Of Lochindaal (vocal) — Set Of Reels (accordian band) — My Home, &c (pipe medley) — The Tailor (country dance band) — Dashing White Sergeant (Scottish band) — When You Wore A Tulip, &c (medley in the manner of a Scottish dance band).

The technical quality is good and, if you know anyone with Scottish blood with a birthday coming up, give them this one as a present! (W.N.W.)

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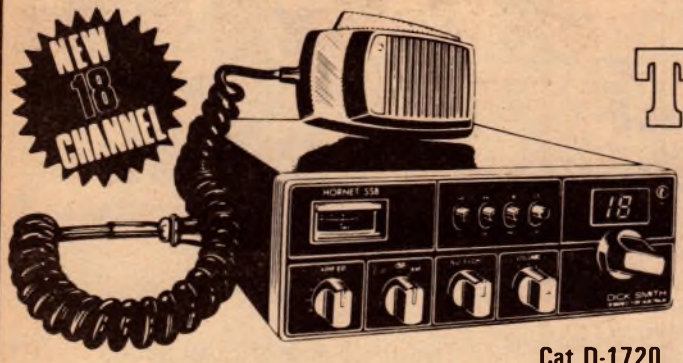

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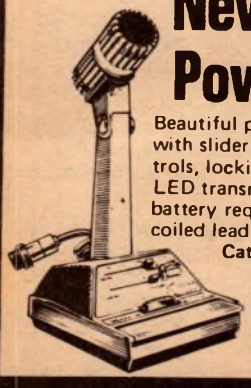

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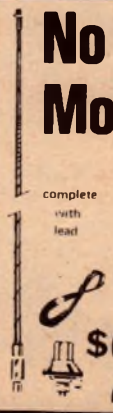

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The Australian CB SCENE

TV INTERFERENCE: SURVEY RESULTS FROM THE USA*

In this article, Dr. Cohen reviews the FCC study on CB-related RFI, and discusses the impact such interference problems may have on the Amateur Service. Based on his experience in, and his contributions to, the field of radiofrequency interference (for which he received the ARRL Technical Merit Award for 1975), Dr. Cohen concludes that only if all parties concerned work together will it be possible to resolve the burgeoning RFI PROBLEM.

by THEODORE J. COHEN

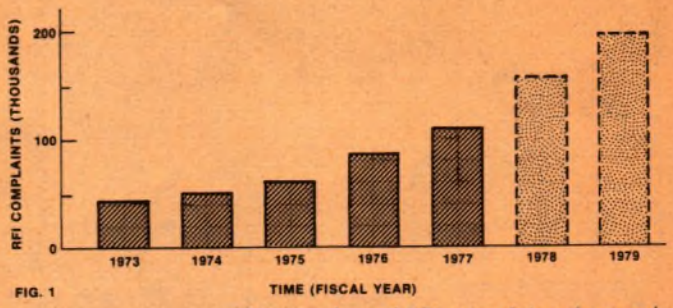


FIG. 1

The number of RFI complaints forwarded to the Commission is expected to reach 200,000 by the year 1979.

In July 1977, the Federal Communications Commission (FCC) released the results for one of the most comprehensive studies ever performed on the incidence of so-called television interference (TVI). Entitled *The Extent with CB Radio Transmissions,* the report analyses more than 70 "in-field" cases of alleged TVI, and summarizes over 560 interviews which the Commission obtained in a Radio Frequency Interference (RFI) Neighborhood Survey.

Among the results obtained in the study is one which shows that almost 55% of all CB-related TVI complaints are at least partially attributable to inadequate suppression of transmitter harmonics.

On the other hand, the study also shows that approximately 45% of all TVI cases investigated are the result of fundamental overload in the television receiver affected.

In the years following World War II, the growth of television as a major form of home entertainment brought with it the potential for severe RFI problems. Whereas complaints of interference during the 1940's largely involved AM broadcast radios and numbered roughly 7,000 per year, the rapid growth of television in the early 1950's was accompanied by an equally-rapid increase in the number of RFI complaints involving this new entertainment form. By 1953, RFI complaints had reached 21,000 per year and were climbing at a relatively moderate pace.

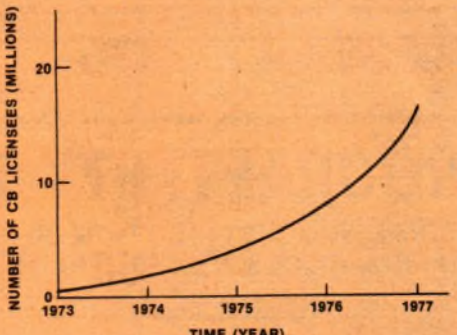


FIG. 2

By the end of 1977, almost 16 million CB licences had been issued in the USA. This is twice the number of individuals licenced at the end of 1976.

While TVI complaints continued to rise during the 1960's, three events occured late in that decade which had a profound effect on the number of interference cases reported to the Commission. These were:

- The phenomenal growth of 27MHz Citizens Band (CB) radio;
- The increased use of semiconductor devices in home-entertainment;
- The increased use of electronic entertainment equipment in the home.

By 1976, the number of RFI complaints reported to the FCC climbed to 80,000 per year (fig 1.), with a conservatively-estimated 87% of all interference cases reported that year involving impaired television reception.

Not surprisingly, 85% of all TVI cases reported in 1976 were associated with Citizens Band radio transmissions, for over six million licensed CB stations (and millions of unlicensed stations) were presumably on the air by that time (fig. 2).

The data in figures 1 and 2 establish a link between the growth of CB licensees and the number of interference cases reported. Further, based on this link and on the anticipated growth in the CB Service (and in the Amateur Service as well), the Commission in 1976, projected that it would receive almost 200,000 RFI complaints per year by the end of this decade.

Clearly, the time had come to examine those factors which have an impact on the television interference problem so that information would be available to aid in establishing and implementing procedures leading to the elimination of this problem.

The study, in essence, involved on-scene analyses of CB and television installations which were involved in TVI complaints filed with the commission by the public.

To this end, 72 randomly-selected complaint locations in six cities served by Commission district offices (Baltimore, Maryland; Buffalo, New York; Kansas City, Missouri; Norfolk, Virginia; San Francisco, California; and Seattle, Washington) were made the subject of a carefully controlled analysis and test measurement programme.

More specifically, FCC engineers were assigned the task of quantifying all factors which may have been associated with, or which may have contributed to, the interference reported. Included

* Reprinted by courtesy of CQ Magazine from the February 1978 issue.

were analyses of the complaintant's television receiver and its attendant antenna system, with attention given to antenna type, type of lead, the antenna mounting location, and whether a booster amplifier was used.

Data were also collected on the signal levels expected at the complaintant's location for television signals delivered to the community, and on the TV and CB signals delivered by the antenna system to the television receiver's antenna terminals.

As regards the CB installation, descriptive data on the transmitting system and its associated antenna installation were collected for analysis purposes.

In particular, a major effort was made to obtain accurate information on the use of (illegal) linear amplifiers by CB operators. To encourage co-operation by CBers in this matter, the FCC assured those operators whose stations were examined that no action would be taken against them as a result of the study findings. All transmitters and linear amplifiers used at a given station were then tested to determine emission characteristics.

Data were also compiled on the physical and electro-magnetic environment in the area around the CB transmitters and the television receiver installations. For example, data were taken on the vertical and horizontal distances between the CB station's antenna and the complainant's television antenna. Attention was also given to such factors as the type of home construction in the area under study, and on the density of housing.

Finally, a non-technical survey was taken in the neighborhood around each CB station included in the study. The information obtained was used to estimate the percentage of RFI complaints which are not reported to the Commission. In all, interviews were conducted at seven or eight households in the vicinity of each CB station examined, with a total of 563 households interviewed during the course of the survey.

In analysing the data collected, it was assumed that the CB stations and households involved in the FCC study on television interference are representative of stations and households throughout the United States.

Given this assumption, the survey results suggest that in Fiscal Year (FY) 1976, 4,000,000 individuals (or about 1.3 million households) probably experienced television interference which was related to the operation of an estimated 22,000 CB stations. Further, the number of individuals who experienced CB-related TVI in FY 1977 is estimated at 5,000,000 (1.5 million households), while as many as 9,000,000 individuals (2.7 million households) will probably be affected during FY 1979.

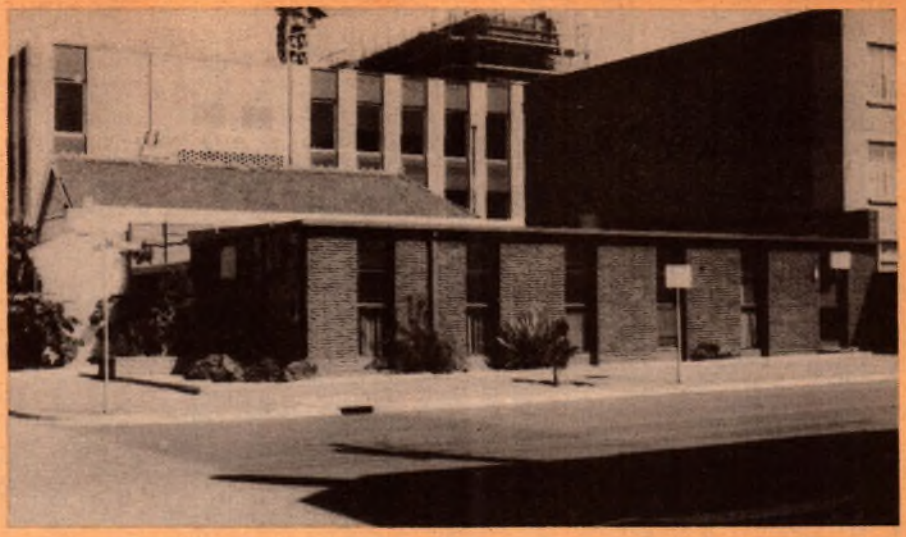
For the stations examined, the FCC found that the primary cause of TVI was inadequate suppression of harmonic and spurious radiation at the CB transmitter. Then too, it was found that even when antenna line harmonic radiation was suppressed by 60 dB or more (the specified value for new transmitters), harmonic radiation was still a basic cause of TVI. Thus, the Commission concluded that the present requirements for the suppression of antenna line harmonic radiation are inadequate.

In sum, antenna line or chassis harmonic radiation from CB transmitters was a contributory factor in 55% of the TVI cases investigated.

With respect to television receivers, the FCC observed that front-end overload was the primary cause of 45% of the TVI complaints investigated. However, in 80% of these cases, a high-pass filter (Drake Model TV-300), installed at the antenna terminals of the television receiver, was found to eliminate or reduce significantly the interference produced by receiver overload.

Based on these results, the Commission concluded that if a greater, "unwanted" signal rejection capability was incorporated in television receivers at the time of manufacture, such actions would eliminate more than one-third of all CB-related TVI cases.

In the case of linear amplifiers, these devices were associated with about 45% of all CB-TVI. On the average, the Commission found that these amplifiers had an average power output level of 120 watts; however most CB stations employing linear amplifiers also were found to use high-gain antennas, thereby compounding the interference problem. If the use of linear amplifiers by CBers was eliminated, the FCC estimates that 25% of all CB-TVI problems would be resolved, with an additional 20% of such TVI problems being improved to the point where the interference observed would probably not be objectionable.



Vicom International Pty Limited have moved to new premises in South Melbourne as part of an expansion program into specialist communications electronics. The new address is 68 Eastern Road, South Melbourne, phone 699-6700.

Dick Smith Contest Cartoon

(From W. Chambers, Hobartville, NSW)

The Australian CB SCENE

With the majority of all TVI cases — and indeed, all RFI cases — related to the operation of stations which use frequencies assigned to the Citizens Band Radio Service, Amateurs may ask why they should be concerned with these problems. The answer, simply put, is that increased regulation which is directed towards CBers, and which is intended to reduce the incidence of CB-RFI problems, affects amateurs as well.

Because of CB-RFI, many communities now enforce strict zoning laws which limit severely the height of antenna towers. Further, CB-RFI has led state and local governments to enact statutes which are being used to fine CB and Amateur operators who disrupt a neighbor's enjoyment of his or her home entertainment equipment. True, these statutes apparently pre-empt federal laws which govern the operation of radio stations, but the Amateur—just as in the case of the CBer—has little choice but to challenge the state and local statutes in court.

Even the design of future Amateur equipment could be impacted because of CB-RFI. The FCC, for example, has issued Docket No. 21116, which proposes to amend the Commission's Rules to prohibit the marketing of external radio frequency amplifiers capable of operation on any frequency from 24 to 35MHz.

Finally, as a result of CB-RFI problems which are related to the use of Amateur transmitters and transceivers by com-

NEW BROCHURE ON CB INTERFERENCE

Following the success of his Australian CB Handbook, Dick Smith has produced a special pamphlet on how to deal with interference caused to TV and radio sets by CB rigs.

The Dick Smith "How to deal with CB interference" (Cat No. B 6025) pamphlet covers various types of TV and BC interference. It explains what causes interference and prescribes various cures in step-by-step sequence. Advice is also given on curing interference to stereo amplifiers, along with circuits and construction details for simple filters to eliminate interference to audio systems.

Other "How-to-do-it" guides published by Dick Smith and available from his stores and dealers include:

"How to install your own TV or FM aerial" . . . . . Cat No. B 6010.
"How to install your own burglar alarm" . . . . . Cat No. B 6000.
"A guide to printed circuit board making" . . . . . Cat No. B 6005.

All are priced at 50 cents each.

munications on the 27MHz Citizens Band, and because such Amateur equipment does not now fall under the Commission's regulations on type acceptance and marketing, the Commission has issued Docket No. 21117. This Docket proposes to amend the Commission's Rules to require type acceptance of equipment marketed for use by operators in the Amateur Service.

While the Commission would not require the spurious and harmonic attenuation levels of type-accepted Amateur transmitters to be as great as those imposed on CB transmitters, the fact that type acceptance might be required for Amateur equipment represents a departure from the traditionally-held view that such regulations impede the innovative process within the Amateur Service.

To say the least, Amateurs have much at stake in the deliberations which address CB-RFI. As such, they can ill afford to ignore the effect such proceedings might have on he Amateur Service.

The FCC study on television reception difficulties associated with CB radio transmitters indicates that TVI (and, indeed, RFI, in general) is a very serious problem.

Further, given the fact that millions of households are now affected by RFI, and that increased regulation of the CB and Amateur Services may evolve as a result of such interference, it behoves all parties concerned—the radio operator, the manufacturers of CB and Amateur equipment, the manufacturers of electronic home-entertainment equipment, and the Commission—to work together in resolving RFI problems.

Copies of the report, entitled "The Extent and Nature of Television Reception Difficulties Associated with CB Radio Transmissions," are available for inspection at the FCC's Public Information Office, Room 202, 1919 M Street, N.W., Washington, D.C. The report may be purchased from the Downtown Copy Center, 1730 K Street, N.W., Washington, D.C. 20006. Telephone (202) 452-1422.

BOOK REVIEW

THE TASC AUSTRALIAN CB ENCYCLOPAEDIA, by Geoff Thomas. Published 1977 by C. Huppert & Co. Pty Ltd. Stiff paper covers, 80 pages, 154 mm x 109 mm. Price in Australia $2.95.

This new, small handbook probably derives its name from the first 25-odd pages, which lists words likely to occur in the CBer's vocabulary — a strange mix of technical terms and CB slang. The reader then learns about "Emus", the Australian equivalent of America's "Bears" who ride around in patrol cars. This is followed by the 10-code, the 13-code, the Q-code and such like, even to the Morse code.

The "Golden Rules for CBers" combine the Mosaic format with Utopian idealism but, while offered sincerely, they have a wry humour in the face of the present chaos. So on to frequencies, regulations (RB-14 style), NCRA, CREST, a list of CB clubs, and a few specimen sheets for logs and records of callsigns and "handles". As you've probably gathered, the material has been put together for, and in, Australia.

Our copy came from the publishers at 175 Grattan St, Carlton, Vic. 3053. (W.N.W.)

Realistic TRC-461 "One Hander" CB

The Realistic TRC-461 "One Hander" CB mobile is intended to solve two urgent problems for the mobile CBer. Firstly, the essential operating controls are grouped on the hand microphone, making it unnecessary for the operator to grope down under the dash whilst driving. The 18-channel selector is right there on the microphone. Secondly, the main body of the transceiver does not need to be in view at all. It can be locked away in the glovebox or, better still, mounted in the car boot, at the end of the 16.5ft cable provided. The TRC-461 is an AM transceiver with 4 watts of RF output, automatic modulation circuitry and permanently operating noise blanker and limiter. Phase locked loop circuitry ensures precise frequency control. The TRC-461 retails for "just under $200". For further information, inquire at any Tandy store or from Tandy International Electronics Pty Ltd, 280-316 Victoria Rd, Rydalmere 2116.

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Lindenow 2m mobile whip	$ 35.00
Scaler ¼ wave whip, 2 metres	$ 6.50
Scaler wave whip, 2 metres	$ 16.70
AS210BN twin 10el beam, 18dB gain	$119.00

CONVERTERS

144MHz, uses 28MHz IF	$ 45.00
432MHz, uses 28MHz IF	$ 50.00
1296MHz, uses 28MHz IF	$ 59.00
QM70 high power, 70w pep max, 2 metres	$119.00

PARABOLIC DISH

PBA-1200 70cm/1.2GHz complete	$349.00

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AL48DXN 40 & 80m trap dipole	$ 59.00

6JS6C	$12.00	6146B	$12.50
6KD6	$14.00	572B	$55.00

TRAP VERTICALS

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V5Jr 80-10m, 6.7m high, no guys	$129.00

HY-GAIN ANTENNAS

Hy-Quad 10/15/20m, 2el	$299.00
204BA 4el monobander, 20m	$249.00
203BA 3el monobander, 20m	$190.00
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18AVT/WB trap vertical 80 thru 10	$139.00
TH3MK3 10/15/20 3el beam	$269.00
TH3Jr 10/15/20 3el beam	$199.00
TH6DXX Thunderbird	$345.00

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PBM18/70 18el 70cm, 14.9dBd gain	$ 69.00
D8/70cm twin 8el, 70cm, 12.3dBd	$ 89.00
10Y/2m 10el, 2m, 11.4dBd gain	$ 77.00
PMH/2C phasing harness	$ 17.00

BALUNS

AS-BL for beams	$ 31.00
BL50A 50 ohm 4Kw for dipoles	$ 25.00
BL70A 70 ohm 4Kw for dipoles	$ 26.00

MORSE KEYS

HK702 deluxe key with marble base	$ 35.00
HK708 economy key	$ 19.00
HK706 operators key	$ 20.00
MK701 manipulator (side-swiper)	$ 38.00
EK103W electronic keyer	$159.00

MICROPHONES

VM-1 noise-cancelling, dynamic, low Z	$ 8.90
VM-2 desk mic, dynamic with pre-amp	$ 29.80

6m ANTENNA

SS-56 6m 5el beam (NAGARA)	$118.00

Prices and specifications subject to change without notice

HAM HEADQUARTERS

ICOM QUALITY PORTABLES FOR 6 & 2

ICOM IC-215 2m FM transceiver

• 2 meter FM • 3 W PEP • 15 channels, 12 by selector, 3 by function switch • Dual power level, 3 W HI for long distance, 0.5 W LOW for local • Dial illumination for night use • Power pilot lamp • Frequency range: 146 to 148 MHz

IC202E 2m ssb portable transceiver	$ 219
IC502 6m ssb portable transceiver	$ 219
IC245 2m fm digital mobile transceiver	$ 450
IC215 2m fm portable with 9 chs. installed	$ 219

ACCESSORIES FOR THE PORTABLES

BC20 nicad pack with charger	$57.00
ICsM2 desk microphone	$54.00
IC50L 6m linear, 3w in, 10w out	$98.00
IC20L 2m linear, 3w in, 10w out	$98.00
Mobile brackets for portables	$17.00

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FT101E transceiver, 160 thru 10M	$899.00
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FT7 HF mobile transceiver	$569.00
FT901DM HF transceiver	$1575.00

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RM10	10m	$16.00
RM15	15m	$16.00
RM20	20m	$16.00
RM40	40m	$20.50
RM80	80m	$22.00

M02 fold-over mast	$ 29.00
BM-1 bumper mount	$249.00

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KENWOOD TS-520S transceiver

TS820S HF transceiver, digital	$1172.00
TS520S HF transceiver 160-10m	$747.00
TV502 2m transverter	$280.00
TV506 6m transverter	$249.00
TR3200 70cm fm transceiver	$317.00
TR7400 2m digital mobile transceiver	$483.00
TR7500 2m mobile synthesises transceiver	$399.00
MC50 desk microphone	$ 58.00
MC10 ptt hand microphone	$ 16.00
TL922 HF linear amplifier	$1099.00
AT200 matching antenna tuner	$169.00
SP820 matching speaker for TS820s	$ 58.00

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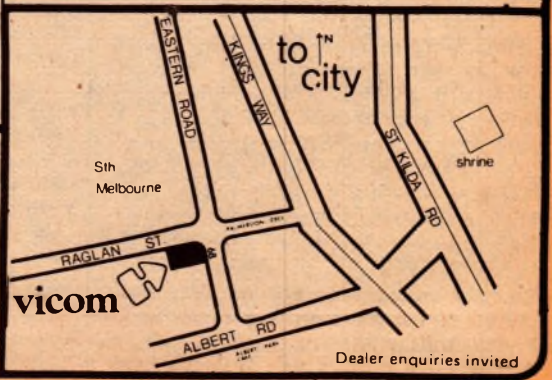

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AMATEUR RADIO

by Pierce Healy, VK2APQ

Dapto moonbounce research program destroyed

Dapto moonbounce station vandalism, IARU report, Pacidic Festival Contest, VHF — UHF records, and ITU World Telecommunication Day are some of the events reported this month.

The Dapto Moonbounce installation has been severely damaged by vandals. The damage was discovered on the 8th February, 1978 by Lyle Patison, VK2ALU when he went to the site to prepare the equipment for scheduled E-M-E tests on Saturday 11th February.

The building had been entered, windows smashed and items in all rooms either smashed or stolen. Fire extinguishers had been discharged over the equipment, paint thrown around, and cupboards emptied. Holes had been smashed in the floor and a fire had been lit in one room but fortunately had not set the building alight.

The padlock had been jemmied off the steel security locker which housed moonbounce equipment and items had been either stolen or damaged. Wiring and cabling had been ripped out and cut.

The police and University were immediately notified.

To try to meet obligations to overseas stations scheduled for E-M-E tests with VK2AMW on the 11th February, Lyle Patison, Charles Proctor, VK2ZEN, and Geoff Cuthbert, VK2ZHU, spent many hours attempting to set up a substitute station, but without success.

Although doors and windows were secured against easy access, the next week saw more serious damage by intruders, locks were smashed and most of the remaining wiring ripped out. In these circumstances no point could be seen in attempting repairs.

On the 2nd March an inspection of the site was made with representatives of the University and the decision reluctantly made that adequate security is not now possible at that location, as even if a burglar proof building could be erected, the dish antenna is too vulnerable. Consideration is now being given to moving the antenna structure to some other location.

After some eight years work by a dedicated project team, who placed Australia among the leaders in E-M-E 432MHz experimental work, the Dapto Moonbounce project has been virtually destroyed.

It is impossible to understand what the intruders gained by such wanton destruction.

However, it is hoped that with the cooperation of the University of Woolongong and amateurs willing to help, it will be possible to continue the moonbounce experiments.

IARU MEETING IN GENEVA: Mention was made last month of an International Amateur Radio Union meeting in Geneva in preparation for WARC 79. The following is a report received from the WIA federal headquarters.

A meeting of the IARU president's WARC advisory committee was held in Geneva from 13th-18th February, 1978.

IARU president, Noel B. Eaton, VE3CJ, invited Dr David Wardlaw, VK3ADW, WIA president, to attend as it is possible that Dr Wardlaw will be a member of the Australian WARC 1979 delegation.

Present at the meeting in Geneva were, in addition, IARU secretary Richard L. Baldwin, W1RU, assistant secretary IARU, David G. Sumner, K1ZZ, secretary of IARU Region 1 Roy F. Stevens, G2BVN, the president of IARU Region 2 Victor C. Clarke, W4KFC, and a director of IARU Region 3 Michael J. Owen, VK3KI. VK3ADW, Wojciech Nietyksza, SP5FM and Merle Glunt, W3OKN, were also present.

The meeting was timed to coincide with the ITU World Administrative Radio Conference (Aeronautical (R) Conference). This enabled those present to observe an actual ITU conference. In addition Merle Glunt, recently retired from the FCC and an expert on ITU procedures, presented a seminar on the workings of that organisation.

The IARU headquarters and Region 1 hosted a reception for the Aeronautical WARC delegates on Thursday, 16th February and this enabled those attending the committee meeting and other amateurs from the Geneva area to meet many of the delegates from many different countries.

The formal committee meetings considered numerous matters relating to the WARC. The importance of an amateur being a member of a delegation, either as an advisor or as a full member, was discussed and a circular will be sent to all societies by IARU headquarters stressing the importance of this.

IARU headquarters will also be forwarding to each society a letter restating the IARU position on article 41 of the radio regulations — the article dealing specifically with the amateur service. The organisation of the IARU team to WARC 79 was discussed in considerable detail and the IARU president will be making a formal statement to IARU member societies on the organisational policy that has been adopted. IARU headquarters has agreed to prepare a descriptive and informative booklet on the amateur radio service suitable for distribution to telecommunication authorities in developing countries. The importance of the special preparatory meeting of the ITU International Radio Consultative Committee (CCIR) in October, 1978 was also discussed and the possibility of the submission of papers furthering the interests of the amateur service was explored.

Following the meeting in Geneva, Region 3 director, Michael Owen, VK3KI and WIA president David Wardlaw, VK3ADW, visited a number of societies in Region 3. Meetings were held in Tokyo with JARL president Shozo Hara, JA1AN. On the 21st February, 1978 the JARL League Head-

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.

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The all-solid state FT-7 mobile transceiver provides high performance on the 80 through 10 metre bands. The operator may select upper or lower sideband or CW operation, and the compact package provides many features engineered for convenience while mobile. A single knob provides all transceiver tuning, and the state-of-the-art noise blanker minimizes impulse-type noise such as that found in mobile applications. Inbuilt speaker, with provision for external speaker or phones. 500 KHz coverage on 10m. The FT-7 is designed for operation directly from your car's 12 volt battery. Dial and meter attractively illuminated in colour. Mic, mobile mount, power cable inc.; also tilt stand for base station operation. **Priced at $578.**

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- Receiver offset tuning
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- Single-knob tune-up eliminates fumbling around panel searching for load and plate controls.
- Extremely compact size for installation under dashboard
- Matching AC power supply with provision for crystal controlled operation available.

*Availability and price of these items TBA.

Prices and specifications subject to change.

Manufacturer's technical data

GENERAL

Frequency coverage: 80m 3.5–4.0 MHz, 40m 7.0–7.5 MHz, 20m 14.0–14.5 MHz, 15m 21.0–21.5 MHz, 10m 28.5–29.0 MHz installed; any 500 KHz segment between 28.0 and 29.7 MHz available as option.
Emission: LSB, USB (A3j), CW (A1)
Input power: A1, A3j, 20 watts DC
Carrier suppression: Better than 50 dB below rated output
Unwanted sideband suppression: Better than 50 dB @ 1000 Hz
Spurious emission: Better than −40dB
Distortion products: Better than −31 dB
Transmitter frequency response: 350–2700 Hz −6dB
Frequency stability: Less than 300 Hz drift from a cold start; less than 100 Hz over a 30 minute period after warm-up.
Antenna output impedance: 50 Ohms nominal
Microphone input impedance: 500 Ohms nominal

RECEIVER

Sensitivity: 0.5 μV for S/N 20 dB
Image rejection: Better than 50 dB
IF rejection: Better than 50 dB
Selectivity: −6 dB: 2.4 KHz, −60 dB: 4.0 KHz
Cross-modulation: Better than 60 dB immunity at 20 KHz off a 20 dB input signal typical.
Audio output: 3 watts @ 10% THD
Audio output impedance: 4 Ohms
Power requirements: 13.5 VDC ±10%, 234 VAC 50/60 Hz (with FP-7 or FP-4 power supply)
Power consumption: 13.5 VDC–3 A transmit, 0.4 A receive
Dimensions: 230(W) x 80(H) x 290(D) mm **Weight:** 5 kg

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	PRINS RADIO, 123 Argyle Street, Hobart 7000	Ph. 34 6912
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A.C.T.	QUICKTRONIC, Jim Bland, Shop 11, Altree Crt., Phillip 2606	Ph. 81 2824, 82 2864

AMATEUR RADIO

quarters were visited and a press conference held. That same evening Michael Owen and David Wardlaw and their wives attended a formal dinner given by JARL. The importance of the CCIR special preparatory meeting was discussed with Shigetake Morimoto, JA1NET, who is director of JARL and president of JAMSAT and Keigo Komuro, JA1KAB, both of whom are deeply involved with JARL's preparation for WARC 79.

On the 22nd and 23rd February a visit was made to Seoul in Korea to meet representatives of the Korean Amateur Radio League. After this two further days were spent in Japan enabling further consultations with the president of JARL, and Region 3 director, Matsumi Saito, JH3PJE.

In Singapore meetings were held with representatives of SARTS and Region 3 director, Tan Lian Huat, 9V10D and Region 3 secretary, David Rankin, 9V1RH.

PACIFIC FESTIVAL CONTEST: This contest is promoted by the Townsville Amateur Radio Club in conjunction with the Townsville Pacific Festival committee, and aims to increase activity on all amateur bands by stations in Australia, New Zealand, Pacific Islands, and all countries bounding the Pacific Ocean. Rules are:—

1—Time of contest: The contest is run for eight days, from 0001GMT Saturday 27th May, 1978 to 2359GMT Sunday 4th June, 1978.

2—Sections:
a. Transmitting all bands — phone only.
b. Transmitting all bands — CW only.
c. Transmitting all bands — open.
d. Transmitting — VHF and UHF — VK only.
e. Recieving all bands — open.

3—Logs: These are to show the section entered and points claimed for each contact. This is most important. If the points claim is not completed only one point per contact will be allowed.
VHF and UHF logs must show distance in kilometres between stations.

4—Contacts:
a. CW contacts count as double score (CW-CW).
b. One (1) contact per band per mode per day only.
c. No cross band contacts.
d. Repeater contacts do not score.

5—Awards: Perpetual trophy is held by the TARC and will be inscribed with the name of the winner, who will receive a smaller trophy.
Overseas stations (excluding VK, P29, ZL) with the highest score will receive a "Pacific Festival" medallion.
Section winners will be awarded a certificate. Commerative QSL cards will be issued.
VK, ZL and P29 call areas to other Pacific seaboard countries and islands — 1 point.
Bonus points — except VK4 stations: 15 points for contacts with VK4WIT; 9 points for contacts with other Townsville stations.
VK4 stations: 1 point per contact for working VK4WIT or other Townsville stations. Intrastate contacts not otherwise permitted.
Overseas stations: excluding ZL and P29 —
3 points for contact with any VK station;
5 points for contact with any VK club station;
9 points for contact with any Townsville station;
15 points for contact with VK4WIT.
All stations:
160 metres — 5 bonus points per contact; RTTY and ATV — 10 bonus points;
CW/CW — Double points.
VHF/UHF stations—scoring table—
0 — 50km — 1 point
50 — 100km — 2 points
100 — 200km — 3 points
200 — 400km — 4 points
400km and over — 5 points
Bonus points — VHF/UHF stations only — other than Townsville stations — contact with your local club station add 15 points, only if your club station has contacted VK4WIT during preceding 24 hours (contact number must be recorded). Townsville stations receive one point per contact only.

7—Identification: All stations identify for ease of scoring, eg. — phone, VK4WIT Townsville; CW, VK4WIT/TVL.
Send logs to:
Townsville Pacific Festival Contest
VK4WIT — CHC No. 6568
PO Box 964 Townsville 4810
Australia.
Closing date for entries:— 23rd July, 1978. Good luck, and send those logs in. Iain Morrison, VK4ZIG, Queensland contest manager 1978.

VHF — UHF DX CONTACTS: On the 9th October, 1977, during a period of intense trans-equatorial propagation on the six metre band, contact was made on 145.9MHz between YV5ZZ in Venezuela and LU1DAU in Argentina. Initially the contact was on CW then both stations switched to SSB. The distance was 5044 kilometres (3135 miles).

Both stations used 10 element crossed polarised Yagi antennas. YV5ZZ was operating portable with 200 watts input and LU1DAU with 100 watts input.

At the end of that contact YV5ZZ worked LU7DJZ with similar results.

Around the same period 144MHz stations in Japan were heard in Darwin, Australia. This has sparked off arrangements for experimental skeds over that path around October, 1978.

The French 50MHz beacon FX3VHF was heard twice in eastern Canada during June, 1977 by VE1ASJ. A Canadian 50MHz beacon VE1SIX is reported to be operational since then.

During October, 1977 FX3VHF signals were heard by ZE2JV in Rhodesia, 8137 kilometres to the south. The signals were also heard by ZE1JJ.

The FX3VHF beacon runs 70 watts into a stack of two six element Yagi arrays giving an ERP of 1kW. The frequency is 50.104MHz.

Close collaboration is being maintained between IARU Region 1 societies and the ITU CCIR working group "6". It is thought that increased amateur participation in scientific studies such as VHF ionspheric propagation research, will be one of the main assest in retaining our amateur frequency allocations and standardising the six metre amateur bands in all regions.

On the 11th January, 1978 a 70cm (432MHz) SSB contact was made between VK6KX portable near Albany, West Australia and VK3ZBJ in Frankston, Victoria, a distance of 2456 kilometres. This could be a world record for the 432MHZ band.

A two-way contact on 13cm (2304MHz) was made on the 17th February, 1978 between VK6WG in Albany WA and VK5QR in Enfield SA, a distance of 1886 kilometres. The last known world record for this band is 760km.

A 70cm (432MHz) contact between VK6XY in Albany WA and VK3ZQV in Carrajung, Victoria, on 22nd February, 1978, is reported. When confirmed, this could extend the world record to 2562km.

During January and February, 1978 several 144MHz and 432MHz contacts were reported between VK6 and VK5 also VK5 and VK3 call areas, all being over a distance of several hundred kilometres.

Contacts were also made between Alice Springs, Central Australia, and Bundaberg, and Brisbane in Qld, and Moree and Gunnedah NSW on 144MHz. These are the first recorded contacts over that path.

ITU NEWS: "Radiocommunications" is the theme proposed for World Telecommunication Day, 17th May, 1978, to mark the 50th anniversary of the establishment of one of the four permanent organs of the International Telecommunication Union — the International Radio Consultative Committee (CCIR), which is responsible for setting international standards in radiocommunications.

The 17th May was chosen because it is the anniversary of the signing in Paris of the first International Telegraphic Convention which established the Union on 17th May, 1865, 113 years ago.

Although no details have yet been

AMATEUR RADIO

received, it is probable that an amateur contest will be conducted to mark the occasion.

OVERSEAS VISITOR: A visitor to Sydney during March, 1978 was VE7DIQ, Petty Officer Dave Eastick, aboard HMCS Restigouche. Dave operates the amateur radio club station aboard ship under the call VE0NA-maritime mobile. His home is in Victoria, Vancouver Island, British Columbia and he had many contacts with New Zealand and Australian amateur stations during the voyage to New Zealand and Australian waters for combined naval exercises.

Arrangements to meet Dave on his arrival in Sydney were made during a 14MHz contact when his ship was off the Hawaiian Islands.

The main activity of the amateur station is to maintain skeds with Canadian amateurs who provide "phone patch" facilities for ship's personnel wishing to speak to their wives and families. (A facility that has so far been denied Australian amateurs).

While in port in Sydney, permission was given to operate on amateur bands using their VE0 call signs with the suffix — portable VK2, but not to use the phone patch facilities that could be arranged by Canadian amateurs.

The irony of the situation was that if the ships had been a few kilometres out to sea, full phone patch facility would have been possible with Canadian amateurs.

The amateur equipment aboard the HMCS Restigouche was a TS 520 transceiver coupled through a matching unit to a 12 metre vertical antenna, both part of the ship's radio installation.

It was a pleasure to meet Dave and enjoy his hospitality aboard ship and hear the appreciative comments about amateur radio from his fellow crew members. On being introduced, the first greeting being — "if you are a friend of Dave, you must be an amateur radio operator".

During the relatively short time available it was my pleasure to show Dave some of the main features and sights of Sydney and the Warragamba Dam. Also, introduce him to fellow amateurs both local and overseas, on air from VK2APQ, and to learn first hand some of the activities among Canadian amateurs and regulations under which they are licensed.

On leaving, Dave expressed his thanks for the hospitality, guided tours and introductions to other amateurs, both personally and on the air, and a hope for lasting friendships via amateur radio.

SYMPOSIUM: Over the weekend 20th and 21st May, 1978, the VHF and TV Group of the WIA, NSW Division,

AMATEUR RADIO

will be conducting a symposium, "Future Amateur Communications Techniques" in Sydney.

This will consist of a series of lectures and workshops covering such topics as microwaves, moonbounce HF propagation expectations, repeaters, microprocessors and antenna design.

A full set of lecture papers will be available with registration, which is expected to be $15.

For further information write to the VHF and TV Group, Wireless Institute Centre, 14 Atchison Street, Crows Nest NSW 2065.

CHANGES TO REGULATIONS: Federal executive of the WIA has received information from the P & T Department regarding proposed changes to the Handbook for Operators of Radio Stations in the Amateur Service.

These changes relate to paragraphs 61, 80, 94 and 112. Paragraphs 61 and 112 have been enlarged to clarify and set out special conditions relating to the transmission of radioteletype.

Paragraph 80 (a) to read — "Messages or visual images on behalf of third parties except for the purpose of providing communications as part of an authorised emergency amateur network. For the conditions relating to the use of emergency networks, refer to paragraph 94 of this handbook."

Paragraph 94 is now written as a three part regulation. The first two parts enlarge and clarify amateur participation in emergency activities.

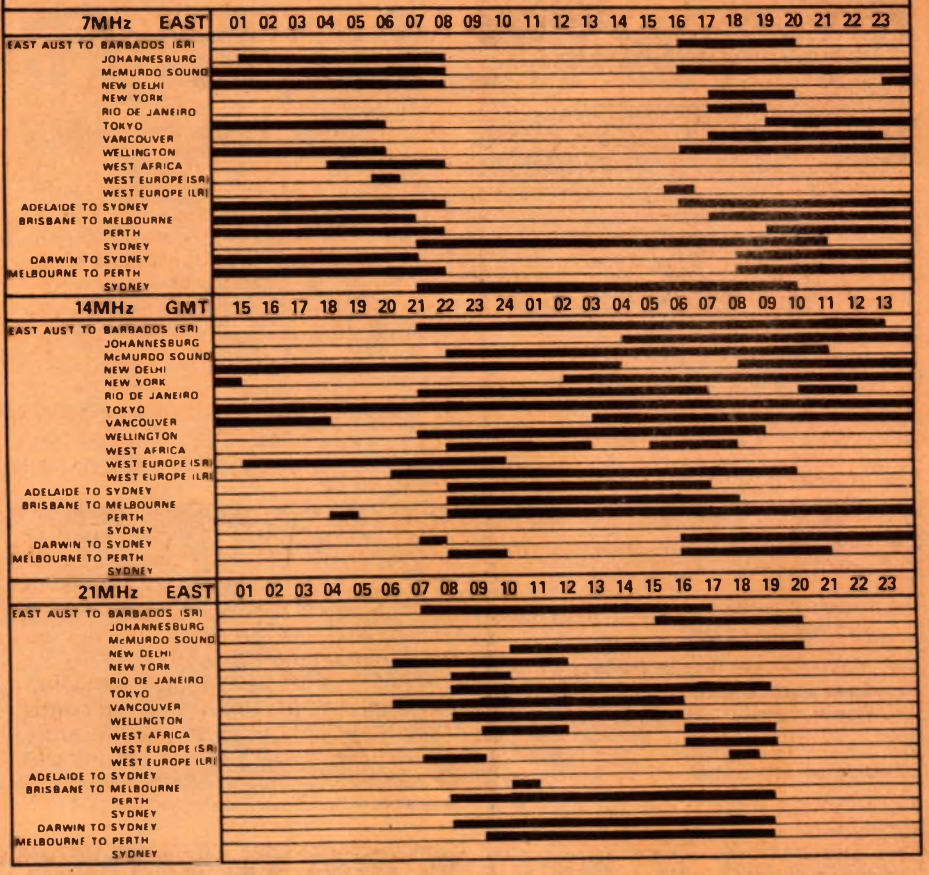
The third reads — "In circumstances involving an extreme emergency, where no authorised emergency network has been established for the purpose, any amateur should act on his own initiative in a responsible manner."

It has been stated that the door is open for comments by the WIA within a reasonable time.

It was announced over WIA news broadcasts on Sunday the 19th March, 1978 that the use of VFO's by novice licencees had been approved by the P & T Department.

IONOSPHERIC PREDICTIONS FOR MAY

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. 5.78



RADIO CLUB NEWS

NORTH WEST AMATEUR RADIO GROUP: Has thirty members spread over a wide area of northern New South Wales, e.g. Moree, Inverell, Glen Innes, Tenterfield, Armidale, Tamworth, Gunnedah, Bingara, Narrabri, Tambar Springs and Quirindi.

The executive committee members are:— president — Ted Lumbewe, VK2ZX (Inverell); vice-president — Barry Harwood, VK2ZAY (Gunnedah); secretary — Kerry Adams, VK2BXT (Moree); treasurer — Don Hunt, VK2ADY (Tamworth).

This scattered membership and their desire to establish three VHF repeaters to cover the area is the first of its kind in Australia. New members are always welcome and should contact any of the executive in their area.

AUSTRALIAN CLUB DIRECTORY

Club name: North West Branch Tasmanian Division WIA.
Club call sign: Repeater VK7RNW.
Meeting place: Lakins Hall, Ulverstone.
Day and time: Second Wednesday of each month at 8.00pm.
Affiliation: WIA Tasmanian Division.
Net frequency: FM channel 4; repeater VK7RNW channel 3.
Contact: Secretary, Kerby Cunningham, VK7ZKC, 27 Hogg Street, Wynyard 7325. Telephone (004) 42 2862.

Club name: Darwin Amateur Radio Club.
Club call sign: VK8DA and VK8VF.
Meeting place: Northern Territory Emergency Services Building, Bishop Street, Winnellie.
Day and time: First Monday of each month at 8.00pm.
Affiliation: South Australian Division WIA.
Net frequency: 3555kHz, 3565kHz, channel 50 FM 146.5MHz.
Contact: Henry Anderson, VK8HA, PO Box 1418, Darwin, NT 5794, telephone (089) 81 8587.

PAPUA NEW GUINEA

Club name: Papua New Guinea Amateur Radio Society.
Club call sign: P29PNG on special occasions only.
Meeting place: Ela Beach RSL Club.
Day and time: First Friday of each month at 5.30pm.
Affiliation: Not stated.
Net frequency: Tuesdays, — 14.17MHz at 0930GMT. Thursday — 3620kHz at 0930GMT and 146.0MHz FM channel continuously.
Contact: PO Box 204 Port Moresby.

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FT-301	HF Transceiver (s s)	$995.00	Cat D-2870	YD-844	Base Microphone	$39.00	Cat C-1116
FP301	Power Supply	$170.00	Cat D-2872	FT-301S	HF transceiver	$710.00	Cat D-2880
FL-110	200W linear amp	$210.00	Cat D-2884	FT-901D	HF transceiver	$1275.00	Cat D-2854
YO-301	Monitor Scope	$355.00	Cat D-2882	FT-7	HF Mobile Transc.	$515.00	Cat D-2866
YO-100	Monitor Scope	$330.00	Cat D-2862	DC DC converter for the FT 901D		$75.00	Cat D-2856
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The Yaesu Musen FRG-7 communications receiver, as supplied for review by Dick Smith Electronics. For price and further details inquire at any Dick Smith store.

Technically, the FRG-7 can be described as a triple-change superhet, using the Wadley-loop principle.

Incoming signals pass through an initial low-noise FET RF amplifier stage to an up converter, which shifts them into a first IF channel 1MHz wide, centred on 55Mhz. They are then down-converted to a second IF channel 1Mhz wide and centred on 2.5MHz. While this might suggest scope for large amounts of frequency drift, the reverse is the case. The heterodyning frequencies are synthesised from a crystal-locked oscillator system, with the further characteristic that any drift which may be evident in the up and down conversion tends to cancel in terms of the final resultant.

What the front end does, in effect, is to shift all the desired signals into the range 2 to 3MHz, virtually drift-free. This makes it relatively simple for the "back end" of the receiver to convert, amplify and demodulate the signals, using a single-range tuneable oscillator, a 455kHz IF channel, BFO, product detector and audio system.

At all times, the frequency to which the receiver is tuned can be read straight off the dials, with no need for a marker oscillator or critical bandset/bandspread adjustments. The actual tuning procedure differs from a normal receiver but will present no problem to anyone used to identifying wanted stations in terms of frequency.

The band selector switch is first set to one of four positions covering the required portion of the spectrum between 0.5 and 30MHz. This automatically illuminates one of four scales to do with RF stage tuning and this is then set to the required number of MHz. An adjacent knob and scale sets the synthesised up-down conversion oscillator to the same range, with a LED indicator to show when the oscillator is under the control of the phase-locked loop.

This done, the main tuning dial directly covers the selected MHz, with calibrations every 10kHz and readable to smaller increments. For example, to receive a station on 14.15MHz, one would set the band switch to position D: 11.0 to 29.9. The "RF Preselect" and "MHz" dials would be set to 14 and the main tuning dial spun round to 150 — and there the station should be!

A further slight nudge will serve to peak the tuning of the RF stage.

Exactly the same procedure is followed, and exactly the same degree of bandspread is available, over the entire range of the receiver: select the wanted "MHz" and use the full sweep of the main tuning dial to cover the 1000kHz up to the next MHz.

The only concession to possible inaccuracy in a properly adjusted receiver is a small "Dial Set" knob which allows the reading cursor to be moved slightly to the left or right.

The normal tuning mechanism is very smooth and all that is likely to be needed for AM stations. However, to facilitate tuning of SSB stations, a small Fine Tune control is now provided, rather like the "clarifier" on SSB transceivers. The stability of the system is extremely good and, once an SSB station has been tuned, we did not notice any drift whatever in the course of ordinary listening.

Other control facilities on the panel include local/DX antenna switch, and audio tone control switch, volume control, power and light off/on switches, a miniature output jack for recorders and another for phones or external speaker. A mode switch selects AM with or without noise limiting, lower sideband SSB and upper sideband/CW. A signal strength meter above the main dial is calibrated in S points.

For broadcast band operation, the use of an ordinary long wire antenna and earth is assumed but, for frequencies above 1.6MHz, provision is made for alternative coaxial cable input via an SO-239 socket. A muting terminal is also provided for use where the receiver is to be teamed with a transmitter.

Normal operation is from the 240V AC mains, with automatic switchover to internal batteries (8 type UM1) if fitted. The FRG-7 can also be operated from an external 12V DC supply.

Size of the receiver is 340mm x 153mm x 285mm (WxHxD) and weight 7kg, without batteries. Sensitivity is given as better than 0.7uV at S/N 10dB for SSB/CW, and better than 2uV at S/N 10dB for AM. Selectivity is ±3kHz at −6dB and ±7kHz at −50dB. Stability is quoted as better than ±500Hz at any 30 minutes after warm-up.

As supplied, the FRG-7 comes complete with a 16-page instruction manual with a large fold-out circuit diagram, and containing a general description, specifications, user instructions, an explanation of circuit principles, alignment and maintenance details, voltage checks and parts list.

It confirmed this reviewer's impression of the FRG-7 in its current form as a well established and very practical receiver, solidly built, smooth in operation and free from any obvious "bugs". (W.N.W.)

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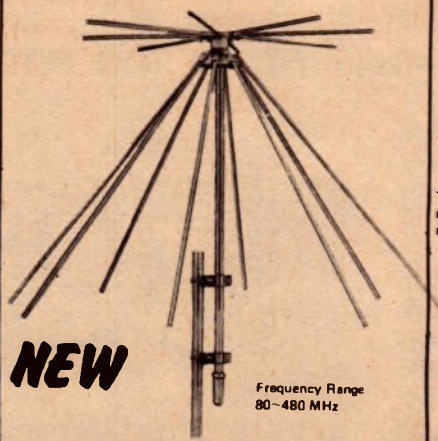

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DAIWA RF SPEECH PROCESSORS
Daiwa have introduced a new range of RF speech processors which are simply attached into the microphone line. Two new models are available, model **RF440** which features a phase shift network and model **RF550** which utilises a crystal filter. The processors are a suitable alternative to a linear amplifier – up to 6dB gain (4 times) improvement on the signal can be expected! Both models feature 240vac/13.9vdc operation and include compression level monitoring via a front panel meter. Impedance is switchable 50K/600ohms with distortion better than 3%.

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SHORTWAVE SCENE

by Arthur Cushen, MBE

AFRTS to continue operation on short-wave

The American Armed Forces Radio and Television Service was scheduled to close down its short-wave operation earlier this year due to a budget cut. However, the Voice of America has offered to carry their program world wide for the time being. Listeners in Australia and New Zealand will therefore continue to receive their 24-hour service of news, interviews and sport.

The Armed Forces Radio and Television Service, broadcasting from studios in Washington earlier this year, was scheduled to cease operation due to a severe budget cut in the AFRS program. As 95% of programs to the American Forces are now carried by satellite or cable, it was felt that the short-wave service to these areas was being received by a very small audience.

AFRS has received many hundreds of letters, not only from American servicemen, but from listeners throughout the world, indicating that the Armed Forces Radio Service, which operates 24 hours a day, is listened to by many thousands of people other than American servicemen. As a result, the Voice of America has agreed to carry the AFRS programs on its transmitters.

A letter from the Deputy Assistant Secretary of the USAF to the writer stated that "In view of this, the Director of the Voice of America, Mr R. Peter Straus, has agreed to continue the short-wave broadcasts of AFRTS programs over the VOA transmitters until we can jointly determine how additional funds can be made available."

The Philippines relay station at Poro was again put into service on March 5, and is listed in their latest program schedule. The AFRTS program schedule includes the following transmissions to the Far East. The transmissions via Dixon for the Armed Forces Radio and Television Service are as follows: 6095 0700-1400, 9700 0330-1400, 11805 0200-0700 and 1800-2000, 15330 2000-0330 and 17765kHz 1800-0200GMT.

The schedule for the relay station at Poro in the Philippines is 11835 1900-2300 and 2300-0100 and 21670kHz 0100-0300 and 0300-1900GMT.

SWEDEN USES 21690kHz

Radio Sweden have made a late change for its broadcast in Swedish to Australia and New Zealand 0630-0830GMT. The program is now on 21690kHz instead of 9605kHz. The signals on 9605kHz were excellent in New Zealand, but it seems that this channel is a little low for Australian listeners.

The broadcasts in English to the Pacific 1100-1130GMT daily (except Monday) have been moved from 17845kHz to 15125kHz. During our summer period 17845kHz did suffer some co-channel interference from Cologne, but Deutsche Welle reduced this by cutting down its power from 500 to 100kW and using an antenna with less side-lobes.

RADIO TANZANIA

Broadcasts on Radio Tanzania Dares-Salaam have been heard during our afternoons on 15435kHz. The reception has included a news bulletin in English preceded by the time signal and station identification signal.

At 0400GMT, when the time signal is heard, signals have been improving and at 0415GMT there has been good reception of a special program for the African Liberation Organisations. On Wednesdays at 0415 there is a talk from the Pan African Congress and in this announcement the frequencies of 9680 and 15435kHz are given. At 0430GMT there is a station identification, followed by popular music.

COLOMBIA EXPANDS SERVICE

According to a recent interview with the Director-General of Radio Nacional at Bogota, Colombia, the station is to extend its service in English to Europe and North America. Douglas Doull of Auckland NZ reports that an interview with the Director-General, recorded when in Vienna and broadcast by the Austrian radio, indicated that three frequencies would be used for the daily broadcasts, and these would be in the 31, 25 and 19 metre bands. According to the 1978 World Radio Handbook the frequencies assigned are 9655, 9685, 11795, 11825 and 15335kHz.

SRI LANKA DX SESSION

The Sri Lanka Broadcasting Corporation at Colombo has been broadcasting Radio Monitors International for the past two years. This session is recorded by Adrian Peterson at Poona in India and in its 15 minutes it contains three features: a station profile, some technical news and a DX Digest. Recently, the program has been extended and is being broadcast three times each Sunday over the SLBC.

The first transmission is at 0315GMT on 9720 and 15425kHz in the All Asian Service for reception in South East Asia. The second broadcast at 1100GMT can be heard on 11835, for reception in Australia and New Zealand and as well on 15115 and 17850kHz. The final program is transmitted at 1900GMT and is on 7190, 9720, 11870, 15115 and 17850kHz, with the first three frequencies being beamed to the Middle-East and the last two to Africa.

SIGNALS FROM INDONESIA

Radio Republik Indonesia Manokwari has been observed by Robert Yeo of Melbourne broadcasting on two new frequencies. The frequency of 3428kHz had station identification at 1330GMT. Then followed a program of local popular music. The new fre-

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.

SHORTWAVE SCENE

quency replaces 3345kHz according to a report in ADXN.

The station was also noted on 6185kHz at 0930GMT with a news relay, and station identification at 0942GMT.

RRI Jayapura has been noted on 4993, having moved from 4980kHz where it suffered interference from a Venezuelan station. The station has been heard from 1000 to close down at 1400GMT. Peter Bunn also reports in ADXN that Jayapura has been heard on 11940kHz with a news relay from Jakarta at 2200GMT, followed by local station announcement at 2212 in Indonesian.

RADIO VERITAS ASIA

The broadcasts of Radio Veritas Asia are frequently heard in this area with transmissions originating from Manila in the Philippines. Three frequencies have been reported during late morning listening and all are giving fair reception.

A broadcast on 9740kHz in Indonesian has been heard at 2300GMT by Dene Lynberg of Wellington. At the same time, reception of Veritas has been noted on 11725kHz with a program in Vietnamese commencing at 2230GMT. On 15135kHz the signal has been noted at 0200GMT when the program is in Telugu.

Another frequency, 15280kHz, has been noted with English news at 0130GMT by John Mainland of Wellington.

Radio Veritas Overseas, which has been broadcasting from Manila since 1969, recently changed its name to Radio Veritas Asia because of the increased transmissions to this continent. The station is now receiving an average of 8000 letters a month from 16 countries in Asia. It is also known that there is a substantial audience in China listening to its gospel programs. Radio Veritas Asia has the mailing address of PO Box 939, Manila, Philippines.

TWR SWAZILAND

Trans World Radio Swaziland, with studios at Manzini, has been noted with gospel programs on 9730kHz from 0400GMT with a broadcast in German. There is severe sideband interference from Cologne on 9735kHz, according to Dene Lynberg of Wellington in the New Zealand DX Times. The frequency of 17745kHz is giving much better reception and opens at 1915GMT with the interval signal and announcements in French. A program in an African language follows to 1930 when French is again broadcast for one hour. The station closes at 2030GMT.

Another channel, 11955kHz, has been heard with poor signals with the usual gospel program at 1830GMT by Arthur Kindell of Levin, NZ.

According to Bob Padula, in Melbourne, Trans World Radio at Manzini is scheduled to use 17775kHz from 1445-1500GMT in Lingala, 1500-1545 in French, 1915-1930 in Lingala and 1930-2015 in French. The transmissions 1430-1500 in Malagache and 1500-1515 in French are expected to be broadcast on either 11760 or 11955kHz.

WINTER RECEPTION

During the winter months listeners will find that short-wave signals are better during the hours of daylight than during darkness, and also that on Sunday, May 7, stations make their usual seasonal frequency changes for the southern hemisphere winter period. This will mean that some channels listed in these notes may be altered at the last moment.

International broadcasting stations make four seasonal frequency adjustments each year: on the first Sunday of November, March, May and September. The winter and summer schedule changes are generally of a major nature. The spring and autumn changes are mainly just frequency adjustments and do not affect many stations on the international broadcast band.

KTWR GUAM

Trans World Radio at Guam is using some new frequencies and, as well, has expressed an interest in commencing a transmission to Australia and New Zealand. The present schedule for KTWR is: 11850kHz 1100-1500GMT, 15115 0800-1100, 15145 1100-1500, 15155 0900-1100 and 2100-2400, 17830 0000-0100, and 17855kHz 0800-0900 and 2200-0130GMT.

Broadcasts in English are 0900-0930, 0930-1000, 1000-1100, 1430-1500 and 0030-0130GMT.

LISTENING BRIEFS

EUROPE

MONACO: Trans World Radio, Monte Carlo, is to shortly install two 500kW transmitters for short-wave broadcasting. These added facilities will be used mainly for broadcasts to Eastern Europe, according to the BBC Monitoring Service.

FINLAND: Radio Finland at Helsinki has been heard with its new transmission to Australia and New Zealand 0930-1000GMT. This English broadcast is carried daily on 17785kHz and on Sundays a mail box program is broadcast. Requests for letters to Box 95, Helsinki 25, Finland are made during the session. Another transmission in English called Sunday Best is broadcast on Sunday's only 0800-0930GMT on 21495kHz.

BELGIUM: The Belgium National Radio at Brussels has been heard on the new frequency of 9615kHz closing at 0615GMT after a broadcast in French. This transmission is on the air daily except Sunday 0500-0615GMT and has been listed as 9610kHz. The new frequency suffers some slight interference from KGEI San Francisco on the same channel.

SPAIN: Radio Exterior de Espana, Madrid has made a frequency change for its service in Spanish to Australia and the Philippines. The transmission 0800-1100GMT is now on 9520 and 11910kHz, according to Bill Vogel reporting in DX Post. 11910kHz replaces the frequency of 11740kHz which suffered interference from Radio Australia and the Vatican Radio.

AFRICA

EGYPT: Cairo has resumed its English transmission to Europe after several months of the service being suspended. The English program has been heard 2215GMT on the usual frequency of 9805kHz. The Voice of Africa program in English from Cairo is still being heard 2030-2200GMT on 15375kHz.

SOUTH AFRICA: Radio South Africa introduced its two 500kW transmitters into its March schedule and has already been heard with this higher power on several frequencies. On 17780kHz on Sunday at 0930GMT the transmitter has been heard opening but mixed with Deutsche Welle, while on week days the broadcast commences at 0958GMT.

The higher powered transmitters are scheduled to use 5980, 9585, 11900 and 17780kHz. Radio RSA in the past used four 250kW transmitters. The station is keen to receive reception reports on the new two transmitters. These should be sent to Box 4559, Johannesburg, South Africa.

ISRAEL: The Israel Broadcasting Authority has four daily transmissions in English and these give good reception in this area, particularly at 0500 and 2000GMT. The broadcast 0500-0515GMT is on 7412, 9835, 11655 and 11960kHz; 1200-1230 on 11655, 15405, 15415, 17815, and 21500kHz; 2000-2030 on 11655, 9815, 9425, and 9009kHz; and 2230-2300GMT on 7412, 9435, 9815 and 11655kHz.

ASIA

PAKISTAN: Radio Pakistan has several transmissions in English, and three of these are giving good reception at the moment. The broadcast 0230-0245 is carried on 17830 and 21590kHz, 1100-1115 on 15115 and 17665 and 2100-2145 on 6235 and 7095kHz.

AMERICAS

ECUADOR: HCJB in Quito, Ecuador is broadcasting to the South Pacific with gospel programs in English on 6130kHz and 11900kHz 0600-1130GMT. Another frequency, 9745kHz, is used 0700-1030GMT. The station has a special program for short-wave listeners called "DX Party Line", and this is broadcast three times a week: Monday, Thursday and Saturday 0930-1000GMT.

USA: Station WYFR, which has studios in Oakland, California, has recently been moving its facilities from Scituate, Massachusetts to Okeechobee, Florida, and two 100kW transmitters are now operating. The latest schedule received from the station is to the Americas 2300-0300 on 15265 and 1521kHz and 0200-0500GMT on 11855 and 9715kHz.

REAL POWER LINEUP

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.

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

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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.

Sanwa Electric Instrument Co., Ltd. can meet your every marketing requirement for multi-testers with an extensive quality range of more than 20 models. Currently exporting to more than 100 countries, we offer 35 years technical experience as Japan's top manufacturer and innovator in this field.

(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 0-0.03-0.3-1.2-3-12-30m 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 ×1-×10-×100-×1k-×10k-×100k (max. 200M) Batt. 1.5V ×1 & 9V ×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 ×1-×10-×1k-×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 ×1-×10-×100-×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 ×1-×10-×1k-×10k (max. 20M)

(CAM-250D)
● ACA 6-30-60-300 ● ACV 300-600 ● kΩ 0-50k ● Batt. 1.5V×1

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● 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-2×3

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sanwa

Letters to the editor

CB servicing

I read with great interest the article included in the Australian CB Scene "Spectrum Anarchy and Conservation" (EA Feb. 1978). The points mentioned are valid, but the authors missed one very important point in regard to control.

In the United States, the FCC is very strict concerning the qualifications one must have to repair or adjust any transmitting equipment. A Commercial Licence is the minimum requirement, and, because of the high technical standards needed to hold one of these licences, a certain amount of control can be exercised on the transmitting scene. By this, I mean that a set could only be repaired or adjusted on production of the owner's licence.

In this country at the present time, anybody can play around with CB, Marine Transceivers, Radar etc., with impunity, to the detriment of technical standards. If the Wireless Telegraphy Act is to be amended this year, provision should be made for only suitably certificated people to do work on these types of equipment.

Gerald K. Wild,
Exmount, W.A.

COMMENT: We understand the official position to be that type approved equipment may only be modified with the approval of the P&T Dept, while maintenance should only be carried out by people who, in the opinion of the Department, are qualified to carry out such work. The problem is not so much with the regulations but of implementing them — which gets back to the "anarchy" theme!

Test equipment

As a regular reader and collector of EA I find of recent times there seems to be too much on mini computers and microprocessors for my liking. However, when I do take an interest (when I can find a legitimate use) I will have a comprehensive library of text material to refer back.

This brings me to the crux of the matter — a desperate need for good test equipment. Heading the list: a wide band dual trace CRO. About 6 years ago I built the 1963 RTV & H unit and this has been, and is an invaluable device though lacking in versatility. Jim Rowe did a really grand job. I have contemplated buying a more pretentious unit but baulk at the price: the best part of $500, though $250-300 is more easily digested.

My neighbour (VK2BMO) and I were discussing just this subject and both agree it has been some years since any worthwhile test gear has been featured. (I exclude 1: Digital Frequency Meter and 2: the really excellent first DVM, too costly for what it did, though I must admit I really fancied it.)

There is a need for the CRO, Signal Generators, Frequency & Voltage standards (not in a myriad of boxes — as is available) and other devices on which you are vastly better informed than me.

A suggestion of a new area for you is that of Psychic Research vis — Alpha brain wave monitors, and a 8-10 cps visual/audio stimulator. ESP and telepathy are associated with marked reduction in Alpha frequency (from 350-500 cps normal) also relaxation and sleep. I am not quite a "NUT" yet, on this subject, but I have proved to my own satisfaction that telepathy & perception exist within my family (and it seems most other emotionally attached groups) in, as yet a limited and interesting way. This would seem to be a growing area for your novelty projects. If you do not already know of it, I quote "Beyond Telepathy" by Andrija Puharich (Picador).

Yours without doubt is a difficult position. This I appreciate. You just can't please everybody all the time — microprocessors and mini Computers are here to stay, along with CB Radio, but a little variation would be most welcome.

For information I do build quite a few of your projects. I currently am on my 3rd Stereo of the Twin 25/40 line, this time for me. A super performer — audibly better to my battered ears.

Anyway enough said, I will be at my newsagent on the 1st Monday next month as usual.

Richard T. Leech,
Gymea Bay, NSW.

COMMENT: Thank you for the letter. We are currently planning a new series of test instruments, and hope to be able to present them soon. We will also look into the Alpha wave monitor idea, but we are a little nervous about encouraging readers to experiment with audio-visual neural stimulation.

I told you so . . .

Now would be an appropriate time to re-read my letter of January or

February '77, and to relate it to your editorial of March '78. I predicted that the Citizens Radio Service would be used by an irresponsible majority rather than an irresponsible minority. The irresponsible categories to communications which you mention by no means exhausts the catalogue.

The chickens are coming home to roost — the chickens which you and many other commercial opportunists helped to hatch and are continuing to nurture.

C. Redman,
Wallsend, NSW.

COMMENT: Despite the current problems discussed in the March leader, I doubt very much that your prediction has proved true. Like those who abuse other public resources CB abusers tend to be more evident than responsible users, so that even a small number can seem disproportionately large — particularly if one is seeking to prove a point.

CB tone caller

Further to my selective tone caller system which you published in the January 1978 issue, I would like to advise readers that some transceivers employ transmit-receive switching in the earth lead to the speaker. A tone decoder with its power supplied by an internal battery will function normally with such a transceiver, but if the power is taken from the same supply as the transceiver, audio feedback can occur in transmit mode.

The cure is to use a 3-pole switch for CB-standby switching, with the third set of contacts used to open the negative lead from the supply to the decoder in the CB position.

I hope this is of interest.

D. Haltermann,
Geelong, Victoria.

Energy costs

I read with great interest your article in the January issue on the oxy-hydrogen economy. I wonder if it has occurred to you that the media may have deliberately tried to confuse the public on this issue. Had the media come out in favour of the invention don't you think the international oil cartels would have been greatly upset?

I refer also to the article on solar energy. Why is it that the conversion of solar energy into electrical energy costs so much? It seems to me that it may be tied up with the cause of inflation and growing unemployment.

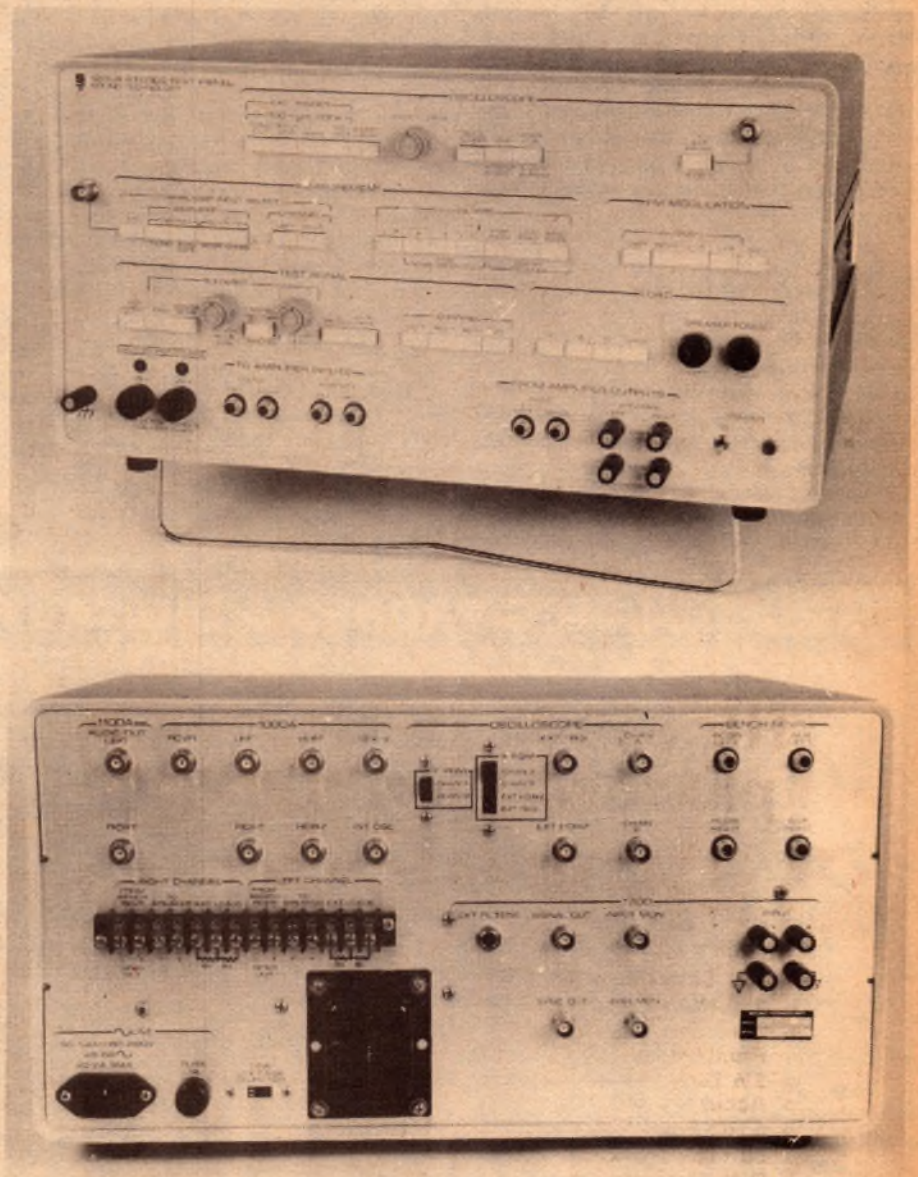
Terry Rumble,
Cairns, Queensland.

COMMENT: I doubt whether the confusing treatment was deliberate; more likely it was due to the lack of technical and scientific knowledge by the reporters. In part, the high cost of solar electricity is due to silicon solar cell cost. Storage is also costly.

New Products

Sound Technology 1200A Stereo Test Panel

The Sound Technology 1200A Test Panel is designed to greatly simplify the connection of test equipment to audio amplifiers and receivers. As well as providing comprehensive patching facilities, the 1200 provides a number of filters not normally available on most distortion analysers.



Specifically, the 1200A is designed to interconnect the Sound Technology 1000A and 1100A FM stereo multiplex test set (reviewed in October 1975), the same company's 1700 auto-nulling distortion test set (reviewed in September 1975), an oscilloscope, 8-ohm dummy loads, a pair of loudspeakers and a program source such as a stereo receiver. All of the above equipment is connected via a maze of cables to the back panel of the 1200A.

The amplifier or receiver to be tested can then be simply connected to the front panel of the 1200A via two pairs of signal cables and a pair of loudspeaker cables. This makes repetitive testing very easy — provided one can remember which of the umpteen buttons to push.

Styling of the 1200A matches the Sound Technology 1700 Distortion test set mentioned above. The dimensions of the two units are identical, at 437 x 220 x 305 mm (W x H x D). Mass of the 1200A is 11.3kg.

Four buttons are provided for amplifier output power switching, at up to 400 watts rms into 4, 8 or 16 ohms. The 1200A switches the four required 8-ohm dummy load resistors to obtain the above load resistances. Fuses are provided for the external speakers — the user should select the fuses to suit the loudspeakers.

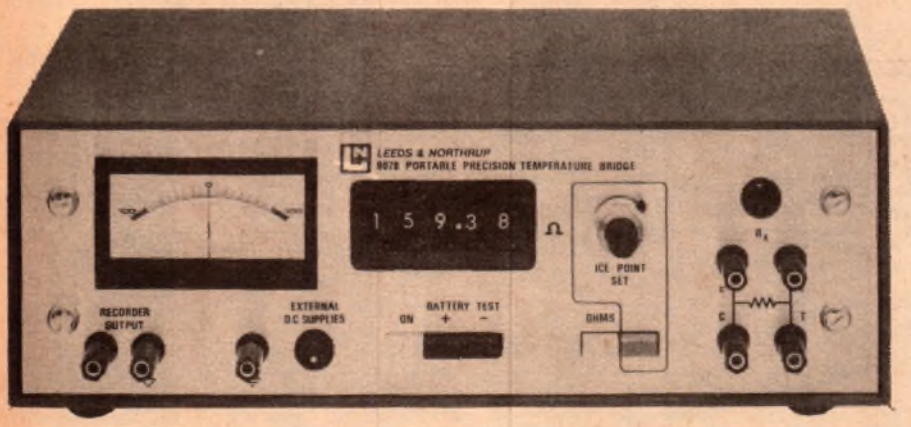
For weighted noise measurements, filters are provided for the A, B and C curves (American National Standards Institute). These are useful, although most manufacturers quoting weighted measurements for audio equipment use CCIR or DIN curves which are quite different from the ANSI curves. Other filters provided are low pass (15kHz), high pass (200Hz) and a bandpass combination of these.

An inverse RIAA filter is provided for ease of testing the accuracy of preamplifier phono equalisation. This is very useful, although it does not go as far as simulating the source impedance of a typical magnetic cartridge. The latter requirement is necessary for realistic signal-noise measurements and for checks for spurious interaction between cartridge and preamplifier.

Further listing of the 1200A would require a great deal of space. It should suffice to state that where a laboratory or hifi retailer is required to make repetitive performance measurements, the 1200 would be a worthwhile piece of equipment. Further information can be obtained from the Australian distributors for Sound Technology equipment, The Dindima Group, P.O. Box 113, Balwyn, Victoria, 3103.

Portable precision temperature bridge

Australian designed and manufactured, the 8078 Portable Precision Temperature Bridge make possible temperature measurements to 0.025°C in the range —200 to 550°C. Over 100 of the units have now been sold, some overseas.



The 8078 is an advanced design developed at the CSIRO National Measurement Laboratory in Sydney. It is based on a patented AC bridge circuit which overcomes the thermal problems commonly associated with competitive, and expensive, precision DC circuits.

The bridge was developed to provide an inexpensive means of utilising the accepted accuracy of platinum resistance thermometers. It can be used in place of such sensors as liquid in glass thermometers, thermocouples and thermistors.

Stability, both short and long term, is assured by the use of a ratio transformer in which inherently stable and accurate ratios are maintained. The bridge is almost totally immune to variations in lead resistance, while the constant sensor current of 1mA introduces only minute self-heating effects of the order of 0.01°C.

In addition, the circuit is unaffected by leakage to ground from the sensor or sensor leads, an important consideration in high temperature applications.

The 8078 is intended to operate principally with 100 ohm platinum resistance thermometers, although it can equally well be used to measure any other four lead resistance thermometer or resistor in the range 0-300 ohms. Manufacturer recommended resistance thermometer assemblies plug directly into the bridge, while additional 3-way terminal posts are provided for non-standard sensors.

For further information, contact Leeds and Northrup Australia Pty Ltd, 289 Botany Road, Alexandria, NSW 2015.

PC board transfers

Now available from Dick Smith Electronics, the "E-Z Etch" transfer kit enables the rapid design and fabrication of PC boards of professional quality.

The etchant resistant, dry transfer sheets include linear patterns for straight conductor runs, 45°, 60° and 90° bends, T sections, ellipses, teardrops, small arrows, IC patterns and other common component layouts. They are applied directly to the copper side of the PC board by burnishing the face of the transfer with a pencil.

Each kit includes 6 pages of images plus instructions. Cost is $5.90.

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$27.50
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125 to 140 M/hz 28 volt DC operated AM single crystal locks both TX and RX on same channel complete with generator.
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EX ABC MAGNETIC RECORDING TAPES ¼"
PROFESSIONAL QUALITY
5" x 600' **$1.60**
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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.
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P&P A. $1.80. B. $3.50. C. $4.55. D. $4.55

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WEIGHT 1¾ lb
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200 MA 24 volt, ½in push movement.
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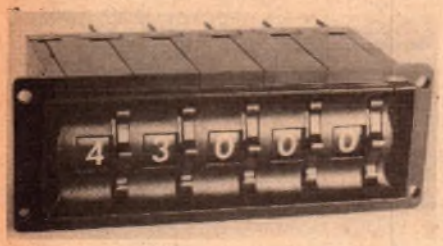
5 watt 6 channel **$99 ea.**
Post A. $1.65. B. $2.75. C. $3.20. D. $3.20.

COMMUNICATIONS RECEIVER
COLLINS R — 391/URP
Continuous tuning of range 500 Kils — 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 using mechanical filters. 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.

LED-lighted switch



The new Digitran LED- Lighted Series 40000 Miniswitch is a lighted miniature digital-readout switch incorporating a LED light source designed to last the life of the switch.

The new switch is said to be comparable in price with competitive unlighted switches, while the version without the LED lighting costs about half as much.

The Series 40000 is offered with red or clear LED lighting, with ten dial positions, and in all popular standard codes. As an optional feature, it can be ordered with pin terminals for printed circuit board mounting.

Other features include ease of assembly and snap-together construction.

For further information contact British Merchandising Pty Ltd, 49-51 York Street, Sydney, NSW 2000.

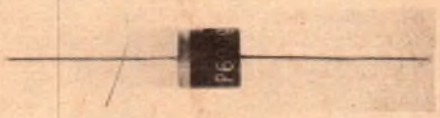
Ampec has APR

Ampec Engineering has advised that they are now Australian agents for the comprehensive range of French made APR switches.

Included in the range are low-cost miniature toggle switches, paddle and rocker snap-in switches professional miniature toggle switches, PC mounting toggle and slide switches, and pushbutton switches. There is also a comprehensive range of standard industrial switches.

A catalog and further information is available from Ampec Engineering, 42 The Strand, Croydon, NSW 2132.

400V 6A diode



Soanar Electronics now include a 400V 6A plastic encapsulated diode in their comprehensive range of discrete diodes and silicon bridge rectifiers.

Designated type P600G, this 6 amp diode has a uniformly moulded plastic case and is lead mounted. Polarity is indicated in the usual manner.

The P600G can withstand a 400 amp surge current and provides a 400V DC blocking voltage when operating at rated load. Average forward rectified current is 6A at ambient temperature (Ta) 60°C.

Cost of the P600G is much less than the cost of 6 amp stud mounted rectifiers.

Enquiries to Soanar Electronics Pty Ltd, 30-32 Lexton Road, Box Hill, Vic. 3128.

Night light for safety

Designed as a safety device for halls, garages bedrooms and nurseries, this low-cost "Nite Lite" has an estimated life of 25,000 hours and costs only 6 cents per year to operate.

The unit plugs directly into a power point and features a high brightness neon light and an extremely tough polycarbonate casing for safety. A version with a 2-metre lead and adhesive backing is also available.

Further information is available from Swann Electronics Pty Ltd, PO Box 350, Mt Waverley, Vic. 3149.

Books & Literature

Amateur radio

UNDERSTANDING AMATEUR RADIO. Principles and Construction. By J. Rusgrove, D. DeMaw and G. Grammer. Stiff paper covers, 220 pages 276mm x 207mm, freely illustrated by diagrams and photographs. Published by the American Radio Relay League. Price in Australia $8.80.

The traditional ARRL Handbook, updated and re-issued each year, is a mine of information, but it can also be rather daunting for the budding amateur, aspiring to pass a basic theory exam. What does he study, and what does he pass over?

This new publication should go some way to solving that problem. It still contains a lot of information — more than the rising amateur would normally need — but it tends to be concentrated at the foundational level, leaving the more exotic areas of amateur expertise to other publications.

Chapter headings include: Needed Fundamentals — Semiconductor and Vacuum Tube Basics — How CW Transmitters Work — How Phone Transmitters Work — How Receivers Work — Antennas and Feeders.

At this point, the contents swing towards practice as distinct from theory: Workshop and Testbench — Building Receivers — Receiver Accessories — Building Transmitters — Tramsmitter Accessories — The Power Supply — Measurements — Antennas and Masts — Setting Up A Station. Again, the emphasis is on basic rather than exotic equipment.

The book is rounded off by a general index and conforms recognisably to the ARRL style. It looks to be a good one for anyone aspiring to climb the ladder of amateur radio.

Our copy came from Technical Book and Magazine Co. Pty Ltd, 289-99 Swanston St, Melbourne (W.N.W.).

And again . . .

THE RADIO AMATEUR'S HANDBOOK, 55th Edition 1978. Published by the American Radio Relay League, Newington, Connecticut. Soft covers, 166 x 233mm, approx 700 pages. Many illustrations. Price $12.00.

If you want the full ARRL handbook in all its glory, here's the latest edition — the 55th! And as usual it looks very similar to those preceding it. The main differences seem to be a replacement of some of the practical projects, so that the book more closely reflects the latest trends in US amateur radio.

There are chapters and sections dealing with virtually every aspect of modern amateur radio, from basic communication using Morse code to radioteleprinter (RTTY), slow-scan television (SSTV) and satellite communications. In addition there is material on activities which are not legal for Australian amateurs, at least at present — like telephone patching.

Some of the chapters do seem a little dated, like that on test equipment which has a valve voltmeter circuit and a frequency marker circuit using now-obsolete RTL integrated circuits. Still, there is a great deal of very valuable and up-to-date information on modern amateur radio.

The review copy came from Dick Smith Electronics, who have it available at all their stores and dealers. Their catalog number is B 2218. (J.R.)

Microwave theory

MICROWAVE HOMODYNE SYSTEMS. by Ray J. King. Published 1978 by Peter Peregrinus Ltd, Stevenage, Herts, England. Hard covers, 368 pages, 135 x 220mm. U.K. overseas price £16.40.

This very new publication is number 3 in the IEE Electromagnetic Wave Series. Its author is Professor and Associate Chairman for Research and Graduate Affairs at the University of Wisconsin, as being a recognised authority on microwave theory and techniques.

In compiling this book he has attempted to collate the ever-expanding literature on the homodyne detection system, as related to microwave technology, so that it may serve both as a reference for practising engineers and as an up-to-date text for a graduate course in advanced microwave measurement.

The early chapters cover the principles of homodyne detection, then explain its measurement role in relation to various classes of modulation. There are chapters dealing with scattering measurement systems, and measurement of fields in open and closed systems. Two chapters are devoted to modulated scatterers, followed by others on automated homodyne systems, automatic frequency stabilisation and coherent transponding systems.

To the inexpert eye, it appears to be a comprehensive and well prepared manual but, having been alerted to its existence, those concerned in this area would be well advised to seek further information direct from the publisher at P.O.Box 8, Southgate House, Stevenage, Herts, SG1 1HQ, England. (W.N.W.).

☆ ☆ ☆

PAMPHLET FOR DXers

Dick Smith Electronics are producing a six-page guide to DX listening, which will be given free with each Yaesu Musen FRG-7 communications receiver bought from one of their stores.

Proof sheets only were available at the time we went to press but they indicate, basically, two kinds of information. One section, written by EAs "Short Wave" correspondent Art Cushen, gives pointers to the reception of overseas broadcasts directed to Australia and of interest to the major ethnic groups.

The other section has to do with operating the FRG-7 receiver itself, hints about the aerial and earth, accessories, and publications of likely interest to short wave listeners.

Inquiries about the FRG-7 receiver and the accompanying pamphlet can be directed to any Dick Smith store or outlet.

L.E. CHAPMAN

EST. 1940
103 ENMORE ROAD, ENMORE, N.S.W. 2042. PHONE 51-1011
NEW Postage Rates Please Add Extra

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1000 MFD	10volt	10 for $1
47uF	35v	10 for $1
47uF	16v	10 for $1
47uF	200v	5 for $1
47uF	25v	5 for $1
220uF	10v	10 for $1
0.39uF	160v	10 for $1
500 MFD	12v	5 for $1
70 MFD	45vac	5 for $1
47uF	160v	5 for $1

SPEAKER PLUG PANEL
Including four speaker plugs and sockets. DIN plug and socket power input, record player, etc.

$2.

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60 MIL 240V 245 ASIDE 6.3 $5.
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Complete with 3½ inch speaker
No cabinet **$3.95**

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B.S.R. CERAMIC STEREO $5
Pick up Cartridges Universal Type

LEVEL AND BALANCE METERS

12,000 ohm 100 Microamps **$2**

SLIDE POTS 50k 4 for $2

Special miniature transistor pots 10k 4 for $1

Special miniature tuning condensors for transistor radio 2 for $1

SPEAKERS

6 x 4, 33 ohm	$4.00
6 x 9, 27 ohm	$7.00
6 x 9, 47 ohm	$7.00
6 inch Dual Cone, 27 ohm	$5.00
6 x 4, 4 ohm	$3.50

ELECTROS
2000 MFD 25 V. 50c

PHILIPS 110 DEG YOKES $10

POTS
½ Meg switch 50 cents
10K switch 50 cents. 1 Meg 50 **cents.** ½ Meg **50 cents.** 100K switch **50 cents.** 250K **50 cents.** 7500K **50 cents.** 25K **50 cents.** Dual concentric 500K 1 Meg **$1.** Dual concentric 50K 25K **$1.** 1 Meg Dual ganged log **$1.** ½ Meg dual ganged double pole switch **$1.** 2 Meg dual ganged Lin **$1.** 1 Meg dual concentric **$1.** 500K min **4 for $1.** 10K min **4 for $1.**

SPECIAL
25 mixed transistors and diodes **$2**

SUPER SPECIAL OUTPUT TRANSISTORS
AD 161
162 K5 **$2.50 A PAIR**

SLIDE SWITCHES
4 mixed types **4 for $1**

SLIDE POTS 250K **4 for $1**
1 Meg **4 for $1**

MICROPHONES
plug and lead $2.50
DYNAMIC

GRAMOPHONE MOTOR
and Turntable 3 speed $3

5 Position Switch Printed Circuit Board
5 Diode, 3 Transistors, etc. **$2**

POWER DIODES
0A636 1000 v 50 cents

VU METER
$3.00 pair

Super Special BSR 4 speed Gramophone motor and pickup, 240 volt with separate power supply for amplifier, etc.
22 volt DC
15 volt AC
$7.95

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for Colour T.V. Complete $4

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balanced complete with ceramic cartridge **$9**

SPEAKER CABINET including 2 dual cone speakers, 6½ inch 10watts RMS **$16.** Size 16½ x 10¼ x 8. Pack & post Interstate **$5** a pair, NSW **$3.00.**

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Gold, width 5ft, top quality
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6 Volt 200 MA **$10**

CROSSOVER SPEAKER CONDENSORS
4 MFD, super quality, 50c.

DC DC CONVERTER
For car radio, cassette, etc. 12 Volt to 6/or 9 Volt **$7.**

SPEAKER SPECIAL
2¼ INCH 8/Ohm 2 for $1.

SPEAKER AND CABINET
Size 10 x 7¼ x 4 **$4.50**
incl 6 x 4 speaker

PHILIPS TV TUNERS
Transistor NT3032 **$10**

POWER TRANSFORMER
300 mil 240 volt; 115; 110; 6.3 **$5**

VALVES
6 BL 8 6 cwt
$1.00 each

SPECIAL SPEAKER SYSTEMS
6-8 watts per channel. 5 pairs only counter sales only **$100 Pair**

POWER LEADS ETC
for tape recorders, etc. **75 cents**

TELESCOPIC AERIALS

$1.50

3 position push button switch 50 cents

PICK-UP ARM CARTRIDGE AND MONO $6.

BARGAINS BARGAINS BARGAINS BARGAINS

Hook up wire 30 mixed colours $1.
250 mixed screws with self tappers, bolts, nuts, etc. $1.25 + postage 50c.
100 mixed radio TV knobs including fine tune & channel change $5.00.
½ meg. double pole switch pots 50c.
Mixed pots 30 including ganged & concentric $5.
Morganite & IRC 33 useful valves fresh stock $2.00 + postage 50c.
Slide switch 3 position 50 cents.
50 ohm Pots ideal for ext. Speakers 50 cents. Transistor and Driver Speaker Transformers $1.00 pair. Ferrite Rods 6½ x ½ inch 50 cents.
Pots 30 mixed values including ganged and concentric $5.
In Line Fuse Holders 20 cents Stereo Speaker Wire 12 cents yard.
100 Mixed TV and Radio Knobs including Fine Tune and Channel Change $5.
Slide Pots 250 K 4 for $1.

Car radio suppressor condenser 30 cents.
boost controls. Includes fancy chrome face plate $10.
Electros 3 in one 100-25-40 24-250-300. 50-250-300 75 cents.
Screw in 6 Volt Pilot Lights $1.50 for 10.
Plug-in type 10 for $1.00.
3.5 to 3.5 Jack Plugs 7ft Shielded Cable 75 cents; 6.5 to 3.5 Jack Plugs 7ft Shielded Cable 75 cents.
Mixed Tag Strips 50 cents for Dozen.
Special Fancy chrome knobs. Ideal for amplifiers. 5 for $1.
Tape Recorder Heads Transistor—Top quality suit most recorders $5.00.
Jack Plug Sockets 6.5 mm 35 cents.
Morganite and IRC resistors 33 values $2 per 100 pack and post 45c.
Philips Gramo Motor and Pickup 4 Speed 6 Volt $7.75.
Crossover Condensers 2 mfd 60 cents.

Microphone Transformers 50 cents.
Perspex tops for record players size 12 x 8½ x 3¼ $1.50.
Pots. 50k 50 cents; 1M 50 cents.
Double Pole Switch Pots 50 cents.
Coaxial TV Feeder Cable 75 ohm 30 cents yard.
Jack Plugs 6.5 mm 50 cents; 3.5 mm 25 cents. R.C.A. Plugs 25 cents.
Hook Up [illegible] 30 mixed colours lengths $1 bag.
Speaker 4 pin plugs 15 cents. 25 mixed and 5 and 10 Watt resistors $2.00.
250 mixed screws. BSA. Whit self-tapper bolts, nuts, etc. $1.25 bag plus 40c post.
TV Aerials Complete Range Hills Color $12 to $60.
Car radio aerials, lockdown, top quality extended 1600 mm $4.50.
Electros 3-in-one: 20, 400, 450; 10, 400, 450, 75, 50, 65 $1.00.

Power Transformer 60 mil 240 volt 36 volt Centre tap 6.3 winding $5.
Mics Dynamic 10k $3.50.
Valve Sockets: 7 or 9 pin 10 cents. Octal 10 cents.
6.3 winding $5 small power transformer 240v. 220v and 22v windings $3.
Pilot Lights: 24 volt screw-in, 10 for $1.50.
Ferrite Rods 6 inch 50. 9 x ½ 75 cents.
Pots: 10K ganged log 50 cents; 1 Meg ganged log $1.25; ½ Meg ganged log $1.25; 2 Meg ganged log $1.25.
2 Meg double pole switch $1.50.
Sharp TV Flyback Transformers 8 FT 604 [illegible].
Miniature Speaker Transformers, drive and output $1.00 pair.
Heat Sinks: 4 x 2 1¾ $1.50.
Speaker Transformers 7000 to 15 ohm $1.75.

SPEAKERS SPEAKERS SPEAKERS

6½ Inch Dual Cone 4 ohm	$5.00	6 inch Dual Cone Tweeters	$6.00
4 x 2 8 ohm	$1.50	5 inch Magnavox Dual or 8 inch 27 ohm	$6.00
8 TACX 8 ohm	$8.00	Magnavox midrange 5 inch dual cone	$8.00
6 x 9 in 8 or 15 ohm	$6.00	MSP 5 x 7 inch 3½ ohm	$4.00
5 x 7 in 8 or 15 ohm	$5.00	Magnavox 5 inch 15 ohm	$4.00
6½ inch 8 or 15 ohm	$4.50	MSP 2¾ inch 8 ohm	$2.00
8 x 4 8 or 15 ohm	$4.50	Magnavox 5 inch 15 ohm	$4.00
6 x 4 8 or 15 ohm	$3.50	Magnavox 6 inch 3½ ohm	$5.00
5 x 4 15 ohm	$2.50	Magnavox 5 x 3 8 ohm	$2.50
4 inch 8 ohm	$2.75	Magnavox 4 ohm 5 x 3	$2.50
		MSP 4 x 2 5 ohm	$3.50
		MSP 6 x 4 4 7 ohm	$6.00
		ROLA 6 x 9 4 7 ohm	$8.00
		Magnavox 5 inch 8 ohm	$4.00
		Magnavox 6 x 9 inch 3½ ohm	$5.00
		Magnavox 5 inch mid range 8 ohm	$6.00
		Magnavox 10 inch dual cone 15 ohm	$10.00
		MSP 4 or 5 inch 3½ ohm	$3.50
		2¾ inch 33 ohm	$2.00
		5 x 4 3.5 ohm	$3.50

INFORMATION CENTRE

VARIABLE DELAY WIPER: In the September 1977 issue a reader wrote to say that he could not stop his unit from mistriggering. I had a similar problem with my unit, and cured it by placing a 22 ohm resistor in series with the positive supply line, and a 12V zener diode in parallel with the wiper unit. (K.C., Dural, NSW).

● Thank you for your comments K.C., which we have included for the benefit of interested readers. You make no mention of the wattage rating of the diode you used. Our calculations indicate that it should be able to dissipate about 1.5W. A three watt unit would be a good choice, so as to provide a margin of safety.

200MHz FREQUENCY METER: I assembled this unit (described in March 1977, File 7/F/21) and it worked satisfactorily for approximately three hours. After switching it on again, the last three digits were showing marks and the first four were zero, on the x1 and x10 ranges. When checking the voltage at pin 9 of the 74LS14 with an AVO 8 meter, all digits showed zero except the last one which showed "1". As soon as I disconnected the meter, the last digits started showing marks. The voltage was still 1.3V. On the x100, only the last digit showed "1". I did a sensitivity check at 1kHz and with approximately 500mV it started to give an accurate and steady reading. (N.S., Southport, Qld).

● Your letter is a little confusing, but we assume that the unit is giving random readings on the three least significant digits, when on the x1 and x10 ranges. This could be due to a malfunction in the front-end, but is more likely due to multiplex hash penetrating the front-end. The cure for this problem was published in the Notes and Errata column in the May 1977 issue.

To recapitulate, the suggested cure is as follows: Replace the two .047uF capacitors associated with the 27 ohm resistors with 100uF electrolytic capacitors; replace the long link which carries the 5V supply to the 74C926's with a 13mm balun wound with six turns of light gauge insulated hook-up wire.

For maximum sensitivity, the 10k resistor at pin 9 of the 7414 (or 74LS14) needs to be reduced to as low as 2.7k. This is a trial and error process.

PLAYMASTER TWIN-40: Can you please tell me why my Playmaster Twin-40 stereo amplifier hums when the phono input leads are applied. Also could you please tell me if low and high filters could be added to the amplifier, also a loudness control? (A.M., Mentone, Vic.)

● It sounds very much as if you have an earth loop via the turntable. To avoid this, the shield braids of the cartridge leads should be kept isolated from the turntable and arm metalwork, as the latter are most likely earthed via the turntable mains cord. You may also have to keep the earth braids of each channel isolated, if possible.

High, low and loudness filters can be added to the amplifier, but with an existing unit this can be messy. We plan to publish a revised design with high and low filters soon.

CHESS CLOCK: I enjoy your magazine very much, especially the projects section. I also play chess, and this leads me to suggest a digital chess clock as a project. All chess clocks I have seen are mechanical clocks geared so that only one operates at a time, with two buttons so that each button stops one clock and starts the other. I enclose some specifications to consider, if you decide in favour of such a project. (J.A.L., Croydon, NSW).

● We will certainly give the idea some thought.

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.

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.

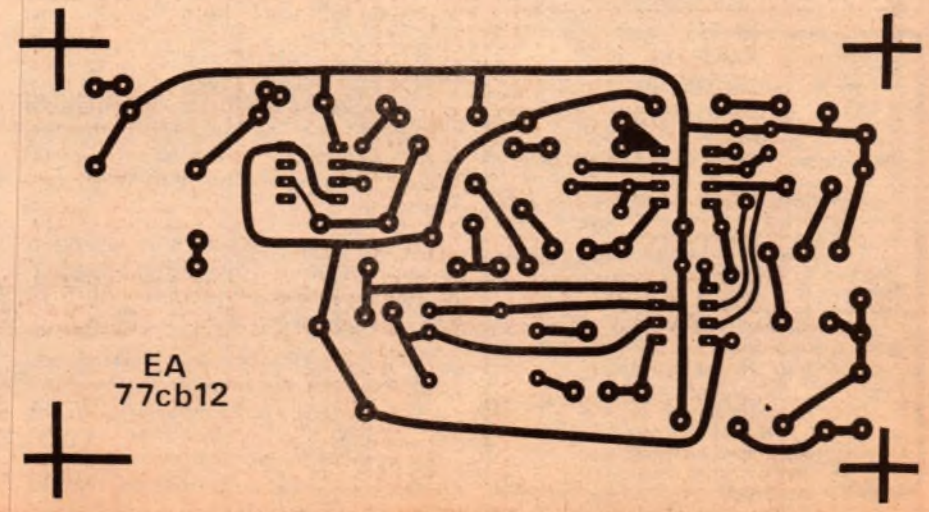
REMITTANCES: Must be negotiable in Australia and made payable to "Electronics Australia". Where the exact charge may be in doubt, we recommend submitting an open cheque endorsed with a suitable limitation.

ADDRESS: All requests to the Assistant Editor, "Electronics Australia", Box 163, Beaconsfield, 2014.

NOTES & ERRATA

CB TONE CALLER (January 1978, File No. 2/MC/14): There are two mistakes in the PCB pattern reproduced on page 44. A corrected pattern is reproduced at right, and may be used to modify existing PC boards. Note that it is not shown actual size. Corrected patterns have been sent to PCB manufacturers.

2650 SOFTWARE RECORD (April 1978): In the section on page 81 describing the Hex Input Routine, the memory address range currently occupied by the routine should read from 1250 to 12BD hexadecimal. Also in the section on page 83 describing the Tape Verifier, the current content of location 13B6 should read 33, not 37 as shown.



Marketplace

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CROSSOVER NETWORKS. Lo-loss air cored inductors, non-saturating, non-distorting. Polyester capacitors in H.F. feed. If you're building up K.E.F. 2 way or 3 way, we make the best crossovers in the business. Unconditional 3 year guarantee. Other models too, inc. my horn crossover (E.A. April 72). Send S.A.E. for details and prices. Free quote for your inductors — send circuit. M.D. McLeod, Wattle Electronics, Box 306, PO Unley, SA 5061.

SPEAKER BOXES. Hand-made, rigid modular construction, fully cleated. Choice veneers. Excellent acoustically. Vol: 42L. Weight 18kg. M/order service. For details write: Sherwood Electronics, PO Sherbrooke 3789.

PRINTED CIRCUIT BOARDS manufactured at best prices. Fast short run and prototype service also available at low cost. For quote write to Peninsula Circuits, c/- 7 Portrush Gr, Mornington 3931, or ring (059) 75 5568 AH and weekends.

PMG TELEPHONE DIALS, NEW, SERIAL, DECIMAL OUTPUT. 2 EXTRA CONTACTS $4.50 PLUS $1.00 P&P. PHONE (02) 449 3968.

LEDs — $15 per 100 — 5mm red with clip $140 per 1000. $8 per 50 or 20c ea. Retail or trade — sample for 40c stamp. Great quality — wide viewing angle — well difused. Also axial electrocap 1000uF/16V same prices but extra 1c each on 40c P&P. Diggerman Electronics, Box 33, Coramba 2466.

SELL 105 ISSUES EA. from June '68, $70 ono, also 74 issues Electronics Today, from Oct. '71, $50 ono. (Sydney delivery free.) G. Brooker, Box 41, Broadmeadow 2292.

AUSTRALIAN RADIO DX CLUB. The premier DX club of Australia, now in its 13th year of national operation. Catering for the interests of both s.w. listeners and dx-ers. The monthly magazine covers the s.w. and m.w. spectrums. For full details write to GPO Box 1310N Hobart 7001, 12 High Street, Cheltenham, Adelaide 5014 or our head office at PO Box 67 Highett, Victoria 3190.

RELAYS, PMG, $2 each, old and new types, other miscellaneous equipment including racks. P&P extra, send $1.00 sample, or SSAE details PO Box 74, Applecross 6153.

COLOUR VIDEO RECORDER. Akai VT 150 portable colour recorder and camera, had very little use, $3500 or nearest offer, including several tapes. One Decca 26" colour monitor receiver, $400. One AVO DA 114 digital MM, $195. One 3M contarta tape player, near new, $175. 8 Ampex 2" colour tape, $20 per reel. Phone (066) 52 3227, Coffs Harbour.

POSITION VACANT

4ZZZ-FM CHIEF ENGINEER. This responsible position at Brisbane's only FM public broadcaster, requires a good working knowledge of VHF transmitter and studio equipment. Hours are long, pay is poor and dedication is essential. Apply to 4ZZZ FM, PO Box 509, Toowong, Queensland 4066.

L. M. Ericcsson . . . cont from p9

His standards were higher than those then considered necessary by foreign competitors, who were gradually forced to raise their sights. The solid quality of Ericsson's work and the elegance of his designs established his products as symbols of the finest telephony.

By the mid-nineties Ericsson's company had approximately 500 employees — a relatively large number in those days in neary all countries — and was firmly established in both domestic and export markets.

The company had customers throughout the world, the bulk of them located in the Scandinavian countries, Russia, England and the countries that today comprise the British Commonwealth.

Export sales consistently exceeded sales in the limited Swedish market and in some years accounted for 70 to 85 per cent of invoicing.

In 1896 Ericsson transferred the business of L. M. Ericsson & Co., to a new corporation, Aktiebolaget L. M. Ericsson & Co., capitalized at one million kronor. Ericsson owned all the shares except for a number distributed as gifts to the faithful Carl John Andersson, his works manager for many years and to 31 other key employees.

Ericsson served as managing director and chairman of the board of the new corporation for four years, retiring as managing director in the fall of 1900. He continued as board chairman, displaying an active interest in the company, until 1903, when he disposed of nis shareholdings and severed all formal connections with enterprise he had founded and guided to a position of international stature.

He took up farming on an estate near Stockholm in 1906 at the age of 60 and died in December 1926 in his 81st year.

Reprinted from "Telecom" by arrangment with the Editor.

ADVERTISING INDEX

JVC offers flexibility in sound reproduction...

Your current hi fi system most likely has a vital, but highly versatile element missing. A JVC SEA-20 graphic equalizer. Take a close look at your current amplifier or receiver and you'll notice it only offers bass and treble controls, and some include a third for midrange, but none approach the accuracy and flexibility of the SEA graphic equalizer system developed and patented by JVC.

Over 400,000 ways to hear better sound.

By adjusting the seven tone controls covering the frequency range at 60Hz, 150Hz, 400Hz, 1,000Hz, 2,400Hz, 6000Hz and 15,000Hz you can create over 400,000 different sounds. A feat normally not achieved (with a stereo amplifier or receiver) outside a professional recording studio. But, then the SEA-20 is a true JVC professional.

Get better performance from your components and listening room.

Why do you need such tremendous variations in tone? Quite simply, they help you to overcome the shortcomings of the acoustics in your listening room; they also help you to compensate for the deficiencies in old or poor recordings.

Finally, they can do wonders for the frequency response of your speakers, and where you place them. SEA is really quite easy to use. For example, the 60Hz switch reduces record hum or rumble, and it can add greater clarity to the ultra low bass of an organ. The problem of booming speakers is simply handled with the 150Hz switch, while boosting the 400Hz switch it adds clarity to the upper bass. And in the important midranges, the 1,000 control adds new dimension to the vocals of your favourite rock performers, while the 2,400Hz controls the upper midrange. The 6,000Hz switch brings out the best in strings. You can even reduce tape hiss and diminish the harsh sound of a phono cartridge at high frequencies, with the 15,000Hz control. Then, to double check any adjustments SEA works with a tone cancellation switch which permits you to instantly compare your setting with a perfectly flat response.

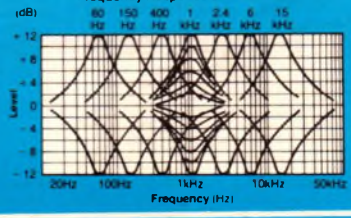
SEA equalized recording.

You'll enjoy an infinite number of practical applications for SEA in home tape recording. SEA equalized responses may be reflected on your tapes as you record them. With SEA it's easy to eliminate record scratch and surface noise, reduce tape hiss, and emphasize vocals or the highlights of any musical instrument. The Monitor and SEA Defeat Switches are also provided to enhance the SEA versatility and utility.

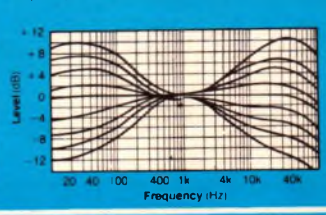
For around $170 JVC offers flexibility in sound reproduction.

Do yourself a favour . . . listen to the SEA-20 versatile performance at your nearest JVC dealer, we believe for around $170, you can afford the accuracy and flexibility which this JVC graphic equalizer offers. Listen . . . you'll find it quite an experience.

Frequency Response of 7-Band S.E.A.



Frequency Response of Bass/Treble Tone Controls



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WT15/78

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RS-9900US. Two components for one reason: To outperform all other cassette decks.

Audio enthusiasts the world over have come to expect exciting innovations from Technics. The RS-9900US is one of them. Unlike other cassette decks it is a 'cassette system'—the separation of the sensitive amplifier electronics from the mechanical tape transport to obtain optimum performance from each.

Features in the transport unit include a closed loop, double-capstan, 3-motor drive to provide smooth tape travel and closest tape-to-head contact; pitch control of ±5% and full IC logic control of all transport functions to ensure tape safety when switching modes. The true 3-head system permits professional-type tape/source monitoring.

Outstanding among the amplifier unit's many features is the fixed plus variable calibration controls for equalisation lines, and Dolby* record and playback levels. Complete with peak reading meters of studio standards, Dolby* noise reduction circuitry and a built-in 400Hz/8kHz test oscillator for level calibration and head azimuth adjustments.

An evaluation of the Technics RS-9900US capabilities will provide the answer to any contradictions about cassette equipment performance.

*Under licence from Dolby Laboratories Inc.

National Technics hi-fi

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